PROVISIONAL PROSTHETIC SYSTEMS AND METHODS OF USING SAME

INCORPORATION BY REFERENCE TO ANY PRIORITY APPLICATIONS

[0001] This application claims the benefit of priority of U.S. Provisional Application No. 62/029,289 filed on July 25, 2014, the entire disclosure of which is incorporated herein by reference.

BACKGROUND

Field

[0002] The present invention relates to prosthetic systems and methods, and more specifically, to dental prosthetic systems and methods.

Description of the Related Art

[0003] Dental prosthetic systems can be used to reconstruct defects in a patient's jaw such as missing or misaligned teeth. Dental prosthetic systems can include components such as a dental implant, an intermediary structure such as an abutment, and a prosthesis such as a crown, bridge or a denture.

[0004] In one method, a provisional dental prosthetic system can be attached to the patient's jaw prior to fabrication and installation of a more permanent dental prosthetic system. This can provide the patient with an interim prosthetic solution which is directly attached to the patient's jaw. However, such provisional dental prosthetic systems and methods often require use of devices, such as long processing screws, which interfere with the clinician's ability to determine and obtain a proper fit for the prosthesis with respect to opposing dentition. Accordingly, there is a need for further improvement of provisional dental prosthetic systems and methods of attaching provisional prosthetic systems to enhance the clinician's ability to obtain a proper fit for the prosthesis.

SUMMARY

[0005] One aspect of the dental prosthetic systems and methods described herein is the recognition of a need for enhancing the fit of a dental prosthesis with respect to opposing dentition. Provisional dental prosthetic systems are often limited due to the use of other devices, such as long processing screws, which interfere with the ability for a clinician to obtain a proper fit.

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[0006] In some embodiments, a method of coupling a dental prosthesis to an implant or an abutment can include the step of coupling a coping to the abutment using a snap-fit connection. The method can also include the step of bonding the prosthesis to the coping. The method can also include the step of decoupling the prosthesis and coping from the abutment via the snap-fit connection. The method can also include the step of forming a through-hole in both the coping and the prosthesis. The method can also include the step of coupling the coping and prosthesis to the abutment using a fastener inserted into the through-hole.

[0007] In some embodiments, the following features can be combined separately, or together with, the embodiment above. In some embodiments, the step of coupling the prosthesis to the coping can include the step of applying a bonding agent to the coping and to the prosthesis and/or backfilling holes formed in the prosthesis with an acrylic, such as a self-curing acrylic or a light cured composite. This acrylic can be the same material used in forming the prosthesis. In some embodiments, the prosthesis can include one or more blind holes and the step of applying the bonding agent to the prosthesis can include the step of introducing the bonding against into the one or more blind holes and/or backfilling holes formed in the prosthesis with an acrylic, such as a self-curing acrylic or a light cured composite. The method can also include the step of temporarily coupling a coping to the abutment via a provisional connection feature. In some embodiments, the step of temporarily coupling the coping to the abutment via a provisional connection feature can include the step of engaging a snap fit connection feature on the coping with a corresponding snap fit connection feature on the abutment. The method can also include the step of modifying the alignment between the prosthesis and coping and coupling the prosthesis to the coping. In some embodiments, the step of modifying the alignment between the prosthesis and coping can include the step of orienting occlusal surfaces and establishing vertical dimension of the prosthesis with occlusal surfaces of opposing dentition. The method can also include the step of removing the prosthesis and coping from the abutment such that the prosthesis and coping remain in the modified alignment. The method can also include the step of forming a hole through at least the prosthesis using a cutting tool. In some embodiments, the step of forming a hole through at least the prosthesis can include the step of attaching an alignment tool to the coping and using the alignment tool to align the cutting tool with respect to the

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prosthesis. The method can also include the step of coupling the coping to the abutment via a second connection feature, the second connection feature being different from the provisional connection feature. In some embodiments, the step of coupling the coping to the abutment via a second connection feature can include the step of fastening the coping to the abutment using a threaded fastener. The method can also include the step of determining a preliminary fit of the prosthesis with respect to the coping prior to the step of attaching the prosthesis to the coping. The method can also include the step of modifying the coping to alter the fit of the prosthesis with respect to the coping.

[0008] In some embodiments, a method of attaching and aligning a dental prosthesis to an abutment and coping in a patient's jaw can include the step of coupling the coping to the abutment via a provisional connection feature. The method can also include the step of bonding the prosthesis to the coping. The method can also include the step of modifying the alignment between the prosthesis and the coping while the prosthesis is being bonded to the coping. The method can also include the step of removing the prosthesis and coping from the abutment.

[0009] In some embodiments, the following features can be combined separately, or together with, the embodiment above. The method can also include the step of forming one or more blind holes in the prosthesis. In some embodiments, the step of bonding the prosthesis to the coping can include the step of bonding the coping within one or more blind holes in the prosthesis. The method can also include forming a hole through the prosthesis using a cutting tool. In some embodiments, the step of forming a hole through the prosthesis can include the step of attaching an alignment tool to the coping and using the alignment tool to align the cutting tool with respect to the prosthesis. The method can also include the step of coupling the coping to the abutment using a threaded fastener. In some embodiments, the step of modifying the alignment between the prosthesis and coping includes the step of placing occlusal surfaces of the prosthesis in contact with occlusal surfaces of opposing dentition.

[0010] In certain embodiments, a system for coupling one or more dental components to a dental implant is provided. The system can include at least one dental component comprising a provisional connection feature. In some embodiments, the dental component can comprise an abutment configured to couple with the dental implant via the

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provisional connection feature. In some such embodiments, the abutment can comprise an abutment integrated with a coping. The provisional connection feature of the abutment can include one or more fingers and/or can include a spring. In some embodiments, the abutment and the implant can be configured to be coupled via a snap-fit and/or via a friction fit.

[0011] In various embodiments where the dental components include a coping and an abutment, the coping can be configured to couple with the abutment via the provisional connection feature, or the abutment can be configured to couple with the coping via the provisional connection feature. In some embodiments, the abutment can include a second connection feature. In some such embodiments, the abutment can be configured to be coupled to the implant via the second connection feature. In various embodiments, the provisional connection feature can comprise one or more fingers and/or can comprise a spring. In some embodiments, the coping and the abutment can be configured to be coupled via a snap-fit and/or via a friction fit. The coping can include an elongate member. In some such embodiments, the elongate member can include a plurality of protrusions and slots. The coping can also include a flange. In some such embodiments, the flange can include a plurality of grooves. In some embodiments, the system can further include a cutting tool.

[0012] In various embodiments the dental component can include an adapter configured to couple with the dental implant via the provisional connection feature. In various embodiments, the provisional connection feature can comprise one or more fingers and/or can comprise a spring. In some embodiments, the adapter and the implant can be configured to be coupled via a snap-fit and/or via a friction fit. On a side opposite the dental implant, the adapter can be configured to be coupled to one or more other dental components. For example, the one or more other dental components can include at least one of a prosthesis, an abutment, an impression post, or a healing cap. In some embodiments, the one or more dental component can include an angulated screw channel.

[0013] In certain embodiments, a method of creating a dental prosthesis configured to be coupled to a dental implant is provided. The method can include coupling one or more dental components to the implant. At least one dental component can have a provisional connection feature. The method can also include bonding the prosthesis to one or more dental components, decoupling the prosthesis and at least one dental component from the implant via the provisional connection feature, and forming a through-hole in both the at

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least one dental component and the prosthesis. The through-hole can be configured to receive a fastener configured to couple with the prosthesis and the at least one dental component to the dental implant. In various embodiments, forming the through-hole can include forming the through-hole using a cutting tool from a distal side of the at least one dental component. Forming the through-hole can further include forming the through-hole using the cutting tool or another cutting tool from an occlusal side of the prosthesis. In some embodiments, the method can further include coupling the at least one dental component and the prosthesis to the implant using the fastener inserted into the through-hole.

[0014] In various embodiments, the provisional connection feature can comprise a snap-fit connection feature and/or a friction fit connection feature. In some embodiments, the at least one dental component can comprise an abutment configured to couple with the implant via the provisional connection feature. In some such embodiments, the abutment can include an abutment integrated with a coping. In some embodiments where the dental components include a coping and an abutment, the coping can be configured to couple with the abutment via the provisional connection feature, or the abutment can be configured to couple with the coping via the provisional connection feature. In some embodiments, the abutment can include a second connection feature. In some such embodiments, the abutment can be configured to be coupled to the implant via the second connection feature.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The foregoing and other features of the present disclosure will become more fully apparent from the following description and appended claims, taken in conjunction with the accompanying drawings. Understanding that these drawings depict only several embodiments in accordance with the disclosure and are not to be considered limiting of its scope, the disclosure will be described with additional specificity and detail through the use of the accompanying drawings.

[0016] FIGURE 1 illustrates a schematic view of embodiments of an anchoring unit, a coping, and a prosthesis of a prosthetic system.

[0017] FIGURE 2 illustrates a schematic view of embodiments of a cutting tool, alignment tool, coping, and prosthesis of the system of Figure 1.

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[0018] FIGURE 3 illustrates a flow diagram of a first method of attaching a provisional prosthetic system.

[0019] FIGURE 4 illustrates a flow diagram of a second method of attaching a provisional prosthetic system.

[0020] FIGURE 5 illustrates a front elevation view of another embodiment of a prosthesis of a prosthetic system.

[0021] FIGURE 6 illustrates a side elevation view of an embodiment of an implant and abutment of a prosthetic system.

[0022] FIGURE 7A illustrates a cross-sectional view of an embodiment of a coping of a prosthetic system.

[0023] FIGURE 7B illustrates a top view of an embodiment of a spring element.

[0024] FIGURE 7C illustrates a top view of another embodiment of a spring element.

[0025] FIGURE 8 illustrates a cross-sectional view of the prosthesis of Figure 5, the abutment of Figure 6, and the coping of Figure 7.

[0026] FIGURE 9 illustrates a cross-sectional view of the apparatus of Figure 8 with a bonding agent.

[0027] FIGURE 10 illustrates a cross-sectional view of embodiments of an alignment tool and a cutting tool attached to the prosthesis of Figure 5 and the coping of Figure 7.

[0028] FIGURE 11 illustrates a cross-sectional view of the apparatus of Figure 10 in a second configuration.

[0029] FIGURE 12 illustrates a cross-sectional view of the apparatus of Figure 9 attached with a fastener.

[0030] FIGURE 13 illustrates a side elevation view of another embodiment of an abutment and of a coping.

[0031] FIGURE 14 illustrates a perspective view of another embodiment of an abutment.

[0032] FIGURE 15 illustrates a side elevation view of the abutment of Figure 14.

[0033] FIGURE 16 illustrates a perspective view of another embodiment of an abutment.

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[0034] FIGURE 17 illustrates a cross-sectional view of the abutment of Figure 16.

[0035] FIGURE 18 illustrates a perspective view of another embodiment of a coping.

[0036] FIGURE 19 illustrates a cross-sectional view of the abutment of Figure 18.

[0037] FIGURE 20 illustrates a cross-sectional view of the abutment of Figure 16 and the coping of Figure 18 attached together.

[0038] FIGURE 21 illustrates a side elevation view of an embodiment of a two-piece coping.

[0039] FIGURE 22 illustrates a cross-sectional view of the two-piece coping of Figure 21.

[0040] FIGURE 23 illustrates a cross-sectional view of the two-piece coping of Figure 21 attached to an embodiment of an abutment and connecting screw.

[0041] FIGURE 24 illustrates a side elevation view of another embodiment of a two-piece coping.

[0042] FIGURE 25 illustrates a cross-sectional view of the two-piece coping of Figure 24.

[0043] FIGURE 26 illustrates a cross-sectional view of the two-piece coping of Figure 24 attached to an embodiment of an abutment and connecting screw

[0044] FIGURE 27A illustrates a perspective view of another embodiment of an abutment.

[0045] FIGURE 27B illustrates a cross-sectional view of the abutment of Figure 27A.

[0046] FIGURES 27C-27E illustrate perspective views of other embodiments of an abutment.

[0047] FIGURE 28A illustrates a perspective view of another embodiment of an abutment.

[0048] FIGURE 28B illustrates a cross-sectional view of the abutment of Figure 28A.

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[0049] FIGURE 29A illustrates a perspective view of another embodiment of an abutment.

[0050] FIGURE 29B illustrates a cross-sectional view of the abutment of Figure 29A.

[0051] FIGURE 30A illustrates a perspective view of another embodiment of a coping.

[0052] FIGURE 30B illustrates a cross-sectional view of the coping of Figure 30A.

[0053] FIGURE 31 illustrates a perspective view of an example abutment configured to mate with the coping of Figures 30A and 30B.

[0054] FIGURE 32A-32D illustrate an example embodiment of a method of coupling a provisional prosthetic system.

[0055] FIGURE 33A illustrates a perspective view of an embodiment of an adapter.

[0056] FIGURE 33B illustrates a perspective view of another embodiment of an adapter.

[0057] FIGURES 34-36 illustrate example components that can be coupled to an adapter.

DETAILED DESCRIPTION

[0058] Embodiments of a prosthetic system and method will now be described with reference to the accompanying figures, wherein like numerals refer to like or similar elements throughout. Although several embodiments, examples and illustrations are disclosed below, it will be understood by those of ordinary skill in the art that the inventions described herein extends beyond the specifically disclosed embodiments, examples and illustrations, and can include other uses of the inventions and obvious modifications and equivalents thereof. The terminology used in the description presented herein is not intended to be interpreted in any limited or restrictive manner simply because it is being used in conjunction with a detailed description of certain specific embodiments of the inventions. In addition, embodiments of the inventions can comprise several novel features and no single

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feature is solely responsible for its desirable attributes or is essential to practicing the inventions herein described.

[0059] Certain terminology may be used in the following description for the purpose of reference only, and thus are not intended to be limiting. For example, terms such as "above" and "below" refer to directions in the drawings to which reference is made. Terms such as "proximal," "distal," "front," "back," "rear," and "side" describe the orientation and/or location of portions of the components or elements within a consistent but arbitrary frame of reference which is made clear by reference to the text and the associated drawings describing the components or elements under discussion. Such terminology may include the words specifically mentioned above, derivatives thereof, and words of similar import.

[0060] As used herein, the term "proximal" refers to the parts of the device and system which are located closer to the operator of the device and system (e.g., clinician) and generally would refer to parts of the device and system located further from the implantation location of the device and system. The term "distal" refers to the parts of the device and system which are located further from the operator of the device and system (e.g., clinician) and generally would refer to parts of the device and system located closer to the implantation location of the device and system.

[0061] As will be described, certain embodiments relate to a maxillofacial prosthesis system and methods of using the system. More specifically, one embodiment is directed to a provisional dental prosthetic system and methods of attaching a provisional dental prosthetic system to a patient. The present systems and methods can be used, for example, within days after dental implants have been affixed into a patient's jaw and before a permanent prosthetic solution has been fabricated and installed. In some instances, the present systems and methods can be used immediately after dental implants have been affixed to the patient's jaw. Accordingly, the patient can be provided with an attachable prosthesis during the healing period and prior to full osseointegration of the implant.

[0062] However, it should be appreciated that while, in some instances, the figures and description herein refer to a provisional dental prosthesis in the form of a full bridge for placement along the maxillary and/or mandibular arches, in modified embodiments, the prosthesis can be any type of prosthesis including, but not limited to,

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partial bridges and crowns. It should also be appreciated that while, in some instances, the figures and description herein refer to a provisional dental prosthesis in the form of a single tooth crown, in modified embodiments, the prosthesis can be any type of prosthesis including, but not limited to, partial and full bridges. In other words, various features described herein can be used for either single tooth or multi-tooth restorations. In addition, while in some examples, various features are described and shown associated with an illustrated dental component (e.g., a coping), in modified embodiments, those features can be associated with any type of dental component (e.g., an abutment, an implant, etc.). Furthermore, it should be appreciated that the systems and methods described herein are at times described as being provisional in nature, such systems and methods can also be applied to the fabrication and attachment of permanent prosthetic solutions.

Provisional Dental Prosthesis and Attachment System

[0063] With reference now to **Figure 1,** an embodiment of a dental prosthesis and attachment system **100** is schematically illustrated. The system **100** can include an anchoring unit **102** for coupling to a patient's bone **10,** as well as a coping **130,** and a prosthesis **140.** As will be explained below, the coping **130** can be coupled to the anchoring unit **102** and the prosthesis **140** can be coupled to the coping **130.** In some embodiments, the anchoring unit **102** can include a bone implant **110,** such as a dental implant, and an abutment **120,** such as a multi-unit abutment. In the illustrated arrangement, the abutment **120** can be removably coupled to the bone implant **110** via a coupling screw **16.** In some embodiments, the implant **110** and the abutment **120** can form an integral unit. Furthermore, it should be understood that certain components of the anchoring unit **102** can be omitted. For example, in some embodiments, the abutment **120** can be omitted from the anchoring unit **102** such that the coping **130** is instead directly attached to the implant **110.** As another example, in some embodiments, the coping **130** and abutment **120** can form an integral unit such that the combined coping **130**/abutment **120** is directly attached to the implant **110.** In some such instances, the combined coping **130**/abutment **120** can sometimes be referred to simply as the coping **130** or simply as the abutment **120.** In other arrangements, the coupling screw **16** can

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be omitted and the abutment **120** can include a threaded end that is inserted into the implant **110**

[0064] As will be described in further detail below, certain of the connection features used to attach the various components together can be designed to facilitate removal of the components from each other. In some embodiments, the connection features form "snap-fit" connections which include, but is not limited to springs, clips, resilient dimples or bosses, can be used to facilitate coupling and then removal of components from each other. For example, the coping **130** can be coupled to the abutment **120** using a "snap-fit" connection. Accordingly, in some embodiments, the coping **130** can be initially coupled to the abutment **120** by a "snap-fit" and then removed from the abutment **120** by applying a separation force in a direction away from the abutment **120** that exceeds the snap-fit. As another example, the coping **130,** the abutment **120,** or the combined coping **130**/abutment **120** can be coupled directly to the implant **110** using a "snap-fit" connection. Accordingly, in some embodiments, the coping **130,** the abutment **120,** or the combined coping **130**/abutment **120** can be initially coupled to the implant **110** by a "snap-fit" and then removed from the implant **110** by applying a separation force in a direction away from the implant that exceeds the "snap-fit."

[0065] However, in other embodiments, other types of provisional connection features can also be used, for example, including a retention collar or other feature which can be tightened to create a friction fit between the components, adhesives between the two components, and the like. In some embodiments, a portion of a dental component can press against a surface of another dental component creating a friction fit or interference fit. In some such embodiments, a distal portion of a first dental component can create a friction fit with a proximal portion of a second dental component. The first dental component can include a coping **130** and the second dental component can include an abutment **120.** As another example, the first and second dental components can include two portions of a multi-unit abutment. As yet another example, the first dental component can include a coping **130,** an abutment **120,** or a combined coping **130**/abutment **120** and the second dental component can include an implant **110.** In some instances, the distal portion of the first dental component can include a portion of an exterior surface, and the proximal portion of the second dental component can include an interior surface (e.g., an inner wall of a recess, bore,

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or cavity). In some other instances, the distal portion of the first dental component can include a portion of an interior surface (e.g., an inner wall of recess, bore, or cavity), and the proximal portion of the second dental component can include an exterior surface. In some embodiments, a friction fit or an adhesive can provide a sufficient initial holding force such that the two components retain their positioning and orientation upon application of a force below a threshold value but are removable once a threshold, separating force has been applied to the two components. Generally, the threshold force required to overcome the provisional connection feature and detach the components should be chosen such that injury to the patient's bone is avoided. This is particularly important in cases of provisional prosthetic systems in which the prosthetic system is being attached immediately or shortly after surgical implantation of the implants 110.

[0066] With continued reference to **Figure** 1, as noted above, the system 100 can include one or more implants 110 (e.g., a dental implant) for affixing into a patient's bone 10. In some embodiments, the implant 110 can have a monolithic structure with a distal end 112 designed to be placed within and osseointegrated with a patient's jaw and a proximal end 114 designed to allow attachment of another dental component such as the abutment 120 (or the coping 130 or the combined coping 130/abutment 120). In some embodiments, the one or more implants 110 can be placed at multiple implantation locations within the patient's jaw based on factors such as the nature of the permanent prosthesis to be fitted to the patient upon complete osseointegration of the implants 110 as well as the patient's bone structure. In some embodiments, a single implant 110 can be used when the patient is being fitted with a crown (i.e., a prosthesis having a single tooth). In other embodiments, two or more implants 110 can be used when the patient is being fitted with a partial or full bridge (i.e., a prosthesis having multiple teeth). For example, in some surgical procedures, four implants 110 can be used for attaching a full bridge dental prosthesis. Such a technique can be used, for example, as part of Nobel Biocare's All-On-4® surgical procedure. Of course, it should be understood that in some surgical procedures, it may be deemed by the clinician that no anchoring units 102 are needed and thus the implants 110 can be omitted entirely from the system 100. Such may be the case, for example, when the patient's existing teeth are deemed sufficient to retain the prosthesis.

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[0067] For affixing the implant 110 to bone 10, the implant 110 can include threading or similar features along at least a portion of the exterior surface. In some embodiments, the implant 110 can include threading at least partially along the exterior surface adjacent the bone 10 when the implant 110 is placed within the implantation location. For example, threading can be included at least partially along exterior surfaces proximate the distal end 112 of the implant 110. Of course, it should be understood that threading or similar features can extend towards the proximal end 114 of the implant 110 or be located primarily at the proximal end 114.

[0068] For attachment to other dental components, such as abutment 120 (or coping 130 or combined coping 130/abutment 120), the implant 110 can include one or more connection features designed to interact with a corresponding connection feature on the other dental component. In some embodiments, the implant 110 can include one or more internal connection elements such as bores or cavities sized and shaped to at least partially receive a portion of the abutment 120 and/or fasteners. For example, as shown in the illustrated embodiment, the implant 110 can include a threaded bore 116 into which a threaded screw, such as coupling screw 16, can be attached. In addition, the implant 110 can include an alignment feature 115 which can comprise internal lobes or an internal hex which correspond to external lobes or an external hex on an abutment 120. The bore 116 of the implant 110 can also include additional elements e.g., a tapered connection portion or less elements. In other embodiments, the implant 110 can include external features (e.g., such as external lobes or an external hex) that can be received within a corresponding recess within the abutment 120. In some embodiments, the alignment feature 115 can be located at or proximate the proximal end 114 of the implant 110. The alignment feature 115 can have an aperture located along a proximal surface of the implant 110 for allowing entry of the dental component into the alignment feature 115 and the threaded bore 116.

[0069] In some embodiments, the implant 110 can include additional features for facilitating and enhancing the connection between the implant 110 and the dental component. For example, the implant 110 can include grooves, dimples, roughening, or the like to enhance the connection with the dental component. As another example, the implant 110 can include other keyed features for ensuring that the dental component cannot rotate with respect to the implant 110. Such keyed components can include providing the bore with a

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specific cross-sectional shape or by adding slots, channels, protrusions or other structure which allow insertion of a dental component in a select number of orientations. Furthermore, the implant **110** can include other connection features to positively engage the dental component and reduce the likelihood that the component becomes inadvertently detached from the implant **110.** For example, the implant **110** can include a "snap-fit" connector for positively engaging a corresponding "snap-fit" connector of the dental component. Such features can be located, for example, on the interior surfaces, exterior surfaces, or both of the implant **110.**

[0070] With continued reference to **Figure 1,** as noted above, the system **100** can include one or more abutments **120** for attachment to one or more other dental components. For example, the abutment **120** can be a multi-unit abutment that is coupled to the implant **110** with a coupling screw **16** that passes through an internal bore **125** and engages threading on the threaded bore **116** of the implant **110.** In some embodiments, the abutment **120** can have a monolithic structure with a distal end **122** designed to be inserted into the implant **110** and a proximal end **124** designed to allow attachment to another dental component, such as the coping **130.** Of course, it should be appreciated that the abutment **120** can also be formed from two or more sub-components. For example, the abutment **120** can have a distal sub-component forming the distal end **122** for attachment to the implant **110** and a proximal sub-component forming the proximal end **124** for attachment to another dental component. The proximal and distal sub-components can be attached together to form the abutment **120.**

[0071] For attachment to a dental component, such as implant **110,** the abutment **120** can include one or more corresponding connection features to attach to the implant **110** and reduce the likelihood of inadvertent removal. As described above, in some embodiments, the abutment **120** can be attached to the implant **110** using a coupling screw **16.** In some embodiments, the abutment **120** can include threading at least partially along an exterior surface of the distal end **122** such that the abutment **120** can engage corresponding threading of the implant **110.** In some embodiments, the abutment **120** can include resiliently deformable members which are received into a corresponding connection feature in the implant **110** which can advantageously provide a "snap-fit" and/or friction fit connection. Other types of connection features, such as a bayonet mounting structure, can also be used.

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It should be understood that such connection features can also be included along interior surfaces of the abutment 120 if the abutment 120 has a bore or cavity.

[0072] To facilitate alignment of the abutment 120 with respect to the implant 110, the abutment 120 can include keyed features which correspond to keyed features of the implant 110. For example, at least a portion of the abutment 120 can have a non-circular cross-section which corresponds to a non-circular cross-section of the bore of the implant 110. For example, the abutment 120 can include an alignment feature 121 which corresponds with the alignment feature 115 of the implant 110. For example, the alignment feature 115 can have a plurality of external lobes or an external hex-shape. In some embodiments, the abutment 120 can include slots, grooves, or other protrusions which align with corresponding slots, grooves, or protrusions on the implant 110 to ensure proper alignment prior to fastening.

[0073] For attachment to other dental components, such as coping 130 and/or to a dental component such as, for example, a dental restoration or dental restoration component such as, for example, a multi-unit bridge and/or restoration, in some embodiments the abutment 120 can include one or more provisional connection features 126 designed to interact with a corresponding provisional connection feature on the other dental component. For example, in some embodiments, the abutment 120 can include a slot or protrusion positioned along an exterior surface configured to engage a corresponding protrusion or slot on the other dental component. Accordingly, the provisional connection feature 126 can be positioned at or proximate the proximal end 124 of the abutment 120. As discussed above, in one embodiment, the provisional connection feature 126 can be designed to allow for a "snap-fit" and or a friction fit connection between the abutment 120 and the other dental component such as the coping 130 thereby advantageously allowing the abutment 120 and the other dental component (e.g., coping 130) to be easily removed via application of a separation force. As will be made apparent through the course of this disclosure, the ability to easily remove the dental component from the abutment 120 can facilitate preparation of the provisional prosthesis system 100 for final installation to the patient's jaw.

[0074] It should be appreciated that, in some embodiments, the provisional connection feature 126 can be included on an interior surface of the abutment 120. For example, the provisional connection feature 126 can be located either entirely or partially

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along an interior surface of a bore, such as bore **125,** of the abutment **120.** Moreover, in some embodiments, the provisional connection feature **126** can be an adhesive component disposed on the component **120.** Such adhesive can be chosen to sever upon application of a threshold separation force.

[0075] In some embodiments, the abutment **120** can include connection features designed to interact with a corresponding connection feature on the other dental component, such as coping **130.** As shown in the illustrated embodiment, the connection feature can be an internally threaded bore **128.** The internally threaded bore **128** can engage a prosthesis screw used to couple the coping **130** to the abutment **120.** In some embodiments, the internally threaded bore **128** can be located at or proximate the proximal end **124** of the abutment **120.** The bore can have an aperture located along a proximal surface of the first abutment **120** for allowing entry of the dental component, a separate fastener, or both into the bore **128.** Although the bore **128** is illustrated as having a greater diameter than that bore **125,** it should be understood that the bore **128** can have the same diameter as bore **125.** Moreover, while the bore **128** is illustrated as being coaxial with bore **125,** it should be understood that the two bores **125, 128** can be non-coaxial. In some embodiments, the connection feature can be located along an exterior surface of the abutment **120.** However, it should be understood that connection feature can be omitted. For example, in some embodiments, a prosthetic screw used to couple the coping **130** to the abutment **120** can engage internal threading on the coupling screw **16** itself if such internal threading is provided.

[0076] With continued reference to **Figure 1,** the system **100** can include one or more copings **130** for attachment to one or more dental components. In some embodiments, the coping **130** can have a monolithic structure with a distal end **132** designed to be attached to a dental component, such as abutment **120** or implant **110,** and a proximal end **134** designed to allow attachment of another dental component such as the provisional prosthesis **140.**

[0077] For attachment to a dental component, such as abutment **120,** the coping **130** can include one or more connection features designed to interact with a corresponding connection feature, such as provisional connection feature **126,** on the abutment **120.** In some embodiments, the coping **130** can include a cavity **136** or bore sized and shaped to at

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least partially receive a portion of the abutment **120** which includes a connection feature along an interior surface to engage provisional connection feature **126.** In some embodiments, the cavity **136** can be located at or proximate the distal end **132** of the coping **130** and can have an aperture located along a distal surface of the coping **130** for allowing entry of the dental component into the cavity **136.**

[0078] The connection feature can include an annular protrusion or annular slot positioned along interior surfaces, such as an interior surface of cavity **136,** configured to engage a corresponding feature, such as provisional connection feature **126,** on the abutment **120.** Accordingly, in some embodiments, both the coping **130** and the abutment **120** can be retained using a "snap-fit" and/or friction fit connection. This can advantageously allow the coping **130** and the abutment **120** to be easily removed. Other types of connection features, such as a bayonet mounting structure, can also be used. Moreover, in some embodiments, the connection feature can be an adhesive component disposed on the coping **130.** Such adhesive can be chosen to sever upon application of a threshold separation force. It should be appreciated that connection features can also be included along exterior surfaces of the coping **130.**

[0079] In some embodiments, the coping **130** can include features for facilitating and enhancing the connection between the coping **130** and the abutment **120.** For example, to facilitate alignment of the coping **130** with respect to the abutment **120,** the coping **130** can include keyed features which correspond to keyed features of the abutment **120.** For example, at least a portion of the cavity **136** of the coping **130** can have a non-circular cross-section which corresponds to a non-circular cross-section of the abutment **120.** In some embodiments, the coping **130** can include slots, grooves, or other protrusions which align with corresponding slots, grooves, or protrusions on the abutment **120.** Such features can be located, for example, on the interior surfaces, exterior surfaces, or both of the coping **130.** For example, such features can be located along an inner surface of the cavity **136.**

[0080] In some embodiments, the coping **130** can include additional connection features to reduce the likelihood of inadvertent detachment of the coping **130** from the abutment **120.** For example, in some embodiments, the coping **130** and the abutment **120** can be attached using a separate fastener such as a prosthetic screw **138.** The prosthetic screw **138** can pass through a bore **139** of the coping **130** and positively engage a connection

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feature of the abutment 120, such as threaded bore 128, or of the coupling screw 16 thereby securely attaching the coping 130 to the abutment 120. This can advantageously further reduce the likelihood of inadvertent detachment of the coping 130 from the abutment. It should be noted that, in some embodiments, the bore 139 is not preliminarily included on the coping 130 but can be formed at a later time.

[0081] For attachment to other dental components, the coping 130 can include corresponding connection features to attach to other dental components and reduce the likelihood of inadvertent removal. In some embodiments, the coping 130 can include ridges, protrusions or other features for positively engaging corresponding features on the other dental component.

[0082] With continued reference to **Figure** 1, the system 100 can include one or more provisional prostheses 140 for attachment to a dental component. In some embodiments, the provisional prosthesis 140 can have a monolithic structure with a distal end 142 designed to be attached to a dental component, such as the coping 130 (or a combined coping 130/abutment 120 or abutment 120), and a proximal end 134 designed to contact opposing dentition.

[0083] For attachment to the coping 130, the provisional prosthesis 140 can include one or more connection features designed to interact with a corresponding connection feature on the coping 130. In some embodiments, the provisional prosthesis 140 can include a cavity 146 or bore sized and shaped to at least partially receive a portion of the coping 130. In some embodiments, the cavity 146 can be located at or proximate the distal end 142 of the provisional prosthesis 140. The cavity 146 can have an aperture located along a distal surface of the provisional prosthesis 140 for allowing entry of the coping 130 into the bore. In some embodiments, the cavity 146 can include a connection feature for facilitating and enhancing the connection between the provisional prosthesis 140 and the coping 130. For example, the bore can include a bonding agent 148 which can be used to bond the provisional prosthesis 140 to the coping 130. Such bonding agents 148 can include self-curing, light-curing or other bonding agents which can convert from a relatively low viscosity fluid to a high viscosity fluid or solid. In some embodiments, the bore can be backfilled with an acrylic, such as a self-curing acrylic or a light cured composite. This acrylic can be the same material used in forming the prosthesis. Other types of connection features can also be used

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including separate fasteners, such as threaded screws or bolts, resiliently deformable members for creating a "snap-fit" or friction fit between the two components, and threading, such as threading along the internal surfaces, of the provisional prosthesis **140.**

[0084] With reference now to **Figure 2,** a cutting system **150** is illustrated which can include a cutting tool **160** and an alignment tool **170.** The cutting system **150** can form part of the provisional prosthetic system **100.** As shown in the illustrated embodiment, the alignment tool **170** can be attached to the coping **130.** However, in some embodiments, the alignment tool **170** might not be used.

[0085] The cutting tool **160** can be an elongate member having cutting surfaces located along the outer surfaces of the tool **160.** In some embodiments, the cutting tool **160** can have a pointed tip **162** to facilitate cutting in a longitudinal direction when the cutting tool **160** is moved along a longitudinal axis of the tool **160.** Accordingly, in some embodiments, the cutting tool **160** can be a drill bit having a circular cross-section. The cutting tool **160** can advantageously be used to create a bore through dental components of the provisional prosthetic system **100** such as the coping **130** and the provisional prosthesis **140.**

[0086] In some embodiments, an alignment tool **170** can be provided for facilitating the creation of a bore through the dental components. Accordingly, the alignment tool **170** can include an alignment feature **172,** such as an alignment bore, through which the cutting tool **160** can pass. In some embodiments, the alignment bore can have a cross-sectional area that is slightly greater than that of the cutting tool **160.** This can advantageously allow the cutting tool **160** to pass through the bore without contacting the sides of the bore. Of course, the bore can have a cross-sectional area that is about equal to the cross-sectional area of the cutting tool **160.** This can advantageously reduce the amount of play between the cutting tool **160** and the alignment tool **170** thereby enhancing the alignment function of the cutting tool **160.** It should be understood that the bore need not have a constant cross-sectional area. In some embodiments, only portions of the bore can be used for alignment of the cutting tool **160.** Furthermore, the bore can include additional features for facilitating use of the alignment tool **170** such as tapering along the entry of the alignment bore to facilitate insertion of the cutting tool **160** into the alignment bore.

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[0087] Furthermore, it should be understood that the bore can be oriented and positioned at various locations within the alignment tool 170 depending on the specific alignment required. For example, in some embodiments, the alignment tool can be used for creating a bore (not shown) through the coping 130 and the provisional prosthesis 140 which is aligned, or at least provides access to, a connection feature, such as threaded bore 128, of the component 120. In some embodiments, after the bore through the prosthesis 140 is created from the coping 130 side (e.g., from the distal side of the coping 130), the cutting tool 160 or another cutting tool (e.g., a cutting tool with a larger diameter than the diameter of cutting tool 160) can also reinforce and/or enlargen the bore by entering from the prosthesis 140 side (e.g., from the proximal or occlusal side of the prosthesis 140). The bore through the coping 130 and prosthesis 140 can subsequently be used to allow a fastener, such as a threaded screw or bolt, to pass therethrough and engage a connection feature of the abutment 120 or implant 110.

[0088] In some embodiments, the alignment tool 170 can be designed to be attached to the coping 130 and the provisional prosthesis 140. Accordingly, the alignment tool 170 can include a connection feature 174 designed to interact with a corresponding connection feature on the other dental component. For example, in some embodiments, the alignment tool 170 can include an annular slot or annular protrusion positioned along an exterior surface configured to engage a corresponding feature on the other dental component. In some embodiments, the connection feature 176 can be similar to provisional connection feature 126 of the abutment 120. The connection feature 176 can be designed to allow for a "snap-fit" and/or friction fit connection between the alignment tool 170 and the coping 130. This can advantageously allow the alignment tool 170 and the other dental component to be easily removed after the cutting operation has been completed. It should be appreciated that connection feature 176 can be any type of connection feature as herein described and can be included on exterior surfaces, interior surfaces, or both of the alignment tool 170.

[0089] The components of the system 100 can be manufactured from a variety of different materials such as, but not limited to, metals including titanium, cobalt chromium alloy, shape-memory alloys, polymers including acrylics, ceramics including zirconia, composite materials, and/or any other material as desired. For example, in some embodiments, the system 100 can include a cage constructed of a material which can have

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different characteristics when subject to heat. For example, the material can have a relatively rigid structure at ambient temperatures whereas the material can have a flexible or relaxed structure when subject to slightly elevated temperatures. While at ambient temperature, the cage can be used to couple two separate components together. For example, the cage can be placed inside the coping **130** to couple with the provisional connection feature **126** of the abutment **120**. To remove the coping from the abutment, the cage can be heated such that the cage has a relatively relaxed structure thereby facilitating decoupling of the coping from the abutment.

Methods of Attaching a Provisional Dental Prosthesis System

[0090] **Figure 3** illustrates a flowchart describing steps of a method **300** for attaching a provisional dental prosthetic system such as the provisional dental prosthetic system **100.** For purposes of clarity, the steps are described as being performed by a clinician; however, it should be understood that some or all of the steps of this procedure can be performed by others such as, but not limited to, the clinician's assistants and other third-parties. Moreover, some or all of the steps described herein can be performed either in situ (i.e., in the patient's mouth) or ex situ. For example, some or all of the steps described herein can be performed on a molding of the patient's teeth.

[0091] As shown in step **302,** a clinician can affix attachment mechanisms to the patient's jaw for allowing the installation of additional dental components. Accordingly, during this step, the clinician can affix one or more anchoring units, such as anchoring unit **102,** to the patient's jaw. The clinician can also affix any additional dental components including a coping, such as the coping **130,** during this step. Depending on the nature of the procedure such as the patient's condition, the remainder of the method **300** can either be performed immediately after or shortly after this step.

[0092] As shown in step **304,** the clinician can then prepare a prosthesis, such as provisional prosthesis **140,** for attachment to the anchoring unit and the coping. In some procedures, the prosthesis can be prepared chairside. That is, the clinician and/or the clinician's assistants can prepare the prosthesis during the course of the operation. For example, the clinician and/or the clinician's assistants can take the patient's existing

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prosthesis, such as a removable partial or full denture, and create one or more blind holes opposite the occlusal surfaces of the prosthesis. These blind holes can be aligned such that the prosthesis would generally be properly oriented within the patient's mouth upon completion of the method 300. Furthermore, the blind holes can be formed with a cross-sectional area slightly greater than the cross-sectional area of the coping and/or anchoring unit to permit some degree of play between the blind hole and the coping and/or anchoring unit. Use of an existing prosthesis can advantageously reduce overall complexity and costs of the procedure as modification of an existing prosthesis can be performed within a short span of time. In some instances, this procedure can be performed during a single sitting.

[0093] Of course, in some procedures, a new prosthesis can be fabricated in lieu of using the existing prosthesis. In some procedures, the new prosthesis can be prepared with the one or more blind holes already incorporated into the prosthesis. This method can be employed advantageously in situations where the clinician already knows the general placement and orientation of the implants. For example, the new prosthesis can be fabricated in advance of the operation based upon the clinician's planned placement of the implants. Accordingly, the prosthesis can be fabricated prior to the operation thereby allowing the prosthesis to be advantageously attached during a single sitting. In some embodiments, the new prosthesis can be fabricated after the implants have already been affixed to the patient's jaw such that the clinician can better judge the placement of the implants. In other procedures, the new prosthesis can be prepared without blind holes so that the clinician can create such holes as the clinician deems necessary. It should be understood that, while reference is made to the creation of blind holes in the prosthesis, other types of holes such as through-holes can also be included on the prosthesis.

[0094] As shown in step 306, the clinician can test the prosthesis for preliminary fit by seating the prosthesis on the anchoring unit, the coping, or a combination of both. During this step, the clinician can place the prosthesis over the anchoring units and copings such that at least the copings are received within one or more blind holes of the prosthesis. Upon placement of the prosthesis over the anchoring units and copings, the clinician can check to see whether the prosthesis is generally aligned with respect to the patient's jaw and opposing dentition. For example, the clinician can determine whether the occlusal surfaces are generally aligned and whether the patient's nose, lips and chin are generally aligned.

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[0095] The clinician can also determine whether the vertical dimension of occlusion (VDO) and/or vertical dimension at rest (VDR) is properly chosen. The VDO indicates the superior-inferior relationship between the maxilla and mandible when the teeth are in maximum intercuspation. Accordingly, particularly for patients who are fully and/or partially edentulous and thus lack the teeth to position in maximum intercuspation, the clinician can perform one or more tests to determine a proper VDO and/or VDR. For example, the clinician can view the overall appearance of the patient when the prosthesis is seated on the coping to determine whether the patient's nose, lips and chin appear to be in an ordinary configuration of the average person. The clinician can also determine a proper VDO and/or VDR by listening to the patient's pronunciation of certain words. The clinician can take any number of steps to ensure that a proper VDO and/or VDR will be established upon the prosthesis being seated on the copings. For example, to increase the distance between the prosthesis and the coping, the clinician can add pads to either the coping and/or the prosthesis. To decrease the distance between the prosthesis and the coping, the clinician can trim down the top most portion of the coping and/or drill a longer blind hole through the prosthesis.

[0096] The clinician can check to see whether only minor adjustments would be needed to place the prosthesis in proper alignment and achieve a proper VDO and/or VDR. Preferably, the adjustments should be sufficiently aligned such that any remaining adjustments made during the attachment step 310 can take place by placing the patient's teeth in a centric occlusion to mate the occlusal surfaces of the prosthesis to the opposing dentition.

[0097] Should the clinician determine that the prosthesis is not generally aligned, due to the location and/or orientation of the anchoring units, the clinician can remove the prosthesis and modify the anchoring units accordingly as illustrated in step 308. For example, if the anchoring unit is positioned too high with respect to the jaw, the clinician can reduce the overall height of the anchoring unit by removing portions of the anchoring unit (e.g., by reducing the height of the coping 130), such as the proximal end. If the inverse is true and the anchoring unit is positioned too low with respect to the jaw, the clinician can also increase the overall height of the anchoring unit by adding portions to the anchoring unit or by modifying other portions of the anchoring unit. If the anchoring unit is positioned at

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an incorrect angle, the clinician can modify the angling of the anchoring unit. It should be understood that any modifications can be made to the anchoring unit in order to achieve a satisfactory fit between the prosthesis and the anchoring unit. Furthermore, it should also be understood that, as an alternative procedure, the clinician can also modify the size, position and/or angle of the blind holes in the prosthesis to achieve a generally aligned fit. Upon making appropriate modifications to the anchoring units and/or prosthesis, the clinician can proceed back to step 306 to test the fit of the prosthesis with the modified anchoring units. The clinician can repeat steps 306 and 308 until a generally aligned fit is achieved.

[0098] As shown in step 310, after the clinician has determined that a satisfactory preliminary fit has been achieved, the clinician can attach the prosthesis to the coping using any of the connection features as herein discussed. Preferably, the clinician attaches the prosthesis to the coping such that the prosthesis and coping are aligned and oriented properly with respect to the opposing dentition.

[0099] For example, in some procedures, the clinician can apply a bonding agent, such as self-curing, light-curing, or other polymeric material, to the prosthesis. In some procedures, the clinician can backfill holes formed in the prosthesis with an acrylic, such as a self-curing acrylic or a light cured composite. In some procedures, the clinician can remove the prosthesis from the anchoring units and introduce the bonding agent to the blind holes and/or backfill the blind holes with an acrylic and reseat the prosthesis on the copings after the bonding agent and/or acrylic has been applied. During the bonding process, the patient's teeth can be placed in a centric occlusion to mate the occlusal surfaces of the prosthesis to the opposing dentition. Since the bonding agent and/or acrylic can have a low viscosity prior to curing and because the copings can have some degree of play within the blind holes, the orientation of the prosthesis with respect to the coping can be further modified or altered during this step. The prosthesis and coping can then be fully cured, either via passage of time or introduction of a catalyst, such as light, to the bonding agent and/or acrylic such that the prosthesis and coping are attached in the modified or altered orientation.

[0100] Accordingly, upon curing of the bonding agent and/or acrylic, the prosthesis and coping can be placed such that the provisional prosthesis is in a more proper relationship with the opposing dentition as compared with the preliminary fit. This can significantly enhance comfort and fit of the provisional prosthesis. Moreover, this

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considerably reduces the amount of guesswork being performed by the clinician who would normally be tasked with estimating the proper orientation and alignment of the prosthesis. In edentulous cases, this can be particularly advantageous as it further allows the clinician to establish the proper jaw relationship with the opposing dentition. It should be understood that other relationships between the prosthesis and opposing dentition can be chosen. For example, the patient can instead close into maximum intercuspation so that the provisional prosthesis is properly aligned in this orientation.

[0101] In some procedures, other connection features can be used to attach the prosthesis to the coping. For example, the provisional prosthesis can be attached to the coping via a fastener, a "snap-fit," a friction fit, a collar, or other connection features.

[0102] As shown in step **312,** the clinician can remove the prosthesis from the patient's jaw after the bonding agent and/or acrylic has sufficiently cured such that the prosthesis is attached to at least the coping. Since the coping is attached to the prosthesis via the cured bonding agent and/or acrylic and because the coping can be attached to the anchoring unit using a "snap-fit," a friction fit, or other similar provisional connection feature, removal of the prosthesis can result in the copings being detached from the anchoring unit. During this process, the anchoring units can remain attached to the prosthesis in an aligned configuration. Accordingly, it should be appreciated that the threshold separation force to overcome the "snap-fit," friction fit, or other provisional connection feature can be chosen such that little to no misalignment between the prosthesis and coping is caused when removing the prosthesis and coping from the anchoring unit.

[0103] As shown in step **314,** the clinician can then use a cutting tool to create a through hole into the prosthesis and coping. In some procedures, the clinician can align the through hole such that the through hole provides access to a connection feature on the abutment. As shown in step **316,** in order to more securely fasten the prosthesis to the anchoring unit, a clinician can use a fastener (e.g., prosthetic screw) to fasten the prosthesis and coping to the anchoring unit. During this step, the clinician can insert a separate fastener, such as a screw or bolt, into the recently created through-hole. The separate fastener can positively engage a connection feature of the anchoring unit, such as internal threading on the abutment, such that the prosthesis is attached to the anchoring unit via the separate fastener. Accordingly, the entire provisional prosthetic system can be attached using

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threads thereby further reducing the likelihood that the components of the system will become inadvertently detached from each other.

[0104] **Figure 4** illustrates a flowchart describing steps of a method **400** for attaching a provisional dental prosthetic system such as the provisional dental prosthetic system **100.** Certain of the steps of method **400** are similar to those of method **300.** For purposes of clarity, the steps are described as being performed by a clinician; however, it should be understood that some or all of the steps of this procedure can be performed by others such as, but not limited to, the clinician's assistants and other third-parties. Moreover, the some or all of the steps described herein can be performed either in situ (i.e., in the patient's mouth) or ex situ. For example, some or all of the steps described herein can be performed on a molding of the patient's teeth.

[0105] As shown in step **402,** a clinician can affix attachment mechanisms to the patient's jaw for allowing installation of additional dental components. Accordingly, during this step, the clinician can affix one or more implants to the patient's jaw. As with method **300,** the remainder of the method **400** can either be performed immediately after this step or shortly thereafter.

[0106] As shown in step **404,** the clinician can attach an abutment to the implant using any of the connection features and techniques as herein described. For example, in some embodiments, the abutment can be attached to the implant using a threaded coupling screw. However, it should be understood that other connection features and techniques can also be used for attaching the abutment to the implant. For example, in some embodiments, the abutment can be attached to the implant using a "snap fit" connection, friction fit connection, and/or other such connection features.

[0107] As shown in step **406,** the clinician can attach a coping to the abutment using any of the connection features and techniques as herein described. For example, in some embodiments, the coping can be attached to the abutment using a "snap-fit" connection feature on the abutment and the coping. Accordingly, the clinician can simply exert a sufficient force upon the coping in a direction towards the abutment until the "snap-fit" connection feature has been properly engaged. In some embodiments, the "snap-fit" connection feature can provide some form of feedback to the clinician to indicate that the "snap-fit" connection feature has been properly engaged. For example, the "snap-fit"

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connection feature can provide audible feedback, tactile feedback, or a combination of both to the clinician to alert the clinician of proper engagement of the coping with the abutment.

[0108] As shown in step 408, the clinician can then prepare the prosthesis for attachment to the coping. As described above with respect to method 300, the prosthesis can be prepared chairside using either the patient's existing prosthesis or a newly fabricated prosthesis. The prosthesis can be provided with blind holes or the clinician can create such blind holes during the procedure. These blind holes can be aligned such that the prosthesis would be properly oriented within the patient's mouth upon completion of the method 400. Furthermore, the blind holes can be designed to allow some degree of play between the blind holes and the coping.

[0109] As shown in step 410, the clinician can test the prosthesis for preliminary fit by seating the prosthesis on the copings. During this step, the clinician can place the prosthesis over the copings such that the copings are received within one or more blind holes of the prosthesis. Upon placement of the prosthesis over the copings, the clinician can check to see whether the prosthesis is generally aligned with respect to the patient's jaw and opposing dentition. For example, the clinician can determine whether the occlusal surfaces are generally aligned and whether the patient's nose, lips and chin are generally aligned.

[0110] The clinician can also determine whether the vertical dimension of occlusion (VDO) and/or vertical dimension at rest (VDR) is properly chosen. The VDO indicates the superior-inferior relationship between the maxilla and mandible when the teeth are in maximum intercuspation. Accordingly, particularly for patients who are fully and/or partially edentulous and thus lack the teeth to position in maximum intercuspation, the clinician can perform one or more tests determine a proper VDO and/or VDR. For example, the clinician can view the overall appearance of the patient when the prosthesis is seated on the coping to determine whether the patient's nose, lips and chin appear to be in an ordinary configuration of the average person. The clinician can also determine a proper VDO and/or VDR by listening to the patient's pronunciation of certain words. The clinician can take any number of steps to ensure that a proper VDO and/or VDR will be established upon the prosthesis being seated on the copings. For example, to increase the distance between the prosthesis and the coping, the clinician can add pads to either the coping and/or the prosthesis. To decrease the distance between the prosthesis and the coping, the clinician can

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trim down the top most portion of the coping and/or drill a longer blind hole through the prosthesis.

[0111] The clinician can check to see whether only minor adjustments would be needed to place the prosthesis in proper alignment and achieve a proper VDO and/or VDR. Preferably, the adjustments should be sufficiently aligned such that any remaining adjustments made during the bonding step **416** can take place by placing the patient's teeth in a centric occlusion to mate the occlusal surfaces of the prosthesis to the opposing dentition.

[0112] Should the clinician determine that the prosthesis is not properly aligned, due to the location and/or orientation of the copings, the clinician can remove the prosthesis and modify the copings accordingly as illustrated in step **412.** Steps to modify the copings are described in connection with step **308** above. Furthermore, it should also be understood that, as an alternative procedure, the clinician can also modify the size, position and/or angle of the blind holes in the prosthesis to achieve a generally aligned fit. Upon making appropriate modifications to the coping and/or prosthesis, the clinician can proceed back to step **410** to test the fit of the prosthesis with the modified copings. The clinician can repeat steps **410** and **412** until a generally aligned fit is achieved.

[0113] As shown in step **414,** after the clinician has determined that a satisfactory fit has been achieved, the clinician can apply a bonding agent, such as self-curing or light-curing polymeric material, to the prosthesis. In some procedures, the clinician can backfill holes formed in the prosthesis with an acrylic, such as a self-curing acrylic or a light cured composite. In some procedures, the clinician can remove the prosthesis from the copings and introduce the bonding agent and/or acrylic to the blind holes. The amount of bonding agent and/or acrylic chosen should be sufficient to adequately cover the copings upon placement of the prosthesis on the copings as this can enhance the connection between the coping and the prosthesis. However, care should be taken such that the blind holes are not overfilled thus causing the bonding agent and/or acrylic to leak onto other components or onto soft tissue thereby potentially causing complications and increasing the overall procedural time. Of course, a greater or lesser amount of bonding material and/or acrylic can be used based on the bonding strength desired.

[0114] As shown in **416,** after the clinician has applied the bonding agent to the prosthesis and/or backfilled the blind holes with an acrylic, the clinician can then bond the

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prosthesis to the copings. In procedures where the bonding agent and/or acrylic was applied to the blind holes, this can be achieved by simply seating the prosthesis in the same manner as was performed during step **410.** During the bonding process, the patient's teeth can be placed into a centric occlusion to mate the occlusal surfaces of the prosthesis to the opposing dentition. Accordingly, the prosthesis can advantageously be placed in a more proper relationship with the opposing dentition. It should be understood that other relationships between the prosthesis and opposing dentition can be chosen. For example, the patient can instead close into maximum intercuspation so that the prosthesis is properly aligned in this orientation.

[0115] As shown in step **418,** after the bonding agent and/or acrylic has sufficiently cured such that the prosthesis is attached to the coping, the clinician can remove the prosthesis from the abutments. Since the copings are attached to the prosthesis via the cured bonding agent and/or acrylic and because the copings are attached to the abutments using only a "snap-fit," friction fit, or other similar provisional connection, removal of the prostheses can result in the copings being removed along with the prosthesis. Moreover, since the copings remain attached via the cured bonding agent and/or acrylic, the copings can remain attached to the prosthesis in an aligned configuration. Accordingly, it should be appreciated that the threshold separation force to overcome the "snap-fit," friction fit, or other provisional connection feature can be chosen such that little to no misalignment between the prosthesis and coping is caused when removing the prosthesis and coping from the abutment.

[0116] As shown in steps **420** and **422,** a through-hole can be created in the prosthesis and the coping to allow for a fastener, such as a screw or bolt, to pass through the prosthesis and coping. During these steps, the clinician can use a cutting tool such as cutting tool **160** to prepare the through-hole.

[0117] As shown in step **420,** in order to assist with proper placement and alignment of the through-hole, the clinician can first attach an alignment tool, similar to alignment tool **170,** to the coping. In some procedures, the alignment tool can be attached to the coping using a "snap-fit," friction fit, or other provisional connection feature. In some procedures, the alignment tool can be keyed to ensure that the alignment tool is properly oriented with respect to the coping. Upon attaching the alignment tool to the coping, the

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clinician can then insert the cutting tool through an alignment feature, such as alignment bore **172,** and create a through hole into the coping and prosthesis as is shown in step **422.** In some embodiments, an alignment tool 170 might not be used. In some embodiments, step **422** can include an additional step of creating an additional hole through the prosthesis from the occlusal surface towards the coping. This additional hole can have a greater diameter than the original through-hole and be generally coaxial with the original through-hole. This step can be performed when a fastener being used is larger than the original through-hole.

[0118] As shown in step **424,** in order to more securely fasten the prosthesis to the abutments, a clinician can use a fastener to fasten the prosthesis to the abutment. During this step, the clinician can insert a separate fastener, such as a screw or bolt, into the recently created through-hole. The separate fastener can positively engage a connection feature on the abutment, such as internal threading, such that the prosthesis and coping is attached to the abutment via the separate fastener. Accordingly, the entire provisional prosthetic system can be attached using threads thereby reducing the likelihood that the components of the system will become inadvertently detached.

[0119] As shown step **426,** the clinician can then seal the through-hole with a sealing agent to enhance the appearance of the prosthesis and prevent or at least reduce the likelihood of foreign matter collecting within the through hole. Upon removal of the prosthesis, such as may be the case prior to attachment of a permanent prosthetic system, the clinician can remove the sealing agent to regain access to the separate fastener and remove the prosthesis and coping from the abutment.

Provisional Dental Prosthesis and Attachment System

[0120] With reference to **Figure 5,** an embodiment provisional prosthesis **510** is illustrated which can be used in a provisional dental prosthesis system described herein. The provisional prosthesis **510** can include a base **512** upon which one or more prosthetic teeth **514** are attached. The base **512** can include a first side on which the teeth **514** are attached and a second side opposite the first side configured to be placed in contact with soft tissue adjacent the patient's jawbone. As shown in the illustrated embodiment, the provisional prosthesis **510** can be a full bridge such that the provisional prosthesis **510** replaces the entire

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set of teeth along either the maxillary and/or mandibular arches. As noted above, the provisional prosthesis **510** can also be a partial bridge that replaces fewer than the entire set of teeth along the maxillary and/or mandibular arches. Furthermore, as noted above, the provisional prosthesis **510** can also be a crown to replace a single tooth. In some embodiments, the provisional prosthesis **510** can be a patient's existing prosthesis such as a full or partial denture.

[0121] **Figures 6** illustrate components of an anchoring unit **600** which can include a dental implant **610** and an abutment **650.** In the illustrated embodiment, the implant **610** can include threading **612** about an external surface of the implant **610** and a flange **614.** The threading **612** can be used to fasten the implant **610** to bone in the patient's jaw and the flange **614** can be designed to sit atop the bone such that the implant **610** remains above soft tissue surrounding the bone. As shown in the illustrated embodiment, the threading **612** can extend partially from the fiange **614** towards a distal end **616** of the implant **610.** Such threading **612** can extend further towards the flange **614** to increase the threaded contact surface of the implant **610.** Furthermore, the threading **612** can begin at a position below the fiange **614.** At a proximal end **618** of the implant **610,** an abutment **650** can be attached using any of the connection features and techniques as herein described. For example, the implant **610** can include an internally threaded bore (not shown) configured to engage a threaded shaft of the abutment **650.** It should be appreciated that, in some embodiments, the flange **614** can be omitted and the threading **612** can extend towards the proximal edge of the implant.

[0122] The abutment **650** can include an annular slot **652** circumscribing a proximal portion **654** of the abutment **650.** This annular slot **652** can serve as a provisional connection feature between the abutment **650** and the coping **700.** Other shapes and designs can also be used. For example, in some embodiments, the slot **652** can circumscribe only portions of the abutment **650.** Moreover, the abutment **650** can include annular protrusions or ribs, dimples circumscribing the abutment **650,** or a combination of any of the above. In some embodiments, the abutment **650** can include vertically oriented slots or protrusions which can both facilitate alignment of the abutment **650** with another component, such as a coping **700** (shown in **Figure 7A).** The abutment **650** can include pins or dowels, or holes

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configured to receive pins or dowels on an attached component, as connection features. In some embodiments, the abutment **650** can omit slot **652.**

[0123] As shown in the illustrated embodiment, the proximal portion of the abutment **650** can have a frustoconical shape which tapers towards the proximal end. However, it should be understood that the proximal portion of the abutment **650** can have any other type of shape and need not exhibit rotational symmetry. As described above, the proximal portion and/or the distal portion (not shown) of the abutment **650** can be keyed such that components attached thereto can be in only certain orientations.

[0124] With reference now to **Figure 7A,** the coping **700** can include a distal portion **702** having a cavity **704** sized and shaped to receive at least some portion of the proximal portion of the abutment **650.** The cavity **704** can have a frustoconical shape, or any other shape, similar to that of the abutment **650.** Preferably, the cavity **704** is shaped to closely fit the shape of the abutment **650.** In some embodiments, the cavity **704** can be sized and shaped to receive a keyed feature on the abutment **650** to further ensure that the abutment **650** and the coping **700** are properly aligned and oriented prior to attachment. The cavity can also include an annular recess **706** located along an interior surface of the cavity **704.** The recess **706** can be sized and to receive a resilient spring element **708** thereby forming a provisional connection feature designed to positively engage the annular slot **652** of the abutment **650**. The resilient spring element **708** can be designed to provide the clinician with audible and/or tactile feedback when the spring element **708** engages the slot **652.** It should be appreciated that use of a separate resilient spring element **708** can advantageously allow the coping **700** to be manufactured from a less resilient, and potentially more durable, material that can be more resistant to deformation. This increased durability can reduce the likelihood that the coping **700** deforms upon removal of the coping **700** from the abutment **650** as described in connection with **Figure 4.** In some embodiments, the spring element **708** can be an annular ring spring **730 (Figure 7B)** which projects radially inward and beyond the recess **706** such that it can positively engage annular slot **652** of the abutment **650.** In some embodiments, the annular ring spring **730** can include resiliently deformable fingers (not shown) which project radially inward and beyond the recess **706.** In some embodiments, a wave spring **732 (Figure 7C)** which has portions which project radially inward beyond the recess **706** can be used. The wave spring **732** can be a flat wire wave spring, a single turn

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wave spring, a Marcel Expander or other type of wave spring as desired. The spring element 708 can have flat or non-flat cross-section including a circular cross-section. Other types of designs can be used such as Belleville washers, curved disc springs, wave washers, split washers, internal and/or external tooth lock washers, internal and/or internal serrated washers, . The characteristics of the spring element 708 can be chosen such that the spring element 708 can maintain the positioning and orientation of the abutment 650 and the coping 700 during the procedure described above yet still be removable without significant force. In the illustrated embodiment, the wave spring 732 includes four (4) radially inward projections. In modified embodiments, the wave spring can include more or less projections, such as, for example, 1, 2, 3, 5, or 6 projections. One advantage of the illustrated wave springe arrangement is that the arrangement can still provide an inward force even if a portion of the radially inward projections encounters an opening in the annular slot 652 (see e.g., Figure 14 and slot 910).

[0125] In some embodiments, other structures can be used to create a provisional connection feature. For example, the coping 700 can include an annular rib, protrusion, dimples or similar resilient features to interact with the annular slot 652. Furthermore, the vertically oriented slots or protrusions can also be included along the interior surface of the cavity 704. Along the outer surface of the distal portion 702, the coping 700 can include a flange 710.

[0126] The proximal portion 712 of the coping 700 can include an elongate member 714 extending in a longitudinal direction. The elongate member 714 can include multiple annular projections 716 or ribs which project outwardly from the elongate member 714 in a radial direction. The annular projections 716 can be spaced apart to form annular slots 718. As will be described in further detail below, inclusion of the projections 716 and slots 718 along the elongate member 714 can advantageously enhance the connection between the coping 700 and the prosthesis 510 when a bonding agent and/or acrylic is used. In some embodiments, protrusions 716 can extend only partially around the elongate member 714 and can extend only partially along the length of the elongate member 716. Other structures can be also used for providing a similar benefit. For example, dimples or bosses can also be used with or without the protrusions 716 and slots 718. Furthermore, the surfaces of the coping 700 can be roughened. In some embodiments, these protrusions 716, slots 718,

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dimples, and/or bosses can also be included on interior surfaces of the elongate member **714** and therefore be located within a bore **720.** Similar structures, e.g., grooves, can also be used on the exterior surface of the flange 710 of the coping.

[0127] As shown in the illustrated embodiment, the elongate member **714** can include a longitudinal bore **720** through at least a portion of the elongate member **714.** As will be described in further detail below, this bore **720** can be sized and shaped to allow a fastener to pass therethrough. At a proximal end of the bore **720,** a plug **722** can be provided which can reduce the likelihood of foreign materials entering into the bore **720.** The plug **722** can be manufactured from the same material as the coping **700** or be manufactured from a different material. In some embodiments, it can be preferable to manufacture the plug **722** from a softer material to facilitate cutting or drilling the plug **722.** At an opposite end of the bore **720,** the coping **700** can include an aperture **724** and a rim **726.**

[0128] With reference now to **Figure 8,** an abutment **650** is shown inserted into the cavity **704** of the coping **700** and the elongate member **714** of the coping **700** is shown inserted into a bore **516** of the prosthesis **510** with prosthesis **510** seated on the elongate member **714.** As shown in the illustrated embodiment, coping **700** has been partially modified to reduce the overall height of the elongate member **714.** As described above in connection with **Figures 3** and **4,** this can be performed by the clinician to achieve a more satisfactory fit between the prosthesis **510** and the coping **700.** Furthermore, as shown in the illustrated embodiment, the abutment **650** and the coping **700** can be attached via the retention spring **708.** In some embodiments, the aperture **724** can be aligned with a bore **654** of the abutment **650** with the rim **726** adjacent to and contacting at least a portion of the proximal end of the abutment **650.** As shown in the illustrated embodiment, the bore **654** can be partially or entirely internally threaded or include a connection feature. Moreover, a coupling screw **656** can pass through the bore **654** for coupling the abutment to the implant **600.**

[0129] With reference now to **Figure 9,** a bonding agent **518** such as a self-curing or light curing polymeric material, and/or an acrylic, can be introduced into the bore **516** of the prosthesis **510.** Upon curing of the bonding agent **518** and/or acrylic, the prosthesis **510** and the coping **700** can be securely attached. This attachment can be enhanced via use of surface features such as protrusions **716** and slots **718.** Furthermore, this attachment can be

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further enhanced by increasing the surface roughness of the interior surfaces of bore **516.** It should be appreciated that due to the existence of plug **722,** the bonding agent **518** and/or acrylic is not introduced into the bore **720.** During a cutting or drilling operation, this can advantageously reduce the likelihood of difficulties associated with cutting or drilling through the cured bonding agent **518** and/or acrylic which could potentially gum up the cutting surfaces of the cutting tool. In some embodiments, the plug can be removed to allow the bonding agent **518** and/or acrylic to be received within the bore **720.** Such an embodiment may be advantageous when a more secure bond between the prosthesis **510** and the coping **700** is desired.

[0130] The metal surfaces of components can be surface treated to further enhance bonding. In some embodiments, a primer can be applied to surfaces of components of the provisional dental prosthesis system such as the coping **700.** For example, a metal primer can be applied to metal surfaces of components to enhance the bond between the metal surfaces and the bonding agent **518** and/or acrylic. In some embodiments, the primer can advantageously enhance the bond between the metal surface of the component and bonding agent **518** and/or acrylic. The primer can be pre-applied to such surfaces such that the clinician need not apply the primer during the procedure. In some embodiments, the surfaces of components can include other surface treatments for further enhance the bond between the surface and the bonding agent **518** and/or acrylic. For example, the surfaces of components, such as metal components, can be roughed to further enhance the bond between the component and the bonding agent **518** and/or acrylic. This can be achieved by sandblasting or other means of roughening a surface.

[0131] With reference now to **Figures 10** and **11,** an alignment tool **800** is shown inserted into the cavity **704** of the coping **700** and the elongate member **714** of the coping **700** is shown inserted into a bore **516** of the prosthesis **510** with prosthesis **510** seated on the elongate member **714.** Furthermore, a drill bit **850** is shown inserted into the alignment tool **800** and the bore **720** of the coping **700.** As shown in the illustrated embodiment, the alignment tool **800** can have a shape similar to that of the abutment **650** and include a similar connection feature in the form of an annular slot **802** for receiving the retention spring **708.** Other connections features between the alignment tool **800** and coping **700** are also contemplated. For example, the alignment tool **800** can be attached to the coping **700** using

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other "snap fit" connections as herein described, friction fit connections, clamps, fasteners, and the like. For example, the alignment tool **800** can be inserted into the cavity of the coping **700** with a friction fit connection or the distal portion of the coping **700** can be inserted into a cavity of the alignment tool **800** (e.g., a drill guide) with a friction fit connection. The alignment tool **800** can include an alignment bore **804** to receive and align the drill bit **850** as the drill bit **850** passes through the alignment tool **800.** As shown in the illustrated embodiment, the alignment bore **804** can be aligned with the aperture **724** of the coping **700** such that the drill bit **850** passes through aperture **724.** The drill bit **850** can then be used to create a bore **519** through the plug **722,** portions of the bonding agent **518** and/or acrylic, and the prosthesis **510** as shown in **Figure 9.** As described herein, in some embodiments, an alignment tool **800** might not be used. As also described herein, in some embodiments, after the bore through the prosthesis **510** is created from the coping **700** or provisional crown side, the drill bit **850** or another drill bit can reinforce and/or enlargen the bore by entering from the prosthesis **510** side.

[0132] With reference now to **Figure 12,** an abutment **650** is shown inserted into the cavity **704** of the coping **700** and the elongate member **714** of the coping **700** is shown inserted into a bore **516** of the prosthesis **510** with prosthesis **510** seated on the elongate member **714.** Furthermore, a fastener **750** has been inserted into the bore **519** and into bore **720** such that the head **752** of the fastener **750** is adjacent to and seated on the rim **726** and the shaft **754** is inserted through aperture **724** and into bore **654** of the abutment **650.** In some embodiments, the shaft **754** can be threaded along an exterior surface such that it engages corresponding threading within bore **654.** Accordingly, the coping **700** and prosthesis **510** can be securely attached to the abutment **650** using the threaded screw. In order to reduce the likelihood of foreign material entering into bore **519,** a seal **520** can be introduced into the bore **519.**

[0133] With reference now to **Figure 13,** another embodiment of an upper portion of an abutment **800** (e.g., a multi-unit abutment) and coping **850** is illustrated. The abutment **800** can have a distal portion **802** for attachment to an implant and a proximal portion **804** for attachment to a coping such as coping **850** and/or to a dental component such as, for example, a dental restoration or dental restoration component, such as, for example, a multi-unit bridge and/or restoration. As shown in the illustrated embodiment, the abutment **800** can

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include a recess slot **806,** such as an annular slot, about a proximal portion **804** of the abutment **800.** Similar to annular slot **652,** slot **806** can serve as a provisional connection feature between the abutment **800** and the coping **850** and/or the coping configurations described above. Other shapes and designs can also be used. For example, in some embodiments, the slot **806** can circumscribe only portions of the abutment **800.** Moreover, the abutment **800** can include annular protrusions or ribs, dimples circumscribing the abutment **800,** or a combination of any of the above. In some embodiments, the abutment **800** can include vertically oriented slots or protrusions which can both facilitate alignment of the abutment **800** with another component, such as a coping **850.** The abutment **800** can include pins or dowels, or holes configured to receive pins or dowels on an attached component, as connection features. In some embodiments, the abutment **800** can omit slot **806.**

[0134] The proximal portion **804** can have a frustoconical shape which tapers towards the proximal end. A tapered portion **807** can be designed to facilitate the placement of the coping over the abutment **800** by providing a lead-in ramp for the provisional connection features of coping **850,** such as spring element **708,** designed to positively engage the slot **806** of the abutment **800.** Of course, it should be understood that the proximal portion of the abutment **800** can have any other type of shape as desired. Moreover, as shown in the illustrated embodiment, the abutment **800** can include a keyed feature **808** such that the component attached thereto, such as the coping **850** is properly aligned prior to coupling with the abutment **800.** This keyed feature **808** can have, for example, a hexagonal cross section designed to engage a corresponding hexagonal recess in the coping. Other shapes can be used for keyed feature **808** such as other types of polygons, lobular shapes such as trilobular and hexalobular shapes, elliptical shapes, and any other shape as desired.

[0135] In some embodiments, the proximal portion **804** can include a flange forming a seat **810.** The seat **810** can be designed to contact a portion of the coping **850,** such as the distal end surface **856,** upon the coping **850** being coupled via the provisional connection feature, a prosthetic screw, or both. The seat **810** can advantageously serve as a stop element for the coping which can prevent or reduce the likelihood that a clinician overshoots insertion of the coping over the abutment **800.** The seat **810** can also be used to

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support a final or temporary restoration such as, for example, multiple unit abutment, bridge, and/or restoration.

[0136] With continued reference to **Figure 13,** the coping **850** can have a similar design to that of coping **700.** For purposes of brevity, reference should be made to the discussion of coping **700** for details regarding the internal structure of coping **850.** As shown in **Figure 13,** the coping **850** can include fewer protrusions **852** and slots **854** As described above, the surfaces of components can be surface treated to further enhance bonding. In some embodiments, a primer can be applied to surfaces of components of the provisional dental prosthesis system such as the coping **850.** For example, a metal primer can be applied to metal surfaces of components to enhance the bond between the metal surfaces and the bonding agent **518** and/or acrylic. In some embodiments, the primer can advantageously enhance the bond between the metal surface of the component and an acrylic bonding agent **518** and/or acrylic. The primer can be pre-applied to such surfaces such that the clinician need not apply the primer during the procedure. In some embodiments, the surfaces of components can include other surface treatments for further enhance the bond between the surface and the bonding agent **518** and/or acrylic. For example, the surfaces of components, such as metal components, can be roughed to further enhance the bond between the component and the bonding agent **518** and/or acrylic. This can be achieved by sandblasting or other means of roughening a surface.

[0137] With reference now to **Figures 14** and **15,** another embodiment of an upper portion of an abutment **900** is illustrated. Abutment **900** can include a distal portion **902** for attachment to an implant and a proximal portion **904** for attachment to a coping such as coping **850** and/or to a dental component such as, for example, a dental restoration or dental restoration component such as, for example, a multi-unit bridge and/or restoration. As shown in the illustrated embodiment, abutment **900** is angled such that the longitudinal axis **906** of the distal portion **902** forms an angle with the longitudinal axis **908** of the proximal portion **904.** Accordingly, when the abutment **900** is attached to an implant and a coping, the coping would form an angle with the implant. Such an angle can be desirable, for example, if the implant is affixed to the jaw such that the implant is not generally orthogonal to the occlusal plane. In some embodiments, a first screw, similar to coupling screw **16,** can be used to couple the abutment **900** to an implant. In some embodiments, the first screw can be

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oriented parallel to axis **906.** Of course, the first screw can also be oriented along another axis. A second screw, similar to prosthetic screw **138,** can be used to couple the coping, such as coping **850,** to the abutment **900.** In some embodiments, the second screw can be oriented parallel to axis **908.** As with first screw, the second screw can be oriented along another axis. In some embodiments, the first screw and the second screw can be oriented parallel to different axes. Accordingly, it should be understood that the abutment **900** can include one or more bores to receive such screws.

[0138] As shown in the illustrated embodiment, the abutment **900** can include slot **910,** such as an annular slot, about a proximal portion **904** of the abutment **900.** Similar to annular slot **652,** slot **910** can serve as a provisional connection feature between the abutment **900** and the coping **850.** Other shapes, designs and features described in connection with abutment **800** can also be used with abutment **900.** For purposes of brevity, reference should be made to the discussion of abutment **800** for details regarding such features. In some embodiments, the abutment **900** can omit slot **910.**

[0139] As shown in the illustrated embodiment, the proximal portion of the abutment **900** can have a frustoconical shape which tapers towards the proximal end. However, it should be understood that the proximal portion of the abutment **900** can have any other type of shape and need not exhibit rotational symmetry. Moreover, the abutment **900** can include a keyed feature (not shown) such that the component attached thereto, such as the coping **850** is properly aligned prior to coupling with the abutment **900.**

[0140] With reference now to **Figures 16** and **17,** an embodiment of an abutment **1000** is illustrated. Abutment **1000** can have features similar to those of abutments **650, 800, 900.** As shown in the illustrated embodiment, the abutment **1000** can include a distal portion **1002** for attachment to an implant and a proximal portion **1004** for attachment to a coping such as those described herein. Along the distal portion **1002,** the abutment **1000** can include a threaded portion **1006,** the threaded portion having a shaft **1008** with external threading at least partially, if not entirely, along its length. The threading of the threaded portion **1006** can be designed to couple with a corresponding internally threaded portion of an implant. As shown in the illustrated embodiment, the threaded portion **1006** can be integrally formed with the abutment **1000.** Accordingly, a clinician can attach the abutment **1000** to an implant by rotating the entire abutment **1000.** The monolithic structure can provide greater structural

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integrity compared to a two-piece structure. In some embodiments, the abutment **1000** can instead utilize a coupling screw, similar to coupling screw **16,** that passes through an internal bore (not shown) of the abutment **1000** similar to the internal bore **125.** The clinician can then attach the abutment **1000** to an implant without rotating the entire abutment **1000.** This can be particularly advantageous in situations where it would be difficult to rotate the abutment **1000.**

[0141] As shown in the illustrated embodiment, the abutment **1000** can include a recess or slot **1010,** such as an annular slot, about a proximal portion **1004** of the abutment **1000.** Similar to annular slot **652,** slot **1010** can serve as a provisional connection feature between the abutment **1000** and a coping, such as coping **1050** described in connection with **Figures 18** and **19.** Other shapes, designs and features described in connection with abutment **800** can also be used with abutment **1000.** For purposes of brevity, reference should be made to the discussion of abutment **800** for details regarding such structures. In some embodiments, the abutment **1000** can omit slot **1010.**

[0142] The proximal portion **1004** can have a frustoconical shape which tapers towards the proximal end. A tapered portion **1012** can be designed to facilitate the placement of the coping over the abutment **1000** by providing a lead-in ramp for the coping's provisional connection feature, such as spring element **708** or other resilient element, designed to positively engage the slot **1010** of the abutment **1000.** Of course, it should be understood that the proximal portion of the abutment **1000** can have any other type of shape as desired. Moreover, as shown in the illustrated embodiment, the abutment **1000** can include a keyed feature **1014.** The keyed feature **1014** can be designed such that the component attached thereto, such as a coping, is properly aligned prior to coupling with the abutment **1000.** This keyed feature **1014** can have, for example, a hexagonal cross section designed to engage a corresponding hexagonal recess in the coping. Other shapes can be used for keyed feature **1014** such as other types of polygons, lobular shapes such as trilobular and hexalobular shapes, elliptical shapes, and any other shape as desired. The keyed feature **1014** can also be used to engage a driving tool to rotate the abutment **1000** for purposes of coupling the abutment **1000** to an implant. In some embodiments, the keyed feature **1014** can include a chamfered or beveled proximal edge which can facilitate placement of the component over the keyed feature **1014.**

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[0143] In some embodiments, the proximal portion **1004** can include a flange forming a seat **1016.** The seat **1016** can be designed to contact a portion of the coping upon the coping being coupled via a provisional connection feature, a prosthetic screw, or both. The seat **1016** can advantageously serve as a stop element for the coping (or other mating component) which can prevent or reduce the likelihood that a clinician overshoots insertion of the coping over the abutment **1000.**

[0144] With reference now to **Figures 18** and **19,** an embodiment of a coping **1100** is illustrated which can have features similar to those described in connection with copings **130, 700, 850** and can be used with the various abutments described herein. As shown in the illustrated embodiment, the coping **1100** can include a distal portion **1102** having a cavity **1104** sized and shaped to receive at least some portion of the proximal portion of an abutment such as abutment **1000.** The cavity **1104** can have a cylindrical shape or any other shape as desired. In some embodiments, the cavity **1104** can be sized and shaped to receive a keyed feature, such as keyed feature **1014,** on the abutment **1000** to further ensure that the abutment **1000** and the coping **1100** are properly aligned and oriented prior to attachment.

[0145] As shown in the illustrated embodiment, the coping **1100** can include a provisional connection feature **1106** integrally formed therein. As shown in the illustrated embodiment, the provisional connection feature **1106** can be in the form of one or more resilient elongate fingers **1108.** The fingers **1108** can be designed to resiliently deform radially outward upon application of a force in that direction. The fingers **1108** can include an engagement protrusion **1110** sized and shaped to be received within a recess or slot, such as slot **1010,** of the abutment **1000.** The fingers **1108** can also have a tapered portion **1112.** This tapered portion **1112** can be designed to abut the tapered portion **1012** of the abutment **1000** thereby enhancing stability of the coping **1100** with respect to the abutment **1000.** Of course, other shapes and sizes for fingers **1108** can be used. For example, the coping **1100** can include an annular rib, protrusion, dimples or similar resilient features to interact with the slot **1010.** Furthermore, the vertically oriented slots or protrusions can also be included along the interior surface of the cavity **1104.** In some embodiments, the provisional connection feature **1106** can be separate from the remainder of the coping **1100** such as is shown in the embodiments of **Figures 21-26.** The provisional connection feature **1106** can be

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manufactured separately from the coping **1100** as one or more pieces which are later attached to the remainder of the coping **1100.** In some embodiments, the provisional connection feature **1106** can be removably attached. In other embodiments, the provisional connection feature **1106** can be permanently attached.

[0146] The distal portion **1102** of the coping **1100** can include a distal surface **1114.** For example, as shown in the illustrated embodiment, the distal surface **1114** can form an annular rim. The distal surface **1114** can contact the seat **1016** of the abutment **1000** when the coping **1100** is engaged to the abutment **1000.** In some embodiments, contact between the seat **1016** and the surface **1114** can form a seal to prevent or reduce the likelihood of foreign matter entering into the cavity **1104.**

[0147] The proximal portion **1116** of the coping **1100** can have a similar design to that of copings **130, 700,** and **850.** In some embodiments, the coping **1100** can include an elongate member **1118** extending in a longitudinal direction. The elongate member **1118** can include multiple projections **1120** or ribs which project radially outwardly from the elongate member **1118.** The projections **1120** can be spaced apart to form annular slots **1122.** As shown in the illustrated embodiment, protrusions **1120** can extend only partially around the elongate member **1118** and can extend only partially along the length of the elongate member **1118.** Other structures as described herein can be also used for providing a similar benefit. For example, dimples or bosses can also be used with or without the protrusions **1120** and slots **1122.** Furthermore, the surfaces of the coping **1100** can be roughened. In some embodiments, these protrusions **1120,** slots **1122,** dimples, and/or bosses can also be included on interior surfaces of the elongate member **1118** and therefore be located within a bore **1124.**

[0148] As shown in the illustrated embodiment, the elongate member **1118** can include a longitudinal bore **1124** through at least a portion of the elongate member **1118.** As will be described in further detail below, this bore **1124** can be sized and shaped to allow a fastener to pass therethrough, similar to bores **139, 720.** The bore **1124** can form an opening **1126** at a proximal end of the elongate member **1118.** Of course, similar to other embodiments described herein, a plug, such as plug **722,** to initially cover the opening **1126.** At an opposite end of the bore **1124,** the coping **1100** can include an aperture **1128** and a rim **1130,** similar to aperture **724** and rim **726,** designed to allow a fastener **1132** to pass

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therethrough and couple the coping **1100** to an abutment such as abutment **1000** as shown in **Figure 20.**

[0149] With reference now to **Figures 21-23,** an embodiment of a coping **1200** is illustrated which can have features similar to those described in connection with copings **130, 700, 850, 1100** and can be used with the various abutments described herein. As shown in the illustrated embodiment, the coping **1200** can include a body component **1202** and a connector component **1204.** As shown in the illustrated embodiment, the body component **1202** and the connector component **1204** can be two separate pieces which can advantageously facilitate manufacture of the coping **1200.** The connector portion **1204** can be designed such that it can be removably attached to the body component **1202** or can be designed such that, once attached, the connector portion **1204** can be difficult to remove.

[0150] With continued reference to **Figures 21-23,** the connector component **1204** can include a head portion **1206** and a foot portion **1208.** The foot portion **1208** can include a provisional connection feature such as resilient fingers **1209** similar to those of coping **1100.** In some embodiments, the foot portion **1208** can include any other provisional connection feature including spring elements such as annular ring spring **730,** wave spring **732,** and any other provisional connection feature. The resilient fingers **1209** can be used to couple the coping **1200** to an abutment such as abutment **1250** or any other abutment such as abutments **120, 650, 800, 900.** A connecting screw **1260** can be used to couple the coping **1200** to the abutment **1250.**

[0151] The head portion **1206** can be sized to be received within a cavity **1210** of the body component **1202.** In some embodiments, the head portion **1206** can have one or more cross-sectional dimensions equal to, or greater than, one or more cross-sectional dimensions of the cavity **1210.** For example, in some embodiments, the cross-sections of the head portion **1206** and/or the cavity **1210** are circular and the head portion **1206** can have a diameter equal to, or greater than, the diameter of the cavity **1210.** In this manner, the head portion **1206** and the cavity **1210** can be coupled via a friction fit or interference fit. In order to facilitate this friction fit, the top edge of the head portion **1206** can be beveled or tapered. In some embodiments, the head portion **1206** can have a cross-section less than that of the cavity **1210.** In such an embodiment, as well as any other embodiment described herein, another fastening mechanism, such as an adhesive or fastener, can be used to couple the body

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component **1202** and the connector component **1204** together. The head portion **1206** can include a keyed feature which corresponds to a keyed feature of cavity **1210** which can facilitate proper orientation of the body component **1202** with the connector component **1204** in embodiments where there are one or more proper orientations. The engagement between the body component **1202** and the connector component **1204** can be chosen such that the force required to separate the two components **1202, 1204** is greater than the force required to separate the coping **1200** from the abutment, such as abutment **1250,** to which it is attached.

[0152] With reference now to **Figures 24-26,** an embodiment of a coping **1300** is illustrated which can have features similar to those described in connection with copings **130, 700, 850, 1100, 1200** and can be used with the various abutments described herein. Similar to coping **1200,** the coping **1300** can include a body component **1302** and a connector component **1304.** The connector component **1304** can include a head portion **1306** and a foot portion **1308.** The foot portion **1308** can include a provisional connection feature such as resilient fingers **1309** similar to those of coping **1100, 1200.** In some embodiments, the foot portion **1308** can include any other provisional connection feature including spring elements such as annular ring spring **730,** wave spring **732,** and any other provisional connection feature. The resilient fingers **1309** can be used to couple the coping **1300** to an abutment such as abutment **1250** or any other abutment such as abutments **120, 650, 800, 900.** A connecting screw **1260** can be used to couple the coping **1300** to the abutment **1250.** As shown in the illustrated embodiment, the head portion **1306** can include external threads **1310** which can engage corresponding internal threads **1312** of the body component **1302.** In some embodiments, the head portion **1306** can include internal threads and the body component **1302** can include internal threading.

[0153] With reference now to **Figures 27A** and **27B,** an embodiment of an abutment **1400** (e.g., a combined abutment and coping) is illustrated which can have any one or more of the features described herein with respect to other embodiments. As shown in the illustrated embodiment, the abutment **1400** can include a distal portion **1402** sized and shaped to be inserted into a recess, bore, or cavity of a proximal portion of an implant. The distal portion **1402** can include an annular surface **1414** and can have a cylindrical shape, a tapered shape, or any other shape as desired.

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[0154] As shown in the illustrated embodiment, the abutment **1400** can include a provisional connection feature **1406.** The provisional connection feature **1406** can be in the form of one or more elongate fingers **1408.** The fingers **1408** can be similar to other fingers described herein. For example, the fingers **1408** can be resilient fingers. As shown in the illustrated embodiment, the fingers **1408** can include a straight portion **1409** and an engagement protrusion **1410.** Of course, other shapes, sizes, and elements for the provisional connection feature **1406** can be used.

[0155] In various embodiments, the distal portion **1402** of the abutment **1400** can be used to mate with the proximal portion of an implant. In some such embodiments, the abutment **1400** can form a snap-fit connection with the implant via the provisional connection feature **1406.** For example, one or more fingers **1408** can be resilient. One or more engagement protrusions **1410** of one or more fingers **1408** can snap-fit into a groove or similar feature of the implant. In some other embodiments, the abutment **1400** can form a friction fit connection with the implant via the provisional connection feature **1406.** For example, one or more engagement protrusions **1410** of one or more fingers **1408** can press against an interior surface (e.g., an interior surface of a recess, bore, or cavity) of the implant.

[0156] In various embodiments, the proximal portion **1416** of the abutment **1400** can include an elongate member **1418** extending in a longitudinal direction as described herein with respect to other embodiments. For example, the elongate member **1418** can include multiple projections **1420** spaced apart to form annular slots **1422.** The proximal portion **1416** and the distal portion **1402** can be formed integrally or manufactured separately. In some embodiments, the proximal portion **1416** and the distal portion **1402** are made with the same material(s), while in other embodiments, they are made with different materials. In one example, the distal portion **1402** including the fingers **1408** is made of a metal (e.g., titanium) and the proximal portion **1416** including the elongate member **1418** is made of a polymer (e.g., a PEEK material). In another example, the distal **1402** and proximal **1416** portions are both made of a metal (e.g., the same metal). In another example, the distal **1402** and proximal **1416** portions are both made of a polymer (e.g,, the same polymer). In some embodiments, a portion of the distal portion **1402** can be made of a different material from another portion of the distal portion **1402.** In some embodiments, a

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portion of the proximal portion **1416** can be made of a different material from another portion of the proximal portion **1402.**

[0157] As described herein, features can vary in size, shape, and elements. For example, **Figures 27C-27E** illustrate other embodiments of an abutment (e.g., a combined abutment and coping) having a variation in the distal portion. In particular, compared to the embodiment shown in **Figures 27A** and **27B,** the fingers **1468, 1478, 1488** in abutments **1460, 1470, 1480** respectively are different in size, shape, and location. Other examples are possible. **Figures 28A** and **28B** illustrate another embodiment of an abutment (e.g., a combined abutment and coping) having a variation in the proximal portion. For example, the elongate member can vary in height, material, and color depending on the individual patient. As one example, the elongate member **1518** of the example abutment **1500** shown in **Figures 28A and 28B** is shorter than the elongate member **1418** of the example abutment **1400** shown in **Figures 27A** and **27B.** In some embodiments, the elongate member can be about 30-50% shorter. In various embodiments, the elongate member can also be adjustable to accommodate the individual patient by removing material from the elongate member. By having a pre-shortened elongate member, time for intraoral adjustment can be reduced.

[0158] With reference now to **Figures 29A** and **29B,** another embodiment of an abutment **1600** (e.g., a combined abutment and coping) is illustrated. As described herein, the abutment **1600** can vary in size shape, and elements. As shown in the illustrated embodiment, the abutment **1600** can include a provisional connectional feature **1606** comprising a plurality of spaced apart elongate elements **1608** coupled together by a circumferential rim **1614.** In some embodiments, the elongate elements **1608** and/or the circumferential rim **1614** can be made of a resilient material. As another example, the circumferential rim **1614** can include a spring element (not shown), such as those described herein with respect to other embodiments. In various embodiments, the abutment **1600** can form a friction fit connection with an implant via the provisional connection feature **1606.** For example, the elongate elements **1608** and/or the circumferential rim **1614** of the provisional connection feature **1606** of the abutment **1600** can press against an interior surface (e.g., of a recess, bore, or cavity) of the implant.

[0159] With reference now to **Figures 30A** and **30B,** an example coping **1700** is illustrated. The coping **1700** can include any one or more features described herein with

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respect to other embodiments. As one example, the coping **1700** can include similar features as the example coping **1100** shown in **Figures 18 and 19.** As illustrated in **Figures 30A** and **30B,** the coping **1700** can have a distal surface **1710** such as a flange or collar. However, compared to the coping **1100** shown in **Figures 18** and **19,** the distal surface **1710** of the coping **1700** can include features such as grooves **1715** (or protrusions and/or slots). In some embodiments, such features can facilitate the retention of a bonding agent or cement used when attaching (intra-orally or extra-orally) a crown or other restoration over the coping **1700.** Furthermore, the coping **1700** can include fingers **1708** as described herein with respect to other embodiments (e.g., **Figures 18** and **19).** The fingers **1708** can include engagement protrusions **1709** sized and shaped to be received within a recess or slot of an abutment. For example, **Figure 31** shows an example abutment **1800** including a slot **1809** configured to receive the engagement protrusion **1709** of the coping **1700** shown in **Figures 30A** and **30B.** The grooves 1715 can be used in combination with the embodiments described above (e.g., Figures 7A and 18) or as a separate independent feature.

[0160] With reference now to **Figures 32A-32C,** an embodiment of a method **2000** is illustrated for coupling a dental prosthesis **2510** to a dental implant **2110.** The method **2000** is an example of the method **300** described with reference to **Figure 3.** For example, the dental implant **2110** can be coupled to a patient's bone (not shown) or in some instances, may not be coupled to a patient's bone (e.g., prepared at a laboratory). Of course, the dental implant **2110** shown in **Figure 32A** is for illustrational purposes and it is understood that other types of dental implants can be used. For example, the example implant **2110** is shown as having a recess **2120** at the proximal end, while an implant with an external boss can also be contemplated.

[0161] As shown in **Figure 32A,** the method **2000** can include coupling a dental component **2700** to the implant **2110.** For illustrational purposes, **Figure 32A** shows the dental component **2700** as the example abutment **1400** shown in **Figures 27A-27B.** However, the dental component **2700** can include any dental component having any of the various features (e.g., a provisional connection feature) described herein with respect to other embodiments. For example, the dental component **2700** can include any one or more copings, abutments, combined copings/abutments, or combinations thereof. In the case where multiple dental components are used (e.g., a multi-unit abutment or a coping used with

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an abutment), at least one of the dental components can include a provisional connection feature as described herein with respect to other embodiments.

[0162] A distal portion of the dental component **2700** can be coupled to a proximal portion of the implant **2110.** In **Figure 32A,** the dental component **2700** can be inserted into the recess **2120** of the implant **2110** and coupled together via the provisional connection feature **2706** of the dental component **2700.** For example, the provisional connection feature **2706** can include a snap-fit, friction fit, or other provisional connection feature as disclosed herein.

[0163] The method **2000** can include bonding the prosthesis **2510** to the dental component **2700.** The prosthesis **2510** is illustrated as a single tooth crown. In other embodiments, the prosthesis **2510** can be a multi-tooth restoration such as a partial or full bridge. As described herein, a bonding agent can be applied to the dental component **2700** and to the prosthesis **2510** and/or backfilling holes formed in the prosthesis **2510** with an acrylic, such as a self-curing acrylic or a light cured composite.

[0164] As shown in **Figure 32B,** the bonded prosthesis **2510** and dental component **2700** can be decoupled from the implant **2110** via the provisional connection feature **2706.** In instances where multiple dental components (e.g., a multi-unit abutment or a coping and an abutment) are used, at least one of the dental components can be decoupled from the implant **2110.** For example, as shown in **Figures 8-12,** the coping **700** can be decoupled from the implant via the provisional connection feature (e.g., the retention spring **708),** while the abutment **650** remains coupled to the implant.

[0165] With continued reference to **Figure 32B,** the method **2000** can also include forming a through-hole (not shown) in both the decoupled dental component **2700** and the prosthesis **2510.** For example, as described herein with respect to other embodiments, the through-hole can be created using a cutting tool **2850** (e.g., a drill bit) from a distal side of the dental component **2700.** In some instances, an alignment tool (e.g., a drill guide) can be used to facilitate the alignment with the cutting tool **2850.** For example, in some embodiments, the distal portion of the dental component **2700** can be coupled to at least the proximal portion of the alignment tool **2800.** In some instances, the dental component **2700** can be inserted into a cavity **2820** of the alignment tool **2800** and coupled together via the provisional connection feature **2706** (e.g., snap-fit, friction fit, or other

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provisional connection feature) of the dental component **2700.** However, in various embodiments, an alignment tool might not be needed. For example, the bore within the provisional connection feature **2706** and/or the decoupled dental component **2700** can, in some embodiments serve as an alignment tool. In some such embodiments, eliminating the steps of coupling and decoupling an alignment tool can simplify the procedure and reduce patient chairtime, In certain embodiments, after creating the through-hole through the prosthesis **2510** from the distal side (e.g., apical to occlusal), the cutting tool **2850** can reinforce the through-hole from a proximal side (e.g., occlusal to apical) of the prosthesis **2510.** In some embodiments, as shown in **Figure 32C,** after creating the through-hole through the prosthesis **2510** from the distal side (e.g., apical to occlusal), another cutting tool **2855** (e.g., having a different diameter such as a larger diameter than the cutting tool **2850** creating the original through-hole) can enlargen the through-hole from a proximal side (e.g., occlusal to apical) of the prosthesis **2510.** As described herein, this hole can have a greater diameter than the original through-hole. For example, the cutting tool **2850** creating the original through-hole can have a cutting diameter of about 1.5 mm, while the other cutting tool **2855** can have a cutting diameter of about 2.0 mm. The cutting diameters can be based on the size of the prosthesis, dental components, implant, and/or fasteners, and are not particularly limited. This step can be performed when a fastener being used is larger than the original through-hole. The method **2000** can further include recoupling the dental component **2700** and the prosthesis **2510** to the implant **2110.** As shown in **Figure 32D,** a fastener (e.g., a screw) **2900** can be inserted into the through-hole to couple the prosthesis **2510** to the implant **2110.**

[0166] Certain embodiments of systems and methods can provide an efficient workflow execution post-surgery, which can reduce the risk of site contamination and extensive tissue swelling, thus reducing healing time. For example, systems and methods using a provisional connection feature as described herein can reduce (e.g., substantially eliminate) the use of screwing and unscrewing components in patients which takes chairtime. In addition, certain embodiments described herein can provide a screw access hole which is easy to locate, but not too large.

[0167] As described herein, e.g., with reference to **Figure 1,** in various embodiments, a dental implant **110** can have a distal end **112** designed to be placed within a

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patient's jaw and a proximal end 114 designed to allow attachment of another dental component such as the abutment 120, the coping 130, or the combined coping 130/abutment 120. The dental component is not particularly limited. For example, the dental component can include an adapter.

[0168] With reference now to **Figures** 33A, an embodiment of an adapter 3000 is illustrated which can have any one or more of the features described herein with respect to other embodiments. For example, the adapter 3000 can have a distal portion 3002, a proximal portion 3004, or both a distal portion 3002 and a proximal portion 3004 having a provisional connection feature. In the illustrated embodiment, the adapter 3000 has a distal portion 3002 having a provisional connection feature 3006. The provisional connection feature 3006 can be in the form of any of the provisional connection features described herein. In the illustrated embodiment, the provisional connection feature 3006 includes elongate fingers 3008 similar to other fingers described herein. Of course, as described herein, other shapes, sizes, and elements (e.g., springs) for the provisional connection feature 3008 can be used. Furthermore, the material or materials of the adapter 3000 are not particularly limited and can include those described herein for other components. For example, the adapter 3000 can be made of a metal.

[0169] In various embodiments, the distal portion 3002 of the adapter 3000 can be used to mate with the proximal portion of an implant. In some such embodiments, the adapter 3000 can form a snap-fit and/or a friction fit connection (as described herein with respect to other embodiments) with the implant via the provisional connection feature 3006. The implant is not particularly limited and can include a conical connection, a tri-lobe connection, a hexagonal connection, etc. Advantageously, certain embodiments of the adapter 3000 having a provisional connection feature 3006 can provide a system that is relatively easy to use (e.g., having less parts such as less screws).

[0170] In various embodiments, the adapter 3000 can be configured to be coupled to one or more other dental components, e.g., on a side opposite the implant. For example, the adapter 3000 can be designed to have a proximal portion 3004 (e.g., a conical connection, a tri-lobe connection, a hexagonal connection, etc.) configured to be coupled to a variety of components (e.g., a prosthesis such as a single or multi-tooth restoration, an abutment, an impression component such as an impression post, a healing cap, scan body etc.). The

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components that can be used are not particularly limited and can include standard, temporary or customer made (CAD/CAM) components . In some embodiments, the components can have a provisional connection feature configured to mate with the adapter **3000** via a snap-fit and/or a friction fit connection. In some embodiments, the components can have an angulated screw channel. In some embodiment, at least a portion of an adapter is designed to face soft tissue when the adapter is coupled with the dental implant. During a healing phase, the soft tissue can adhere to said portion of the adapter. In some embodiments the portion facing the soft tissue has a width "w" measured along a vertical axis of the adapter of at least 4 mm (see figure 36). Advantageously, certain adapters **3000** can remain coupled with the implant, e.g., during the impression and/or healing period, for better soft tissue management and can allow for use of a variety of components. In other words, the adapter may act as a platform that remains coupled to the implant and at least partially contacting the soft tissue to which other dental component can be connected. This avoids destruction of the adhesion between the adapter and the soft tissue that is created during healing of the soft tissue and result in better soft tissue management.

[0171] **Figure 33B** illustrates an embodiment of an adapter **3100** including a proximal portion **3104** having a provisional connection feature **3010** configured to mate with one or more dental components. The illustrated provisional connection feature **3010** includes a slot, e.g., configured to mate with a corresponding snap-fit element. However, of course, as described herein, other provisional connection features can be used.

[0172] **Figures 34, 35 and 36** illustrate example components that can be coupled to an adapter. For example, as shown in **Figure 34,** after the implant (not shown) is placed within a patient's jaw, an adapter **3200** coupled with an impression component **3300** (e.g., an open or closed tray impression post) can be mounted on the implant. The upper part of the impression post can remain in impression material and can act as a connection member for the implant replica. Alternatively, the impression post can act as an intra-oral scan post. As another example, the adapter **3200** coupled with a healing cap **3400,** can be mounted on the implant. The impression can be taken on the healing cap **3400** and scanned with a desktop or intra-oral scanner on the healing cap **3400.** Other examples are possible, for example, the adapter can be mounted on the implant, and a temporary, a standard or a individualized (CAD/CAM) abutment can be coupled with the adapter. **Figures 35 and 36** illustrates yet

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another example embodiment. The adapter 3500 can be mounted on the implant 3501. A prosthesis 3510 (only partially shown on figure 36) can be coupled to the adapter 3500 by a fastener 3590. In some embodiments, the prosthesis 3510 can include an angulated screw channel 4000 (e.g., up to about 25 degrees from the axis of the implant 3501) for receiving the fastener 3590. It should be appreciated that the adapter can be configured to couple with various designs of dental components and various materials of dental components (e.g., dental components made of titanium, titanium alloy, PEEK, zirconia, gold, CoCr, etc.). In certain embodiments, the adapter can be used to create a "tissue level implant". Once placed, the adapter is normally not removed and other dental components can therefore be connected to the adapter at its proximal (coronal) end. This can be done for example by using a screw passing through the adapter and received within a socket of the implant. Therefore, the adapter is provided with a friction fit retention connection allowing connection to the implant, but also allowing disconnection of the adapter to the implant in case of need.

[0173] It should be emphasized that many variations and modifications may be made to the herein-described embodiments, the elements of which are to be understood as being among other acceptable examples. All such modifications and variations are intended to be included herein within the scope of this disclosure and protected by the following claims. Moreover, any of the steps described herein can be performed simultaneously or in an order different from the steps as ordered herein. Moreover, as should be apparent, the features and attributes of the specific embodiments disclosed herein may be combined in different ways to form additional embodiments, all of which fall within the scope of the present disclosure.

[0174] Conditional language used herein, such as, among others, "can," "could," "might," "may," "e.g.," and the like, unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain embodiments include, while other embodiments do not include, certain features, elements and/or states. Thus, such conditional language is not generally intended to imply that features, elements and/or states are in any way required for one or more embodiments or that one or more embodiments necessarily include logic for deciding, with or without author input

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or prompting, whether these features, elements and/or states are included or are to be performed in any particular embodiment.

Listing of Embodiments

1. A system for coupling a dental component to a dental implant, the device comprising:

a coping comprising a provisional connection feature.

2. The system of Embodiment 1, further comprising:

an abutment comprising a provisional connection feature and a second connection feature;

wherein the coping and the abutment are configured to be temporarily coupled together via the provisional connection feature; and

wherein the abutment is configured to be coupled to the implant.

3. The system of Embodiment 2, further comprising a fastener comprising threading, the threading configured to engage the second connection feature to couple the coping with the abutment.

4. The system of any of Embodiments 1-3, wherein the coping further comprises an elongate member, the elongate member comprising a plurality of protrusions and slots.

5. The system of any of Embodiments 1-4, wherein the provisional connection feature of the coping comprises a resilient member.

6. The system of Embodiment 5, wherein the resilient member comprises a wave spring.

7. The system of Embodiment 6, wherein the wave spring is received within a slot of the provisional coping.

8. The system of Embodiment 5, wherein the provisional connection feature of the coping comprises one or more resilient fingers.

9. The system of any of Embodiments 1-8, wherein the coping comprises a body component and a connector component, wherein the connector component comprises the provisional connection feature of the coping.

10. The system of Embodiment 9, wherein the body component comprises the elongate member.

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11. The system of any of Embodiments 9 or 10, wherein the body component and the connector component are configured to be coupled together.

12. The system of Embodiment 11, wherein the body component and the connector component are configured to be coupled via a friction fit.

13. The system of Embodiment 11, wherein the connector component comprises threading configured to engage corresponding threading on the body component.

14. The system of any of Embodiments 1-13, further comprising a cutting tool.

15. The system of Embodiment 14, further comprising an alignment tool configured to be removably coupled to the coping via the provisional connection feature of the coping.

16. The system of Embodiment 15, the alignment tool further comprising an alignment feature through which the cutting tool can pass.

17. A method of coupling a dental prosthesis to an implant and an abutment in a patient's jaw, the method comprising:

coupling a coping to the abutment using a snap-fit connection;

bonding the prosthesis to the coping;

decoupling the prosthesis and coping from the abutment via the snap-fit connection,

forming a through-hole in both the coping and the prosthesis; and

coupling the coping and prosthesis to the abutment using a fastener inserted into the through-hole.

18. A method of coupling a dental prosthesis to an implant and an abutment in a patient's jaw, the method comprising:

temporarily coupling a coping to the abutment via a provisional connection feature;

modifying the alignment between the prosthesis and coping and coupling the prosthesis to the coping;

removing the prosthesis and coping from the abutment such that the prosthesis and coping remain in the modified alignment.

19. The method of Embodiment 18, further comprising forming a hole through at least the prosthesis using a cutting tool.

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20. The method of Embodiment 19, wherein the step of forming a hole through at least the prosthesis comprises attaching an alignment tool to the coping and using the alignment tool to align the cutting tool with respect to the prosthesis.

21. The method of any of Embodiments 18 or 19, further comprising coupling the coping to the abutment via a second connection feature, the second connection feature being different from the provisional connection feature.

22. The method of Embodiment 21, wherein the step of coupling the coping to the abutment via a second connection feature comprises fastening the coping to the abutment using a threaded fastener.

23. The method of any of Embodiments 18-22, wherein the step of temporarily coupling the coping to the abutment via a provisional connection feature comprises engaging a snap fit connection feature on the coping with a corresponding snap fit connection feature on the abutment.

24. The method of any of Embodiments 18-23, wherein the step of coupling the prosthesis to the coping comprises applying a bonding agent to the coping and to the prosthesis.

25. The method of Embodiment 24, wherein the prosthesis comprises one or more blind holes and the step of applying the bonding agent to the prosthesis comprising introducing the bonding against into the one or more blind holes.

26. The method of any of Embodiments 18-25, wherein the step of modifying the alignment between the prosthesis and coping comprises orienting occlusal surfaces and establishing vertical dimension of the prosthesis with occlusal surfaces of opposing dentition.

27. The method of any of Embodiments 18-26, further comprising determining a preliminary fit of the prosthesis with respect to the coping prior to the step of attaching the prosthesis to the coping.

28. The method of Embodiment 27, further comprising modifying the coping to alter the fit of the prosthesis with respect to the coping.

29. A method of attaching and aligning a dental prosthesis to an abutment and coping in a patient's jaw, the method comprising:

coupling the coping to the abutment via a provisional connection feature;

bonding the prosthesis to the coping;

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modifying the alignment between the prosthesis and the coping while the prosthesis is being bonded to the coping;

removing the prosthesis and coping from the abutment.

30. The method of Embodiment 29, further comprising forming one or more blind holes in the prosthesis and the step of bonding the prosthesis to the coping comprises bonding the coping within the one or more blind holes.

31. The method of Embodiment 29, further comprising forming a hole through the prosthesis using a cutting tool.

32. The method of Embodiment 31, wherein the step of forming a hole through the prosthesis comprises attaching an alignment tool to the coping and using the alignment tool to align the cutting tool with respect to the prosthesis.

33. The method of Embodiment 31, further comprising coupling the coping to the abutment using a threaded fastener.

34. The method of Embodiment 29, wherein the step of modifying the alignment between the prosthesis and coping comprises placing occlusal surfaces of the prosthesis in contact with occlusal surfaces of opposing dentition.

35. A system for coupling one or more dental components to a dental implant, the system comprising:

at least one dental component of the one or more dental components comprising a provisional connection feature.

36. The system of Embodiment 35, wherein the at least one dental component comprises an abutment configured to couple with the dental implant via the provisional connection feature.

37. The system of Embodiment 36, wherein the abutment comprises an abutment integrated with a coping.

38. The system of Embodiment 36, wherein the provisional connection feature of the abutment comprises one or more fingers.

39. The system of Embodiment 36, wherein the provisional connection feature of the abutment comprises a spring.

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40. The system of Embodiment 36, wherein the abutment and the implant are configured to be coupled via a snap-fit.

41. The system of Embodiment 36, wherein the abutment and the implant are configured to be coupled via a friction fit.

42. The system of Embodiment 35, wherein the one or more dental components comprise a coping and an abutment,

wherein the at least one dental component comprises the coping configured to couple with the abutment via the provisional connection feature, or

wherein the at least one dental component comprises the abutment configured to couple with the coping via the provisional connection feature.

43. The system of Embodiment 42, wherein the abutment comprises a second connection feature, and the abutment is configured to be coupled to the implant via the second connection feature.

44. The system of Embodiment 42, wherein the provisional connection feature comprises one or more fingers.

45. The system of Embodiment 42, wherein the provisional connection feature comprises a spring.

46. The system of Embodiment 42, wherein the coping and the abutment are configured to be coupled via a snap-fit.

47. The system of Embodiment 42, wherein the coping and the abutment are configured to be coupled via a friction fit.

48. The system of Embodiment 42, wherein the coping comprises an elongate member, the elongate member comprising a plurality of protrusions and slots.

49. The system of Embodiment 42, wherein the coping comprises a flange, the flange comprising a plurality of grooves.

50. The system of Embodiment 35, further comprising a cutting tool.

51. The system of Embodiment 35, wherein the at least one dental component comprises an adapter configured to couple with the dental implant via the provisional connection feature.

52. The system of Embodiment 51, wherein the provisional connection feature comprises one or more fingers.

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53. The system of Embodiment 51, wherein the provisional connection feature comprises a spring.

54. The system of Embodiment 51, wherein the adapter and the implant are configured to be coupled via a snap-fit.

55. The system of Embodiment 51, wherein the adapter and the implant are configured to be coupled via a friction fit.

56. The system of Embodiment 51, wherein the adapter is configured to be coupled to one or more other dental components on a side opposite the dental implant.

57. The system of Embodiment 56, wherein the one or more other dental components comprise at least one of a prosthesis, an abutment, an impression post, and a healing cap.

58. The system of Embodiment 57, wherein the one or more other dental components comprise an angulated screw channel.

59. A method of creating a dental prosthesis configured to be coupled to a dental implant, the method comprising:

coupling one or more dental components to the implant, at least one dental component of the one or more dental components having a provisional connection feature;

bonding the prosthesis to the one or more dental components;

decoupling the prosthesis and the at least one dental component from the implant via the provisional connection feature; and

forming a through-hole in both the at least one dental component and the prosthesis, wherein the through-hole is configured to receive a fastener configured to couple with the prosthesis and the at least one dental component to the dental implant.

60. The method of Embodiment 59, wherein forming the through-hole comprises forming the through-hole using a cutting tool from a distal side of the at least one dental component.

61. The method of Embodiment 60, wherein forming the through-hole further comprises forming the through-hole using the cutting tool or another cutting tool from an occlusal side of the prosthesis.

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62. The method of Embodiment 59, further comprising coupling the at least one dental component and the prosthesis to the implant using the fastener inserted into the through-hole.

63. The method of Embodiment 59, wherein the provisional connection feature comprises a snap-fit connection feature.

64. The method of Embodiment 59, wherein the provisional connection feature comprises a friction fit connection feature.

65. The method of Embodiment 59, wherein the at least one dental component comprises an abutment configured to couple with the implant via the provisional connection feature.

66. The method of Embodiment 65, wherein the abutment comprises an abutment integrated with a coping.

67. The method of Embodiment 59, wherein the one or more dental components comprise a coping and an abutment,

wherein the at least one dental component comprises the coping configured to couple with the abutment via the provisional connection feature, or

wherein the at least one dental component comprises the abutment configured to couple with the coping via the provisional connection feature.

68. The method of Embodiment 67, wherein the abutment comprises a second connection feature, and the abutment is configured to be coupled to the implant via the second connection feature.

69. A Method of creating a dental restoration comprising:

a) coupling a first dental components, such as an adapter to a dental implant installed in a jaw bone using a snap fit and/or a friction fit connection such that at least a portion of said first dental component faces soft tissue, said first dental component being designed not to be removed from the dental implant;

b) coupling at least another dental component to said first dental component.

70. The method of embodiment 69 wherein coupling another dental component comprises coupling a healing abutment, an impression component or an intra-oral scan post a to the first dental component.

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71. The method of embodiment 69 wherein coupling another dental component comprises coupling a prosthesis including an angulated screw channel to the first dental component using a fastener.

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WHAT IS CLAIMED IS:

1. A system for coupling a dental component to a dental implant, the device comprising:

a coping comprising a provisional connection feature.

2. The system of Claim 1, further comprising:

an abutment comprising a provisional connection feature and a second connection feature;

wherein the coping and the abutment are configured to be temporarily coupled together via the provisional connection feature; and

wherein the abutment is configured to be coupled to the implant.

3. The system of Claim 2, further comprising a fastener comprising threading, the threading configured to engage the second connection feature to couple the coping with the abutment.

4. The system of any of Claims 1-3, wherein the coping further comprises an elongate member, the elongate member comprising a plurality of protrusions and slots.

5. The system of any of Claims 1-4, wherein the provisional connection feature of the coping comprises a resilient member.

6. The system of Claim 5, wherein the resilient member comprises a wave spring.

7. The system of Claim 6, wherein the wave spring is received within a slot of the provisional coping.

8. The system of Claim 5, wherein the provisional connection feature of the coping comprises one or more resilient fingers.

9. The system of any of Claims 1-8, wherein the coping comprises a body component and a connector component, wherein the connector component comprises the provisional connection feature of the coping.

10. The system of Claim 9, wherein the body component comprises the elongate member.

11. The system of any of Claims 9 or 10, wherein the body component and the connector component are configured to be coupled together.

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12. The system of Claim 11, wherein the body component and the connector component are configured to be coupled via a friction fit.

13. The system of Claim 11, wherein the connector component comprises threading configured to engage corresponding threading on the body component.

14. The system of any of Claims 1-13, further comprising a cutting tool.

15. The system of Claim 14, further comprising an alignment tool configured to be removably coupled to the coping via the provisional connection feature of the coping.

16. The system of Claim 15, the alignment tool further comprising an alignment feature through which the cutting tool can pass.

17. A method of coupling a dental prosthesis to an implant and an abutment in a patient's jaw, the method comprising:

coupling a coping to the abutment using a snap-fit connection;

bonding the prosthesis to the coping;

decoupling the prosthesis and coping from the abutment via the snap-fit connection,

forming a through-hole in both the coping and the prosthesis; and

coupling the coping and prosthesis to the abutment using a fastener inserted into the through-hole.

18. A method of coupling a dental prosthesis to an implant and an abutment in a patient's jaw, the method comprising:

temporarily coupling a coping to the abutment via a provisional connection feature;

modifying the alignment between the prosthesis and coping and coupling the prosthesis to the coping;

removing the prosthesis and coping from the abutment such that the prosthesis and coping remain in the modified alignment.

19. The method of Claim 18, further comprising forming a hole through at least the prosthesis using a cutting tool.

20. The method of Claim 19, wherein the step of forming a hole through at least the prosthesis comprises attaching an alignment tool to the coping and using the alignment tool to align the cutting tool with respect to the prosthesis.

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21. The method of any of Claims 18 or 19, further comprising coupling the coping to the abutment via a second connection feature, the second connection feature being different from the provisional connection feature.

22. The method of Claim 21, wherein the step of coupling the coping to the abutment via a second connection feature comprises fastening the coping to the abutment using a threaded fastener.

23. The method of any of Claims 18-22, wherein the step of temporarily coupling the coping to the abutment via a provisional connection feature comprises engaging a snap fit connection feature on the coping with a corresponding snap fit connection feature on the abutment.

24. The method of any of Claims 18-23, wherein the step of coupling the prosthesis to the coping comprises applying a bonding agent to the coping and to the prosthesis.

25. The method of Claim 24, wherein the prosthesis comprises one or more blind holes and the step of applying the bonding agent to the prosthesis comprising introducing the bonding against into the one or more blind holes.

26. The method of any of Claims 18-25, wherein the step of modifying the alignment between the prosthesis and coping comprises orienting occlusal surfaces and establishing vertical dimension of the prosthesis with occlusal surfaces of opposing dentition.

27. The method of any of Claims 18-26, further comprising determining a preliminary fit of the prosthesis with respect to the coping prior to the step of attaching the prosthesis to the coping.

28. The method of Claim 27, further comprising modifying the coping to alter the fit of the prosthesis with respect to the coping.

29. A method of attaching and aligning a dental prosthesis to an abutment and coping in a patient's jaw, the method comprising:

coupling the coping to the abutment via a provisional connection feature;

bonding the prosthesis to the coping;

modifying the alignment between the prosthesis and the coping while the prosthesis is being bonded to the coping;

removing the prosthesis and coping from the abutment.

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30. The method of Claim 29, further comprising forming one or more blind holes in the prosthesis and the step of bonding the prosthesis to the coping comprises bonding the coping within the one or more blind holes.

31. The method of Claim 29, further comprising forming a hole through the prosthesis using a cutting tool.

32. The method of Claim 31, wherein the step of forming a hole through the prosthesis comprises attaching an alignment tool to the coping and using the alignment tool to align the cutting tool with respect to the prosthesis.

33. The method of Claim 31, further comprising coupling the coping to the abutment using a threaded fastener.

34. The method of Claim 29, wherein the step of modifying the alignment between the prosthesis and coping comprises placing occlusal surfaces of the prosthesis in contact with occlusal surfaces of opposing dentition.

35. A system for coupling one or more dental components to a dental implant, the system comprising:

at least one dental component of the one or more dental components comprising a provisional connection feature.

36. The system of Claim 35, wherein the at least one dental component comprises an abutment configured to couple with the dental implant via the provisional connection feature.

37. The system of Claim 36, wherein the abutment comprises an abutment integrated with a coping.

38. The system of Claim 36, wherein the provisional connection feature of the abutment comprises one or more fingers.

39. The system of Claim 36, wherein the provisional connection feature of the abutment comprises a spring.

40. The system of Claim 36, wherein the abutment and the implant are configured to be coupled via a snap-fit.

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41. The system of Claim 36, wherein the abutment and the implant are configured to be coupled via a friction fit.

42. The system of Claim 35, wherein the one or more dental components comprise a coping and an abutment,

wherein the at least one dental component comprises the coping configured to couple with the abutment via the provisional connection feature, or

wherein the at least one dental component comprises the abutment configured to couple with the coping via the provisional connection feature.

43. The system of Claim 42, wherein the abutment comprises a second connection feature, and the abutment is configured to be coupled to the implant via the second connection feature.

44. The system of Claim 42, wherein the provisional connection feature comprises one or more fingers.

45. The system of Claim 42, wherein the provisional connection feature comprises a spring.

46. The system of Claim 42, wherein the coping and the abutment are configured to be coupled via a snap-fit.

47. The system of Claim 42, wherein the coping and the abutment are configured to be coupled via a friction fit.

48. The system of Claim 42, wherein the coping comprises an elongate member, the elongate member comprising a plurality of protrusions and slots.

49. The system of Claim 42, wherein the coping comprises a flange, the flange comprising a plurality of grooves.

50. The system of Claim 35, further comprising a cutting tool.

51. The system of Claim 35, wherein the at least one dental component comprises an adapter configured to couple with the dental implant via the provisional connection feature, said adapter comprising at least a portion designed to face soft tissue.

52. The system of Claim 51, wherein the provisional connection feature comprises one or more fingers.

53. The system of Claim 51, wherein the provisional connection feature comprises a spring.

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54. The system of Claim 51, wherein the adapter and the implant are configured to be coupled via a snap-fit.

55. The system of Claim 51, wherein the adapter and the implant are configured to be coupled via a friction fit.

56. The system of Claim 51, wherein the adapter is configured to be coupled to one or more other dental components on a side opposite the dental implant.

57. The system of Claim 56, wherein the one or more other dental components comprise at least one of a prosthesis, an abutment, an impression post, and a healing cap.

58. The system of Claim 57, wherein the one or more other dental components comprise an angulated screw channel.

59. A method of creating a dental prosthesis configured to be coupled to a dental implant, the method comprising:

coupling one or more dental components to the implant, at least one dental component of the one or more dental components having a provisional connection feature;

bonding the prosthesis to the one or more dental components;

decoupling the prosthesis and the at least one dental component from the implant via the provisional connection feature; and

forming a through-hole in both the at least one dental component and the prosthesis, wherein the through-hole is configured to receive a fastener configured to couple with the prosthesis and the at least one dental component to the dental implant.

60. The method of Claim 59, wherein forming the through-hole comprises forming the through-hole using a cutting tool from a distal side of the at least one dental component.

61. The method of Claim 60, wherein forming the through-hole further comprises forming the through-hole using the cutting tool or another cutting tool from an occlusal side of the prosthesis.

62. The method of Claim 59, further comprising coupling the at least one dental component and the prosthesis to the implant using the fastener inserted into the through-hole.

63. The method of Claim 59, wherein the provisional connection feature comprises a snap-fit connection feature.

64. The method of Claim 59, wherein the provisional connection feature comprises a friction fit connection feature.

65. The method of Claim 59, wherein the at least one dental component comprises an abutment configured to couple with the implant via the provisional connection feature.

66. The method of Claim 65, wherein the abutment comprises an abutment integrated with a coping.

67. The method of Claim 59, wherein the one or more dental components comprise a coping and an abutment,

wherein the at least one dental component comprises the coping configured to couple with the abutment via the provisional connection feature, or

wherein the at least one dental component comprises the abutment configured to couple with the coping via the provisional connection feature.

68. The method of Claim 67, wherein the abutment comprises a second connection feature, and the abutment is configured to be coupled to the implant via the second connection feature.

69. -Method of creating a dental restoration comprising:

c) coupling a first dental components, such as an adapter to a dental implant installed in a jaw bone using a snap fit and/or a friction fit connection such that at least a portion of said first dental component faces soft tissue, said first dental component being designed not to be removed from the dental implant;

d) coupling at least another dental component to said first dental component.

70. The method of claim 69 wherein coupling another dental component comprises coupling a healing abutment, an impression component or an intra-oral scan post a to the first dental component.

71. The method of claim 69 wherein coupling another dental component comprises coupling a prosthesis including an angulated screw channel to the first dental component using a fastener.

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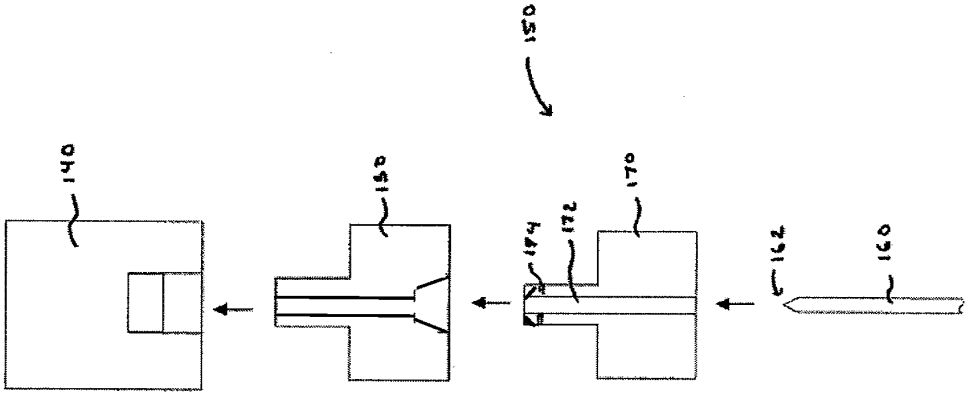


Figure 2

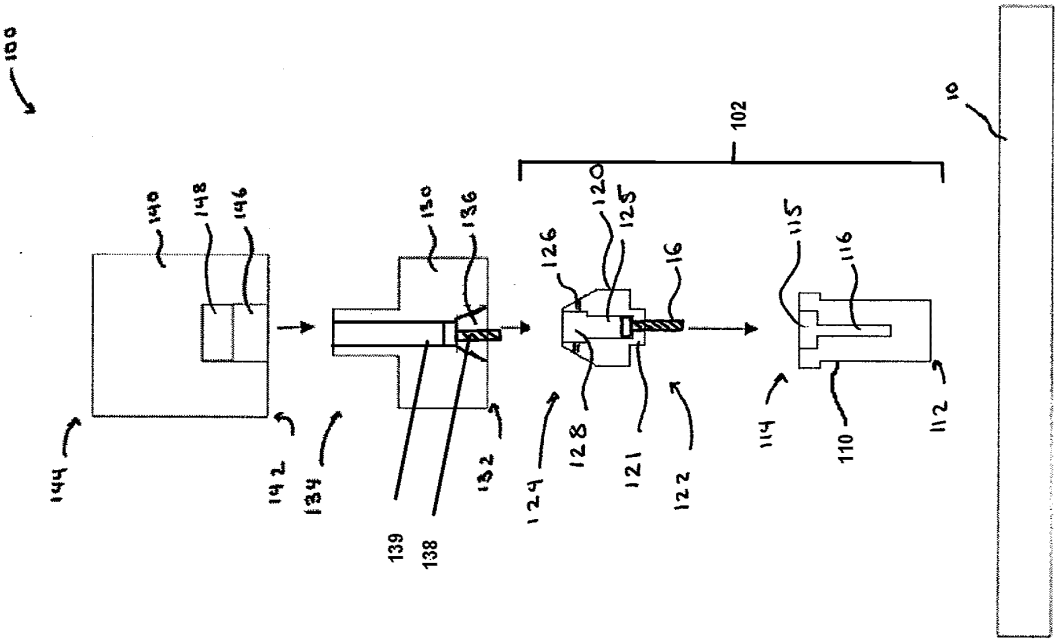


Figure 1

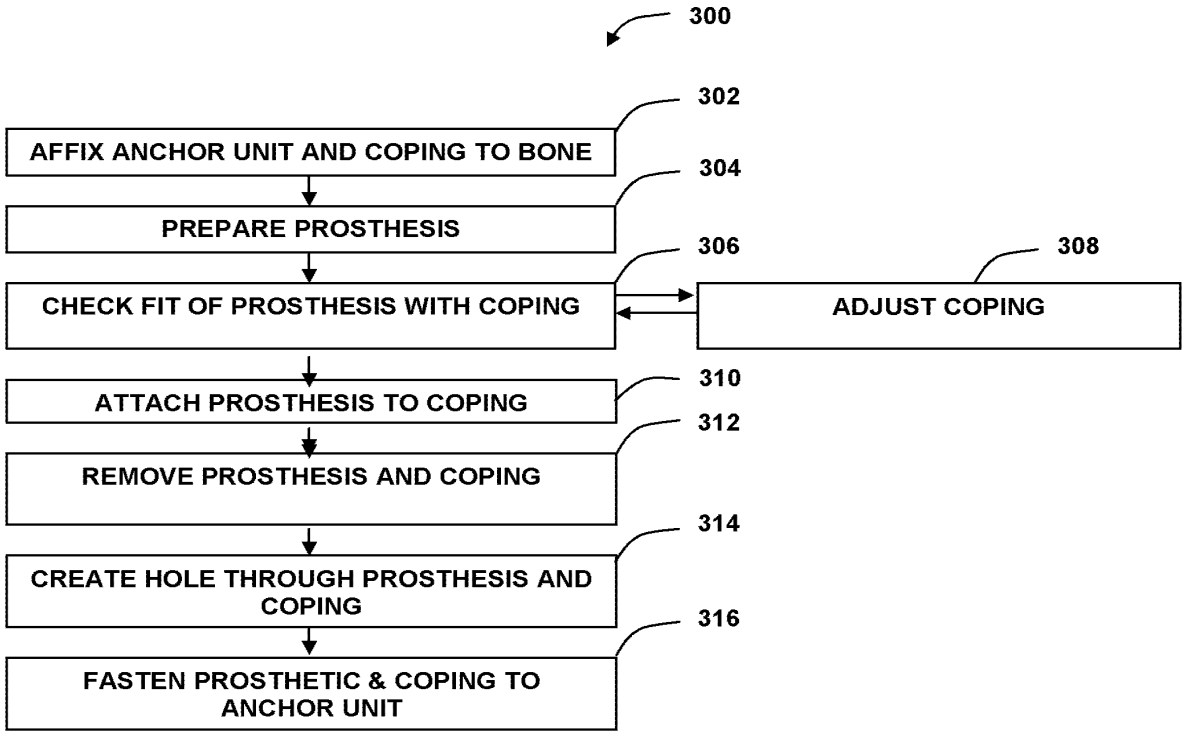


Figure 3

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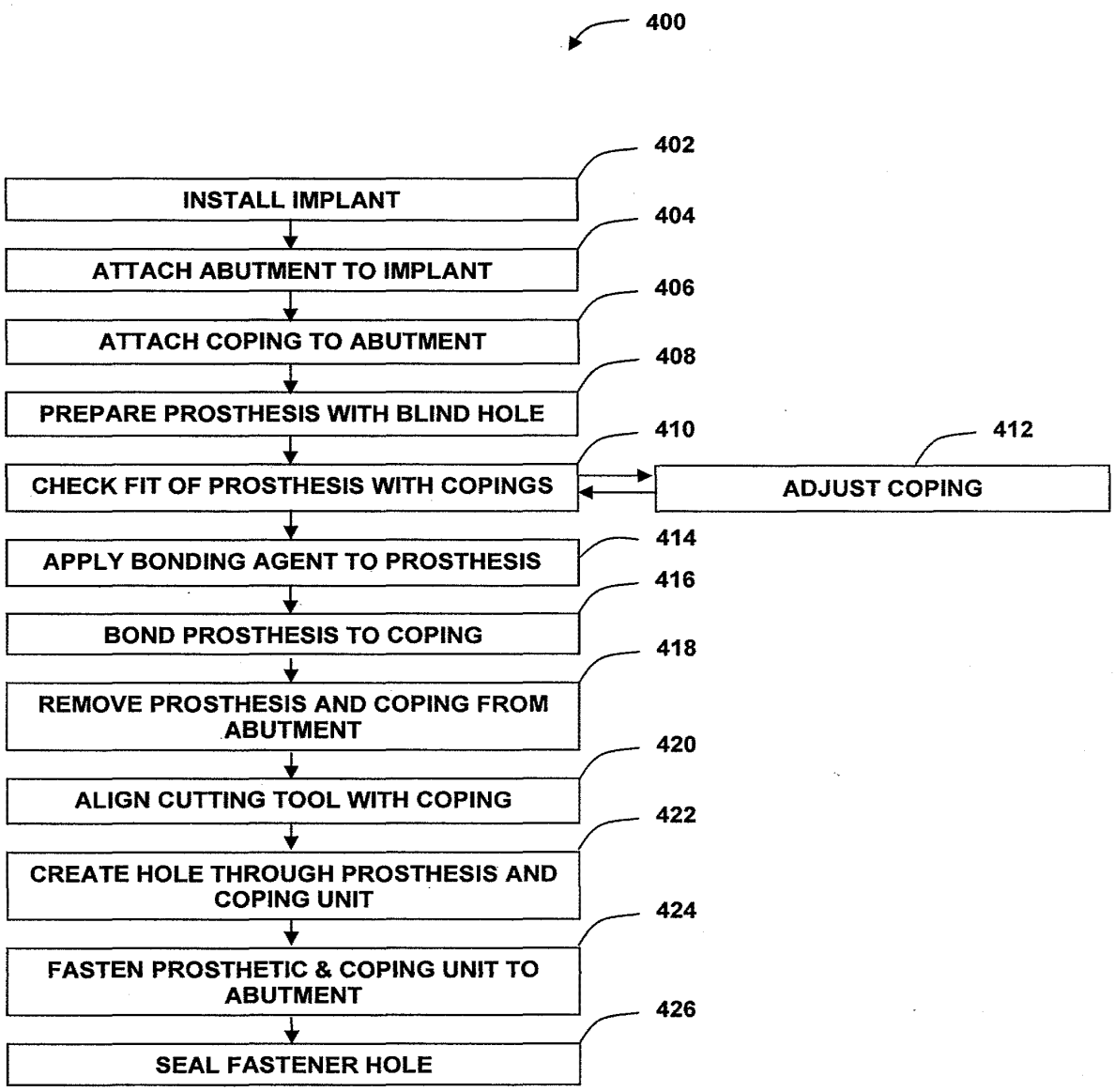

400
402
INSTALL IMPLANT
404
ATTACH ABUTMENT TO IMPLANT
406
ATTACH COPING TO ABUTMENT
408
PREPARE PROSTHESIS WITH BLIND HOLE
410
CHECK FIT OF PROSTHESIS WITH COPINGS
412
ADJUST COPING
414
APPLY BONDING AGENT TO PROSTHESIS
416
BOND PROSTHESIS TO COPING
418
REMOVE PROSTHESIS AND COPING FROM ABUTMENT
420
ALIGN CUTTING TOOL WITH COPING
422
CREATE HOLE THROUGH PROSTHESIS AND COPING UNIT
424
FASTEN PROSTHETIC & COPING UNIT TO ABUTMENT
426
SEAL FASTENER HOLE

Figure 4

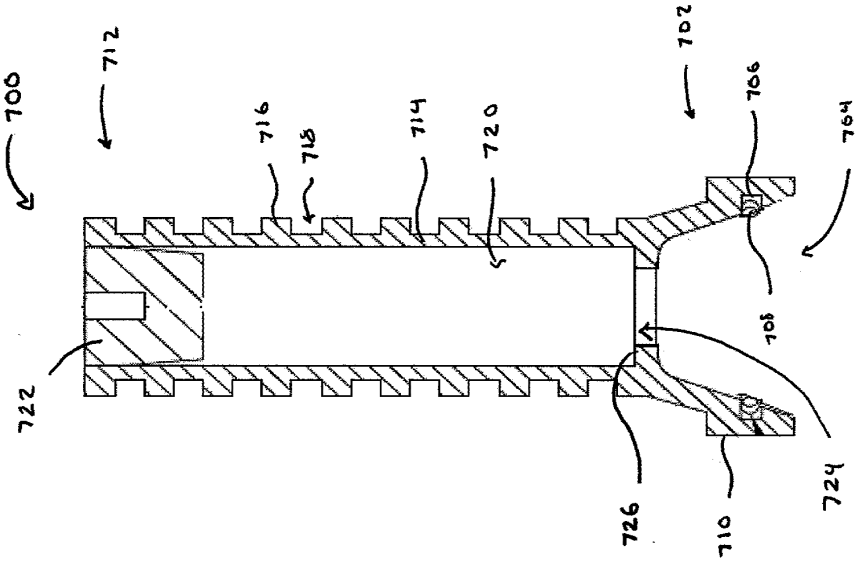


Figure 7A

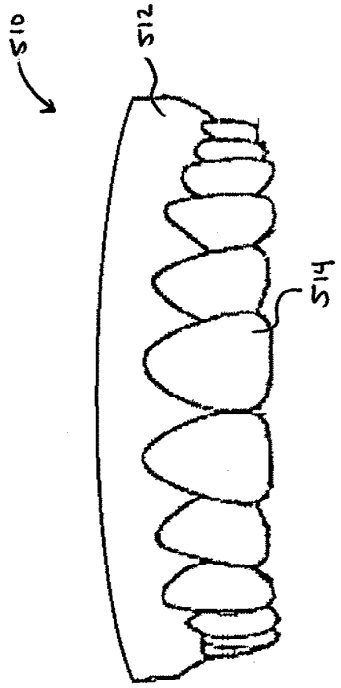


Figure 5

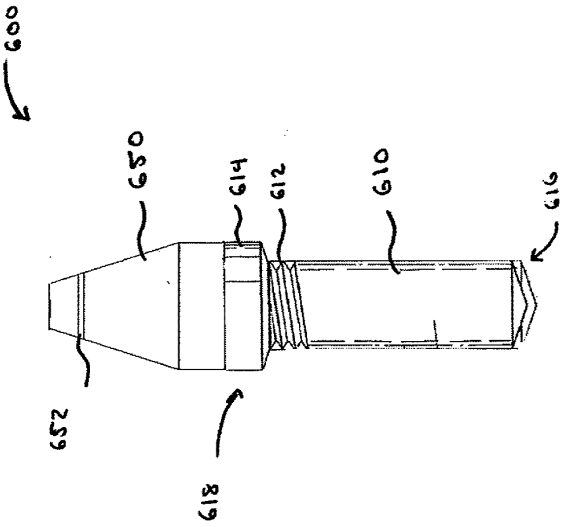


Figure 6

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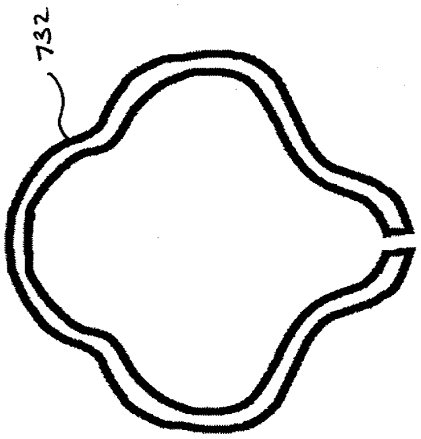


Figure 7C

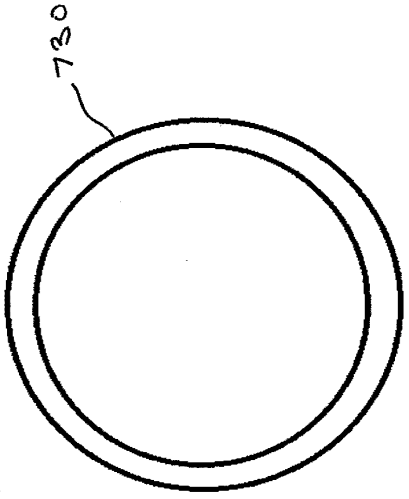


Figure 7B

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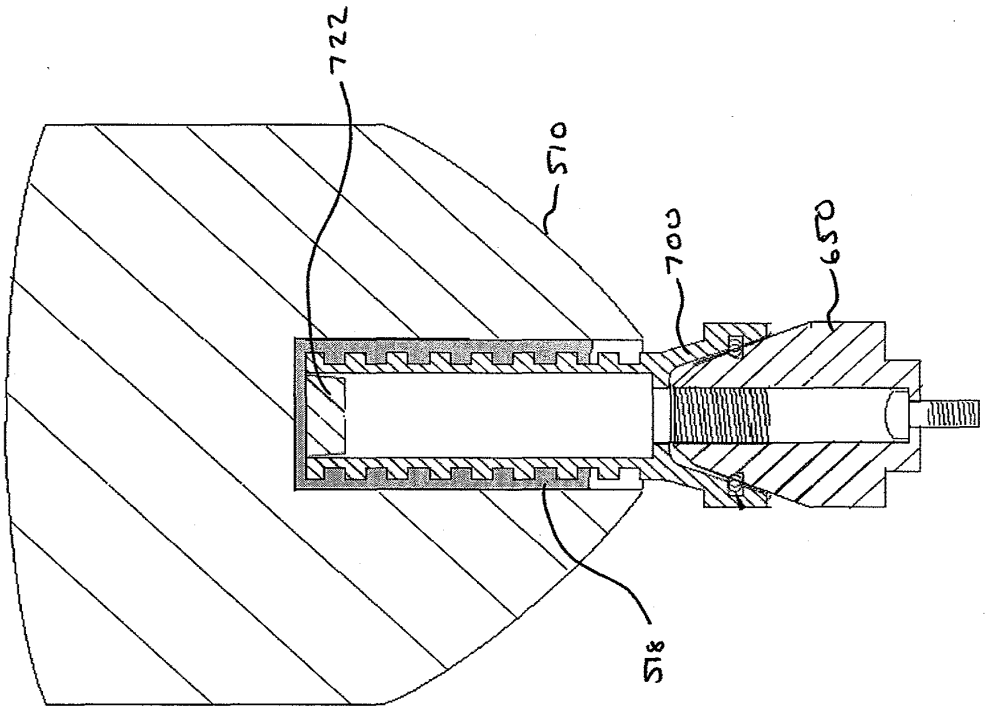


Figure 9

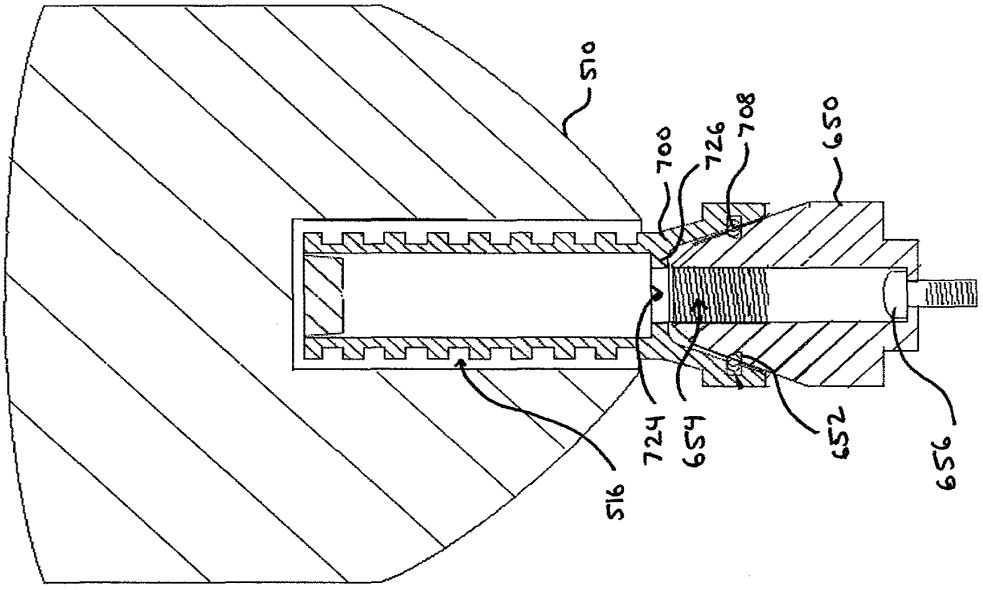


Figure 8

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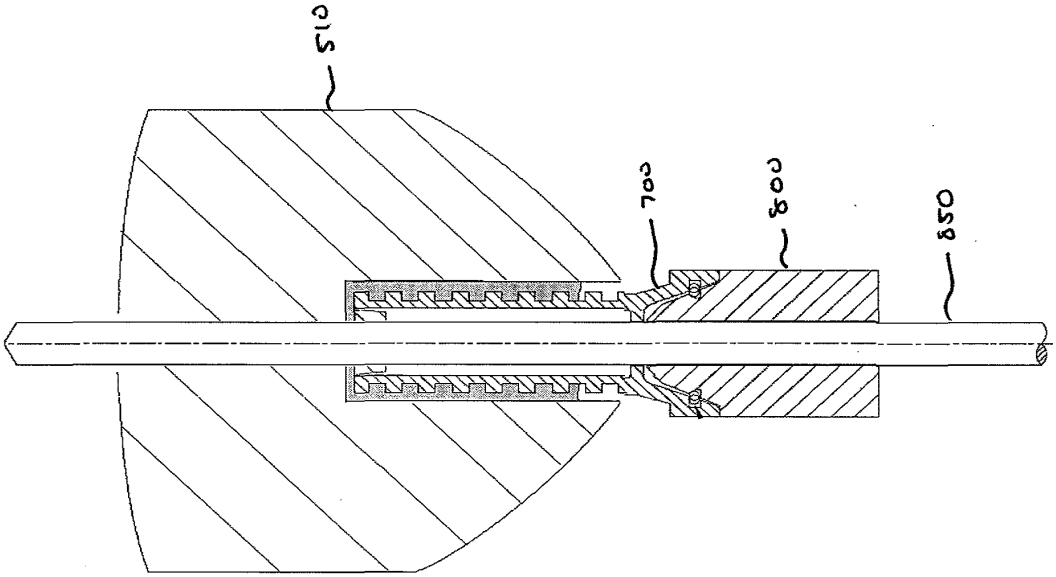


Figure 11

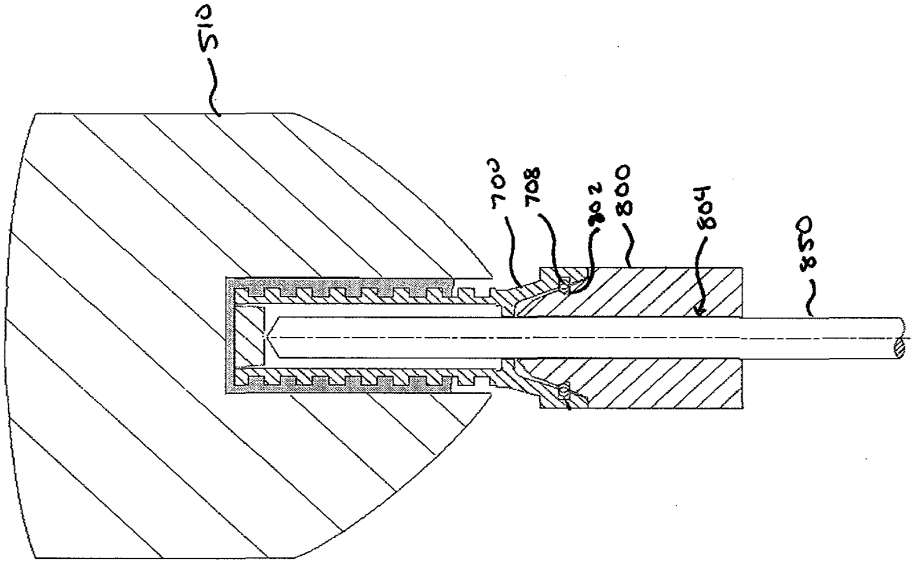


Figure 10

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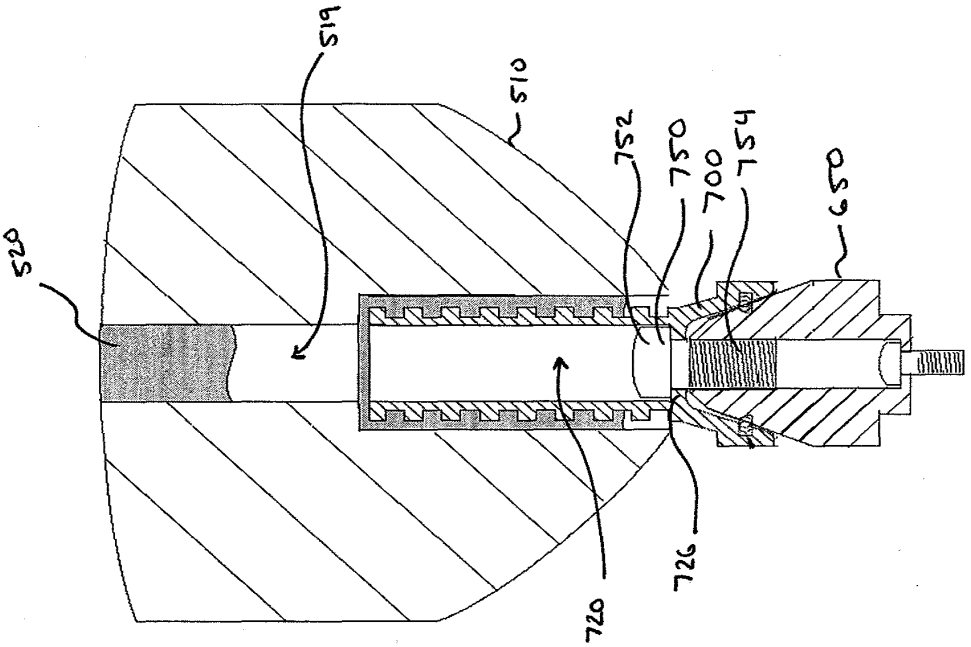


Figure 12

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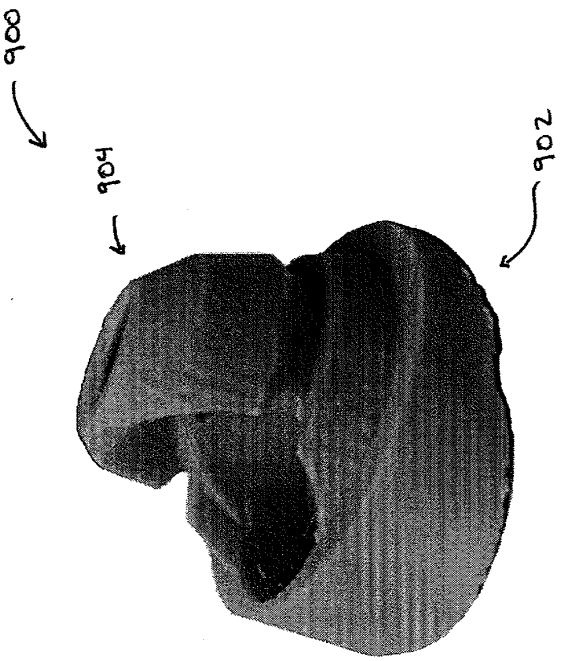


Figure 14

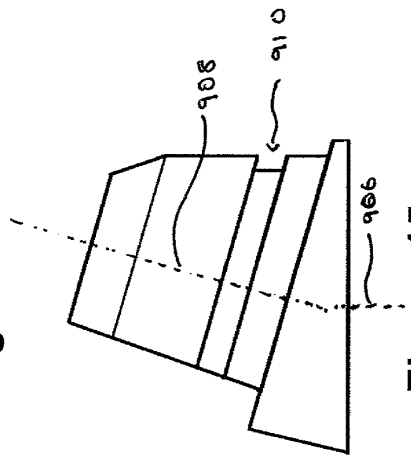


Figure 15

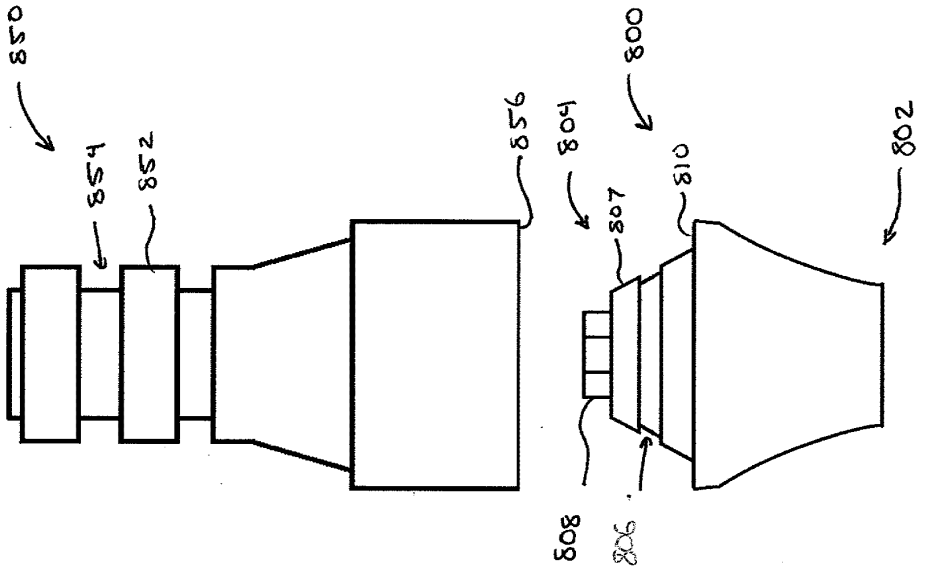


Figure 13

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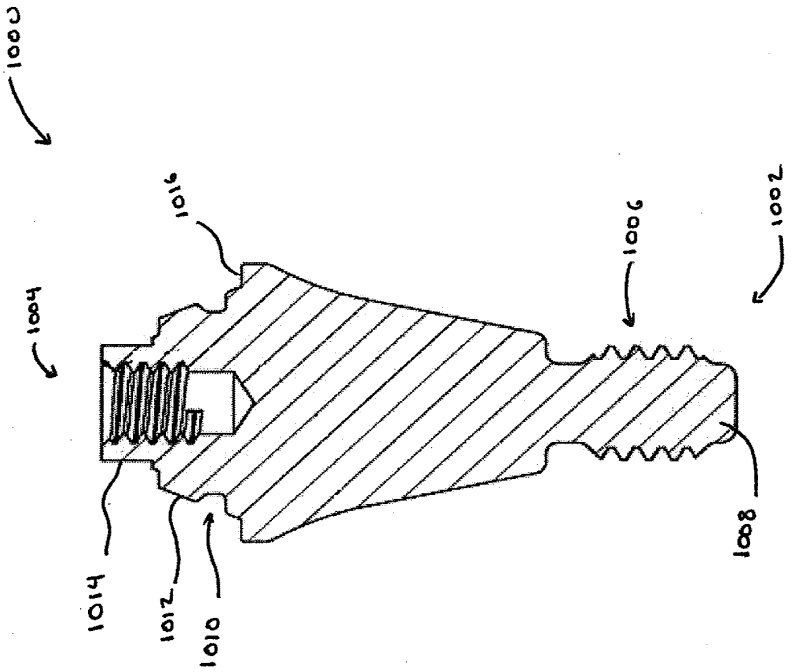


Figure 17

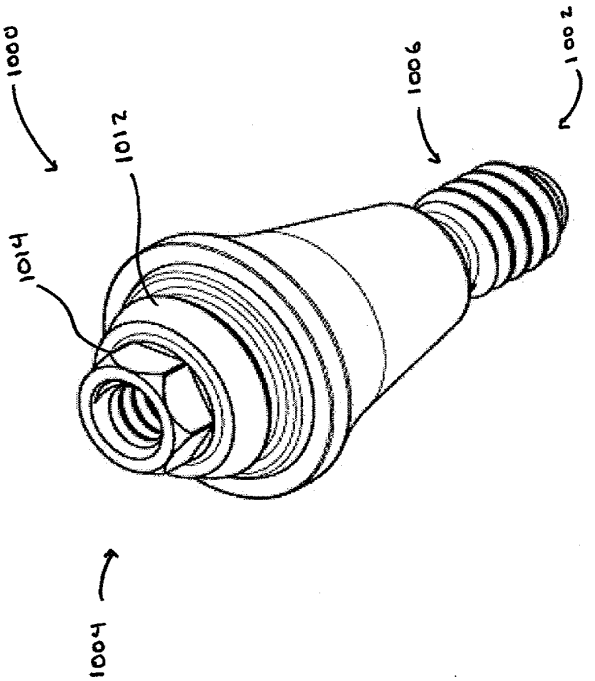


Figure 16

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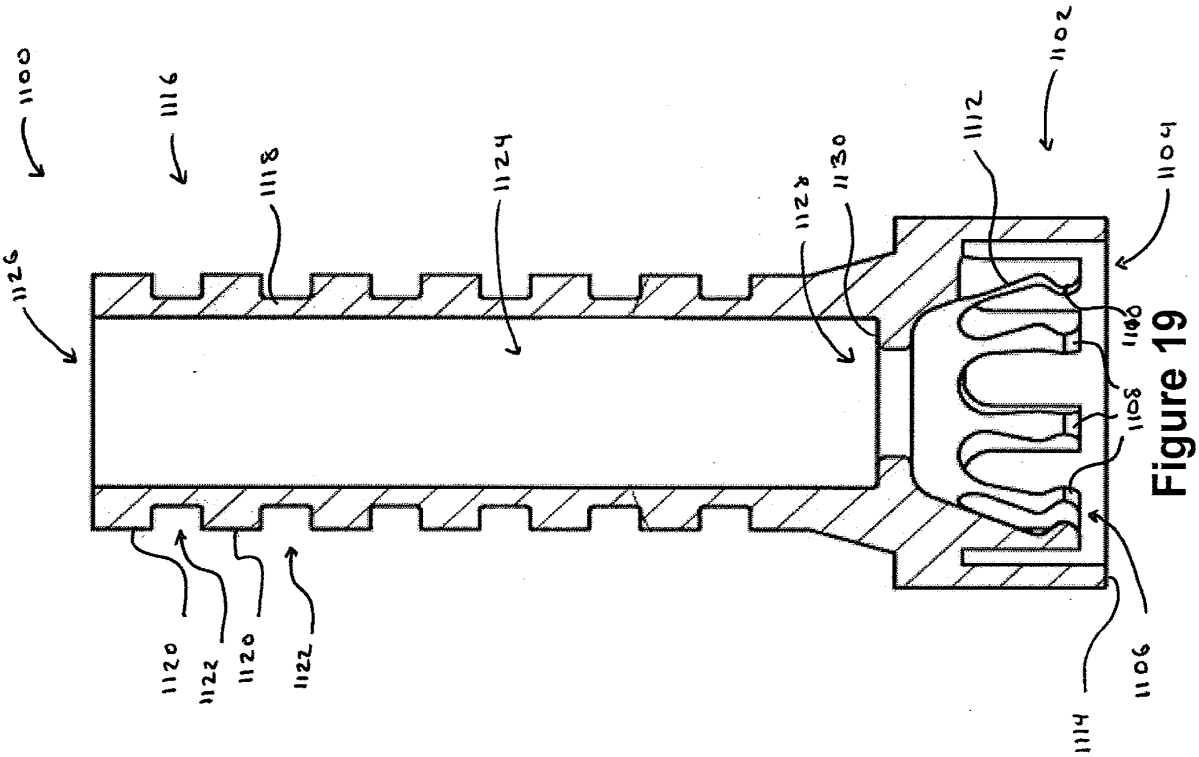


Figure 19

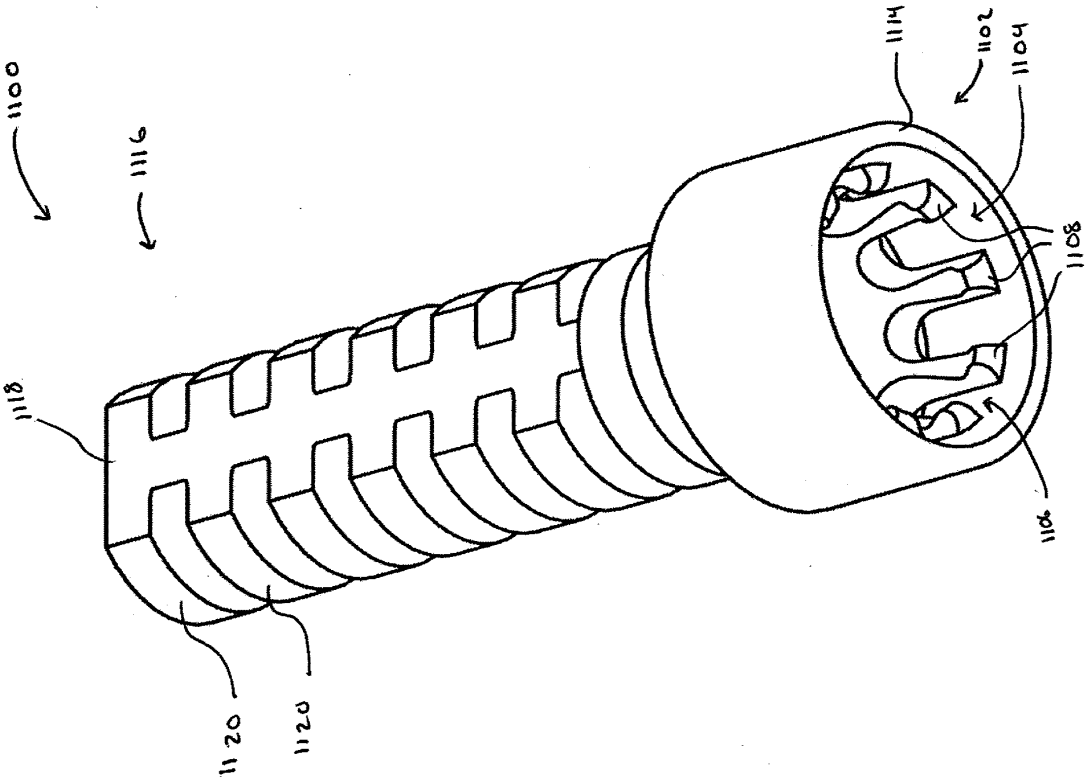


Figure 18

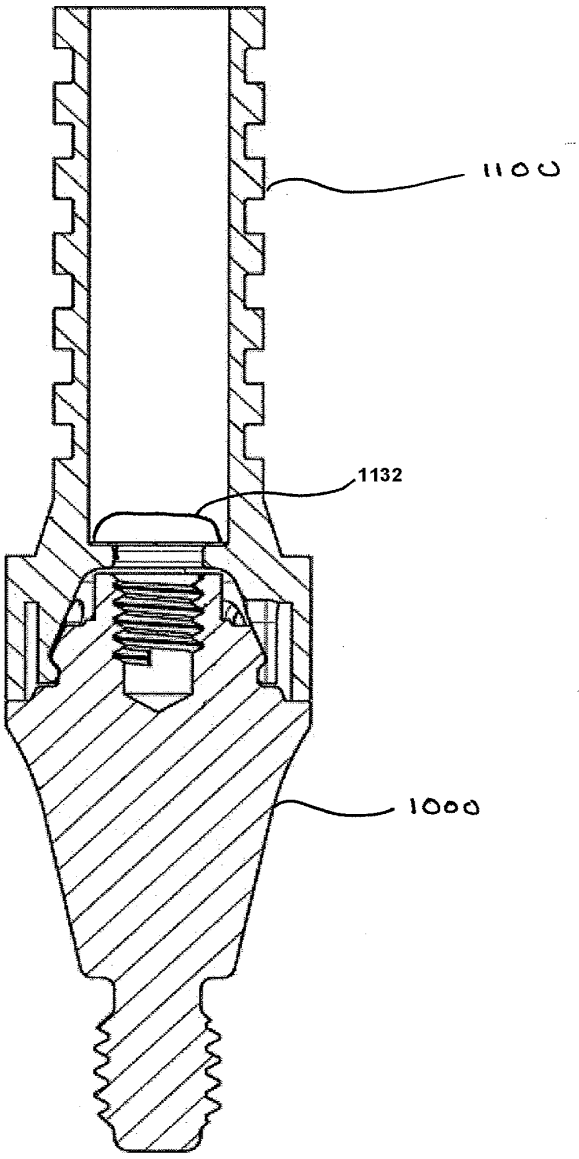


Figure 20

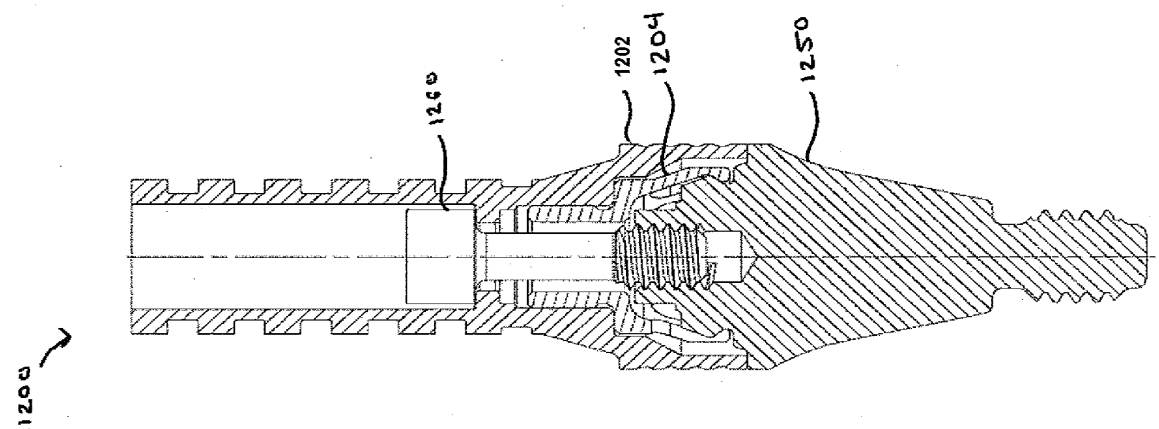


Figure 23

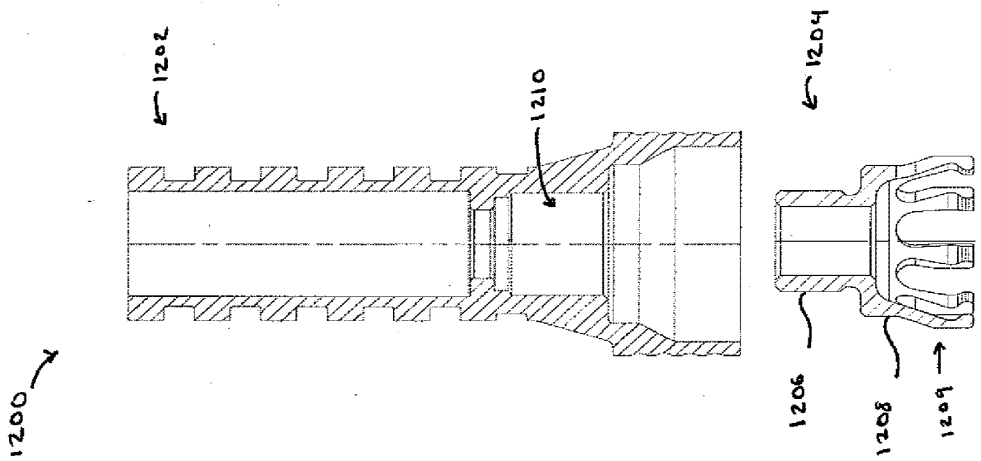


Figure 22

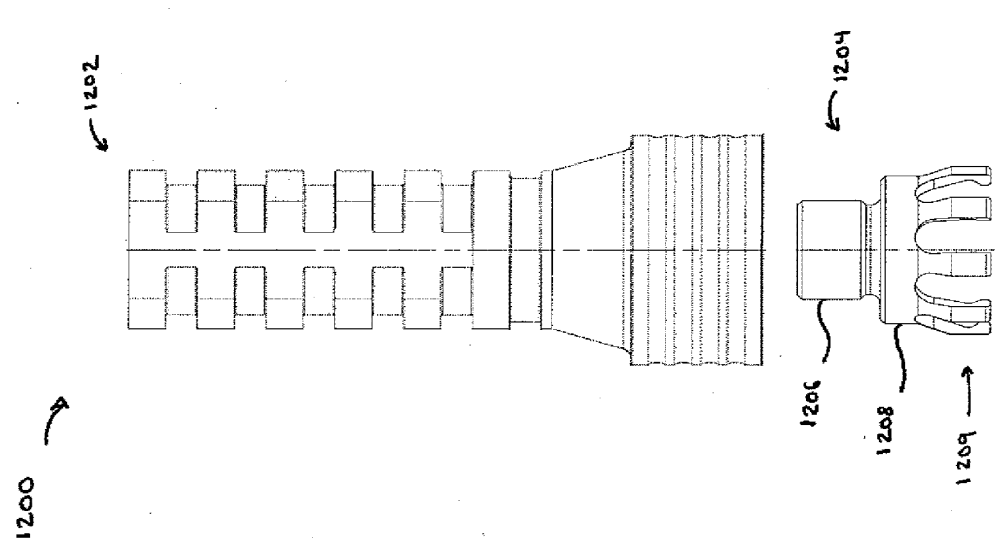


Figure 21

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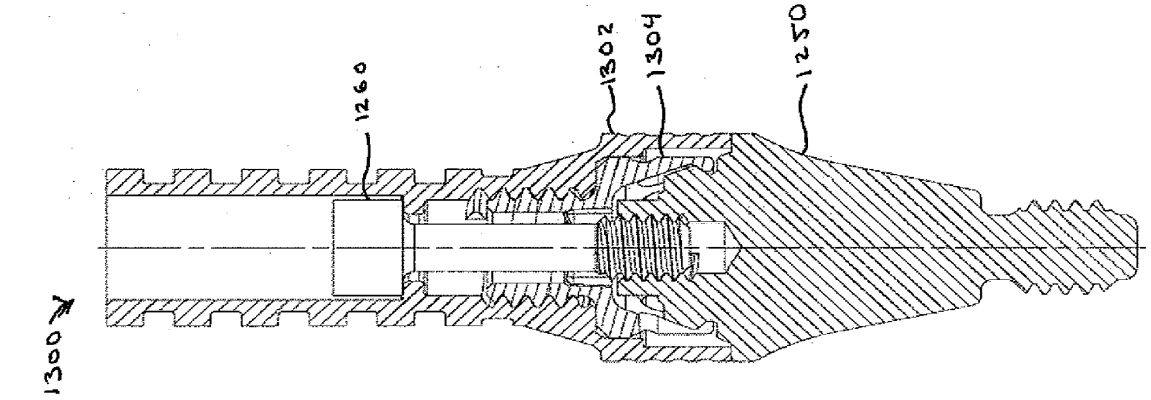


Figure 26

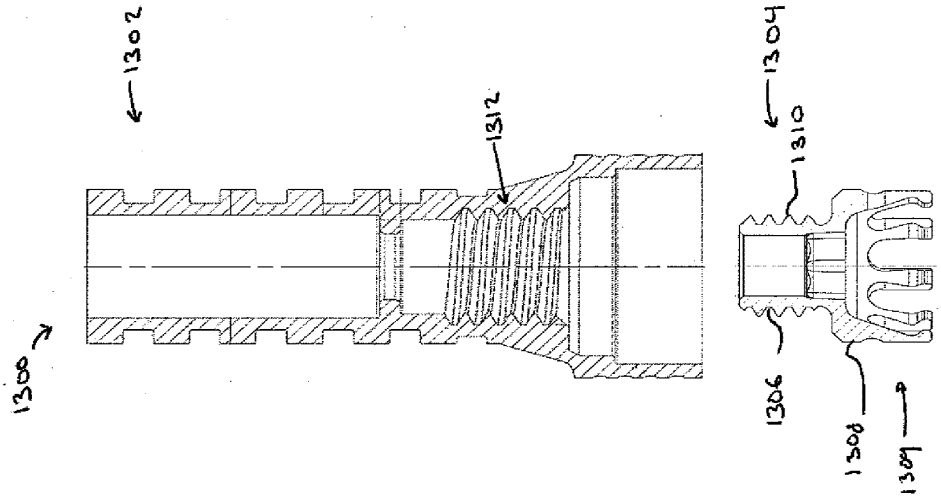


Figure 25

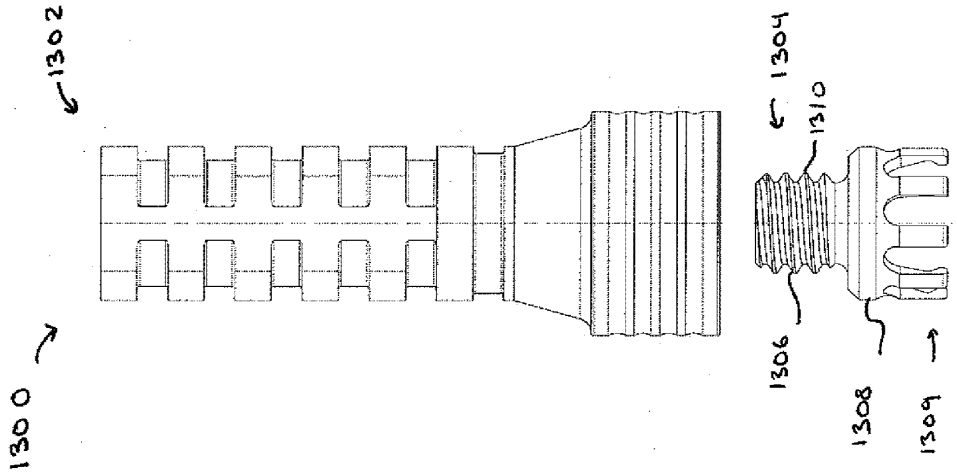
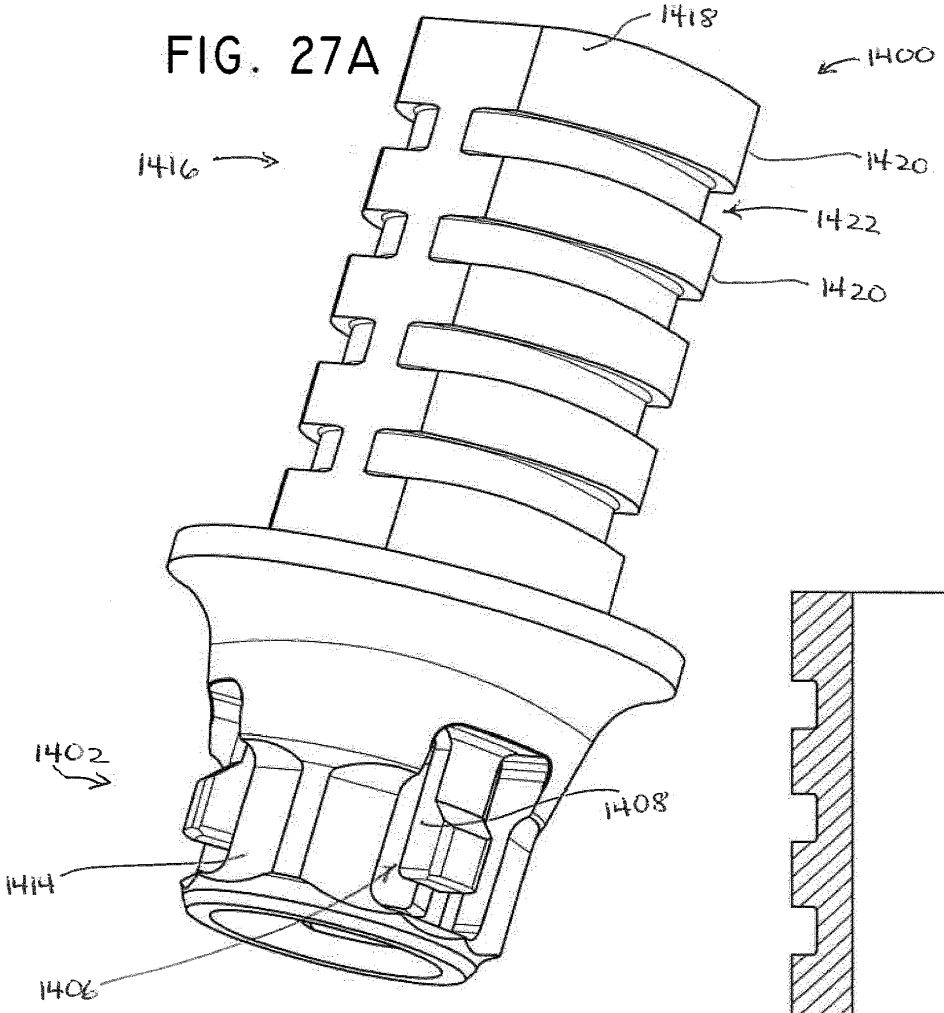


Figure 24

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FIG. 27A



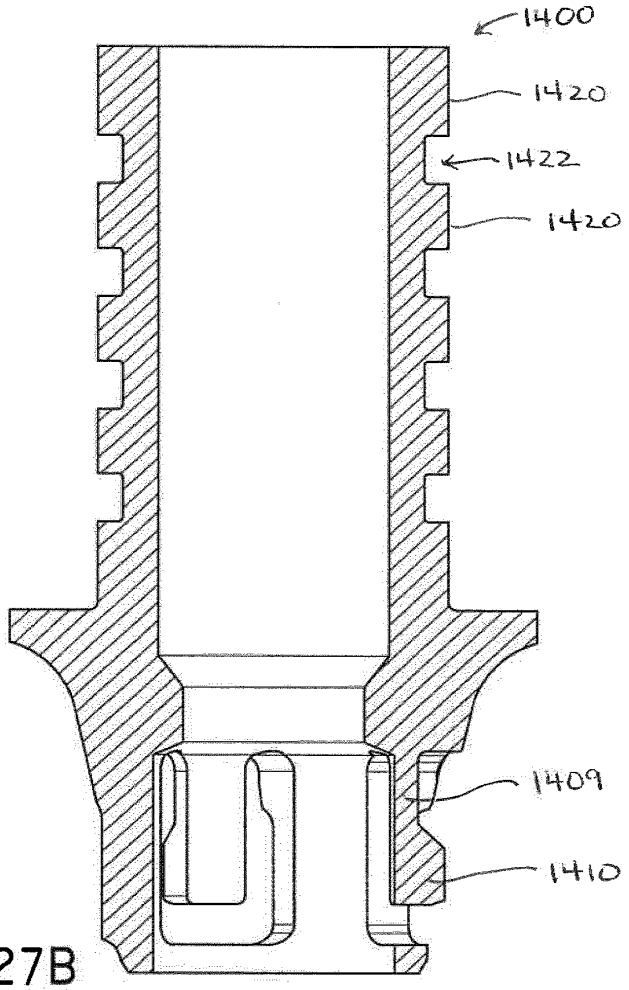


FIG. 27B

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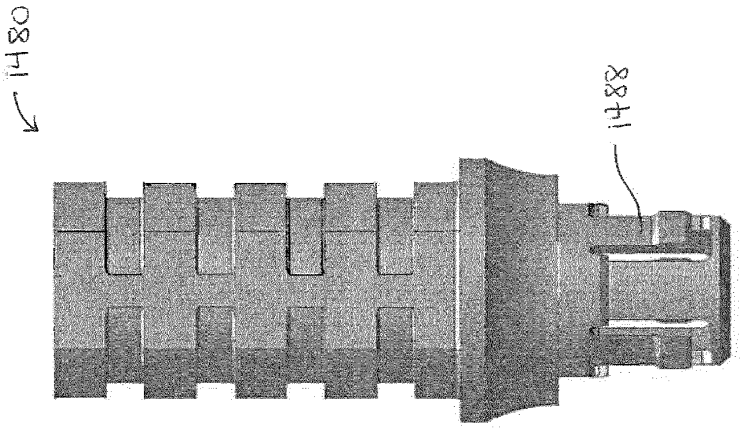


Figure 27E

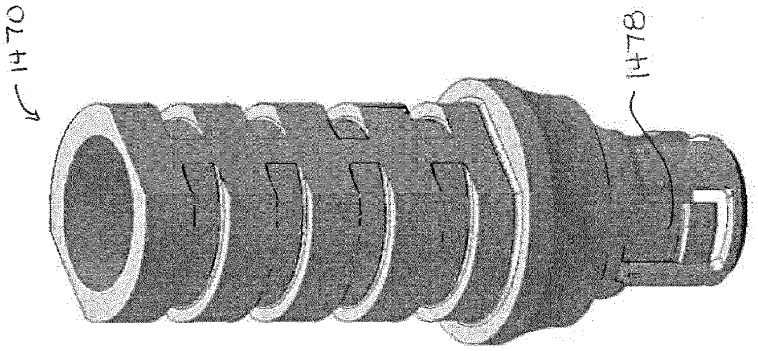


Figure 27D

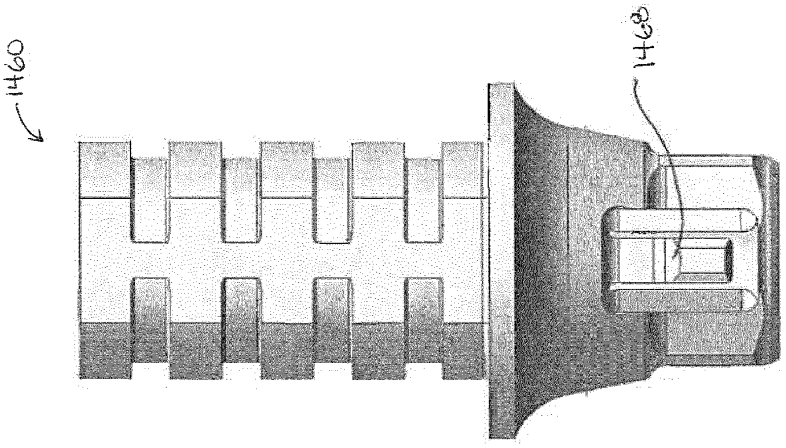


Figure 27C

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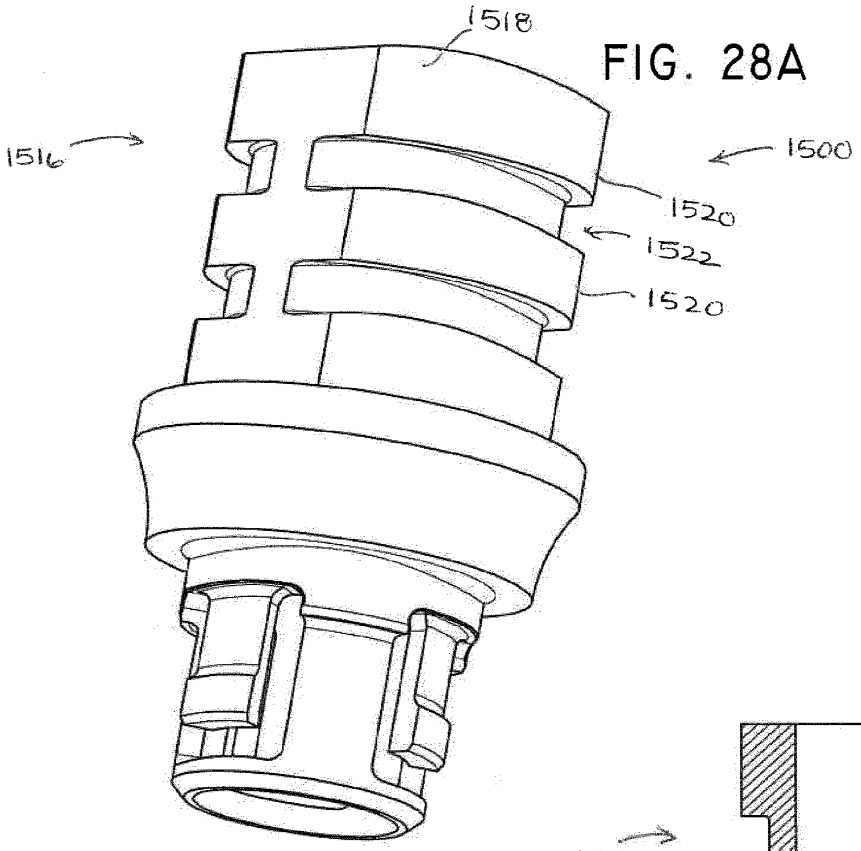


FIG. 28A

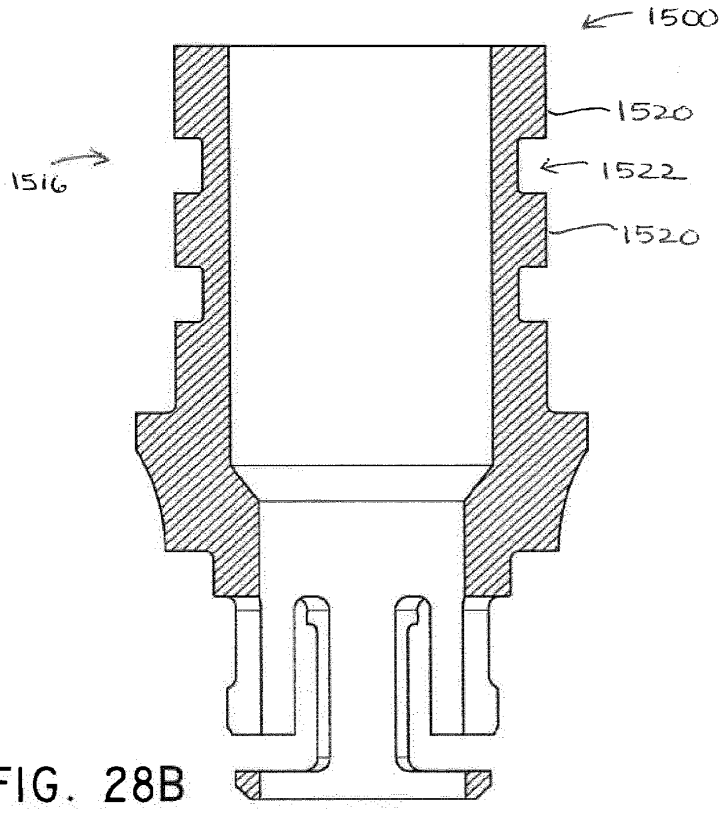
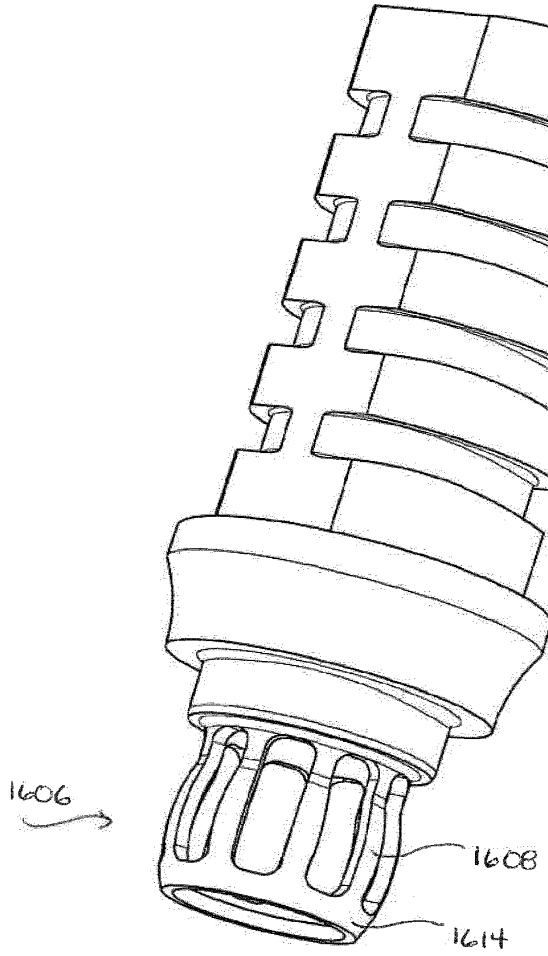


FIG. 28B

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FIG. 29A



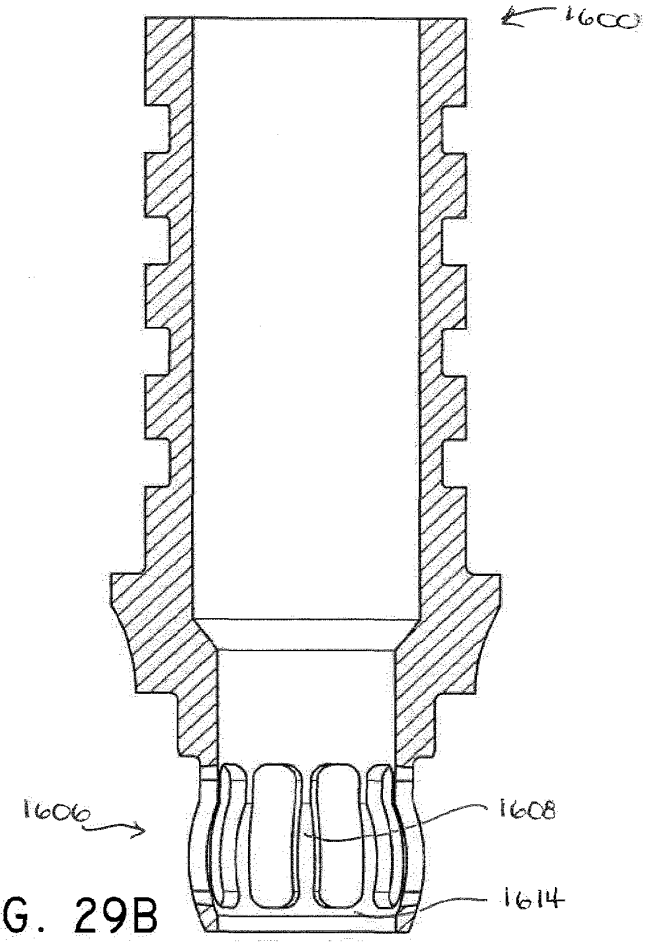
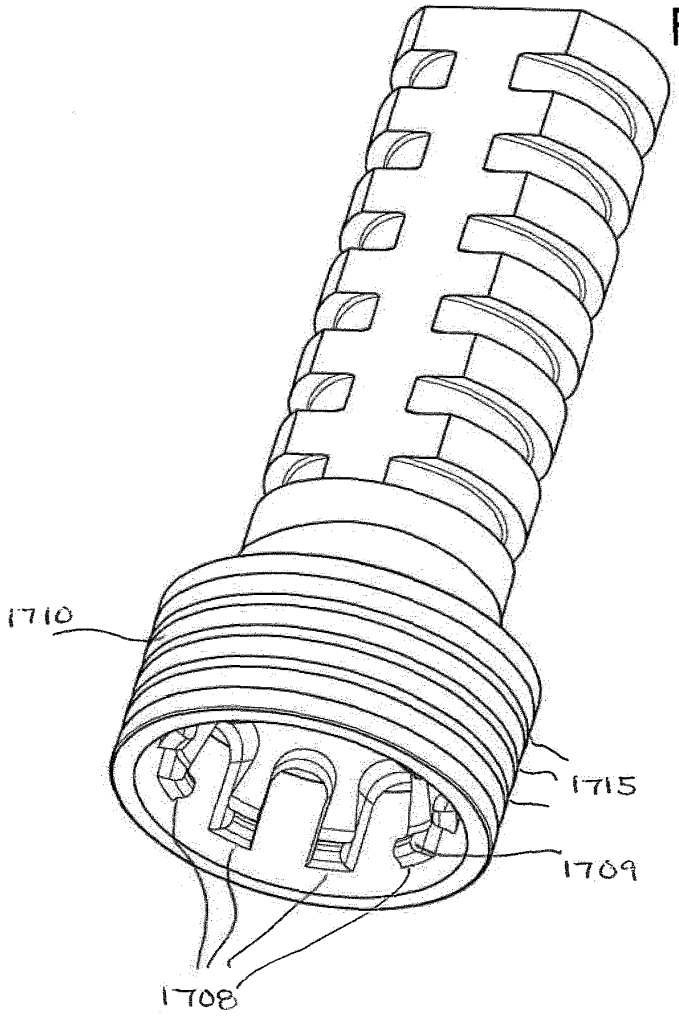


FIG. 29B

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FIG. 30A



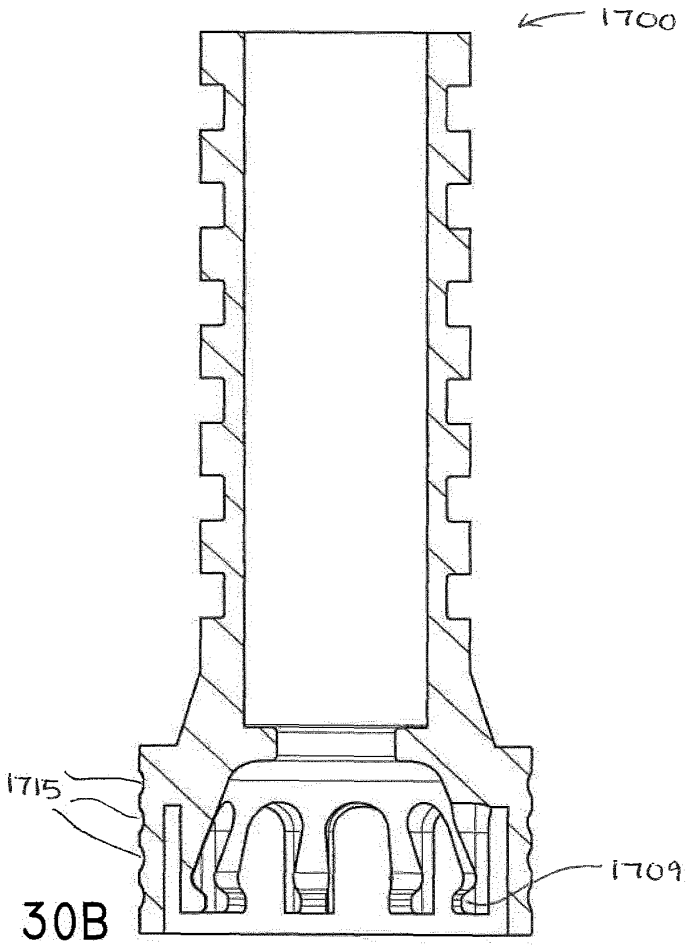


FIG. 30B

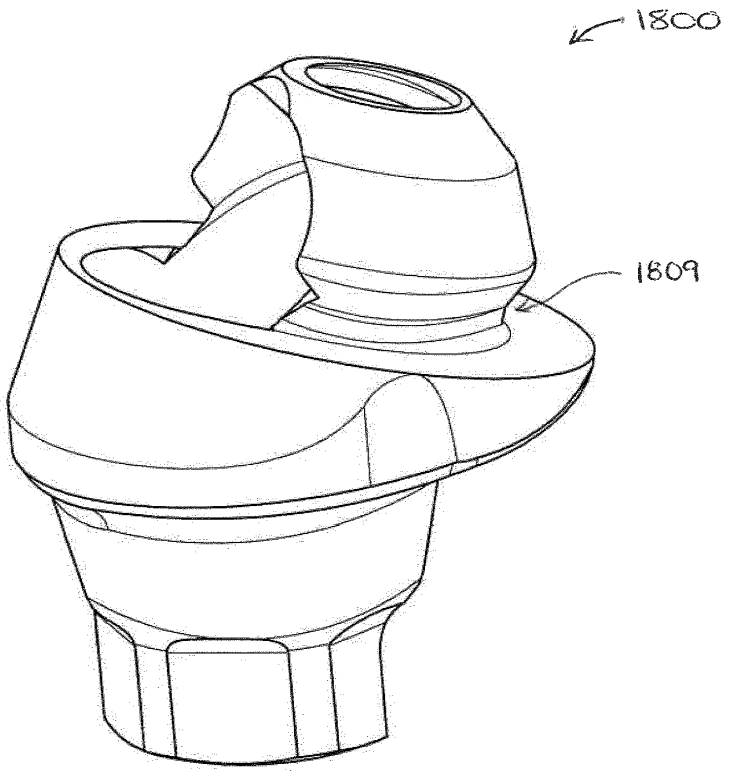


FIG. 31

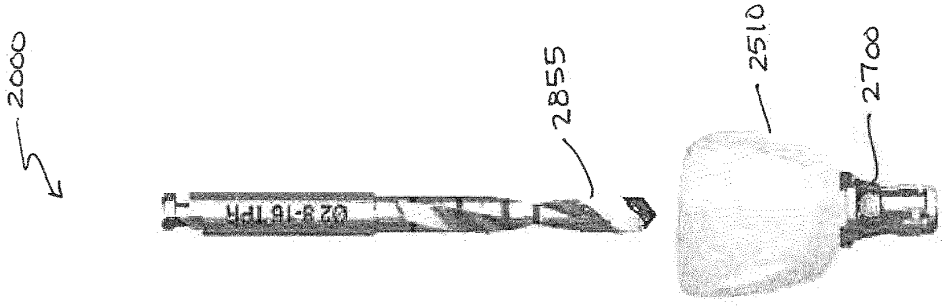


Figure 32C

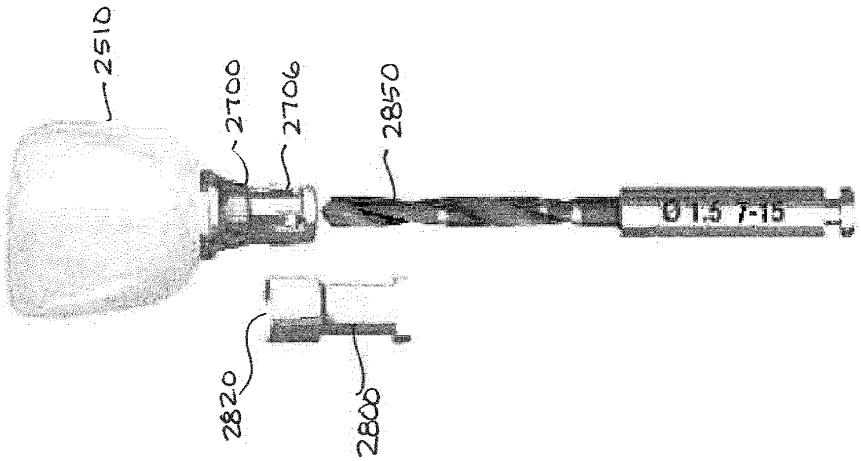


Figure 32B

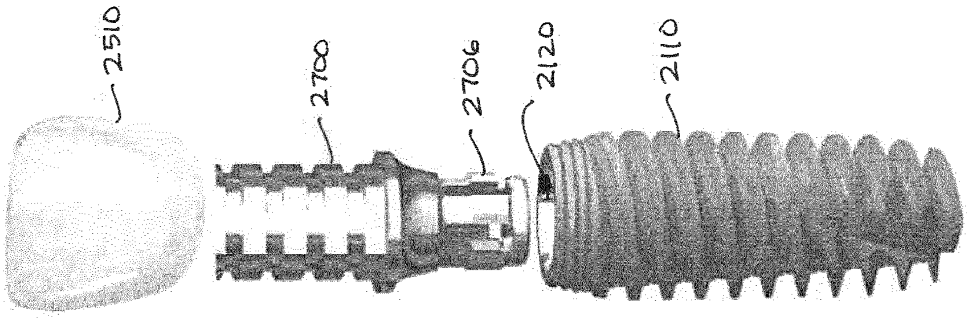


Figure 32A

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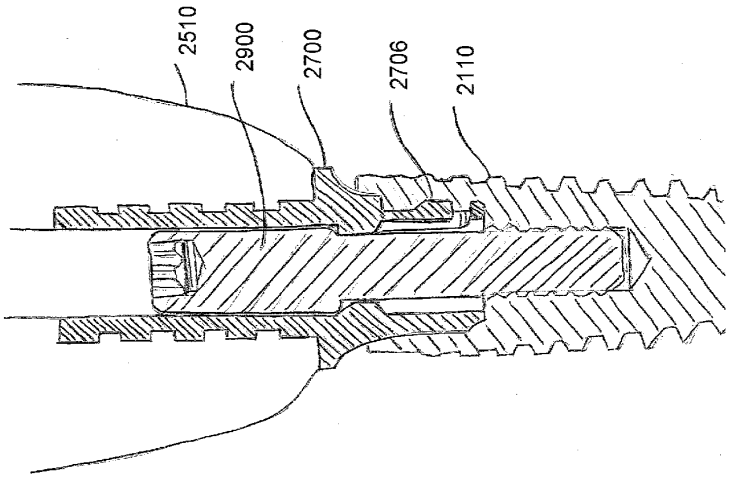


Figure 32D

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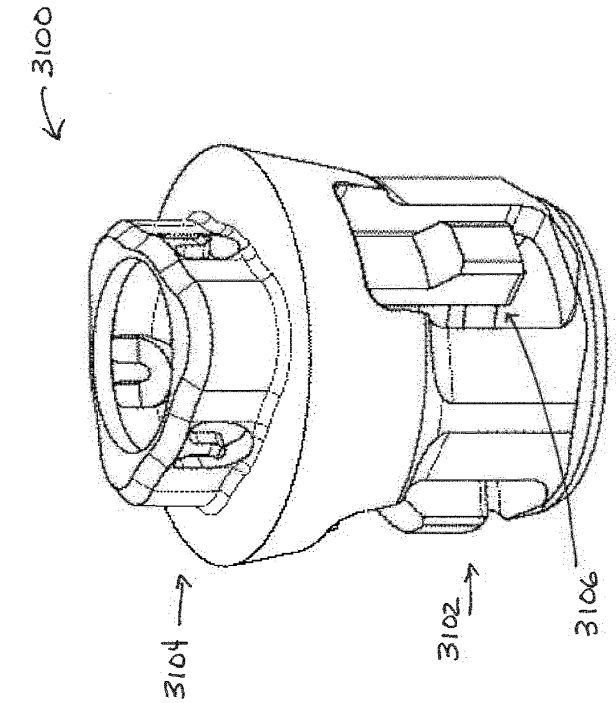


Figure 33B

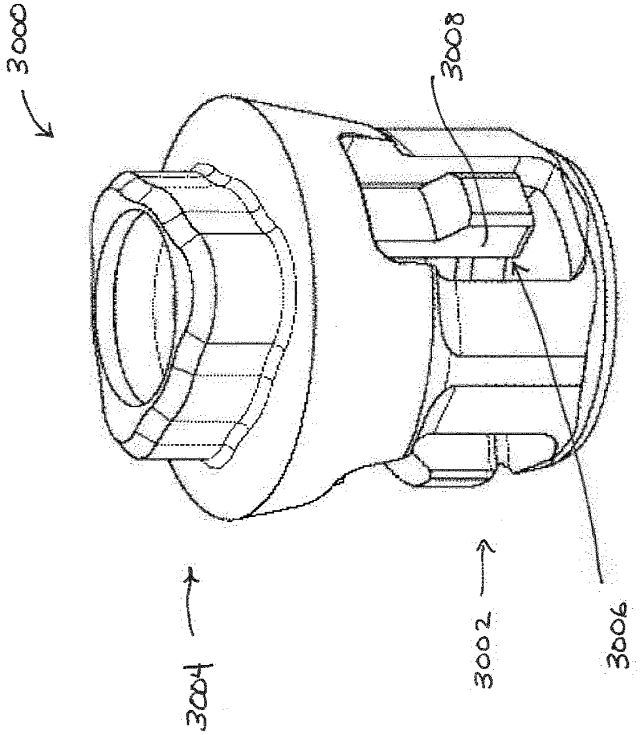


Figure 33A

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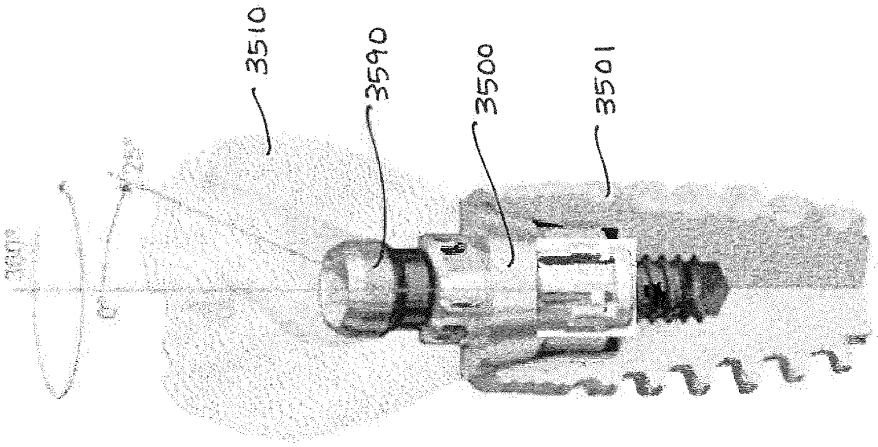


Figure 35

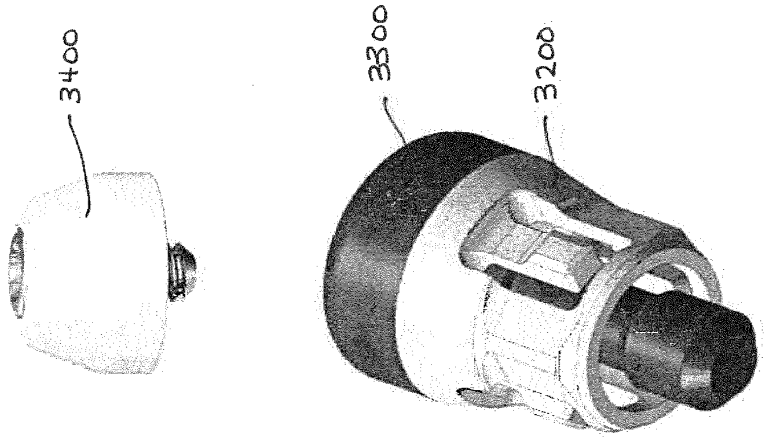


Figure 34

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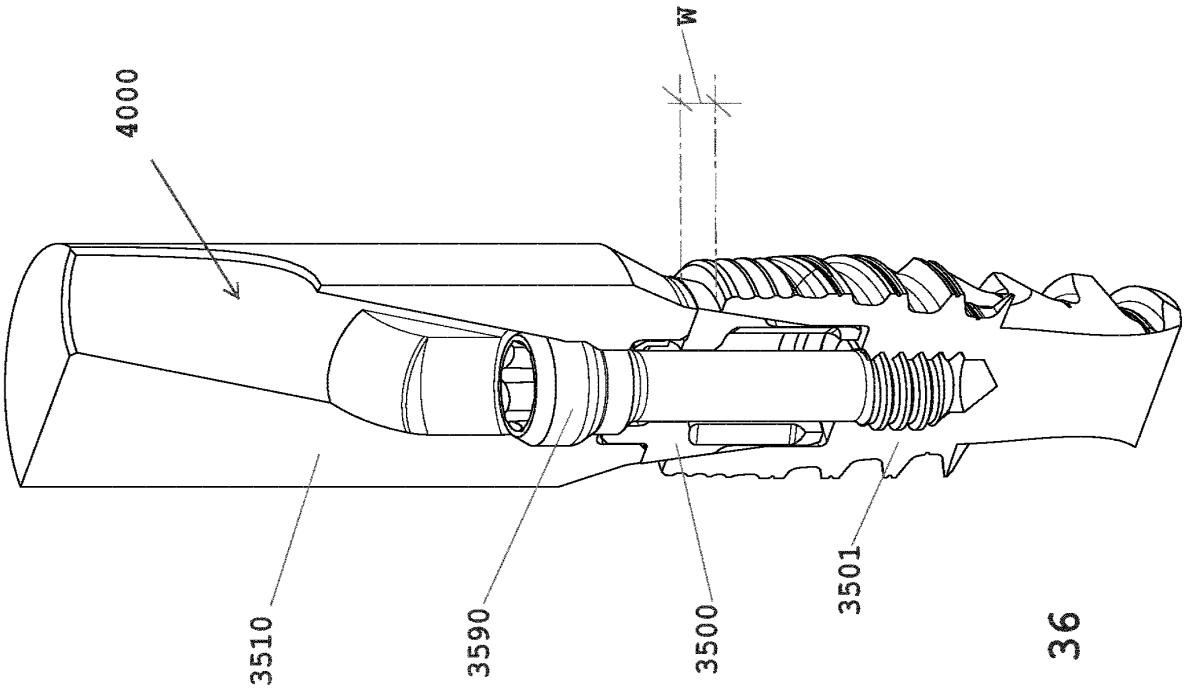


Figure 36

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/ EP2015/066970

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.: 17, 62, 69-71
because they relate to subject matter not required to be searched by this Authority, namely:

see FURTHER INFORMATION sheet PCT/ISA/210

2. [ ] Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 64(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

[ ] The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

[ ] No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)

Straumann USA Exhibit 1015

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/066970

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C8/Q0
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 850 873 A (LAZZARA RICHARD J [US] ET AL) 25 July 1989 (1989-07-25)	1-3, 9-15,35, 42,43
Y	column 2, line 49 - line 65; figure 1	4

X	US 6 068 479 A (KWAN NORMAN H0-KW0NG [CA]) 30 May 2000 (2000-05-30)	5-8, 14, 15, 42-47, 50-58
Y	column 9, lines 61-64; column 10, lines 10-23; figures 9, 9A	48,49

X	US 2012/295226 Al (R0BB T TAIT [US] ET AL) 22 November 2012 (2012-11-22)	18, 21-30,34
Y	paragraph [0055]; figures 6A, 13A, 13F, 15	4,48,49

	-/-	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) orwhich is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 September 2015	28/09/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schmidt, Karsten

1

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INTERNATIONAL SEARCH REPORT

International application No
PCT/ EP2015/06697O

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/093737 A2 (AETON MEDICAL LLC [US] ; HOGAN STEPHEN [US] ; KRIVORUK ANATOLI [US] ; RAN) 19 August 2010 (2010-08-19) figures 31-35	1,2,5, 9-11,15, 35,42, 43,46
X	KR 101 401 793 B1 (KIM HYUNG WOO [KR] ; KIM SUN YOUNG [KR] ; KIM GYUN HWAN [KR]) 29 May 2014 (2014-05-29) figure 5	1,2,4,5, 8,35-41, 51-58
A,P	EP 2 803 331 A1 (CPM PRÄZISIONSDREHTECHNIK GMBH [DE]) 19 November 2014 (2014-11-19) abstract ; figure 6	1-16, 29-61, 63-68

1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2015/066970

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4850873 A	25-07-1989	NONE	
US 6068479 A	30-05-2000	NONE	
US 2012295226 A1	22-11-2012	AU 2012255865 A1	12-12-2013
		CA 2833215 A1	22-11-2012
		EP 2709554 A1	26-03-2014
		JP 2014515960 A	07-07-2014
		US 2012295223 A1	22-11-2012
		US 2012295226 A1	22-11-2012
		US 2015104756 A1	16-04-2015
		WO 2012158769 A1	22-11-2012
WO 2010093737 A2	19-08-2010	EP 2395938 A2	21-12-2011
		JP 2012517861 A	09-08-2012
		US 2010209877 A1	19-08-2010
		US 2014193775 A1	10-07-2014
		WO 2010093737 A2	19-08-2010
KR 101401793 B1	29-05-2014	KR 101401793 B1	29-05-2014
		WO 2014175539 A1	30-10-2014
EP 2803331 A1	19-11-2014	NONE	

Form PCT/ISA/210 (patent family annex) (April 2005)

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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 17, 62, 69-71

Claim 17 relates to a method of coupling a dental prosthesis to an implant, thereby installing the dental prosthesis in a patient's jaw. Installation of a prosthesis in a patient's jaw, however, is a method of treatment of the human body by therapy in the sense of Article 17(2) (a) (i), Rule 39.1(iv) PCT, which is excluded from search. Claim 62 likewise includes a step of coupling a dental prosthesis to an implant in a patient's mouth and is therefore excluded from search. Claims 69-71 define a method of creating a dental restauration in the mouth of a patient. Such methods are also methods of treatment of the human body by therapy in the sense of Article 17(2) (a) (i), Rule 39.1(iv) PCT and therefore excluded from search.

Related Resources: Hardware

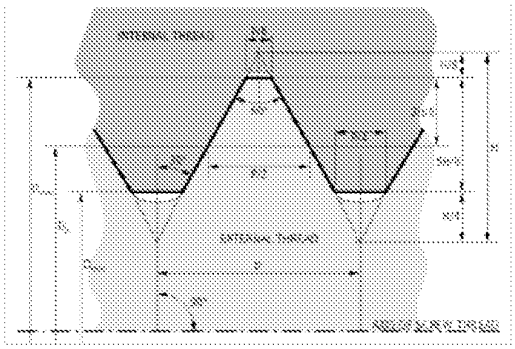
ISO 68-1 Metric Thread Profile Specifications and Equations

Engineering ANSI Hardware Design Data
Engineering Metric Hardware Design Data

ISO 68-1 Basic Metric Thread Profile Specifications and Equations

The ISO metric screw threads are the world-wide most commonly used type of general-purpose screw thread. They were one of the first international standards agreed when the International Organization for Standardization was set up in 1947.

The "M" designation for metric screws indicates the nominal outer diameter of the screw, in millimeters (e.g., an M6 screw has a nominal outer diameter of 6 millimeters).



Each thread is characterized by its major diameter, D (D_{maj} in the diagram), and its pitch, P. ISO metric threads consist of a symmetric Vshaped thread. In the plane of the thread axis, the flanks of the V have an angle of 60° to each other.

The thread depth is 0.614 × pitch. The outermost 1⁄8 and the innermost 1⁄4 of the height H of the V-shape are cut off from the profile.

The relationship between the height, H, and the pitch, P, is described by the following equation:

$$H = \frac{\sqrt{3}}{2} \times P = \cos(30^\circ) \times P \approx 0.866 \times P$$

or

$$P = \frac{2}{\sqrt{3}} \times H = \frac{H}{\cos(30^\circ)} \approx 1.155 \times H$$

In an external (male) thread (e.g., on a bolt), the major diameter D_{maj} and the minor diameter D_{min} define maximum dimensions of the thread. This means that the external thread must end flat at D_{maj}, but can be rounded out below the minor diameter D_{min}. Conversely, in an internal (female) thread (e.g., in a nut), the major and minor diameters are minimum dimensions, therefore the thread profile must end flat at D_{min} but may be rounded out beyond D_{maj}.

The minor diameter D_{min} and effective pitch diameter D_p are derived from the major diameter and pitch as:

$$D_{min} = D_{maj} - 2 \times \frac{5}{8} \times H = D_{maj} - \frac{5\sqrt{3}}{8} \times P \approx D_{maj} - 1.082532 \times P$$

$$D_p = D_{maj} - 2 \times \frac{3}{8} \times H = D_{maj} - \frac{3\sqrt{3}}{8} \times P \approx D_{maj} - 0.649519 \times P$$

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Link to this Webpage:

ISO 68-1 Metric Thread Profile Specifications and Equations

Engineers Edge

https://www.engineersedge.com/hardware/iso_681_metric_thread_14599.htm

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(12) 공개특허공보(A)

(11) 공개번호 10-2014-0080313
(43) 공개일자 2014년06월30일

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A61C 8/00 (2006.01) *A61C 13/263* (2006.01)
(21) 출원번호 10-2012-0149984
(22) 출원일자 2012년12월20일
심사청구일자 없음

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인천 연수구 해돋이로 107, 1동 4002호 (송도동, 더샵퍼스트월드)
(74) 대리인
김국진

전체 청구항 수 : 총 15 항

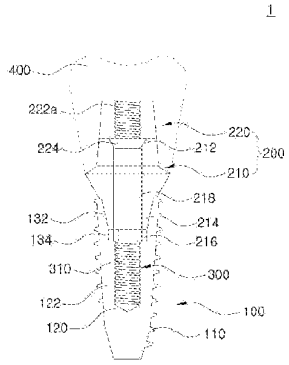
(54) 발명의 명칭 **치과용 임플란트**

(57) 요 약

본 발명은 치과용 임플란트에 관한 것으로, 보다 상세하게는 별도의 나사기둥을 이용하여 픽스쳐와 어버트먼트를 결합시킴으로써 임플란트 나사결합부의 파절을 방지함과 동시에 접촉면 전체에 골고루 힘이 전달되도록 하여 응력이 부분적으로 집중되는 현상을 방지할 수 있고, 픽스쳐와 어버트먼트 사이의 나사결합 방향을 달리하여 픽스쳐와 어버트먼트 사이의 결합력을 향상시키고, 나사의 풀림을 원천적으로 방지할 수 있는 치과용 임플란트에 관한 것이다.

본 발명은 픽스쳐와 어버드먼드를 포함하여 구성되는 치과용 임플란드에 있어서, 상기 어버드먼드는 픽스쳐에 끼움 결합되는 하부 어버트먼트와, 상기 하부 어버트먼트의 상부에 연결 설치되는 상부 어버트먼트로 분리 구성되고, 상기 상부 어버트먼트와 픽스쳐는 나사기둥에 의해 체결 고정되는 것을 특징으로 한다.

대 표 도 - 도3



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특허청구의 범위

청구항 1

외주면에 나사산이 형성된 픽스쳐와, 픽스쳐의 내측으로 삽입 결합되는 어버트먼트를 포함하여 구성되는 치과용 임플란트에 있어서,

상기 어버트먼트는 픽스쳐에 끼움 결합되는 하부 어버트먼트와, 상기 하부 어버트먼트의 상부에 연결 설치되는 상부 어버트먼트로 분리 구성되고,

상기 상부 어버트먼트와 픽스쳐는 나사기둥에 의해 체결 고정되는 것을 특징으로 하는 치과용 임플란트.

청구항 2

제 1항에 있어서,

상기 픽스쳐와 상부 어버트먼트에는 나사기둥이 결합되는 제1 및 제2암나사가 각각 형성되고, 상기 제1 및 제2암나사에 대응되는 위치의 나사기둥에는 제1 및 제2수나사가 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 3

제 2항에 있어서,

상기 제1암나사 및 제1수나사와, 제2암나사 및 제2수나사는 서로 반대방향의 나사산을 갖도록 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 4

제 2항에 있어서,

상기 상부 어버트먼트의 하단에는 돌출부가 형성되고, 상기 하부 어버트먼트의 상단에는 상기 돌출부가 끼움 결합되는 안착홈이 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 5

제 2항에 있어서,

상기 상부 어버트먼트의 하단에는 내주면에 제2암나사가 형성된 연장부가 돌출 형성되고, 상기 하부 어버트먼트의 상단에는 상기 연장부가 삽입 결합되는 삽입홈이 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 6

제 2항에 있어서,

상기 하부 어버트먼트의 하부에는 결합홈이 형성되고, 상기 픽스쳐의 상단부에는 결합홈에 끼움 결합되는 고정부가 돌출 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 7

제 1항에 있어서,

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상기 상부 어버트먼트의 외주면에는 시팅 그루브(seating groove)가 형성되고, 하부 어버트먼트의 외주면에는 시팅 릿지(seating ridge)가 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 8

제 2항에 있어서,

상기 나사기둥은 그 하단부와 상단부에 각각 형성되는 제1 및 제2수나사와, 상기 제1 및 제2수나사의 사이에 형성되는 다각 형상의 포스트로 구성된 것을 특징으로 하는 치과용 임플란트.

청구항 9

제 8항에 있어서,

상기 나사기둥의 제2수나사 외주면에는,

내주면에 제2암나사가 형성되고, 외주면에 제3수나사가 형성된 나사링이 결합되고, 상기 상부 어버트먼트에는 제3수나사가 체결되는 제3암나사가 형성된 제1체결홀이 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 10

제 9항에 있어서,

상기 나사기둥의 포스트에는 외주면에 제4수나사가 형성된 체결구가 끼움 결합되고, 상기 하부 어버트먼트에는 제4수나사가 체결되는 제4암나사가 형성된 제2체결홀이 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 11

제 10항에 있어서,

상기 체결구의 하단부에는 다각형상으로 이루어지는 회전방지부가 형성되고,

상기 픽스처의 상부에는 상기 회전방지부가 끼움 결합되는 회전방지홈이 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 12

제 10항에 있어서,

상기 체결구의 상단에는 픽스처의 내측에 결합된 나사기둥이 풀리는 방향을 향해 상향으로 경사진 톱니 형상의 제1스텝부가 형성되고, 상기 나사링과 체결구의 사이에는 하단부에 제1스텝부와 대응되는 형상의 제2스탭부가 형성된 제1스텝링이 설치되는 것을 특징으로 하는 치과용 임플란트.

청구항 13

제 10항에 있어서,

상기 제1암나사와 제1수나사의 나사 방향은,

픽스처에 형성된 나사산과, 제2 내지 제4암나사 및 제2 내지 제4수나사의 나사 방향과 반대로 형성된 것을 특징으로 하는 치과용 임플란트.

청구항 14

제 8항에 있어서,

상기 하부 어버트먼트의 내측에는 상단부에 픽스처의 내측에 결합된 나사기둥이 풀리는 방향을 향해 상향으로 경사진 톱니 형상의 제1스텝부가 형성되고,

상기 제1스텝부의 상부에는 하단부에 제1스텝부와 대응되는 형상의 제2스텝부가 형성된 제1스텝링이 하부 어버트먼트의 내측으로 삽입 결합된 것을 특징으로 하는 치과용 임플란트.

청구항 15

제 1항에 있어서,

상기 하부 어버트먼트의 상단부에는 픽스처의 내측에 결합된 나사기둥이 풀리는 방향을 향해 상향으로 경사진 경사면을 포함하는 계단 형상의 제3스텝부가 형성되고, 상기 하부 어버트먼트와 상부 어버트먼트의 사이에는 하단부에 제3스텝부와 대응되는 형상의 제4스텝부가 형성된 제2스텝링이 설치되는 것을 특징으로 하는 치과용 임플란트.

명 세 서

기 술 분 야

[0001] 본 발명은 치과용 임플란트에 관한 것으로, 보다 상세하게는 별도의 나사기둥을 이용하여 픽스처와 어버트먼트를 결합시킴으로써 임플란트 나사결합부의 파절을 방지함과 동시에 접촉면 전체에 골고루 힘이 전달되도록 하여 응력이 부분적으로 집중되는 현상을 방지할 수 있고, 픽스처와 어버트먼트 사이의 나사결합 방향을 달리하여 픽스처와 어버트먼트 사이의 결합력을 향상시키고, 나사의 풀림을 원천적으로 방지할 수 있는 치과용 임플란트에 관한 것이다.

배 경 기 술

[0002] 일반적으로, 임플란트(implant)란 자연치아와 동일한 형태와 기능을 재현할 수 있도록 구성되는 인공 대체물을 의미하는 것으로, 그 구성은 도 1에 나타낸 바와 같이, 외주면에 나사산(11)이 형성되어 치조골(A)에 설치되도록 자연치아의 치근 형태를 본뜬 티타늄 재질의 픽스처(fixture)(10)와, 상기 픽스처(10)의 상부에 연결 설치되고 그 상부에 인공치아(B)가 결합되는 어버트먼트(abutment)(20)와, 상기 픽스처(10)와 어버트먼트(20)를 서로 고정시키는 고정나사(30)를 포함하여 이루어진다.

[0003] 즉, 종래의 일반적인 임플란트 구조는 내부에 나사공이 형성된 픽스처(10)의 상부에 어버트먼트(20)를 위치시킨 후, 어버트먼트(20)를 통해 픽스처(10)의 나사공 내측으로 고정나사(30)를 삽입 결합시켜 고정나사(30)의 회전에 의해 픽스처(10)와 어버트먼트(20)가 서로 고정 결합되도록 구성된 것이다.

[0004] 하지만, 상기와 같은 구성이 고정나사(30)의 헤드부분이 어버트먼트(20)의 내측으로 삽입되어 픽스처(10)와 어버트먼트(20)의 결합부에 지지되도록 구성되어 있어, 고정나사(30)의 길이가 짧아 픽스처(10)와 어버트먼트(20)의 결합력이 약하고, 음식물을 씹는 경우 등의 저작작용시 받는 하중이 고정나사(30)의 좁은 표면적에 집중되어 픽스처(10)와 어버트먼트(20)의 결합부에서 고정나사(30)가 파절되거나 풀릴 수 있는 문제점이 있다.

[0005] 이러한 문제점을 해결하기 위한 종래 기술로 미국 공개특허공보 US2003/0224328호에는 생물학적 기능을 갖는 치아 임플란트(1)가 게재되어 있는데, 그 주요 기술적 구성은 도 2에 나타낸 바와 같이, 환자의 입 안 잇몸뼈(64)에 크라운부(50)를 부착시키기 위한 생물학적 기능을 갖는 치과 임플란트(1)에 있어서, 환자의 잇몸뼈(64)에 형성되는 소켓(움푹 들어간 곳) 안쪽의 검라인(62)(치아와 잇몸이 만나 이루는 선) 아래에 심어지는 뿌리부(3)와, 환자의 잇몸뼈(64)에 형성되는 소켓의 안쪽에 상기 뿌리부(3)를 고정시키기 위한 수단과, 크라운부(50)와, 상기 뿌리부(3)에 크라운부(50)를 연결시키기 위한 플렉시블한 어버트먼트 포스트(18)를 포함하여 구성되되, 상기 플렉시블한 어버트먼트 포스트(18)는 상기 크라운부(50)가 환자의 잇몸뼈(64)에 형성되는 소켓 안쪽에 고정

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되는 뿌리부(3)에 대해 이동이 가능하도록 하기 위하여 구부러질 수 있도록 형성된 것에 그 특징이 있다.

[0006] 상기 구성은 치근부를 둘러싸는 뼈 구조에 인간의 성장인자를 분배할 수 있도록 하는 공급 통로를 제공할 수 있도록 구성된 것에 특징이 있으나, 그 구성이 복잡하여 고, 크라우부(50)와 뿌리부(3) 사이의 결합력이 약하며, 어버트먼트 포스트(18)에 의한 크라운부(50)와 뿌리부(3)의 나사 결합이 풀릴 위험이 존재한다는 문제점이 있다.

[0007] 하지만, 상기 구성은 나사부(5)가 상부설치대(2)에 일체로 형성되어 있어, 나사부(5)가 형성된 상부설치대(2)가 파절될 위험이 여전히 존재하고, 상부설치대(2)가 파절될 경우 파절된 나사부(5)를 제거하는 것이 어렵다는 단점이 있다.

[0008] 또한, 상기 나사부(5)가 인공치아고정체(11)의 내측에서만 나사결합되므로, 나사 결합되는 부분의 표면적이 작아 인공치아고정체(11)와 상부설치대(2) 및 하부설치대(6) 사이의 결합력이 약하고, 나사결합이 풀릴 위험이 존재한다는 문제점이 있다.

[0009] 또한, 상기 종래 구성은 어버트먼트가 잇몸부분과 맞닿는 면이 없이 크라운부(50)가 통채로 뿌리부(3)에 연결된 구조이므로, 완벽하게 잇몸뼈가 존재하는 경우에만 적용이 가능하고, 검라인(62) 부근에 치태와 치석이 많이 침착하게 되는 문제점도 있다.

발명의 내용

해결하려는 과제

[0010] 본 발명은 상기와 같은 종래 기술의 문제점들을 해결하기 위하여 안출된 것으로, 본 발명의 목적은 픽스처와 어버트먼트의 결합을 위해 별도의 나사기둥을 사용함으로써 픽스처와 어버트먼트가 나사 결합되는 면적을 증가시킴으로써 픽스처와 어버트먼트 사이의 결합력을 증가시키고, 나사기둥의 파절 위험을 최소화할 수 있을 뿐만 아니라, 나사기둥의 파절시에도 파절된 나사기둥을 용이하게 제거할 수 있는 치과용 임플란트를 제공함에 있다.

[0011] 또한, 본 발명은 픽스처에 나사기둥을 먼지 결합시킨 후 그 상부에 어버트먼트를 체결 고정시킬 수 있도록 하여 픽스처와 어버트먼트의 결합을 보다 용이하고 정확하게 할 수 있도록 하는 치과용 임플란트를 제공함에 다른 목적이 있다.

[0012] 또한, 본 발명은 어버트먼트를 상부 어버트먼트와 하부 어버트먼트로 분리 구성함으로써 상,하부 어버트먼트의 높이, 기울기, 굵기 등의 형상을 다양하게 선택하여 조립할 수 있도록 하는 치과용 임플란트를 제공함에 또 다른 목적이 있다.

[0013] 또한, 본 발명은 나사기둥을 이용하여 상부 어버트먼트와 나사기둥의 사이, 픽스처와 나사기둥의 사이로 나사 결합부를 두 군데로 분리하여 구성함과 동시에 분리 구성되는 나사 결합부의 결합 방향을 서로 반대가 되도록 함으로써 픽스처와 어버트먼트 사이의 결합력을 향상시키고, 나사의 풀림을 원천적으로 방지할 수 있는 치과용 임플란트를 제공함에 또 다른 목적이 있다.

[0014] 또한, 본 발명은 나사기둥과 상,하부 어버트먼트의 사이에 나사링 및 체결구를 삽입 결합시킴으로써 상,하부 어버트먼트 사이의 결합력 및 상,하부 어버트먼트와 픽스처 사이의 결합력을 향상시킬 수 있는 치과용 임플란트를 제공함에 또 다른 목적이 있다.

[0015] 또한, 본 발명은 픽스처의 매식 방향 및 나사기둥과 상,하부 어버트먼트 사이의 결합방향과, 나사기둥과 픽스처 사이의 결합방향을 반대로 함으로써 나사기둥의 풀림방지 효과를 극대화시킬 수 있도록 하는 치과용 임플란트를 제공함에 또 다른 목적이 있다.

[0016] 또한, 본 발명은 하부 어버트먼트의 내측 또는 상부 어버트먼트와 하부 어버트먼트의 사이에 스텝링을 삽입 설치하여 하부 어버트먼트가 다각 형상으로 이루어지는 나사기둥의 포스트에 밀착되도록 함으로써 임플란트의 제조 과정에서 발생되는 공차에도 불구하고 흔들림 없이 견고한 고정 상태를 유지할 수 있도록 하는 치과용 임플란트를 제공함에 또 다른 목적이 있다.

[0017] 또한, 본 발명은 상부 어버트먼트와 하부 어버트먼트의 외주면에 시팅 그루브 또는 시팅 릿지를 각각 형성시켜 인공치아의 내측면에 시팅 그루브와 시팅 릿지의 형상에 대응되는 돌출부와 홈이 형성되도록 함으로써 상부 어

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버트먼트와 하부 어버트먼트를 고정시킬 수 있도록 하는 치과용 임플란트를 제공함에 또 다른 목적이 있다.

발명의 구성 및 작용

[0018] 상기와 같은 목적들을 달성하기 위한 본 발명은,

[0019] 픽스쳐와 어버트먼트를 포함하여 구성되는 치과용 임플란트에 있어서, 상기 어버트먼트는 픽스쳐에 끼움 결합되는 하부 어버트먼트와, 상기 하부 어버트먼트의 상부에 연결 설치되는 상부 어버트먼트로 분리 구성되고, 상기 상부 어버트먼트와 픽스쳐는 나사기둥에 의해 체결 고정되는 것을 특징으로 한다.

[0020] 이때, 상기 픽스쳐와 상부 어버트먼트에는 나사기둥이 결합되는 제1 및 제2암나사가 각각 형성되고, 상기 제1 및 제2암나사에 대응되는 위치의 나사기둥에는 제1 및 제2수나사가 형성된 것을 특징으로 한다.

[0021] 또한, 상기 제1암나사 및 제1수나사와 제2암나사 및 제2수나사는 서로 반대방향의 나사산을 갖도록 형성된 것을 특징으로 한다.

[0022] 그리고, 상기 상부 어버트먼트의 하단에는 돌출부가 형성되고, 상기 하부 어버트먼트의 상단에는 상기 돌출부가 끼움 길합되는 안착홈이 형성된 것을 특징으로 한다.

[0023] 또한, 상기 상부 어버트먼트의 하단에는 내주면에 제2암나사가 형성된 연장부가 돌출 형성되고, 상기 하부 어버트먼트의 상단에는 상기 연장부가 삽입 결합되는 삽입홈이 형성된 것을 특징으로 한다.

[0024] 또한, 상기 하부 어버트먼트의 하부에는 결합홈이 형성되고, 상기 픽스쳐의 상단부에는 결합홈에 끼움 결합되는 고정부가 돌출 형성된 것을 특징으로 한다.

[0025] 그리고, 상기 상부 어버트먼트의 외주면에는 시팅 그루브(seating groove)가 형성되고, 하부 어버트먼트의 외주면에는 시팅 릿지(seating ridge)가 형성된 것을 특징으로 한다.

[0026] 한편, 상기 나사기둥은 그 하단부와 상단부에 각각 형성되는 제1 및 제2수나사와, 상기 제1 및 제2수나사의 사이에 형성되는 다각 형상의 포스트로 구성된 것을 특징으로 한다.

[0027] 이때, 상기 나사기둥의 제2수나사 외주면에는, 내주면에 제2암나사가 형성되고, 외주면에 제3수나사가 형성된 나사링이 결합되고, 상기 상부 어버트먼트에는 제3수나사가 체결되는 제3암나사가 형성된 제1체결홀이 형성된 것을 특징으로 한다.

[0028] 또한, 상기 나사기둥의 포스드에는 외주면에 제4수나사가 형성된 체결구가 끼움 결합되고, 상기 하부 어버드먼트에는 제4수나사가 체결되는 제4암나사가 형성된 제2체결홀이 형성된 것을 특징으로 한다.

[0029] 그리고, 상기 체결구의 하단부에는 다각형상으로 이루어지는 회전방지부가 형성되고, 상기 픽스처의 상부에는 상기 회전방지부가 끼움 결합되는 회전방지홈이 형성된 것을 특징으로 한다.

[0030] 또한, 상기 체결구의 상단에는 픽스처의 내측에 결합된 나사기둥이 풀리는 방향을 향해 상향으로 경사진 톱니 형상의 제1스텝부가 형성되고, 상기 나사링과 체결구의 사이에는 하단부에 제1스텝부와 대응되는 형상의 제2스텝부가 형성된 제1스텝링이 설치되는 것을 특징으로 한다.

[0031] 또한, 상기 제1임나사와 제1수나사의 나사 방향은, 픽스처에 형성된 나사산과, 제2 내지 제4암나사 및 제2 내지 제4수나사의 나사 방향과 반대로 형성된 것을 특징으로 한다.

[0032] 그리고, 상기 하부 어버트먼트의 내측에는 상단부에 픽스처의 내측에 결합된 나사기둥이 풀리는 방향을 향해 상향으로 경사진 톱니 형상의 제1스텝부가 형성되고, 상기 제1스텝부의 상부에는 하단부에 제1스텝부와 대응되는 형상의 제2스텝부가 형성된 제1스텝링이 하부 어버트먼트의 내측으로 삽입 결합된 것을 특징으로 한다.

[0033] 또한, 상기 하부 어버트먼트의 상단부에는 픽스처의 내측에 결합된 나사기둥이 풀리는 방향을 향해 상향으로 경사진 경사면을 포함하는 계단 형상의 제3스텝부가 형성되고, 상기 하부 어버트먼트와 상부 어버트먼트의 사이에는 하단부에 제3스텝부와 대응되는 형상의 제4스텝부가 형성된 제2스텝링이 설치되는 것을 특징으로 한다.

발명의 효과

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[0034] 본 발명에 따르면, 픽스처와 어버트먼트의 결합을 위해 별도의 나사기둥을 사용함으로써 픽스처와 어버트먼트가 나사 결합되는 면적을 증가시킴으로써 픽스처와 어버트먼트 사이의 결합력을 증가시키고, 나사결합되는 부분에 전체적으로 하중이 분산되어 전달되어 응력집중에 의한 나사기둥의 파절 위험을 최소화할 수 있을 뿐만 아니라, 나사기둥의 파절시에도 파절된 나사기둥을 용이하게 제거할 수 있는 효과를 갖는다.

[0035] 또한, 본 발명은 픽스처에 나사기둥을 결합시킨 후 그 상부에 어버트먼트를 체결 고정시킬 수 있도록 하여 픽스처와 어버트먼트의 결합을 보다 용이하고 정확하게 할 수 있는 효과를 추가로 갖는다.

[0036] 또한, 본 발명은 어버트먼트를 상부 어버트먼트와 하부 어버트먼트로 분리 구성함으로써 상,하부 어버트먼트의 높이, 기울기, 굵기 등의 형상을 다양하게 선택하여 조립할 수 있는 효과를 추가로 갖는다.

[0037] 또한, 본 발명은 나사기둥을 이용하여 상부 어버트먼트와 나사기둥의 사이, 픽스처와 나사기둥의 사이로 나사 결합부를 두 군데로 분리하여 구성함과 동시에 분리 구성되는 나사 결합부의 결합 방향을 서로 반대가 되도록 함으로써 픽스처와 어버트먼트 사이의 결합력을 향상시키고, 나사의 풀림을 원천적으로 방지할 수 있을 뿐만 아니라, 픽스처와 어버드먼드의 접촉 부분이 부분적으로 응력을 받지 않고 전체적으로 밀착되므로 픽스처와 어버트먼트의 결합부 틈새로 외부물질이 침투되는 것을 방지함으로써 임플란트 내부에서의 세균 번식에 의한 임플란드 주위염과 임플란드 주위 점막염의 발생을 예방할 수 있는 효과를 추가로 갖는다.

[0038] 또한, 본 발명에 따르면, 나사기둥과 상,하부 어버드먼드의 사이에 나사링 및 체결구를 삽입 결합시킴으로써 상,하부 어버트먼트 사이의 결합력 및 상,하부 어버트먼트와 픽스처 사이의 결합력을 향상시킬 수 있을 뿐만 아니라, 픽스처의 매식 방향 및 나사기둥과 상,하부 어버드먼드 사이의 결합방향과, 나사기둥과 픽스처 사이의 결합방향을 반대로 함으로써 나사기둥의 풀림방지 효과를 극대화시킬 수 있도록 하는 효과를 추가로 갖는다.

[0039] 또한, 본 발명에 따르면 하부 어버트먼트의 내측 또는 상부 어버트먼트와 하부 어버트먼트의 사이에 스텝링을 삽입 설치하여 하부 어버트먼트의 내측면이 다각 형상으로 이루어지는 나사기둥의 포스트의 외주면에 밀착 고정되도록 함으로써 임플란트의 제조 과정에서 발생되는 공차에도 불구하고 흔들림 없이 견고한 고정 상태를 유지할 수 있도록 하는 효과를 추가로 갖는다.

[0040] 또한, 본 발명에 따르면 상부 어버트먼트와 하부 어버트먼트의 외주면에 시팅 그루브 또는 시팅 릿지를 각각 형성시켜 인공치아의 내측년에 시팅 그루브와 시팅 릿지의 형상에 대응되는 들출부와 홈이 형성되도록 함으로써 상부 어버트먼트와 하부 어버트먼트를 견고히 고정시켜 풀림 현상을 방지할 수 있는 효과를 추가로 갖는다.

도면의 간단한 설명

[0041] 도 1은 일반적인 종래의 임플란트가 시술된 모습을 개략적으로 나타낸 도면.

도 2는 종래의 치아 임플란트의 결합 모습을 나타낸 단면도.

도 3은 본 발명에 따른 치과용 임플란트의 일실시예를 나타낸 결합 단면도.

도 4는 도 3에 나타낸 본 발명을 분리하여 나타낸 단면도.

도 5의 (a),(b),(c)는 도 3에 나타낸 본 발명 중 어버트먼트의 실시예를 분리하여 나타낸 단면도.

도 6의 (a),(b),(c)는 도 3에 나타낸 본 발명 중 나사기둥의 실시예를 나타낸 도면.

도 7은 본 발명에 따른 치과용 임플란드의 제2실시예를 나타낸 결합 단면도.

도 8은 본 발명에 따른 치과용 임플란드의 제3실시예를 나타낸 결합 단면도.

도 9는 본 발명에 따른 치과용 임플란트의 제4실시예를 분리하여 나타낸 단면도.

도 10은 도 9에 나타낸 본 발명의 결합 단면도.

도 11의 (a),(b),(c)는 도 9에 나타낸 본 발명 중 하부 어버트먼트의 결합과정을 나타낸 단면도.

도 12의 (a),(b)는 도 10에 나타낸 본 발명 중 픽스처와 하부 어버트먼트 사이의 결합부를 나타낸 평단면도.

도 13은 본 발명에 따른 치과용 임플란트의 제5실시예를 분리하여 나타낸 단면도.

도 14는 도 13에 나타낸 본 발명의 결합 단면도.

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도 15는 본 발명에 따른 치과용 임플란트의 제6실시예를 분리하여 나타낸 단면도.

도 16은 본 발명에 따른 치과용 임플란트 중 상,하부 어버트먼트의 다른 실시예를 분리하여 나타낸 도면.

발명을 실시하기 위한 구체적인 내용

[0042] 이하, 첨부된 도면을 참고로 하여 본 발명에 따른 치과용 임플란트의 바람직한 실시예들을 상세히 설명하기로 한다.

[0043] 도 3은 본 발명에 따른 치과용 임플란트의 일실시예를 나타낸 결합 단면도이고, 도 4는 도 3에 나타낸 본 발명을 분리하여 나타낸 단면도이며, 도 5의 (a),(b),(c)는 도 3에 나타낸 본 발명 중 어버트먼트의 실시예를 분리하여 나타낸 단면도이고, 도 6의 (a),(b),(c)는 도 3에 나타낸 본 발명 중 나사기둥의 실시예를 나타낸 도면이며, 도 7은 본 발명에 따른 치과용 임플란트의 제2실시예를 나타낸 결합 단면도이고, 도 8은 본 발명에 따른 치과용 임플란트의 제3실시예를 나타낸 결합 단면도이며, 도 9는 본 발명에 따른 치과용 임플란트의 제4실시예를 분리하여 나타낸 단면도이고, 도 10은 도 9에 나타낸 본 발명의 결합 단면도이며, 도 11의 (a),(b),(c)는 도 9에 나타낸 본 발명 중 하부 어버트먼트의 결합과정을 나타낸 단면도이고, 도 12는 본 발명에 따른 치과용 임플란트의 제5실시예를 분리하여 나타낸 단면도이며, 도 13은 도 12에 나타낸 본 발명의 결합 단면도이고, 도 14는 본 발명에 따른 치과용 임플란트의 제6실시예를 분리하여 나타낸 단면도이며, 도 15는 본 발명에 따른 치과용 임플란트 중 상,하부 어버트먼트의 다른 실시예를 분리하여 나타낸 도면이다.

[0044] 본 발명은 별도의 나사기둥(300,300')을 이용하여 픽스쳐(100)와 어버트먼트(200)를 결합시킴으로써 임플란트 나사결합부의 파절을 방지함과 동시에 접촉면 전체에 골고루 힘이 전달되도록 하여 응력이 부분적으로 집중되는 현상을 방지할 수 있고, 픽스쳐(100)와 어버트먼트(200) 사이의 나사결합 방향을 달리하여 픽스쳐(100)와 어버트먼트(200) 사이의 결합력을 향상시키고, 나사의 풀림을 원천적으로 방지할 수 있는 치과용 임플란트(1)에 관한 것으로, 그 일실시예의 구성은 도 3 및 도 4에 나타낸 바와 같이, 픽스쳐(100)와 어버트먼트(200) 및 나사기둥(300)을 포함하여 이루어진다.

[0045] 보다 상세히 설명하면, 상기 픽스쳐(fixture)(100)는 임플란트(1)의 뿌리 역할을 하는 것으로 자연치아의 치근 형상을 갖도록 형성되고, 그 외주면에는 나사산(110)이 형성되어 치조골의 내측으로 삽입 결합될 수 있도록 구성되어 있다.

[0046] 또한, 상기 픽스쳐(100)의 상부 중심에는 후술할 나사기둥(300)이 삽입되어 체결되는 제1암나사(122)가 형성되고, 상기 제1암나사(122)의 상부에는 후술할 어버트먼트(200)의 하부가 끼움 결합되는 테이퍼홈(132) 및 회전방지홈(134)이 어버트먼트(200)의 하부 형상과 대응되도록 형성된다.

[0047] 다음, 상기 어버트먼트(abutment)(200)는 픽스쳐(100)의 상부에 연결 설치되고, 그 상부에 인공치아(400)가 결합되는 것으로, 임플란트(1)의 연결 기둥 역할을 하는 것이다.

[0048] 이때, 상기 어버트먼트(200)는 픽스쳐(100)의 내측으로 삽입 결합되어 고정되는 하부 어버트먼트(210)와, 하부 어버트먼트(210)의 상부에 회전 가능하도록 끼움 결합되는 상부 어버트먼트(220)로 분리 구성되는데, 이는 어버트먼트(200)와 픽스쳐(100)의 결합을 용이하게 하면서도 어버트먼트(200)의 고정력을 향상시킨 수 있도록 하기 위한 것으로 이에 대해서는 후술하기로 한다.

[0049] 다음, 상기 나사기둥(300)은 어버트먼트(200)와 픽스쳐(100)의 내측으로 삽입되어 어버트먼트(200)와 픽스쳐(100)를 체결 고정시키는 역할을 하는 것으로, 나사기둥(300)의 외주면에는 수나사(310)가 형성되어 있다.

[0050] 보다 상세히 설명하면, 상기 상부 어버트먼트(220)의 중심부에는 측벽에 제2암나사(222a)가 형성된 체결공(222)이 형성되고, 상기 하부 어버트먼트(210)의 중심부에는 관통공(218)이 형성되며, 픽스쳐(100)의 중심부에는 측벽에 제1암나사(122)가 형성된 체결홈(120)이 형성되어 외주면에 수나사(310)가 형성된 나사기둥(300)이 상부 어버트먼트(220), 하부 어버트먼트(210) 및 픽스쳐(100)의 중심부를 통해 삽입 결합되어 상부 어버트먼트(220)에 형성된 제2암나사(222a) 및 픽스쳐(100)의 중심부에 형성된 제1암나사(122)에 체결 고정될 수 있도록 구성되어 있다.

[0051] 즉, 본 발명의 바람직한 실시예에 의하면, 픽스쳐(100)에 나사기둥(300)을 체결 고정시킨 후, 그 상부에 하부 어버트먼트(210) 및 상부 어버트먼트(220)를 순차적으로 결합시키는데, 먼저 치조골의 내측으로 삽입 결합된 픽스쳐(100)에 형성된 체결홈(120)의 내측으로 나사기둥(300)을 삽입시켜 체결홈(120)의 측벽에 형성된 제1암나사

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(122)에 체결 고정시킨다.

[0052] 다음, 하부 어버트먼트(210)를 나사기둥(300)에 끼워 넣음으로써 픽스쳐(100)에 결합시키는데, 하부 어버트먼트(210)에 형성된 관통공(218)을 통해 나사기둥(300)에 끼움 결합하여 하부 어버트먼트(210)의 하단부가 픽스쳐(100)의 상부에 삽입 결합되도록 한다.

[0053] 이때, 도시하지는 않았지만, 상기 하부 어버트먼트(210)의 중심부에 형성된 관통공(218)의 측벽에도 암나사를 형성하여 하부 어버트먼트(210)가 나사기둥(300)의 외주면에 나사 결합되도록 구성할 수도 있음은 물론이다.

[0054] 다음, 상부 어버트먼트(220)에 형성된 제2암나사(222a)를 이용하여 상부 어버트먼트(220)를 나사기둥(300)의 상단부에 체결 고정시키면 픽스쳐(100)와 어버트먼트(200)의 결합이 완료되는데, 상기와 같은 결합방식에 의해 픽스쳐(100)와 어버트먼트(200)의 결합을 보다 용이하고 정확하게 할 수 있을 뿐만 아니라, 나사기둥(300)에 의해 픽스쳐(100)와 어버트먼트(200)가 나사 결합되는 면적이 증가되므로 픽스쳐(100)와 어버트먼트(200) 사이의 결합력을 증가시킬 수 있게 된다.

[0055] 또한, 픽스쳐(100)와 어버트먼트(200)를 결합시키기 위한 나사기둥(300)을 별도로 구비하고, 나사기둥(300)에 나사 결합되는 부분을 픽스쳐(100)의 내측과 상부 어버트먼트(220)의 내측으로 분리 구성함으로써 음식물을 씹는 경우 등의 저작작용시 받는 하중을 분산시킬 수 있게 되어 나사기둥(300)의 파절 위험을 최소화 할 수 있을 뿐만 아니라, 나사기둥(300)의 파절시에도 파절된 나사기둥(300)을 용이하게 제거할 수 있게 된다.

[0056] 한편, 상기 나사기둥(300)의 외주면에 형성되는 수나사(310)는 도 6의 (b),(c)에 나타낸 바와 같이, 제1 및 제2수나사(312,314)로 분리되도록 형성시킬 수도 있는데, 상기 제1수나사(312)는 나사기둥(300)의 하단부 외주면, 즉 픽스쳐(100)에 형성된 제1암나사(122)와 체결되는 부분에 형성되고, 제2수나사(314)는 나사기둥(300)의 상단부 외주면, 즉 상부 어버트먼트(220)에 형성된 제2암나사(222a)와 체결되는 부분에 형성된다.

[0057] 이때, 상기 제1암나사(122) 및 제1수나사(312)와, 제2암나사(222a) 및 제2수나사(314)는 서로 반대방향의 나사산을 갖도록 형성될 수 있는데, 이는 나사결합이 풀리는 것을 원천적으로 방지함으로써 픽스쳐(100)와 어버트먼트(200) 사이의 결합력을 유지시킬 수 있도록 하기 위함이다.

[0058] 보다 상세히 설명하면, 상기 제1암나사(122)와 제1수나사(312)를 오른나사로 형성할 경우 제2암나사(222a)와 제2수나사(314)를 왼나사로 형성하고, 제1암나사(122)와 제1수나사(312)를 왼나사로 형성할 경우 제2암나사(222a)와 제2수나사(314)를 오른나사로 형성함으로써, 픽스쳐(100)에 나사기둥(300)을 결합시키는 경우의 나사기둥(300)의 회전방향과, 나사기둥(300)에 상부 어버트먼트(220)를 결합시키는 경우의 상부 어버트먼트(220)의 회전방향이 서로 반대가 되도록 하는 것이다.

[0059] 이와 같은 결합방식은 나사기둥(300)이 일방향으로 회전하여 제1암나사(122)와 제1수나사(312) 사이의 결합부 또는 제2암나사(222a)와 제2수나사(314) 사이의 결합부가 풀리려 하는 경우, 상기와 반대방향으로의 회전에 의해 결합된 제2암나사(222a)와 제2수나사(314) 사이의 결합부 또는 제1암나사(122)와 제1수나사(312) 사이의 결합이 보다 강하게 이루어지게 되어 나사기둥(300)이 더 이상 회전하는 것을 방지함으로써 나사결합이 풀리는 것을 원천적으로 방지할 수 있게 되고, 그에 따라 픽스쳐(100)와 어버트먼트(200) 사이의 견고한 결합상태가 유지될 수 있게 되는 것이다.

[0060] 한편, 본 발명에 따른 치과용 임플란트(1)는 전술한 바와 같이 어버트먼트(200)를 상부 어버트먼트(220)와 하부 어버트먼트(210)로 분리 구성함으로써 상,하부 어버트먼트(220,210)의 높이, 기울기, 굵기 등의 형상을 다양하게 선택하여 조립할 수 있게 되는데, 그 일실시예로 도 5의 (a)에 나타낸 바와 같이, 상부 어버트먼트(220)의 하단에는 돌출부(224)가 형성되고, 하부 어버트먼트(210)의 상단에는 돌출부(224)의 형상에 대응되는 안착홈(212)이 형성되어 상부 어버트먼트(220)가 하부 어버트먼트(210)의 상부에 안정적으로 설치될 수 있도록 구성할 수 있다.

[0061] 이때, 상기 상부 어버트먼트(220)는 나사기둥(300)과의 체결 고정을 위해 하부 어버트먼트(210)에 회전 가능하도록 끼움 결합되는 것이므로 상기 돌출부(224) 및 안착홈(212)은 그 수평 단면이 원형을 이루도록 형성된다.

[0062] 다음, 도 5의 (b)에 나타낸 바와 같이, 상부 어버트먼트(220)가 하부 어버트먼트(210)의 상부에 단순히 안치되도록 하여 나사기둥(300)에 의해서만 결합되도록 구성할 수도 있고, 도 5의 (c)에 나타낸 바와 같이, 상부 어버트먼트(220)의 하단에 원통 형상의 연장부(226)를 돌출 형성시키고, 하부 어버트먼트(210)의 상단에 상기 연장부(226)가 삽입 결합되는 삽입홈(213)을 형성시킬 수도 있다.

[0063] 이때, 상기 연장부(226)의 내측에는 상부 어버트먼트(220)에 구비되는 제2암나사(222a)가 형성된 체결공(222)이

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연장 형성되어 나사기둥(300)에 나사결합되는 면적을 증가시킴으로써 나사기둥(300)에 의한 어버트먼트(200)와 픽스쳐(100) 사이의 결합력을 향상시킬 수 있도록 구성된다.

[0064] 다음, 상기 픽스쳐(100)에 끼움 결합되는 어버트먼트(200)의 하부 즉, 하부 어버트먼트(210)의 하단에는 테이퍼부(214)와 회전방지부(216)가 형성되는데, 상기 테이퍼부(214)는 하부로 갈수록 직경이 작아지는 원추형상으로 이루어진 것으로, 하부 어버드먼드(210)가 픽스쳐(100)의 상단부에 보다 안정적으로 설치될 수 있도록 하는 역할을 하는 것이다.

[0065] 즉, 상기 픽스쳐(100)의 상부에는 상기 테이퍼부(214)의 형상에 대응되도록 하는 원추형의 테이퍼홈(132)이 형성되어 하부 어버드먼드(210)가 픽스쳐(100)의 내측으로 삽입 결합되는 경우 하부 어버드먼드(210)와 픽스쳐(100) 사이의 접촉면적을 넓힘으로써 보다 안정적으로 설치되도록 하여 결합력을 향상시킬 수 있도록 하는 역할을 하게 된다.

[0066] 또한, 상기 회전방지부(216)는 테이퍼부(214)의 하부에 다각형의 형상을 갖도록 돌출 형성되는 것으로, 픽스쳐(100)의 테이퍼홈(132) 하부에는 상기 회전방지부(216)의 형상에 대응되는 다각형으로 이루어진 회전방지홈(134)이 형성되어 상기 회전방지부(216)가 회전방지홈(134)에 끼움 결합되는 경우 하부 어버드먼드(210)가 픽스쳐(100)의 상부에 끼움 결합된 상태에서 회전하는 것을 방지함으로써 픽스쳐(100)에 끼움 결합된 하부 어버트먼드(210)의 고정력을 향상시킬 수 있도록 하는 역할을 하게 된다.

[0067] 한편, 본 발명의 제2실시예에 따르면, 전술한 바와 같은 나사기둥(300)을 이용한 픽스쳐(100)와 어버트먼트(200)의 결합 방식은 어버트먼트(200)의 하단부가 픽스쳐(100)의 내측으로 삽입 결합되는 인터널 타입 임플란트(Internal type implant) 뿐만 아니라, 도 7에 나타낸 바와 같이 픽스쳐(100)의 상단부가 어버트먼트(200)의 하단부 내측으로 삽입 결합되는 익스터널 타입 임플란트(External type implant)에도 적용될 수 있다.

[0068] 즉, 상기 픽스쳐(100)의 상단부에 고정부(140)가 돌출 형성되고, 상기 어버트먼트(200) 즉, 하부 어버트먼트(210)의 하단부에는 상기 고정부(140)가 끼움 결합되는 결합홈(219)이 형성되어 픽스쳐(100)가 하부 어버트먼트(220)의 내측으로 삽입 결합되는 경우에도 나사기둥(300)을 이용한 결합구조를 적용할 수 있는 것이다.

[0069] 이때, 상기 픽스쳐(100)의 고정부(140) 및 하부 어버트먼트(210)에 형성된 결합홈(219)은 전술한 회전방지부(216) 및 회전방지홈(134)과 마찬가지로 다각형의 형상으로 이루어져 하부 어버트먼트(210)가 픽스쳐(100)의 상부에 끼움 결합된 상태에서 회전하는 것을 방지할 수 있도록 구성되어 있다.

[0070] 한편, 본 발명에 따른 치과용 임플란트(1)의 제3실시예에 의하년, 도 8에 나타낸 바와 같이, 상부 어버트먼트(220)와 하부 어버트먼트(210)의 외주면에 하나 이상의 시팅 그루브(seating groove)(250) 또는 시팅 릿지(seating ridge)(260)가 더 형성될 수 있는데, 상기 시팅 그루브(250) 및 시팅 릿지(260)는 상부 어버트먼트(220)와 하부 어버트먼트(210) 사이의 고정력을 강화시키는 역할을 하는 것이다.

[0071] 보다 상세히 설명하면, 전술한 바와 같은 과정에 의해 나사기둥(300)을 이용하여 상,하부 어버트먼트(220,210)와 픽스쳐(100)를 결합시킨 상태에서 상,하부 어버트먼트(220,210)의 외주변에 치과용 접착제(cement)를 이용하여 인공치아(보철물)(400)를 씌우게 되는데, 이때, 치과용 버(bur) 등을 이용하여 외주면에 시팅 그루브(250)를 형성시킨 상부 어버트먼트(220)와, 제조 과정에서 외주변에 시팅 릿지(260)를 일체로 형성시킨 하부 어버트먼트(210)를 사용하는 경우, 인상채득한 보철제작용 석고모델, 즉 인공치아(보철물)(400)의 내측면에 시팅 그루브(250)의 형상에 대응되는 돌출부(미도시)와, 시팅 릿지(260)의 형상에 대응되는 홈(미도시)이 형성된다.

[0072] 따라서, 시팅 그루브(250)가 형성된 상부 어버트먼트(220)와, 시팅 릿지(260)가 형성된 하부 어버트먼트(210)에 인공치아(400)를 부착시키면 인공치아(400)에 형성된 돌출부가 시팅 그루브(250)의 내측으로 삽입 결합되고, 하부 어버트먼트(210)에 형성된 시팅 릿지(260)가 인공치아(400)에 형성된 홈의 내측으로 삽입 결합되어 상부 어버트먼트(220)와 하부 어버트먼트(210)가 풀리지 않고 고정된 상태를 유지할 수 있게 되는 것이다.

[0073] 또한, 상기 시팅 그루브(250)와 시팅 릿지(260)는 상,하부 어버트먼트(220,210)와 인공치아(400) 사이의 접착면적을 증가시키므로 상,하부 어버트먼트(220,210)와 인공치아(400) 사이의 결합력을 증대시키는 역할도 하게 된다.

[0074] 이때, 상기 상부 어버트먼트(220)와 하부 어버트먼트(210)에 시팅 그루브(250) 또는 시팅 릿지(260)가 선택적으로 형성될 수도 있음은 물론이다. 즉, 상부 어버트먼트(220)에 시팅 릿지(260)가 형성되고, 하부 어버트먼트(210)에 시팅 그루브(250)가 형성되거나, 상,하부 어버트먼트(220,210) 모두에 시팅 그루브(250) 또는 시팅 릿지(260)가 형성될 수도 있는 것이다.

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[0075] 한편, 본 발명에 따른 치과용 임플란트(1')의 제4실시예에 의하면, 도 9에 나타낸 바와 같이, 나사기둥(300')은 제1 및 제2수나사(312',314')와, 제1 및 제2수나사(312',314')의 사이에 형성되는 포스트(316')로 구성할 수 있는데, 상기 제1수나사(312')는 전술한 실시예들과 마찬가지로 나사기둥(300')의 하단부에 형성되어 픽스처(100')의 체결홈(120')에 형성되는 제1암나사(122')에 체결되어 나사기둥(300')을 픽스처(100')에 고정시키는 역할을 하는 것이다.

[0076] 다음, 상기 제2수나사(314')는 나사기둥(300')의 상단부에 형성되는 것으로, 그 외주면에는 후술할 나사링(320')이 결합되어 상부 어버트먼트(220')의 내측에 삽입 결합된다.

[0077] 즉, 전술한 실시예들과는 다르게 나사기둥(300')이 상부 어버트먼트(220')와 직접 결합하는 것이 아니라, 내주면에 제2암나사(324')가 형성되고 외주면에는 제3수나사(326')가 형성된 중공 형상의 나사링(320')을 나사기둥(300')의 제2수나사(314')에 끼움 결합시킨 후 상부 어버트먼트(220')의 내측에 형성되는 제3암나사(226')가 형성된 제1체결홀(222')에 나사링(320')의 제3수나사(326')를 체결 고정시키는 것으로, 이와 같은 결합방식에 의해 전체적으로 나사기둥(300')과 상부 어버트먼트(220') 사이의 나사 결합 면적이 증가하게 되어 체결력이 강화되는 것이다.

[0078] 한편, 상기 나사기둥(300')의 제2수나사(314') 하부에 형성되는 포스트(316')의 외측에는 체결구(330')가 끼움 결합되는데, 상기 체결구(330')는 포스트(316')의 외주면에 끼움 결합되어 하부 어버트먼트(210')의 조임 작용에 의해 픽스처(100')의 체결홈(120')에 형성되는 제1암나사(122')에 체결되는 나사기둥(300')의 제1수나사(312')가 풀리는 방향으로 회전함으로써 하부 어버트먼트(210')가 흔들림 없이 고정될 수 있도록 하여 하부 어버트먼트(210')의 풀림 현상을 방지할 수 있도록 하는 역할을 하는 것이다.

[0079] 보다 상세히 설명하면, 상기 나사기둥(300')의 포스트(316')는 다각 형상으로 이루어지고, 상기 체결구(330')의 내측에는 포스트(316')의 단면 형상에 대응되는 다각 형상이 홀이 형성되어 포스트(316')의 외측으로 끼움 결합될 수 있도록 구성되어 있다.

[0080] 또한, 상기 체결구(330')는 나사결합부(332')와 회전방지부(334')로 구성되는데, 상기 나사결합부(332')는 체결구(330')의 상부에 형성되는 것으로, 그 외주면에는 제4수나사(338')가 형성되어 하부 어버트먼트(210')의 내측에 형성되는 제4암나사(218')에 나사 결합될 수 있도록 구성되어 있다.

[0081] 또한, 상기 회전방지부(334')는 전술한 실시예에서의 하부 어버트먼트(210)에 형성되는 회전방지부(216)와 동일한 역할을 하는 것으로, 픽스처(100')에 형성된 회전방지홈(134')에 끼움 결합된다.

[0082] 즉, 상기 회전방지부(334')는 사각, 육각 또는 팔각 등의 다각 형상으로 이루어져 회전방지부(334')와 동일한 형상을 이루도록 하여 픽스처(100')의 상단부에 형성된 회전방지홈(134')에 끼움 결합되어 체결구(330')가 픽스처(100')의 내측으로 삽입 결합된 경우 더 이상의 회전을 방지하여 체결구(330')와 픽스처(100') 사이의 풀림 현상을 방지하는 것이다.

[0083] 보다 상세히 설명하면, 상기 나사기둥(300')의 포스트(316') 및 체결구(330')의 내측에 형성되는 홀과, 픽스처(100')에 형성된 회전방지홈(134') 및 체결구(330')의 회전방지부(334')는 모두 다각 형상으로 이루어져 포스트(316')와 체결구(330') 사이의 결합부 및 픽스처(100')와 체결구(330') 사이의 결합부의 회동을 방지할 수 있도록 구성된 것에 특징이 있으나, 도 12의 (a)에 나타낸 바와 같이, 나사기둥(300')과 체결구(330') 및 픽스처(100')의 제조 과정에서의 공차 등에 의해 각 결합부가 밀착되지 않게 되어 결합 후 흔들림이 발생할 수 있고, 이와 같은 흔들림이 장기화되는 경우 결합부가 풀리게 되는 문제가 발생할 수 있다.

[0084] 따라서, 상기 나사기둥(300')의 포스트(316')에 체결구(330')을 끼움 결합시킨 상태에서 하부 어버트먼트(210')를 체결구(330')의 나사결합부(332') 외측으로 결합시킨 후, 하부 어버트먼트(210')를 회전시켜 조이면, 체결구(330')가 일방향으로 약간 회전하게 되어 다각 형상으로 이루어진 포스트(316')와 체결구(330') 사이의 결합부 및 픽스처(100')와 체결구(330') 사이의 결합부가 나사기둥(300')이 회전하려는 방향으로 밀착되어 제조 과정에서의 공차에 의해 발생될 수 있는 어긋남을 없앰으로써 픽스처(100')와 나사기둥(300') 및 체결구(330')가 보다 견고히 결합될 수 있다.

[0085] 이때, 상기 픽스처(100')와 나사기둥(300') 사이의 나사결합 방향, 즉 제1암나사(122')와 제1수나사(312')의 나사 방향과, 하부 어버트먼트(210')와 체결구(330') 사이의 나사결합 방향 즉, 제4암나사(218')와 제4수나사(338')의 나사 방향은 서로 반대가 되도록 하는 것이 바람직한데, 그 이유는 포스트(316')와 체결구(330') 사이

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의 결합부 및 픽스처(100')와 체결구(330') 사이의 결합부가 픽스처(100')와 나사기둥(300')의 결합이 풀리는 방향으로 밀착되도록 하기 위함이다.

[0086] 즉, 제1암나사(122')가 형성된 픽스쳐(100')의 체결홈(120')에 나사기둥(300')의 제1수나사(312')를 체결 고정시킨 상태에서 체결구(330')를 나사기둥(300')의 포스트(316') 외주면에 끼움 결합하여 회전방지부(334')가 픽스처(100')의 회전방지홈(134')의 내측에 삽입 결합되도록 한 후, 체결구(330')의 나사결합부(332')의 외측으로 하부 어버트먼트(210')를 결합시키게 되는데, 이때, 제1암나사(122') 및 제1수나사(312')와, 하부 어버트먼트(210')의 제4암나사(218') 및 나사결합부(332')의 제4수나사(338')가 반대 방향으로 형성된 경우에는 하부 어버트먼트(210')를 회전시켜 조이는 경우 도 12의 (b)에 나타낸 바와 같이, 체결구(330')가 픽스처(100')의 체결홈(120')에 삽입 결합된 나사기둥(300')의 제1수나사(312')가 풀리는 방향으로 회전하게 되어 포스트(316')와 체결구(330') 사이의 결합부 및 픽스처(100')의 회전방지홈(134')과 체결구(330')의 회동방지부(334') 사이의 결합부가 나사기둥(300')이 풀리려는 방향으로 틈새 없이 밀착되므로, 다각 형상의 결합부 형상으로 인해 픽스처(100')와 나사기둥(300') 사이의 나사 결합이 풀리지 않게 되는 것이다.

[0087] 한편, 본 실시예에서도 픽스처(100'), 어버트먼트(200') 및 나사기둥(300')의 나사 결합방향을 달리하여 나사기둥(300')의 결합이 풀리는 것을 원천적으로 방지할 수 있는데, 그 일실시예로 제1수나사(312')와 제1암나사(122')의 나사 결합 방향을 나머지 모든 나사 결합 방향과 반대로 할 수 있다.

[0088] 즉, 제1수나사(312')와 제1암나사(122')의 나사 결합 방향을 왼나사/또는 오른나사로 할 경우, 픽스처(100')에 형성된 나사산(110')의 결합 방향과 제2 내지 제4수나사(314',326',338')와 제2 내지 제4암나사(324',226',218')에 형성된 나사산의 결합 방향을 오른나사/또는 왼나사로 하여 나사 결합이 풀리는 것을 원천적으로 방지할 수 있는 것이다.

[0089] 현재 주로 사용되고 있는 임플란트의 나사 결합방향이 오른나사이므로 이하에서는, 제1수나사(312')와 제1암나사(122')의 나사 결합 방향이 왼나사이고, 나머지 부분들의 나사 결합 방향이 오른나사인 경우를 예를 들어 설명하기로 한다.

[0090] 먼저, 외주면에 나사산(110')이 형성된 픽스처(100')를 치조골에 오른 나사 방향으로 삽입 결합시킨다.

[0091] 그 후, 픽스처(100')의 체결홈(120')에 형성된 제1암나사(122')에 나사기둥(300')의 제1수나사(312')를 결합시키는데, 이때 상기 제1암나사(122')와 제1수나사(312')는 왼나사 방향으로 형성되어 나사기둥(300')을 왼쪽 방향으로 회전시켜 나사기둥(300')을 픽스처(100')의 내측으로 삽입 결합시킨다.

[0092] 다음, 나사결합부(332')와 회전방지부(334')로 이루어진 체결구(330')을 나사기둥(300')의 포스트(316') 외측으로 끼움 결합시킨다.

[0093] 다음, 상기 나사기둥(300')의 상부에 형성된 제2수나사(314')에 내주면에 제2암나사(324')가 형성된 나사링(320')을 오른나사 방향으로 회전 결합시킨다.

[0094] 그 후, 도 11의 (a)에 나타낸 바와 같이, 하부 어버트먼트(210')에 형성된 제2체결홈(212')을 통해 하부 어버트먼트(210')를 체결구(330')의 나사결합부(332') 외주면에 결합시키는데, 이때, 상기 제2체결홈(212')에 형성된 제4암나사(218')와, 체결구(330')의 외주면에 형성된 제4수나사(338')는 모두 오른나사 방향이므로 하부 어버트먼트(210')를 오른나사 방향으로 회전시켜 결합시킨다.

[0095] 즉, 도 11의 (b)에 나타낸 바와 같이, 하부 어버트먼트(210')를 나사링(320')의 상부로부터 끼움 결합시켜 오른나사 방향으로 지속적으로 회전시키면, 체결구(330')가 오른나사 방향, 즉 픽스처(100')의 체결홈(120')에 삽입 결합된 나사기둥(300')의 제1수나사(312')가 풀리는 방향으로 회전하게 되어 포스트(316')와 체결구(330') 사이의 결합부 및 픽스처(100')와 체결구(330') 사이의 결합부가 틈새 없이 밀착되므로, 다각 형상의 결합부 형상으로 인해 픽스처(100')와 나사기둥(300') 사이의 나사 결합이 풀리지 않게 된다.

[0096] 다음, 도 11의 (c)에 나타낸 바와 같이, 상기 상부 어버트먼트(220')의 제1체결홈(222')에 형성된 제3암나사(226')를 나사링(320')의 외주면에 형성된 제3수나사(326')에 결합시키는데, 이때 상기 제3암나사(226')와 제3수나사(326')는 모두 오른나사로 형성되므로, 상부 어버트먼트(220')를 오른나사 방향으로 회전시키면, 상부 어버트먼트(220')가 나사링(320')을 따라 회전하면서 하강하여 하부 어버트먼트(210')를 강하게 가압하게 되고, 상기와 같은 과정에 의해 본 발명에 따른 치과용 임플란트(1')의 설치가 완료된다.

[0097] 즉, 치과용 임플란트(1') 구조에 있어서 가장 문제가 되는 부분은 장기간 사용시 임플란트에 가해지는 충격에

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의해 나사결합이 풀리는 것이다.

[0098] 상기와 같이 구성된 본 발명의 경우, 픽스쳐(100')와 나사기둥(300')의 결합이 왼나사 방향으로 이루어져 있으므로, 나사기둥(300')의 결합이 풀리기 위해서는 오른나사 방향으로의 회전이 이루어져야 한다.

[0099] 하지만, 본 발명에서는 픽스쳐(100')와 나사기둥(300') 사이의 결합부를 제외한 부분의 나사 결합을 모두 오른나사 방향으로 형성하였으므로, 나사기둥(300')이 오른나사 방향으로 회전하는 경우, 상부 어버트먼트(220') 및 하부 어버드먼드(210')와 나사링(320') 및 체결구(330') 사이의 결합력이 더욱 견고해지므로 나사기둥(300')이 더 이상 회전하지 못하게 되므로, 나사기둥(300')의 회전에 의한 풀림현상을 원천적으로 방지할 수 있게 되는 것이다.

[0100] 이때, 별도로 도시하지는 않았지만, 상기 상부 어버드먼드(220')와 하부 어버드먼드(210')의 구조는 도 5의 (a),(b),(c)에 나타낸 바와 같은 전술한 실시예와 마찬가지로 다양한 형상으로 형성될 수 있고, 상,하부 어버트먼드(220',210')의 외주면에 시팅 그루브(250') 또는 시팅 릿지(260')가 형성될 수도 있음은 물론이다.

[0101] 한편, 본 발명에 따른 치과용 임플란트(1")의 제5실시예에 의하면, 도 13에 나타낸 바와 같이, 하부 어버트먼트(210")의 내측에 제1스텝링(340")이 삽입 설치되는 것에 특징이 있는 것으로, 상기 제1스텝링(340")은 픽스쳐(100")의 회전방지홈(134") 내측에 삽입 결합된 상태의 하부 어버트먼트(210")를 픽스쳐(100")의 내측에 삽입 결합된 나사기둥(300")이 풀리는 방향으로 미세하게 회전시킴으로써 나사기둥(300")의 풀림을 방지할 수 있도록 구성되어 있다.

[0102] 보다 상세히 설명하면, 상기 나사기둥(300")은 전술한 제4실시예와 마찬가지로 제1 및 제2수나사(312",314")와, 제1 및 제2수나사(312",314")의 사이에 형성되는 포스트(316")로 구성되는데, 상기 포스트(316")는 사각 또는 육각과 같은 다각 형상으로 이루어진다.

[0103] 또한, 상기 하부 어버트먼트(210")는 그 내측에 포스트(316")의 외주면에 끼움 결합되는 다각 형상의 관통공(218")이 형성되고, 관통공(218")의 상부에는 그 상단부에 톱니 형상의 제1스텝부(215")가 형성되며, 하부 어버트먼트(210")의 하단부에는 픽스쳐(100")의 상부 내측에 형성되는 다각 형상의 회전방지홈(134")에 삽입 결합되는 회전방지부(216")가 회전방지홈(134")과 동일한 형상으로 형성된다.

[0104] 이때, 상기 제1스텝부(215")의 톱니 형상은 픽스쳐(100")의 내측에 결합된 나사기둥(300")이 풀리는 방향을 향해 상향으로 경사지도록 형성된다.

[0105] 또한, 상기 제1스텝부(215")와 상부 어버트먼트(220")의 사이에는 제1스텝링(340")이 삽입 설치되는데, 상기 제1스텝링(340")의 내측에는 나사기둥(300")의 포스트(316") 형상에 대응되는 다각 형상의 홈이 형성되고, 제1스텝링(340")의 하단부에는 제1스텝부(215")의 톱니 형상과 동일한 형상을 갖는 제2스텝부(345")가 형성되어 있다.

[0106] 즉, 제1암나사(122")가 형성된 픽스쳐(100")의 체결홈(120")에 나사기둥(300")의 제1수나사(312")를 체결 고정시킨 상태에서 하부 어버트먼트(210")를 나사기둥(300")의 상부로부터 끼움 결합시키면, 하부 어버트먼트(210")의 회전방지부(216")가 픽스쳐(100")에 형성된 다각 형상의 회전방지홈(134")에 삽입 결합되고, 하부 어버트먼트(210")의 내측에 형성되는 다각 형상의 관통공(218")은 나사기둥(300")의 포스트(316")에 의해 지지되어 하부 어버트먼트(210") 및 나사기둥(300")의 회전이 제한되므로, 픽스쳐(100")에 삽입 결합된 나사기둥(300")의 풀림 현상을 방지할 수 있게 된다.

[0107] 하지만, 픽스쳐(100")와 하부 어버트먼트(210") 및 나사기둥(300")의 제조 과정에서의 공차 등에 의해 다각 형상으로 이루어진 각 결합부, 즉 픽스쳐(100")의 회전방지홈(134")과 하부 어버트먼트(210")의 회전방지부(216") 사이의 결합부 및 하부 어버트먼트(210")의 관통공(218")과 나사기둥(300")의 포스트(316") 사이의 결합부가 밀착되지 않게 되어 결합 후 흔들림이 발생할 수 있고, 이와 같은 흔들림이 장기화되는 경우 결합부가 풀리게 되는 문제가 발생할 수 있게 된다.

[0108] 따라서, 상기 포스트(316")의 외측으로 제1스텝링(340")을 삽입시켜 제1스텝링(340")이 하부 어버트먼트(210")의 내측, 즉 제1스텝부(215")의 상부에 위치되도록 한 후, 상부 어버트먼트(220")를 나사기둥(300")의 제2수나사(314")에 결합시키면, 상부 어버트먼트(220")가 하강하면서 제1스텝링(340")의 상단부를 가압하게 되고, 그에 따라 제1스텝링(340")이 하강하게 된다.

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[0109] 이때, 상기 제1스텝링(340")의 하단부에 형성된 제2스텝부(345")가 하부 어버트먼트(210")에 형성된 제1스텝부(215")와 만나게 되어 톱니의 경사 방향을 따라 제1스텝링(340")은 픽스쳐(100")와 나사기둥(300") 사이의 결합 방향(도 14를 기준으로 하였을 때 시계방향)으로 회전하게 되고, 제1스텝부(215")가 일체로 형성된 하부 어버트먼트(210")는 픽스쳐(100")와 나사기둥(300") 사이의 결합이 풀리는 방향(도 14를 기준으로 하였을 때 반시계방향)으로 회전하게 된다.

[0110] 이와 같은, 하부 어버트먼트(210")의 회전에 의해 픽스쳐(100")의 회전방지홈(134")과 하부 어버트먼트(210")의 회전방지부(216") 사이의 결합부 및 하부 어버트먼트(210")의 관통공(218")과 나사기둥(300")의 포스트(316") 사이의 결합부는 최소한의 틈새도 존재하지 않도록 완벽하게 밀착되어 각 결합부에서의 결합력이 극대화되고, 각 결합부가 형성하는 다각 형상의 모양으로 인해 나사기둥(300")은 픽스쳐(100")와의 결합이 풀리는 방향으로 회전할 수 없게 되므로, 장기간의 사용에도 나사 결합이 풀리는 현상이 발생되지 않는 치과용 임플란트(1")를 구성할 수 있게 되는 것이다.

[0111] 한편, 본 실시예에서도 상,하부 어버트먼트(220",210")의 외주면에 시팅 브리지(250") 또는 시팅 릿지(260")가 형성될 수 있는 등 나머지 구성요소들은 전술한 실시예들과 동일하므로 이에 대한 상세한 설명을 생략하기로 한다.

[0112] 다음, 도 15는 본 발명에 따른 치과용 임플란트(1')의 제6실시예를 나타낸 것으로, 전술한 제4실시예와 제5실시예의 특징적인 구성을 조합한 것이다.

[0113] 보다 상세히 설명하면, 상기 제6실시예는 다각 형상으로 이루어지는 포스트(316')의 외주면에 끼움 결합되는 체결구(330')의 상단에 픽스쳐(100')의 내측에 결합된 나사기둥(300')이 풀리는 방향을 향해 상향으로 경사진 톱니 형상을 갖는 제1스텝부(335')를 형성하고, 상기 제1스텝부(335')의 상부 즉, 체결구(330')와 나사링(320')의 사이에는 그 하단부에 제1스텝부(335')의 톱니 형상과 동일한 형상의 제2스텝부(345')가 형성된 제1스텝링(340')을 삽입 설치한 것에 특징이 있는 것이다.

[0114] 따라서, 임플란트(1')의 결합과정에서 상부 어버트먼트(220')를 나사기둥(300')의 제2수나사(314')에 결합시키는 경우, 상부 어버트먼트(220')의 회전에 의해 나사링(320')이 하강하게 되어 그 하부에 설치된 제1스텝링(340')을 가압하게 되고, 그에 따라 제2스텝부(345')가 체결구(330')에 형성된 제1스텝부(335')를 따라 미끄러지면서 체결구(330')를 픽스쳐(100')와 나사기둥(300') 사이의 결합이 풀리는 방향으로 회전시키게 되므로, 포스트(316')와 체결구(330') 사이의 결합부 및 픽스쳐(100')와 체결구(330') 사이의 결합부가 나사기둥(300')이 풀리려는 방향으로 틈새 없이 밀착될 수 있게 되고, 다각 형상의 결합부 형상으로 인해 픽스쳐(100')와 나사기둥(300') 사이의 나사 결합이 풀리지 않게 되는 것이다.

[0115] 한편, 상기와 같은 스텝링의 개념은 상부 어버트먼트(220")와 하부 어버트먼트(210") 사이의 결합에서도 적용될 수 있는데, 보다 상세히 설명하면, 도 16에 나타낸 바와 같이, 하부 어버트먼트(210")의 상단부에 픽스쳐(100")의 내측에 결합된 나사기둥(300")이 풀리는 방향을 향해 상향으로 경사진 경사면(217"a)을 포함하는 계단 형상의 제3스텝부(217")를 형성시키고, 상부 어버트먼트(220")와 하부 어버트먼트(210")의 사이에는 그 하단부에 제3스텝부(217")와 동일한 형상의 제4스텝부(355")가 형성된 제2스텝링(350")을 삽입 결합시킬 수 있다.

[0116] 즉, 전술한 제5실시예에서와 마찬가지로 픽스쳐(100")와 나사기둥(300") 및 하부 어버트먼트(210")를 차례대로 결합시킨 상태에서, 하부 어버트먼트(210")의 상부에 제2스텝링(350")을 위치시킨 후, 제2스텝링(350")의 상부로부터 상부 어버트먼트(220")를 결합시키면, 상부 어버트먼트(220")의 가압에 의해 제2스텝링(350")이 하강하게 되고, 제2스텝링(350")의 하단부에 형성된 제4스텝부(355")가 하부 어버트먼트(210")의 상단부에 형성된 제3스텝부(217")를 따라 미끄러지면서 하부 어버트먼트(210")를 픽스쳐(100")에 결합된 나사기둥(300")이 풀리려는 방향으로 회전시키게 되므로, 다각 형상으로 이루어진 픽스쳐(100")와 하부 어버트먼트(210") 사이의 결합부가 나사기둥(300")이 풀리려는 방향으로 틈새없이 밀착되어 나사기둥(300")이 풀리려는 방향으로 회전하는 것을 방지할 수 있게 되는 것이다.

[0117] 따라서, 전술한 바와 같은 본 발명에 따른 치과용 임플란트(1,1',1")에 의하면 픽스쳐(100,100',100")와 어버트먼트(200,200',200")의 결합을 위해 별도의 나사기둥(300,300',300")을 사용하여 픽스쳐(100,100',100")와 어버트먼트(200,200',200")가 나사 결합되는 면적을 증가시킴으로써 픽스쳐(100,100',100")와 어버트먼트

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(200,200',200") 사이의 결합력을 증가시키고, 나사결합되는 부분에 전체적으로 하중이 분산되어 전달되므로 응력집중에 의한 나사기둥(300,300',300")의 파절 위험을 최소화할 수 있으며, 나사기둥(300,300',300")의 파절시에도 파절된 나사기둥(300,300',300")을 용이하게 제거할 수 있을 뿐만 아니라, 픽스처(100,100',100")에 나사기둥(300,300',300")을 결합시킨 후 그 상부에 어버트먼트(200,200',200")를 체결 고정시킬 수 있도록 하여 픽스처(100,100',100")와 어버트먼트(200,200',200")의 결합을 보다 용이하고 정확하게 할 수 있고, 다양한 방법에 의해 나사기둥(300,300',300")이 풀리는 것을 다중으로 방지할 수 있도록 함으로써 임플란트(1,1',1")의 제조 과정에서 발생되는 공차에도 불구하고 흔들림 없이 견고한 고정 상태를 유지할 수 있도록 할 뿐만 아니라, 장기적인 사용에도 나사의 풀림현상을 원천적으로 방지할 수 있는 등의 다양한 장점을 갖는 것이다.

[0118] 전술한 실시예들은 본 발명의 가장 바람직한 예에 대하여 설명한 것이지만, 상기 실시예에만 한정되는 것은 아니며, 픽스처(100,100')와 어버트먼트(200,200')를 견고히 결합시키는 역할을 하는 나사기둥(300,300')의 형상을 다양하게 변형시킬 수 있는 등 본 발명의 기술적 사상을 벗어나지 않는 범위 내에서 다양한 변형이 가능하다는 것은 당업자에게 있어서 명백한 것이다.

산업상 이용가능성

[0119] 본 발명은 치과용 임플란트에 관한 것으로, 보다 상세하게는 별도의 나사기둥을 이용하여 픽스처와 어버트먼트를 결합시킴으로써 임플란트 나사결합부의 파절을 방지함과 동시에 접촉면 전체에 골고루 힘이 전달되도록 하여 응력이 부분적으로 집중되는 현상을 방지할 수 있고, 픽스처와 어버트먼트 사이의 나사결합 방향을 달리하여 픽스처와 어버트먼트 사이의 결합력을 향상시키고, 나사의 풀림을 원천적으로 방지할 수 있는 치과용 임플란트에 관한 것이다.

부호의 설명

[0120]

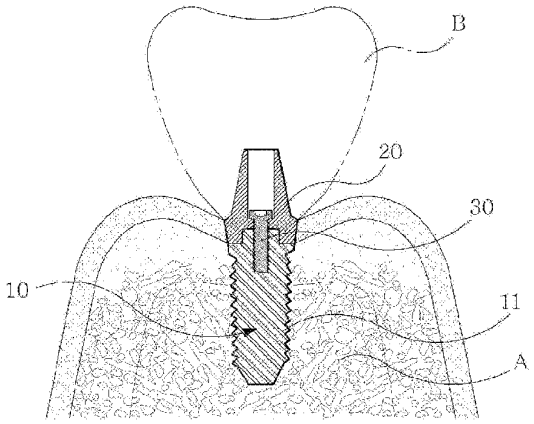
1,1',1" : 치과용 임플란트	100,100',100" : 픽스처
110,110' : 나사산	120,120',120" : 체결홈
122,122',122" : 제1암나사	132 : 테이퍼홈
134,134',134" : 회전방지홈	140 : 고정부
200,200',200" : 어버트먼트	210,210',220" : 하부 어버트먼트
212 : 안착홈	212' : 제2체결홀
213 : 삽입홈	214 : 테이퍼부
215",335' : 제1스텝부	216,216",334' : 회전방지부
218,218" : 관통공	217" : 제3스텝부
217"a : 경사면	218' : 제4암나사
219 : 결합홈	220,220',220" : 상부 어버트먼트
222 : 체결공	222a : 제2암나사
222' : 제1체결홀	224 :돌출부
226 : 연장부	226' : 제3암나사
250,250',250" : 시팅 그루브	260,260',260" : 시팅 릿지
300,300',300" : 나사기둥	310 : 수나사
312,312',312" : 제1수나사	314,314',314" : 제2수나사

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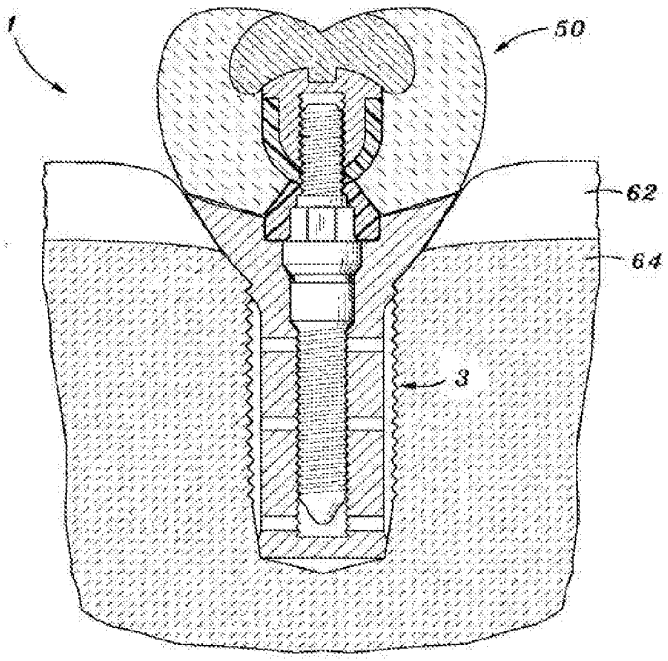
316',316" : 포스트
320' : 나사링
324' : 제2암나사
326' : 제3수나사
330' : 체결구
332' : 나사결합부
338' : 제4수나사
340',340" : 제1스텝링
345',345" : 제2스텝부
350" : 제2스텝링
355" : 제4스텝부
400 : 인공치아

도면

도면1

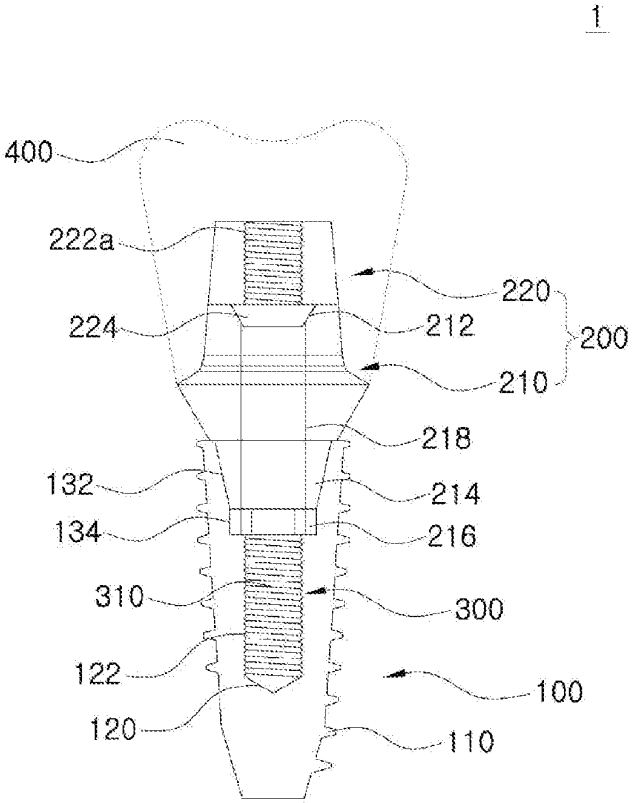


도면2



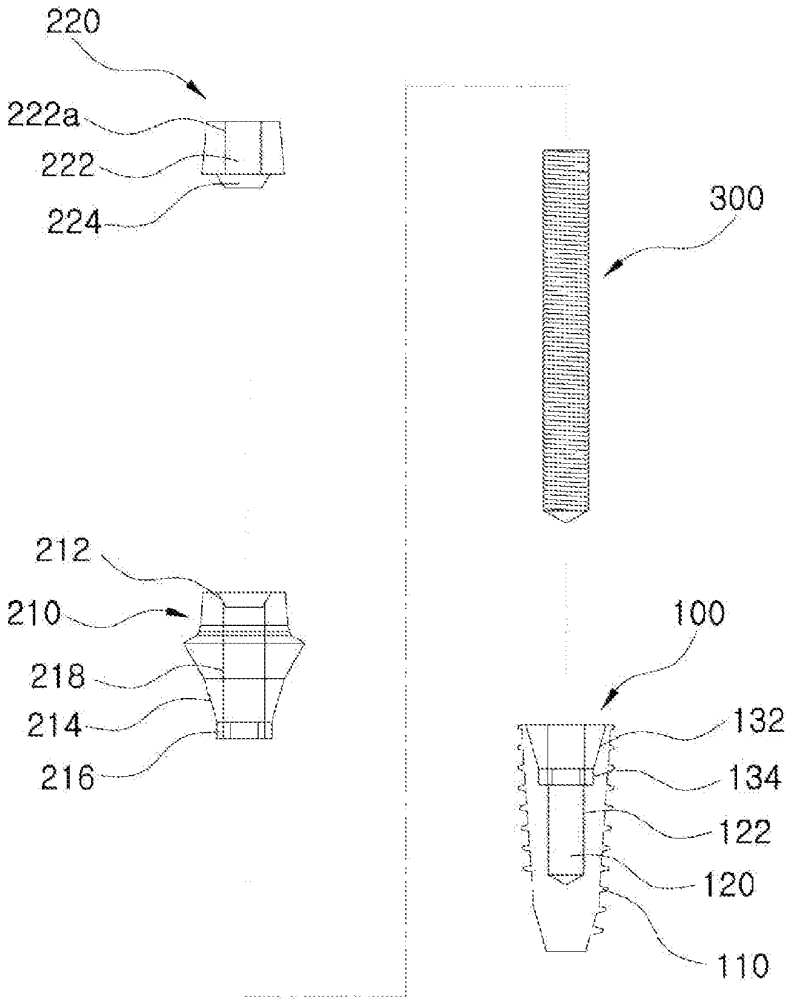
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도면3

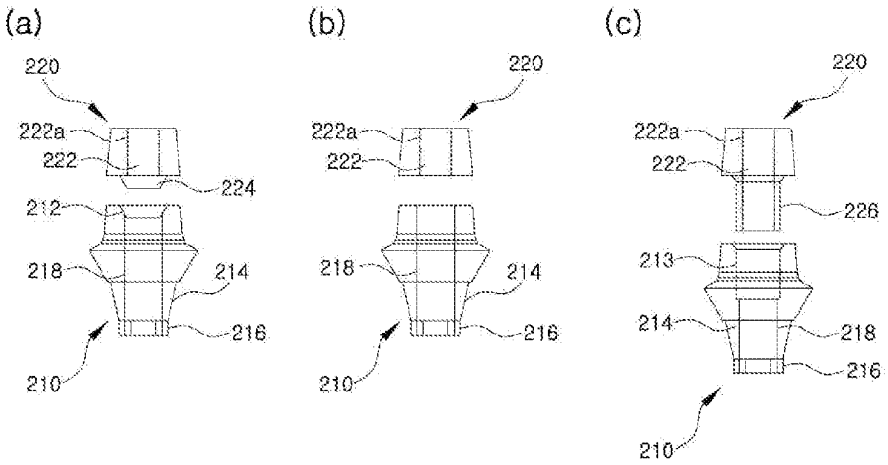


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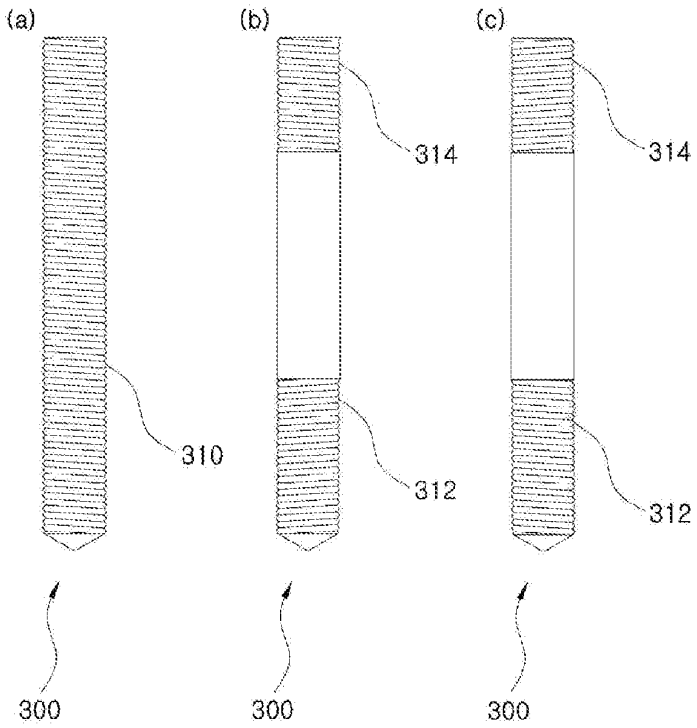
도면4



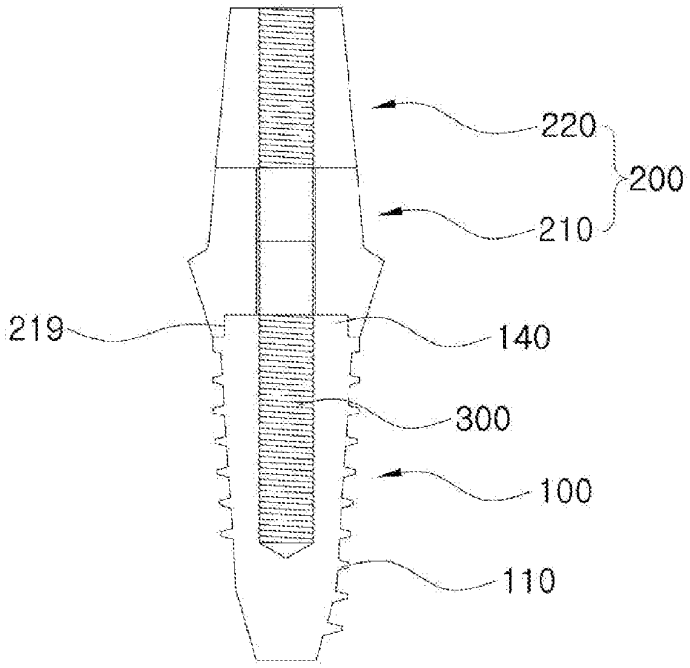
도면5


(a)
(b)
(c)
220
222a
222
224
212
218
214
216
210
226
213

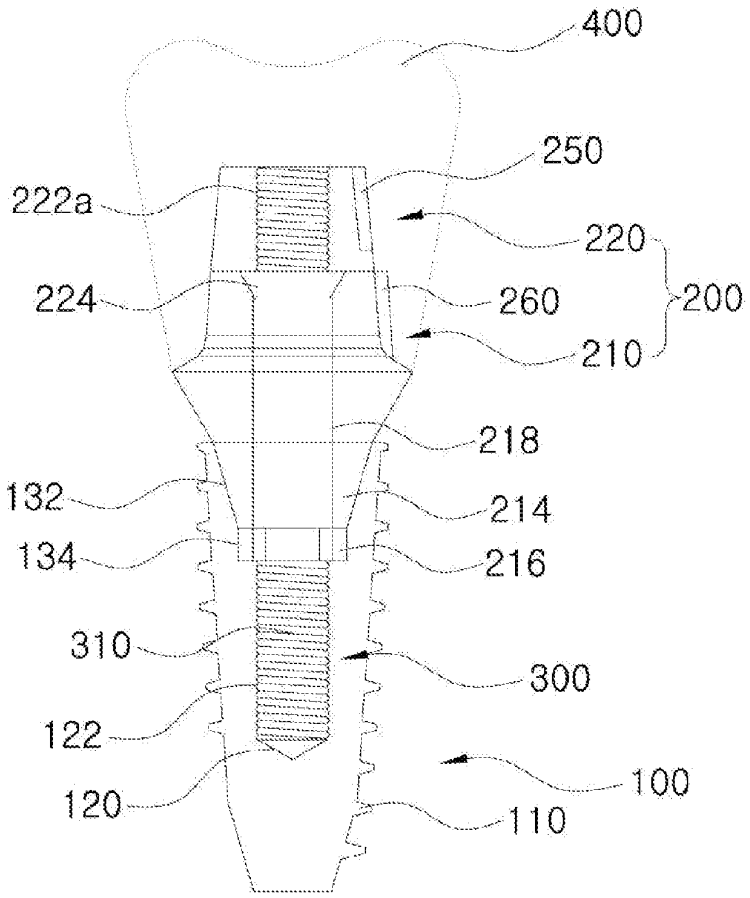
도면6


(a)
(b)
(c)
310
314
312
300

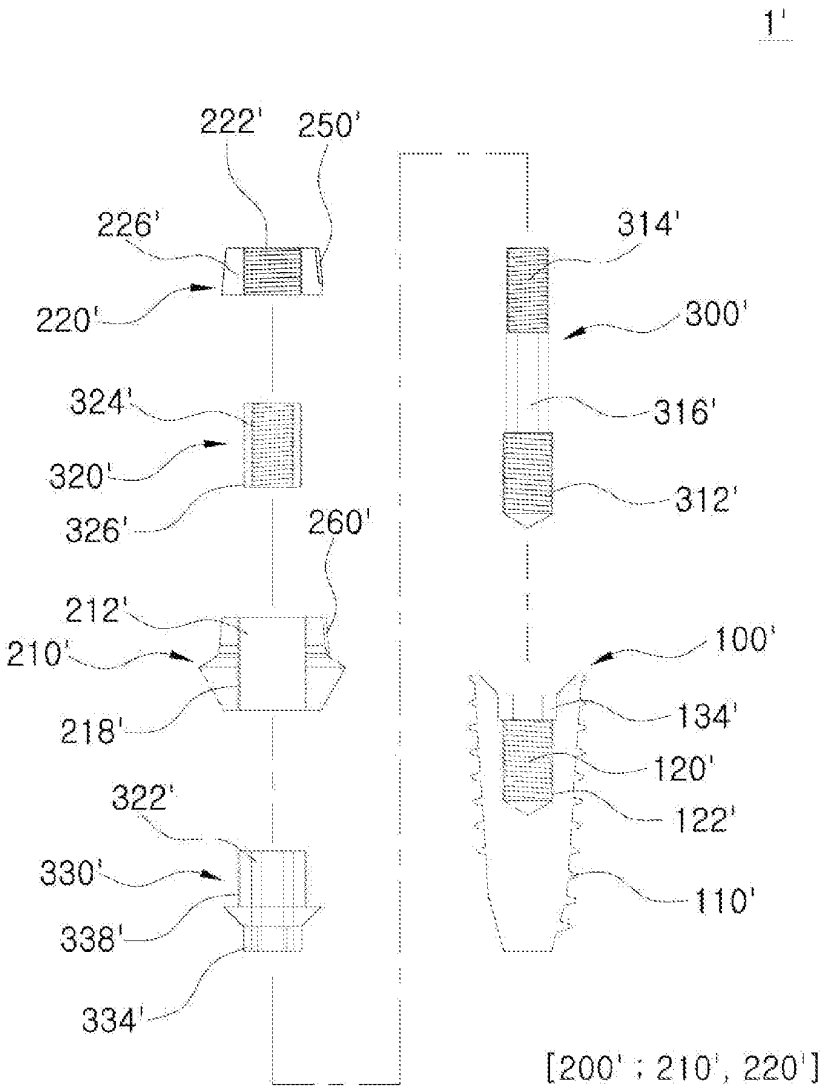
도면7



도면8

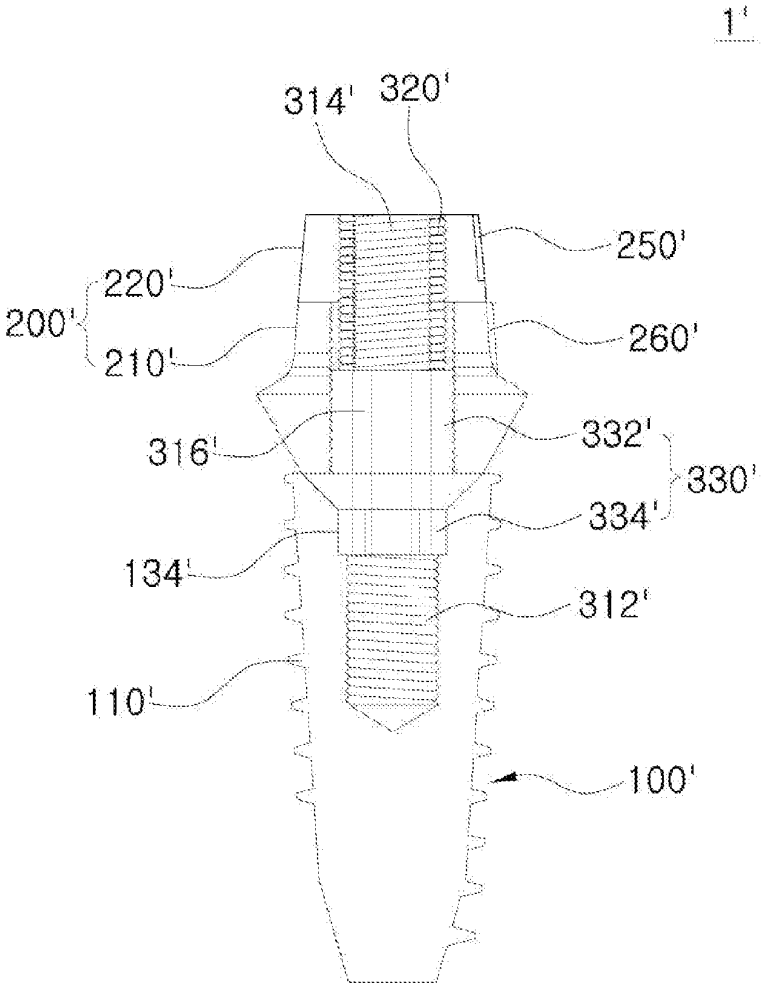

400
250
222a
220
200
224
260
210
218
132
214
134
216
310
300
122
100
120
110

도면9



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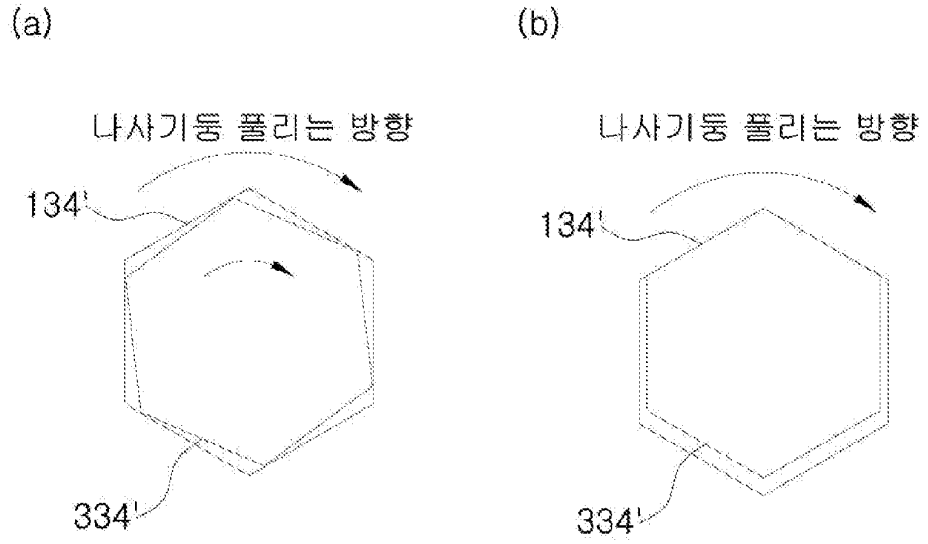
도면10



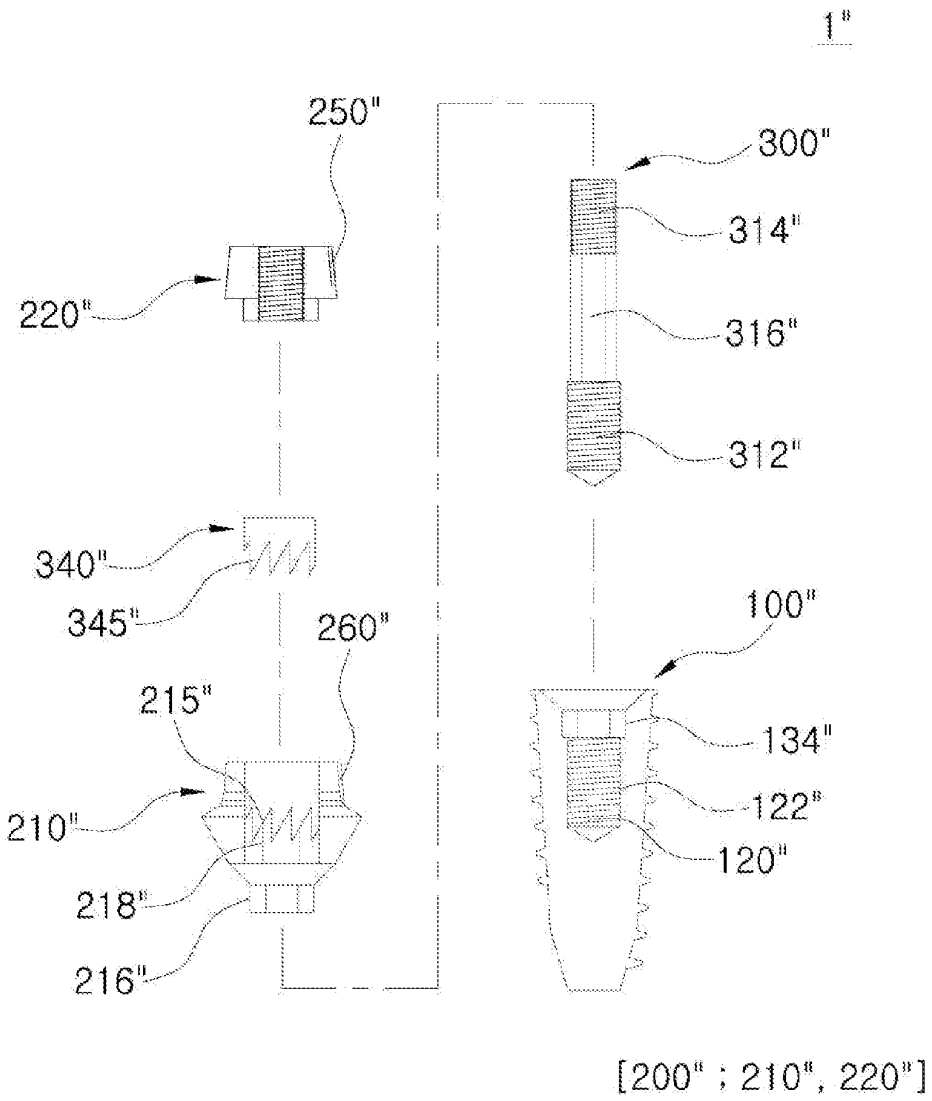
도면11

(a)
(b)
(c)
212'
260'
210'
218'
314'
320'
316'
332'
330'
134'
334'
132'
312'
100'
110'
220'
250'

도면12

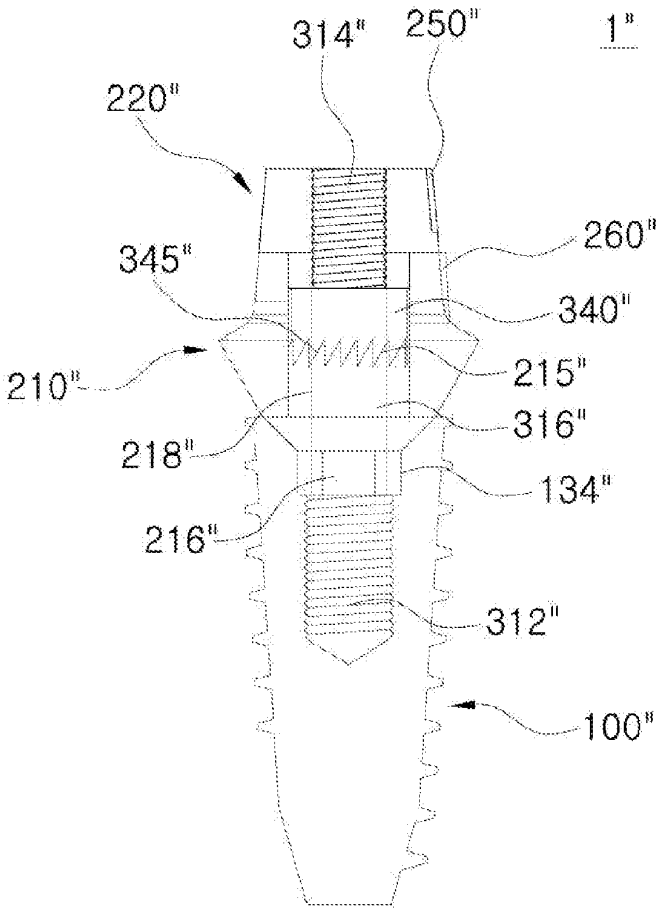


도면13

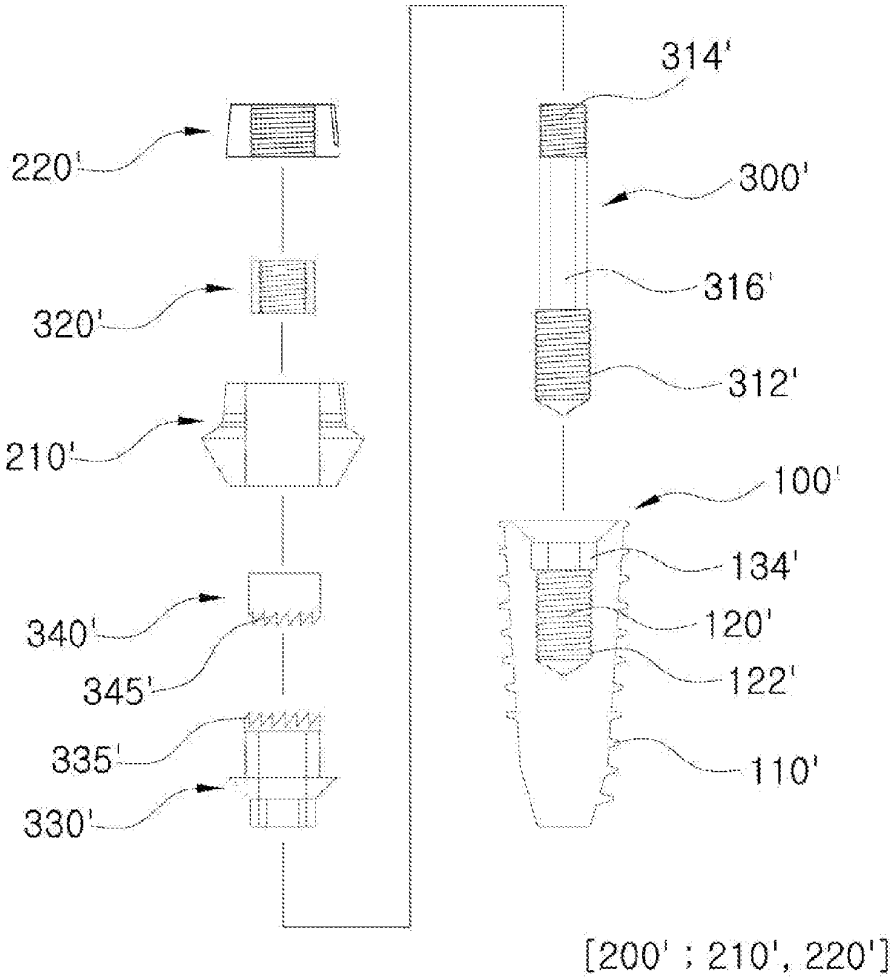


[200" ; 210", 220"]

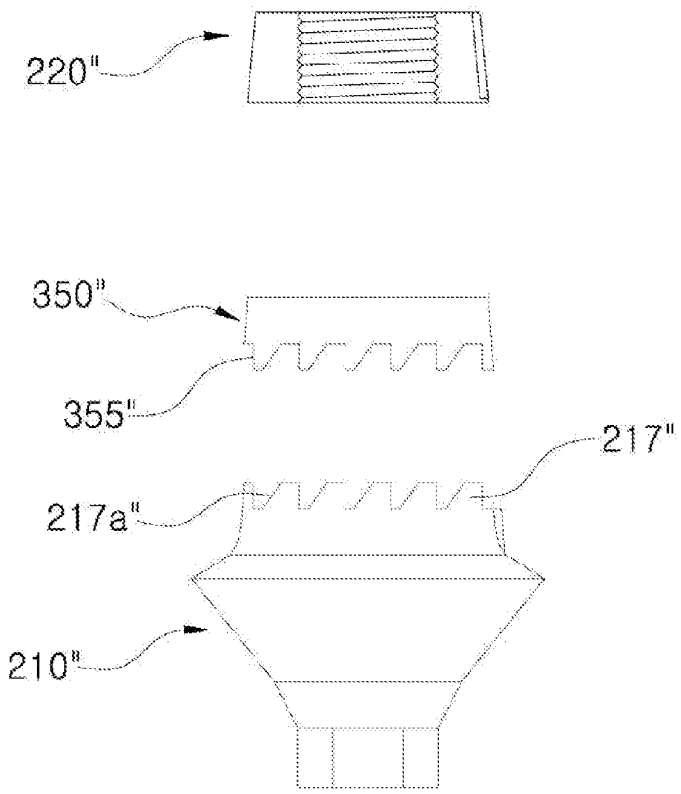
도면14



도면15


1'
314'
220'
300'
320'
316'
312'
210'
100'
134'
340'
120'
345'
122'
335'
110'
330'
[200' ; 210', 220']

도면16



Espacenet

KR20140080313A DENTAL IMPLANT

Applicants: DENTOZ CO LTD [KR]

Inventors: CHOI HO JUN [KR]

Classifications:
IPC ***A61C13/263; A61C8/00;***

CPC **A61C8/0059 (KR); A61C8/006 (KR); A61C8/0062 (KR); A61C8/0068 (KR);**

Priorities: KR20120149984A 2012-12-20

Application: KR20120149984A·2012-12-20

Publication: KR20140080313A·2014-06-30

Published as: **KR101509643B1**; KR20140080313A

DENTAL IMPLANT

Abstract

The present invention relates to a dental implant capable of preventing the fracture of an implant screw binding part by binding a fixture and an abutment using an additional screw support, while preventing stress from being concentrated partially through controlling power to be evenly delivered at a contact surface, improving binding force between the fixture and the abutment by differing screwed directions of the fixture and the abutment, and fundamentally preventing the release of a screw. The present invention relates to the dental implant including the fixture and the abutment, wherein the abutment is divided into a lower abutment inserted into the fixture and an upper abutment connected to the upper part of the lower abutment, and the upper abutment and the fixture are fixed by the screw support.

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DESCRIPTION KR20140080313A

11 Dental implant {Dental implant}

[0001]

15 The present invention relates to a dental implant, and more particularly, by combining a fixture and an abutment using a separate screw column, the fracture of the implant screw coupling part is prevented and the force is uniformly transmitted to the entire contact surface so that the stress is reduced. For dental implants that can prevent partial concentration, improve the bonding force between the fixture and the abutment by changing the screwing direction between the fixture and the abutment, and prevent loosening of the screw. it's about

[0002]

25 In general, an implant means an artificial substitute configured to reproduce the same shape and function as a natural tooth, and the configuration is as shown in FIG. A fixture (10) made of titanium imitating the root shape of natural teeth to be installed in A), and an abutment (abutment) 20 and a fixing screw 30 for fixing the fixture 10 and the abutment 20 to each other.

[0003]

33 That is, in the conventional general implant structure, the abutment 20 is positioned on the upper portion of the fixture 10 having a screw hole formed therein, and then the fixing screw is inserted into the screw hole of the fixture 10 through the abutment 20 . The fixture 10 and the abutment 20 are configured to be fixedly coupled to each other by the rotation of the fixing screw 30 by inserting and coupling the 30 .

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[0004]

41 However, in the above configuration, the head portion of the fixing screw 30 is inserted into the abutment 20 to be supported by the coupling portion of the fixture 10 and the abutment 20, so that the fixing screw 30 is inserted into the abutment 20. The length of 30 is short, so the bonding force between the fixture 10 and the abutment 20 is weak, and the load received during mastication, such as when chewing food, is concentrated on the narrow surface area of the fixing screw 30, and the fixture (10) There is a problem in that the fixing screw 30 may be fractured or loosened at the coupling portion of the abutment 20 and the abutment 20 .

[0005]

52 As a prior art for solving this problem, US Patent Publication No. US2003/0224328 discloses a dental implant 1 having a biological function, its main technical configuration is as shown in FIG. 2 , the gingival bone in the patient's mouth. In the dental implant 1 having a biological function for attaching the crown 50 to the 64, the gum line 62 (the tooth and the root part 3 planted below the line formed by meeting the gums), means for fixing the root part 3 to the inside of the socket formed in the patient's gingival bone 64, and the crown part 50 and a flexible abutment post 18 for connecting the crown part 50 to the root part 3, wherein the flexible abutment post 18 is the crown part 50 It is characterized in that it is formed so as to be able to be bent in order to be movable with respect to the root part 3 fixed inside the socket formed in the gingival bone 64 of the patient.

[0006]

66 The configuration is characterized in that it is configured to provide a supply passage for distributing human growth factors to the bone structure surrounding the root part, but the configuration is complicated, and the crown 50 and the root part 3) is weak, and there is a problem that there is a risk that the screw coupling of the crown part 50 and the root part 3 by the abutment post 18 is loosened.

[0007]

74 However, in the above configuration, since the screw part 5 is integrally formed with the upper mounting table 2, there is still a risk that the upper mounting table 2 on which the screw part 5 is formed is broken, and the upper mounting table 2 is broken. In this case, there is a disadvantage in that it is difficult to remove the fractured screw portion 5 .

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[0008]

82 In addition, since the screw portion 5 is screwed only on the inside of the artificial tooth fixture 11, the surface area of the screwed portion is small, and the coupling force between the artificial tooth fixture 11 and the upper installation table 2 and the lower installation table 6 T his weak, there is a problem that there is a risk that the screw connection is loosened.

[0009]

90 In addition, since the conventional configuration is a structure in which the crown part 50 is connected to the root part 3 as a whole without the surface in which the abutment is in contact with the gum part, it can be applied only when the gum bone is perfectly present, T here is also a problem in that a lot of plaque and tartar are deposited in the vicinity of the line 62 .

[]

98 T he present invention has been devised to solve the problems of the prior art as described above, and an object of the present invention is to reduce the area in which the fixture and the abutment are screwed by using a separate screw column for coupling the fixture and the abutment. By increasing the bond strength between the fixture and the abutment, it is possible to minimize the risk of fracture of the screw pillar, and to provide a dental implant that can easily remove the fractured screw pillar even when the screw pillar is broken. have. In addition, the present invention provides a dental implant capable of more easily and accurately coupling the fixture and the abutment by first coupling the screw column to the fixture and then fixing the abutment on the upper part. T here is a purpose. In addition, the present invention provides a dental implant that can be assembled by selecting various shapes such as height, inclination, thickness, etc. of the upper and lower abutments by separating the abutment into an upper abutment and a lower abutment. T here is another purpose to provide. In addition, the present invention is configured by separating the screw coupling portion in two places between the upper abutment and the screw pillar and between the fixture and the screw pillar using a screw column, and at the same time the direction of coupling of the screwed portion configured separately is opposite to each other A nother object of the present invention is to provide a dental implant capable of improving the bonding force between the fixture and the abutment and fundamentally preventing the loosening of the screw. In addition, the present invention improves the coupling force between the upper and lower abutments and the coupling force between the upper and lower abutments and the fixture by inserting and coupling the screw ring and the fastener between the screw column and the upper and lower abutments. It is another object to provide a dental implant that can. In

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addition, the present invention is for dentistry to maximize the effect of preventing loosening of the screw column by reversing the implantation direction of the fixture, the coupling direction between the screw column and the upper and lower abutments, and the coupling direction between the screw column and the fixture. Another object is to provide an implant. In addition, the present invention inserts and installs a step ring inside the lower abutment or between the upper abutment and the lower abutment so that the lower abutment is in close contact with the post of the screw column having a polygonal shape. Another object of the present invention is to provide a dental implant capable of maintaining a solid fixation state without shaking despite the tolerance generated during the process.

132 In addition, the present invention forms a seating groove or a seating ridge on the outer peripheral surfaces of the upper abutment and the lower abutment, respectively, so that protrusions and grooves corresponding to the shapes of the seating groove and the seating ridge are formed on the inner surface of the artificial tooth. Another object of the present invention is to provide a dental implant capable of fixing the abutment and the lower abutment.

138 The present invention for achieving the above objects, In the dental implant comprising a fixture and an abutment, the abutment is a lower abutment fitted to the fixture, and the lower abutment It is composed of an upper abutment that is connected to and installed on the upper part, and the upper abutment and the fixture are fastened and fixed by a screw column. At this time, the fixture and the upper abutment are respectively formed with first and second female screws to which the screw posts are coupled, and the first and second male screws are formed on the screw posts at positions corresponding to the first and second female screws. characterized. In addition, the first female screw, the first male screw, and the second female screw and the second male screw are formed to have threads in opposite directions to each other. And, a protrusion is formed at a lower end of the upper abutment, and a seating groove into which the protrusion is fitted is formed at an upper end of the lower abutment. In addition, an extension portion having a second female screw is formed protruding from the lower end of the upper abutment, and an insertion groove into which the extension portion is inserted and coupled is formed at the upper end of the lower abutment. In addition, a coupling groove is formed in the lower portion of the lower abutment, and a fixing part to be fitted into the coupling groove is protruded from the upper end of the fixture. And, a seating groove is formed on the outer peripheral surface of the upper abutment, and a seating ridge is formed on the outer peripheral surface of the lower abutment. On the other hand, the screw column is characterized in that it is composed of first and second male screws formed at the lower end and upper end, respectively, and a post having a polygonal shape formed between the first and second male screws. At this time, the second male screw is formed on the outer circumferential surface of the screw column, the second female screw is formed on the inner circumferential surface, the screw ring having the third male screw is formed on the outer

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circumferential surface is coupled, and the third female screw to which the third male screw is fastened is coupled to the upper abutment. It is characterized in that the formed first fastening hole is formed. In addition, the post of the screw pillar is fitted with a fastener having a fourth male screw formed on an outer circumferential surface, and a second fastening hole having a fourth female screw to which the fourth male screw is fastened is formed in the lower abutment.

170 And, the lower end of the fastener is formed with a rotation preventing portion made of a polygonal shape, it is characterized in that the upper portion of the fixture is formed with a rotation preventing groove to which the rotation preventing portion is fitted. In addition, at the upper end of the fastener, a first step portion of a sawtooth shape inclined upward in the direction in which the screw column coupled to the inside of the fixture is unwound is formed, and between the screw ring and the fastener, the lower end corresponds to the first step portion It is characterized in that the first step ring formed with the second step portion of the shape to be installed. In addition, the screw direction of the first female screw and the first male screw is characterized in that formed in the opposite direction to the screw thread formed in the fixture, the second to fourth female screw and the second to fourth male screw. And, on the inside of the lower abutment, a first step portion having a sawtooth shape inclined upward in the direction in which the screw column coupled to the inside of the fixture is released is formed at the upper end portion, and the first step portion is formed on the upper portion of the first step portion at the lower end portion It is characterized in that the first step ring formed with the second step portion having a shape corresponding to the step portion is inserted and coupled to the inside of the lower abutment. In addition, the upper end of the lower abutment is formed with a step- shaped third step portion including an inclined surface inclined upward in the direction in which the screw column coupled to the inner side of the fixture is released, the lower abutment and the upper abutment It is characterized in that a second step ring is installed between the ment and the fourth step portion having a shape corresponding to the third step portion at the lower end.

193 According to the present invention, the coupling force between the fixture and the abutment is increased by increasing the area where the fixture and the abutment are screwed by using a separate screw column for coupling the fixture and the abutment, and the screwed portion As the load is distributed and transmitted to the whole, it is possible to minimize the risk of fracture of the screw pillar due to stress concentration, and also has the effect of easily removing the fractured screw pillar even when the screw pillar is fractured. In addition, the present invention further has the effect of more easily and accurately coupling the fixture and the abutment by allowing the abutment to be fastened to the upper part after coupling the screw column to the fixture. In addition, the present invention has an additional effect that can be assembled by selecting various shapes such as the height, inclination, thickness, etc. of the upper and lower abutments by separating the abutment into an upper abutment and a lower abutment. . In addition, the present invention is

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configured by separating the screw coupling portion in two places between the upper abutment and the screw pillar and between the fixture and the screw pillar using a screw column, and at the same time the direction of coupling of the screwed portion configured separately is opposite to each other T his not only improves the bonding force between the fixture and the abutment and prevents loosening of the screw, but also ensures that the contact part between the fixture and the abutment is in close contact as a whole without being partially stressed. By preventing the penetration of foreign substances into the joint gap of the implant, it has the additional effect of preventing the occurrence of peri- implantitis and peri- implant mucositis due to bacterial propagation inside the implant. In addition, according to the present invention, the coupling force between the upper and lower abutments and the coupling force between the upper and lower abutments and the fixture by inserting and coupling the screw ring and the fastener between the screw column and the upper and lower abutments Not only can it improve, but also to maximize the effect of preventing loosening of the screw column by reversing the direction of implantation of the fixture, the coupling direction between the screw column and the upper and lower abutments, and the coupling direction between the screw column and the fixture. have an additional effect.

224 In addition, according to the present invention, by inserting a step ring inside the lower abutment or between the upper abutment and the lower abutment, the inner surface of the lower abutment is formed on the outer peripheral surface of the post of the screw column having a polygonal shape. By making it closely fixed, it has an additional effect of maintaining a solid fixed state without shaking despite tolerances generated during the manufacturing process of the implant. In addition, according to the present invention, by forming a seating groove or a seating ridge on the outer peripheral surfaces of the upper abutment and the lower abutment, respectively, protrusions and grooves corresponding to the shapes of the seating groove and the seating ridge are formed on the inner surface of the artificial tooth. By firmly fixing the upper abutment and the lower abutment, it additionally has an effect of preventing loosening.

[0041]

239 1 is a view schematically showing a state in which a conventional conventional implant has been operated.

241 Figure 2 is a cross- sectional view showing a conventional dental implant combination.

243 Figure 3 is a combined cross- sectional view showing an embodiment of the dental implant according to the present invention.

245 Figure 4 is a cross- sectional view showing the present invention shown in Figure 3 separated.

247 5 (a), (b), (c) is a cross- sectional view showing an embodiment of the abutment of

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the present invention shown in FIG. 3 separately.

249 Figure 6 (a), (b), (c) is a view showing an embodiment of the screw column of the present invention shown in Figure 3;

251 7 is a combined cross- sectional view showing a second embodiment of the dental implant according to the present invention.

253 8 is a combined cross- sectional view showing a third embodiment of the dental implant according to the present invention.

255 9 is a cross- sectional view showing a fourth embodiment of a dental implant according to the present invention separately.

257 10 is a cross- sectional view of the present invention shown in FIG.

258 11 (a), (b), (c) is a cross- sectional view showing the coupling process of the lower abutment in the present invention shown in FIG.

260 Figure 12 (a), (b) is a plan sectional view showing a coupling portion between the fixture and the lower abutment of the present invention shown in Figure 10.

262 13 is a cross- sectional view showing a fifth embodiment of a dental implant according to the present invention separately.

264 14 is a cross- sectional view of the present invention shown in FIG. 13;

265 15 is a cross- sectional view showing a sixth embodiment of a dental implant according to the present invention separately.

267 16 is a view showing separately another embodiment of the upper and lower abutments of the dental implant according to the present invention.

[0042]

272 Hereinafter, preferred embodiments of the dental implant according to the present invention will be described in detail with reference to the accompanying drawings.

[0043]

277 Figure 3 is a combined cross- sectional view showing an embodiment of the dental implant according to the present invention, Figure 4 is a cross- sectional view showing the present invention shown in Figure 3 separately, Figure 5 (a), (b), (c) is a cross- sectional view showing an embodiment of the abutment of the present invention shown in FIG. 3 separately, and (a), (b), (c) of FIG. 6 is an embodiment of a screw column of the present invention shown in FIG. Figure 7 is a combined cross- sectional view showing a second embodiment of the dental implant according to the present invention, Figure 8 is a combined cross- sectional view showing a third embodiment of the dental implant according to the present invention, Figure 9 is the present invention A cross- sectional view showing a fourth embodiment of a dental implant according to FIG. 10 is a combined cross- sectional view of the present invention shown in FIG. 9, (a), (b), (c) of FIG. A cross- sectional view showing the coupling process of the lower abutment in the present invention, Fig. 12

is a cross- sectional view showing a fifth embodiment of the dental implant according to the present invention separately, Fig. 13 is a combined cross- sectional view of the present invention shown in Fig. 12 , FIG. 14 is a cross- sectional view showing a sixth embodiment of a dental implant according to the present invention, and FIG. 15 is a view showing another embodiment of upper and lower abutments of the dental implant according to the present invention. .

[0044]

299 The present invention prevents fracture of the implant screw coupling portion by coupling the fixture 100 and the abutment 200 using separate screw pillars 300 and 300 ′ and at the same time allows the force to be uniformly transmitted to the entire contact surface so that the stress is partially can be prevented from being concentrated, and the screw coupling direction between the fixture 100 and the abutment 200 is changed to improve the coupling force between the fixture 100 and the abutment 200, and loosening of the screw relates to a dental implant (1) capable of fundamentally preventing is made including

[0045]

310 In more detail, the fixture 100 serves as the root of the implant 1 and is formed to have the root shape of a natural tooth, and a screw thread 110 is formed on its outer peripheral surface to be inserted into the inner side of the alveolar bone. It is designed to be

[0046]

317 In addition, a first female screw 122 to which a screw column 300 to be described later is inserted and fastened is formed in the upper center of the fixture 100 , and an abutment 200 to be described later is formed on the upper portion of the first female screw 122 .), a tapered groove 132 and an anti- rotation groove 134 to which the lower portion is fitted are formed to correspond to the lower shape of the abutment 200 .

[0047]

326 Next, the abutment (abutment) 200 is installed to be connected to the upper portion of the fixture 100, the artificial tooth 400 is coupled to the upper portion, and serves as a connecting pillar of the implant (1).

[0048]

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332 At this time, the abutment 200 includes a lower abutment 210 that is inserted and fixed to the inside of the fixture 100 and an upper abutment that is rotatably fitted to the upper portion of the lower abutment 210 . It consists of a separate abutment 220, which facilitates the coupling of the abutment 200 and the fixture 100 while improving the fixing force of the abutment 200, which will be described later.

[0049]

340 Next, the screw column 300 is inserted into the abutment 200 and the fixture 100 to serve to fasten and fix the abutment 200 and the fixture 100, the screw column 300 A male screw 310 is formed on the outer peripheral surface of the .

[0050]

346 In more detail, a fastening hole 222 having a second female screw 222a formed on the sidewall is formed in the central portion of the upper abutment 220 , and a through hole 218 is formed in the central portion of the lower abutment 210 .) is formed, and in the center of the fixture 100, a fastening groove 120 having a first female screw 122 formed on the side wall is formed, and a screw column 300 having a male screw 310 formed on the outer circumferential surface is the upper abutment 220), the lower abutment 210 and the second female screw 222a formed in the upper abutment 220 by being inserted through the center of the fixture 100 and the first female screw 122 formed in the center of the fixture 100 .) so that it can be fastened and fixed.

[0051]

359 T hat is, according to a preferred embodiment of the present invention, after fastening and fixing the screw column 300 to the fixture 100, the lower abutment 210 and the upper abutment 220 are sequentially coupled thereto. , First, by inserting the screw column 300 into the inside of the fastening groove 120 formed in the fixture 100 inserted and coupled to the inside of the alveolar bone, the first female screw 122 formed on the side wall of the fastening groove 120 is fastened and fixed. .

[0052]

368 Next, the lower abutment 210 is coupled to the fixture 100 by inserting it into the screw column 300 , and is inserted into the screw column 300 through the through hole 218 formed in the lower abutment 210 . By combining, the lower end of the lower abutment 210 is inserted and coupled to the upper portion of the fixture 100 .

[0053]

375 At this time, although not shown, a female screw is also formed on the side wall of the through hole 218 formed in the center of the lower abutment 210 so that the lower abutment 210 is screwed to the outer circumferential surface of the screw column 300 . Of course you can do it.

[0054]

382 Next, when the upper abutment 220 is fastened to the upper end of the screw column 300 using the second female screw 222a formed in the upper abutment 220, the fixture 100 and the abutment 200 is completed, the coupling of the fixture 100 and the abutment 200 can be made more easily and accurately by the coupling method as described above, as well as the fixture 100 and the abutment by the screw column 300 . Since the area to which the abutment 200 is screwed is increased, it is possible to increase the coupling force between the fixture 100 and the abutment 200 .

[0055]

393 In addition, a screw column 300 for coupling the fixture 100 and the abutment 200 is separately provided, and the part screwed to the screw column 300 is attached to the inner side of the fixture 100 and the upper abutment (220), it is possible to distribute the load received during the chewing action, such as when chewing food, thereby minimizing the risk of fracture of the screw pillar 300 as well as when the screw pillar 300 is broken. T he fractured screw column 300 can be easily removed.

[0056]

402 On the other hand, the male screw 310 formed on the outer circumferential surface of the screw column 300 may be formed to be separated into first and second male screws 312 and 314, as shown in (b) and (c) of FIG. 6 , T he first male screw 312 is formed on the outer peripheral surface of the lower end of the screw column 300 , that is, a portion fastened with the first female screw 122 formed in the fixture 100 , and the second male screw 314 is the screw column 300 . It is formed on the outer peripheral surface of the upper end of the, that is, the portion fastened to the second female screw (222a) formed in the upper abutment (220).

[0057]

413 At this time, the first female screw 122 and the first male screw 312 and the second female screw 222a and the second male screw 314 may be formed to have threads in opposite directions to each other, which prevents the screw coupling from being

loosened. This is to ensure that the bonding force between the fixture 100 and the abutment 200 can be maintained by fundamentally preventing it.

[0058]

421 More specifically, when the first female screw 122 and the first male screw 312 are formed as a right- hand screw, the second female screw 222a and the second male screw 314 are formed as a left- hand screw, and the first female screw 122 is formed as a left- hand screw. And when the first male screw 312 is formed as a left- hand screw, by forming the second female screw 222a and the second male screw 314 as a right- hand screw, a screw column in the case of coupling the screw column 300 to the fixture 100 (The direction of rotation of 300 and the direction of rotation of the upper abutment 220 in the case of coupling the upper abutment 220 to the screw column 300 are to be opposite to each other.

[0059]

433 In this coupling method, the screw column 300 rotates in one direction so that the coupling part between the first female screw 122 and the first male screw 312 or the coupling part between the second female screw 222a and the second male screw 314 is In the case of loosening, the coupling portion between the second female screw 222a and the second male screw 314 coupled by rotation in the opposite direction to the above, or the coupling between the first female screw 122 and the first male screw 312 . Since this is made stronger, it is possible to fundamentally prevent the screw coupling from being loosened by preventing the screw column 300 from rotating any more, and accordingly, the solid coupling state between the fixture 100 and the abutment 200 will be able to be maintained.

[0060]

446 On the other hand, in the dental implant 1 according to the present invention, as described above, the upper and lower abutments (It is possible to assemble by selecting various shapes such as height, inclination, thickness, etc. of 220 and 210 , and as one embodiment thereof, as shown in FIG.) is formed, and a seating groove 212 corresponding to the shape of the protrusion 224 is formed at the upper end of the lower abutment 210 so that the upper abutment 220 is positioned on the upper portion of the lower abutment 210 . It can be configured to be installed stably.

[0061]

456 At this time, since the upper abutment 220 is rotatably fitted to the lower abutment 210 for fastening and fixing with the screw column 300, the protrusion 224 and the

seating groove 212 are T he horizontal cross section is formed to form a circle.

[0062]

462 Next, as shown in FIG. 5 (b), the upper abutment 220 may be configured to be simply seated on the upper portion of the lower abutment 210 to be coupled only by the screw column 300, as shown in FIG. As shown in (c) of 5, a cylindrical extension 226 is protruded from the lower end of the upper abutment 220, and the extension 226 is formed on the upper end of the lower abutment 210. An insertion groove 213 to be inserted and coupled may be formed.

[0063]

471 At this time, the fastening hole 222 in which the second female screw 222a provided in the upper abutment 220 is formed is extended inside the extension part 226 to increase the area screwed to the screw column 300 . By doing so, it is configured to improve the coupling force between the abutment 200 and the fixture 100 by the screw column 300 .

[0064]

479 Next, a tapered portion 214 and a rotation preventing portion 216 are formed at the lower portion of the abutment 200 fitted to the fixture 100 , that is, at the lower end of the lower abutment 210 , the tapered portion Reference numeral 214 has a conical shape that decreases in diameter toward the bottom, and serves to enable the lower abutment 210 to be more stably installed at the upper end of the fixture 100 .

[0065]

487 T hat is, a conical tapered groove 132 is formed in the upper portion of the fixture 100 to correspond to the shape of the tapered portion 214 , so that the lower abutment 210 is inserted and coupled to the inside of the fixture 100 . In this case, by increasing the contact area between the lower abutment 210 and the fixture 100, it is installed more stably, thereby serving to improve the coupling force.

[0066]

495 In addition, the anti- rotation part 216 is protruded to have a polygonal shape at the lower portion of the tapered part 214, and the lower portion of the tapered groove 132 of the fixture 100 has a shape of the anti- rotation part 216. When the anti-rotation groove 134 made of a corresponding polygon is formed so that the anti-rotation part 216 is fitted into the anti- rotation groove 134 , the lower abutment 210

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is fitted to the upper portion of the fixture 100 . It serves to improve the fixing force of the lower abutment 210 fitted to the fixture 100 by preventing it from rotating in the current state.

[0067]

506 On the other hand, according to the second embodiment of the present invention, in the coupling method of the fixture 100 and the abutment 200 using the screw column 300 as described above, the lower end of the abutment 200 is the fixture 100) as well as an internal type implant that is inserted into the inside of the external type implant (External type implant) can also be applied.

[0068]

514 That is, the fixing part 140 is formed to protrude from the upper end of the fixture 100 , and the fixing part 140 is fitted to the lower end of the abutment 200 , that is, the lower abutment 210 . Even when the groove 219 is formed and the fixture 100 is inserted and coupled to the inside of the lower abutment 220 , the coupling structure using the screw column 300 can be applied.

[0069]

522 At this time, the coupling groove 219 formed in the fixing part 140 and the lower abutment 210 of the fixture 100 has a polygonal shape like the above- described rotation preventing part 216 and rotation preventing groove 134 . It is configured to prevent the lower abutment 210 from rotating in a state fitted to the upper portion of the fixture 100 .

[0070]

530 On the other hand, according to the third embodiment of the dental implant 1 according to the present invention, as shown in FIG. 8 , one or more seating grooves (A seating groove 250 or a seating ridge 260 may be further formed, wherein the seating groove 250 and the seating ridge 260 include the upper abutment 220 and the lower abutment 210 .) to strengthen the fixation between them.

[0071]

538 In more detail, in a state in which the upper and lower abutments 220 and 210 and the fixture 100 are coupled using the screw column 300 by the process as described above, the outer peripheral surfaces of the upper and lower abutments 220 and 210 are The artificial tooth (prosthesis) 400 is covered by using a dental adhesive

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(cement), and at this time, the upper abutment (220) and the lower abutment 210 in which the seating ridge 260 is integrally formed on the outer circumferential surface during the manufacturing process, the impression taken of the prosthetic plaster model, that is, the artificial tooth (prosthesis) 400 A protrusion (not shown) corresponding to the shape of the seating groove 250 and a groove (not shown) corresponding to the shape of the seating ridge 260 are formed on the inner surface.

[0072]

551 T herefore, when the artificial tooth 400 is attached to the upper abutment 220 in which the seating groove 250 is formed and the lower abutment 210 in which the seating ridge 260 is formed, the protrusion formed in the artificial tooth 400 is T he seating ridge 260 formed in the lower abutment 210 is inserted and coupled to the inside of the seating groove 250, and the upper abutment 220 and the lower part are inserted and coupled to the inside of the groove formed in the artificial tooth 400. T he abutment 210 is not released and can be maintained in a fixed state.

[0073]

561 In addition, since the seating groove 250 and the seating ridge 260 increase the adhesion area between the upper and lower abutments 220 and 210 and the artificial tooth 400, the upper and lower abutments 220 and 210 and the artificial teeth (400) also serves to increase the bonding force between them.

[0074]

568 In this case, of course, the seating groove 250 or the seating ridge 260 may be selectively formed in the upper abutment 220 and the lower abutment 210 .

570 T hat is, a seating ridge 260 is formed in the upper abutment 220, a seating groove 250 is formed in the lower abutment 210, or a seating groove (250) or a seating ridge 260 may be formed.

[0075]

576 On the other hand, according to the fourth embodiment of the dental implant (1') according to the present invention, as shown in Figure 9, the screw column 300' with the first and second male screws (312', 314'), It may be configured as a post 316' formed between the first and second male screws 312' and 314', and the first male screw 312' is the screw column 300' as in the above- described embodiments.) is formed at the lower end of the fixture 100' and is fastened to the first female screw 122' formed in the fastening groove 120' of the fixture 100' to fix the screw column 300' to the fixture 100'. .

[0076]

587 Next, the second male screw 314' is formed at the upper end of the screw column 300', and a screw ring 320', which will be described later, is coupled to its outer circumferential surface and inserted into the upper abutment 220'. are combined

[0077]

593 T hat is, unlike the above- described embodiments, the screw column 300' is not directly coupled to the upper abutment 220', but a second female screw 324' is formed on the inner circumferential surface and a third male screw 326' is formed on the outer circumferential surface.) of the hollow screw ring 320' formed thereon with the second male screw 314' of the screw column 300', and then the third female screw 226 formed inside the upper abutment 220'. ') is to fasten and fix the third male screw 326' of the screw ring 320' to the first fastening hole 222' formed therein. T he screwing area between the ment 220' is increased, so that the fastening force is strengthened.

[0078]

605 On the other hand, a fastener 330' is fitted to the outside of the post 316' formed under the second male screw 314' of the screw column 300', and the fastener 330' is a post (316') is fitted to the outer circumferential surface of the screw pillar (300') rotates in a direction in which the first male screw 312' is loosened so that the lower abutment 210' can be fixed without shaking, thereby preventing the lower abutment 210' from loosening. will play a role

[0079]

614 In more detail, the post 316' of the screw column 300' has a polygonal shape, and a polygonal shape corresponding to the cross- sectional shape of the post 316' is formed inside the fastener 330'. T his is formed so that it can be fitted to the outside of the post 316'.

[0080]

621 In addition, the fastener 330' is composed of a screw coupling part 332' and a rotation preventing part 334', wherein the screw coupling part 332' is formed on the upper part of the fastener 330'. , a fourth male screw 338' is formed on its outer circumferential surface so as to be screw- coupled to the fourth female screw 218' formed inside the lower abutment 210'.

[0081]

629 In addition, the anti- rotation part 334 ′ serves the same role as the anti- rotation part 216 formed in the lower abutment 210 in the above- described embodiment, and the anti- rotation groove formed in the fixture 100 ′ . (134') is fitted.

[0082]

635 T hat is, the anti- rotation part 334' is formed in a polygonal shape such as a square, hexagonal or octagonal shape to form the same shape as the anti- rotation part 334', and the anti- rotation groove 134' formed at the upper end of the fixture 100'.) to prevent further rotation when the fastener 330' is inserted and coupled to the inside of the fixture 100' to prevent loosening between the fastener 330' and the fixture 100'. .

[0083]

644 In more detail, the hole formed inside the post 316 ′ and the fastener 330 ′ of the screw column 300 ′ , and the anti- rotation groove 134 ′ and the fastener formed in the fixture 100 ′ . T he anti- rotation part 334' of the 330' is made of a polygonal shape, so the coupling part between the post 316' and the fastener 330' and the coupling between the fixture 100' and the fastener 330' It is characterized in that it is configured to prevent negative rotation, but as shown in FIG. As a result, each coupling part does not come into close contact, and shaking may occur after coupling.

[0084]

655 Accordingly, the lower abutment 210' is screwed into the screw coupling part 332' of the fastener 330' in a state where the fastener 330' is fitted to the post 316' of the screw column 300'.) After coupling to the outside, when the lower abutment 210' is rotated and tightened, the fastener 330' is slightly rotated in one direction between the post 316' and the fastener 330' having a polygonal shape. T he coupling part of the fixture 100' and the coupling part between the fixture 100' and the fastener 330' are in close contact in the direction in which the screw column 300' is going to rotate, thereby eliminating the deviation that may be caused by tolerances in the manufacturing process. 100'), the screw pillar 300', and the fastener 330' may be more firmly coupled.

[0085]

668 At this time, the screw coupling direction between the fixture 100' and the screw column 300', that is, the screw direction of the first female screw 122' and the first male screw 312', and the lower abutment 210'. It is preferable that the screwing direction between the and the fastener 330', that is, the screw direction of the fourth female screw 218' and the fourth male screw 338' be opposite to each other, because the post 316' T he coupling portion between the and the fastener 330 ′ and the coupling portion between the fixture 100 ′ and the fastener 330 ′ are in close contact in the direction in which the coupling between the fixture 100 ′ and the screw column 300 ′ is released. am.

[0086]

680 T hat is, in a state in which the first male screw 312' of the screw column 300' is fastened to the fastening groove 120' of the fixture 100' in which the first female screw 122' is formed, the fastener 330') to the outer peripheral surface of the post 316' of the screw column 300' so that the anti- rotation part 334' is inserted and coupled to the inside of the anti- rotation groove 134' of the fixture 100', and then the fastener T he lower abutment 210' is coupled to the outside of the screw coupling part 332' of the 330'. At this time, the first female screw 122' and the first male screw 312', and the lower abutment When the fourth female screw 218' of the ment 210' and the fourth male screw 338' of the screw coupling part 332' are formed in opposite directions, the lower abutment 210' is rotated and tightened. As shown in (b) of 12, the direction in which the first male screw 312' of the screw column 300' in which the fastener 330' is inserted into the fastening groove 120' of the fixture 100' is loosened. between the coupling part between the post 316' and the fastener 330' and the rotation preventing groove 134' of the fixture 100' and the rotation preventing part 334' of the fastener 330'. Since the coupling portion of the screw pillar 300 ′ is in close contact without a gap in the direction in which it is intended to be loosened, the screw coupling between the fixture 100 ′ and the screw pillar 300 ′ is not loosened due to the shape of the polygonal coupling portion.

[0087]

701 On the other hand, in this embodiment as well, by changing the screw coupling directions of the fixture 100', the abutment 200', and the screw pillar 300', it is possible to fundamentally prevent the coupling of the screw pillar 300' from loosening. , in one embodiment, the screw coupling direction of the first male screw 312 ′ and the first female screw 122 ′ may be reversed to all other screw coupling directions.

[0088]

710 T hat is, when the screw coupling direction of the first male screw 312' and the first female screw 122' is a left- hand screw/or a right- hand screw, the coupling direction of the screw thread 110' formed in the fixture 100' and the second to second T he loosening of the screw coupling is fundamentally caused by setting the coupling direction of the threads formed on the four male screws 314', 326', 338' and the second to fourth female screws 324', 226', 218' to a right- hand thread/or a left- hand thread. that can be prevented.

[0089]

720 Since the screwing direction of implants currently mainly used is a right- hand screw, in the following, when the screwing direction of the first male screw 312' and the first female screw 122' is a left- hand screw, and the screwing direction of the remaining parts is a right- hand screw will be described with an example.

[0090]

727 First, the fixture (100') having a screw thread (110') formed on the outer circumferential surface is inserted and coupled to the alveolar bone in the right screw direction.

[0091]

733 T hereafter, the first male screw 312' of the screw column 300' is coupled to the first female screw 122' formed in the fastening groove 120' of the fixture 100', at this time the first female screw 122. ') and the first male screw 312' are formed in the left- hand direction to rotate the screw pillar 300' in the left direction to insert and couple the screw pillar 300' to the inside of the fixture 100'.

[0092]

741 Next, the fastener 330 ' comprising the screw coupling portion 332 ' and the rotation preventing portion 334 ' is fitted to the outside of the post 316 ' of the screw column 300 ' .

[0093]

747 Next, the screw ring 320' having the second female screw 324' formed on the inner circumferential surface of the second male screw 314' formed on the screw column 300' is rotated in the right- hand direction.

[0094]

753 T hen, as shown in (a) of Figure 11, the lower abutment 210' through the second fastening hole 212' formed in the lower abutment 210' of the fastener 330'. It is coupled to the outer circumferential surface of the screw coupling part 332', and at this time, the fourth female screw 218' formed in the second fastening hole 212' and the fourth male screw 338' formed on the outer circumferential surface of the fastener 330'.) is a right- hand thread direction, so the lower abutment 210' is rotated in the right- hand thread direction to be coupled.

[0095]

763 T hat is, as shown in (b) of Figure 11, when the lower abutment 210' is fitted from the top of the screw ring 320' and continuously rotated in the right- hand thread direction, the fastener 330' is T he right- hand screw direction, that is, the first male screw 312' of the screw column 300' inserted and coupled to the fastening groove 120' of the fixture 100' rotates in a direction in which the post 316' and the fastener are loosened. Since the coupling part between the 330' and the coupling part between the fixture 100' and the fastener 330' is in close contact without a gap, due to the polygonal coupling part shape, the fixture 100' and the screw column 300') T he screw connection between them is not loosened.

[0096]

775 Next, as shown in FIG. 11(c), the third female screw 226' formed in the first fastening hole 222' of the upper abutment 220' is applied to the outer peripheral surface of the screw ring 320'. It is coupled to the formed third male screw 326'. At this time, since both the third female screw 226' and the third male screw 326' are formed as right- hand screws, the upper abutment 220' is rotated in the right- hand direction. When the upper abutment 220' rotates along the screw ring 320', it descends to strongly press the lower abutment 210', and by the same process as above, the dental implant according to the present invention T he installation of (1') is completed.

[0097]

787 T hat is, the most problematic part in the structure of the dental implant 1' is that the screw coupling is loosened by the impact applied to the implant during long- term use.

[0098]

793 In the case of the present invention configured as described above, since the coupling

of the fixture 100 ′ and the screw column 300 ′ is made in the left- hand thread direction, in order to loosen the coupling of the screw column 300 ′ , rotation in the right- hand thread direction must be made. .

[0099]

800 However, in the present invention, since all of the screw couplings of the part except for the coupling part between the fixture 100' and the screw column 300' are formed in the right- hand thread direction, when the screw column 300' rotates in the right-hand thread direction, Since the coupling force between the upper abutment 220' and the lower abutment 210' and the screw ring 320' and the fastener 330' becomes stronger, the screw column 300' does not rotate any more. T herefore, it becomes possible to fundamentally prevent the loosening phenomenon caused by the rotation of the screw column 300'.

[0100]

811 At this time, although not shown separately, the structure of the upper abutment 220 ′ and the lower abutment 210 ′ is the above- described embodiment as shown in (a), (b) and (c) of FIG. 5 . It may be formed in various shapes as in the case of the upper and lower abutments 220' and 210', and of course, a seating groove 250' or a seating ridge 260' may be formed on the outer circumferential surface of the upper and lower abutments 220' and 210'.

[0101]

820 On the other hand, according to the fifth embodiment of the dental implant (1") according to the present invention, as shown in FIG. 13, the first step ring 340" is inserted and installed inside the lower abutment 210". As a feature of being, the first step ring 340" is the fixture 100" through the lower abutment 210" in a state of being inserted and coupled to the inside of the anti- rotation groove 134" of the fixture 100".) is configured to prevent loosening of the screw pillar 300" by finely rotating in the direction in which the screw pillar 300" inserted and coupled to the inside of the screw pillar 300" is loosened.

[0102]

831 More specifically, the screw column 300" is the same as in the fourth embodiment described above, with first and second male screws 312" and 314" and first and second male screws 312" and 314". It is composed of posts 316" formed between them, and the posts 316" have a polygonal shape, such as a square or hexagon.

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[0103]

838 In addition, the lower abutment 210" is formed with a polygonal through- hole 218" fitted to the outer circumferential surface of the post 316" on its inner side, and an upper end of the through- hole 218" is formed in the upper part of the lower abutment 210". A sawtooth- shaped first step portion 215 ″ is formed, and the lower end of the lower abutment 210 ″ is inserted into a polygonal anti- rotation groove 134 ″ formed inside the upper portion of the fixture 100 ″ . The anti-rotation portion 216 ″ coupled thereto is formed in the same shape as the anti-rotation groove 134 ″ .

[0104]

849 At this time, the sawtooth shape of the first step portion 215 ″ is formed to be inclined upwardly in the direction in which the screw column 300 ″ coupled to the inner side of the fixture 100 ″ is loosened.

[0105]

855 In addition, a first step ring 340" is inserted and installed between the first step part 215" and the upper abutment 220", and the screw column is inside the first step ring 340". A hole having a polygonal shape corresponding to the shape of the post 316 ″ of 300 ″ is formed, and at the lower end of the first step ring 340 ″ , a first step having the same shape as the sawtooth shape of the first step part 215 ″ . A two-step portion 345" is formed.

[0106]

864 That is, in the state in which the first male screw 312" of the screw column 300" is fastened and fixed to the fastening groove 120" of the fixture 100" in which the first female screw 122" is formed, the lower abutment 210 ") is fitted from the top of the screw column 300", the anti- rotation part 216" of the lower abutment 210" is formed in the fixture 100" and the anti- rotation groove 134" of a polygonal shape. The through- hole 218" of a polygonal shape that is inserted into and coupled to the lower abutment 210" and formed inside the lower abutment 210" is supported by the post 316" of the screw column 300", and the lower abutment 210 ") and the rotation of the screw pillar 300" is limited, so that the loosening phenomenon of the screw pillar 300" inserted and coupled to the fixture 100" can be prevented.

[0107]

877 However, due to tolerances in the manufacturing process of the fixture 100", the

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lower abutment 210", and the screw column 300", each coupling part formed in a polygonal shape, that is, the rotation preventing groove of the fixture 100" (134") and the coupling part between the anti- rotation part 216" of the lower abutment 210", and the through hole 218" of the lower abutment 210" and the post (300") of the screw column 316") may not come into close contact with each other, and vibration may occur after bonding.

[0108]

887 Accordingly, by inserting the first step ring 340" to the outside of the post 316", the first step ring 340" is inside the lower abutment 210", that is, the first step part 215".), when the upper abutment 220" is coupled to the second male screw 314" of the screw column 300", the upper abutment 220" descends while the first step T he upper end of the ring 340" is pressed, and accordingly, the first step ring 340" is lowered.

[0109]

896 At this time, the second step portion 345" formed at the lower end of the first step ring 340" meets the first step portion 215" formed on the lower abutment 210" to determine the inclination direction of the teeth. Accordingly, the first step ring 340 "is rotated in the coupling direction (clockwise when referring to FIG. 14) between the fixture 100" and the screw column 300", and the first step part 215") T he lower abutment 210 ″ formed integrally with the fixture 100 ″ rotates in a direction in which the coupling between the screw column 300 ″ is released (counterclockwise with reference to FIG. 14).

[0110]

907 As such, by the rotation of the lower abutment 210", the coupling portion between the rotation preventing groove 134" of the fixture 100" and the rotation preventing portion 216" of the lower abutment 210" and T he coupling part between the through hole 218" of the lower abutment 210" and the post 316" of the screw column 300" is perfectly close so that there is no minimum gap, so that the coupling force at each coupling part is reduced. Due to the shape of the polygonal shape formed by each coupling part, the screw column 300" cannot rotate in the direction in which the coupling with the fixture 100" is released. It will be possible to configure the dental implant (1") that does not.

[0111]

919 On the other hand, in this embodiment as well, the remaining components such as the

seating bridge 250 " or the seating ridge 260" may be formed on the outer peripheral surfaces of the upper and lower abutments 220 ", 210 ", etc., are Since it is the same as , a detailed description thereof will be omitted.

[0112]

926 Next, FIG. 15 shows a sixth embodiment of a dental implant 1' according to the present invention, in which the characteristic configurations of the above- described fourth and fifth embodiments are combined.

[0113]

932 More specifically, the sixth embodiment is a screw column 300' coupled to the inside of the fixture 100' to the upper end of the fastener 330' fitted to the outer circumferential surface of the post 316' having a polygonal shape.) to form a first step portion 335' having a sawtooth shape inclined upward toward the unwinding direction, and the upper portion of the first step portion 335', that is, the fastener 330' and the screw ring 320 ') is characterized in that a first step ring 340' having a second step portion 345' having the same shape as the sawtooth shape of the first step portion 335' is inserted and installed at the lower end thereof. .

[0114]

943 T herefore, when the upper abutment 220' is coupled to the second male screw 314' of the screw column 300' during the coupling process of the implant 1', the rotation of the upper abutment 220' is affected. As a result, the screw ring 320' is lowered to press the first step ring 340' installed thereunder, and accordingly, the second step portion 345' is a first step formed in the fastener 330'. As it slides along the part 335', the fastener 330' rotates in a direction in which the coupling between the fixture 100' and the screw column 300' is released, so the post 316' and the fastener 330') between the coupling part and the coupling part between the fixture 100' and the fastener 330' can be in close contact without a gap in the direction in which the screw column 300' is to be loosened, and due to the shape of the polygonal coupling part, the fixture T he screw coupling between the (100') and the screw column (300') is not loosened.

[0115]

958 On the other hand, the concept of the step ring as described above can also be applied to the coupling between the upper abutment 220 ″ and the lower abutment 210 ″ . A third step portion (217"), and between the upper abutment 220" and the lower abutment 210", a fourth step portion 355" having the same shape as the third

step portion 217" is formed at the lower end thereof. T he second step ring 350 ″ in which is formed may be inserted and coupled.

[0116]

967 T hat is, in a state in which the fixture 100 ″ , the screw column 300 ″ , and the lower abutment 210 ″ are sequentially coupled as in the above- described fifth embodiment, the upper part of the lower abutment 210 ″ After positioning the second step ring 350" on the , when the upper abutment 220" is coupled from the upper part of the second step ring 350", the T he second step ring 350" is descended, and the fourth step portion 355" formed at the lower end of the second step ring 350" is formed at the upper end of the lower abutment 210" and the third step portion (217") and rotates the lower abutment 210" in the direction in which the screw column 300" coupled to the fixture 100" is to be loosened, so the fixture 100" and the lower T he coupling portion between the abutments 210 ″ is in close contact without a gap in the direction in which the screw column 300 ″ is to be loosened, so that it is possible to prevent the screw column 300 ″ from rotating in the direction to be loosened.

[0117]

983 T herefore, according to the dental implant (1,1',1") according to the present invention as described above, a separate screw for coupling the fixtures 100,100',100" and the abutments 200,200',200" Fixtures 100,100',100" and abutment by increasing the area where fixtures 100,100',100" and abutment 200,200',200" are threaded using posts 300,300',300" (200,200',200") increases the bonding force between the screws, and the load is distributed and transmitted as a whole to the screwed part, so it is possible to minimize the risk of fracture of the screw pillars 300,300',300" due to stress concentration, and the screw pillars Even when the (300,300',300") is broken, the broken screw pillar (300,300',300") can be easily removed as well as the screw pillar (300,300',300") on the fixture (100,100',100") After coupling the abutment (200,200',200") to the upper part to be able to fasten and fix the fixture (100,100',100") and the abutment (200,200',200") more easily and accurately In spite of the tolerances generated in the manufacturing process of the implant (1, 1', 1") by preventing multiple loosening of the screw pillars 300, 300', 300" by various methods, it is sturdy without shaking. Not only can it be maintained in a fixed state, but it also has various advantages such as being able to fundamentally prevent loosening of screws even in long- term use.

[0118]

1003 Although the above- described embodiments have been described with respect to

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the most preferred example of the present invention, it is not limited to the above embodiment, and the screw pillars 300 and 300' that serve to firmly couple the fixtures 100 and 100' and the abutments 200 and 200'.) It is apparent to those skilled in the art that various modifications are possible without departing from the technical spirit of the present invention, such as various modifications of the shape.

[0119]

1012 T he present invention relates to a dental implant, and more particularly, by combining a fixture and an abutment using a separate screw column, the fracture of the implant screw coupling part is prevented and the force is uniformly transmitted to the entire contact surface so that the stress is reduced. For dental implants that can prevent partial concentration, improve the bonding force between the fixture and the abutment by changing the screwing direction between the fixture and the abutment, and prevent loosening of the screw. it's about

[0120]

1022 1,1',1": dental implant 100,100',100": fixture 110,110': thread 120,120',120": fastening groove 122,122',122": first female thread 132: taper groove 134,134',134": anti- rotation groove 140: Fixing part 200,200',200": abutment 210,210',220": lower abutment 212: seating groove 212': second fastening hole 213: insertion groove 214: tapered part 215",335': first step part 216,216",334': anti- rotation part 218,218": through hole 217": third step part 217"a: inclined surface 218': fourth female thread 219: coupling groove 220,220',220": upper abutment 222: fastening hole 222a: second female screw 222': first fastening hole 224: protrusion 226: extension 226': third female screw 250,250',250": seating groove 260,260',260": seating ridge 300,300',300": screw column 310 : Male thread 312,312',312" : 1st male thread 314,314',314" : 2nd male thread 316',316" : Post 320' : T hread ring 324' : 2nd female thread 326' : 3rd male thread 330' : Fastener 332 ': screw coupling part 338': fourth male thread 340', 340": first step ring 345', 345": second step part 350": second step ring 355": fourth step part 400: artificial tooth

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CLAIMS KR20140080313A

1.

14 A dental implant comprising a fixture having a thread formed on its outer circumferential surface and an abutment inserted and coupled to the inside of the fixture, wherein the abutment includes a lower abutment fitted to the fixture, and the lower abutment It consists of an upper abutment that is connected and installed on the upper part of the dental implant, characterized in that the upper abutment and the fixture are fastened and fixed by a screw column.

2.

23 According to claim 1, The fixture and the upper abutment is respectively formed with first and second female screws to which the screw posts are coupled, the first and second screw posts at positions corresponding to the first and second female screws. Dental implant, characterized in that the male thread is formed.

3.

30 The dental implant of claim 2, wherein the first female screw and the first male screw, and the second female screw and the second male screw are formed to have threads in opposite directions to each other.

4.

36 The dental implant according to claim 2, wherein a protrusion is formed at a lower end of the upper abutment, and a seating groove into which the protrusion is fitted is

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formed at an upper end of the lower abutment.

5.

42 According to claim 2, Dentistry, characterized in that the lower end of the upper abutment has an extension formed with a second female screw protruding from an inner circumferential surface, and an insertion groove into which the extension is inserted and coupled to the upper end of the lower abutment. for implants.

6.

49 The dental implant according to claim 2, wherein a coupling groove is formed in a lower portion of the lower abutment, and a fixing part to be fitted into the coupling groove is protruded from an upper end of the fixture.

7.

55 The dental implant of claim 1, wherein a seating groove is formed on an outer circumferential surface of the upper abutment, and a seating ridge is formed on an outer circumferential surface of the lower abutment.

8.

61 According to claim 2, The screw column is for dentistry, characterized in that consisting of first and second male screws respectively formed on the lower end and upper end thereof, and a polygonal- shaped post formed between the first and second male screws. implant.

9.

68 According to claim 8, The second male screw outer circumferential surface of the screw column, A second female screw is formed on the inner circumferential surface, a screw ring having a third male screw formed on the outer circumferential surface is coupled, and a third male screw is fastened to the upper abutment. Dental implant, characterized in that the first fastening hole formed with a third female screw is formed.

10.

77 10 . The method of claim 9 , wherein a fastener having a fourth male screw formed thereon is fitted to the post of the screw column, and a second fastening hole having a fourth female screw to which a fourth male screw is fastened is formed in the lower

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abutment. Characterized by dental implants.

11.

84 The dental implant according to claim 10, wherein a polygonal anti- rotation part is formed at a lower end of the fastener, and a rotation- preventing groove into which the anti- rotation part is fitted is formed on the upper portion of the fixture.

12.

90 According to claim 10, The upper end of the fastener is formed with a first step portion of a sawtooth shape inclined upward in the direction in which the screw column coupled to the inner side of the fixture is loosened, and between the screw ring and the fastener, a first step is formed at the lower end. Dental implant, characterized in that the first step ring formed with a second step portion having a shape corresponding to the step portion is installed.

13.

99 The dental use of claim 10 , wherein the screw directions of the first female screw and the first male screw are opposite to the screw threads formed in the fixture and the second to fourth female screws and the second to fourth male screws. implant.

14.

105 According to claim 8, The inner side of the lower abutment is formed with a first step portion in the shape of a sawtooth inclined upward in the direction in which the screw column coupled to the inner side of the fixture is released at the upper end portion, The upper portion of the first step portion A dental implant, characterized in that the first step ring formed with a second step portion having a shape corresponding to the first step portion at the lower end is inserted and coupled to the inside of the lower abutment.

15.

115 According to claim 1, The upper end of the lower abutment is formed with a step-shaped third step portion including an inclined surface inclined upward toward the loosening direction of the screw column coupled to the inside of the fixture, the lower abutment Dental implant, characterized in that the second step ring is installed between the upper abutment and the fourth step portion having a shape corresponding to the third step portion at the lower end.

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APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
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Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	2867	FILED BY	Daniel Whittle
PATENT CENTER #	63475684	FILING DATE	06/03/2023
CUSTOMER #	112823	FIRST NAMED INVENTOR	Brandon Dale Kofford
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 26

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CHAPTER

1

Basic Biology of Oral Microbes

1.1 CYTOLOGICAL BASIS OF MICROORGANISMS

The cell is the fundamental unit of all living organisms. Various subunit structures and chemical substances found on and inside the cell make complex cellular functions possible. Microbes can be divided into three major groups according to their morphological structure, degree of differentiation, and chemical composition: eukaryote, prokaryote, and acellular microorganisms (Figure 1.1(A)–(B)).

1.2 MICROBIAL MORPHOLOGY

Microorganisms, also known as microbes, are tiny organisms that are only visible under an optical microscope or an electron microscope. They are small in size and simple in structure. Microbes reproduce quickly, can tolerate a wide range of environmental conditions, are widely distributed, highly variable, and tend to congregate.

1.2.1 Microbial Size

As many types of microbes exist, they vary widely in size. Generally, the units used to measure microbes are μm and nm. Most cocci are 1 μm in diameter. Bacilli can be further divided into coccobacilli, brevibacteria, and long bacilli, and measure approximately 1–10 μm in length and 0.3–1 μm in width. Spirochetes measure approximately 6–20 μm in length and 0.1–0.2 μm in width. Fungi are several times larger than bacteria. Most viruses are smaller than 150 nm and are only visible under the electron microscope. The same microbes can change in size depending on their environment or age (Figure 1.2).

1.2.2 Microbial Morphology

Different types of microbes have different, but characteristic, shapes. Under suitable conditions, the shape and size of microbes are relatively stable. It is important to know the morphological structure of microbes, as it provides us with a better understanding of microbial physiology, pathogenic mechanisms, antigenic features, and allows us to identify them by species. In addition, knowledge of microbial morphology can be helpful in diagnosing disease and in preventing microbial infections.

1. Bacteria are complex and highly variable microbes. They come in four basic shapes: spherical (cocci), rod-shaped (bacilli), arc-shaped (vibrio), and spiral (spirochete) (Figure 1.3(A)).
2. Fungi are divided into unicellular and multicellular according to the number of cells that make up the organism. Unicellular fungi, such as *Saccharomyces* and other yeast-like fungi, are usually round or oval. Multicellular fungi have hyphae and spores. The hyphae and spores of different fungi are shaped differently (Figure 1.3(B) and (C)).
3. Many viruses are spherical or almost spherical, some are rod-shaped (often seen in plant viruses), filamentous (e.g., freshly isolated influenza virus), bullet-shaped (e.g., rabies virus), brick-shaped (e.g., poxvirus), and tadpole-shaped (e.g., bacteriophage) (Figure 1.3(D)).

1.3 MICROBIAL CELL STRUCTURE

Although different microbes possess different cellular structures, there are certain commonalities within groups of microbes.

1.3.1 Basic Bacterial Structures

The architecture of bacterial cells consists of basic and special structures. Basic structures include the cell wall, cell membrane, cytoplasm, nuclear material, ribosome, plasmid, etc. Special structures, which are only found in some bacteria, include the flagellum, pilus, capsule, spore, etc. (Figure 1.4).

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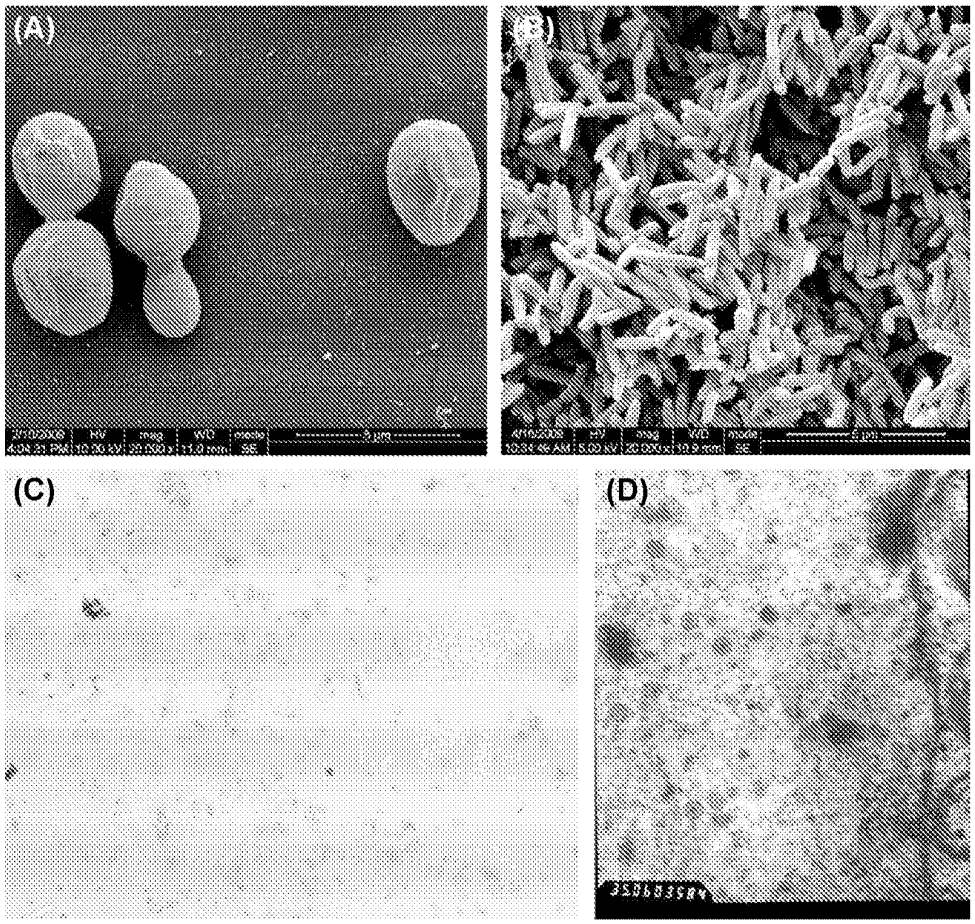


FIGURE 1.1 (A) Eukaryotic microbes (*Saccharomyces*, SEM): The eukaryotic cell has a high degree of nuclear differentiation. It has a nuclear membrane, nucleoli, and chromosomes. There is a complete complement of structured organelles in the cytoplasm and cellular reproduction takes place by mitosis. Examples include fungi and algae. (B) Prokaryotic microbes (bacteria). (C) Prokaryotic microbes (mycoplasma): The prokaryotic cell has a primitive nucleoplasm and cell membrane; it has no nuclear membrane, nucleolus, or organelles. Prokaryotes include bacteria such as *Mycoplasma*, *Chlamydia*, and *Rickettsia*. (D) Acellular microorganisms (herpes simplex virus): Acellular microorganisms are the smallest microorganism with no typical cell structure and no enzymatic energy-production system. They consist merely of a nucleic acid genome (DNA/RNA) and a protein coat (the capsid). Acellular microorganisms can only reproduce inside a living cell. Examples include viruses and subviral agents.

1.3.1.1 Cell Wall

The cell wall is the outermost structure of the bacterial cell and is located outside the cell membrane. It is transparent, tough, and flexible. The average thickness ranges from 15 to 30 nm. It mainly consists of peptidoglycan, also called mucopeptide, glycopeptide, or murein. Bacteria are classified into gram-positive and gram-negative based on the appearance of the cells after Gram stain. The peptidoglycan of gram-positive bacteria is composed of a glycan backbone, tetrapeptide side chains, and a pentapeptide cross-linking bridge (Figure 1.5(A)). The peptidoglycan of gram-negative bacteria is composed of a glycan backbone and a tetrapeptide side chain (Figure 1.5(B)).

Gram-positive and gram-negative bacteria have unique structures other than peptidoglycan in their cell walls (Figure 1.5(C) and (D)). Other substances, such as compound polysaccharide, surface protein, proteins M and G of *Streptococcus*, protein A of *Staphylococcus aureus*, etc. are found on the outer layer of the cell wall of some gram-positive bacteria.

1.3.1.2 Cell Wall-Deficient Bacteria (Bacterial L Form)

Cell wall-deficient bacteria are strains of bacteria that lack cell walls. The peptidoglycan that makes up the cell wall can be destroyed or inhibited by physical, chemical, or biological factors. When gram-positive bacteria lack a cell wall, the cytoplasm is surrounded by the cell membrane, and the entire structure is known as a protoplast. When gram-negative bacteria do not have a cell wall, the cytoplasm is protected by the outer membrane, and the entire structure is called a spheroplast. Bacteria

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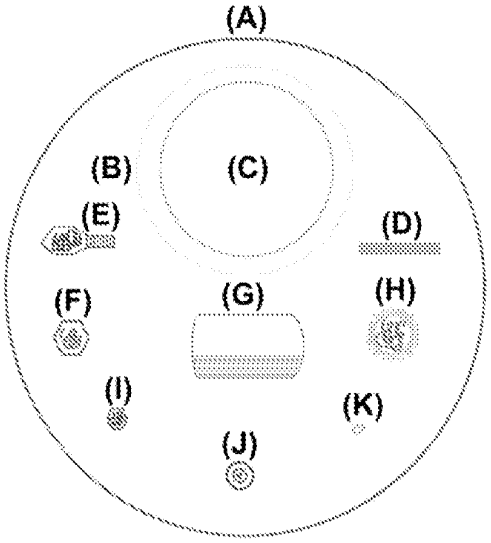


FIGURE 1.2 Microbial size. (A) *Staphylococcus* 1000 nm. (B) *Rickettsia* 450 nm. (C) *Chlamydia* 390 nm. (D) Tobacco mosaic virus 300 × 15 nm. (E) *Escherichia coli* bacteriophages, head 65 × 95 nm, tail 12 × 100 nm. (F) Adenovirus 70 nm. (G) Poxvirus 300 × 230 nm. (H) Influenza virus 100 nm. (I) Poliovirus 30 nm. (J) Japanese encephalitis virus 40 nm. (K) Molecule of egg protein 10 nm.

that have lost their cell wall are still capable of growing and dividing as cell wall-deficient bacteria. Examples of these were first isolated in 1935 by Emmy Klieneberger-Nobel, who named them "l-forms" after the Lister Institute in London where she was working at the time. l-form bacteria give rise to a variety of cell morphologies and sizes and can be spherical, rod-shaped, filiform, etc. The rate of growth and division of l-form bacteria is slow. They also form distinctive bacterial colonies when plated on agar. Some l-form strains have a tendency to revert to the normal phenotype when the conditions that were used to produce the cell wall deficiency are reduced. l-form bacteria are difficult to stain or stain unevenly. In a Gram stain test, l-form bacteria always show up as gram-negative, due to the lack of a cell wall.

1.3.1.3 Cell Membrane

The cell membrane is a selectively permeable biological membrane found inside the cell wall and surrounding the cytoplasm. It is made of a lipid bilayer. The cell membrane is compact and flexible, and measures approximately 7.5 nm in thickness. It accounts for 10–30% of the bacterial cell dry weight. The structure of the bacterial cell membrane resembles that of eukaryotic cell membranes, except it is deficient in cholesterol. The lipid bilayer is embedded with carrier proteins and zymoprotein, which possess specific functions.

The cell membrane of some bacteria can form invaginations into the cytoplasm called mesosomes.

1.3.1.4 Cytoplasm

The cytoplasm is the gel-like substance enclosed within the cell membrane, which is made up of water, proteins, lipids, nucleic acids, inorganic salts, etc. Most metabolic activities take place within the cytoplasm, and subcellular structures, such as ribosomes, plasmids, and cytoplasmic granules, are located in the cytoplasm.

Ribosomes are found in cytoplasm. They are approximately 15–20 nm in diameter and are composed of a small (30S) and a large (50S) subunit. The association between subunits requires the presence of Mg^{2+}. Ribosomes are made up of 30% ribosomal proteins and 70% ribosomal RNA.

Plasmids are small, circular, double-stranded DNA molecules and are extrachromosomal genetic material. They can replicate independently of chromosomal DNA and transmit genes encoding drug resistance, bacteriocins, toxins, and more from one bacterium to another via conjugation and transduction.

Cytoplasmic granules is a general term referring to many types of cytoplasmic inclusion granules. They are an intracytoplasmic (inside the cytoplasm of a cell) form of storing nutrients and energy and include molecules such as polysaccharides, lipids, phosphates, etc. They are not essential or permanent structures in cells. Cytoplasmic granules are also known as metachromatic granules because they may stain into different colors than other bacterial cell structures.

1.3.1.5 Nuclear Material

The bacterial nuclear material is also called the nucleoid. It is a piece of double-stranded DNA devoid of nuclear membrane, nucleolus, or histones and is the bacterial equivalent of chromatin. The function of the nucleoid is similar to that of the nucleus in eukaryotic cells and encodes genes necessary for activities and traits such as growth, metabolism, reproduction, heredity, mutation, etc.

1.3.2 Special Bacterial Structures

1.3.2.1 Capsule

The capsule is a layer of slime that lies outside the bacterial cell wall. It is secreted by bacteria and diffuses into the surrounding medium. Based on its appearance when examined by light microscope, the bacterial capsule is classified into two types: microcapsule, which is less than 0.2 μm in thickness and escapes optical detection; and capsule or large capsule, which is over 0.2 μm in thickness, binds tightly to the cell wall, and presents an obvious

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boundary under optical microscope. The capsule shows up as negatively stained when ordinary

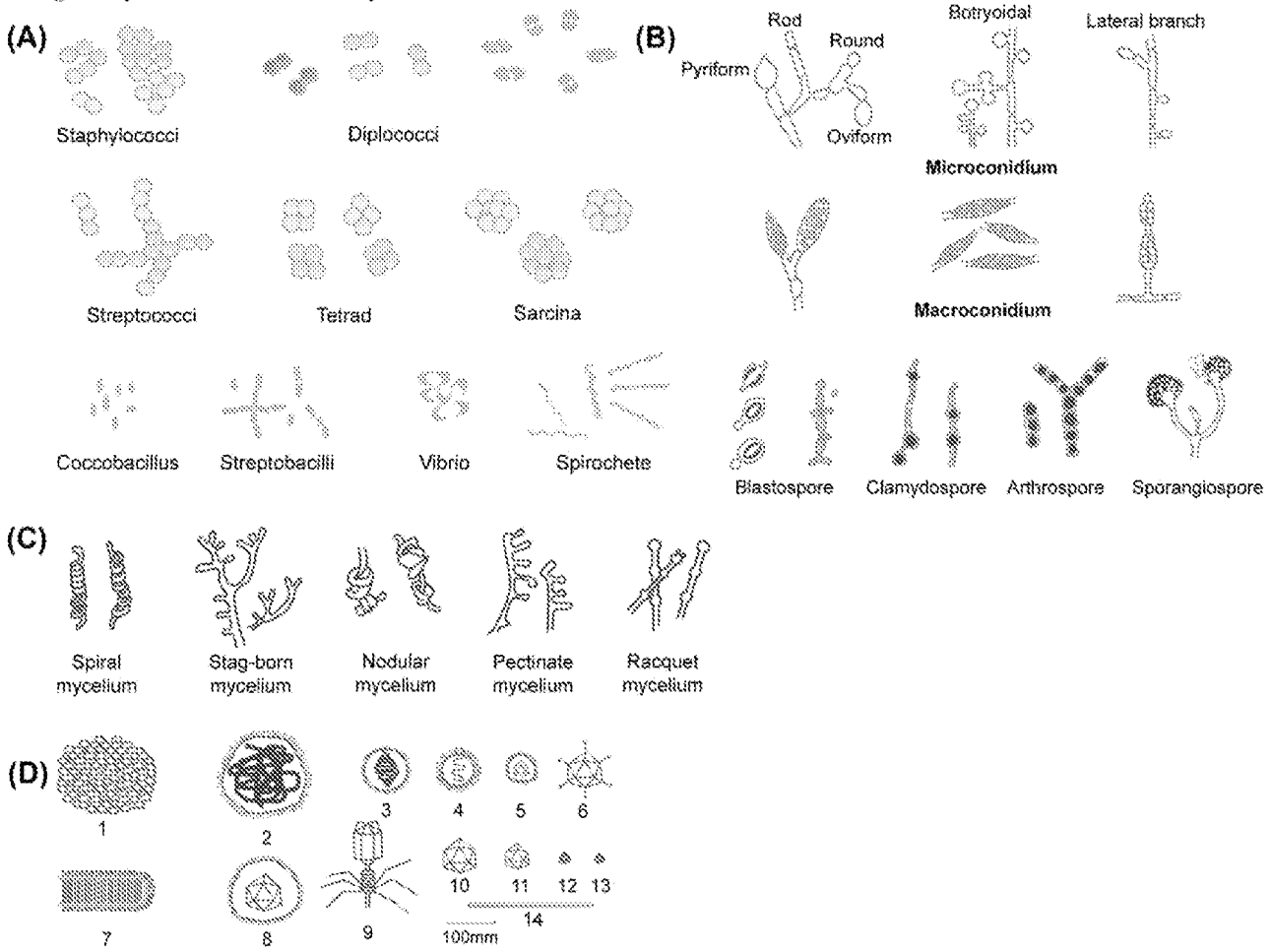


FIGURE 1.3 **(A) Basic shape of bacteria. (B) Fungal spores. (C) Fungal hyphae. (D) Morphology and structure of viruses: 1. Poxvirus, 2. Paramyxovirus, 3. Orthomyxovirus, 4. Coronavirus, 5. Togaviridae, 6. Adenovirus, 7. Bullet-shaped virus, 8. Herpes virus, 9. T2 bacteriophage, 10. Reovirus, 11. Papovavirus, 12. Picornavirus, 13. Picodnavirus, 14. Tobacco mosaic virus.**

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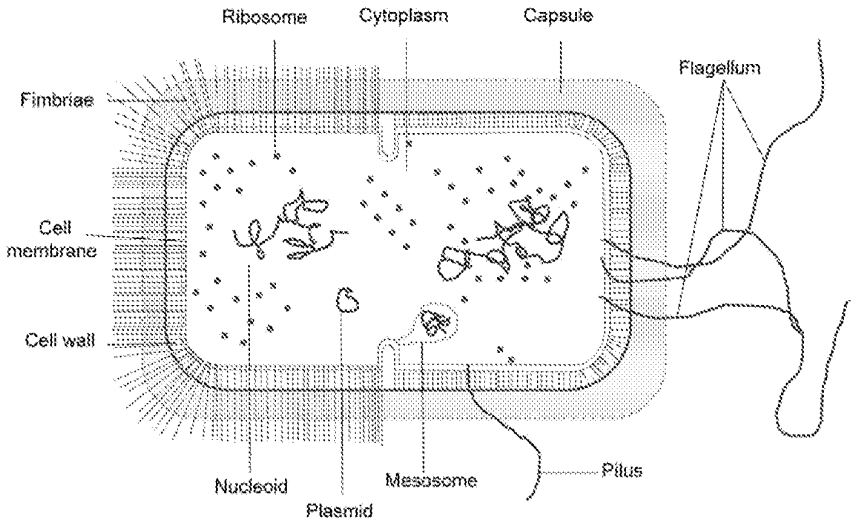


FIGURE 1.4 **Schematic representation of bacterial cell structure.**

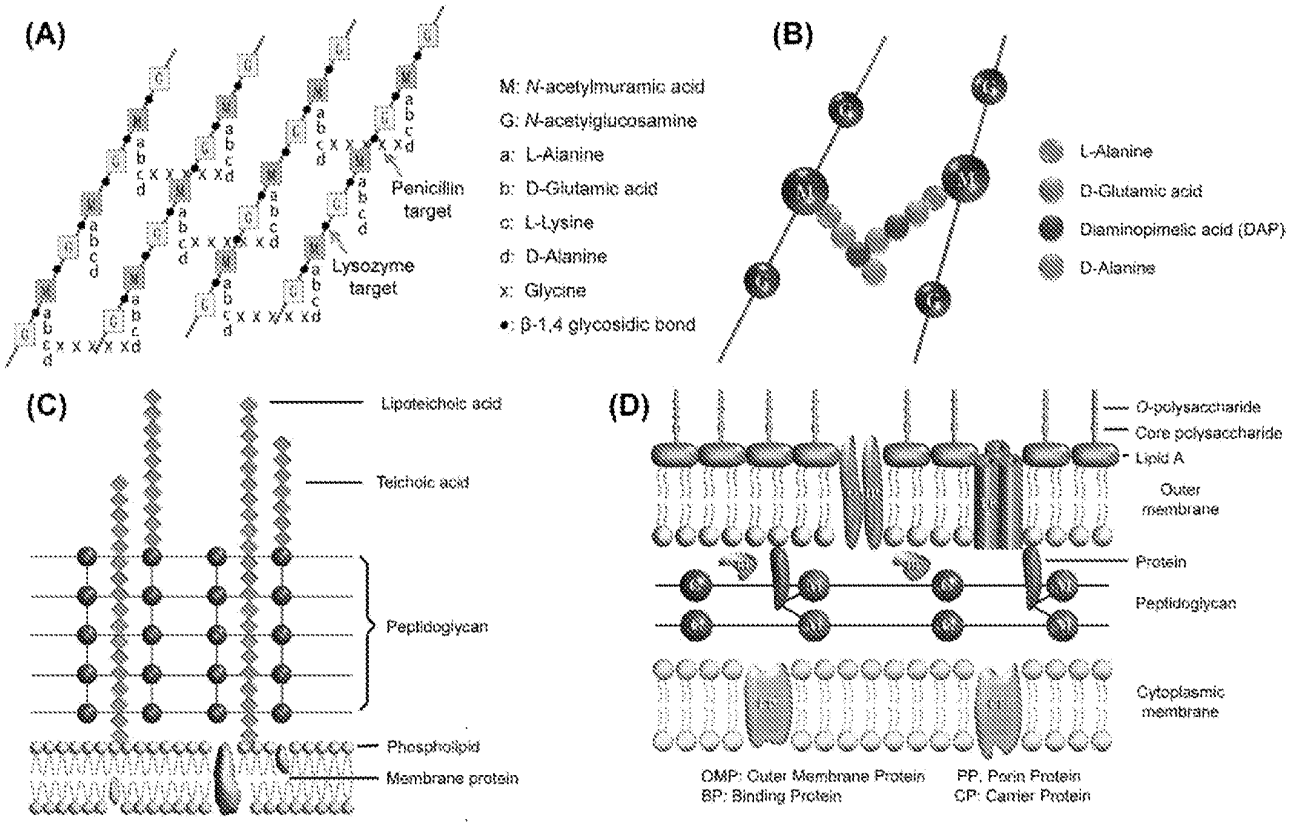


FIGURE 1.5 **(A) Schematic representation of *Staphylococcus aureus* cell wall peptidoglycan. M: *N*-Acetylmuramic acid, G: *N*-acetylglucosamine, O: β-1,4 glycosidic bond, a: l-alanine, b: d-aspartic acid, c: l-lysine, d: d-aspartic acid, x: glycine. (B) Schematic representation of *Escherichia coli* cell wall peptidoglycan. M: *N*-Acetylmuramic acid, G: *N*-acetylglucosamine, Ala: alanine, Glu: glutamic acid, DAP: diaminopimelic acid. (C) Schematic of gram-positive bacteria cell wall. Gram-positive bacteria have a thick (20–80 nm) cell wall composed of 15–50 layers of peptidoglycan, many teichoic acids, and some teichuroic acid. Teichoic acids are unique to gram-positive bacterial cell walls and constitute a class of important antigens related to the serotype classification of certain bacterial species. Teichoic acid accounts for about 50% of the dry weight of the cell wall. It is a polymer consisting of ribitol or glycerin residues that are bound by phosphodiester bonds into a long chain, which is then anchored in peptidoglycan. Teichoic acids are classified into cell wall teichoic acids and membrane teichoic acids (also known as lipoteichoic acid, LTA) according to the cellular structure to which they are anchored. (D) Schematic representation of the cell wall of gram-negative bacteria. Gram-negative bacteria have a comparatively thin cell wall,**

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approximately 10–15 nm in thickness. It is made up of one to two layers of peptidoglycan and other complex structures. On the outside of the peptidoglycan is the outer membrane, which is the main component of the gram-negative bacteria cell wall and accounts for approximately 80% of the dry weight of the cell wall. The outer membrane is composed of three layers: lipoprotein, lipid bilayer, and lipopolysaccharide (LPS) ordered from the interior to the exterior. OMP: outer membrane protein, PP: porin, BP: nutrient binding protein, CP: carrier protein, M: *N*-acetylmuramic acid, G: *N*-acetylglucosamine.

staining techniques are used. It appears as a clear halo around the bacterium when stained samples are examined by light microscope. Using special staining, the capsule can be stained differently from the bacterial cell (Figure 1.6). Most bacterial capsules are composed of polysaccharides, but a few capsules are made of polypeptides.

Capsular polysaccharides are highly hydrated molecules in which water accounts for more than 95% of the composition. They bind to phospholipids or lipid A on the cell surface through covalent bonds. The capsule is considered as an important virulence factor because it protects bacteria from engulfment by eukaryotic immune cells, desiccation, and helps bacteria adhere to surfaces.

1.3.2.2 Flagellum

The flagellum is a lash-like appendage that protrudes from the cell body and usually measures 5–20 μm in length and 10–30 nm in diameter. It is the locomotive organelle of motile bacteria such as *Selenomonas* and *Wolinella succinogenes*. The flagellum is composed of three parts: basal body, hook, and filament (Figure 1.7(A)). Different bacteria can have anywhere from one or two flagella to hundreds of flagella (Figure 1.7(B)). Flagella can only be observed directly by electronic microscope or by light microscope after special staining (Figure 1.7(C)). The flagellum is involved in the pathogenesis of some diseases and is antigenic (for example, antigen H). Examples of flagellate bacteria include *Vibrio cholerae*

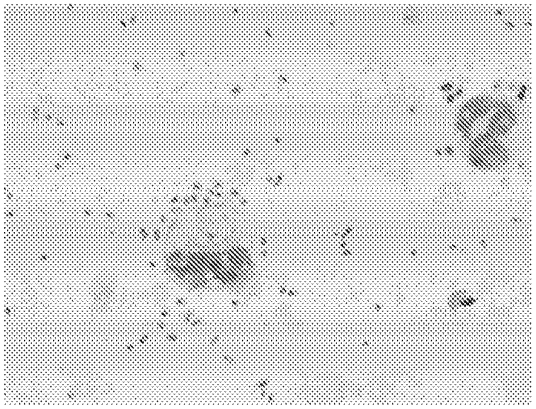


FIGURE 1.6 Capsule of *S. pneumoniae* (Murs staining method). Bacterial cells are stained red and the capsule around the cell appears as blue transparent circles.

and *Campylobacter jejuni*, which use multiple flagella to propel themselves through the mucus lining of the small intestine to reach the epithelium and produce toxin.

Flagella can be classified as monotrichous, amphi trichous, lophotrichous, and peritrichous according to their number and location.

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1.3.2.3 Pilus

The pilus is a hair-like structure associated with bacterial adhesion and related to bacterial colonization and infection. Pili are primarily composed of oligomeric pilin proteins, which arrange helically to form a cylinder. New pilin protein molecules insert into the base of the pilus. Pili are antigenic, and genes encoding pili can be located in the bacterial chromosome or in plasmids. Pili are not locomotive structures. They are classified into ordinary

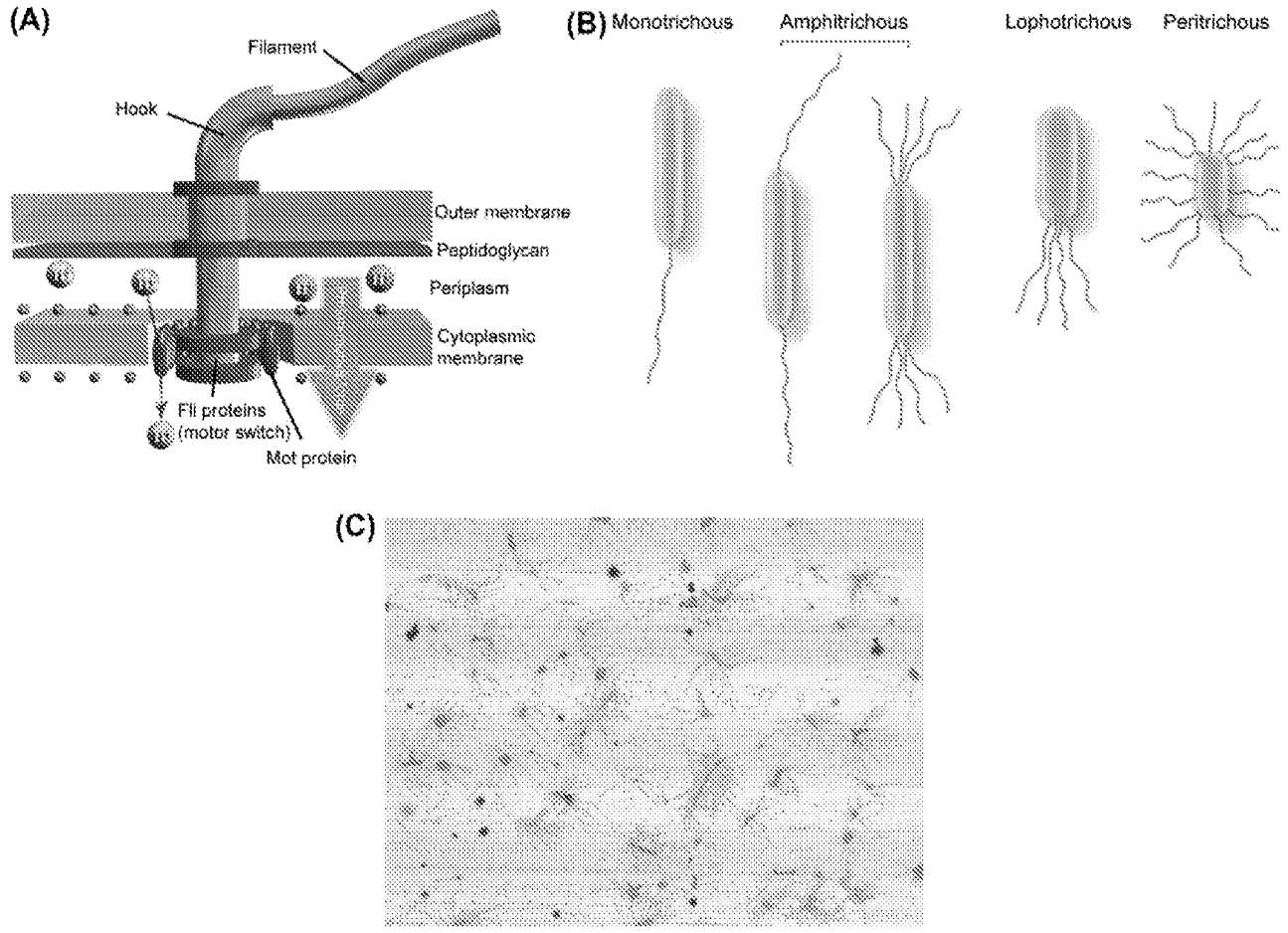


FIGURE 1.7 **(A) Schematic of *E. coli* flagellum. Basal body: Located at the base of the flagellum. The basal body, embedded in the cell wall and cell membrane, is the output device. It acts as an engine to provide energy for locomotion. The nearby switch determines the direction of rotation. Hook: This structure points directly away from the cell and has a sharp bend (about 90°) from which filaments protrude. Filament: This filiform structure protrudes from the bacterial cell. It is a hollow tube made of the protein flagellin. Its acts like a ship's or plane's propeller to move the bacterial cell. (B) Examples of bacterial flagellar arrangement. (C) Periplasmic flagella (flagella staining). The bacterial cell is stained red and the flagella are stained light red around the bacterial cell.**

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pilus or sex pilus according to their morphology, distribution, and function.

The pilus is found on the surface of many grampositive bacteria and some gram-negative bacteria. It is thinner and shorter than the flagellum. Ordinary pili are 0.3–1.0 μm in length and about 7 nm in diameter and are distributed all over the bacterial cell surface. Sex pili can be found in a handful of gram-negative bacteria. These pili are longer and thicker than ordinary pili, and each bacterial cell can have from one to four sex pili.

1.3.2.4 Spore

The spore is a small round or oval body that forms in bacteria due to cytoplasmic dehydration under unfavorable conditions (Figure 1.8(A)). It is surrounded by multiple membrane layers and has low permeability. Only gram-positive bacteria can form spores, including species such as *Bacillus subtilis*, *Clostridium tetani* (Figure 1.8(B)), etc. The spore contains a complete karyoplasm and enzymatic system and can maintain all the essential activities for the bacteria to remain alive.

The multiple membrane layers of the spore are, from the exterior to the interior, as follows: spore coating, spore shell, outer membrane, cortex, cell wall of spore, and inner membrane, which surrounds the nucleus of the spore.

Spores are difficult to stain due to their thick cell wall. Special staining is required to stain the spore and distinguish it from the bacterial cell (Figure 1.8(B)).

The size, morphology, and location of the spore differ between bacterial species and can be used to help identify bacteria (Figure 1.8(C)). For example, the *C. tetani* spore is round and larger than the transverse diameter of the bacterial cell, forming a drumstick-like structure, as the spore is located at the tip of the bacterial cell (Figure 1.8(B)).

1.3.3 Basic Structure of Virus

Viruses are a kind of acellular microbe consisting mainly of nucleic acid and proteins. Some viruses are composed of a small amount of lipids and polysaccharides. The basic structure of viruses is made up by the

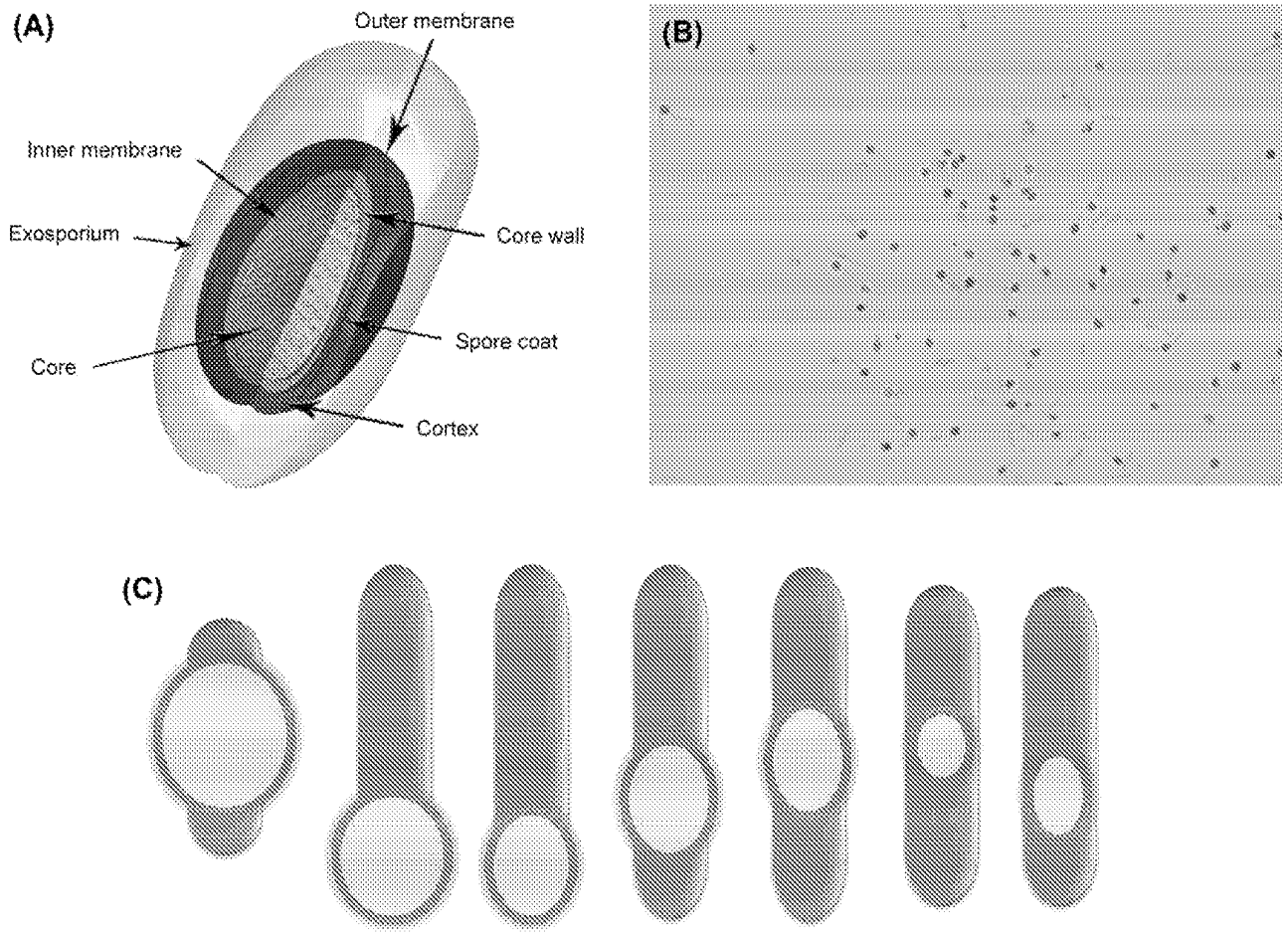


FIGURE 1.8 (A) Schematic representation of the bacterial spore. (B) Spore stain of *C. tetani* (fuchsin-methylene blue stain). (C) Size, morphology, and location of bacterial spores.

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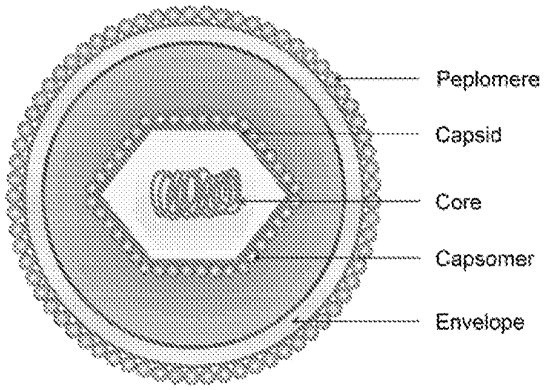


FIGURE 1.9 Basic structure of a virus.

viral core, viral capsid, as well as a membrane envelope in some viruses (Figure 1.9). The size, morphology, and structure of viruses play important roles in viral taxonomy and in diagnosing viral infections.

1. Viral core: namely the nucleic acid component, which makes up the genome of the virus. The viral core provides genetic information that determines pathogenicity, antigenicity, proliferation, heredity, variation, etc. The chemical components of the viral core are DNA or RNA, based on whether the virus is classified as a DNA virus or an RNA virus. Nucleic acid can be single or double stranded. The relative molecular mass of the viral core is $2–160 \times 10^6$.
2. Viral capsid: it is a protein shell that surrounds and protects the nucleic acid of the virus. The viral capsid is sometimes associated with the viral nucleic acid, and this structure is known as the nucleocapsid. In virions without an envelope, the nucleocapsid makes up the entirety of the virus. The viral capsid is composed of repeated protein subunits known as capsomeres, which are made of one or more proteins known as the chemical subunit or structural subunit.
3. Envelope: this is the one or two layers of membrane that surround the capsid of some viruses, which is a structure unique to the class of viruses known as enveloped viruses. The envelope is formed during the maturation process when certain viruses bud out from the cell membrane. Therefore, the envelope can be composed of the host cell membrane and/or the nuclear membrane. The surface of some viral envelopes carries protein protrusions called peplomers or spikes.

1.4 MICROBIAL PHYSIOLOGY

Bacterial cells are synthesis machines that multiply themselves. The growth and division of bacteria include approximately 2000 different types of biochemical reactions that mediate energy conversion or enzymatic biosynthesis.

1.4.1 Binary Fission Reproduction

Binary fission is a process by which many prokaryotes reproduce from a single cell into two new cells (Figure 1.10(A)). Bacteria reproduce asexually by binary fission. Cocci can divide from different planes to form different arrangements. Bacilli divide along their horizontal axis; however, some bacterial species such as *Mycobacterium tuberculosis* occasionally spilt by branching.

During cell division, the cell volume increases and a diaphragm is generated where the cell division is to take place. Then, a single cell will divide into two cells (Figure 1.10(B) and (C)). Under suitable conditions, the majority of bacteria divide quickly, about 20–30 min for one division. However, the growth of some b acterial species can be relatively slow. For example, *M. tuberculosis* takes 18–20 h to complete one round of division.

1.4.2 Bacterial Growth

Mastering the fundamentals of bacterial growth allows the researcher to change culture conditions artificially, adjust the bacterial phases of growth and reproduction, and use beneficial bacteria more efficiently. Bacterial growth involves inoculating a certain number of bacteria into a suitable liquid medium and checking the number of viable cells at different time intervals. With the collected information, it is possible to generate a growth curve using culture time as the horizontal axis and the logarithmic number of viable cells in the culture as the vertical axis (Figure 1.11). Growth curves can generally be divided into four major sections.

1. Lag phase: During this process, the bacteria are adapting to their new environment. The volume of bacterial cells increases and their metabolism is active, but cell division is slow and reproduction is minimal.
2. Logarithmic phase: In this period, bacteria grow rapidly and divide and reproduce at a constant speed. The number of bacteria increases exponentially and the number of viable cells increases logarithmically.
3. Stationary phase: The bacterial growth rate gradually decreases, and the number of dead bacteria increases. The number of newly produced bacteria is approximately equal to the number of dying bacteria, and the number of viable cells remains relatively stable.
4. Decline phase: Bacterial growth rate slows and stops, and the number of dead bacteria is higher than that

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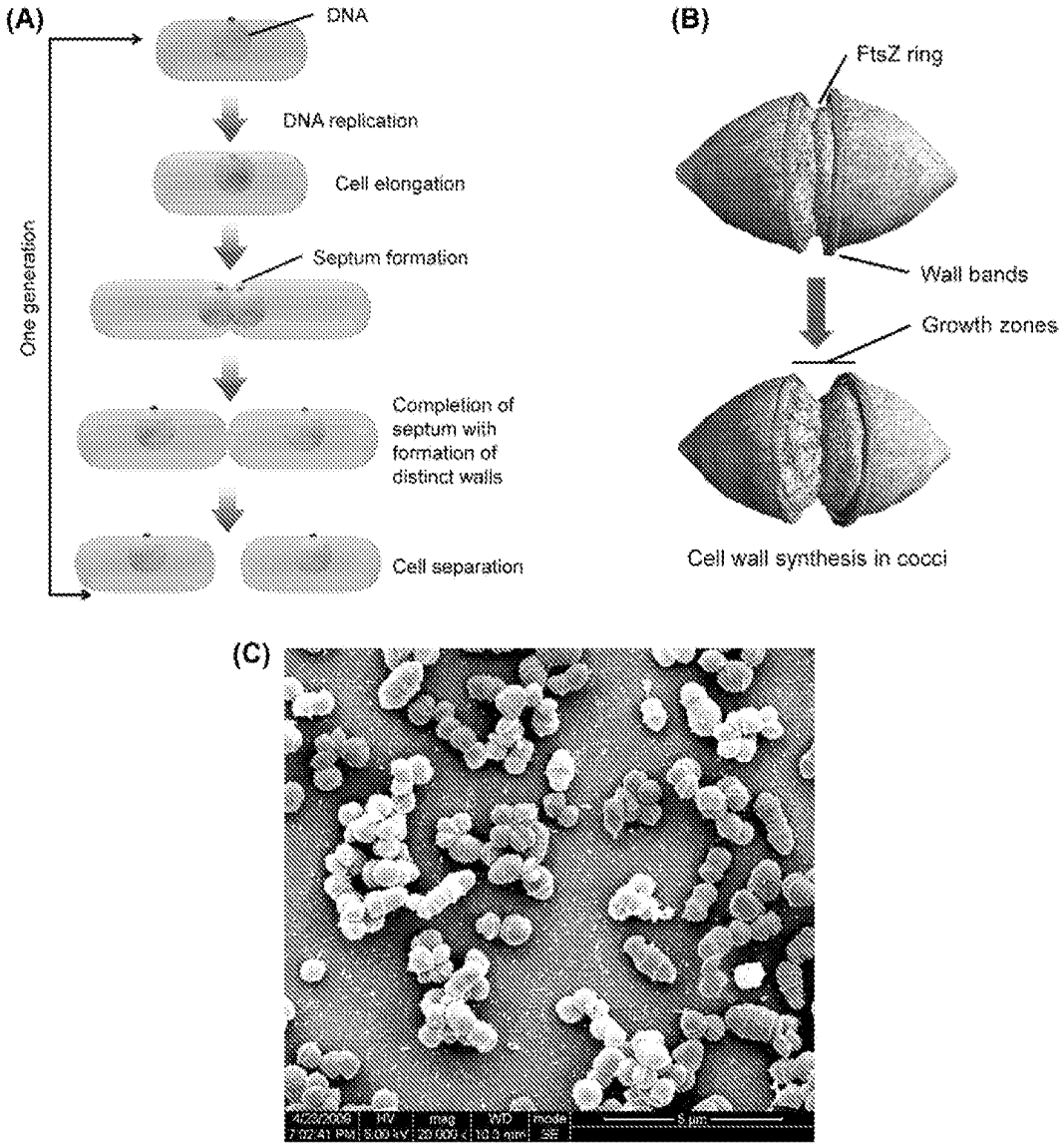


FIGURE 1.10 (A) Binary fission in bacilli. (B) Synthesis of gram-positive bacterial cell wall. During cell division, the volume of the cell increases and a new cell wall is formed. New cell wall materials are added to the preexisting cell wall to maintain structural integrity. (C) Division of gram-positive bacteria (SEM). Cell division in *Streptococcus gordonii*, showing a clear division.

of viable cells. Cells become polymorphic, showing morphologies such as cell deformation, swelling, or autolysis.

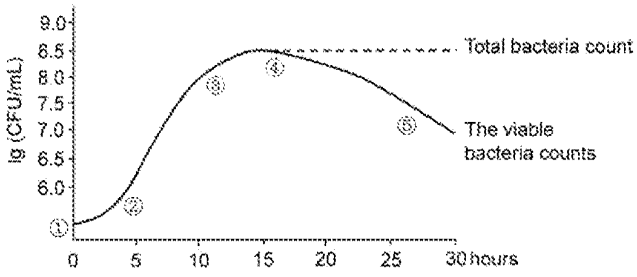


FIGURE 1.11 The growth curve of *E. coli*.

1.5 MICROBIAL GENETICS

Like the other living organisms, microorganisms have heredity and variable characteristics. Heredity keeps microbial genetic traits relatively stable to ensure the reproduction of the species, while variations produce changes in the microorganisms that are useful for

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microbial survival and evolution and ultimately lead to the generation of new species.

1.5.1 Heredity

Heredity is the similarity in biological traits between offspring and its parent. Cells can be considered as a chemical plant in which information can be stored and transformed into a useful product. Enzymes are the molecular machines that catalyze specific chemical reactions. The information is stored DNA, which exists in the cell as two long molecular coiled chains (DNA double helix). The intracellular genetic information is replicated, transcribed, and translated by enzymes, which then leads to protein synthesis (Figure 1.12).

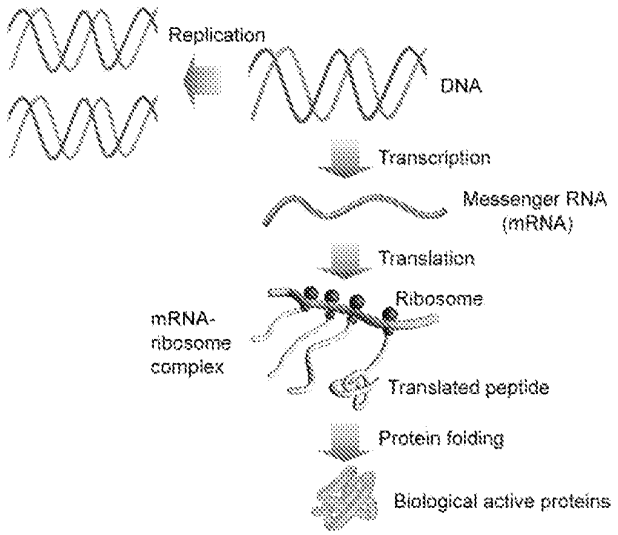


FIGURE 1.12 The processes of replication, transcription, translation of intracellular genetic information and protein synthesis.

1.5.2 Variation

Variation refers to the differences between offspring and its parent under certain conditions, including variations in morphology and structure, virulence, drug resistance, and so on. The variability of microorganisms is divided into genetic variation and nongenetic variation. The former is due to changes in bacterial gene structure. The new characteristics can be stably transmitted to future generations, which is why this type of variation is called genotype variation, as the change is mostly irreversible (Figure 1.13). The latter is caused by the influence of certain environmental conditions that do not change the genetic structure of bacteria. The change is not transmitted to the offspring and is therefore called a phenotypic variation. Genetic variation is rarely influenced by external environmental factors. Therefore, genetic variation tends to occur in individual bacterial cells, while phenotypic variation tends to occur in a bacterial flora due to the effect of environmental factors. These variations can revert with the removal of the stimulating environmental factors.

1.5.3 Genetic Material of Bacteria

Nucleic acids are the basis of organismal heredity. Two types of nucleic acid exist: DNA and RNA. DNA is the genetic material in prokaryotic and eukaryotic organisms, while the genetic material in viruses is DNA and RNA. The genetic material found in microorganisms includes chromosomes, plasmids, bacteriophages, and transposable elements.

Bacteriophages are viruses that infect bacteria, fungi, actinomycetes, mycoplasmas, and spirochetes. They inject their genetic material into the infected host cell and can

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induce bacterial cell lysis under certain conditions. Bacteriophages, known as phages, can only reproduce in specific host strains and have high specificity for

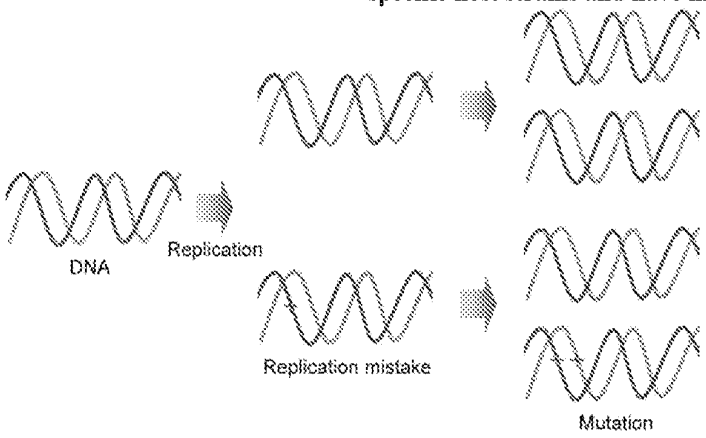


FIGURE 1.13 DNA mutation.

their host. The specificity is related to phage cell binding molecules and the structure and complementarity of the host bacterial strain's surface receptor molecules.

Since phages are small, they can only be observed under electron microscope. They can be divided into three basic morphologies: tadpole-shaped, spherical, and rod-shaped. Most phages are tadpole-shaped and consist of a head and a tail (Figure 1.14(A)).

The relationship between the phage life cycle and its host bacteria is shown in Figure 1.14(B). Phages that infect bacteria can produce two outcomes. The first, observed in virulent phage, involves phage multiplication resulting in the production of many progeny phages, bacterial cell lysis, and cell death. This cycle is known as the lytic cycle. The second outcome is lysogeny, observed in temperate phages. It involves the integration of phage nucleic acid with the bacterial chromosome, resulting in the formation of a prophage. The phage genetic material is reproduced when the bacterial cell divides.

1.5.4 Mechanism of Microbial Variation

Genetic variation in microorganisms has its basis in mutations caused by changes in their genetic sequence. These changes are stable and heritable. Mutations can generally be classified as gene mutations and chromosomal aberrations. The spontaneity and randomness of microbial mutations can be tested by using fluctuation test or replica plating (Figure 1.15(A) and (B)).

1.5.5 Gene Transfer and Recombination

Gene transfer is a process by which exogenous genetic material from a donor cell is transferred to the receptor cell. However, simply the process of transferring genetic material is not enough, as the recipient cell must be able to accommodate exogenous genes. Integration between the transferred gene and the DNA of the recipient cell is a process known as recombination, whereby the recipient cell acquires certain characteristics of the donor strain. Gene transfer and recombination in bacteria can take place through processes such as transformation, conjugation, transduction, cell fusion, and lysogenic conversion.

1.5.5.1 Transformation

Transformation takes place when donor bacteria DNA is cleaved and free DNA fragments are directly taken up by receptors. As a result, recipient cells acquire certain genetic traits from the donor cell. This phenomenon was confirmed in *Streptococcus pneumoniae*, *Staphylococci*, and *Haemophilus influenzae*. Griffith first showed that bacterial transformation takes place by infecting mice with *S. pneumoniae* in 1928. An outline of the experiment is shown in Figure 1.16.

1.5.5.2 Conjugation

Conjugation is the method by which bacteria physically connect with one another through their pilus to transfer genetic material (mainly plasmid DNA). Plasmid transfer from the donor to the recipient cell results in the recipient cell acquiring some of the genetic traits of the donor cell. Plasmids that can be transferred through conjugation are called conjugative plasmids, which include the F, R, Col, and virulence plasmids. The F plasmid encodes the pilus, controls pilus formation and whether or not the pilus enables conjugation (Figure 1.17(A)).

Plasmids that cannot be transferred between bacteria through a pilus are called nonconjugative plasmids.

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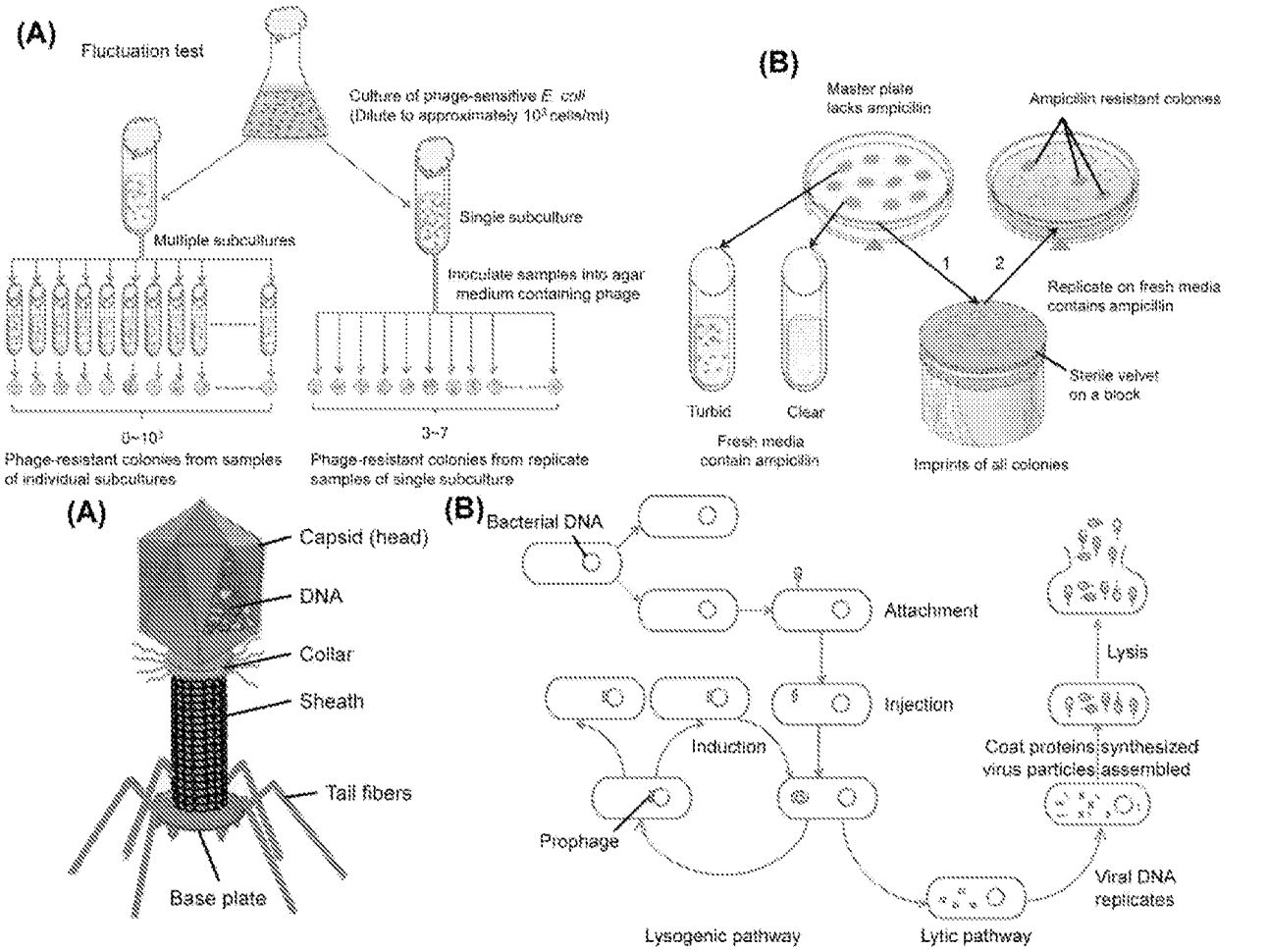


FIGURE 1.14 (A) The structural model of a phage. The phage head is icosahedral and is approximately 80 × 100 nm in size. It consists of the capsid protein that surrounds the internal nucleic acid. The tail is a tubular structure composed of protein, including the tail whiskers, tail collar, tail tube, tail sheath, tail fibers, and tail baseplate. (B) Lysogenic and lytic cycles of lysogenic phage.

FIGURE 1.15 (A) Fluctuation test: The fluctuation test shows that mutations preexist in a population of bacteria in the absence of selection. This was tested by Luria and Delbruck using naturally existing phage-resistant mutations in bacterial populations. A given concentration (10^9/ ml) of *Escherichia coli* sensitive to specific phages was inoculated in two equal volumes (10 ml) of broth medium. One inoculum was concentrated in a large test tube and the other was evenly distributed into 50 small test tubes. After 24–36 h incubation under the same conditions, the bacterial cultures from the large and small tubes were plated onto phage-containing plates, and the number of colonies was measured. The results typically showed that of 50 phage-coated plates inoculated with bacteria from the large test tube, the fluctuation in the colony number was small (3–7). On the other hand, when the 50 small tubes were plated onto 50 plates, the number of the colonies tended to fluctuate significantly, from zero colonies to several hundreds. (B) Replica plating: Replica plating (Lederberg et al., 1952) involves plating antibiotic-susceptible strains on agar plates in the absence of antibiotics until scattered single colonies grow. Using a block covered with sterile velvet, gently press the velvet onto the surface of the agar plates so that bacterial colonies are imprinted onto the sticky velvet surface. Then, press the velvet surface onto an agar plate containing antibiotics. After an appropriate culture time, bacteria susceptible to the antibiotics are completely suppressed, but drug-resistant colonies will be visible on the plate. We can find colonies corresponding to drug-resistant colonies on the original plates lacking antibiotics. The drug-resistant colonies can then be transplanted to culture broth containing the appropriate antibiotics to observe bacterial growth. Although the bacterial colonies on the original agar plate have never been in contact with antibiotics, they are nonetheless resistant to antibiotic drugs.

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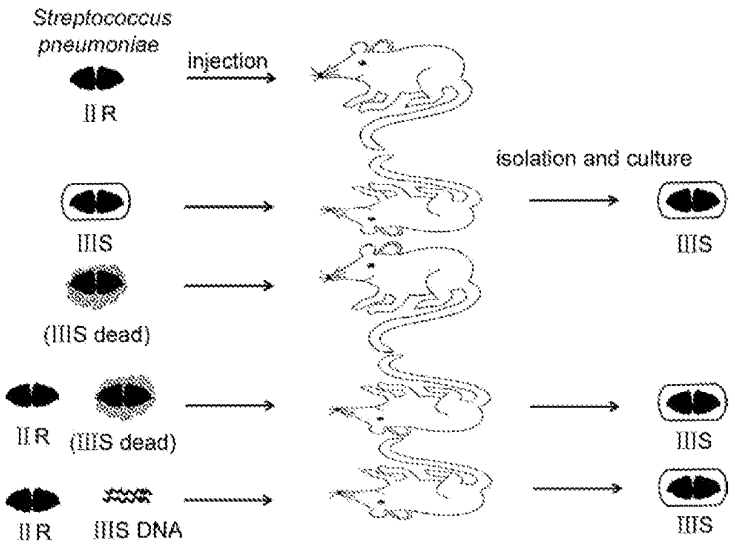
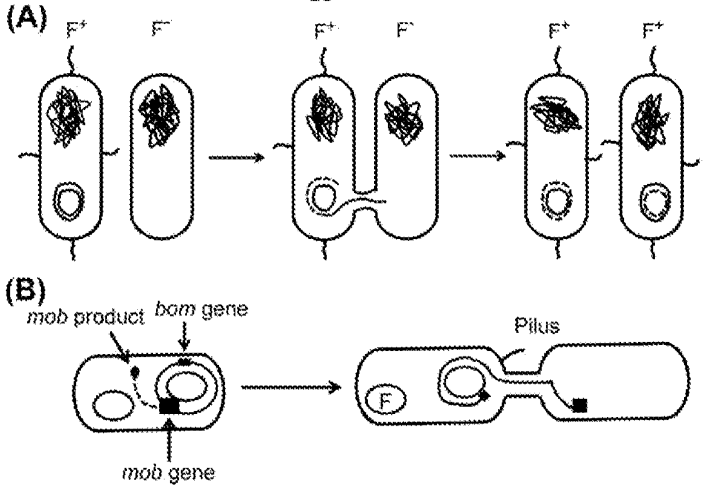


FIGURE 1.16 ***Streptococcus pneumoniae*** **transformation in mice.** *S. pneumoniae* **with a polysaccharide capsule belong to the virulent type III strain. These colonies are smooth (S) in appearance.** *S. pneumoniae* **without the polysaccharide capsule belong to the avirulent type II strain and appear as rough (R) type colonies. In the classic Griffith experiment, type II-R bacteria and type III-S bacteria were injected into mice. Mice that received the type II-R bacteria survived, and those that received the type III-S bacteria died. The type III-S bacteria were isolated from the blood of the dead mice and were heated until they were no longer active. These dead type III-S bacteria were injected into mice, and the mice survived. However, when dead type III-S bacteria and live type II-R bacteria were both injected into the same mice, the mice died, and type III-S bacteria were isolated from their blood. This experiment showed that the live type II R-type bacteria were able to obtain genetic material from dead type III-S bacteria that transformed them from an avirulent strain to a virulent one. It also suggests that the genetic material encoded the capsule virulence factor from type III-S bacteria.**

FIGURE 1.17 **(A) The transfer and replication of the F plasmid during conjugation. Bacteria possessing the F plasmid and F-pili are the male equivalent strain (F^+), while bacteria lacking the F plasmid and F-pili are the female equivalent strain (F^-). When the F^+ and F^- strains are present in the same environment, the F-pilus from the F^+ bacterial cell conjugates to the F^- surface receptor. The F-pilus gradually shortens so that the two cells are pulled close to each other and a channel is formed. Plasmid DNA from the F^+ bacteria breaks at the origin of transfer (*oriT*) and the 5′ end extends through the channel into the F^- bacteria. Single-stranded DNA in both bacterial cells replicate by rolling circle replication, and each cell forms a complete F plasmid. Therefore, the donor cell has not lost its F plasmid after the transfer, and the recipient cell becomes F^+ strain bacteria after receiving the F plasmid. (B) Nonconjugative plasmid (ColE1) induced to transfer by F plasmid. The ColE1 plasmid can be induced to transfer from a donor to a recipient cell. This process requires two genes encoded on the ColE1 plasmid: the specific site *bom* on ColE1 DNA (also known as the *nic* locus) and the nuclease encoded by the *mobA* gene. When both F and ColE1 plasmids are present in the same bacterial cell, the *mobA* gene is transcribed and its product creates a single strand break at the *bom* locus to form a gap. As a result, the ColE1 plasmid goes from a supercoiled plasmid to an open loop.**

The nonconjugative plasmid ColE1 is relatively low in molecular mass and does not encode the necessary gene required for it to be transferred from one cell to another. However, if there is another conjugative plasmid in the host

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cell, ColE1 can tag along and be transferred from one cell to another. For example, the F plasmid that encodes the genes necessary for pilus formation can help ColE1 transfer from one cell to another (Figure 1.17(B)).

Conjugation is widespread in gram-negative bacteria and can be observed in almost all members of the *Enterobacteriaceae*. Some gram-positive bacteria have been reported to conjugate (e.g., *Streptococcus*, *Bacillus subtilis*), and the phenomenon has also been observed in *Streptomyces*.

1.5.5.3 Transduction

Transduction uses a temperate phage as the vehicle by which DNA from a donor cell is transferred into a recipient cell. Transduction can transfer larger fragments of DNA than transformation. According to the genes involved in transduction, the process can be divided into generalized transduction and restricted transduction (Figure 1.18(A) and (B)).

Generalized transduction can transfer plasmids. The transduction of plasmid R in *S. aureus* is a very important clinical feature.

In generalized transduction, the packaged DNA can be from any part of the donor strain chromosome. When phages exit the lysogenic phase, the prophage will excise

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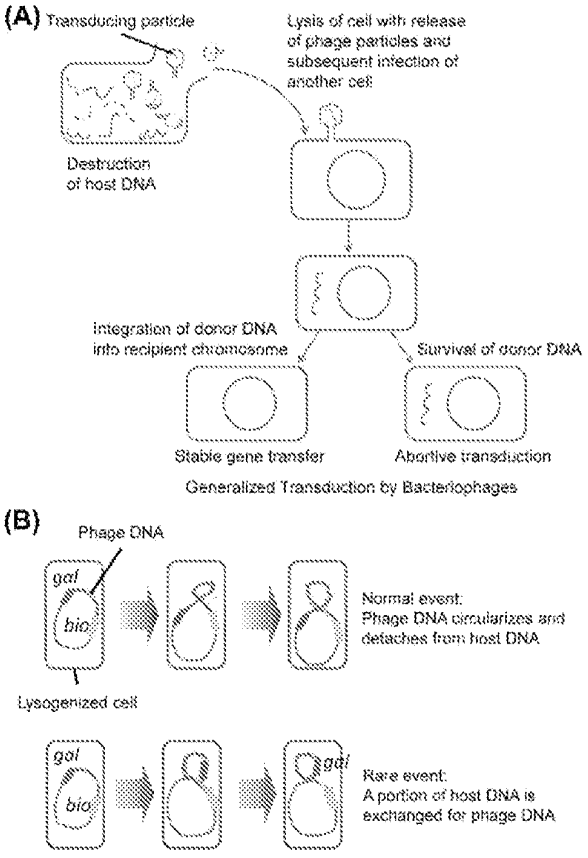


FIGURE 1.18 **(A) Generalized mode of transduction. (B) Restricted mode of transduction.**

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itself from the bacterial chromosome and enter into the lytic phase. In the latest stages of the lytic phase, phage DNA is replicated in large quantities and errors can occur during phage assembly. Approximately one in 10^5–10^7 phages will contain bacterial DNA fragments that have been mistakenly packaged into the phage head, which results in the formation of a transducting phage. Transducting phages can infect another host bacterium and inject the DNA fragment they are carrying into the recipient cell, thereby transferring DNA from one bacterial cell to another.

Restricted transduction, or specific transduction, describes the process in which transduction is restricted to specific genes from the chromosome of the donor strain. If phage λ is transferred into *E. coli* K12 while it is in the lysogenic phase, the phage DNA is integrated into a specific site in the *E. coli* chromosome, between the galactose (*gal*) and biotin (*bio*) genes.

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Application Number	18328730
Filing Date	2023-06-03
First Named Inventor	Kofford, Brandon Dale
Art Unit	3772
Examiner Name	Huynh, Courtney Nguyen
Attorney Docket Number	SDC010

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	3	2018029650	WO	A1	2018-02-15	Samsfort et al.		☒
	4	2019007852	WO	A1	2019-01-10	Andersen et al.		☐
	5	0727193	EP	A1	1996-08-21	Balfour		☐
	6	0104284	EP	A1	1984-04-04	Vlock		☐
	7	20140080313	KR	A	2014-06-30	Hojun		☒
	8	101745575	KR	B1	2017-06-12	Kim		☒
	9	1996029019	WO	A1	1996-09-26	Sutter et al.		☒
	10	2009024838	WO	A2	2009-02-26	Dayangac		☐
	11	2014195955	WO	A1	2014-12-11	Honig		☐

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	Application Number	18328730
	Filing Date	2023-06-03
	First Named Inventor	Kofford, Brandon Dale
	Art Unit	3772
	Examiner Name	Huynh, Courtney Nguyen
	Attorney Docket Number	SDC010

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	1	MCGLUMPHY et al., "The combination Implant Crown: A Cement- and Screw-Retained Restoration", Compend Contin Educ Dent, Feb. 1992, pp. 34, 36,38, 40-42, Vol. XIII, No. 1.	☐
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	5	AL JABBARI et al., "Mechanical Behavior and Failure Analysis of Prosthetic Retaining Screws after Long-term Use in vivo. Part 4: Failure Analysis of 10 Fractured Retaining Screws Retrieved from Three Patients" (2008). Biomedical Engineering Faculty Research and Publications. 553. https://epublications.marquette.edu/bioengin_fac/553	☐
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	9	WINKLER et al. “Implant screw mechanics and the settling effect: an overview”, Journal of Oral Implantology 2003;29 (5):242-5.	☐

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	10	TESMER "Bacterial colonization of the dental implant fixture-abutment interface: an in vitro study", J Periodontol. 2009 Dec;80(12):1991-7.	☐
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Signature	/Daniel John Whittle, #54,537/	Date (YYYY-MM-DD)	2023-12-05
Name/Print	Daniel John Whittle	Registration Number	54,537

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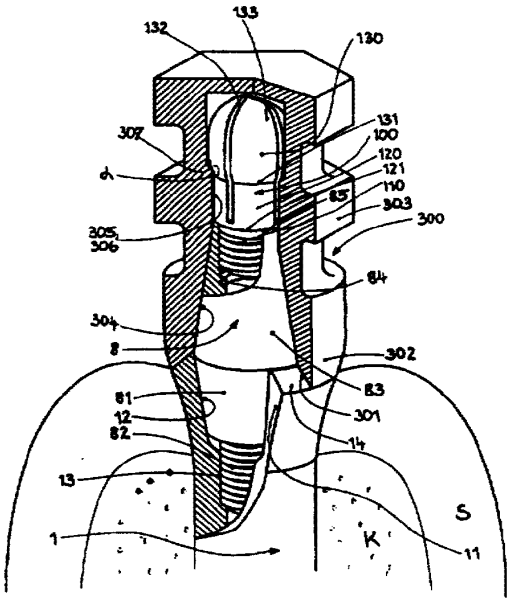
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(54) Title: CONNECTOR FOR TOOTH REPLACEMENTS IMPLANT-MOUNTED

(54) Bezeichnung: VERBINDUNGSANORDNUNG FÜR IMPLANTAT GESTÜTZTEN ZAHNERSATZ

(57) Abstract

The plug connector proposed is particularly suitable in all phases of tooth-replacement work, from the taking of impressions of implants (1) inserted in the jaw bone (K), to the production of the master model and finally the fixing of a supra-construction on the implants (1) in the patient's mouth. Use of the connector considerably facilitates the work for the patient, the dentist and the dental technician. The main components of the connector are an anchor pin (100) with an elastic clamp head (130), and a contoured element fitting the anchor pin. This contoured element, a snap-in shoulder (307) for instance, is located in the other part of the connector, i.e. in the impression cap (300), the crown cap or a secondary element (8). The secondary element (8) can be inserted in the implant (1) or in a manipulatory implant, or can be a fixed constituent of such implants.



(57) Zusammenfassung

Die Steck-Verbindungsanordnung eignet sich besonders in der gesamten Folge der Arbeitsphasen, beginnend mit Abdrucknahme an im Kieferknochen (K) eingesetzten Implantaten (1), bei der weiteren Herstellung des Meistermodells und schliesslich zur Befestigung einer Suprakonstruktion auf den Implantaten (1) im Mund des Patienten. Mit der Verbindungsanordnung tritt für den Patienten, den Zahnarzt und den Zahntechniker eine erhebliche Erleichterung ein. Die wesentlichen Bestandteile bilden ein Steckanker (100) mit elastischem Klemmkopf (130) und eine dazu komplementäre Kontur. Diese Kontur - z.B. eine Rastschulter (307) - ist im Gegenstück der Steckverbindung angeordnet, also in der Abdruckkappe (300), der Kronenkappe oder in einem vorhandenen Sekundärteil (8). Das Sekundärteil (8) kann in das Implantat (1) bzw. in ein Manipulierimplantat eingesetzt oder deren fester Bestandteil sein.

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Verbindungsanordnung für Implantat gestützten Zahnersatz

Die Erfindung betrifft eine Verbindungsanordnung für Implantat gestützten Zahnersatz gemäss dem Oberbegriff des unabhängigen Patentanspruchs 1, einsetzbar zur Abdrucknahme, Herstellung des Meistermodells oder Befestigung einer Suprakonstruktion auf dem im Kieferknochen eingesetzten Implantat.

Bei der Konstruktion, der Werkstofforschung, den Instrumentarien und den Implantiertechniken wurden bereits grosse Fortschritte erzielt, so dass heutzutage eine sehr hohe Erfolgsquote zu verzeichnen ist und sich immer mehr Menschen mit fehlenden Zähnen oder auch nicht mehr vorhandenen Zahnwurzeln entschliessen, Implantate einsetzen zu lassen. Derartig betroffene Personen können durch Implantate ihre Lebensqualität entscheidend verbessern. Vor dem Einsetzen von Zahnprothesen oder einzelnen künstlichen Zähnen muss die intraorale Geometrie mittels einer Abdrucknahme originalgetreu auf ein Meistermodell übertragen werden. Die vorliegende Erfindung befasst sich mit einer Verbindungsanordnung, die einerseits die Abdrucknahme und zahntechnische Bearbeitung wesentlich vereinfacht und andererseits dem Patienten einen exakt ausgerichteten, konstruktiv unkomplizierten, jedoch zuverlässigen und zudem kostengünstigen Implantat gestützten Zahnersatz ermöglicht.

Stand der Technik

Die Figuren 0.a bis 0.c veranschaulichen eine herkömmlich gebräuchliche Anordnung und Prozedur bei der Abdrucknahme, wie sie beispielsweise von Schroeder, A. u.a. in: Orale Implantologie. Georg Thieme Verlag Stuttgart, 2. Aufl., 1994, S. 209 ff., beschrieben wird.

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Figur 0.a

Im Ober- oder Unterkieferknochen K ist das Implantat 1 - hier ein perforiertes Hohlzylinderimplantat - intraossal und transgingival eingesetzt, so dass der Implantatkopf 11 die Schleimhaut S durchdringt. Das beschriebene Beispiel bezieht sich nur auf ein Implantat 1. Bei einer umfassenderen Versorgung können auch mehrere Implantate 1 gesetzt sein, so dass sich die zahntechnischen Aufbauten entsprechend vervielfachen. Nach der 3-4 monatigen Einheilphase des Implantats 1 wurde die hier nicht mehr sichtbare Einheilkapppe entfernt und das Octa-Sekundärteil 2 in situ in das Implantat 1 eingeschraubt. Damit sitzt der Basiskonus 21 des Octa-Sekundärteils 2 im Implantatkonus 12 und das Gewindesegment 22 des Octa-Sekundärteils 2 greift in die Gewindebohrung 13 des Implantats 1 ein. Die Gewindebohrung 13 erstreckt sich aus dem Raum des Implantatkonus 12, von dessen Bodenfläche axial abwärts. Das Octasegment 23 des Octa-Sekundärteils 2 überragt die Implantatschulter 14. Auf die Implantatschulter 14 ist die nicht reponierbare Abdruckkappe 3 mit ihrer Gegenschulter 31 aufgesetzt. Die Abdruckkappe 3 ist mittels einer diese axial durchdringenden Positionierschraube 4 mit dem Octa-Sekundärteil 2 verschraubt, indem das Gewindesegment 41 der Positionierschraube 4 in die sacklochförmige Gewindebohrung 24 im Octa-Sekundärteil 2 eingreift. Zum Octasegment 23 sind an der Anschlusspartie 32 der Abdruckkappe 3 komplementäre Innenkonturen vorgesehen, so dass die Teile einen formschlüssigen Verbund bilden. Für den Eingriff eines Eindrehinstrumentes besitzt die Positionierschraube 4 am Schraubenkopf 42 einen Kreuzschlitz 43. Auf die zu versorgende Kieferpartie und die Abdruckkappe 3 wird ein mit Abdruckmasse 5 gefüllter Abdrucklöffel 6 gesetzt, der an

seinem Scheitel einen Durchlass 61 für den Schraubenkopf 42 und für das Entweichen überschüssiger Abdruckmasse 5 besitzt, welche beim Aufpressen des Abdrucklöffels 6 auf die Kieferpartie verdrängt wird. Die Abdruckkappe 3 besitzt die an sich typisch kantige Aussenkontur mit mehreren äusseren und zueinander beabstandeten Rippen 33 zur Förderung des Verbundes mit der die Abdruckkappe 3 umgebenden Abdruckmasse 5.

Figuren 0.b und 0.c

Hier ist der weitere Ablauf ersichtlich. Nach dem Abbinden der Abdruckmasse 5 muss der aus dem Durchlass 61 herausgequollene Massepfropfen 51 entfernt werden, um den Schraubenkopf 42 freizulegen und die Positionierschraube 4 aus dem Octa-Sekundärteil 2 herausdrehen zu können. Erst jetzt kann man den Abdrucklöffel 6 mit der in der Abdruckmasse 5 fest eingebetteten Abdruckkappe 3 aus dem Mund des Patienten herausnehmen. In die Abdruckmasse 5 ist die Kontur der Kieferpartie negativ geformt.

Für die gesamte weitere Beschreibung gilt folgende Festlegung. Sind in einer Figur zum Zweck zeichnerischer Eindeutigkeit Bezugsziffern enthalten, aber im unmittelbar zugehörigen Beschreibungstext nicht erläutert, so wird auf deren Erwähnung in vorangehenden Figurenbeschreibungen Bezug genommen.

Figur 0.c

Das nun auf die Abdruckkappe 3 gesteckte Manipulierimplantat 7 ist an seinem Kopf 71 ebenso beschaffen wie der Implantatkopf 11 des Implantats 1 mit der Implantatschulter 14 und dem eingeschraubten Octa-Sekundärteil 2 und dessen herausragenden Octasegment 23. Das Manipulierimplantat 7

besitzt demzufolge den analogen Kopf 71 mit der Implantatschulter 74 und dem herausragenden Octasegment 73, die formschlüssig an die Anschlusspartie 32 der Abdruckkappe 3 ansetzen. Zur Gewindebohrung 24 im Octa-Sekundärteil 2 ist im Kopf 71 eine gleichartige, sacklochförmige Gewindebohrung 72 vorgesehen. Durch den Durchlass 61 im Abdrucklöffel 6 und die Abdruckkappe 3 wird erneut eine Positionierschraube 4 eingedreht, um das Manipulierimplantat 7 mit der im Abdrucklöffel 6 eingeschlossenen Abdruckkappe 3 fest und spaltfrei zu verbinden. So greift das Gewindesegment 41 in die Gewindebohrung 72 ein. Zur Erstellung des Meistermodells wird sodann die von der behandelten Kieferpartie erhaltene Negativform mit einem Hartgips ausgegossen und dabei das Manipulierimplantat 7 eingebettet.

Zeichnerisch nicht mehr dargestellt sind die sich anschliessenden Arbeitsphasen. Nach Verfestigung des Hartgipses wird die Positionierschraube 4 herausgedreht und die Negativform von der Hartgipsform - dem erhaltenen Meistermodell, welches exakt der betroffenen Kontur im Mund des Patienten entspricht -, getrennt. Hiernach bringt man auf das Meistermodell und auf den herausragenden Kopf 71 des Manipulierimplantats 7 eine Goldkappe auf. Schliesslich wird auf der Goldkappe die Restauration aufgewachst und gegossen und zuletzt für die endgültige Prothese Keramik aufgebrannt. Die fertige Restauration erhält der Patient eingesetzt, wobei diese von einer Titanokklusalschraube durchdrungen ist und in das im Implantat 1 eingeschraubte Octa-Sekundärteil 2 eingreift, so dass die Restauration nun fest auf dem Implantat 1 sitzt.

Dieses herkömmliche System weist bei der Abdrucknahme eine Reihe von Nachteilen auf, so insbesondere:

- zur Befestigung der Abdruckkappe 3 auf dem Implantat 1 müssen beide Konstruktionsteile durch eine Positionierschraube 4 miteinander verbunden werden;

- der Abdrucklöffel 6 muss mit Durchlässen 61 versehen sein, die vor der Abdrucknahme genau zu plazieren sind;

- die aus den Durchlässen 61 ausgetretene überschüssige Abdruckmasse, d.h. die um die Schraubenköpfe 42 gebildeten Massepfropfen 51, müssen nach dem Aushärten der Abdruckmasse 5 entfernt werden, um die Positionierschrauben 4 herausdrehen zu können;

- erst nachdem die Positionierschrauben 4 herausgedreht sind, kann der Abdrucklöffel 6 aus dem Mund des Patienten entnommen und dem Dentallabor überwiesen werden;

- ausserdem muss man im Dentallabor vor der Herstellung des Meistermodells Manipulierimplantate 7 an die Anschlusspartien 32 der Abdruckkappen 3 ansetzen und mit Positionierschrauben 4 fixieren.

Mit der vorstehend beschriebenen Verbindungsanordnung ist die Erstellung des Meistermodells insgesamt kompliziert, erfordert zahlreiche Arbeitsgänge und ist für den Patienten, den Zahnarzt sowie für den Zahntechniker eine mühevolle Prozedur.

Aus den US-PS 3 797 114 und 5 195 891 sind lösbare Verbindungsanordnungen in Form einer Steck-Aufnahme-Kombination bekannt. Die Schnappverbindungen werden dadurch gebildet, indem ein Steckelement in ein Aufnahmeelement eingeschoben wird, wobei das Steckelement einen Zapfen mit einem kugelförmigen Kopf besitzt und das Aufnahmeelement eine elastisches Greifmittel aufweist. Beim Einführen des Steckelementes wird das Greifmittel zunächst aufgeweitet; ist der Kopf des Steckelementes gänzlich eingeführt, kontrak-

tiert sich das Greifmittel wieder. Die so beschaffenen Schnappverbindungen bestehen aus einer Vielzahl relativ komplizierter Einzelteile. Besonders unzulänglich ist, dass man keine zuverlässige Kontrolle über die hinreichende Festigkeit der Verbindung hat.

Schliesslich ist eine weitere lösbare Verbindungsanordnung mit ineinandergreifenden Elementen bekannt. Hier besitzt das Aufnahmeelement einen unter Federdruck stehenden Arretierschieber, der in eine Aussparung im Steckelement einrastet, wenn letzteres bis in die Endlage eingeschoben ist. Dass sich die Verbindung nur umständlich lösen lässt und der federnde Arretierschieber einen Unsicherheitsfaktor hinsichtlich der Funktionszuverlässigkeit darstellt, sind die Nachteile dieser Verbindungsanordnung.

Angesichts der Unvollkommenheiten des vorgängig beschriebenen Standes der Technik hat sich die Erfindung die Aufgabe gestellt, eine vielfach verbesserte Verbindungsanordnung zu schaffen. Dabei gilt es, Systemelemente zu entwickeln, welche es ermöglichen, die Abdrucknahme und die nachfolgende zahntechnische Bearbeitung entscheidend zu vereinfachen. Ferner sollen für den Aufbau der Suprakonstruktionen, d.h. zur intraoralen Befestigung der künstlichen Zahnersatzteile, möglichst wenig Elemente erforderlich sein. Das Herstellen bzw. Lösen der Verbindung ist durch einfache lineare Relativbewegung und ohne zusätzliche Drehung zu realisieren, da ansonsten der Mechanismus wieder verkompliziert werden würde. Man geht davon aus, dass ein Teil der Verbindungsanordnung fest mit dem Implantat verbunden ist.

Die Lösung dieser Aufgabe wird durch die kennzeichnenden Merkmale des unabhängigen Patentanspruchs 1 definiert, während sich bevorzugte Ausführungsvarianten aus den abhängigen Ansprüchen ergeben. Das Wesen der Erfindung besteht darin, dass ein Steckanker mit elastischem Klemmkopf und eine dazu komplementäre Kontur vorgesehen sind, die zusammen eine lösbare Steckverbindung ergeben. Diese Kontur - z.B. eine Rastschulter - ist im Gegenstück der Steckverbindung, die nicht mit dem Steckanker fest verbunden ist, angeordnet. Das kann alternativ die Abdruckkappe, die Kronenkappe oder ein vorhandenes Sekundärteil sein, wobei das Sekundärteil im Implantat bzw. im Manipulierimplantat eingesetzt oder deren fester Bestandteil ist. Der Steckanker ist entweder aufwärts weisend fest im Sekundärteil oder abwärts weisend fest in der Abdruck- bzw. Kronenkappe angeordnet. Durch gezielte Bemessung der geometrischen Relationen wird die zum Lösen der Steckverbindung erforderliche Trennkraft differenziert ausgelegt.

Im folgenden wird die erfindungsgemässe Verbindungsanordnung unter Bezugnahme auf die beigefügten Zeichnungen detaillierter beschrieben. Dabei zeigen:

Figur 0.a: einen Teilschnitt durch ein enostal gesetztes Dentalimplantat bei der Abdrucknahme mit Abdruckkappe und -löffel gemäss dem Stand der Technik;

0.b: die Darstellung gemäss Figur 0.a mit abgehobenem Abdrucklöffel und ausgedrehter Positionierschraube;

0.c: die Darstellung gemäss Figur 0.b mit angesetztem Manipulierimplantat und eingedrehter Positionierschraube;

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Figur 1: die erfindungsgemässe Verbindungsanordnung zur Abdrucknahme in Aufwärtsposition mit Konus-Sekundärteil und vertiefter Ausnehmung in der Abdruckkappe;

2: die Verbindungsanordnung gemäss Figur 1 mit einer Innenwulst in der Abdruckkappe;

3: die Verbindungsanordnung gemäss Figur 1 mit einer Abdruckkappe gleichförmiger Innenkontur und einem Steckanker mit einem Klemmkopf erhöhter Spreizkraft;

4: die Verbindungsanordnung gemäss Figur 1 mit einer zusätzlichen Zentrierhülse;

5: die Verbindungsanordnung gemäss Figur 4 in abgewinkelter Version;

Figur 6a: zwei enostal gesetzte Implantate mit eingeschraubten, axialsymmetrischen Konus-Sekundärteilen und angenäherten Steckankern zur Vorbereitung der Abdrucknahme für eine Zahn-Brückenkonstruktion;

6b: die Darstellung gemäss Figur 6a mit eingeschraubten Steckankern und angenäherten Abdruckkappen;

6c: die Darstellung gemäss Figur 6b mit aufgesteckten Abdruckkappen;

Figur 7: divergierend positionierte Implantate mit axialsymmetrischen Konus-Sekundärteilen und flexiblen bzw. abgewinkelten Steckankern;

Figur 8: die Verbindungsanordnung gemäss Figur 2 zur Befestigung einer fertigen Krone auf einem Einzelzahn bzw. für eine Zahn-Brückenkonstruktion;

Figur 9: die Verbindungsanordnung gemäss Figur 1 mit einem Octa-Sekundärteil und komplementärem Innenachtkant in der Abdruckkappe als Rotationssicherung;

10: die Verbindungsanordnung gemäss Figur 9 mit zusätzlicher Halteschraube;

11: eine Kronenkappe mit Transversalverschraubung für die Verbindungsanordnung

gemäss Figur 10 als Basis für eine Suprakonstruktion;

Figur 12: die Verbindungsanordnung zur Abdrucknahme in Abwärtsposition mit Konus-Sekundärteil und einer Innenwulst in der Abdruckkappe;

13: die Verbindungsanordnung gemäss Figur 12 mit Klemmring und Nut am Konus-Sekundärteil zur Transversalverschraubung;

14: die Verbindungsanordnung gemäss Figur 13 mit okklusalem Gewinde im Konus-Sekundärteil zur Befestigung einer fertigen Krone;

15: die Verbindungsanordnung gemäss Figur 14 mit weit beweglichem Steckanker für extrem divergent sitzende Implantate;

Figur 16: die Verbindungsanordnung gemäss Figur 12 mit angesetztem Manipulierimplantat für die Modellherstellung;

Figur 17: die Verbindungsanordnung gemäss Figur 12 zur Befestigung einer fertigen Krone auf einem Einzelzahn bzw. für eine Zahn-Brückenkonstruktion;

18: die Verbindungsanordnung gemäss Figur 13 mit transversaler Verschraubung der fertigen Krone;

19: die Verbindungsanordnung gemäss Figur 14 mit Befestigung der fertigen Krone mittels des Steckankers;

20: die Verbindungsanordnung gemäss Figur 14 mit okklusaler Befestigung der fertigen Krone;

Figuren 21a-21e: Arbeitsablauf der Abdrucknahme unter Verwendung der Verbindungsanordnung gemäss Figur 4;

22a-22e: Arbeitsablauf gemäss den Figuren 21a-21e unter Verwendung der Verbindungsanordnung nach Figur 5;

23a-23e: Arbeitsablauf gemäss den Figuren 21a-21e unter Verwendung der Verbindungsanordnung nach Figur 9;

24a-24e: Arbeitsablauf gemäss den Figuren 21a-21e unter Verwendung eines eine Nut aufweisenden Konus-Sekundärteils;

Figuren 25a-25e: Arbeitsablauf der Modell- und Kronenherstellung unter Verwendung der Verbindungsanordnung nach Figur 1 und okklusaler Verschraubung der Goldkappe bzw. der fertigen Krone;

26a-26e: Arbeitsablauf gemäss den Figuren 25a-25e unter Verwendung der Verbindungsanordnung gemäss Figur 5;

27a-27e: Arbeitsablauf gemäss den Figuren 25a-25e mit festzementierter Goldkappe bzw. fertiger Krone;

28a-28e: Arbeitsablauf gemäss den Figuren 26a-26e mit festzementierter Goldkappe bzw. fertiger Krone;

Figuren 29a-29e: Arbeitsablauf der Modell- und Kronenherstellung unter Verwendung der Verbindungsanordnung nach Figur 9;

30a-30e: Arbeitsablauf gemäss den Figuren 25a-25e unter Verwendung eines Konus-Sekundärteils mit Nut;

31a-31e: Arbeitsablauf gemäss den Figuren 30a-30e mit transversal verschraubter Goldkappe bzw. fertiger Krone;

32a-32e: Arbeitsablauf gemäss den Figuren 29a-29e zur Befestigung einer provisorischen Krone.

Figur 1

Die erfindungsgemässe Verbindungsanordnung für die Abdrucknahme besteht im Prinzip aus dem in den Kieferknochen K eingesetzten Implantat 1, dem darin eingeschraubten Konus-Sekundärteil 8, dem in letzteres eingeschraubten Steckanker 100 und der auf diesen aufsteckbaren Abdruckkappe 300.

Das Implantat 1 besitzt in herkömmlicher Weise einen sich konisch erweiternden Implantatkopf 11, der die Schleimhaut S durchdringt und oberseitig mit der Implantatschulter 14 abschliesst. Im Implantatkopf 11 ist eine sich abwärts

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konisch verengende Bohrung - der Implantatkonus 12 - vorgesehen. Vom Boden des Implantatkonus 12 erstreckt sich axial abwärts eine sacklochförmige Gewindebohrung 13, in welche das Gewindesegment 82 des Konus-Sekundärteils 8 eingeschraubt ist. Das Konus-Sekundärteil 8 besteht ferner aus dem sich an das Gewindesegment 82 anschliessenden Basiskonus 81 und dem darauf befindlichen, aufwärts verjüngten Konuspfeiler 83. Der Basiskonus 81 ist im Implantatkonus 12 eingebettet und schliesst mit seiner Oberkante praktisch am erhöhten, inneren Ansatz der Implantatschulter 14 ab, während der Konuspfeiler 83 aus dem Implantat 1 herausragt. Von der Deckfläche des Konuspfeilers 83 und damit von der Deckfläche des gesamten Konus-Sekundärteils 8 verläuft axial abwärts eine sacklochförmige Gewindebohrung 84.

In die Gewindebohrung 84 ist das Gewindesegment 110 des Steckankers 100 eingeschraubt. Der Steckanker 100 besteht ferner aus dem sich an das Gewindesegment 110 anschliessenden, an einer kreisringförmigen Auflageschulter 121 übergehenden und im Durchmesser erweiterten Schaftsegment 120, das aus dem Konuspfeiler 83 herausragt, wobei die Auflageschulter 121 auf der Konuspfeilerschulter 85 aufsitzt. An das zylindrische Schaftsegment 120 schliesst sich überhangartig und abrupt erweitert der kuppelförmige Klemmkopf 130 an, so dass sich eine deutlich konturierte, radial umlaufende Rastflanke 131 zwischen dem Schaftsegment 120 und dem Klemmkopf 130 ergibt. Vom Klemmkopf 130 vertikal in das Schaftsegment 120 ziehen sich Teilungsschlitze 132, vorzugsweise zwei kreuzweise angeordnete Teilungsschlitze 132, wodurch vier identische, in der horizontalen Ebene elastische Ankerlamellen 133 entstehen.

Die Abdruckkappe 300 besitzt die an sich typisch kantige Aussenkontur mit Rippen 303. An der Unterseite der Abdruckkappe 300 befindet sich die Anschlusspartie 302 mit der zur Implantatschulter 14 komplementären Gegenschulter 301, womit ein fugenfreies Aufsetzen der Abdruckkappe 300 auf das Implantat 1 gewährleistet ist. Von der Anschlusspartie 302 her, ausgehend von der Unterseite der Abdruckkappe 300, erstreckt sich eine axiale und aufwärts verengte Konusbohrung 304 in das Innere der Abdruckkappe 300. Aufsteigend geht die Konusbohrung 304 in eine Zylinderbohrung 305 über, die sich hinter einer an der Innenwandung 306 vorgesehenen radial umlaufenden Rastschulter 307 kavitätisch erweitert. Die Rastschulter 307 ist kreisringförmig und abwärts konisch verengend ausgebildet, so dass sie mit der Vertikalachse einen Anstiegswinkel α einnimmt, wobei vorzugsweise $30° \leq \alpha \leq 60°$ gilt.

Im Zustand aufgesteckter Abdruckkappe 300 sitzen der Konuspfeiler 83 in der Konusbohrung 304 und das Schaftsegment 120 im unteren Abschnitt der Zylinderbohrung 305, während sich der Klemmkopf 130 oberhalb der Rastschulter 307, im erweiterten Abschnitt der Zylinderbohrung 305 befindet. Die Elastizität des feststehenden Steckankers 100 mit den Ankerlamellen 133 bewirkt einen Druck der Rastflanke 131 auf die Rastschulter 307, wodurch die Abdruckkappe 300 quasi in vertikaler Richtung auf das Implantat 1 gezogen wird. Die Gegenschulter 301 der Abdruckkappe 300 wird auf die Implantatschulter 14 gedrückt. Zur Gewährleistung dieser Funktion muss ein Mindestspiel zwischen der Konusbohrung 304 und der Aussenkontur des Konuspfeilers 83

eingehalten werden; die beiden Konen dürfen nicht aufeinanderliegen. Die Anordnung, wo der Steckanker 100 in das Konus-Sekundärteil 8 eingeschraubt ist und der Klemmkopf 130 herausragt, wird als Aufwärtsposition bezeichnet. Auf die geometrischen Verhältnisse zur idealen Kräftebemessung wird bei den nachfolgenden Erläuterungen eingegangen.

Figur 2

Gezeigt ist eine erste konstruktive Modifikation zu der Verbindungsanordnung. Das Implantat 1, das darin eingeschraubte Konus-Sekundärteil 8 und der in letzterem eingeschraubte Steckanker 100 stimmen mit der zuvor besprochenen Ausführungsform überein. Lediglich der Klemmkopf 130 ist flacher gestaltet; im Prinzip unverändert ist auch die Aussenkontur der Abdruckkappe 300. Zur Aufnahme des Konuspfeilers 83 und des Schaftsegmentes 120 sind in der Abdruckkappe 300 gleichfalls eine axiale Konusbohrung 304 sowie eine sich unmittelbar daran anschliessende Zylinderbohrung 305 vorgesehen. Anstelle der gemäss Figur 1 vorhandenen Rastschulter 307 mit dem darüber befindlichen erweiterten Abschnitt der Zylinderbohrung 305 ist hier auf der Innenwandung 306 und innerhalb der sacklochförmigen Zylinderbohrung 305 ein radial umlaufender, erhabener Raststeg 308 vorhanden.

Die Zylinderbohrung 305 weist den lichten Bohrungsdurchmesser d_B auf, der sich im Bereich voller Höhe des Raststeges 308 auf das Mass des lichten Raststegdurchmessers d_R verengt, und der Klemmkopf 130 besitzt den Klemmkopfdurchmesser d_K. Folglich erhält man die Durchmesserverhältnisse mit

$d_B > d_K > d_R$. Der Raststeg 308 hat die Querschnittsform eines gleichschenkeligen Trapezes, dessen Grundlinie auf der Innenwandung 306 liegt. Die Trapezschenkel nehmen mit der Vertikalachse hier gleichfalls den Anstiegswinkel α ein. Ist die Abdruckkappe 300 auf den Steckanker 100 aufgesteckt, so befindet sich der Klemmkopf 130 oberhalb des Raststeges 308, im oberen Abschnitt der Zylinderbohrung 305, und die Rastflanke 131 des Klemmkopfes 130 drückt auf den oberen Trapezschenkel des Raststeges 308. Hierdurch wird die Abdruckkappe 300 wiederum in vertikaler Richtung auf das Implantat 1 gezogen. Die Gegenschulter 301 der Abdruckkappe 300 sitzt fugenlos auf der Implantatschulter 14; Abdruckkappe 300 und Implantat 1 sind für das Verfahren der Abdrucknahme gegenseitig fixiert.

Beim Aufstecken bzw. beim Abziehen der Abdruckkappe 300 vom Steckanker 100 - der Klemmkopf 130 überwindet die Verengung am Raststeg 308 - muss für die zusammengedrückten Ankerlamellen 133 genügend Freiraum vorhanden sein. Die Teilungsschlitze 132 im Klemmkopf 130 müssen daher eine ausreichende Schlitzbreite b_S aufweisen. Die Teilungsschlitze 132 sind in einer Schlitzlänge l_S vorgesehen, die sich bis in die Nähe des Gewindesegmentes 110 des Steckankers 100 erstrecken kann.

Um die Steckverbindung zwischen dem Implantat 1 und der Abdruckkappe 300 herzustellen, ist die Steckkraft F_S aufzuwenden; um die Abdruckkappe 300 nach der Abdrucknahme - die Abdruckmasse 5 muss hinreichend ausgehärtet sein -

abzuziehen, benötigt man die Trennkraft F_T. Die aufzuwendenden Kräfte F_S und F_T stehen in funktionaler Abhängigkeit zum Bohrungs-, Raststeg- und Klemmkopfdurchmesser d_B, d_R und d_K, zur Kontur der Rastflanke 131 und -schulter 307 bzw. des Raststegs 308 sowie zur Elastizität der Ankerlamellen 133. Auf die Elastizität der Ankerlamellen 133 haben deren Materialbeschaffenheit und Geometrie, so auch die Schlitzbreite und -länge b_S, l_S, Einfluss.

Figur 3

Als abweichende Besonderheit ist bei dieser Konstruktionsvariante vorgesehen, die sacklochförmige Zylinderbohrung 305 in der Abdruckkappe 300 unterbrechungslos, d.h. ohne eine Rastschulter 307 bzw. einen Raststeg 308, auszubilden. Die Fixierung zwischen der aufgesteckten Abdruckkappe 300 und dem Klemmkopf 130 des Steckankers 100 beruht hier auf der gegen die Innenwandung 306 wirkenden Spreizkraft der unter Federspannung stehenden, zusammengedrückten Ankerlamellen 133. Im Zustand abgezogener Abdruckkappe 300 ist der Klemmkopf 130 mehr gespreizt. Ist die Abdruckkappe 300 aufgesteckt, so bewirkt die Friktion an der Berührungsfläche zwischen der Innenwandung 306 und der Aussenwölbung des Klemmkopfes 130 den Halt der Abdruckkappe 300 auf dem Implantat 1, d.h. die Anschlusspartie 302 der Abdruckkappe 300 sitzt fixiert auf dem Implantatkopf 11 und die Gegenschulter 301 liegt damit fugenlos auf der Implantatschulter 14 auf. Eine gezielt geschaffene Oberflächenrauhigkeit am Klemmkopf 130 und an der Innenwandung 306 ist dem während der Abdrucknahme notwendigen, festen, spaltfreien Sitz der

Gegenschulter 301 der Abdruckkappe 300 auf der Implantatschulter 14 förderlich.

In Abwandlung der soeben beschriebenen völlig unkonturiert, durchgängigen Innenwandung 306, ist es auch praktikabel, die Zylinderbohrung 305 in zwei Abschnitten unterschiedlichen Durchmessers zu gestalten. Betrachtet man die Abdruckkappe 300 aufgesteckt, so ergibt sich, dass, anschliessend an die Konusbohrung 304, die Zylinderbohrung 305 über einen weiten Bereich des Schaftsegmentes 120 einen grösseren Durchmesser aufweist als im aufwärts gelegenen Abschnitt, wo der Klemmkopf 130 positioniert ist. Den Übergang zwischen dem unteren, erweiterten Abschnitt der Zylinderbohrung 305 und dem oberen, engeren Abschnitt bildet eine relativ schmale, kreisringförmige Konusfläche. Beim Aufstecken der Abdruckkappe 300 durchfährt der Klemmkopf 130 somit zuerst den erweiterten Abschnitt der Zylinderbohrung 305. Beim Passieren der verengenden Konusfläche werden die Ankerlamellen 133 des Klemmkopfes 130 fortschreitend zusammengedrückt. Auf diese Weise vorgespannt, gleitet der Klemmkopf 130 dann in den oberen, engeren Abschnitt der Zylinderbohrung 305 und hält die Abdruckkappe 300, wie vorbeschrieben, aufgrund von Friktion.

Figur 4

Diese Ausführungsform der Verbindungsanordnung ist zur Figur 1 insofern eine Erweiterung, als man eine zusätzliche Zentrierhülse 9 im Implantatkopf 11 anordnet, die den in seiner Grösse reduzierten Basiskonus 81 des Konus-Sekundärteils 8 (s. Figur 5) umgibt. Somit erreicht man eine grössere Übertragungsgenauigkeit bei der Abdrucknahme mit

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Konus-Sekundärteilen 8. Die Ausrichtung zwischen den Konen des Konuspfeilers 83 und der Konusbohrung 304 ist genauer. Zur Erzielung einer gewissen Elastizität besitzt die Zentrierhülse 9 an der Hülsenschale 91 vertikal angeordnete Dehnungsschlitze 92. Unter dem Druck des eingeschraubten Konus-Sekundärteils 8 schmiegt sich die Hülsenschale 91 an den Implantatkonus 12 an, während sie den in ihr sitzenden Basiskonus 81 zentriert. Bei dieser Ausführungsform besitzt der Konuspfeiler 83 eine unterseitige, radial umlaufende Schulterpartie 86, die direkt auf die Implantatschulter 14 aufsetzt. Entsprechend verschmälert ist die Gegenschulter 301 der Abdruckkappe 300, um der Schulterpartie 86 auf der Implantatschulter 14 Platz zu lassen. Der Steckanker 100 ist in der vorbeschriebenen Weise beschaffen.

Figur 5

Veranschaulicht wird der Aufbau der Verbindungsanordnung für die Abdrucknahme unter Verwendung eines abgewinkelten Konus-Sekundärteils 8. Diese Konstruktion stimmt weitgehend mit der zuvor beschriebenen Figur 4 mit einem axialsymmetrischen Konus-Sekundärteil 8 überein. Das nun eingesetzte abgewinkelte Konus-Sekundärteil 8 ermöglicht mit den übrigen Konstruktionsteilen, die Abdrucknahme auch bei einer Neigung des Implantats 1 im Bereich von 0° bis 30° durchzuführen. Entsprechend dem Neigungswinkel des Konus-Sekundärteils 8 muss man angepasste Abdruckkappen 300 vorsehen. Die Gegenschulter 301 der Abdruckkappe 300 sowie die Schulterpartie 86 des Konus-Sekundärteils 8 sitzen auch hier auf der Implantatschulter 14 auf. Vorteilhafterweise kann ebenfalls eine Zentrierhülse 9 im Implantatkopf 11 des unveränderten Implantats 1 vorgesehen werden. Die Abdruck-

kappe 300 und der Steckanker 100 sind im übrigen identisch mit den vorherigen Ausführungsvarianten ausgebildet. Zur Fixierung des Konus-Sekundärteils 8 im Implantatkopf 11 wird eine einführbare Schraube 87 benutzt, die sich an einem integrierten Sitz im Konus-Sekundärteil 8 abstützt und in die Gewindebohrung 13 im Implantat 1 eingreift.

Figuren 6a bis 6c

Anhand dieser Figurenfolge werden drei Aufbauphasen der Verbindungsanordnung zur Abdrucknahme, beispielsweise einer Zahn-Brückenkonstruktion, gezeigt. Gemäss Figur 6a sind in den Kieferknochen K zwei mässig zueinander divergent stehende Implantate 1 enostal gesetzt. Eine derartig diverdierende Implantation kann durch das spezifische Knochenangebot erforderlich sein. Die Implantatköpfe 11 durchdringen dabei die Schleimhaut S und fungieren somit als transmukosale Einheiten. In die Implantate 1 eingeschraubt, sind axialsymmetrische Konus-Sekundärteile 8, in deren Gewindebohrungen 84 nun die Steckanker 100 mit ihren Gewindesegmenten 110 eingedreht werden. Figur 6b zeigt die soweit vorbereiteten Verbindungsanordnungen mit den positionierten Steckankern 100 und den aufzusteckenden Abdruckkappen 300 (Konstruktion entsprechend Figur 1). Nach Figur 6c sind die Vorbereitungen zur Abdrucknahme abgeschlossen. Die Abdruckkappen 300 werden von den Klemmköpfen 130 gehalten und sitzen mit ihren Gegenschultern 301 fugenlos auf den Implantatschultern 14 auf.

Figur 7

Hieraus geht eine weitere konstruktive Modifikation der Verbindungsanordnung für stark divergent sitzende Implan-

tate 1 hervor. Die Abänderung bezieht sich auf den Steckanker 100; ansonsten entspricht die Gestaltung der Figur 1, d.h. in das Implantat 1 ist ein axialsymmetrisches Konus-Sekundärteil 8 eingeschraubt. Die mittig gezeichnete Kombination aus Implantat 1, Konus-Sekundärteil 8 und Steckanker 100 soll lediglich für einen anschaulichen Vergleich die ideale Vertikalposition darstellen. Die Anpassung an eine starke Schräglage erzielt man dadurch, dass am Steckanker 100, unterhalb der Rastflanke 131, radial um das Schaftsegment 120 umlaufend, ein Einstich 122 vorgesehen ist. Wird für den Steckanker 100, zumindest für den Klemmkopf 130 und das sich anschliessende Schaftsegment 120, ein flexibles Material - z.B. ein Kunststoff - verwendet, so ermöglicht man damit ein die Schräglage kompensierendes Abbiegen der einzelnen, durch die Teilungsschlitze 132 entstehenden Ankerlamellen 133. Die Stabilität der Klemmverbindung zwischen dem Klemmkopf 130 und der aufgesteckten Abdruckkappe 300 wird hierdurch nicht beeinträchtigt.

Figur 8

Gezeigt ist die Verwendung der Verbindungsanordnung über die bisher beschriebene Abdrucknahme hinausgehend, nun zur Befestigung einer Suprakonstruktion, z.B. in Form einer künstlichen Zahnkrone Zk für einen Einzelzahn (Einzelkrone). Die Zahnkrone Zk besteht aus der innenliegenden, gerüstbildenden Kronenkappe 500 und dem darauf aufmodellierten Zahn Za. Im Prinzip besitzt die Kronenkappe 500 eine zu den Abdruckkappen 300 gemäss den vorherigen Figuren (ausgenommen Figur 3) identische Innenkontur. Die nach Figur 3 allein auf Friktion beruhende Klemmverbindung zwischen dem Klemmkopf 130 und der Abdruckkappe 300 kommt für

die Fixierung einer Zahnkrone Zk, wegen des hier notwendigen festeren Sitzes, nicht in Betracht.

Vorhanden ist das Implantat 1 mit dem Implantatkopf 11, dem Implantatkonus 12, der aus diesem Raum sich abwärts erstreckenden Gewindebohrung 13 und der obenauf radial umlaufenden Implantatschulter 14. In das Implantat 1 ist ein Konus-Sekundärteil 8 eingesetzt, dessen Konstruktion und Schraubverbindung mit dem Implantat 1 bereits beschrieben wurde. Der Konuspfeiler 83 ragt, wie vorangehend schon dargestellt, aus dem Implantatkopf 11 heraus. In die Gewindebohrung 84 des Konuspfeilers 83 ist wiederum ein Steckanker 100 mit seinem Gewindesegment 110 eingeschraubt. In zuvor geschilderter Weise sind das Schaftsegment 120 und der Klemmkopf 130 beschaffen. Die Kronenkappe 500 besitzt eine zuunterst befindliche Anschlusspartie 502 mit der Gegenschulter 501, die fugenlos auf der Implantatschulter 14 aufsitzt. Analog zur Abdruckkappe 300 erstreckt sich eine Konusbohrung 504 von der Anschlusspartie 502 axial aufwärts in die Kronenkappe 500 hinein, die Konusbohrung 504 geht in die sacklochförmige Zylinderbohrung 505 über, und auf der Innenwandung 506 ist der Raststeg 508 vorgesehen.

Beim Aufstecken der Zahnkrone Zk, kurz bevor die Kronenkappe 500 fugenlos auf dem Implantat 1 sitzt, springt der Raststeg 508 über den Klemmkopf 130 und die Rastflanke 131 drückt nun auf den Raststeg 508, wodurch die Zahnkrone Zk auf das Implantat 1 gezogen wird. Die Zahnkrone Zk muss wesentlich sicherer und fester auf dem Implantat 1 aufgesteckt sein, als dies bei einer Abdrucknahme erforderlich

ist. Die bei Befestigung einer Suprakonstruktion zum Lösen der Verbindungsanordnung aufzuwendende Trennkraft F_T' muss deutlich höher bemessen werden, als bei einer Abdrucknahme. Um dies zu erreichen, sind verschiedene einzelne Massnahmen oder deren Kombination möglich. Am praktikabelsten ist es, einen - im Verhältnis zur Abdrucknahme - verkleinerten Raststegdurchmesser d_R' vorzusehen, wonach sich $d_R > d_R'$ ergibt. Auch könnte der Anstiegswinkel α vergrössert werden, so dass der für den Halt massgebliche obere Trapezschenkel am Raststeg 508 sich mehr der Horizontalen annähert und damit ein grösseres Hindernis für die Rastflanke 131 beim beabsichtigten oder ungewollten Abziehen der Zahnkrone Zk darstellt. Diese Verbindungsanordnung kann desgleichen für die Befestigung von künstlichen Einzelzähnen oder Brückenkonstruktionen verwendet werden.

Figur 9

Speziell für den Einzelzahnersatz vorteilhaft ist die Ausführung der Verbindungsanordnung mit Rotationssicherung, die zunächst für eine Abdrucknahme erläutert wird. Anstelle des bisher eingesetzten Konus-Sekundärteils 8 wird nun ein Octa-Sekundärteil 2 in das Implantat 1 eingeschraubt, wie es in der Darstellung zum Stand der Technik anhand der Figuren 0.a bis 0.c bereits gezeigt wurde. Der Basiskonus 21 des Octa-Sekundärteils 2 sitzt im Implantatkonus 12, und das Gewindesegment 22 des Octa-Sekundärteils 2 greift in die Gewindebohrung 13 des Implantats 1 ein. Das ganze Octasegment 23 überragt die Implantatschulter 14. Aufgrund von Toleranzen und unterschiedlicher Einschraubtiefe des Octa-

Sekundärteils 2 kann sich auch der horizontale Sims 25 zwischen dem Basiskonus 21 und dem Octasegment 23 über die Implantatschulter 14 erheben.

Wiederum ist ein Steckanker 100 mit seinem Gewindesegment 110 in die im Octa-Sekundärteil 2 vorhandene Gewindebohrung 24 eingeschraubt. Das an das Gewindesegment 110 ansetzende Schaftsegment 120 und der obenauf angeordnete Klemmkopf 130 erstrecken sich ohne die aufgesteckte Abdruckkappe 300 frei in die Höhe. Dabei sitzt die das Schaftsegment 120 nach unten abgrenzende Auflageschulter 121 auf der Octaschulter 26 auf. Im Verhältnis zu den Abdruckkappen 300 aus den Figuren 1 oder 2 hat die nun verwendete Abdruckkappe 300 äusserlich die gleiche Beschaffenheit. In aufgesteckter Position sitzt die Abdruckkappe 300 mit ihrer Gegenschulter 301 fugenlos auf der Implantatschulter 14. Jedoch ist die Innenkontur der Anschlusspartie 302 der Abdruckkappe 300 komplementär zu dem Octasegment 23 gestaltet und weist demnach einen Innenachtkant 27 auf. Für den Fall, dass der Sims 25 über die Implantatschulter 14 hinausragt, ist an der Innenkante der Gegenschulter 301 eine radial umlaufende Ausnehmung 309 vorgesehen. Damit kann die Gegenschulter 301 auch bei erhöhtem Sims 25 fugenlos auf die Implantatschulter 14 aufsetzen.

Der Innenachtkant 27 setzt sich axial aufsteigend als sacklochförmige Zylinderbohrung 305 fort, in die sich das Schaftsegment 120 sowie der Klemmkopf 130 erstrecken. Wie bereits zu den vorangehenden Figuren beschrieben, ist an der Innenwandung 306 ein erhabener, radialer Raststeg 308 vorhanden. Im zusammengesteckten Zustand sitzt dann der

obere Trapezschenkel des Raststeges 308 unter der Rastflanke 131 des Klemmkopfes 130. Anstelle des Raststeges 308 könnte auch eine Rastschulter 307 (vgl. Figur 1) auf der Innenwandung 306 eingearbeitet sein oder die Innenwandung 306 ist durchgängig gestaltet (vgl. Figur 3). Mit dem Einsatz eines Octa-Sekundärteils 2 in der Verbindungsanordnung ist ein Verdrehen der aufgesteckten, angepassten Abdruckkappe 300 ausgeschlossen.

Figur 10

Veranschaulicht wird die Verbindungsanordnung unter Verwendung eines Octa-Sekundärteils 2 während der Abdrucknahme, wobei schliesslich die Befestigung einer Suprakonstruktion mit Transversalverschraubung vorgesehen ist. Bei der Konstruktion gemäss Figur 9 schraubt man das Gewindesegment 110 des Steckankers 100 direkt in die Gewindebohrung 24 des Octa-Sekundärteils 2. Jetzt hingegen wird zusätzlich ein für die nachfolgend vorgenommene Transversalverschraubung benötigter Schraubenbolzen 200 eingefügt. Der Schraubenbolzen 200 besitzt ein Gewindesegment 210, welches in die Gewindebohrung 24 des Octa-Sekundärteils 2 geschraubt wird. An das Gewindesegment 210 schliesst sich ein Hülsensegment 220 an, welches eine sich axial von oben erstreckende, sacklochförmige Gewindebohrung 221 zur Aufnahme des Gewindesegments 110 des Steckankers 100 aufweist. Am Aussenumfang besitzt das Hülsensegment 220 eine Radialnut 222.

Dieser Schraubenbolzen 200 kann bereits vor der Abdrucknahme eingeschraubt werden. Man benötigt dann allerdings eine spezielle Abdruckkappe 300 mit einer erweiterten Aushöhlung 310, um für den Schraubenbolzen 200 Raum zu

schaffen. Auch ist es möglich, die Abdrucknahme mit der Verbindungsanordnung gemäss Figur 9 - ohne den Schraubenbolzen 200 - vorzunehmen und diesen erst nach Entfernen des Steckankers 100, in Vorbereitung der Transversalverschraubung (siehe Figur 11), einzusetzen.

Figur 11

Gezeigt ist die dem Zahntechniker als Gerüst für den Aufbau einer Suprakonstruktion dienende Kronenkappe 500 mit Transversalverschraubung, vorzugsweise in Form einer Goldkappe. Die Suprakonstruktion, z.B. eine Zahnkrone, wird vor dem Einsetzen in das Gebiss des Patienten auf die Kronenkappe 500 aufgebracht. Vorhanden ist ein Implantat 1, welches mit einem Octa-Sekundärteil 2 bestückt ist, dessen Octasegment 23 die Implantatschulter 14 überragt. Das Octasegment 23 und der aufgeschraubte Schraubenbolzen 200 werden von der Kronenkappe 500 aufgenommen. Letztgenannte besitzt eine Anschlusspartie 502, deren Gegenschulter 501 fugenlos auf der Implantatschulter 14 aufsitzt. An der Innenkante der Gegenschulter 501 ist eine radial umlaufende Ausnehmung 509 vorgesehen. Sollte der Sims 25 des Octa-Sekundärteils 2 über die Implantatschulter 14 hinausragen, wird somit das Anstossen an die Gegenschulter 501 vermieden.

Von der Ausnehmung 509 erstreckt sich ein 24-Innenkant 403 vertikal in die Kronenkappe 500 hinein, der das Octasegment 23 aufnimmt. Durch die Kombination 24-Innenkant 503 und Octasegment 23 ergeben sich für die aufzusetzende Kronenkappe 500 insgesamt 24 mögliche Steckpositionen in jeweils 15°-Stufen. Zugleich dienen die aneinanderliegenden Flanken des 24-Innenkants 503 und des Octasegments 23 als Führung

für die Kronenkappe 500. Weiter aufwärts geht der 24-Innenkant 503 in eine sacklochförmigen Zylinderbohrung 505 über, um das Hülsensegment 220 aufzunehmen.

Seitlich besitzt die Kronenkappe 500 einen kompakten Materialschenkel 510 mit einer abwärts weisenden, durchgängigen und auf die Radialnut 222 gerichteten Gewindebohrung 515. In dieser Gewindebohrung 515 steckt versenkt eine Stiftschraube 516, deren rundliche Spitze 513 tangential auf die obere Randbegrenzung der Radialnut 222 trifft und somit das Aufdrücken der Kronenkappe 500 auf die Implantatschulter 14 bewirkt. Mittels der Stiftschraube 516 ist die Kronenkappe 500 fixiert. Für das Ansetzen eines Eindrehwerkzeuges besitzt die Stiftschraube 516 einen Kopfschlitz 514.

Figur 12

Beginnend mit dieser Figur folgen nun Ausführungsbeispiele der Verbindungsanordnung in Abwärtsposition. In der Aufwärtsposition ist der Steckanker 100 mit seinem Gewindesegment 110 jeweils in einem Octa-Sekundärteil 2 oder in einem Konus-Sekundärteil 8 eingeschraubt und der Klemmkopf 130 aufwärts gerichtet, während die aufzusteckende Abdruck- bzw. Kronenkappe 300, 500 den Klemmkopf 130 in sich aufnimmt. Das Charakteristische der Abwärtsposition hingegen besteht darin, dass eine Umkehrung insoweit vorgesehen ist, als jetzt der abwärts gerichtete Steckanker 100 permanent in der Abdruck- bzw. Kronenkappe 300, 500 sitzt und zum Herstellen der Klemmverbindung in ein speziell, zur Aufnahme des Klemmkopfes 130 gestaltetes Konus-Sekundärteil 8, eingesteckt wird.

Die Verbindungsanordnung zur Abdrucknahme geht zunächst gleichfalls von dem vorhandenen Implantat 1 mit dem Implantatkopf 11, dem Implantatkonus 12, der Gewindebohrung 13 sowie der Implantatschulter 14 aus. Axial in das Implantat 1 eingeschraubt ist ein Konus-Sekundärteil 8, dessen Gewindesegment 82 in die Gewindebohrung 13 eingreift und dessen Basiskonus 81 im Implantatkonus 12 sitzt. Über die Implantatschulter 14 hinaus ragt der Konuspfeiler 83, der oben mit der kreisringförmigen und radial umlaufenden Konuspfeilerschulter 85 abschliesst. Von der Oberseite des Konuspfeilers 83 und damit von der Oberseite des gesamten Konus-Sekundärteils 8 erstreckt sich eine sacklochförmige Zylinderbohrung 805 axial in das Innere, die der Aufnahme des Steckankers 100 dient. Im hiesigen Beispiel weist die Innenwandung 806 einen erhabenen Raststeg 808 auf, welcher die gleiche Funktion und Kontur besitzt, wie der Raststeg 308 aus Figur 2. Auch ist es möglich, anstelle des Raststegs 808, eine zur Rastschulter 307 (siehe Figur 1) identische Kontur vorzusehen oder die Innenwandung 806 durchgängig zu gestalten (siehe Figur 3).

Die Massrelationen innerhalb der Zylinderbohrung 805 sind adäquat zu den Verhältnissen in der Abdruckkappe 300 (siehe Figur 2) ausgelegt. Die Zylinderbohrung 805 besitzt den lichten Bohrungsdurchmesser d_B, der sich im Bereich des Raststeges 808 auf den Raststegdurchmesser d_R verengt. Die Trapezschenkel am Raststeg 808 nehmen auch hier mit der Vertikalachse den Anstiegswinkel α ein.

Unterschiedslos sind die Aussenkonturen der Abdruckkappen 300, unabhängig davon, ob es sich um die Variante der Aufwärts- oder Abwärtsposition handelt, verschieden jedoch sind die Innenkonfigurationen. Die Abdruckkappe 300 für die Abwärtsposition besitzt in identischer Weise zunächst auch eine Anschlusspartie 302 mit der Gegenschulter 301 und eine aufwärts sich verengende Konusbohrung 304 mit dem Gipfeldurchmesser d_G zur Aufnahme des gesamten Konuspfeilers 83. An die Konusbohrung 304 schliesst sich eine engere und relativ flache Zylinderbohrung 311 an, von der aus sich erneut verschmälert, eine sacklochförmige Gewindebohrung 312 axial aufsteigend erstreckt. Die Zylinderbohrung 311 bildet einen formschlüssigen Sitz für das darin partiell befindliche, zylindrische Trägersegment 140 des Steckankers 100. Das Trägersegment 140 bildet ein Zwischenglied; an dessen Oberseite setzt das aufsteigende Gewindesegment 110 an, während sich von der Unterseite das abwärts weisende Schaftsegment 120 erstreckt, an dem zuunterst der Klemmkopf 130 angeformt ist. In die Gewindebohrung 312 greift das Gewindesegment 110 des Steckankers 100 ein, so dass dieser festsitzend mit der Abdruckkappe 300 verbunden ist. Der Klemmkopf 130 besitzt wiederum die Rastflanke 131, Teilungsschlitze 132 mit der Schlitzbreite b_S und der Schlitzlänge l_S und dadurch gebildete Ankerlamellen 133 sowie das geometrische Mass des Klemmkopfdurchmessers d_K. Die Durchmesserverhältnisse ergeben sich dadurch mit

$$d_R < d_K < d_B < d_G.$$

Im Zustand aufgesteckter Abdruckkappe 300 sitzt der Konuspfeiler 83 in der Konusbohrung 304, die Konuspfeilerschulter 85 befindet sich nahe dem Boden der Konusbohrung 304 und das Trägersegment 140 hat sich partiell in die Zylinderbohrung 805 eingeschoben. In die Zylinderbohrung 805 hinein erstrecken sich auch das Schaftsegment 120 mit dem Klemmkopf 130. Der Klemmkopf 130 hat den verengenden Raststeg 808 überwunden, so dass die Rastflanke 131 nun den unteren Trapezschenkel des Raststeges 808 untergreift. Da dieser jedoch feststehend ist, sind die elastischen Ankerlamellen 133 bestrebt, sich vom Raststeg 808 abzustossen und ziehen dadurch die mit dem Steckanker 100 verbundene Abdruckkappe 300 abwärts. Im Ergebnis dessen wird die Abdruckkappe 300 auf das Implantat 1 gedrückt und die Gegenschulter 301 sitzt fugenlos auf der Implantatschulter 14. Für das Herstellen der Steckverbindung ist die Steckkraft F_S erforderlich; will man die Verbindung trennen, ist die Trennkraft F_T aufzubringen.

Figur 13

Die Veränderungen gegenüber der vorherigen Figur beziehen sich auf ein modifiziertes Konus-Sekundärteil 8, die Breite der auf die Implantatschulter 14 aufsetzenden Gegenschulter 301 sowie die Fixierung des Steckankers 100 in der Abdruckkappe 300. Das Gewindesegment 110 des Steckankers 100 und die in der Abdruckkappe 300 zum Einschrauben vorgesehene Gewindebohrung 312 werden nun durch einen Steckstift 150 am Steckanker 100 und eine, einen Presssitz bildende Zylinderbohrung 322 in der Abdruckkappe 300 ersetzt. Der in die Zylinderbohrung 322 eingeführte Steckstift 150 wird durch die

Klemmwirkung des Presssitzes in der Abdruckkappe 300 gehalten.

Der Konuspfeiler 83 des Konus-Sekundärteils 8 besitzt hier ebenfalls die unterseitige, radial umlaufende Schulterpartie 86, die direkt auf die Implantatschulter 14 aufsetzt. Die Gegenschulter 301 der Abdruckkappe 300 ist in ihrer Breite reduziert, damit auch die Schulterpartie 86 auf der Implantatschulter 14 aufsetzen kann (siehe Figur 4). Ferner ist am Konuspfeiler 83 eine äusserlich umlaufende Radialnut 809 vorgesehen, die erst der späteren Transversalverschraubung dient. Am oberen Abschluss des Basiskonus 81 - unmittelbar unter dem Ansatz des Konuspfeilers 83 und noch vom Implantatkopf 11 umgeben - ist eine weitere Radialnut 810 eingearbeitet. Diese Radialnut 810 dient der Aufnahme eines Klemmringes 900, welcher die Funktion der Zentrierung des Konus-Sekundärteils 8 - ähnlich der Zentrierhülse 9 (siehe Figur 4) - hat. Zudem wirkt der Klemmring 900 zugleich als Rotationssicherung; das Herausschrauben des Konus-Sekundärteils 8 aus dem Implantat 1 wird erschwert. Anstatt des Klemmrings 900 wäre auch die Zentrierhülse 9 einsetzbar, sofern man die Kontur des Basiskonus 81 entsprechend reduziert.

Figur 14

Diese Ausführungsform der Verbindungsanordnung zur Abdrucknahme stellt gegenüber der Vorgängervariante insofern eine Erweiterung dar, als dass die Zylinderbohrung 805 im Konuspfeiler 83 des Konus-Sekundärteils 8 partiell mit einen Innengewinde 811 versehen ist. Das Innengewinde 811 erstreckt sich vom Raststeg 808 aufwärts bis in Höhe einer

von der Konuspfeilerschulter 85 abwärts verlaufenden zylindrischen Ansenkung 812. Gegenüber der Zylinderbohrung 805 ist die Ansenkung 812 vergrössert, in welche im zusammengesteckten Zustand das Trägersegment 140 partiell eingeschoben wird. Wie die Radialnut 809 ist auch das Innengewinde 811 für die Abdrucknahme zunächst ohne Funktion. Erst für die transversale bzw. okklusale Verschraubung der auf das mit dem Konus-Sekundärteil 8 bestückte Implantat 1 aufgesetzten Suprakonstruktion wird die Radialnut 809 oder das Innengewinde 811 von einer Schraube genutzt. Die Gewindespitzen des Innengewindes 811 sind abgeflacht, so dass die Ankerlamellen 133 des Klemmkopfes 130, und in gewisser Hinsicht auch das Innengewinde 811 selbst, beim Einschieben bzw. Ausziehen des Steckankers 100 geschont werden.

Figur 15

Vorgestellt wird eine konstruktive Modifikation der Verbindungsanordnung zum Zweck der Abdrucknahme an extrem divergent gesetzten Implantaten 1. Gegenüber der Vorgängervariante sind die Aufnahme des Steckankers 100 in der Abdruckkappe 300 sowie der Steckanker 100 selbst verändert, der hier seitlich auslenkbar gelagert ist. Die Konusbohrung 304 und/oder der Konuspfeiler 83 des Konus-Sekundärteils 8 müssen so bemessen sein, dass im Zustand aufgesteckter Abdruckkappe 300 zwischen der Innenwandung 306 und dem Konuspfeiler 83 ein Spalt für den Vorgang des Abziehens der Abdruckkappe 300 vorhanden ist. Von der Deckfläche der Abdruckkappe 300 erstreckt sich eine axiale Gewindebohrung 330, die sich als Zylinderbohrung 332 bis zu einer verengenden Gelenkpfanne 333 fortsetzt. Von der Gelenkpfanne

333 zur Konusbohrung 304 verläuft eine zylindrische Durchbruchsbohrung 334.

Der Steckanker 100 besitzt den Klemmkopf 130, das sich daran anschliessende Schaftsegment 120 und - nunmehr neu - eine andererseits am Schaftsegment 120, dem Klemmkopf 130 diametral gegenüberliegend, angeordnete Gelenkkugel 160. Die Gelenkkugel 160 befindet sich in der Zylinderbohrung 332 und wird dabei von einem über der Gelenkkugel 160 ebenfalls in der Zylinderbohrung 332 angeordneten Distanzsegment 340 spielfrei auf der Gelenkpfanne 333 gehalten. Auf der der Gelenkkugel 160 zugewandten Seite besitzt das Distanzsegment 340 eine kegelige Ansenkung 341. Von einer in die Gewindebohrung 330 eingedrehten Schraube 350 erhält das Distanzsegment 340 einen gewissen Druck in Richtung der Gelenkkugel 160. Das Schaftsegment 120 durchdringt die grössere Durchbruchsbohrung 334, so dass eine baulich begrenzte, seitliche Auslenkung des Steckankers 100 möglich ist. Das Distanzsegment 340 und die Schraube 350 werden vorzugsweise aus Kunststoff gefertigt.

Zum Steckanker 100 mit der unmittelbar an das Schaftsegment 120 angesetzten Gelenkkugel 160 ist eine abgewandelte Alternativlösung möglich. Man verwendet einen Steckanker 100 mit einem sich an das Schaftsegment 120 anschliessenden Gewindesegment 110 (siehe Figur 1), welches in eine Gelenkkugel 160, die eine komplementäre Gewindebohrung besitzt, eingeschraubt wird. Die Verbindungsanordnung gemäss Figur 15 kann anstelle des zur Zentrierung in die Radialnut 810 eingesetzten Klemmrings 900 auch mit der Zentrierhülse 9 (siehe Figur 4) ausgestattet werden.

Nachfolgend wird die Funktion dieser speziellen Verbindungsanordnung beschrieben. Angenommen, eine Abdrucknahme am Kiefer mit zwei stark divergent gesetzten Implantaten 1 ist durchzuführen. Zuerst steckt man jeweils eine Abdruckkappe 300 mit dem seitlich auslenkbaren Steckanker 100 auf die Implantate 1. Die Klemmköpfe 130 gleiten unter die Raststege 808, wodurch die Abdruckkappen 300 auf den Implantaten 1 fixiert sind; die Gegenschultern 302 sitzen fugenlos auf den Implantatschultern 14. Entsprechend der Divergenz der eingesetzten Implantate 1 sind auch die Abdruckkappen 300 divergent zueinander positioniert. Nun drückt man den mit Abdruckmasse 5 gefüllten Abdrucklöffel 6 auf den Kiefer auf, wobei die zueinander schräg stehenden Abdruckkappen 300 so ausgerichtet in der Abdruckmasse 5 eingebettet werden (vgl. Figur 0.a). Nach Aushärtung der Abdruckmasse 5 wird der Abdrucklöffel 6 abgehoben. Während des Abhebens fahren die Schaftsegmente 120 und Klemmköpfe 130 der Steckanker 100 aus den Zylinderbohrungen 805, nachdem zuerst die Klemmköpfe 130 die Raststege 808 überwunden haben. Mit fortschreitendem Abheben des Abdrucklöffels 6 erfahren die beweglichen Steckanker 100 eine Auslenkung, um die divergente Ausgangsposition zu kompensieren.

Figur 16

Dargestellt ist die Verbindungsanordnung in Abwärtsposition nach der Abdrucknahme (vgl. Figur 0.c). Die Abdruckkappe 300 ist im Abdrucklöffel 6 mit der erhärteten Abdruckmasse 5 eingebettet und das Manipulierimplantat 7, welches eine zum Implantatkopf 1 analoge Aussengeometrie besitzt, ist mit der Abdruckkappe 300 bereits zusammengesteckt. Auf

diese Weise hat man die Situation an der betreffenden Kieferpartie, in Form eines Abdrucks Ab als Negativabbild mit dem das originale Implantat 1 ersetzenden Manipulierimplantat 7 erhalten. Es folgt nun die Herstellung des Meistermodells. Auch während dieser Arbeitsphase wird die erfindungsgemässe Verbindungsanordnung nutzbringend verwendet.

Die Abdruckkappe 300 weist in ihrem Innern den axial und abwärts positionierten Steckanker 100 auf. Auf den Kopf 71 des Manipulierimplantats 7 ist eine Steckaufnahme 700 aufgesetzt. Vorzugsweise sind das Manipulierimplantat 7 und die Steckaufnahme 700 einstückig gestaltet. Somit entspricht die Aussenkontur des Manipulierimplantats 7 mit der Steckaufnahme 700 der Kombination aus Implantat 1 und Sekundärteil - hier Konus-Sekundärteil 8. Analog zu dem als Gegenstück der Verbindungsanordnung fungierenden Konus-Sekundärteil 8 ist die Steckaufnahme 700 beschaffen (vgl. Figur 12). So besitzt die Steckaufnahme 700 einen zur in der Abdruckkappe 300 vorhandenen Konusbohrung 304 komplementären Konuspfeiler 783, der äusserlich über die Implantatschulter 774 zum Manipulierimplantat 7 übergeht. Oberseitig schliesst die Steckaufnahme 700 mit der Konuspfeilerschulter 785 ab. Ferner besitzt die Steckaufnahme 700 eine sich axial und vertikal erstreckende, sacklochförmige Zylinderbohrung 705 mit der Innenwandung 706, an der der erhabene Raststeg 708 radial umläuft.

Im zusammengesteckten Zustand sitzt die Gegenschulter 301 der Abdruckkappe 300 fugenlos auf der Implantatschulter 774. Der Konuspfeiler 783 der Steckaufnahme 700 ist in die

in der Abdruckkappe 300 befindlichen Konusbohrung 304 eingeschoben, so dass die Konuspfeilerschulter 785 nahe dem obenliegenden Grund der Konusbohrung 304 steht. In die Zylinderbohrung 705 sind partiell das Trägersegment 140 des Steckankers 100 sowie gänzlich dessen Schaftsegment 120 und Klemmkopf 130 eingeschoben. Der Klemmkopf 130 überfährt beim Verbinden von Manipulierimplantat 7 und Abdruckkappe 300 den Raststeg 708, wird dabei zusammengedrückt und spreizt sich hinter dem Raststeg 708 wieder, so dass die Rastflanke 131 unter dem Raststeg 708 arretiert ist. Bei Verbindungsanordnungen in Abwärtsposition kann man mit Vorteil für die Befestigung an Octa- und Konus-Sekundärteilen 2, 8 ein Innengewinde 811 vorsehen. Für die Steckaufnahmen 700 an Manipulierimplantaten 7 hingegen ist eine Zylinderbohrung 705 ausreichend. Ebenfalls genügt es, die geometrischen Relationen derart zu bemessen, das sich die für die Abdrucknahme ausreichende Steckkraft F_S bzw. Trennkraft F_T einstellt. Nach dem Giessen des Meistermodells, unter Verwendung des vorhandenen Abdrucks Ab mit dem angesteckten Manipulierimplantat 7, kann die Steckverbindung zwischen der Abdruckkappe 300 und dem Manipulierimplantat 7 auf einfache Weise wieder gelöst werden. Das so gewonnene Meistermodell dient als positives Abbild der Originalsituation aus dem Mund des Patienten der nachfolgenden Erstellung der Suprakonstruktion.

Die folgenden Figuren 17 bis 20 zeigen verschiedene, zuvor beschriebene Ausführungen der Verbindungsanordnung in Abwärtsposition, die nun zur Befestigung einer Einzelkrone Zk verwendet werden.

Figur 17

Diese Ausführung stellt eine konstruktive Umkehr zur Verbindungsanordnung der Figur 8 mit Benutzung eines als Steckaufnahme dienenden Konus-Sekundärteils 8 aus Figur 12 dar. Entsprechend besteht die Anordnung nach Figur 17 aus dem Implantat 1, dem Konus-Sekundärteil 8 mit dem als Steckaufnahme ausgebildeten Konuspfeiler 83 sowie einer Kronenkappe 500. Auf gleiche Weise wie in der Abdruckkappe 300 gemäss Figur 12 ist der Steckanker 100 beschaffen und im Innern der Kronenkappe 500 angeordnet.

Da es sich um die Befestigung einer Zahnkrone Zk handelt, wird man dafür sorgen, dass die zum Abziehen der Zahnkrone Zk erforderliche Trennkraft F_T' deutlich grösser bemessen ist, als die Trennkraft F_T bei einer Abdrucknahme. Im hiesigen Beispiel wird die erhöhte Trennkraft F_T' dadurch eingestellt, indem man den Raststegdurchmesser auf den Wert d_R' verengt. Dies bedeutet, man benötigt für die Abdrucknahme und für die Zahnkronenbefestigung unterschiedliche Konus-Sekundärteile 8. Eine alternative Möglichkeit, differenzierte Trennkräfte F_T bzw. F_T' für beide Aufgaben vorzusehen, besteht darin, verschiedene Steckanker 100 einzusetzen, d.h. die Geometrie oder die Werkstoffeigenschaften zu ändern.

Steckt man die Zahnkrone Zk auf das Implantat 1, so fährt die Anschlusspartie 502 der Kronenkappe 500 über den Konuspfeiler 83 bis die Gegenschulter 501 fugenlos auf der

Implantatschulter 14 sitzt. Synchron durchfährt der Klemmkopf 130 die Zylinderbohrung 805 und springt schliesslich unter den Raststeg 808. Hierzu muss man die Steckkraft F_S' aufbringen. Es ist einfacher zu realisieren und nichts spricht dagegen, bei einer erhöhten Trennkraft F_T' auch eine erhöhte Steckkraft F_S' einzustellen. Ist die Steckverbindung zwischen Zahnkrone Zk und Implantat 1, z.B. für eine Reinigung, zu lösen, muss man den Klemmkopf 130 unter Aufwendung der grösseren Trennkraft F_T' über das Hindernis des Raststeges 808 ziehen.

Figur 18

Für diese Verbindungsanordnung, ebenfalls ein Konstruktionsbeispiel zur Befestigung einer einzelnen Zahnkrone Zk, werden ein Konus-Sekundärteil 8 gemäss Figur 13 sowie eine Kronenkappe 500 mit Transversalverschraubung, in abgewandelter Form zur Figur 11, benutzt. In das Implantat 1 ist ein Konus-Sekundärteil 8 eingesetzt, welches eine auf der Implantatschulter 14 aufliegende Schulterpartie 86, eine Radialnut 810 im Basiskonus 81 zur Aufnahme eines Klemmringes 900 sowie eine Radialnut 809 zum Ansatz der Spitze 513 einer Stiftschraube 516 für die transversale Verschraubung besitzt. Die Zahnkrone Zk besteht aus der gerüstbildenden Kronenkappe 500 mit der Transversalverschraubung, dem die Kronenkappe 500 weitgehend verkleidenden Goldanguss Go sowie letzteren abdeckendem Porzellanüberzug Po.

Der mit seinem Klemmkopf 130 nach unten gerichtete Steckanker 100 sitzt mit dem haltenden Steckstift 150 in der als

Presssitz wirkenden Zylinderbohrung 522, und das sich an den Steckstift 150 anschliessende Trägersegment 140 sitzt mit seinem oberen Teil in der sich koaxial und unten an die Zylinderbohrung 522 anschliessenden Zylinderbohrung 511. Vom Trägersegment 140 erstreckt sich abwärts das Schaftsegment 120 mit dem zuunterst angeordneten Klemmkopf 130. Die Kronenkappe 500 selbst besteht aus dem Kappengehäuse mit der sich an die Zylinderbohrung 511 koaxial anschliessenden, von letzterer erweitert beginnenden und abwärts sich öffnenden Konusbohrung 504. Seitlich weist die Kronenkappe 500 einen kompakten, verdickten Materialschenkel 510 auf, in dem eine abwärts weisende, durchgängige und auf die im Konuspfeiler 83 vorgesehene Radialnut 809 gerichtete Gewindebohrung 515 vorhanden ist. In der Gewindebohrung 515 ist eine Stiftschraube 516 positioniert, deren rundliche Spitze 513 tangential auf die obere Randbegrenzung der Radialnut 809 trifft, sich davon abstösst und somit das Aufdrücken der Kronenkappe 500 auf die Implantatschulter 14 bewirkt. Mit einem Schraubwerkzeug kann man in den Kopfschlitz 514 der Stiftschraube 516 zur Justierung eingreifen.

Ist die Zahnkrone Zk auf das Implantat 1 aufgesteckt und die Transversalverschraubung erfolgt, so hat man eine zusätzlich gesicherte Fixierung der Zahnkrone Zk auf dem Implantat 1 erreicht. Beim Aufstecken der Zahnkrone Zk kommt zunächst die Schnappverbindung zwischen dem Klemmkopf 130 und dem Konuspfeiler 83 zustande; die Rastflanke 131 ist unter den Raststeg 808 gesprungen. Wird dann die Stiftschraube 516 soweit in die Gewindebohrung 515 eingedreht, dass die Spitze 513 der Stiftschraube 516 in die Radialnut 809 eindringt und gegen die Oberkante der Radialnut 809

stösst, tritt die sichernde Wirkung der Transversalverschraubung ein. Durch das laterale Aufeinandertreffen von Stiftschraube 516 und Konuspfeiler 83 wird die gesamte Kronenkappe 500 mit der aufgebrachten Zahnkrone Zk in Richtung des Implantats 1 gedrückt. Die Gegenschulter 501 sitzt fugenlos auf der Implantatschulter 14.

Die Kronenkappe 500 mit ihrer Konusbohrung 504 erhält ihre Führung an der konischen Aussenkontur des Konuspfeilers 83. Eine Zentrierung der gesamten Verbindungsanordnung bewirken ferner der Klemmring 900 sowie das formschlüssig einerseits in der Zylinderbohrung 511 sitzende und andererseits in der Zylinderbohrung 805 gehaltene Trägersegment 140. Einem etwaigen Verkanten der Kronenkappe 500, hervorgerufen durch die Kraftwirkung der Stiftschraube 516, stellt sich das Trägersegment 140 entgegen. Die präzise Zentrierung der gerüstbildenden Kronenkappe 500 und der von dieser getragenen Zahnkrone Zk kann somit durch die Transversalverschraubung nicht beeinträchtigt werden. Ist es notwendig, die Zahnkrone Zk abzunehmen, muss man als erstes die Stiftschraube 516 und darauf die Schnappverbindung unter Aufbringen der Trennkraft F_T' lösen. Angesichts der zusätzlichen Sicherung durch die Transversalverschraubung ist es hier jedoch nicht zwingend erforderlich, die vorbeschrieben Vorkehrungen zu treffen, um die gegenüber F_T erhöhte Trennkraft F_T' einzustellen.

Figur 19

Im Unterschied zur Figur 18 - ansonsten stimmen die Konstruktionen völlig überein - findet hier eine standard-

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gemässe Kronenkappe 500 ohne die zusätzliche Transversalverschraubung Verwendung und im Innern des Konuspfeilers 83 ist dem Raststeg 808 vorgelagert, ein Innengewinde 811 angebracht (vgl. Figur 14). Die Fixierung der Zahnkrone Zk auf dem Implantat 1 wird jetzt nur durch die Steckverbindung zwischen dem Steckanker 100 und dem Raststeg 808 im Innern des Konus-Sekundärteils 8 bewirkt. Die Radialnut 809 sowie das Innengewinde 811 besitzen momentan keine Funktion, d.h., sie werden im hiesigen Beispiel nicht genutzt. Angesichts der stärkeren Belastung der Steckverbindung bei der Befestigung einer Zahnkrone Zk - gegenüber einer weniger belasteten Abdruckkappe 300 -, muss man die erhöhte Trennkraft F_T' einstellen. Die hierzu in Betracht kommenden Möglichkeiten wurden bereits erläutert. Besonders bietet sich an, einen Steckanker 100 mit - im Verhältnis zur Abdrucknahme - vergrössertem Klemmkopf 130 dafür einzusetzen. Da die Steckanker 100 mit den Kronenkappen 500 im Presssitz zwischen dem Steckstift 150 und der Zylinderbohrung 522 fest verbunden sind, ist jegliche Verwechslungsgefahr ausgeschlossen.

Figur 20

Die Zahnkrone Zk ist mit dem in das Implantat 1 eingesetzten Konus-Sekundärteil 8 okklusal verschraubt; der Steckanker 100 entfällt nun völlig. Zusätzlich benötigt man hier eine Okklusalschraube 400, in Form einer Kopfschraube, sowie eine Zugangsbohrung Zu durch den aufmodellierten Zahn Za zur Kronenkappe 500 und eine Ansenkung 530 auf der Oberseite der Kronenkappe 500. Verwendet wird wiederum eine standardgemässe Kronenkappe 500, die mit dem aufgebrachten Goldanguss Go und Porzellanüberzug Po zur Zahnkrone Zk

aufgebaut wurde. Von der Kaufläche der Zahnkrone Zk her verläuft die vertikale Zugangsbohrung Zu durch alle Schichten des auf die Kronenkappe 500 aufmodellierten Zahnes Za hindurch. Diese Zugangsbohrung Zu wird für das Einführen und auch für das eventuell notwendige Herausnehmen der Okklusalschraube 400 aus der Zahnkrone Zk benötigt. Ist die Verschraubung hergestellt, verschliesst man die Zugangsbohrung Zu mit einer entsprechenden Masse.

Die auf der Oberseite der Kronenkappe 500 vorgesehene Ansenkung 530 dient zur Aufnahme und als Sitz für den Kopf 420 der Okklusalschraube 400. Das Gewindesegment 410 der Okklusalschraube 400 durchdringt die in der Decke der Kronenkappe 500 befindliche Zylinderbohrung 522 und greift in das Innengewinde 811, welches zu diesem Zweck im Konuspfeiler 83 vorgesehen ist, ein. Zum Ansetzen eines Schraubwerkzeuges besitzt der Kopf 420 eine Eingriffskontur 421 in Form eines Schlitzes, eines Kreuzschlitzes oder eines Mehrfachinnenkants. Ohne Funktion sind bei dieser Verbindungsart der Raststeg 808, die Radialnut 809 und die Ansenkung 812, so dass diese entfallen könnten. Nicht zwingend nötig, aber der Zentrierung des Konus-Sekundärteils 8 förderlich, ist der in die Radialnut 810 eingesetzte Klemmring 900.

Das Problem der Steck- bzw. Trennkräfte F_S, F_S'; F_T, F_T' stellt sich hier naturgemäss nicht. Die Steckverbindung, welche den wesentlichen Erfindungsgegenstand verkörpert, ist in der soeben dargestellten Befestigung einer Zahnkrone Zk allein durch Okklusalverschraubung nur elementweise enthalten. Dennoch umfasst die Erfindung auch diese Verbin-

dungsart, da in den vorangehenden Arbeitsphasen - z.B. Abdrucknahme und Herstellung des Meistermodells - ein vollständiger Satz der alternativ zur Verfügung stehenden Verbindungselemente genutzt wird und man für die letztendliche Kronenbefestigung noch einen Teil der zuvor verwendeten Verbindungselemente beibehält. Das wird auch aus der nun zu behandelnden Figurenfolge 21a bis 32e sichtbar.

Figuren 21a bis 32e

Die Figurenfolge bezweckt, die einzelnen, aneinander anschliessenden Arbeitsphasen, in denen die erfindungsgemässe Verbindungsanordnung durch den Zahnarzt und den Zahntechniker effizient eingesetzt werden kann, nochmals in einem Gesamtüberblick zu veranschaulichen. Aus der Darstellung geht zugleich der Systemcharakter der Elemente der Verbindungsanordnung hervor, was sich in den vielfältigen konstruktiven Modifikationen, der variablen Einsetzbarkeit und der Kombinationsfähigkeit der Elemente zeigt. Im Interesse der Übersicht sind alle Verbindungsanordnungen nur in der Aufwärtsposition wiedergegeben; selbstverständlich sind auch die analogen Umkehrungen als Abwärtsposition realisierbar.

Die Figuren 21a bis 24e befassen sich dabei mit der Phase der Abdrucknahme, um die Mundsituation im Bereich eines eingesetzten Implantats 1 geometrisch zu erfassen. Ausgangsstadium ist hierbei jeweils der Mundbereich mit dem im Kieferknochen K eingesetzten Implantat 1 (Bilder a). Endstadium ist der auf die aufgesteckte Abdruckkappe 300 auf-

gedrückte, mit Abdruckmasse 5 gefüllte Abdrucklöffel 6 (Bilder e).

Die Figuren 25a bis 28e enthalten Beispiele zur Herstellung von Meistermodellen Mo und Zahnkronen Zk, die schliesslich im Mund des Patienten fixiert sind, wobei man Konus-Sekundärteile 8 einsetzt. Ausgangsstadium ist das Ansetzen des Manipulierimplantats 7 an den Abdruck Ab (Bilder a). Das Endstadium bildet die auf dem im Mund des Patnienten eingesetzten Implantat 1 befestigte fertige Zahnkrone Zk (Bilder e).

Die Figuren 29a bis 32e zeigen weitere Beispiele zur Herstellung von Meistermodellen Mo und Zahnkronen Zk sowie die Befestigung der letztgenannten im Mund des Patienten. Hier werden sowohl Octa-Sekundärteile 2 als auch Konus-Sekundärteile 8 eingesetzt. Ausgangsstadium ist der bereits abgenommene Abdruck Ab (Bilder a) und Endstadium die im Mund auf dem Implantat 1 befestigte Zahnkrone Zk (Bilder e). Nachstehend werden die Wesensinhalte der einzelnen Figuren mit den jeweiligen Detailbildern schematisch wie folgt aufgelistet:

Figur 21

Bild a: Implantat 1 im Kieferknochen K eingesetzt;
Bild b: axialsymmetrisches Konus-Sekundärteil 8 mit verkleinertem Basiskonus 81 sowie die Zentrierhülse 9 werden in das Implantat 1 eingeschraubt;
Bild c: Steckanker 100 wird in das Konus-Sekundärteil 8 eingesetzt und Abdruckkappe 300 aufgesteckt;
Bild d: Abdruckkappe 300 ist aufgesteckt;
Bild e: Abdrucknahme, d.h. mit Abdruckmasse 5 gefüllter Abdrucklöffel 6 ist aufgedrückt;

Figur 22

Bild a: Implantat 1 im Kieferknochen K eingesetzt;
Bild b: abgewinkeltes Konus-Sekundärteil 8 und Zentrierhülse 9 werden in das Implantat 1 eingeschraubt;
Bild c: Steckanker 100 wird in das Konus-Sekundärteil 8 eingesetzt;
Bild d: abgeschrägte Abdruckkappe 300 wird aufgesteckt;
Bild e: Abdrucknahme, d.h. mit Abdruckmasse 5 gefüllter Abdrucklöffel 6 ist aufgedrückt;

Figur 23
Bild a: Implantat 1 im Kieferknochen K eingesetzt;
Bild b: Octa-Sekundärteil 2 mit bereits eingeschraubtem Steckanker 100 wird in das Implantat 1 eingeschraubt;
Bild c: Abdruckkappe 300 mit zum Octasegment 23 komplementärer Anschlusspartie 302 wird aufgesteckt;
Bild d: Abdruckkappe 300 ist aufgesteckt;
Bild e: Abdrucknahme, d.h. mit Abdruckmasse 5 gefüllter Abdrucklöffel 6 ist aufgedrückt;

Figur 24
Bild a: Implantat 1 im Kieferknochen K eingesetzt;
Bild b: axialsymmetrisches Konus-Sekundärteil 8 mit Radialnut 809 für eventuell spätere Transversalverschraubung und mit verkleinertem Basiskonus 81 sowie die Zentrierhülse 9 werden in das Implantat 1 eingeschraubt;
Bild c: Steckanker 100 wird in das Konus-Sekundärteil 8 eingesetzt;
Bild d: Abdruckkappe 300 mit zum Konuspfeiler 83 komplementärer Anschlusspartie 302 wird aufgesteckt;
Bild e: Abdrucknahme, d.h. mit Abdruckmasse 5 gefüllter Abdrucklöffel 6 ist aufgedrückt;

Figur 25
Bild a: Steckanker 100 wird in den Konuspfeiler 783 des ein- oder zweiteiligen Manipulierimplantats 7 eingeschraubt und zusammen in den Abdruck Ab, d.h. in die darin eingebettete Abdruckkappe 300 mit der komplementären Anschlusspartie 302 eingesteckt;
Bild b: Manipulierimplantat 7 und Abdruck Ab sind verbunden;
Bild c: auf das Meistermodell Mo wird die standardgemässe Kronenkappe 500 mit der Ansenkung 530 und

Zylinderbohrung 522 für das spätere Einsetzen der Okklusalschraube 400 aufgesetzt;

Bild d: auf dem Meistermodell Mo sitzend ist die Kronenkappe 500 mit der Okklusalschraube 400 verschraubt, die Herstellung der Zahnkrone Zk kann beginnen;

Bild e: die fertige Zahnkrone Zk ist auf dem Implantat 1 sitzend mit der Okklusalschraube 400 verschraubt;

Figur 26

Bild a: Steckanker 100 wird in den abgewinkelten Konuspfeiler 83 bzw. 783 des ein- oder zweiteiligen Manipulierimplantats 7 eingeschraubt und zusammen in den Abdruck Ab, d.h. in die darin eingebettete abgeschrägte Abdruckkappe 300 mit der komplementären Anschlusspartie 302 eingesteckt;

Bild b: Manipulierimplantat 7 und Abdruck Ab sind verbunden;

Bild c: auf das Meistermodell Mo wird die abgeschrägte Kronenkappe 500 mit der Ansenkung 530 und Zylinderbohrung 522 für das spätere Einsetzen der Okklusalschraube 400 aufgesetzt;

Bild d: auf dem Meistermodell Mo sitzend, ist die abgeschrägte Kronenkappe 500 mit der Okklusalschraube 400 verschraubt und die Herstellung der Zahnkrone Zk kann beginnen;

Bild e: die fertige, zum Implantat 1 schrägstehende Zahnkrone Zk ist auf diesem sitzend mit der Okklusalschraube 400 verschraubt;

Figur 27

Bild a: identisch zu Figur 25, Bild a;

Bild b: identisch zu Figur 25, Bild b;

Bild c: eine standardgemässe Kronenkappe 500 wird auf den aus dem Meistermodell Mo herausragenden Konuspfeiler 83 bzw. 783 aufgesetzt;

Bild d: die Kronenkappe 500 sitzt auf dem Konuspfeiler 83 bzw. 783 und die Herstellung der Zahnkrone Zk kann beginnen;

Bild e: die fertige Zahnkrone Zk ist auf dem Implantat 1 sitzend festzementiert;

Figur 28

Bild a: identisch zu Figur 26, Bild a;

Bild b: identisch zu Figur 26, Bild b;
Bild c: auf das Meistermodell Mo wird die abgeschrägte Kronenkappe 500 aufgesetzt;
Bild d: die abgeschrägte Kronenkappe 500 ist auf das Meistermodell Mo aufgesteckt und die Herstellung der Zahnkrone Zk kann beginnen;
Bild e: die fertige, zum Implantat 1 schrägstehende Zahnkrone Zk ist auf diesem sitzend festzementiert;

Figur 29
Bild a: als Abdruck Ab liegt eine im Abdrucklöffel 6 eingebettete Abdruckkappe 300 mit einem 24-Innenkant in der Anschlusspartie 302 vor;
Bild b: fest im Octasegment 23 bzw. 73 des Manipulierimplantats 7 sitzt der Steckanker 100 und ist so in den Abdruck Ab eingeführt;
Bild c: auf das Meistermodell Mo mit dem herausragenden Octasegment 23 bzw. 73 und dem Steckanker 100 wird eine Kronenkappe 500 mit einem inneren Raststeg 508 und einem 24-Innenkant 503 aufgesteckt;
Bild d: die Kronenkappe 500 ist auf das Meistermodell Mo aufgesteckt und die Herstellung der Zahnkrone Zk kann beginnen;
Bild e: die fertige Zahnkrone Zk ist mit dem Steckanker 100 auf dem Implantat 1 befestigt;

Figur 30
Bild a: als Abdruck Ab liegt eine im Abdrucklöffel 6 eingebettete Abdruckkappe 300 mit einer Konusbohrung 304 in der Anschlusspartie 302 vor;
Bild b: fest im Konuspfeiler 83 bzw. 783 des Manipulierimplantats 7, der eine Radialnut 809 für eine eventuell spätere Transversalverschraubung aufweist, sitzt der Steckanker 100 und ist so in den Abdruck Ab eingeführt;
Bild c: auf das Meistermodell Mo mit dem herausragenden Konuspfeiler 83 bzw. 783 und dem Steckanker 100 wird eine Kronenkappe 500 mit einem inneren Raststeg 508 und einer Konusbohrung 504 aufgesteckt;
Bild d: die Kronenkappe 500 ist auf das Meistermodell Mo aufgesteckt und die Herstellung der Zahnkrone Zk kann beginnen;

Bild e: die fertige Zahnkrone Zk ist mit dem Steckanker 100 auf dem Implantat 1 befestigt;

Figur 31

Bild a: identisch zu Figur 30, Bild a;
Bild b: identisch zu Figur 30, Bild b;
Bild c: auf den aus dem Meistermodell Mo herausragenden Konuspfeiler 83 bzw. 783 wird eine Kronenkappe 500 mit dem angesetzten Materialschenkel 510 für die Transversalverschraubung aufgesetzt;
Bild d: die Kronenkappe 500 ist auf das Meistermodell Mo aufgesteckt und mit der Stiftschraube 516 transversal verschraubt; so kann die Herstellung der Zahnkrone Zk beginnen;
Bild e: die fertige Zahnkrone Zk ist auf dem Implantat 1 durch die transversal eingreifende Stiftschraube 516 befestigt;

Figur 32

Bild a: identisch zu Figur 29, Bild a;
Bild b: identisch zu Figur 29, Bild b;
Bild c: identisch zu Figur 29, Bild c, jedoch mit einer andersartigen Kronenkappe 500, die zur Herstellung einer provisorischen Zahnkrone Zk vorgesehen ist;
Bild d: die Kronenkappe 500 ist auf das Meistermodell Mo aufgesteckt und die Herstellung der provisorischen Zahnkrone Zk kann beginnen;
Bild e: die provisorische Zahnkrone Zk ist mit dem Steckanker 100 auf dem Implantat 1 befestigt.

Zu den vorbeschriebenen konstruktiven Modifikationen an den Elementen der Verbindungsanordnung und zu den bisher aufgezeigten Kombinationsmöglichkeiten sind weitere Variationen hinsichtlich der Gestaltung sowie der Austauschbarkeit realisierbar. Hier ausdrücklich erwähnt seien noch:

- unabhängig von der Aufwärts- oder Abwärtsposition des vorgesehenen Steckankers 100 können die Manipulierimplantate 7 in ihrem Kopf 71 den Konuspfeiler 83, 783 oder das Octasegment 73, 23 als fest integrierte Bestandteile bereits beinhalten oder diese Bestandteile sind einfügbar;

- zum Einrasten für den Klemmkopf 130 könnte anstelle einer Rastschulter 307 oder eines Raststeges 308, 508, 708 auch eine Rastmulde in die entsprechende Innenwandung eingearbeitet sein;
- der Steckanker 100 könnte mit dem Sekundärteil 2, 8, der Abdruckkappe 300, der Kronenkappe 500 oder dem Manipulierimplantat 7 ein Stück bilden bzw. in oder an diesen Teilen auch durch Kleben, Löten oder formschlüssige Verbindung befestigt sein;
- ebenfalls ist es möglich, den Klemmkopf 130 aus elastischem Vollmaterial herzustellen;
- anstelle des Octa-Sekundärteils 2 mit seinem achtkantigen Octasegment 23 und der komplementären Kontur als 24-Innenkant 403 in der Anschlusspartie 302, 502 der Abdruckkappe 300 bzw. Kronenkappe 500 kann man auch andere nicht kreisrunde Geometrien, z.B. einen Sechskant, zur Rotationssicherung einarbeiten; derartige Rotationssicherungen sind an Konus-Sekundärteilen 8 ebenfalls anbringbar;
- in den Sekundärteilen 2, 8 kann man zugleich eine Gewindebohrung 24, 84, einen sich daran anschliessenden Raststeg 808 bzw. die äquivalenten Konturen und einen sich daran anschliessenden, sacklochförmig endenden Abschnitt einer Zylinderbohrung 805 vorsehen, so dass wahlweise das Gewindesegment 110 oder der Klemmkopf 130 des Steckankers 100 oder eine Okklusalschraube 400 einsetzbar ist;
- das Trägersegment 140 sowie die damit in Eingriff kommende obere Partie der Innenwandung 706, 806 können mit gegenseitig komplementären Rillungen versehen sein, um eine Positionierung zu ermöglichen;

- die erfindungsgemässe Verbindungsanordnung ist nicht nur bei der dargestellten Implantatform anwendbar, sondern bei allen möglichen Konfigurationen.

E

Patentansprüche

1. Lösbare Steck-Verbindungsanordnung für Implantat gestützten Zahnersatz mit einem axial in eine Steckaufnahme einschiebbaren elastischen Steckanker, **dadurch gekennzeichnet**, dass

a) der Steckanker (100) mittelbar oder unmittelbar vertikal in das eingesetzte Implantat (1) bzw. ein zum Zweck der Herstellung eines Meistermodells (Mo) verwendeten Manipulierimplantats (7) einsetzbar ist, sich der elastische Klemmkopf (130) dabei zuoberst befindet und das Implantat (1) bzw. das Manipulierimplantat (7) überragt - bezeichnet als Aufwärtsposition - oder

b) der Steckanker (100) mittelbar oder unmittelbar vertikal im Innern einer Abdruckkappe (300) bzw. einer Kronenkappe (500) einsetzbar ist und sich der Klemmkopf (130) dabei zuunterst befindet - bezeichnet als Abwärtsposition - und

c) in der Aufwärtsposition im Innern der Abdruckkappe (300) bzw. der Kronenkappe (500) als Arretierung für den Klemmkopf (130) eine Rastschulter (307), ein Raststeg (308, 508) oder eine Rastmulde vorgesehen ist bzw.

d) in der Abwärtsposition unmittelbar im Implantat (1) bzw. Manipulierimplantat (7) oder in einem in letztgenannten einsetzbaren Sekundärteil (2, 8) als Arretierung für den Klemmkopf (130) ein Raststeg (708, 808), eine -schulter oder eine -mulde vorgesehen ist.

2. Steck-Verbindungsanordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass

a) als Arretierung für den Klemmkopf (130), anstelle der Rastschulter, des -steges oder der -mulde (307, 308, 508 708, 808), eine den Klemmkopf (130) einengend umgebende Innenwandung (306, 506, 706, 806) im jeweiligen Gegenstück der Steck-Verbindungsanordnung ausgebildet ist, wodurch sich zusammen mit dem unter spreizender Federspannung stehenden Klemmkopf (130) eine für die Verbindung ausreichende Haftreibung einstellt und als Option

b) die Innenwandung (306, 506, 706, 806) und/oder der Aussenmantel des Klemmkopfes (130) mit einer Oberflächenrauhigkeit versehen wird, um die Reibung zwischen beiden zu erhöhen.

3. Steck-Verbindungsanordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass

a) der Stecker (100) aus einem abschliessenden, verdickten Klemmkopf (130) und einem den Klemmkopf (130) tragenden, verjüngten Schaftsegment (120), an das sich unmittelbar ein Gewindesegment (110), ein Stiftsegment (150) oder eine Gelenkkugel (160) anschliessen oder

b) dem Klemmkopf (130), dem Schaftsegment (120), an das sich unmittelbar ein verdicktes Trägersegment (140) anschliesst, an welchen andererseits das Gewindesegment (110) oder das Stiftsegment (150) ansetzt, besteht sowie dass

c) am Übergang zwischen Klemmkopf (130) und Schaftsegment (120) eine Rastflanke (131) gebildet wird und als Option

d) der Klemmkopf (130) durch sich vom Klemmkopf (130) bis in das Schaftsegment (120) erstreckende Teilungsschlitze (132) in mehrere elastische Ankerlamellen (133) aufgeteilt ist, am Übergang zwischen dem Schaftsegment (120) und dem Klemmkopf (130) eine Auflageschulter (121) vorgesehen ist und oberhalb der Auflageschulter (121), in Richtung des Klemmkopfes (130) ein radial umlaufender Einstich (122) vorhanden ist.

4. Steck-Verbindungsanordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass bei der Aufwärtsposition

a) in das Implantat (1) ein Sekundärteil (2, 8) mit oder ohne rotationssichernder Kontur eingesetzt wird;

b) als Sekundärteil ein Octa-Sekundärteil (2) vorgesehen wird, das an einem Sims (25), etwa in der Höhe der Implantatschulter (14) gelegen, in ein achtkantiges Octasegment (23) übergeht, welches oberseitig mit einer Octaschulter (26) abschliesst, wobei die achtkantige Kontur durch eine nicht kreisrunde Geometrie analog ersetzbar ist;

c) oder ein Konus-Sekundärteil (8) vorgesehen wird, welches einen die Implantatschulter (14) überragenden Konuspfeiler (83) aufweist, der oberseitig mit einer Konuspfeilerschulter (85) abschliesst;

d) im Sekundärteil (2, 8) eine von oben zugängliche, sich axial abwärts erstreckende, sacklochförmige Gewindebohrung (24, 84) zur Aufnahme des Gewindesegments (110) des Steckankers (100) oder des Gewindesegments (410) einer Okklusalschraube (400) angeordnet ist.

5. Steck-Verbindungsanordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass bei der Abwärtsposition

a) in das Implantat (1) ein Sekundärteil (2, 8) mit oder ohne rotationssichernder Kontur eingesetzt wird;

b) als Sekundärteil ein Octa-Sekundärteil (2) vorgesehen wird, das an einem Sims (25), etwa in der Höhe der Implantatschulter (14) gelegen, in ein achtkantiges Octasegment (23) übergeht, welches oberseitig mit einer Octaschulter (26) abschliesst, wobei die achtkantige Kontur durch eine nicht kreisrunde Geometrie analog ersetzbar ist;

c) oder ein Konus-Sekundärteil (8) vorgesehen wird, welches einen die Implantatschulter (14) überragenden Konuspfeiler (83) aufweist, der oberseitig mit einer Konuspfeilerschulter (85) abschliesst;

d) im Sekundärteil (2, 8) eine von oben zugängliche, sich axial abwärts erstreckende, sacklochförmige Zylinderbohrung (705, 805) mit der Innenwandung (706, 806) vorgesehen ist;

e) sich an der Innenwandung (706, 806), radial umlaufend, ein Raststeg (708, 808), eine Rastschulter (307) oder eine Rastmulde zur einrastenden Aufnahme des Klemmkopfes (130) befindet und

f) an der Octaschulter (26) bzw. an der Konuspfeilerschulter (85) eine Ansenkung (812) zur partiellen Aufnahme des im Mittelteil des Steckankers (100) vorhandenen Trägersegments (140) vorgesehen ist.

6. Steck-Verbindungsanordnung nach Anspruch 4 oder 5, **dadurch gekennzeichnet**, dass in den Sekundärteilen (2, 8)

a) am Octasegment (23) oder an einem dazu nicht kreisrunden, analogen Segment bzw. am Konuspfeiler (83) eine äussere, umlaufende Radialnut (809) für eine eventuelle Transversalverschraubung eingearbeitet ist;

b) am Übergang zwischen dem Basiskonus (21, 81) und dem Octasegment (23) oder dem analogen Segment bzw. dem Konuspfeiler (83) eine Schulterpartie (86) in der Art eines Flügelansatzes vorgesehen ist, die einen inneren Kreisring der Implantatschulter (14) belegt und

c) am äusseren Umfang des Basiskonus (21, 81), in der Höhe der Implantatschulter (14), eine Radialnut (810) zur Aufnahme eines Klemmringes (900) vorgesehen ist oder zur Zentrierung in den Implantatkonus (12) eine Zentrierhülse (9) eingesetzt wird.

7. Steck-Verbindungsanordnung nach den Ansprüchen 4 bis 6, **dadurch gekennzeichnet**, dass in den Sekundärteilen (2, 8) vorhanden sind:

a) an der Octaschulter (26) bzw. an der Konuspfeilerschulter (85) die Ansenkung (812),

b) die sich vertikal erstreckende, sacklochförmige Zylinderbohrung (705, 805),

c) an der Innenwandung (706, 806) der Zylinderbohrung (705, 805) ein Innengewinde (811), das von der Ansenkung (812) bis zum Raststeg (708, 808), der Rastschulter (307) oder der Rastmulde verläuft,

d) die Schulterpartie (86) und

e) die Radialnuten (809 und 810).

8. Steck-Verbindungsanordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass die Abdruckkappe (300) besteht aus:

a) einem unten offenen Kappengehäuse,

b) einer zur Implantatschulter (14) komplementären Gegenschulter (301) und

c) einer Anschlusspartie (302) mit komplementärer Innenkontur, die dem die Implantatschulter (14) überragenden Octasegment (23) oder dem dazu nicht kreisrunden, analogen Segment bzw. dem Konuspfeiler (83) entspricht, nämlich mit einem Innenachtkant (27) oder einer analogen Geometrie bzw. einer Konusbohrung (304) und dass als Option

d) die Abdruckkappe (300) angesichts von Toleranzen, bezogen auf die Höhenlage des Simses (25) des Octa-Sekundärteils (2) bzw. des geometrisch analogen Sekundärteils, am Innenrand der Gegenschulter (301) eine radial umlaufende Ausnehmung (309) aufweist.

9. Steck-Verbindungsanordnung nach Anspruch 8, **dadurch gekennzeichnet**, dass die Abdruckkappe (300) für die Aufwärtsposition

a) eine sich an den Innenachtkant (27) oder die analoge Geometrie bzw. die Konusbohrung (304) anschliessende und axial aufwärts erstreckende, sacklochförmige Zylinderbohrung (305) zur Aufnahme des im Sekundärteil (2, 8) eingesetzten Steckankers (100) aufweist und

b) an der Innenwandung (306) der Zylinderbohrung (305), radial umlaufend eine Rastschulter (307), einen -steg (308) oder eine -mulde zur einrastenden Aufnahme des Klemmkopfes (130) besitzt und dass die Abdruckkappe (300) für die Abwärtsposition

c) am Boden der Konusbohrung (304) eine verengte Zylinderbohrung (311) zur partiellen Aufnahme des Trägersegmentes (140) des Steckankers (100) aufweist;

d) eine Gewindebohrung (312) zur Aufnahme des Gewindesegments (110) des Steckankers (100) oder

e) eine Zylinderbohrung (322) als Passsitz zur Aufnahme des Steckstiftes (150) des Steckankers (100) oder

f) eine verengte Durchbruchsbohrung (334) als Durchlass für das Schaftsegment (120) des Steckankers (100) und eine über der Durchbruchsbohrung (334) angeordnete Gelenkpfanne (333) zur Aufnahme der Gelenkkugel (160) besitzt.

10. Steck-Verbindungsanordnung nach Anspruch 9, **dadurch gekennzeichnet**, dass

a) sich aufwärts von der Gelenkpfanne (333) eine axiale Zylinderbohrung (322) erstreckt, die in eine an der Oberseite der Abdruckkappe (300) mündende Gewindebohrung (330) übergeht und

b) in die Gewindebohrung (330) eine Schraube (350) eingesetzt ist, die auf ein zwischen der Schraube (350) und der Gelenkkugel (160) eingefügtes Distanzsegment (340) Druck ausübt.

11. Steck-Verbindungsanordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass die Kronenkappe (500) besteht aus:

a) einem unten offenen Kappengehäuse,

b) einer zur Implantatschulter (14) komplementären Gegenschulter (501) und

c) einer Anschlusspartie (502) mit komplementärer Innenkontur, die dem die Implantatschulter (14) überragenden Octasegment (23) oder dem dazu nicht kreisrunden, analogen Segment bzw. dem Konuspfeiler (83) entspricht, nämlich mit einem Innenachtkant (27), einem 24-Innenkant (503) oder der analogen Geometrie bzw. einer Konusbohrung (504).

12. Steck-Verbindungsanordnung nach Anspruch 11, **dadurch gekennzeichnet**, dass die Kronenkappe (500) für die Aufwärtsposition

a) eine sich an den Innenachtkant (27), den 24-Innenkant (503) oder die analoge Geometrie bzw. die Konusbohrung (304) anschliessende und axial aufwärts erstreckende, sacklochförmige Zylinderbohrung (505) zur Aufnahme des im Sekundärteil (2, 8) eingesetzten Steckankers (100) aufweist und

b) an der Innenwandung (506) der Zylinderbohrung (505), radial umlaufend eine, Rastschulter (507), ein Raststeg (508) oder eine Rastmulde zur einrastenden Aufnahme des Klemmkopfes (130) vorgesehen ist; und dass die Kronenkappe (500) für die Abwärtsposition

c) am Boden der Konusbohrung (504) eine verengte Zylinderbohrung (511) zur partiellen Aufnahme des Trägersegments (140) des Steckankers (100) besitzt;

d) eine Gewindebohrung (512) zur Aufnahme des Gewindesegments (110) des Steckankers (100) oder

e) eine Zylinderbohrung (522) als Passsitz zur Aufnahme des Steckstiftes (150) des Steckankers (100) aufweist.

13. Steck-Verbindungsanordnung nach Anspruch 11, **dadurch gekennzeichnet**, dass die Kronenkappe (500)

a) angesichts von Toleranzen, bezogen auf die Höhenlage des Simses (25) des Octa-Sekundärteils (2) bzw. des analogen Sekundärteils, am Innenrand der Gegenschulter (501) eine radial umlaufende Ausnehmung (509) aufweist;

b) für eine Transversalverschraubung einen lateralen, kompakten Materialschenkel (510) besitzt, in welchem sich zur Aufnahme einer Stiftschraube (516) eine Gewindebohrung (515) befindet, die auf die Radialnut (809) am Sekundärteil (2, 8) oder auf die Radialnut (222) am eingesetzten Schraubenbolzen (200) gerichtet ist;

c) für eine okklusale Verschraubung mit einem aufmodellierten Zahn (Za) in der Decke eine Ansenkung (530) aufweist, von der sich eine axiale Zylinderbohrung (522) in das Innere der Kronenkappe (500) erstreckt, wodurch der Kopf (420) einer eingedrehten Okklusalschraube (400) seinen Sitz erhält und das Gewindesegment (410) dieser Okklusalschraube (400) die Decke durchdringt.

14. Steck-Verbindungsanordnung nach Anspruch 13, **dadurch gekennzeichnet**, dass

a) der Schraubenbolzen (200) mit seinem Gewindesegment (210) auf ein Octasegment (23) bzw. das analoge Segment aufgeschraubt ist;

b) das Hülsensegment (220) des Schraubenbolzens (200) in der Zylinderbohrung (505) der Kronenkappe (500) seinen Sitz hat;

c) die Radialnut (222) am Schraubenbolzen (200) in der Flucht zu der im Materialschenkel (510) befindlichen Gewindebohrung (515) liegt und

d) das Hülsensegment (220) eine von oben zugängliche Gewindebohrung (221) besitzt.

15. Steck-Verbindungsanordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass für Schrägstellungen anstelle von axialsymmetrischen Konus-Sekundärteilen (8), Abdruckkappen (300) und Kronenkappen (500) abgewinkelte Konus-Sekundärteile (8), Abdruckkappen (300) mit abgeschrägter Anschlusspartie (302) bzw. Kronenkappen (500) mit abgeschrägter Anschlusspartie (502) vorgesehen sind.

16. Steck-Verbindungsanordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass diese verwendet wird:

a) zur Abdrucknahme an im Kieferknochen (K) eingesetzten Implantaten (1), um den Abdruck (Ab) zu erhalten und/oder

b) zur Herstellung des Meistermodells (Mo) und/oder

c) zur Befestigung von Zahnkronen (Zk) bzw. einer komplexeren Suprakonstruktion auf den im Mund des Patienten eingesetzten Implantaten (1).

17. Steck-Verbindungsanordnung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet**, dass

a) für die Abdrucknahme und die Herstellung des Meistermodells (Mo) zum Abziehen der Abdruckkappen (300) eine Trennkraft (F_T) eingestellt wird und man

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b) für eine befestigte Zahnkrone (Zk) eine erhöhte Trennkraft (F_T') vorsieht, indem Materialien höherer Klemmwirkung und verringerter Elastizität eingesetzt werden bzw. durch Änderung der geometrischen Massverhältnisse.

18. Steck-Verbindungsanordnung nach Anspruch 17, **dadurch gekennzeichnet**, dass eine erhöhte Trennkraft (F_T') vorgesehen wird, indem man

a) den Klemmkopfdurchmesser von (d_K) auf (d_K') vergrössert und/oder

b) den Raststegdurchmesser von (d_R) auf (d_R') verengt und/oder

c) die Schlitzbreite (b_S) im Klemmkopf (130) und Schaftsegment (120) auf (b_S') verschmälert und/oder

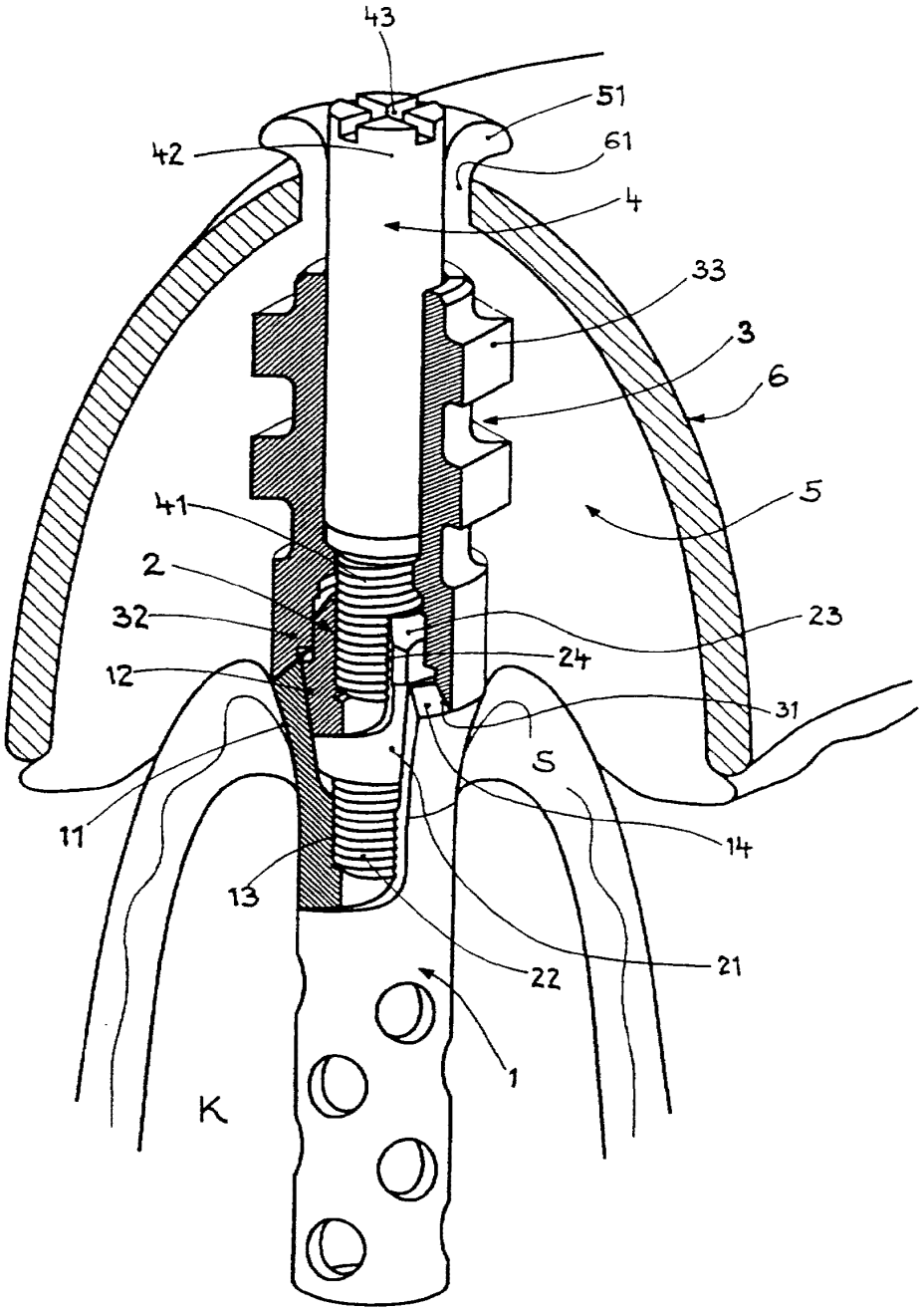
d) die Schlitzlänge (l_S) im Klemmkopf (130) und Schaftsegment (120) verkürzt und/oder

e) den Anstiegswinkel (α) an der Rastschulter (307, 507, 707, 807) bzw. dem Raststeg (308, 508, 708, 808) der Horizontalen mehr annähert.

E

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Fig. 0.a



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Fig. 0.b

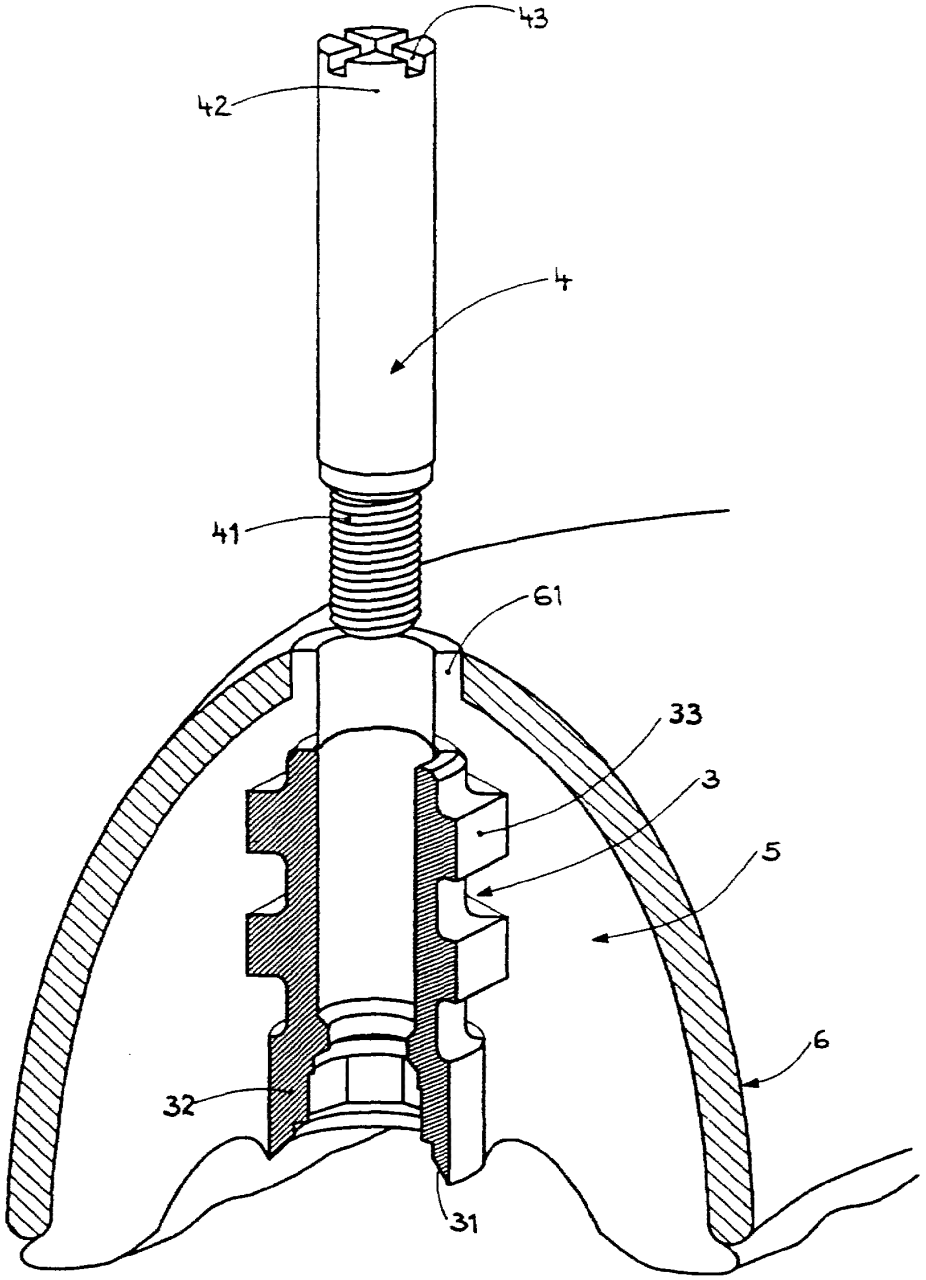


Fig. 0.c

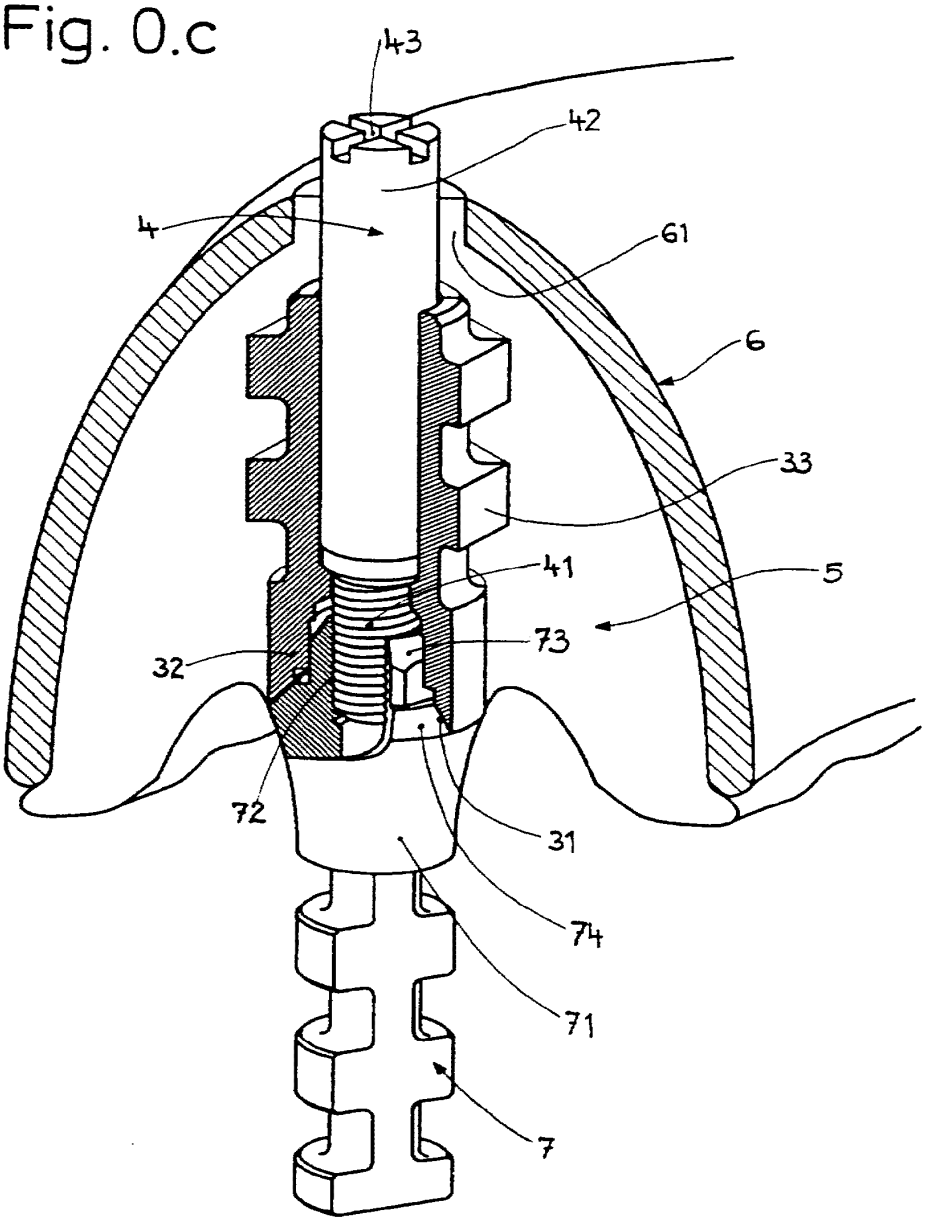


Fig. 1

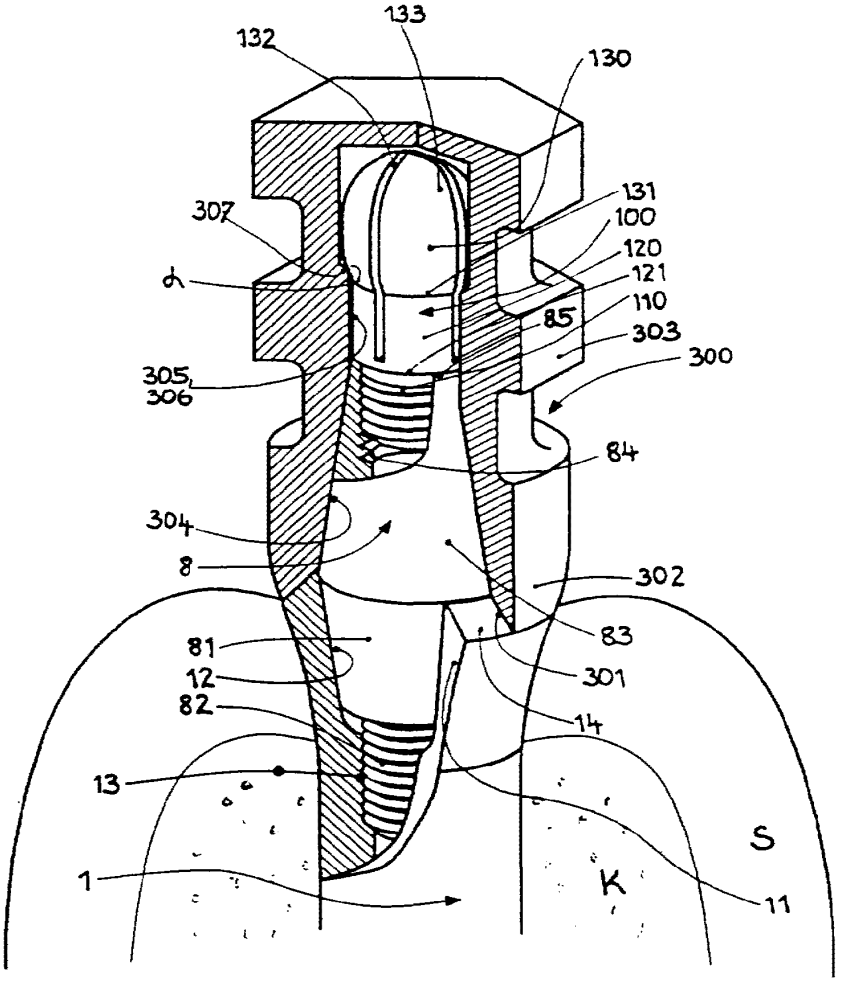
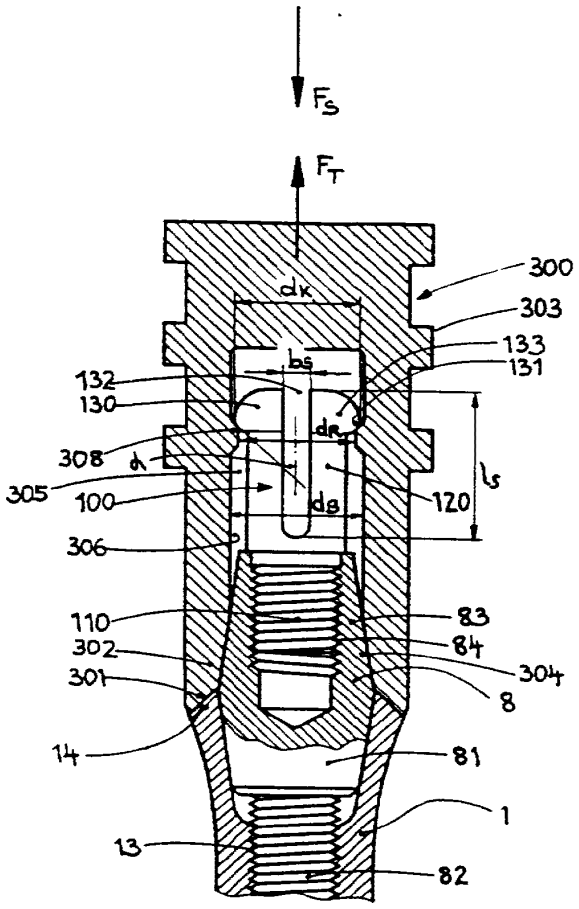

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Fig. 2


F_S
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d_R
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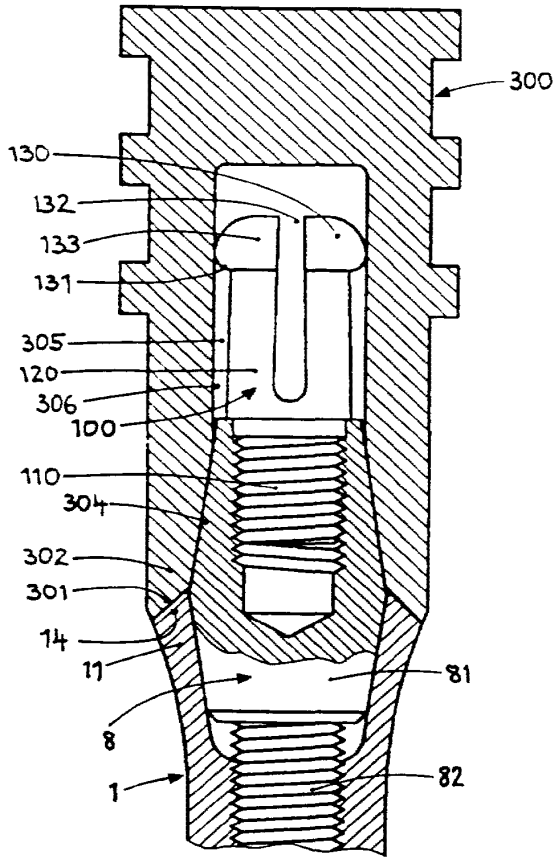

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Fig. 3

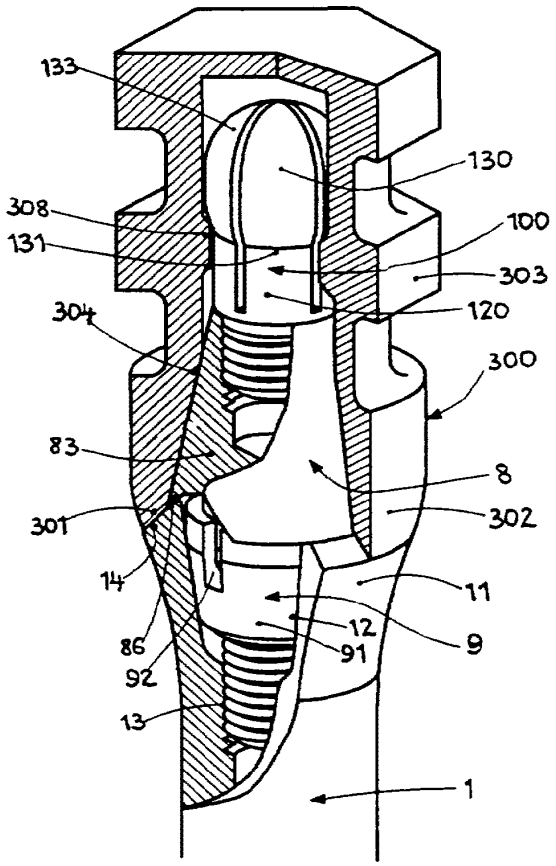

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Fig. 4

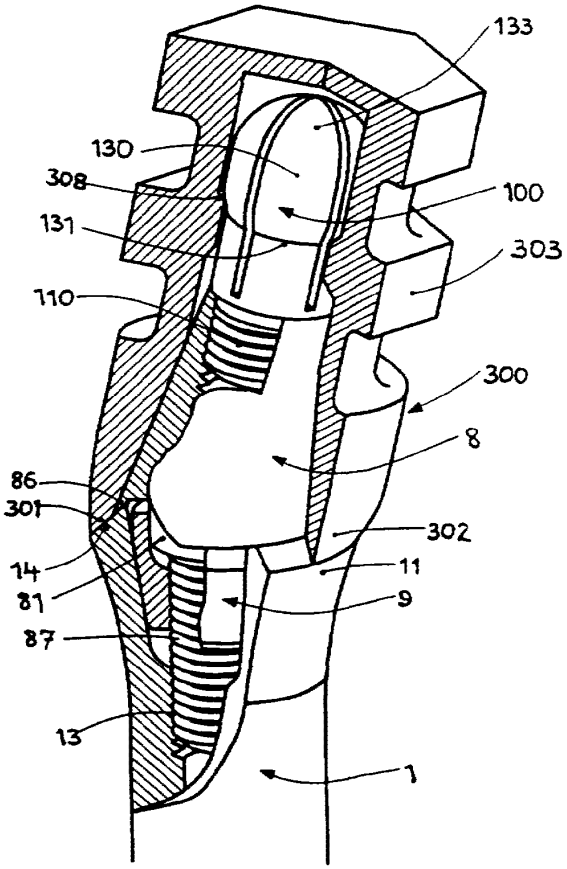

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Fig. 5

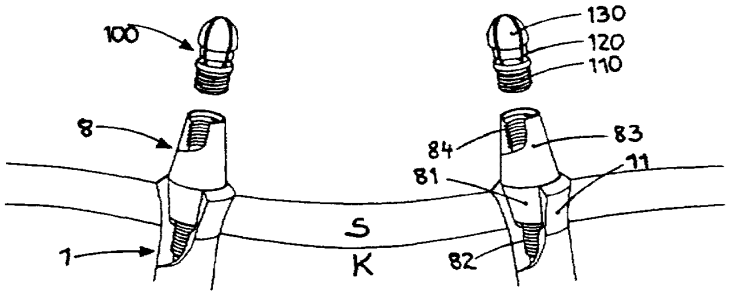


Fig. 6a

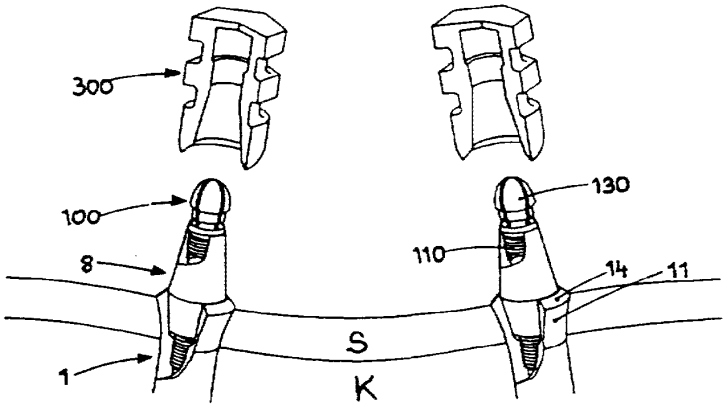


Fig. 6b

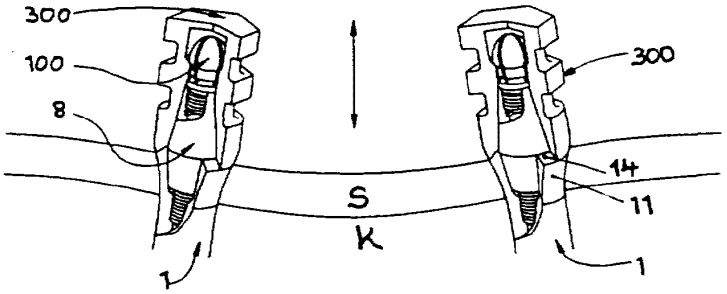
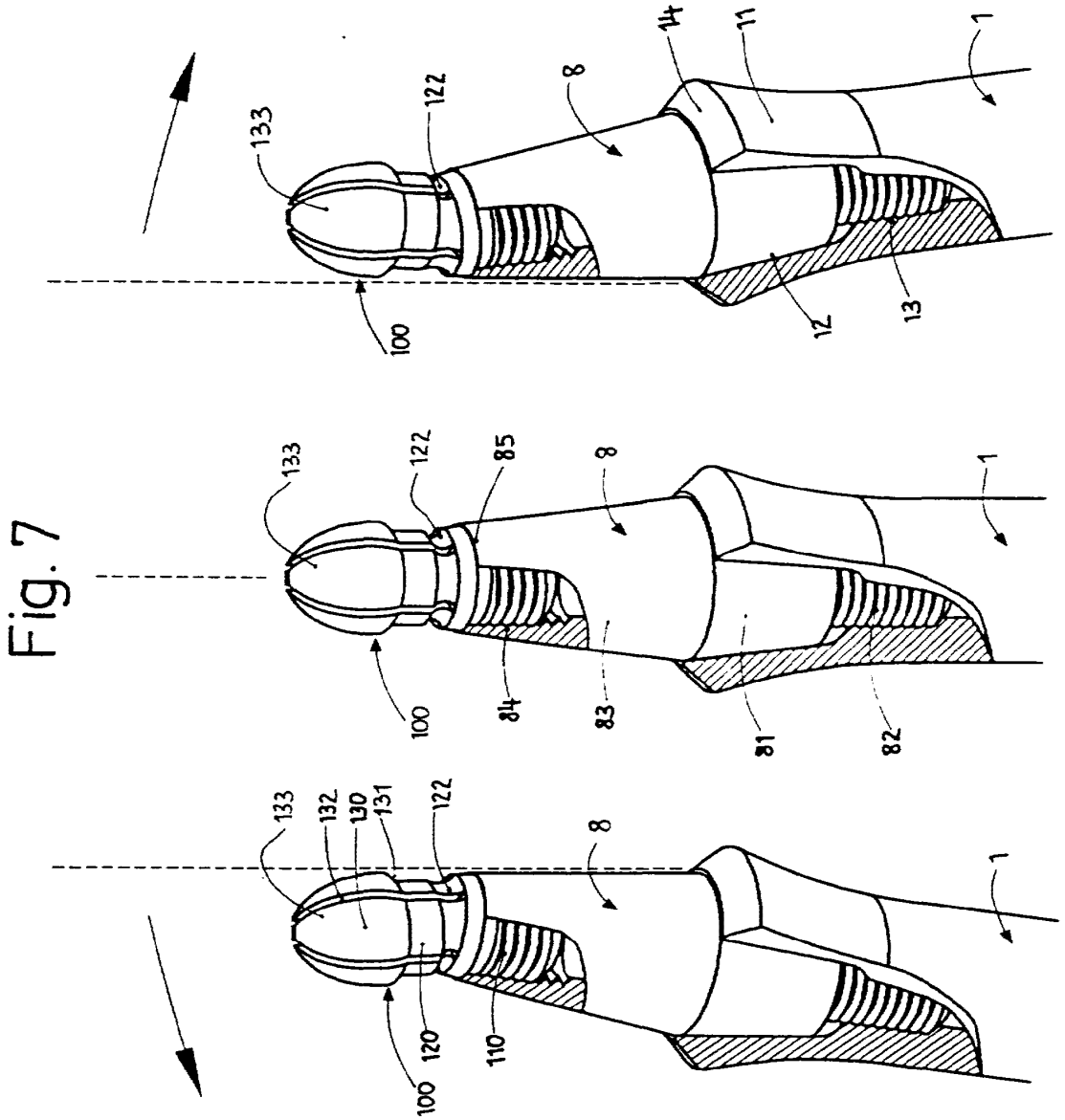


Fig. 6c

Fig. 7



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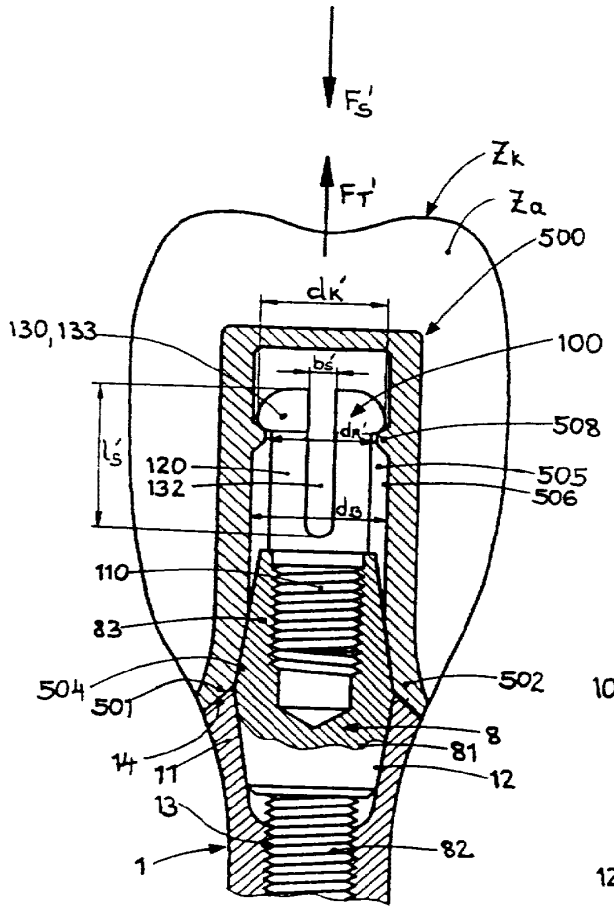

F_S'
F_T'
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z_a
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d_K'
130, 133
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l_S'
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Fig. 8

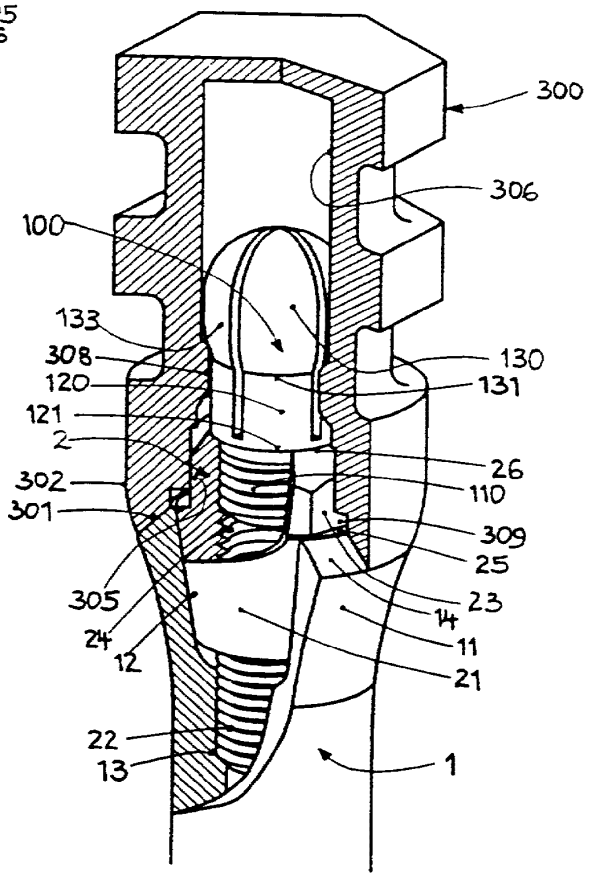

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Fig. 9

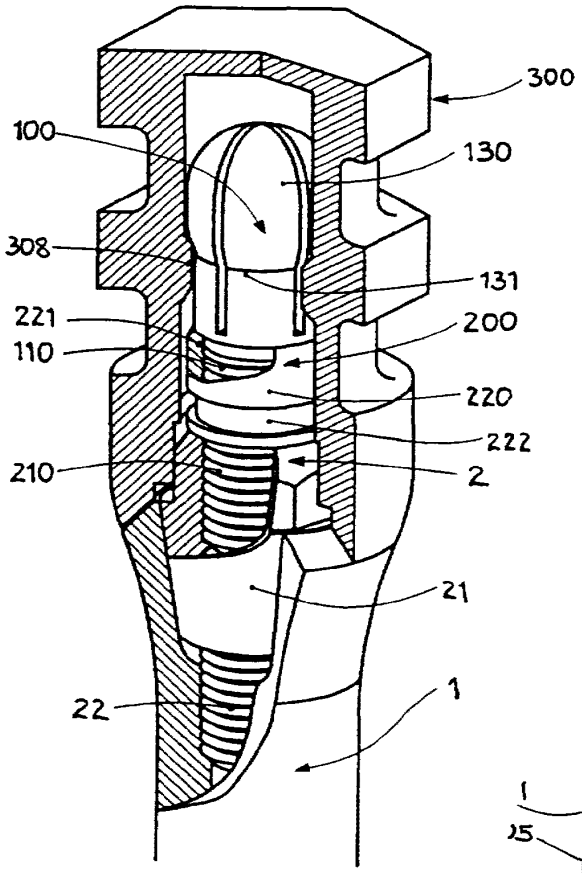

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Fig. 10

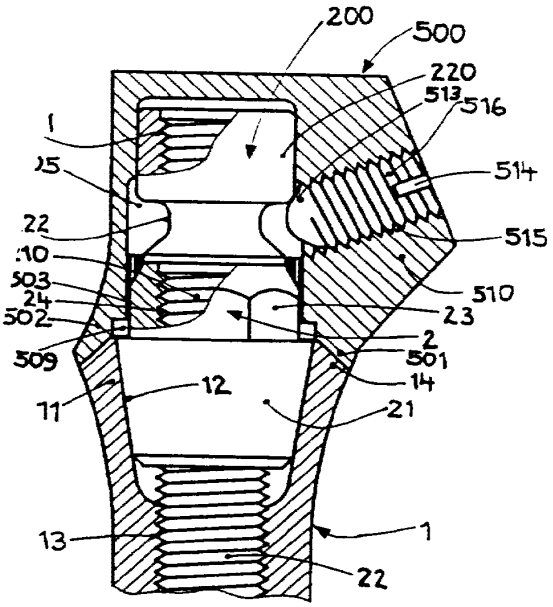

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Fig. 11

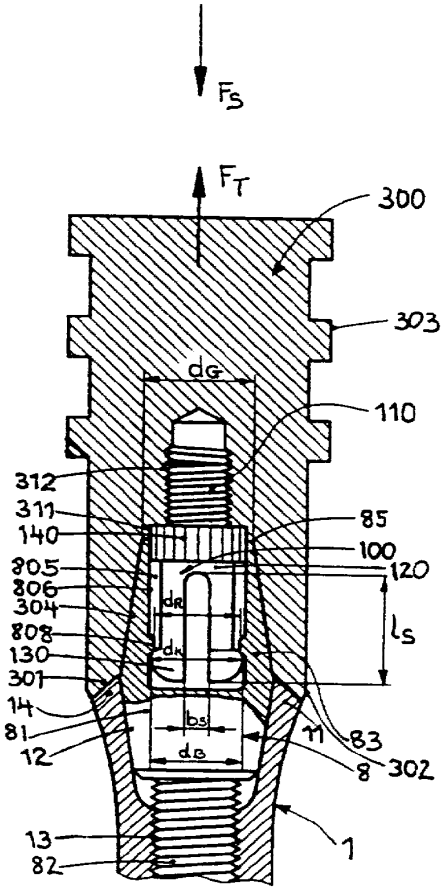

F_S
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Fig. 12

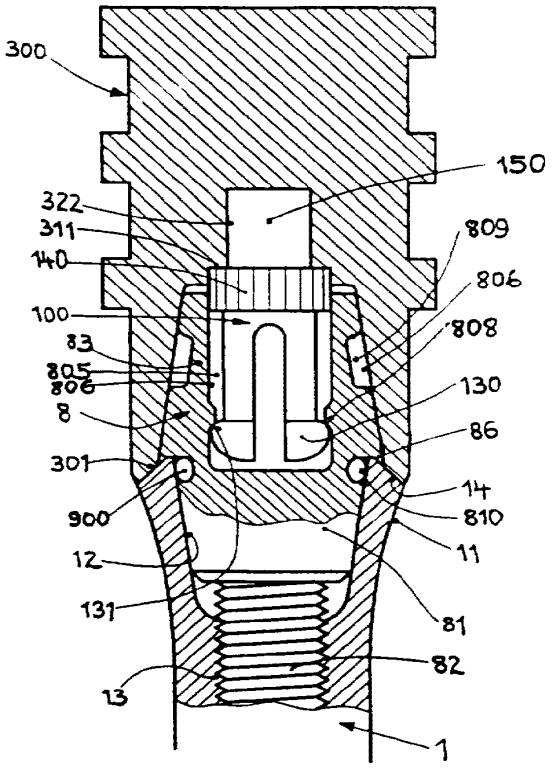

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140
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805
806
8
301
900
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809
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86
14
810
11
81
82
13
1

Fig. 13

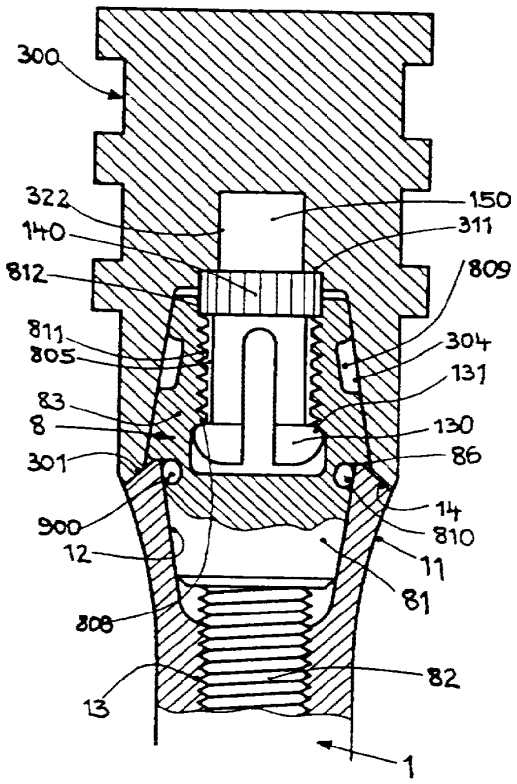

300
322
140
812
811
805
83
8
301
900
12
808
13
150
311
809
304
131
130
86
14
810
11
81
82
1

Fig. 14

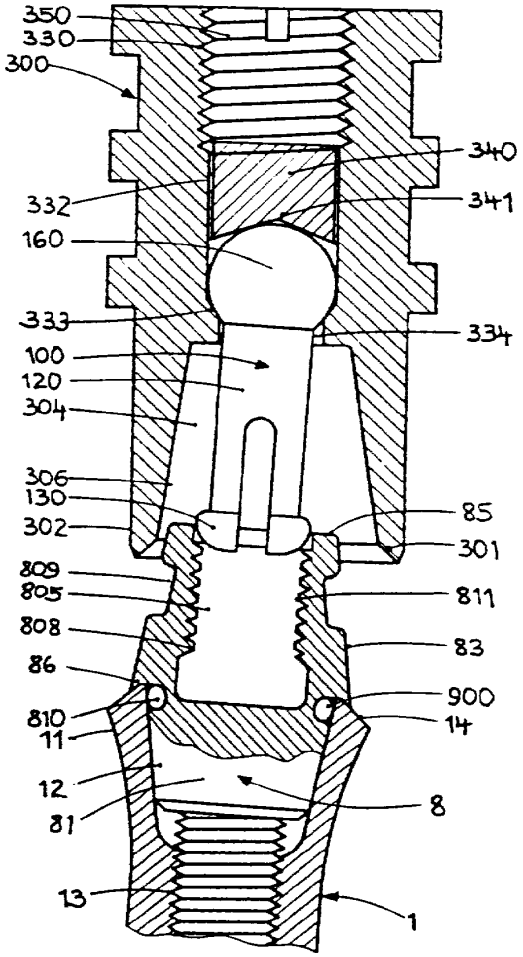
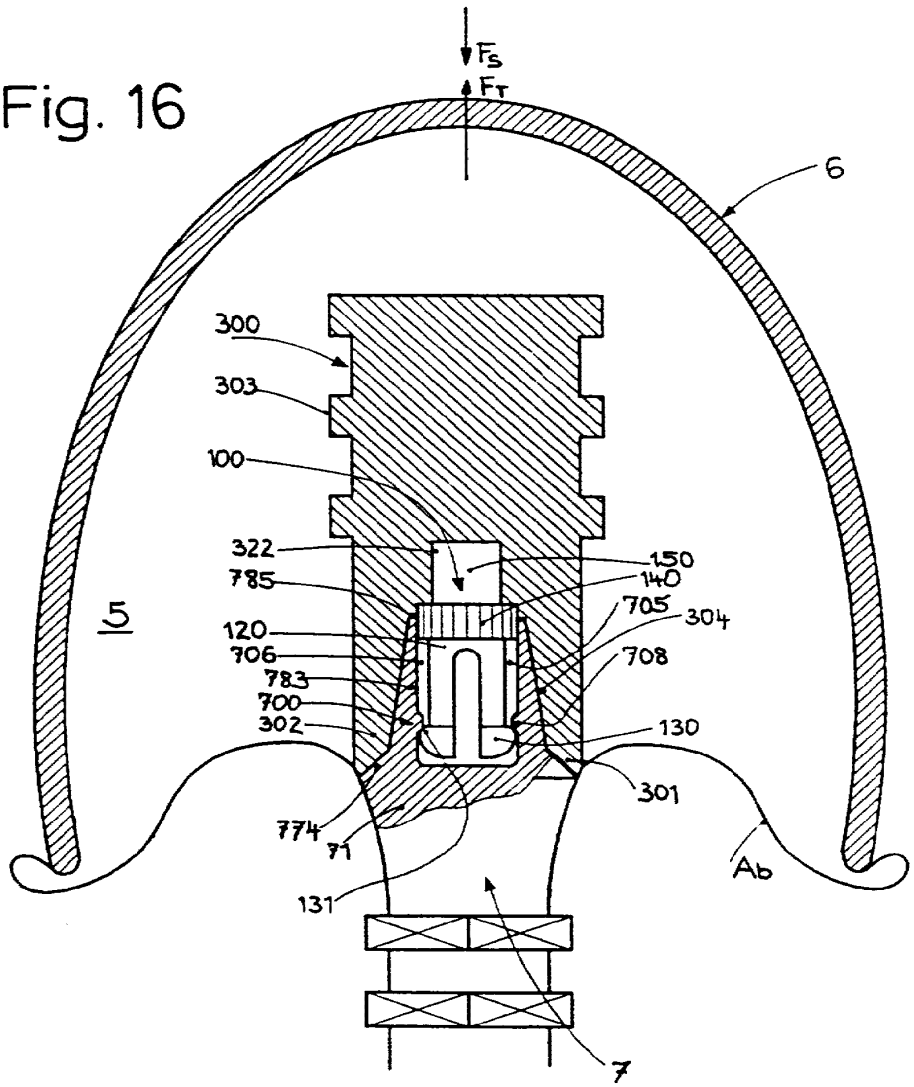

350
330
300
340
332
341
160
333
334
100
120
304
306
130
302
85
301
809
805
811
808
83
86
900
14
810
11
12
8
81
13
1

Fig. 15

Fig. 16


F_S
F_T
6
300
303
100
322
785
150
140
705
304
120
706
708
783
700
302
130
301
774
71
131
Ab
5
7

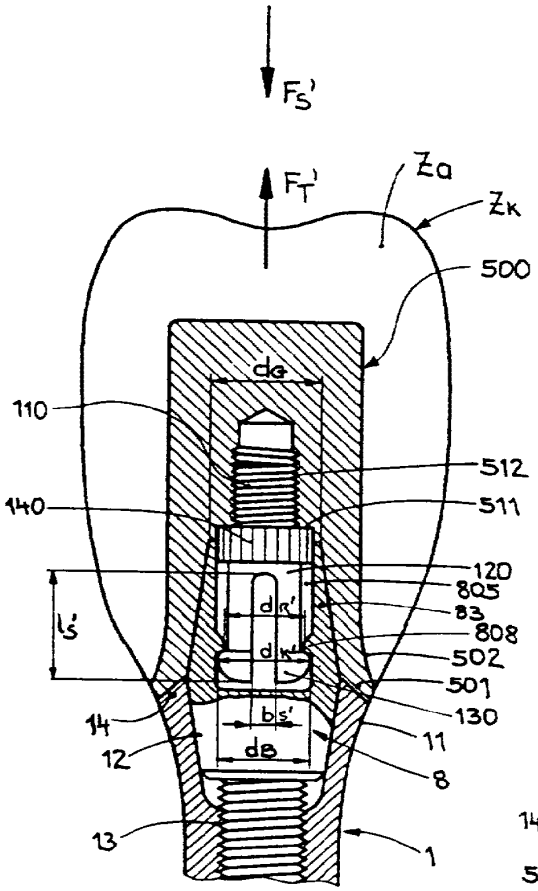

F_S'
F_T'
Za
Zk
500
110
512
140
511
120
805
83
808
502
501
130
11
8
1
14
12
13
ls'
dK'
dK
bs'
dB

Fig. 17

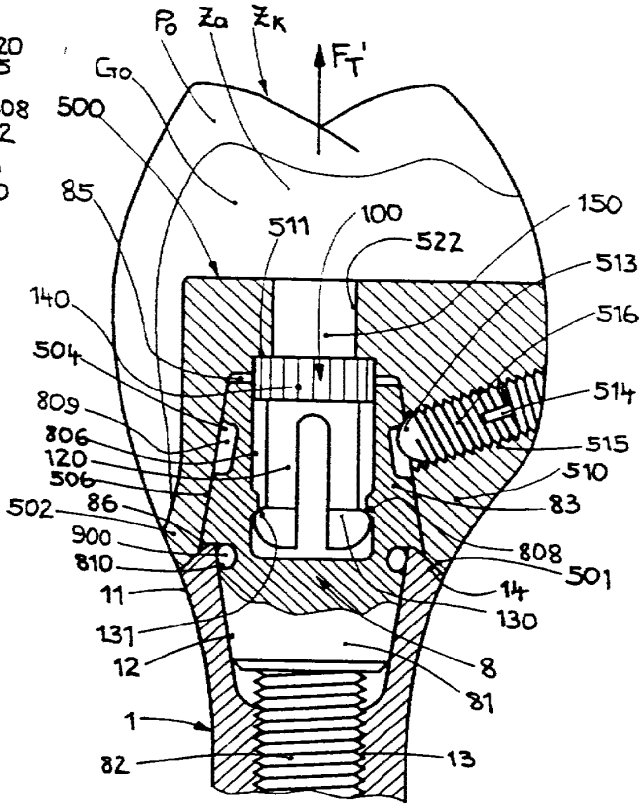

Po
Za
Zk
F_T'
Go
500
85
511
100
522
150
513
516
514
515
510
83
808
501
14
130
8
81
140
504
809
806
120
506
502
86
900
810
11
131
12
1
82
13

Fig. 18

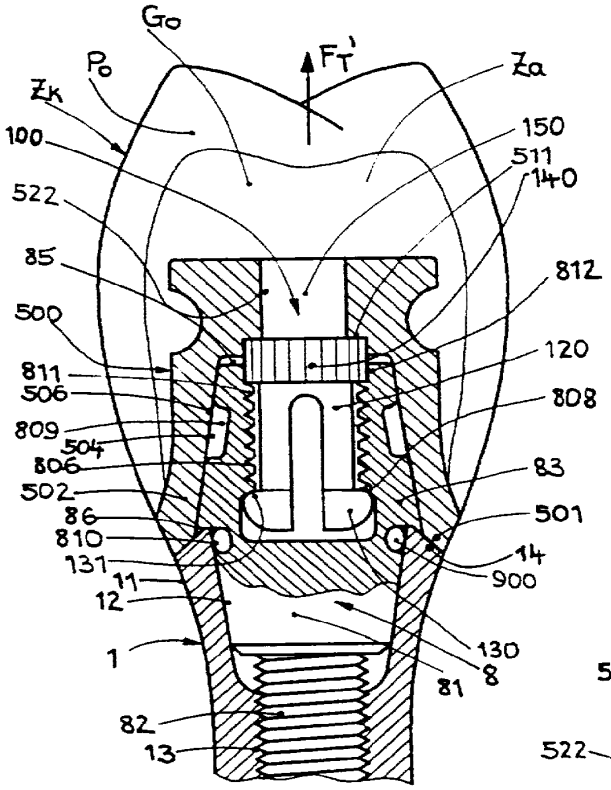

Go
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Zk
Ft
Za
100
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511
140
522
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500
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504
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Fig. 19

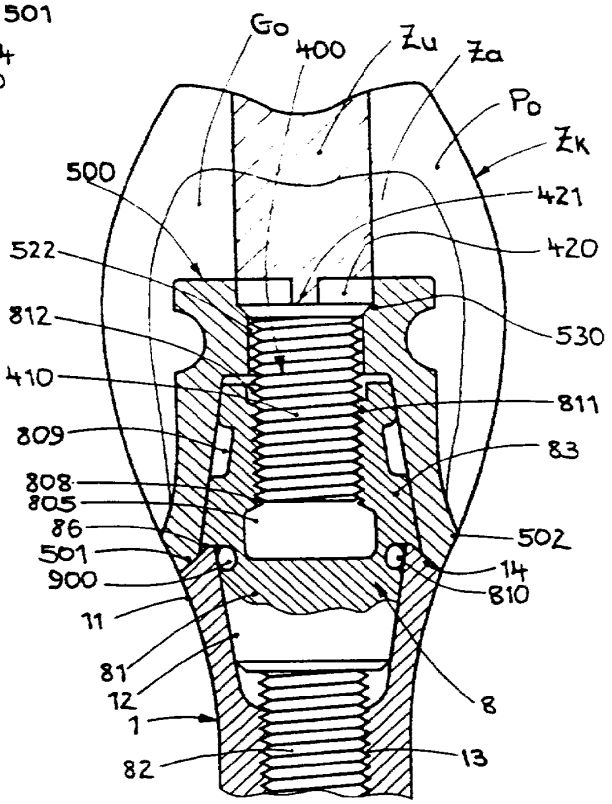

Go
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Zu
Za
Po
Zk
500
421
420
522
530
812
410
811
809
83
808
805
86
502
501
14
900
810
11
81
12
8
1
82
13

Fig. 20

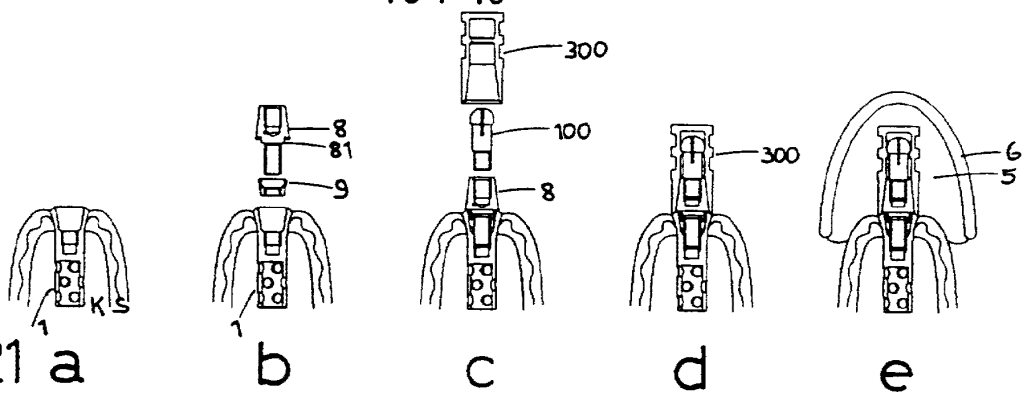


Fig.21 a b c d e

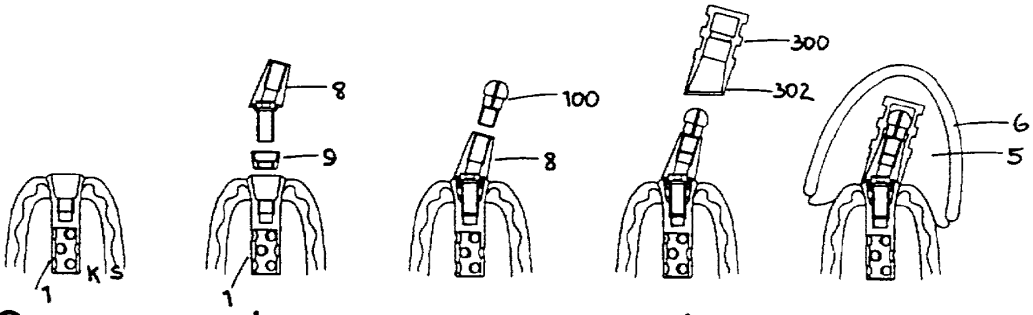


Fig.22 a b c d e

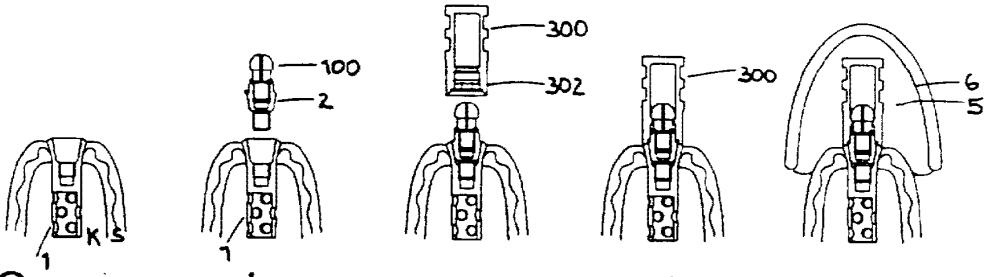


Fig.23 a b c d e

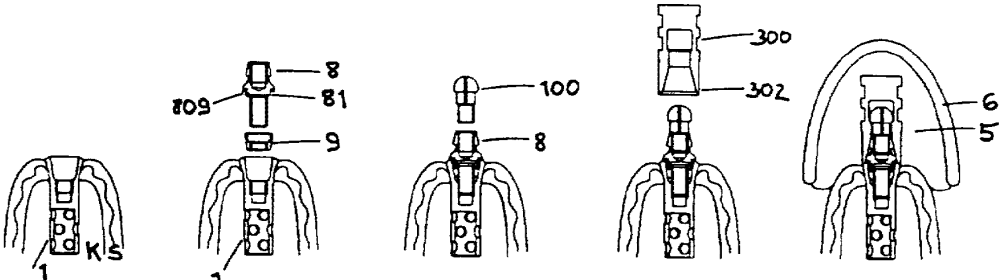


Fig.24 a b c d e

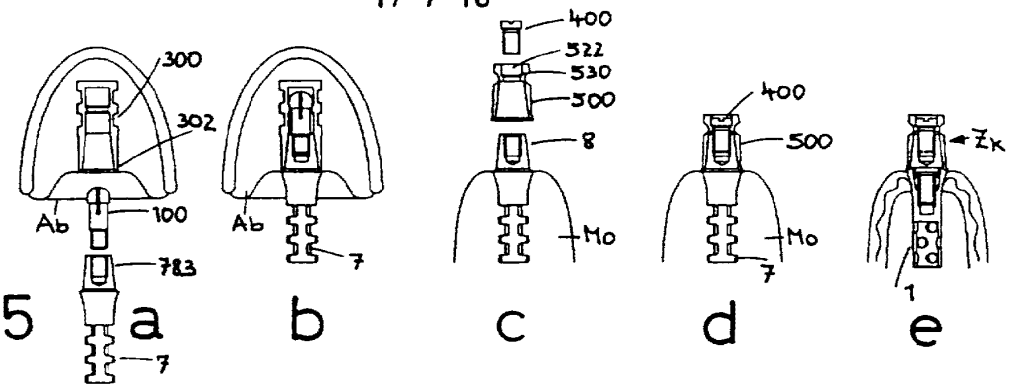


Fig. 25 a b c d e

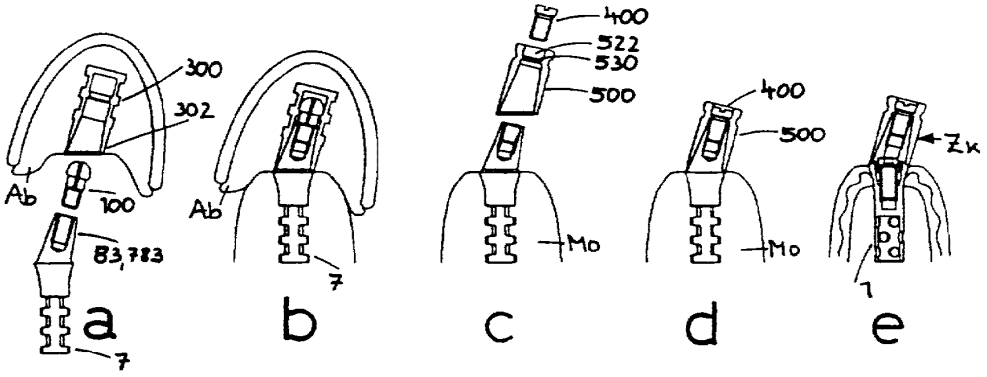


Fig. 26 a b c d e

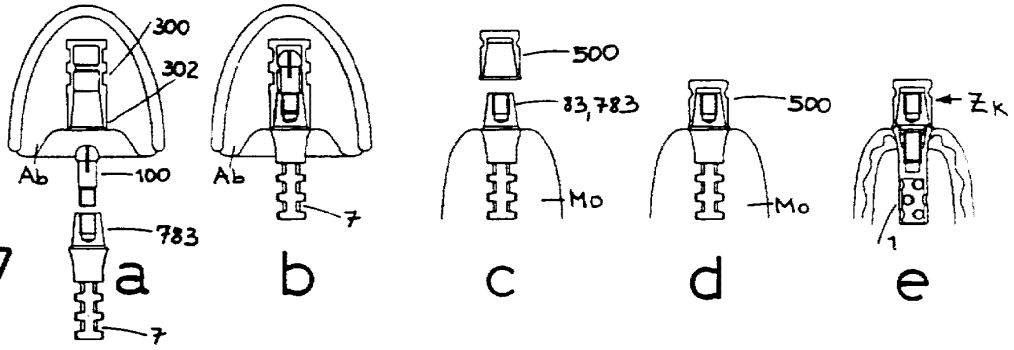


Fig. 27 a b c d e

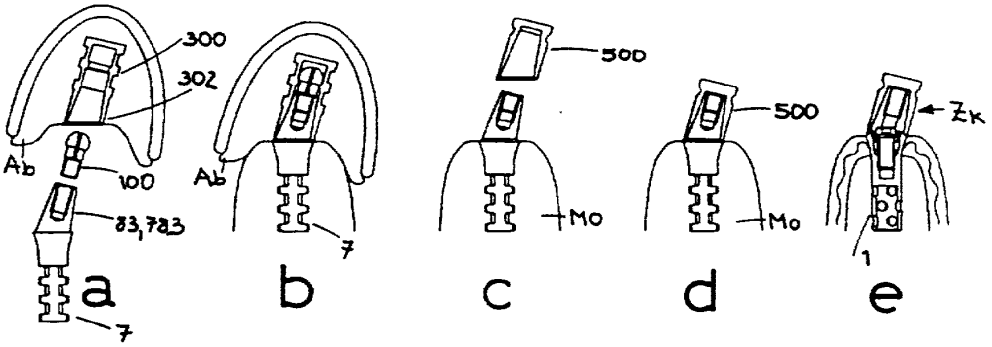


Fig. 28 a b c d e

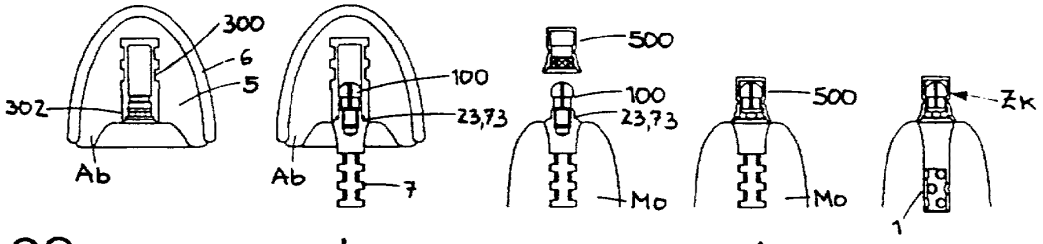


Fig. 29 a b c d e

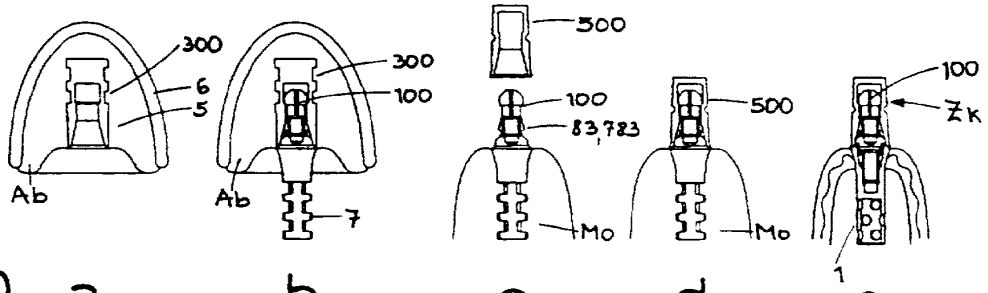


Fig. 30 a b c d e

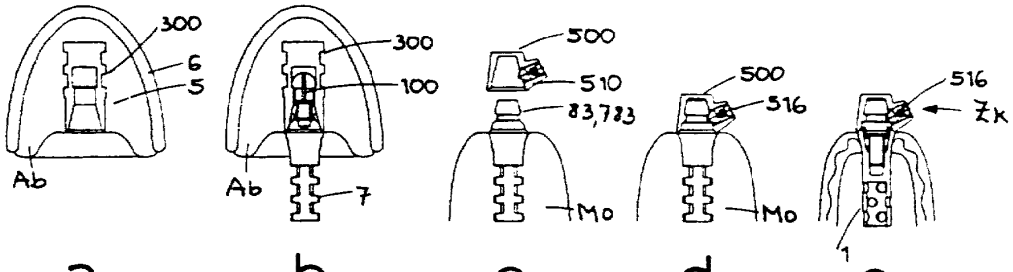


Fig. 31 a b c d e

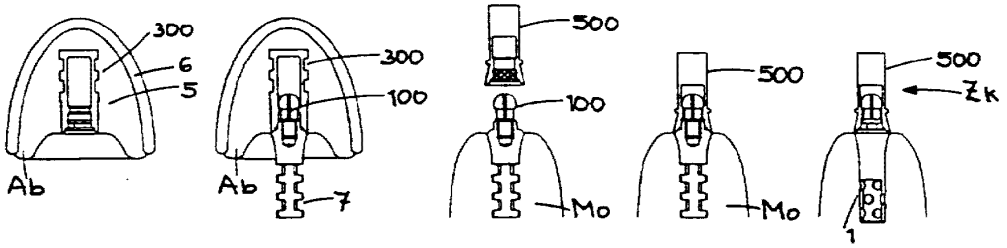


Fig. 32 a b c d e

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INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/CH 96/00099

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61C8/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,92 10145 (SULC) 25 June 1992 see page 9, line 17 - line 35; figures 1-7	1,3
X	DE,A,33 00 764 (BADEMIS) 12 July 1984 see page 15, line 33 - page 16, line 6; figure 1	1
A	WO,A,89 06941 (FRISCHHERZ) 10 August 1989 see abstract; figures 1,2	1
A	DE,A,43 26 841 (BECKER VERFAHRENSTECHNIK) 16 February 1995 see column 6, line 50 - column 7, line 7; figures 2A,2B	1
A	US,A,5 302 125 (KOWNACKI) 12 April 1994 references 40	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
31 May 1996	11.06.96
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Authorized officer Papone, F

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INTERNATIONAL SEARCH REPORT

Int .onal Application No
PCT/CH 96/00099

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE,A,41 12 178 (KÖRBER) 15 October 1992	
A	WO,A,91 10410 (ATTACHMENTS INT.AL) 25 July 1991 see figure 4	

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/CH 96/00099

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-9210145	25-06-92	US-A-	5195891	23-03-93
		EP-A-	0560889	22-09-93
		JP-T-	6505645	30-06-94
DE-A-3300764	12-07-84	NONE		
WO-A-8906941	10-08-89	DE-D-	58905476	07-10-93
		EP-A,B	0406243	09-01-91
DE-A-4326841	16-02-95	NONE		
US-A-5302125	12-04-94	NONE		
DE-A-4112178	15-10-92	NONE		
WO-A-9110410	25-07-91	US-A-	5169309	08-12-92
		AU-B-	7322291	05-08-91
		DE-D-	69112605	05-10-95
		DE-T-	69112605	09-05-96
		EP-A-	0510115	28-10-92

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/CH 96/00099

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 6 A61C8/00

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 6 A61C

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	WO,A,92 10145 (SULC) 25.Juni 1992 siehe Seite 9, Zeile 17 - Zeile 35; Abbildungen 1-7	1,3
X	DE,A,33 00 764 (BADEMIS) 12.Juli 1984 siehe Seite 15, Zeile 33 - Seite 16, Zeile 6; Abbildung 1	1
A	WO,A,89 06941 (FRISCHHERZ) 10.August 1989 siehe Zusammenfassung; Abbildungen 1,2	1
A	DE,A,43 26 841 (BECKER VERFAHRENSTECHNIK) 16.Februar 1995 siehe Spalte 6, Zeile 50 - Spalte 7, Zeile 7; Abbildungen 2A,2B	1
A	US,A,5 302 125 (KOWNACKI) 12.April 1994 bezugszeichen 40	1

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[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
31.Mai 1996	11. 06. 96
Name und Postanschrift der Internationale Recherchenbehörde Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	**Bevollmächtigter Bediensteter** Papone, F

Formblatt PCT/ISA/210 (Blatt 2) (Juli 1992)

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INTERNATIONALER RECHERCHENBERICHT

Int. ..nales Aktenzeichen
PCT/CH 96/00099

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	DE,A,41 12 178 (KÖRBER) 15.Oktober 1992 ---	
A	WO,A,91 10410 (ATTACHMENTS INT.AL) 25.Juli 1991 siehe Abbildung 4 -----	

1

Formblatt PCT/ISA/210 (Fortsetzung von Blatt 2) (Juli 1992)

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INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Int. ...nales Aktenzeichen
PCT/CH 96/00099

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
WO-A-9210145	25-06-92	US-A-	5195891	23-03-93
		EP-A-	0560889	22-09-93
		JP-T-	6505645	30-06-94
DE-A-3300764	12-07-84	KEINE		
WO-A-8906941	10-08-89	DE-D-	58905476	07-10-93
		EP-A,B	0406243	09-01-91
DE-A-4326841	16-02-95	KEINE		
US-A-5302125	12-04-94	KEINE		
DE-A-4112178	15-10-92	KEINE		
WO-A-9110410	25-07-91	US-A-	5169309	08-12-92
		AU-B-	7322291	05-08-91
		DE-D-	69112605	05-10-95
		DE-T-	69112605	09-05-96
		EP-A-	0510115	28-10-92

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ABSTRACT WO9629019A1

10 The plug connection arrangement is particularly suitable for the entire sequence of work phases, starting with taking an impression on the implants (1) inserted in the jawbone (K), during the further manufacture of the master model and finally for fastening a superstructure on the implants (1) in the mouth of the Patient. The connection arrangement is a considerable relief for the patient, the dentist and the dental technician. The essential components form a plug-in anchor (100) with an elastic clamping head (130) and a complementary contour. This contour - z. B. a locking shoulder (307) - is arranged in the counterpart of the plug connection, so in the impression cap (300), the crown cap or in an existing secondary part (8). The secondary part (8) can be inserted into the implant (1) or into a manipulation implant, or it can be an integral part thereof.

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DESCRIPTION WO9629019A1

10 Connection arrangement for implant-supported dentures The invention relates to a connection arrangement for implant-supported dentures according to the preamble of independent claim 1, which can be used for taking impressions, producing the master model or fastening a superstructure on the implant inserted in the jawbone.

14 Great progress has already been made in construction, materials research, instruments and implantation techniques, so that nowadays a very high success rate can be recorded and more and more people with missing teeth or no longer existing tooth roots are deciding to have implants inserted. Those affected in this way can significantly improve their quality of life with implants. Before inserting dental prostheses or individual artificial teeth, the intraoral geometry must be faithfully transferred to a master model using an impression. The present invention is concerned with a connection arrangement which, on the one hand, considerably simplifies the taking of impressions and dental processing and, on the other hand, enables the patient to have a precisely aligned, structurally uncomplicated, yet reliable and also inexpensive implant-supported denture.

24 PRIOR ART Figures O.a to O.c illustrate a conventionally common arrangement and procedure for taking an impression, as described, for example, by Schroeder, A. et al. in: Oral implantology. Georg Thieme Verlag Stuttgart, 2. Ed., 1994, pp. 209 ff., Is described.

27 PigurO.a In the upper or lower jaw bone K, the implant 1 is here a perforated hollow cylinder implant - inserted intraosseously and transgingivally, so that the implant head 11 penetrates the mucous membrane S. The example described only relates to an implant 1. In the case of a more comprehensive restoration, several implants 1 can also be placed, so that the dental superstructures are correspondingly multiplied. After the 3-4 month healing phase of the implant 1, the healing cap, which is no longer visible here, was removed and the octa secondary part 2 screwed into the implant 1 in situ. The base cone 21 of the octa secondary part 2 is thus seated in the implant cone 12 and the thread segment 22 of the octa secondary part 2 engages in the threaded bore 13 of the implant 1. The threaded bore 13 extends out of the space of the implant cone 12, axially downward from its bottom surface. The octa segment 23 of the octa secondary part 2 projects beyond the implant shoulder 14. The impression cap 3, which cannot be

repositioned, is placed with its opposing shoulder 31 on the implant shoulder 14.

39 The impression cap 3 is screwed to the octa secondary part 2 by means of a positioning screw 4 penetrating axially through the latter, in that the threaded segment 41 of the positioning screw 4 engages in the blind hole-shaped threaded bore 24 in the octa secondary part 2. Complementary inner contours are provided for the octa segment 23 on the connection part 32 of the impression cap 3, so that the parts form a form-fitting connection. For the engagement of a rotary instrument, the positioning screw 4 has a cross-head 43 on the screw head 42. An impression spoon 6 filled with impression compound 5 is placed on the jaw area to be treated and the impression cap 3, which has a passage 61 at its apex for the screw head 42 and for the escape of excess impression compound 5, which is displaced when the impression tray 6 is pressed onto the jaw area . The impression cap 3 has the generally angular outer contour with a plurality of outer ribs 33 spaced apart from one another to promote the bond with the impression compound 5 surrounding the impression cap 3.

51 Figures o.b and O.c Here the further process can be seen. After the impression compound 5 has set, the compound plug 51 that has swelled out of the passage 61 must be removed in order to expose the screw head 42 and to be able to unscrew the positioning screw 4 from the octa secondary part 2. Only now can the impression tray 6 with the impression cap 3 firmly embedded in the impression compound 5 be removed from the patient's mouth. In the impression compound 5, the contour of the jaw area is negatively shaped.

57 The following definition applies to the rest of the description. If reference numbers are contained in a figure for the purpose of clarity of the drawing, but not explained in the directly associated description text, reference is made to their mention in the preceding figure descriptions.

60 Figuroc The manipulation implant 7 now placed on the impression cap 3 has the same structure on its head 71 as the implant head 11 of the implant 1 with the implant shoulder 14 and the screwed-in octa secondary part 2 and its protruding octa segment 23. The manipulation implant 7 accordingly has the analog head 71 with the implant shoulder 74 and the protruding octa segment 73, which attach to the connection part 32 of the impression cap 3 in a form-fitting manner. For the threaded hole 24 in the octa secondary part 2, a similar, blind hole-shaped threaded hole 72 is provided in the head 71. A positioning screw 4 is screwed in again through the passage 61 in the impression tray 6 and the impression cap 3 in order to connect the manipulation implant 7 to the impression cap 3 enclosed in the impression tray 6 firmly and without gaps. The threaded segment 41 thus engages in the threaded bore 72. To create the master model, the negative form obtained from the treated jaw area is then poured out with hard plaster and the manipulation implant 7 is embedded in the process.

72 The subsequent work phases are no longer shown in the drawing. After the hard plaster of paris has solidified, the positioning screw 4 is unscrewed and the negative mold is separated from the hard plaster of paris mold - the master model obtained, which corresponds exactly to the affected contour in the patient's mouth. A gold cap is then placed on the master model and on the protruding head 71 of the manipulation implant 7. Finally, the restoration is waxed on and cast on the gold coping and finally ceramic is fired on for the final prosthesis. The patient receives the finished restoration in place, with a titanium occlusal screw penetrating it and engaging the octa secondary part 2 screwed into the implant 1 so that the restoration is now

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firmly seated on the implant 1.

81 This conventional system has a number of disadvantages when taking an impression, in particular: to attach the impression cap 3 on the implant 1, both structural parts must be connected to one another by a positioning screw 4; the impression tray 6 must be provided with passages 61 which are to be precisely placed before the impression is taken; the excess leaked from the passages 61 Impression compound, i.e. the ge around the screw heads 42 formed earth plugs 51 must after curing of the Impression compound 5 can be removed to unscrew the positioning screws 4; only after the positioning screws 4 have been unscrewed can the impression tray 6 be removed from the patient's mouth and referred to the dental laboratory; you also have to go to the dental laboratory before making the Place the master model manipulation implants 7 on the connecting parts 32 of the impression caps 3 and fix them with positioning screws 4.

92 With the connection arrangement described above, the creation of the master model is complicated overall, requires numerous operations and is a laborious procedure for the patient, the dentist and the dental technician.

95 From US Pat. Nos. 3,797,114 and 5,195,891, releasable connection arrangements in the form of a plug-in combination are known. The snap connections are formed in that a plug-in element is pushed into a receiving element, the plug-in element having a pin with a spherical head and the receiving element having an elastic gripping means. When inserting the plug-in element, the gripping means is first expanded; once the head of the plug-in element is fully inserted, the gripping means contract again. The snap connections made in this way consist of a large number of relatively complicated individual parts. It is particularly inadequate that there is no reliable control over the sufficient strength of the connection.

103 Finally, another releasable connection arrangement with interlocking elements is known. Here the receiving element has a locking slide which is under spring pressure and which engages in a recess in the plug-in element when the latter is pushed into the end position.

106 The disadvantages of this connection arrangement are that the connection can only be loosened with great difficulty and that the resilient locking slide represents an uncertainty factor with regard to functional reliability.

109 In view of the imperfections of the prior art described above, the object of the invention is to create a connecting arrangement which has been improved in many ways. The aim is to develop system elements that make it possible to decisively simplify the taking of impressions and the subsequent dental processing. Furthermore, for the construction of the superstructures, i. for the intraoral fastening of the artificial tooth replacement parts, as few elements as possible are required. The manufacture or The connection can be loosened by a simple linear relative movement and without additional rotation, since otherwise the mechanism would become more complicated again. It is assumed that part of the connection arrangement is firmly connected to the implant.

118 The solution to this problem is defined by the characterizing features of independent claim 1, while preferred design variants result from the dependent claims. The essence of the invention is that a plug-in anchor with an elastic clamping head and a complementary contour are provided, which together result in a detachable plug connection.

122 This contour - z. B. a locking shoulder - is arranged in the counterpart of the connector, which is not firmly connected to the plug anchor. This can alternatively be the impression cap, the crown cap or an existing secondary part, the secondary part being inserted in the implant or in the manipulation implant or being an integral part thereof.

126 The sticking anchor is either fixed in the abutment pointing upwards or fixed in the impression resp. Crown cap arranged. The separation force required to loosen the plug connection is designed in a differentiated manner through the targeted dimensioning of the geometric relationships.

130 In the following, the connecting arrangement according to the invention is described in more detail with reference to the accompanying drawings. The figures show: FIG. O.a: a partial section through a dental implant placed enostalgically when taking an impression with an impression cap and tray according to the prior art; O.b: the illustration according to FIG. 0.a with lifted impression tray and twisted one Positioning screw; O.c: the representation according to figure o.b with attached manipulation implant and screwed in positioning screw; FIG. 1: the connection arrangement according to the invention for taking an impression in the upward position Cone secondary part and recessed recess in the impression cap;

2:

141 the connection arrangement according to FIG. 1 with an inner bead in the impression cap;

3:

145 the connection arrangement according to FIG. 1 with an impression cap is more uniform Inner contour and a sticking anchor with one Clamping head increased expansion force;

4:

150 the connection arrangement according to Figure 1 with an additional centering sleeve;

5:

154 the connection arrangement according to Figure 4 in an angled version; FIG. 6a: two implants placed enostally with a screwed, axially symmetrical cone Secondary parts and approximated plug-in anchors in preparation for taking an impression for a tooth bridge construction;

6

160 b: the representation according to FIG. 6a with screwed-in plug-in anchors and approximated impression caps; 6c: the illustration according to FIG. 6b with the impression caps fitted; FIG. 7: divergent positioned implants with axially symmetrical conical secondary parts and flexible or angled plug-in anchors; FIG. 8: the connection arrangement according to FIG. 2 for

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fastening a finished crown on a single tooth or for a tooth bridge construction; FIG. 9: the connection arrangement according to FIG. 1 with an octa secondary part and a complementary inner octagon in the impression cap as a rotation lock; 10: the connection arrangement according to FIG. 9 with an additional retaining screw; 11: a crown cap with transversal screw connection for the connection arrangement according to FIG. 10 as the basis for a superstructure; FIG. 12: the connection arrangement for taking an impression in the downward position with a conical secondary part and an inner bead in the impression cap; 13: the connection arrangement according to Figure 12 with clamping ring and groove on the cone secondary part for transversal screwing;

173 14: the connection arrangement according to FIG. 13 with an occlusal thread in the cone secondary part for fastening a finished crown; 15: the connection arrangement according to FIG. 14 with a widely movable plug anchor for extremely divergent implants; FIG. 16: the connection arrangement according to FIG. 12 with the manipulation implant attached for the production of the model; FIG. 17: the connection arrangement according to FIG. 12 for fastening a finished crown on a single tooth or for a tooth bridge construction; 18: the connection arrangement according to Figure 13 with transverse screwing of the finished crown; 19: the connection arrangement according to FIG. 14 with fastening of the finished crown by means of the plug-in anchor; 20: the connection arrangement according to Figure 14 with occlusal attachment of the finished Crown; FIGS. 21a-21e: workflow for taking an impression using the connection arrangement according to FIG Figure 4; 22a-22e: workflow according to FIGS. 21a-21e using the connection arrangement according to FIG. 5;

185 23a-23e: work flow according to FIGS. 21a-21e using the connection arrangement according to FIG. 9; 24a-24e: workflow according to FIGS. 21a-21e using a conical secondary part having a groove; FIGS. 25a-25e: Workflow of the model and crown production using the connection arrangement according to FIG. 1 and occlusal Screw connection of the gold cap or the finished crown; 26a-26e: workflow according to FIGS. 25a-25e using the connection arrangement according to FIG. 5; 27a-27e: workflow according to FIGS. 25a-25e with cemented gold cap or finished crown; 28a-28e: work sequence according to FIGS. 26a-26e with permanently cemented gold cap or finished crown; FIGS. 29a-29e: the working sequence of the model and crown production using the connection arrangement according to FIG. 9; 30a-30e: Work sequence according to FIGS. 25a-25e using a conical secondary part with a groove; 31a-31e: workflow according to FIGS. 30a-30e with transversely screwed gold cap or finished crown;

196 32a-32e: Workflow according to FIGS. 29a-29e for fastening a provisional Crown.

197 FIG. 1 The connection arrangement according to the invention for taking impressions consists in principle of the implant 1 inserted into the jawbone K, the secondary cone 8 screwed into it, the plug-in anchor 100 screwed into the latter and the impression cap 300 that can be attached to it.

201 The implant 1 has in a conventional manner a conically widening implant head 11 which penetrates the mucous membrane S and terminates on the top with the implant shoulder 14. In the implant head 11 a downwardly conically narrowing bore - the implant cone 12 - is provided. A blind hole-shaped threaded bore 13, into which the threaded segment 82 of the conical secondary part 8 is screwed, extends axially downward from the base of the implant cone 12.

The cone secondary part 8 also consists of the base cone 81 adjoining the thread segment 82 and the upwardly tapering cone pillar 83 located thereon. The base cone 81 is embedded in the implant cone 12 and practically closes with its upper edge on the raised, inner attachment of the implant shoulder 14, while the cone pillar 83 protrudes from the implant 1.

210 A blind hole-shaped threaded bore 84 runs axially downward from the top surface of the conical pillar 83 and thus from the top surface of the entire conical secondary part 8.

212 The threaded segment 110 of the plug-in anchor 100 is screwed into the threaded bore 84. The plug-in anchor 100 also consists of the shaft segment 120 adjoining the thread segment 110, merging at an annular support shoulder 121 and having an enlarged diameter, which protrudes from the conical pillar 83, the bearing shoulder 121 being seated on the conical pillar shoulder 85. The dome-shaped clamping head 130 adjoins the cylindrical shaft segment 120 like an overhang and widens abruptly, so that a clearly contoured, radially circumferential locking flank 131 results between the shaft segment 120 and the clamping head 130. Dividing slits 132, preferably two dividing slits 132 arranged crosswise, extend vertically from the clamping head 130 into the shaft segment 120, whereby four identical anchor lamellas 133 are formed which are elastic in the horizontal plane.

222 The impression cap 300 has the generally angular outer contour with ribs 303. On the underside of the impression cap 300 is the connection part 302 with the opposing shoulder 301 complementary to the implant shoulder 14, which ensures that the impression cap 300 is placed on the implant 1 without any joints. Starting from the connection part 302, starting from the underside of the impression cap 300, an axially and upwardly narrowed conical bore 304 extends into the interior of the impression cap 300. In an ascending manner, the conical bore 304 merges into a cylinder bore 305 which, behind a radially encircling locking shoulder 307 provided on the inner wall 306, widens in the cavity.

230 The latching shoulder 307 is circular and conically narrowing downwards, so that it assumes an angle of increase α with the vertical axis, preferably 300 <CL <600.

232 When the impression cap 300 is attached, the conical pillar 83 is seated in the conical bore 304 and the shaft segment 120 is located in the lower section of the cylinder bore 305, while the clamping head 130 is located above the locking shoulder 307 in the enlarged section of the cylinder bore 305. The elasticity of the fixed plug-in anchor 100 with the anchor lamellae 133 causes pressure of the locking flank 131 on the locking shoulder 307, whereby the impression cap 300 is pulled onto the implant 1 in a quasi vertical direction. The counter shoulder 301 of the impression cap 300 is pressed onto the implant shoulder 14. To ensure this function, a minimum clearance must be observed between the conical bore 304 and the outer contour of the conical pillar 83; the two cones must not lie on top of one another. The arrangement where the plug-in anchor 100 is screwed into the conical secondary part 8 and the clamping head 130 protrudes is referred to as the upward position. The following explanations deal with the geometrical relationships for ideal force measurement.

244 FIG. 2 shows a first structural modification to the connection arrangement. The implant 1, the conical secondary part 8 screwed into it and the plug-in anchor 100 screwed into the latter correspond to the embodiment discussed above. Only the clamping head 130 is designed to be flatter; In principle, the outer contour of the impression cap 300 is also unchanged. To

accommodate the conical pillar 83 and the shaft segment 120, an axial conical bore 304 and a cylinder bore 305 directly adjoining it are likewise provided in the impression cap 300. Instead of the locking shoulder 307 present according to FIG. 1 with the enlarged section of the cylinder bore 305 located above it, a radially circumferential, raised locking web 308 is present on the inner wall 306 and within the blind hole-shaped cylinder bore 305.

253 The cylinder bore 305 has the clear bore diameter dB, which narrows in the area of the full height of the locking web 308 to the extent of the clear locking web diameter dR, and the clamping head 130 has the clamping head diameter dK. Consequently, the diameter ratios are obtained with dB> dK> dR. The locking web 308 has the cross-sectional shape of an isosceles trapezoid, the base line of which lies on the inner wall 306. The trapezoidal legs here likewise assume the angle of rise a with the vertical axis. If the impression cap 300 is attached to the plug-in anchor 100, the clamping head 130 is located above the locking web 308, in the upper section of the cylinder bore 305, and the locking flank 131 of the clamping head 130 presses on the upper trapezoidal leg of the locking web 308. As a result, the impression cap 300 is again drawn onto the implant 1 in the vertical direction. The opposite shoulder 301 of the impression cap 300 sits seamlessly on the implant shoulder 14; Impression cap 300 and implant 1 are mutually fixed for the process of taking an impression.

265 When attaching or removing the impression cap 300 from the plug-in anchor 100 - the clamping head 130 overcomes the narrowing at the locking web 308 - there must be enough free space for the compressed anchor lamellas 133. The dividing slots 132 in the clamping head 130 must therefore have a sufficient slot width bs. The dividing slots 132 are provided with a slot length ls which can extend into the vicinity of the threaded segment 110 of the plug-in anchor 100.

270 In order to establish the plug connection between the implant 1 and the impression cap 300, the plugging force Fs must be applied; In order to remove the impression cap 300 after the impression has been taken - the impression compound 5 must be sufficiently hardened, the separating force FT is required. The forces Fs and FT to be applied are functionally dependent on the bore, locking web and clamping head diameters dB, dR and dK, and the contour of the locking flank 131 and shoulder 307 or

276 of the locking web 308 and for the elasticity of the anchor lamellas 133. The material properties and geometry of the anchor lamellas 133, as well as the slot width and length bs, ls, have an influence on the elasticity.

279 Figure 3 As a deviating special feature is provided in this design variant, the blind hole-shaped cylinder bore 305 in the impression cap 300 without interruption, i.e. without a locking shoulder 307 or a locking web 308 to be formed.

282 The fixation between the attached impression cap 300 and the clamping head 130 of the plug-in anchor 100 is based here on the spreading force of the compressed anchor lamellae 133, which is under spring tension, acting against the inner wall 306. When the impression cap 300 is removed, the clamping head 130 is spread more widely. If the impression cap 300 is attached, the friction on the contact surface between the inner wall 306 and the outer curve of the clamping head 130 holds the impression cap 300 on the implant 1, i.e. the connection part 302 of the impression cap 300 sits fixedly on the implant head 11 and the opposing shoulder 301 rests seamlessly on the implant shoulder 14. A specifically created surface roughness on

the clamping head 130 and on the inner wall 306 is conducive to the firm, gap-free seating of the opposing shoulder 301 of the impression cap 300 on the implant shoulder 14, which is necessary during the impression taking.

293 In a modification of the completely uncontoured, continuous inner wall 306 just described, it is also practical to design the cylinder bore 305 in two sections of different diameters. If the impression cap 300 is put on, the result is that, following the conical bore 304, the cylinder bore 305 has a larger diameter over a wide area of the shaft segment 120 than in the upward section where the clamping head 130 is positioned. The transition between the lower, enlarged section of the cylinder bore 305 and the upper, narrower section is formed by a relatively narrow, annular conical surface. When the impression cap 300 is put on, the clamping head 130 thus first travels through the enlarged section of the cylinder bore 305. When passing the narrowing conical surface, the anchor lamellae 133 of the clamping head 130 are progressively compressed. Pretensioned in this way, the clamping head 130 then slides into the upper, narrower section of the cylinder bore 305 and holds the impression cap 300, as described above, due to friction.

305 FIG. 4 This embodiment of the connection arrangement is an extension of FIG. 1 in that an additional centering sleeve 9 is arranged in the implant head 11, which base cone 81 of the cone secondary part 8 (see FIG. Figure 5) surrounds. In this way, greater transfer accuracy is achieved when taking an impression with conical secondary parts 8. The alignment between the cones of the cone pillar 83 and the cone bore 304 is more accurate.

310 To achieve a certain elasticity, the centering sleeve 9 has expansion slots 92 arranged vertically on the sleeve shell 91. Under the pressure of the screwed-in cone secondary part 8, the sleeve shell 91 clings to the implant cone 12 while it centers the base cone 81 seated in it. In this embodiment, the conical pillar 83 has a radially circumferential shoulder section 86 on the underside, which sits directly on the implant shoulder 14. The opposite shoulder 301 of the impression cap 300 is correspondingly narrowed in order to leave room for the shoulder portion 86 on the implant shoulder 14. The sticking anchor 100 is designed in the manner described above.

318 FIG. 5 illustrates the structure of the connection arrangement for taking an impression using an angled conical secondary part 8. This construction largely corresponds to the previously described FIG. 4 with an axially symmetrical cone secondary part 8. The angled conical secondary part 8 now inserted, together with the other structural parts, enables the impression to be taken even when the implant 1 is inclined in the range from 0 to 30. Adapted impression caps 300 must be provided in accordance with the angle of inclination of the secondary part 8. The opposite shoulder 301 of the impression cap 300 and the shoulder section 86 of the conical secondary part 8 also sit here on the implant shoulder 14. A centering sleeve 9 can also advantageously be provided in the implant head 11 of the unchanged implant 1. The impression cap 300 and the sticking anchor 100 are otherwise identical to the previous design variants. To fix the conical secondary part 8 in the implant head 11, an insertable screw 87 is used, which is supported on an integrated seat in the conical secondary part 8 and engages in the threaded hole 13 in the implant 1.

331 FIGS. 6a to 6c On the basis of this sequence of figures, three construction phases of the

connection arrangement for taking impressions, for example a tooth bridge construction, are shown. According to FIG. 6a, two moderately divergent implants 1 are placed enostally in the jawbone K. Such a divergent implantation may be necessary due to the specific bone availability. The implant heads 11 penetrate the mucous membrane S and thus function as transmucosal units. Axially symmetrical conical secondary parts 8 are screwed into the implants 1 and the plug-in anchors 100 with their threaded segments 110 are now screwed into their threaded bores 84. FIG. 6b shows the connection arrangements prepared so far with the positioned plug-in anchors 100 and the impression caps 300 to be attached (construction corresponding to FIG. 1). According to FIG. 6c, the preparations for taking an impression are complete. The impression caps 300 are held by the clamping heads 130 and sit with their opposing shoulders 301 seamlessly on the implant shoulders 14.

343 FIG. 7 This shows a further structural modification of the connection arrangement for strongly divergent seated implants 1. The modification relates to the sticking anchor 100; otherwise the design corresponds to Figure 1, i.e. An axially symmetrical cone secondary part 8 is screwed into the implant 1. The combination of implant 1, conical secondary part 8 and plug-in anchor 100 shown in the middle is intended to represent the ideal vertical position only for an illustrative comparison. The adaptation to a steep incline is achieved in that a recess 122 is provided on the plug-in anchor 100, below the locking flank 131, radially circumferentially around the shaft segment 120. If a flexible material is used for the plug-in anchor 100, at least for the clamping head 130 and the adjoining shaft segment 120, e.g. If, for example, a plastic is used, this enables the individual armature lamellae 133 created by the dividing slots 132 to be bent to compensate for the inclined position.

354 The stability of the clamping connection between the clamping head 130 and the attached impression cap 300 is not impaired as a result.

356 FIG. 8 shows the use of the connection arrangement beyond the previously described impression taking, now for fastening a superstructure, e.g. B. in the form of an artificial tooth crown Zk for a single tooth (single crown). The tooth crown Zk consists of the internal, framework-forming crown cap 500 and the tooth Za modeled on it. In principle, the crown cap 500 has an inner contour which is identical to the impression caps 300 according to the previous figures (with the exception of FIG. 3). The clamping connection between the clamping head 130 and the impression cap 300, which according to FIG. 3 is based solely on friction, cannot be used for the fixation of a tooth crown Zk, because of the more tight fit required here.

364 The implant 1 is present with the implant head 11, the implant cone 12, the threaded bore 13 extending downward from this space and the implant shoulder 14 extending radially on top. A conical secondary part 8 is inserted into the implant 1, the construction and screw connection of which with the implant 1 has already been described. As already shown above, the conical pillar 83 protrudes from the implant head 11. In turn, a plug-in anchor 100 with its threaded segment 110 is screwed into the threaded bore 84 of the conical pillar 83. The shaft segment 120 and the clamping head 130 are designed in the manner described above. The crown cap 500 has a connection section 502 located at the bottom with the counter shoulder 501, which sits seamlessly on the implant shoulder 14. Analogous to the impression cap 300, a conical bore 504 extends axially upward from the connection part 502 into the crown cap 500, the

conical bore 504 merges into the blind hole-shaped cylinder bore 505, and the locking web 508 is provided on the inner wall 506.

376 When the tooth crown Zk is attached, shortly before the crown cap 500 sits seamlessly on the implant 1, the locking web 508 jumps over the clamping head 130 and the locking flank 131 now presses on the locking web 508, whereby the tooth crown Zk is pulled onto the implant 1. The tooth crown Zk must be placed much more securely and more firmly on the implant 1 than is necessary when taking an impression. The separating force FT 'which has to be expended when attaching a superstructure to loosen the connection arrangement must be significantly higher than when taking an impression.

383 To achieve this, various individual measures or a combination thereof are possible. It is most practicable to provide a detent web diameter dR 'which is reduced in relation to the impression taken, after which dR> dR' results. The rise angle CL could also be increased so that the upper trapezoidal leg on the locking web 508, which is decisive for the stop, approaches the horizontal more closely and thus represents a greater obstacle for the locking flank 131 when the tooth crown Zk is intentionally or unintentionally pulled off. This connection arrangement can also be used for the attachment of artificial individual teeth or bridge structures.

390 FIG. 9 The design of the connection arrangement with a rotation lock, which is explained first for taking an impression, is particularly advantageous for individual tooth replacement. Instead of the previously used conical secondary part 8, an octa secondary part 2 is now screwed into the implant 1, as has already been shown in the illustration of the prior art with reference to FIGS. The base cone 21 of the octa secondary part 2 is seated in the implant cone 12, and the thread segment 22 of the octa secondary part 2 engages in the threaded bore 13 of the implant 1. The entire octa segment 23 projects beyond the implant shoulder 14. Due to tolerances and different screw-in depths of the octa secondary part 2, the horizontal ledge 25 between the base cone 21 and the octa segment 23 can also rise above the implant shoulder 14.

400 Again, a plug-in anchor 100 with its threaded segment 110 is screwed into the threaded bore 24 present in the octa secondary part 2. The shaft segment 120 attached to the threaded segment 110 and the clamping head 130 arranged on top extend freely upwards without the impression cap 300 attached. In this case, the support shoulder 121 delimiting the shaft segment 120 downwards sits on the octa shoulder 26. In relation to the impression caps 300 from FIGS. 1 or 2, the impression cap 300 now used has the same external properties. In the attached position, the impression cap 300 sits with its opposing shoulder 301 without a joint on the implant shoulder 14. However, the inner contour of the connection part 302 of the impression cap 300 is designed to be complementary to the octa segment 23 and accordingly has an inner octagon 27. In the event that the ledge 25 protrudes beyond the implant shoulder 14, a radially circumferential recess 309 is provided on the inner edge of the opposing shoulder 301.

412 In this way, the opposing shoulder 301 can sit seamlessly on the implant shoulder 14 even when the ledge 25 is raised.

414 The inner octagon 27 continues in an axially ascending manner as a blind hole-shaped cylinder bore 305 into which the shaft segment 120 and the clamping head 130 extend. As already

described for the preceding figures, a raised, radial locking web 308 is provided on the inner wall 306. In the assembled state, the upper trapezoidal leg of the locking web 308 then sits under the locking flank 131 of the clamping head 130. Instead of the locking web 308, a locking shoulder 307 (cf. Figure 1) be incorporated on the inner wall 306 or the inner wall 306 is designed to be continuous (cf. Figure 3). With the use of an octa secondary part 2 in the connection arrangement, twisting of the attached, adapted impression cap 300 is excluded.

422 FIG. 10 illustrates the connection arrangement using an octa secondary part 2 while the impression is being taken, the attachment of a superstructure with transversal screwing being provided. In the construction according to FIG. 9, the threaded segment 110 of the plug-in anchor 100 is screwed directly into the threaded bore 24 of the octa secondary part 2. Now, on the other hand, a screw bolt 200 required for the transversal screw connection carried out subsequently is additionally inserted. The screw bolt 200 has a threaded segment 210 which is screwed into the threaded bore 24 of the octa secondary part 2.

429 A sleeve segment 220 adjoins the threaded segment 210 and has a blind hole-shaped threaded bore 221 extending axially from above for receiving the threaded segment 110 of the plug-in anchor 100. The sleeve segment 220 has a radial groove 222 on the outer circumference.

433 This screw bolt 200 can already be screwed in before the impression is taken. In this case, however, a special impression cap 300 with an enlarged cavity 310 is required in order to create space for the screw bolt 200. It is also possible to take the impression with the connection arrangement according to FIG. 9 - without the screw bolt 200 - and to insert this only after removing the plug-in anchor 100, in preparation for the transverse screw connection (see FIG. 11).

439 FIG. 11 shows the crown cap 500 with transversal screw connection, preferably in the form of a gold cap, which is used by the dental technician as a framework for the construction of a superstructure.

442 The superstructure, e.g. B. a dental crown is applied to the crown cap 500 prior to insertion into the patient's teeth. An implant 1 is present, which is equipped with an octa secondary part 2, the octa segment 23 of which projects beyond the implant shoulder 14. The octa segment 23 and the screwed-on screw bolt 200 are received by the crown cap 500. The latter has a connection part 5G2, the counter shoulder 501 of which sits seamlessly on the implant shoulder 14. A radially circumferential recess 509 is provided on the inner edge of the counter shoulder 501. If the ledge 25 of the octa secondary part 2 protrudes beyond the implant shoulder 14, the impact on the opposing shoulder 501 is thus avoided.

450 A 24 inner edge 403 extends vertically from the recess 509 into the crown cap 500 and receives the octa segment 23. The combination of 24 inner edge 503 and octa segment 23 results in a total of 24 possible plug-in positions in 150 steps each for the crown cap 500 to be attached. At the same time, the adjacent flanks of the 24 inner edge 503 and the octase segment 23 serve as a guide for the crown cap 500. Further upwards, the 24 inner edge 503 merges into a blind hole-shaped cylinder bore 505 in order to receive the sleeve segment 220.

456 At the side, the crown cap 500 has a compact material leg 510 with a downward-facing, continuous threaded bore 515 directed towards the radial groove 222.

458 A stud screw 516 is sunk into this threaded hole 515, the rounded tip 513 of which meets the upper edge delimitation of the radial groove 222 tangentially and thus causes the crown cap 500 to be pressed onto the implant shoulder 14. The crown cap 500 is fixed by means of the stud screw 516. The stud 516 has a head slot 514 for attaching a screwing tool.

462 FIG. 12 Starting with this figure, exemplary embodiments of the connecting arrangement now follow in the downward position. In the upward position, the plug-in anchor 100 is screwed with its threaded segment 110 in an octa secondary part 2 or in a cone secondary part 8 and the clamping head 130 is directed upwards, while the Abdruckbzw. Crown cap 300, 500 accommodates the clamping head 130. The characteristic of the downward position, on the other hand, is that a reversal is provided insofar as the downwardly directed plug-in anchor 100 is now permanently in the impression or Crown cap 300, 500 is seated and, in order to produce the clamping connection, is inserted into a conical secondary part 8 specially designed to accommodate the clamping head 130.

471 The connection arrangement for taking an impression is initially also based on the existing implant 1 with the implant head 11, the implant cone 12, the threaded hole 13 and the implant shoulder 14. A conical secondary part 8 is screwed axially into the implant 1, the threaded segment 82 of which engages in the threaded bore 13 and the base cone 81 of which sits in the implant cone 12. The conical pillar 83 projects beyond the implant shoulder 14 and terminates at the top with the circular ring-shaped and radially encircling conical pillar shoulder 85. From the top of the conical pillar 83 and thus from the top of the entire conical secondary part 8, a blind-hole-shaped cylinder bore 805 extends axially into the interior, which is used to receive the plug-in anchor 100. In the example here, the inner wall 806 has a raised locking web 808, which has the same function and contour as the locking web 308 from FIG. 2. It is also possible, instead of the locking web 808, to provide a contour identical to the locking shoulder 307 (see FIG. 1) or to make the inner wall 806 continuous (see FIG. 3).

483 The dimensional relationships within the cylinder bore 805 are designed to be adequate to the relationships in the impression cap 300 (see FIG. 2). The cylinder bore 805 has the clear bore diameter dB, which narrows in the area of the locking web 808 to the locking web diameter dR. The trapezoid legs on the locking web 808 also assume the angle of rise CL here with the vertical axis.

488 The outer contours of the impression caps 300 are indistinguishable, regardless of whether it is the variant of the upward or downward position, but the inner configurations are different. The impression cap 300 for the downward position initially also has, in an identical manner, a connection part 302 with the opposing shoulder 301 and an upwardly narrowing conical bore 304 with the summit diameter dG for receiving the entire conical pillar 83.

493 The conical bore 304 is adjoined by a narrower and relatively flat cylinder bore 311, from which, narrowed again, a blind-hole-shaped threaded bore 312 extends axially ascending. The cylinder bore 311 forms a form-fitting seat for the cylindrical carrier segment 140 of the plug-in anchor 100 partially located therein. The carrier segment 140 forms an intermediate member; the ascending thread segment 110 is attached to its upper side, while the downwardly pointing shaft segment 120 extends from the lower side, on which the clamping head 130 is formed at the bottom. The threaded segment 110 of the plug-in anchor 100 engages in the threaded

bore 312, so that it is firmly connected to the impression cap 300. The clamping head 130 in turn has the latching flank 131, dividing slots 132 with the slot width bs and the slot length ls and the anchor lamellae 133 formed thereby as well as the geometrical dimension of the clamping head diameter dK. The diameter ratios result from this: dR <dK <dB <When the impression cap 300 is attached, the conical pillar 83 sits in the conical bore 304, the conical pillar shoulder 85 is located near the bottom of the conical bore 304 and the carrier segment 140 has partially pushed into the cylinder bore 805.

507 The shaft segment 120 with the clamping head 130 also extend into the cylinder bore 805. The clamping head 130 has overcome the narrowing locking web 808 so that the locking flank 131 now engages under the lower trapezoidal leg of the locking web 808. However, since this is stationary, the elastic anchor lamellas 133 endeavor to push off from the locking web 808 and thereby pull the impression cap 300 connected to the sticking anchor 100 downwards. As a result, the impression cap 300 is pressed onto the implant 1 and the counter shoulder 301 sits seamlessly on the implant shoulder 14.

514 The insertion force Fs is required to establish the plug connection; if you want to separate the connection, the separation force FT must be applied.

516 FIG. 13 The changes compared to the previous figure relate to a modified conical secondary part 8, the width of the opposing shoulder 301 placed on the implant shoulder 14 and the fixation of the plug-in anchor 100 in the impression cap 300. The threaded segment 110 of the plug-in anchor 100 and the threaded hole 312 provided for screwing in the impression cap 300 are now replaced by a plug pin 150 on the plug-in anchor 100 and a cylinder bore 322 in the impression cap 300 that forms a press fit. The plug pin 150 inserted into the cylinder bore 322 is held in the impression cap 300 by the clamping effect of the press fit.

523 The conical pillar 83 of the conical secondary part 8 here likewise has the radially circumferential shoulder section 86 on the underside, which sits directly on the implant shoulder 14.

526 The counter shoulder 301 of the impression cap 300 is reduced in its width so that the shoulder portion 86 can also sit on the implant shoulder 14 (see FIG. 4). Furthermore, an externally circumferential radial groove 809 is provided on the conical pillar 83, which is only used for the later transverse screw connection. A further radial groove 810 is incorporated at the upper end of the base cone 81 - immediately below the approach of the cone pillar 83 and still surrounded by the implant head 11. This radial groove 810 serves to receive a clamping ring 900, which has the function of centering the conical secondary part 8 - similar to the centering sleeve 9 (see FIG. 4). In addition, the clamping ring 900 also acts as a rotation lock; unscrewing the conical secondary part 8 from the implant 1 is made more difficult. Instead of the clamping ring 900, the centering sleeve 9 could also be used, provided that the contour of the base cone 81 is correspondingly reduced.

537 Fig. 4 This embodiment of the connection arrangement for taking impressions represents an expansion compared to the previous variant in that the cylinder bore 805 in the conical pillar 83 of the conical secondary part 8 is partially provided with an internal thread 811. The internal thread 811 extends upwards from the locking web 808 to the level of a cylindrical countersink 812 running downwards from the conical pillar shoulder 85. Compared to the cylinder bore

805, the countersink 812 is enlarged, into which the carrier segment 140 is partially pushed in the assembled state. Like the radial groove 809, the internal thread 811 is initially without function for taking the impression. The radial groove 809 or the internal thread 811 of a screw is only used for the transverse or occlusal screwing of the superstructure placed on the implant 1 fitted with the conical secondary part 8. The thread tips of the internal thread 811 are flattened, so that the anchor lamellas 133 of the clamping head 130, and to a certain extent also the internal thread 811 itself, when pushed in or out.

549 Pulling out the plug-in anchor 100 is protected.

550 FIG. 15 A structural modification of the connection arrangement is presented for the purpose of taking impressions on extremely divergent implants 1. Compared to the previous variant, the receptacle of the plug-in anchor 100 in the impression cap 300 as well as the plug-in anchor 100 itself, which is supported in a laterally deflectable manner, have been changed. The conical bore 304 and / or the conical pillar 83 of the conical secondary part 8 must be dimensioned such that, when the impression cap 300 is attached, there is a gap between the inner wall 306 and the conical pillar 83 for the process of removing the impression cap 300. An axial threaded bore 330 extends from the top surface of the impression cap 300 and continues as a cylinder bore 332 as far as a narrowing joint socket 333. A cylindrical through-hole 334 runs from the joint socket 333 to the conical bore 304.

560 The plug-in anchor 100 has the clamping head 130, the adjoining shaft segment 120 and, now newly, a joint ball 160 arranged on the other hand on the shaft segment 120, diametrically opposite the clamping head 130.

563 The joint ball 160 is located in the cylinder bore 332 and is held free of play on the joint socket 333 by a spacer segment 340 also arranged in the cylinder bore 332 above the joint ball 160.

565 On the side facing the joint ball 160, the spacer segment 340 has a conical countersink 341. The spacer segment 340 receives a certain pressure in the direction of the joint ball 160 from a screw 350 screwed into the threaded bore 330. The shaft segment 120 penetrates the larger through hole 334, so that a structurally limited, lateral deflection of the plug-in anchor 100 is possible. The spacer segment 340 and the screw 350 are preferably made of plastic.

570 A modified alternative solution to the plug-in anchor 100 with the joint ball 160 attached directly to the shaft segment 120 is possible. A plug-in anchor 100 is used with a threaded segment 110 adjoining the shaft segment 120 (see FIG. 1), which is screwed into a joint ball 160 which has a complementary threaded hole. The connection arrangement according to FIG. 15 can also be equipped with the centering sleeve 9 (see FIG. 4) instead of the clamping ring 900 inserted into the radial groove 810 for centering.

576 The function of this particular connection arrangement is described below. Assume that an impression is to be taken on the jaw with two strongly divergent implants 1. First, an impression cap 300 with the laterally deflectable plug-in anchor 100 is placed on the implants 1. The clamping heads 130 slide under the locking webs 808, whereby the impression caps 300 are fixed on the implants 1; the counter shoulders 302 sit seamlessly on the implant shoulders 14. According to the divergence of the inserted implants 1, the impression caps 300 are also positioned divergently to one another. The impression spoon 6 filled with impression compound 5 is now pressed onto the jaw, with the impression caps 300, which are inclined to

one another, being embedded in the impression compound 5 in an aligned manner <RTI> (cf. </RTI> Figure 0.a). After the impression compound 5 has hardened, the impression tray 6 is lifted off. During the lift-off, the shaft segments 120 and clamping heads 130 of the plug-in anchors 100 move out of the cylinder bores 805 after the clamping heads 130 have first overcome the locking webs 808.

589 As the impression tray 6 continues to be lifted off, the movable sticking anchors 100 experience a deflection in order to compensate for the divergent starting position.

591 FIG. 16 The connection arrangement is shown in the downward position after the impression has been taken (cf. Figure 0.c). The impression cap 300 is embedded in the impression tray 6 with the hardened impression compound 5 and the manipulation implant 7, which has an external geometry analogous to the implant head 1, is already plugged together with the impression cap 300. In this way, the situation on the relevant jaw part was obtained in the form of an impression Ab as a negative image with the manipulation implant 7 replacing the original implant 1. The production of the master model now follows. The connection arrangement according to the invention is also used beneficially during this work phase.

599 The impression cap 300 has in its interior the plug-in anchor 100 positioned axially and downwards. A plug-in receptacle 700 is placed on the head 71 of the manipulation implant 7. The manipulation implant 7 and the plug-in receptacle 700 are preferably designed in one piece. The outer contour of the manipulation implant 7 with the plug-in receptacle 700 thus corresponds to the combination of implant 1 and secondary part - here the conical secondary part 8. The plug-in receptacle 700 is designed analogously to the cone secondary part 8 functioning as the counterpart of the connecting arrangement (cf.

606 Figure 12). The plug-in receptacle 700 thus has a conical pillar 783 which is complementary to the conical bore 304 in the impression cap 300 and which externally merges with the manipulation implant 7 via the implant shoulder 774. The plug-in receptacle 700 ends with the conical pillar shoulder 785 at the top. Furthermore, the plug-in receptacle 700 has an axially and vertically extending, blind hole-shaped cylinder bore 705 with the inner wall 706, on which the raised latching web 708 runs radially.

612 In the assembled state, the counter shoulder 301 of the impression cap 300 sits seamlessly on the implant shoulder 774. The conical pillar 783 of the plug-in receptacle 700 is pushed into the conical bore 304 located in the impression cap 300, so that the conical pillar shoulder 785 is close to the overhead base of the conical bore 304. The carrier segment 140 of the plug-in anchor 100 and completely its shaft segment 120 and clamping head 130 are partially inserted into the cylinder bore 705. When the manipulation implant 7 and impression cap 300 are connected, the clamping head 130 moves over the locking web 708, is thereby compressed and spreads again behind the locking web 708, so that the locking flank 131 is locked under the locking web 708. In the case of connection arrangements in the downward position, an internal thread 811 can advantageously be provided for attachment to octa and cone secondary parts 2, 8. On the other hand, a cylinder bore 705 is sufficient for the plug-in receptacles 700 on the manipulation implants 7.

624 It is also sufficient to dimension the geometrical relationships in such a way that the insertion force Fs resp. Separating force FT sets. After casting the master model using the existing

impression Ab with the attached manipulation implant 7, the plug connection between the impression cap 300 and the manipulation implant 7 can be released again in a simple manner. The master model obtained in this way serves as a positive image of the original situation from the patient's mouth for the subsequent creation of the superstructure.

630 The following FIGS. 17 to 20 show various, previously described embodiments of the connecting arrangement in the downward position, which are now used for fastening a single crown Zk.

633 FIG. 17 This embodiment represents a constructive reversal of the connection arrangement of FIG. 8 with the use of a cone secondary part 8 from FIG. 12 serving as a plug-in receptacle. Correspondingly, the arrangement according to FIG. 17 consists of the implant 1, the conical secondary part 8 with the conical pillar 83 designed as a plug-in receptacle and a crown cap 500. The plug-in anchor 100 is designed in the same way as in the impression cap 300 according to FIG. 12 and is arranged in the interior of the crown cap 500.

639 Since a tooth crown Zk is being fastened, it will be ensured that the separating force FT 'required to pull off the tooth crown Zk is significantly greater than the separating force FT when an impression is taken. In the example here, the increased separation force FT 'is set by narrowing the locking bar diameter to the value dR'. This means that different conical secondary parts 8 are required for taking the impression and for attaching the tooth crown. An alternative possibility to use differentiated separation forces FT resp. To provide FT 'for both tasks is to use different stick anchors 100, i. change the geometry or the material properties.

646 If the tooth crown Zk is placed on the implant 1, the connecting part 502 of the crown cap 500 moves over the conical pillar 83 until the opposing shoulder 501 sits seamlessly on the implant shoulder 14. The clamping head 130 synchronously travels through the cylinder bore 805 and finally jumps under the latching web 808. To do this, the insertion force Fs' must be applied. It is easier to implement and nothing speaks against setting an increased insertion force Fs 'with an increased separating force FT'. If the plug connection between the tooth crown Zk and the implant 1, z. B. for cleaning, you have to pull the clamping head 130 using the greater separation force FT 'over the obstacle of the locking web 808.

654 FIG. 18 A conical secondary part 8 according to FIG. 13 and a crown cap 500 with transverse screw connection, in a form modified from FIG. 11, are used for this connection arrangement, likewise a construction example for fastening a single tooth crown Zk. A conical secondary part 8 is inserted into the implant 1, which has a shoulder section 86 resting on the implant shoulder 14, a radial groove 810 in the base cone 81 for receiving a clamping ring 900 and a radial groove 809 for attaching the tip 513 of a stud screw 516 for transverse screwing . The tooth crown Zk consists of the framework-forming crown cap 500 with the transversal screwing, the gold sprue Go, which largely covers the crown cap 500, and the porcelain coating Po covering the latter.

663 The plug-in anchor 100, which is directed downwards with its clamping head 130, sits with the holding plug-in pin 150 in the cylinder bore 522, which acts as a press fit, and the carrier segment 140 adjoining the plug-in pin 150 sits with its upper part in the one that adjoins the cylinder bore 522 coaxially and below Cylinder bore 511.

667 The shaft segment 120 with the clamping head 130 arranged at the bottom extends downward

from the carrier segment 140. The crown cap 500 itself consists of the cap housing with the conical bore 504 which adjoins the cylinder bore 511 coaxially, starts expanding from the latter and opens downward. At the side, the crown cap 500 has a compact, thickened material leg 510, in which a downwardly pointing, continuous threaded bore 515 directed towards the radial groove 809 provided in the conical pillar 83 is present. A stud 516 is positioned in the threaded hole 515, the rounded tip 513 of which meets the upper edge delimitation of the radial groove 809 tangentially, pushes itself off from it and thus causes the crown cap 500 to be pressed onto the implant shoulder 14.

676 A screwing tool can be used to engage in the head slot 514 of the stud screw 516 for adjustment.

678 If the tooth crown Zk is placed on the implant 1 and the transversal screwing is carried out, an additionally secured fixation of the tooth crown Zk on the implant 1 has been achieved. When the tooth crown Zk is slipped on, the snap connection between the clamping head 130 and the conical pillar 83 is initially established; the locking flank 131 has jumped under the locking web 808. If the stud screw 516 is then screwed into the threaded hole 515 so that the tip 513 of the stud screw 516 penetrates into the radial groove 809 and hits the upper edge of the radial groove 809, the locking effect of the transverse screw connection occurs. As a result of the lateral meeting of stud screw 516 and conical abutment 83, the entire crown cap 500 with the applied tooth crown Zk is pressed in the direction of the implant 1. The counter shoulder 501 sits seamlessly on the implant shoulder 14.

688 The crown cap 500 with its conical bore 504 is guided on the conical outer contour of the conical pillar 83.

690 The clamping ring 900 and the support segment 140, which is seated in a form-fitting manner on the one hand in the cylinder bore 511 and on the other hand held in the cylinder bore 805, also center the entire connecting arrangement. Any tilting of the crown cap 500, caused by the force of the stud screw 516, is opposed by the carrier segment 140. The precise centering of the framework-forming crown cap 500 and the tooth crown Zk carried by it can thus not be impaired by the transverse screw connection. If it is necessary to remove the tooth crown Zk, the first thing to do is to loosen the stud 516 and then the snap connection while applying the separating force FT '. In view of the additional securing through the transversal screw connection, however, it is not absolutely necessary here to take the precautions described above in order to set the separating force FT ', which is increased compared to FT.

700 Figure 1 In contrast to Figure 18 - otherwise the constructions are completely the same - a standard crown cap 500 without the additional transverse screw connection is used here and inside the conical pillar 83, an internal thread 811 is attached in front of the locking web 808 (cf. Figure 14). The fixation of the tooth crown Zk on the implant 1 is now brought about only by the plug connection between the plug-in anchor 100 and the locking web 808 in the interior of the cone secondary part 8. The radial groove 809 and the internal thread 811 currently have no function, i.e. they are not used in the example here.

707 In view of the greater stress on the plug connection when attaching a tooth crown Zk - compared to an impression cap 300 which is less stressed - the increased separating force FT 'must be set. The possible options for this have already been explained. It is particularly

advisable to use a plug-in anchor 100 with a clamping head 130 which is enlarged in relation to the taking of the impression.

712 Since the plug-in anchors 100 are firmly connected to the crown caps 500 in a press fit between the plug-in pin 150 and the cylinder bore 522, any risk of confusion is excluded.

714 FIG. 20 The tooth crown Zk is screwed occlusally to the conical secondary part 8 inserted into the implant 1; the sticking anchor 100 is now completely omitted. An occlusal screw 400, in the form of a head screw, as well as an access hole Zu through the modeled tooth Za to the crown cap 500 and a countersink 530 on the top of the crown cap 500 are also required here. A standard crown cap S00 is used, which was built up with the applied gold sprue Go and porcelain coating Po to form the tooth crown Zk. From the purchase surface of the tooth crown Zk, the vertical access bore Zu runs through all layers of the tooth Za modeled on the crown cap 500. This access bore Zu is required for the introduction and also for the possibly necessary removal of the occlusal screw 400 from the tooth crown Zk. Once the screw connection has been made, the access hole Zu is closed with an appropriate compound.

724 Countersink 530 provided on the top of crown cap 500 serves to receive and seat the head 420 of occlusal screw 400. The thread segment 410 of the occlusal screw 400 penetrates the cylinder bore 522 located in the ceiling of the crown cap 500 and engages in the internal thread 811 which is provided in the conical abutment 83 for this purpose. To attach a screwdriver, the head 420 has an engagement contour 421 in the form of a slot, a cross slot or a multiple internal edge. With this type of connection, the locking web 808, the radial groove 809 and the countersink 812 have no function, so that these could be omitted. The clamping ring 900 inserted into the radial groove 810 is not absolutely necessary, but is conducive to the centering of the conical secondary part 8.

733 The problem of plug-in or Separation forces Fs, FS 'FT, FT' naturally do not arise here. The plug-in connection, which embodies the essential subject matter of the invention, is only contained element-wise in the fastening of a tooth crown Zk just shown by means of occlusal screwing alone. Nevertheless, the invention also includes this connec tion type, since in the previous work phases - z. B. Impression taking and production of the master model - a complete set of the alternatively available connecting elements is used and a part of the connecting elements previously used is retained for the final crown attachment. This is also evident from the sequence of figures 21a to 32e to be dealt with.

741 FIGS. 21a to 32e The purpose of the sequence of figures is to once again illustrate in an overall overview the individual, subsequent working phases in which the connection arrangement according to the invention can be used efficiently by the dentist and the dental technician. At the same time, the system character of the elements of the connection arrangement emerges from the illustration, which is evident in the various structural modifications, the variable applicability and the ability to combine the elements. For the sake of clarity, all connection arrangements are shown only in the upward position; Of course, the analog inversions can also be implemented as a downward position.

749 FIGS. 21a to 24e deal with the phase of taking an impression in order to geometrically capture the oral situation in the area of an inserted implant 1. The initial stage here is the mouth area with the implant 1 inserted in the jawbone K (Fig. A). The final stage is when the impression

spoon 6 is pressed onto the attached impression cap 300 and filled with impression compound 5 (images e).

754 FIGS. 25a to 28e contain examples for the production of master models Mo and tooth crowns Zk, which are finally fixed in the patient's mouth, with conical secondary parts 8 being used. The initial stage is the attachment of the manipulation implant 7 to the impression Ab (Fig. A). The final stage is formed by the finished tooth crown Zk attached to the implant 1 inserted in the patient's mouth (images e).

759 FIGS. 29a to 32e show further examples for the production of master models Mo and tooth crowns Zk as well as the fastening of the latter in the patient's mouth. Both octa secondary parts 2 and cone secondary parts 8 are used here. The initial stage is the already taken impression Ab (pictures a) and the final stage is the tooth crown Zk fastened in the mouth on the implant 1 (pictures e).

764 The essential contents of the individual figures with the respective detailed images are listed below schematically as follows: Figure 21 Image a: Implant 1 inserted in the jawbone K; Image b: axially symmetrical cone secondary part 8 with a reduced base cone 81 and the centering sleeve 9 are screwed into the implant 1; Image c: Stick anchor 100 is inserted into the conical secondary part 8 and the impression cap 300 is attached; Image d: impression cap 300 is attached; Image e: taking an impression, i.e. filled with impression compound 5 Impression spoon 6 is pressed open; Figure 22 Image a: Implant 1 inserted in the jawbone K; Image b: angled cone secondary part 8 and Centering sleeves 9 are screwed into the implant 1; Image c: Stick anchor 100 is inserted into the cone secondary part 8; Image d: beveled impression cap 300 is attached; Image e: taking an impression, i.e. filled with impression compound 5 Impression spoon 6 is pressed open; Figure 23 Image a: Implant 1 inserted in the jawbone K;

775 Image b: Octa secondary part 2 with already screwed in Stick anchor 100 is screwed into the implant 1; Image c: impression cap 300 with connection part 302 complementary to octasegment 23 is attached; Image d: impression cap 300 is attached; Image e: taking an impression, i.e. filled with impression compound 5 Impression spoon 6 is pressed open; Figure 24 Image a: Implant 1 inserted in the jawbone K; Image b: axially symmetrical cone secondary part 8 with Radial groove 809 for possible later transversal screwing and with a reduced base cone 81 and the centering sleeve 9 are in the Implant 1 screwed in; Image c: Stick anchor 100 is inserted into the cone secondary part 8; Image d: Impression cap 300 with connection part 302 complementary to the conical pillar 83 is attached; Image e: taking an impression, i.e. filled with impression compound 5 Impression spoon 6 is pressed open; Figure 25 Image a: The plug-in anchor 100 is screwed into the conical pillar 783 of the one- or two-part manipulation implant 7 and together in the impression Ab, i.e. inserted into the imprint cap 300 with the complementary connection part 302 embedded therein;

788 Image b: manipulation implant 7 and impression Ab are connected; Image c: the standard crown cap 500 with countersinking 530 and Cylinder bore 522 placed for later insertion of occlusal screw 400; Image d: sitting on the master model Mo, the crown cap 500 is screwed to the occlusal screw 400, and the production of the tooth crown Zk can begin; Image e: the finished tooth crown Zk is screwed onto the implant 1 with the occlusal screw 400; Figure 26 Image a: Stick anchor 100 is inserted into the angled cone pillar 83 or 783 of the one-piece or

two-piece Manipulierimplantats 7 screwed and together in the impression Ab, i. inserted into the beveled impression cap 300 embedded therein with the complementary connection part 302; Image b: Manipulierimplantat 7 and impression Ab are connected; Image c: the beveled is placed on the master model Mo Crown cap 500 with the countersink 530 and Zylin derbohrung 522 for the later insertion of the

799 Occlusal screw 400 attached; Image d: sitting on the master model Mo, the bevelled crown cap 500 is screwed to the occlusal screw 400 and the Tooth crown Zk can begin; Image e: the finished, inclined to the implant 1 Tooth crown Zk is sitting on this with the Screwed occlusal screw 400; Figure 27 Picture a: identical to Figure 25, picture a; Figure b: identical to Figure 25, Figure b; Image c: a standard crown cap 500 is placed on the protruding from the master model Mo Conical pillars 83 or 783 attached; Image d: the crown cap 500 sits on the cone pillar 83 or 783 and the production of the tooth crown Zk can begin; Image e: the finished tooth crown Zk is cemented while sitting on the implant 1; Figure 28 Figure a: identical to Figure 26, Figure a; Figure b: identical to Figure 26, Figure b; Image c: the beveled is placed on the master model Mo Crown cap 500 attached; Pic d: the beveled crown cap 500 is on the The master model Mo is attached and the production of the tooth crown Zk can begin;

810 Image e: the finished, inclined to the implant 1 Tooth crown Zk is firmly cemented on this; Figure 29 Image a: as an impression Ab there is an impression cap 300 embedded in the impression tray 6 with a 24 Inside edge in the connection part 302 in front; Image b: the plug-in anchor 100 sits firmly in the octa segment 23 or 73 of the manipulating implant 7 and is thus inserted into the impression Ab; Image c: on the master model Mo with the outstanding Octa segment 23 or 73 and the sticking anchor 100 is a crown cap 500 with an inner Snap-in web 508 and a 24-inner edge 503 attached; Image d: the crown cap 500 is placed on the master model Mo and the production of the tooth crown Zk can begin; Picture e: the finished tooth crown Zk is with the sticking anchor 100 attached to the implant 1; Figure 30 Image a: as an imprint Ab there is an imprint cap 300 embedded in the imprint spoon 6 with a Conical bore 304 in the connection part 302 in front; Image b: firmly in the conical pillar 83 or 783 of the manipulating implant 7, which has a radial groove 809 for a possible later transverse screw connection, the plug-in anchor 100 is seated and is thus inserted into the impression Ab;

823 Image c: on the master model Mo with the outstanding Cone pillars 83 or 783 and the plug-in anchor 100 is a crown cap 500 with an inner Locking web 508 and a conical bore 504 attached; Image d: the crown cap 500 is placed on the master model Mo and the production of the tooth crown Zk can begin; Picture e: the finished tooth crown Zk is with the sticking anchor 100 attached to the implant 1; Figure 31 Figure a: identical to Figure 30, Figure a; Figure b: identical to Figure 30, Figure b; Image c: on the one protruding from the master model Mo Cone pillar 83 or 783 becomes a crown cap 500 placed with the attached material leg 510 for the transverse screw connection; Image d: the crown cap 500 is placed on the master model Mo and screwed transversely with the stud screw 516; so can manufacture the Tooth crown Zk begin; Image e: the finished tooth crown Zk is on the implant 1 through the transversely engaging stud screw 516 attached; Figure 32

834 Figure a: identical to Figure 29, Figure a; Figure b: identical to Figure 29, Figure b; Image c: identical to FIG. 29, image c, but with a different type of crown cap 500, which is provided for

the production of a provisional tooth crown Zk; Image d: the crown cap 500 is placed on the master model Mo and the production of the provisional tooth crown Zk can begin; Image e: the provisional tooth crown Zk is with the Stick anchor 100 is attached to the implant 1.

839 In addition to the above-described structural modifications to the elements of the connection arrangement and to the combination options shown so far, further variations in terms of design and interchangeability can be implemented. The following are expressly mentioned here: - Regardless of the upward or downward position of the provided plug-in anchor 100, the manipulating implants 7 can in their head 71 the conical pillar 83, 783 or the Octa segment 73, 23 already include as permanently integrated components or these components can be inserted; - To snap into place for the clamping head 130 could instead of a Locking shoulder 307 or a locking web 308, 508, 708 also have a locking recess machined into the corresponding inner wall; - The stick anchor 100 could with the secondary part 2, 8, the Impression cap 300, the crown cap 500 or the Manipu lierimplantat 7 form a piece or in or on these Share also be attached by gluing, soldering or positive connection Ver; - It is also possible to produce the clamping head 130 from elastic solid material ;; - instead of the octa secondary part 2 with its octagonal

852 Octa segment 23 and the complementary contour as a 24-In nenkant 403 in the connection part 302, 502 of the impression cap 300 or Crown cap 500 can also have other non-circular geometries, e.g. B. incorporate a hexagon to secure rotation; such Rotationssicherun gene can also be attached to cone secondary parts 8; - In the secondary parts 2, 8 you can also debohrung a threaded 24, 84, an adjoining locking web 808 or the equivalent contours and an adjoining, blind hole-shaped ending portion of a cylinder bore 805 provide, so that optionally Thread segment 110 or the clamping head 130 of the plug-in anchor 100 or an occlusal screw 400 can be used; The carrier segment 140 and the upper part of the inner wall 706, 806 that come into engagement therewith can be provided with mutually complementary grooves in order to enable positioning; The connection arrangement according to the invention can be used not only with the implant shape shown, but with all possible configurations.

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CLAIMS WO9629019A1

10 Claims

1.

14 Detachable plug-in connection arrangement for implant-supported dentures with an elastic plug-in anchor which can be pushed axially into a plug-in receptacle, characterized in that a) the plug-in anchor (100) directly or indirectly vertically into the inserted implant (1) or for the purpose of

18 Manufacture of a master model (Mo) used Mani pulierimplantats (7) can be used, the elastic

19 Clamping head (130) is at the top and the Implan did (1) or the manipulation implant (7) protrudes - be characterized as an upward position - or b) the sticking anchor (100) directly or indirectly vertically inside an impression cap (300) or a Crown cap (500) can be used and the clamping head (130) is at the very bottom - referred to as the downward position - and c) in the upward position inside the impression cap (300) or the crown cap (500) as a lock for the

24 Clamping head (130), a locking shoulder (307), a locking web (308, 508) or a locking recess is provided or

26 d) in the downward position directly in the implant (1) or

27 Manipulierimplantat (7) or in a secondary part (2, 8) which can be used in the latter as a locking device for the

29 Clamping head (130) a locking web (708, 808), a shoulder or a trough is provided.

2.

33 Plug connection arrangement according to claim 1, characterized in that a) as a locking device for the clamping head (130), instead of the

35 Locking shoulder, web or recess (307, 308, 508

36 708, 808), one surrounding the clamping head (130)

37 Inner wall (306, 506, 706, 806) is formed in the respective counterpart of the plug-in connection

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arrangement, which, together with the clamping head (130) standing under expanding spring tension, sets a sufficient static friction for the connection and as

Option b) the inner wall (306, 506, 706, 806) and / or the

Outer jacket of the clamping head (130) is provided with a surface roughness in order to increase the friction between the two.

3.

Plug-in connection arrangement according to Claim 1, characterized in that a) the plug (100) consists of a terminating, thickened

Clamping head (130) and a tapered shaft segment (120) carrying the clamping head (130), to which a thread segment (110), a pin segment (150) or a joint ball (160) directly adjoin or b) the clamping head (130), the shaft segment (120), which is directly adjoined by a thickened carrier segment (140), on which the thread segment (110) or the pin segment (150) is attached, and that c) at the transition between the clamping head (130) and the shaft segment (120)) a locking flank (131) is formed and as option d) the clamping head (130) is divided up into several elastic anchor plates (133) at the transition by dividing slots (132) extending from the clamping head (130) to the shaft segment (120) a support shoulder (121) is seen between the shaft segment (120) and the clamping head (130) and above the support shoulder (121), in

Direction of the clamping head (130) a radially circumferential

Puncture (122) is present.

4.

Plug-in connection arrangement according to Claim 1, characterized in that in the upward position a) a secondary part (2, 8) with or without a rotation-locking contour is inserted into the implant (1); b) as a secondary part, an octa secondary part (2) is provided, which is attached to a ledge (25), approximately at the height of the

Implant shoulder (14) located in an octagonal

Octa segment (23) passes, which on the top with a

Oca shoulder (26) closes, with the octagonal

The contour can be replaced by a non-circular geometry in an analogous manner; c) or a conical secondary part (8) is provided which has a conical pillar (83) projecting above the implant shoulder (14) and which terminates on the top with a conical pillar shoulder (85); d) in the secondary part (2, 8) accessible from above, axially downwardly extending, blind hole-shaped threaded hole (24, 84) for receiving the threaded segment (110) of the

Sticking anchor (100) or the thread segment (410) of a

Occlusal screw (400) is arranged.

5.

Plug-in connection arrangement according to Claim 1, characterized in that in the downward

position a) a secondary part (2, 8) with or without a rotation-locking contour is inserted into the implant (1); b) as a secondary part, an octa secondary part (2) is provided, which is attached to a ledge (25), approximately at the height of the

Implant shoulder (14) located in an octagonal

Octa segment (23) passes, which on the top with a

Oca shoulder (26) closes, with the octagonal

The contour can be set by a non-circular geometry analogously; c) or a conical secondary part (8) is provided which has a conical pillar (83) projecting above the implant shoulder (14) and which terminates on the top with a conical pillar shoulder (85); d) in the secondary part (2, 8) an accessible from above, axially downwardly extending, blind hole-shaped cylinder bore (705, 805) with the inner wall (706, 806) is easily seen; e) there is a detent web (708, 808), a detent shoulder (307) or a detent recess for engaging the clamping head (130) on the inner wall (706, 806), radially circumferentially, and f) on the octa shoulder (26) or A countersink (812) on the conical pillar shoulder (85) for partially receiving the one present in the central part of the plug-in anchor (100)

Support segment (140) is provided.

6.

Plug connection arrangement according to claim 4 or

5, characterized in that in the secondary parts (2, 8) a) on the octa segment (23) or on a non-circular analog segment or on the conical pillar (83) an outer, circumferential radial groove (809) for a possible

Transverse screw connection is incorporated; b) at the transition between the base cone (21, 81) and the

Octa segment (23) or the analog segment or the

Conical pillar (83) a shoulder section (86) is provided in the manner of a wing attachment, which has an inner

Circular ring of the implant shoulder (14) occupied and c) on the outer circumference of the base cone (21, 81), at the level of the implant shoulder (14), a radial groove (810)

Receiving a clamping ring (900) is provided or for

Centering in the implant cone (12) a centering sleeve (9) is used.

7.

Plug connection arrangement according to claims 4 to 6, characterized in that the secondary parts (2, 8) contain: a) on the octa shoulder (26) or on the

Conical pillar shoulder (85) the countersink (812), b) the vertically extending, blind hole-shaped

Cylinder bore (705, 805), c) on the inner wall (706, 806) of the cylinder bore (705, 805) an internal thread (811) which extends from the countersink (812) to the locking web (708, 808), the locking shoulder (307) or the latching recess runs, d) the shoulder section (86) and e) the radial grooves (809 and 810).

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8.

125 Plug connection arrangement according to Claim 1, characterized in that the impression cap (300) consists of: a) a cap housing open at the bottom, b) one which is complementary to the implant shoulder (14)

128 Counter shoulder (301) and c) a connection part (302) with a complementary inner contour that protrudes beyond the implant shoulder (14)

130 Octa segment (23) or the non-circular, analog segment or the conical pillar (83), namely with an internal octagon (27) or an analog

132 Geometry or a conical bore (304) and that as

133 Option d) the impression cap (300) in view of tolerances, based on the height of the ledge (25) of the octa secondary part (2) or the geometrically analogous secondary part, on the inner edge of the opposing shoulder (301) a radially circumferential recess (309).

9.

139 Plug-in connection arrangement according to Claim 8, characterized in that the impression cap (300) for the upward position a) is attached to the inner octagon (27) or is similar

141 Geometry or the conical bore (304) adjoining and axially upwardly extending, blind hole-shaped cylinder bore (305) for receiving the plug-in anchor (100) inserted in the secondary part (2, 8) and b) on the inner wall (306) of the cylinder bore (305) , a locking shoulder (307), a web (308) or a recess for engaging the

145 Has clamping head (130) and that the impression cap (300) for the downward position c) at the bottom of the conical bore (304) has a narrowed cylinder bore (311) for partially receiving the support segment (140) of the plug-in anchor (100); d) a threaded bore (312) for receiving the threaded segment (110) of the plug-in anchor (100) or e) a cylinder bore (322) as a snug fit for receiving the

150 Plug-in pin (150) of the plug-in anchor (100) or f) a narrowed through-hole (334) as a passage for the shaft segment (120) of the plug-in anchor (100) and a joint socket (333) arranged above the through-hole (334) for receiving the joint ball (160) owns.

10.

156 Plug-in connection arrangement according to Claim 9, characterized in that a) an axial one extends upwards from the joint socket (333)

158 Cylinder bore (322) extends into one of the

159 The upper side of the impression cap (300) merges with a threaded hole (330) which opens and b) a screw (350) is inserted into the threaded hole (330), which is placed on a spacer segment (340) inserted between the screw (350) and the joint ball (160)

162 Pressure.

11.

166 Plug-in connection arrangement according to claim 1, characterized in that the crown cap (500) consists of: a) a cap housing open at the bottom, b) a counter shoulder (501) complementary to the implant shoulder (14) and c) a connection part (502) with a complementary one Inside contour that protrudes from the implant shoulder (14)

170 Octa segment (23) or the non-circular, analogous segment or the conical pillar (83), namely with an internal octagon (27), a 24 internal edge (503) or the analogous geometry or a conical hole (504) .

12.

176 Plug-in connection arrangement according to Claim 11, characterized in that the crown cap (500) for the upward position a) has an adjoining internal octagon (27), the 24-internal edge (503) or the analogous geometry or the conical bore (304) axially upwardly extending, blind-hole-shaped cylinder bore (505) for receiving the plug-in anchor (100) inserted in the secondary part (2, 8) and b) on the inner wall (506) of the cylinder bore (505), radially circumferential, a locking shoulder (507) Locking web (508) or a locking recess for engaging the

183 Clamping head (130) is provided; and that the crown cap (500) for the downward position c) at the bottom of the conical bore (504) has a narrowed cylinder bore (511) for partially receiving the support segment (140) of the plug-in anchor (100); d) a threaded bore (512) for receiving the threaded segment (110) of the plug-in anchor (100) or e) a cylinder bore (522) as a snug fit for receiving the

188 Has plug pin (150) of the plug anchor (100).

13.

192 Plug connection arrangement according to claim 11, characterized in that the crown cap (500) a) in view of tolerances, based on the height of the

194 Simses (25) of the octa secondary part (2) or the analog

195 Secondary part, on the inner edge of the counter shoulder (501) has a radially circumferential recess (509); b) has a lateral, compact material leg (510) for a transverse screw connection, in which there is a threaded hole (515) for receiving a stud screw (516), which connects to the radial groove (809) on the

199 The secondary part (2, 8) or the radial groove (222) on the inserted screw bolt (200) is directed; c) for an occlusal screw connection with a modeled tooth (Za) in the ceiling has a countersink (530) from which an axial cylinder bore (522) extends into the interior of the crown cap (500), whereby the head (420) a The screwed-in occlusal screw (400) receives its seat and the thread segment (410) of this

204 The occlusal screw (400) penetrates the ceiling.

14.

208 Plug connection arrangement according to Claim 13, characterized in that a) the screw bolt (200) is screwed with its thread segment (210) onto an octa segment (23) or the analog segment; b) the sleeve segment (220) of the screw bolt (200) in the cylinder bore (505) of the crown cap (500)

212 Has its seat; c) the radial groove (222) on the screw bolt (200) in the

213 Align with the one located in the material leg (510)

214 Threaded hole (515) and d) the sleeve segment (220) is one accessible from above

215 Has threaded hole (221).

15.

219 Plug-in connection arrangement according to Claim 1, characterized in that for inclinations instead of axially symmetrical conical secondary parts (8),

221 Angled impression caps (300) and crown caps (500)

222 Cone secondary parts (8); Impression caps (300) with angled connection section (302) or

223 Crown caps (500) with a beveled connection part (502) are provided

16.

227 Plug-in connection arrangement according to Claim 1, characterized in that it is used: a) for taking impressions of those inserted in the jawbone (K)

229 Implants (1) to obtain the impression (Ab) and / or b) to produce the master model (Mo) and / or c) to attach tooth crowns (Zk) or a more complex superstructure to the one used in the patient's mouth Implants (1).

17.

235 Plug-in connection arrangement according to one of the preceding claims, characterized in that a) for taking an impression and producing the master model (Mo) for removing the impression caps (300)

238 Separating force (FT) is set and b) for a fixed tooth crown (Zk) an increased separating force (fit ') is provided by using materials of higher clamping effect and reduced elasticity or by changing the geometric dimensions.

18.

244 Plug connection arrangement according to claim 17, characterized in that an increased separation force (fit ') is provided by a) increasing the clamping head diameter from (dK) to (dK') and / or b) increasing the locking web diameter from (dR) to (dR ') narrows and / or c) the slot width (bs) in the clamping head (130) and shaft segment (120) narrowed to (bs') and /

or d) the slot length (ls) in the clamping head (130) and shaft segment (120) shortens and / or e) the rise angle (a) on the locking shoulder (307, 507,

250 707, 807) or the locking web (308, 508, 708, 808) of the

251 More converges to the horizontal.

The press-fit implant impression coping technique

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An accurate implant impression is essential for the fabrication of an accurately fitting superstructure. This is important to reduce stress in the implant components and bone adjacent to the implants. The unique implant-bone relationship requires a high standard of fit and is considered critical to the long-term success of a prosthesis.[1-4]

The popular pick-up (open tray) implant impression technique, using square copings, has been shown to be accurate and a primary factor in increasing the precision of fit for the restorative complex.[5,6] The transfer (closed tray) impression technique, using tapered copings, is a simpler method, in which the impression coping-analog assemblies are placed back into the impression extraorally. However, the reinsertion of the coping-analog assembly into the impression creates less accurate working casts.[7-10]

Both techniques may be uncomfortable for the patient and the clinician while the impression copings are being screwed and unscrewed intraorally. Slight movement of the copings may result in deformation of the impression material while unscrewing the guide pins from the impression copings during tray removal, or screwing/replacing the matching implant replicas in the impression tray. The press-fit impression coping is easier to manipulate, time saving, and more comfortable for both the clinician and patient because the coping is connected to the implant by pressing instead of screwing. The press-fit coping design allows removal of the coping with the impression and has the advantage of both the open- and closed-tray implant impression techniques. Thus, the press-fit impression coping helps to overcome movement of impression copings inside the impression material. An implant impression technique in which the press-fit impression coping was used to achieve accurate working casts is described.

PROCEDURE

1. Connect the press-fit impression coping (MD-PF375; MIS Implant Technologies Ltd, Shlomi, Israel) to the implant by pressing on, instead of screwing, the copings (Fig. 1).
2. Verify, radiographically, the fit of the press-fit copings (Fig. 1).
3. Remove the impression tray with the press-fit copings (Fig. 2).
4. Connect the implant replicas (MD-RSM10; MIS Implant Technologies Ltd) into the impression without screwing (Fig. 2).

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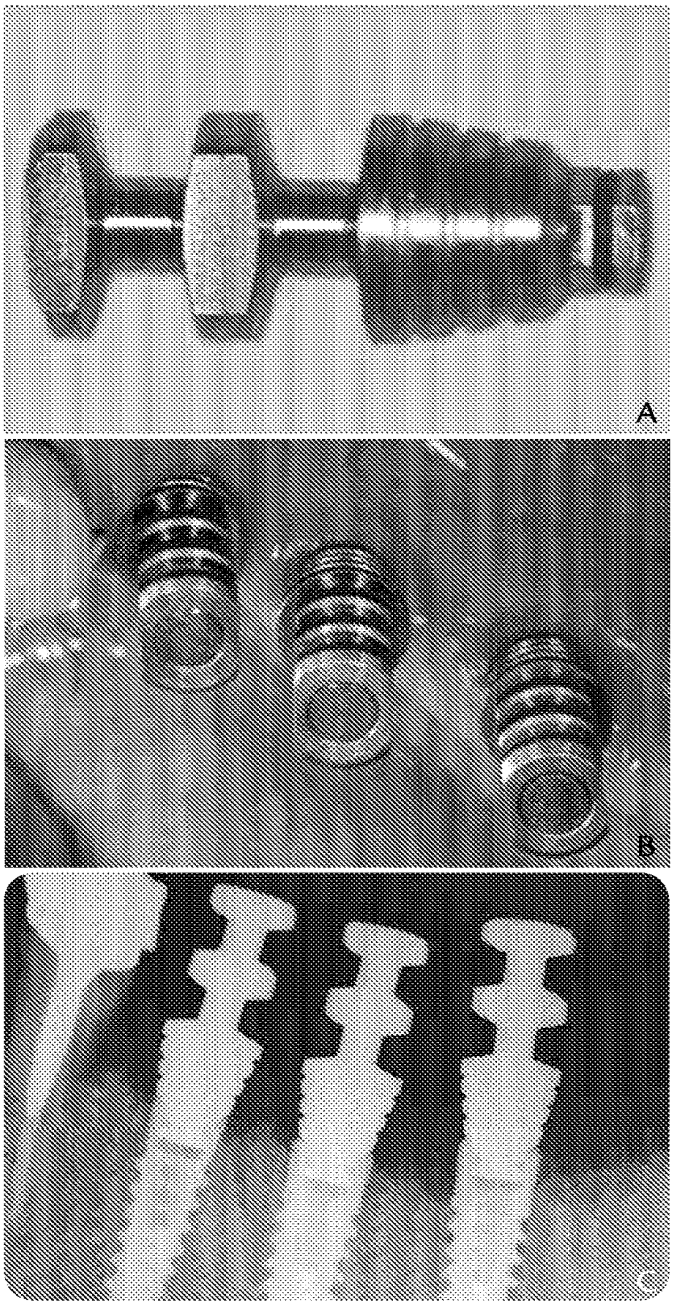
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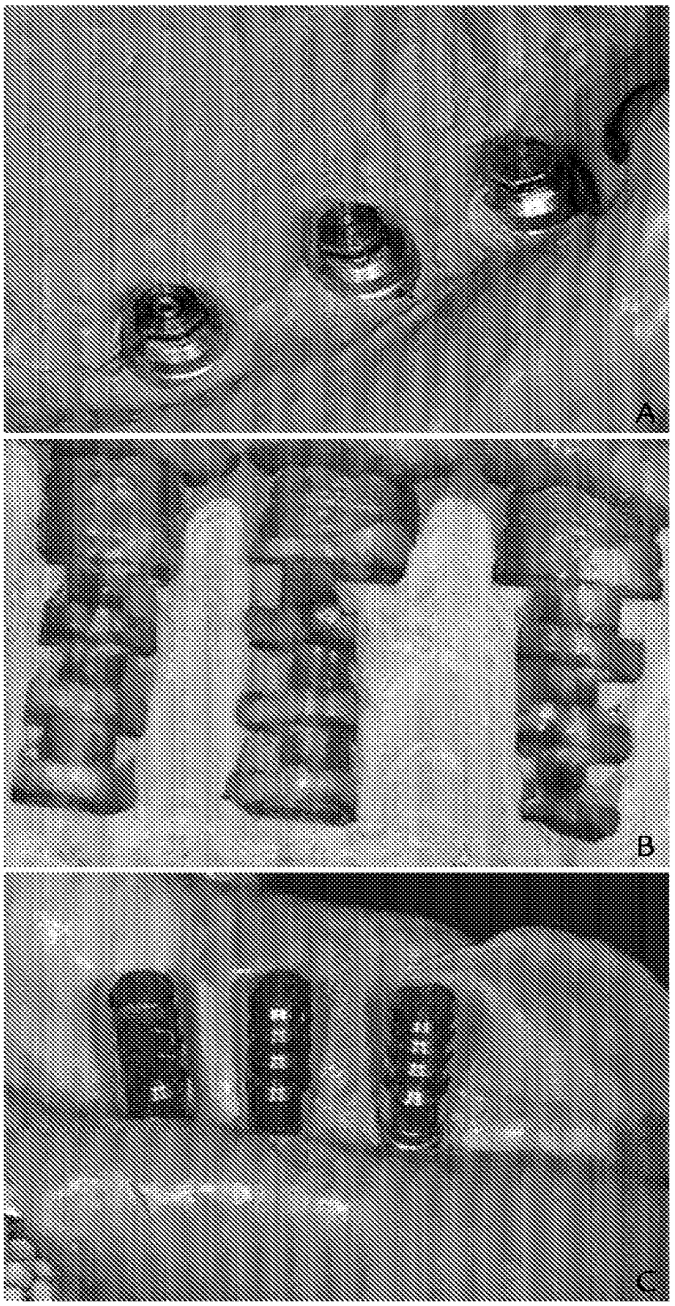
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1 A, Press-fit impression coping. B, Press-fit impression copings connected to implants. C, Radiograph of impression copings for verification of fit.



2 A, Press-fit copings after impression. B, Coping retention in impression. C, Connection of implant replicas.

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IMPLANT SCREW MECHANICS AND THE SETTLING EFFECT: AN OVERVIEW

Sheldon Winkler, DDS
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One of the most serious and prevalent problems associated with the restorative aspect of dental implants is loosening and fracturing of screws. Implant screws should be retightened 10 minutes after the initial torque application as a routine clinical procedure to help compensate for the settling effect. Mechanical torque gauges should be used instead of hand drivers to ensure consistent tightening of implant components to torque values recommended by implant manufacturers.

KEY WORDS

Implant
Screw mechanics
Preload
Torque
Settling effect

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INTRODUCTION

One of the most dramatic services the dental profession has to offer is the replacement of missing teeth with implants. Implants are not new to dentistry. Seashell fragments were used to replace 3 missing mandibular incisors as early as 600 AD, and human transplants were used in many diverse early cultures. In recent years, oral implantology has undergone a well-deserved rebirth or rediscovery, and implants are now considered the treatment of choice in an increasing number of carefully selected cases. Today, implant prosthodontics has reached the point at which it can be successfully performed by both general dentists and specialists.

One of the most serious and prevalent problems associated with the restorative aspect of dental implants is loosening and fracturing of the screws that attach the prosthesis to the implant. Screw loosening may be an early warning of inadequate biomechanical design and/or occlusal overloading. In order to attempt to solve the problem of loose screws, the clinician must first understand the mechanics involved with the screw joint.

SCREW MECHANICS

McGlumphy et al[1] defined the screw joint as 2 parts tightened together by a screw, such as an abutment and implant being held together by a screw. A screw is tightened by applying torque. The applied torque develops a force within the screw called the preload. As a screw is tightened, it elongates, producing tension. Elastic recovery of the screw pulls the 2 parts together, creating a clamping force.[2] The preload in the screw, from elongation and elastic recovery, is equal in magnitude to the clamping force.[1]

Opposing the clamping force is a joint-separating force, which attempts to separate the screw joint. Screw loosening occurs when the joint-separating forces acting on the screw joint are greater than the clamping forces holding the screw unit together.[1] Excessive forces cause slippage between threads of the screw and threads of the bore, resulting in a loss of preload.[3]

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It is not necessary to eliminate separating forces, only to minimize them.[1] Minimizing separating forces and maximizing clamping forces will act to prevent screw loosening.

When the clinician applies a torque to a screw to tighten its components together, the tightening torque creates a preload in the screw. The preload is determined by the applied torque and other factors, such as the screw alloy, screw head design, and abutment surface. The established preload is proportional to the applied torque. The torque value can be controlled by the clinician and can be reproduced from implant prosthesis to implant prosthesis. Too little torque may allow separation of the joint and result in screw fatigue, loosening, and failure. Too large a torque may strip the screw threads.[1]

Increasing the torque will increase the preload. Increasing the preload maximizes the stability of the screw joint by increasing the clamping threshold that separating forces must overcome to cause screw loosening. The amount of torque than can be applied is limited by the ultimate strength of the screw. McGlumphy et al[1] have stated that the optimal torque value is 75% of the torque needed to cause screw failure.

Another variable in the amount of torque that can be applied is how the torque is produced by the clinician. Torque can be applied manually or with a mechanical device. Until the introduction of mechanical torquing devices to the profession, implant components were tightened manually. The novice or inexperienced clinician often undertightened the screws in an implant system. Dellinges and Tebrock[4] found that the average torque applied with a screwdriver is only 10 N-cm.

In a pilot study, Jaarda et al[5] found that test subjects with little implant experience were not generally able to provide the recommended torque to implant prosthesis–retaining slotted gold screws. The investigators also reported that experienced test subjects tended to generate more than the recommended torque, and none of the test subjects were able to generate consistent torque values (Figure 1).

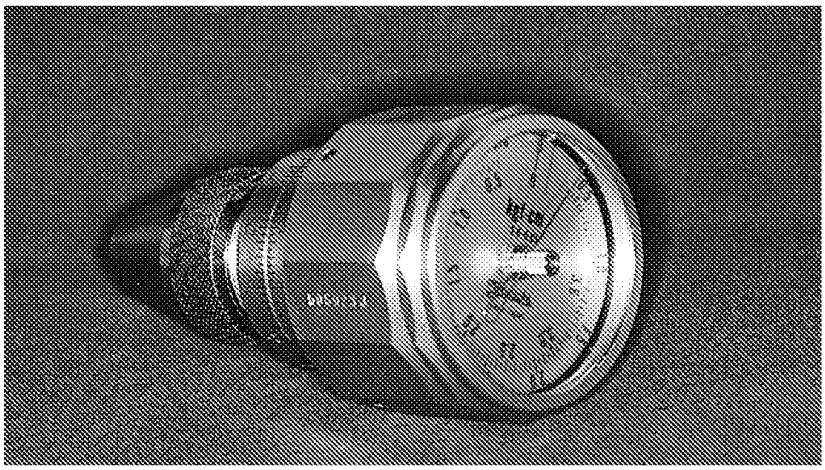


FIGURE 1. Tohnichi torque gauge used for research in Jaarda et al,[5,7] Bakaeen et al,[9] Siamos et al,[10] and Winkler et al (unpublished data, 2003), (Tohnichi America Corporation, Northbrook, Ill).

Joint-separating Forces

Clinically, the screw unit within an implant prosthesis is constantly subject to external joint-separating forces. Such intraoral separating forces may include off-axis occlusal contacts, lateral excursive contacts, interproximal contacts between natural teeth and implant restorations, protrusive contacts, parafunctional forces, and nonpassive frameworks that attach to the implants. Once external forces exceed the screw joint preload, the joint becomes unstable. The external load rapidly erodes the preload, resulting in vibration and micromovement that lead to screw loosening. Once loosening occurs, the screw joint ceases to perform the function for which it was intended and can be considered as failed.[3]

The clinician must recognize the possible forces that will be acting on the screw joint, so that screw loosening and other possible complications can be minimized or avoided.

Clinicians are urged to use some type of mechanical torque-applying instrument to ensure consistent tightening of implant components to the specified torque values recommended by implant manufacturers.

Settling Effect

A significant mechanism that results in screw loosening of implant-supported restorations is the settling effect. The settling effect (embedment relaxation), which plays a critical role in screw stability, is the result of no surface being completely smooth. No matter how carefully machined an implant surface is, it is slightly rough when viewed microscopically. Because of this microroughness, no two surfaces are completely in contact with one another.

Settling occurs as the rough spots flatten under load, since they are the only contacting surfaces when the initial tightening torque is applied. When the screw interface is subjected to external loads, micromovement occurs between the surfaces. Wear of the contact areas brings the 2 surfaces closer together. It has been reported that 2% to 10% of the initial preload is lost as a result of settling.[6] As a result, the torque necessary to remove a screw is less than the torque initially used to place the screw.[7]

The extent of settling depends on the initial surface roughness, surface hardness, and magnitude of the loading forces. Rough surfaces and large

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external loads increase the settling. When the total settling effect is greater than the elastic elongation of the screw, the screw works loose because there are no longer any contact forces to hold it in place.[8]

Thread friction is higher for the first tightening and loosening of a screw, and then decreases after repeated tightening and loosening cycles.[8] A number of authors have suggested tightening of implant screw joints after the initial screw insertion and periodically thereafter.[2,9,10]

Bakaeen et al[9] have reported that when prosthetic gold screws were tightened to 10 N-cm according to the manufacturer's instructions, the untightening torque of the different groups tested was about 2 to 3 N less than the tightening torque. These observations correspond to the findings of Sakaguchi and Borgersen,[6] who reported a 2% to 10% reduction in preload within the first few seconds or minutes after tightening as a result of the settling effect.

Siamos et al,[10] as a result of an in vitro investigation, also suggested that retightening abutment screws 10 minutes after initial torque applications should be routinely performed. The investigators also reported that increasing the torque values for abutment screws above 30 N-cm can be beneficial for abutment-implant stability and to decrease screw loosening.

To reduce the settling effect, implant screws should be retightened 10 minutes after the initial torque application.[2,9,10] This technique should be used as a routine clinical procedure.

In vitro studies

In vitro studies examining the dynamics of screw loosening using servohydraulic testing machines have limitations due to the difficulty of reproducing the complex nature of the chewing cycle. Clinical variables, such as intermittent high impact loads, varying angles of load application, and varying positions of load application in relation to the implant axis, may have significant damaging effects on the implant-abutment interface leading to screw loosening and failure.[11(p68)]

Ideally, load application and duration applied during testing should simulate these normal functional parameters. Cyclic fatigue studies frequently report maximum load applications of 100 to 200 N, which are at the low range of reported data for maximum bite forces (200–3500 N).[11(p68)] It is assumed that an individual has 3 episodes of chewing per day, each 15 minutes in duration, at a chewing rate of 60 cycles per minute. This produces an equivalent of 2700 chewing cycles per day or 10^6 cycles per year.[12,13] Accurately simulating these normal functional parameters is both time consuming and technically challenging.

DISCUSSION

Generally, simple tightening or replacement of loose retaining or abutment screws is all that is necessary, which is an inconvenience for both the clinician and the patient. Often extensive repair is involved, especially if abutment screws cannot be retrieved. This may necessitate abandonment of the involved implant and/or require modification or remake of the affected prosthesis.

Bakaeen et al[9] found that screw loosening can be reduced by narrowing the occlusal table of molar single-tooth implants when using 1 implant for support.

Ongoing research at Temple University School of Dentistry (S. Winkler et al, unpublished data, 2003) suggests that the percentage of difference between the applied torque and the counter torque increases significantly at lower initial torque values. The research also indicates that high initial torque values recommended by some manufacturers for their implant screws are beyond the limitations of the screws provided and may result in stripping, breakage, and other problems.

CONCLUSIONS

To reduce the settling effect, implant screws should be retightened 10 minutes after the initial torque application as a routine clinical procedure. Mechanical torque instruments should be used instead of hand drivers to ensure consistent tightening of implant components to the specified torque values recommended by implant manufacturers.

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CONFIRMATION #	2867	FILED BY	Daniel Whittle
PATENT CENTER #	63475684	AUTHORIZED BY	-
CUSTOMER #	112823	FILING DATE	06/03/2023
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Brandon Dale Kolford

Payment Information

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Different Mechanical Complications of Implant Prosthodontics: Review Article

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Abstract Nowadays implant therapy is an effective and reliable treatment with a high success rate, but various mechanical Complications can occur. Thus, the scope for prevention and management needs to be emphasized. The aim of this review article is to identify the different causes of dental implant failure due to fixture and or abutment screw fractures and to describe the management and the preventive options for these failures, so trying to assist the clinicians to plan accurately the implant-supported prosthesis treatment.

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1. Introduction

The longevity and success of an implant-retained or implant-supported prosthesis depend primarily on biological and mechanical factors [1]. The implant failure can be classified into early or late failures. Early failures occur shortly after surgery and characterized by the lack of osseointegration. In contrast, late failures correspond to those implants that have been regarded as successful for some time, and they occur after prosthetic restoration has been made [2,3].

There are two main causes for late implant fracture:

(a) *Mechanical problems*, the most frequent cause, including Metal fatigue, due to biomechanical overloading leading to loosening /or fracture of abutment or prosthetic screws and the wear and fracture of the prosthesis or various components in the system.

(b) *Biological problems*, loss of supporting tissue secondary to infection or peri-implantitis; the prevalence of periimplantitis is estimated to be 4-15% among the surviving implant population (i.e., implants still in the mouth) [4,5].

The present review identifies the different causes of dental implant failure due to fixture and or abutment screw fractures and also to describe the management and the preventive options for these failures. However, to solve these complications, one needs to understand the mechanics of such components.

2. Implant Fixture Fracture

2.1. Causes

a) Mechanical overloads; as a result of:

i. Metal fatigue when the resistance limit is exceeded.
ii. Patient's physiological alterations (e.g., para functional activity).
iii. Prosthetic problems, including inadequate occlusion, the presence of distal extensions or cantilevers in implant-supported prostheses, and a lack of prosthetic passive fit over the implants [6-10].

b) Peri implant vertical bone loss; as a result of:

i. Chronic peri-implant inflammation. ii. Occlusal trauma.

When vertical bone loss coincides with the apical limit of the screw, thereby joining trans-epithelial abutment to implant, the risk of implant fracture increases drastically [6-11].

c) Defects in implant design and manufacturing:

Metal fractures are related to microstructures that influence the material properties. They are related to the localized identification of chemical phases and segregations, frequently associated with failures at interfaces or components, which in turn can cause the fractures [12,13].

2.2. Incidence/Location of Implant Fracture

The incidence of dental implant fracture is between 0.16-1.5% as reported in the literature [14-19]. One study reported that the majority of fractured implants are located

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in the regions of the molars and premolars [7,11,20] and that the fractures were evenly distributed between the maxilla and the mandible, [12] whereas another study reported more fractures in the maxilla than in the mandible. [20]

2.2.1. Diameter of Implant

Implants with small diameters such as 4 mm [20] and 3.75 mm [12,13] tend to fracture more easily than those with large diameters, especially when placed in a posterior location. A study has reported that an implant with a diameter of 5.0 mm is three times stronger than one with a diameter of 3.75 mm, whereas a 6.0-mm implant is six times stronger than a 3.75-mm implant [20].

2.2.2. Mechanism of Implant Fracture

Coronal bone resorption observed in most implant fracture cases has been described as a primary cause of fracture [7,21,22,23] Loss of supporting bone if extended to the level corresponding to the end of the abutment screw, the bending resistance in this region will be reduced. When such resorption extends apically beyond the third implant thread, it reaches a structurally weak zone coinciding with the end of the prosthetic screw and the border of the hybrid surface. This contributes to the fatigue at a point of low resistance to torque. The warning signs of such fatigue include loosening, torsion, or fracture of the post screws, and ceramic fractures of the prosthesis.

2.2.3. Clinical Manifestations

Patients may often report spontaneous bleeding and mobility. Exploration (manually or electronically) confirms increased mobility, increased pocket depth, and gingival indexes, and occasionally, also, plaque accumulation resulting from the patient's fear of the pain is triggered by brushing. Radiologically, separation of the fragments and bone loss may be seen. It has been reported that marginal bone reabsorption seems to be the most important risk factor indicating the start of an implant fracture, and may often extend beyond the actual fracture line [12]. Thus, an x-ray study is very useful.

For diagnostic purposes, the fracture risk factors have been grouped into three main categories [Table 1]. In the presence of more than three factors pertaining to one or more of these categories, the risk of fracture is high. [24]

Table 1. Clinical findings frequently documented in the literature and related to implant fracture, grouped by categories.

Patient factors	Implant factors	Prosthetic fractures
Pocket depth >5 mm	Diameter <4 mm	Loosening/torsion prosthesis screw
Bone loss	Crown/implant >1	Cantilevers
Overload (bruxism)	Implants design	Ceramic fracture

2.3. Management

There are three management options in the event of an implant fracture: [12,25]

a) Complete removal of the fractured implant using explanation trephines [12,25]. After the removal of the fractured implant, a new larger diameter implant can be installed at the same surgical bed or at another place to achieve primary stability [22] Their complete removal is considered to be the best solution to the problem
b) Removal of the coronal portion of the fractured implant with the purpose of placing a new prosthetic post [12,25]. It is essential to radiologically confirm the absence of radio transparency and to electronically determine the mobility of the fragment. A prosthetic post should be considered only if there is still sufficient remaining internal thread retention [12].
c) Removal of the coronal portion of the fractured implant, leaving the remaining apical part integrated in the bone [12,25] and the missing tooth/teeth can be restored using conventional prosthodontic procedures like removable partial denture, fixed partial denture etc.

A recent study described "apicoectomy" as a suitable technique for removing fractured implants and inserting new implants at the same clinical session. This technique was based on opening a hole in the bone in order to improve the visualization of the apical fragments of the fractured implants and to remove those fragments through this hole. Afterward, a new implant is placed in a conventional manner, and the hole is closed by using the same bone that is removed from the patient [26].

2.3.1. Preventive Measures

The following preventive measures have been suggested:

a) Avoid placing hybrid-type implant fixtures.
b) Carefully control occlusal forces: Eliminate all posterior contacts in mandibular eccentric movements
c) Perform staggered placement of implants: Avoid a straight-line configuration
d) Avoid or minimize posterior cantilevers and buccolingual offsets, particularly in partially edentulous patients
e) During the chronic loosening of gold or abutment screws or the fracture of components, critically reassess the prosthesis, retighten the abutment or use a gold screw, and check the fit.
f) Pronounced bruxers or clenchers who have experienced multiple implant fractures should be managed by the placement of additional implants fractures [20].
g) Ensure perfect fit: Resolder and assess passive fit [27].

2.4. Implant-Abutment Connection System

Two types of screws are used in implant dentistry: abutment screws and prosthetic screws. Abutment and prosthetic screws come in various shapes and sizes and are made from a variety of materials, including gold, commercially pure titanium, and surface-treated or coated titanium alloys. Although seemingly simple, the mechanics of abutment and prosthetic screws are complex, a phenomenon described as screw joint mechanics [28].

The misfit at the abutment-implant interface and the absence of a passive adaptation between the prosthesis and the abutment can lead to fracture and the most common technical complication is a fracture of the abutment screw.

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The stability of the implant abutment connection is influenced by factors such as internal connection versus external connection, screw head design, screw geometry, materials, screw diameter, preload, joint separating force, settling effect, and overall screw mechanics.

Factors affecting the implant-abutment connection system are as follows:

2.4.1. Internal Connection versus External Connection

The implant-abutment interface connection is generally described as an internal or external connection. Relative to external connections, the internal implant-abutment connections have been shown to present a higher stability and improved force distribution as a result of :

a) The internal implant-abutment connections have the ability to dissipate lateral loads deeply within the implant, there by shielding the abutment screw better from stress.
b) The longer internal wall engagement that creates a stiff, integrated body to resist joint opening (micro movement) [29,30].
c) After cyclic loading the internal abutment connection is stronger relative to external connections [31,32].

While mechanical strength is gained, the thinner lateral fixture wall at the connecting part of the internal connections may lead to a higher absolute strain value at the cervical area. Such stress shift has raised concerns regarding an increased risk of marginal bone resorption or fixture fracture [33].

Although there are studies that show that the fracture strength in implant systems with an external fixation is equal or superior to those with internal fixation [34,35].

The literature supports a gold alloy screw with a flat head, internal hex or square, and a high tightening force (torque driver) as having the greatest ability to produce the best results [36].

2.4.2. Screw Head Design

- To maximize the preload and minimize the loss of input torque to friction, the head of the screw should be wider than the thread diameter.
- An abutment head most often should be flat. A tapered head design reduces the clamping effect and reduces the tensile force in the threads of the screw. The tapered screw head distorts and aligns non passive components and gives a non passive casting the appearance of proper fit. However, the superstructure is not deformed permanently and leads to stress in the system. A flat-head screw distributes forces more evenly within the threads and the head of the screw, and is also less likely to distort a non passive casting. As such, the abutment head should also be flat on top to increase the clamping force in the screw head and the tensile force in the threads [37].

2.4.3. Screw Material

The most commonly used retaining screws are either of gold or titanium. Gold screws are designed to be the most "flexible" portion of the implant assembly. Due to their higher modulus of elasticity than titanium, they permit an adequate micro movement to distribute force to the implant body [38]. Implant posts, that are retained with gold or gold coated screws, show a reduction of screw loosening and improved clamping force in comparison with titanium screws [39,40].

Titanium alloy has four times the bending fracture resistance of grade 1 titanium. Therefore, abutment screws made of grade 1 titanium will deform and fracture more easily than the alloy. A higher torque magnitude can be used on the titanium alloy abutment screw and implant body [39]. Titanium retaining screws are stronger than gold, but have a lower modulus of elasticity; metal fatigue will produce a gold screw fracture before the titanium retaining screw is affected.[41] The major disadvantage of titanium retaining screws is their tendency to cause galling, which results in excessive friction between the two mating surfaces thereby causing a localized welding with a further roughening of the mating surfaces. [42] Galling occurs in the following manner: Titanium of the retaining screw slides in contact with the titanium of the implant body, the coefficient of friction increases whereby titanium molecules transfer from the mating surfaces. [43] This has been described as the adhesive wear mechanism [44] which causes slight damage to both the implant body and the retaining screw threads.

2.4.4. Screw Diameter

The greater the diameter, the higher the preload that may be applied and the greater the clamping force on the screw joint. As a general rule, abutment screws loosen less often and can take a higher preload than coping screws [45].

2.4.5. Preload

The screw joint has been described as two parts tightened together by a screw, such as an abutment and implant being held together by a screw. The initial clamping force, or preload, is the tensile force that develops when the screw is tightened into place. Preload depends on the torque applied, material, and design of the screw, and surface roughness [46]. Frictional forces that develop between the screw threads make the applied torque inversely proportional to the preload, so the more torque that is applied, the more preload is lost [47,48]. If the torque delivered to a screw is not optimal, screw loosening may occur, making the system susceptible to fracture under occlusal load. As a screw is tightened, it elongates, thereby producing tension. Elastic recovery of the screw pulls the two parts together, creating a clamping force [49]. Excessive forces cause slippage between the threads of the screw and the threads of the bone, resulting in the loss of the preload [50]. Fractured abutment and prosthetic screws are a challenging and time-consuming complication in implant dentistry [51]. When a screw fractures, the fragment inside the implant or abutment must be removed, or the implant must be modified. Otherwise, it may lose its original ability to retain prosthesis and could become useless [50].

2.4.6. Joint Separating Forces

Intra oral separating forces may include off-axis occlusal contacts, lateral excursive contacts, interproximal contacts between natural teeth and implant restorations, protrusive contacts, para functional forces, and non passive

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frameworks that attach to the implants. Opposing the clamping force is a joint-separating force, which attempts to separate the screw joint. Screw loosening occurs when the joint-separating forces acting on the screw joint are greater than the clamping forces holding the screw unit together [41].

2.4.7. Settling effect

Settling occurs as the rough spot interfaces flatten under load/micro movements, since they are the only contacting surfaces when the initial tightening torque is applied [51]. It has been reported that 2-10% of the initial preload is lost as a result of settling [52]. This reduction effect is known as embedment relaxation [53].

2.4.8. Process of Screw Loosening

The process of screw loosening has been described in two stages [54]. Initially, external forces such as mastication applied to the screw joint causes slippage, contributing to the release of preload of the screw. The second stage of loosening involves continual preload reduction below critical level, allowing threads to turn and the loss of intended screw joint junction [55].

2.4.9. Incidence of Screw Loosening

A literature review of clinical complications of osseointegrated implants showed that screw loosening or screw fracture varied from 2 to 45% of the implant restorations, with the highest amount in single crowns [8]. In one of the systematic reviews that evaluated the 5-year survival rates of implant-supported single crowns, it was observed that from the 26 clinical studies included, the cumulative incidence of abutment screw or abutment loosening was 7.3% after 5 years of clinical service in both external and internal connections [56].

2.4.10. Location of Screw Loosening

Posterior abutment screws loosen at a higher percentage than anterior implants. This supports the project of eliminating unnecessary occlusal and off-axial forces on implant-supported restorations [36]. One of the studies have reported a 38% loosening of single implant restorations in the posterior maxilla and mandible, but such studies do not take into account various important factors [57].

2.4.11. Preventive Management

a) It is recommended in clinical practice that in order to reduce the settling effect, the implant screws should be retightened 10 min after the initial torque application [58,59,60,61].
b) Mechanical torque gauges should be used instead of hand drivers to ensure a consistent tightening of the implant components to recommended torque values [51].
c) The use of sealers to fill in the gaps between these crews and implant threads and adhesives to increase the frictional resistance has been suggested to reduce screw loosening. (Ceka Bond, Preat, San Mateo, CA) is listed as an adhesive paste on the package insert. [62]
d) Cho et al 2004 [36] supported the following clinical recommendations:
   i. Ensure that implants are placed perpendicular to the occlusal plane.
   ii. Frameworks should have minimal cantilever lengths.
   iii. Use components with low tolerance levels for component misfit.
   iv. Use components with anti rotational features for single tooth restorations.

2.4.12. Clinical Techniques to manage Fractured Abutment Screws

Generally, treatment or intervention should always mitigate future risk and improve the prognosis [62]. In certain situations, however, the intervention itself may be the biggest risk factor. In reviewing published studies, some techniques have been found to be clearly more likely to cause irreversible damage to the implant components and should therefore be considered higher risk procedures. Because a direct relationship exists between the risk of damage and degree of difficulty, the clinician must understand not only the technique itself but also the inherent risks and difficulty associated with each technique

2.4.13. Examination and Diagnosis

The first step in managing any fractured screw is to obtain a detailed history and perform a thorough clinical examination. Every attempt should be made to determine the cause of the screw fracture to minimize the risk of subsequent complications. The next important step is to confirm that the screw is fractured and determine the location of the fracture. Generally, fractures that occur above the implant level are easier to manage than fractures occurring more apically. Screw fracture may be confirmed by direct visualization, radiographic examination, tactile sensation through the use of an instrument, comparison with an undamaged screw of the same system, or by using other undamaged components of the same system to see if an obstruction is prohibiting complete seating. If the restoration has been missing for an extended period, the peri-implant soft tissue may overgrow, making access to and visualization of the implant difficult. In this situation, a low-frequency diode laser may be used to trim the tissue and expose the implant platform. Use of an electrosurgery unit or scalpel should be avoided to avoid any heat transfer within the implant or scratching of the implant surface. Other techniques that may help to improve visualization include the use of dental loupes with a coaxial or light-emitting diode headlamp or a dental surgical microscope, especially in situations with deep screw fractures [63,64].

The application of risk-based decision-making plan, in relation to the various reported techniques for managing fractured screws may allow for a logical and structured approach in managing fractured abutment and prosthetic screws.

2.4.14. Low Risk: Basic Instrumentation and Instrument Modification

Once the appropriate examination and diagnostic steps are complete, a tentative plan should be established using the proposed decision making tree [1,65,66,67,68,69]. A

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small rigid instrument such as a scaler, sickle explorer, or endodontic explorer was the initial instrument of choice for rotating the remaining apical portion counterclockwise and removing the fractured fragment. Oblique fractures may be easier to manage with this technique because a purchase point usually exists in which the instrument may be engaged. Although this is considered a low-risk choice, care should always be used in engaging the broken segment with any instrument because the instrument may fracture or damage the internal threads of the implant. Flexible instruments such as endodontic files or modified instruments should be used with caution because of the decreased strength of the instrument. If the fractured segment does not move with use of a hand instrument, an ultrasonic scaler can be used to loosen the screw [67]. This technique can be used in conjunction with standard instrumentation or in an alternating fashion, but care must always be taken not to damage the internal threads of the implant. In addition, this method should only be attempted a few times to ensure that the broken segment is not wedged further into the implant. Sometimes, even after the screw has been loosened, it is still difficult to grasp and remove. If a loose fragment is near the platform, a cotton tip applicator may be used as a driver, as the cotton threads can often grip the fragment, making removal easier [69].

2.4.15. Moderate Risk: Screw Modification

If the remaining screw fragment cannot be rotated with basic hand instruments, it may be rotated using rotary instruments [50,70-78]. This can be done by introducing a bur, a drill, or a trephine mounted on a handpiece into the internal chamber of the implant until it contacts the screw fragment. Then, as it is rotated counterclockwise, it may unwind the screw fragment [71,72]. If the screw fragment cannot be engaged with an instrument, a dimple or access point can be created using a ½ round bur mounted on a handpiece under copious irrigation; this dimple may be modified into a slot for better engagement [50,75,78,80]. Furthermore, burs and instruments may also be modified to allow for better engagement of the fragment and to prevent damage to the implant [72,75]. Aftermarket screw retrieval kits are available, including Fragment Fork (Astra Tech; Dentsply Sirona), ITI Dental Implant System (Institut Straumann AG), IMZ TwinPlus Implant System1 (Dentsply Sirona), Screw Removal Kit Replace (Nobel Biocare), and Certain-Screw Removal Kit (Biomet 3i). These kits may be helpful when low-risk techniques have been unsuccessful [74,77,80]. If all attempts at rotating the screw fragment fail, it may be drilled out completely, although this technique requires a high degree of attention and care to prevent damage. Specialized systems and drill guides are important in these situations, and a screw tap tool may become necessary [79]. An important consideration when removing a fractured screw is not to damage the internal threads of the implant, so care must always be taken whenever a rotary instrument is introduced into the internal chamber of the implant [80,81]. The use of drill guides or sleeves can help stabilize the drill and subsequently reduce the risk of damage to the internal threads [50,73,76,81]. Furthermore, there is a high risk of heat generation whenever screws are drilled, and for that reason, drilling should be performed intermittently at a reduced speed with copious irrigation [74,78].

2.4.16. High Risk: Implant Modification

In situations where removal of the screw fragments is not possible using a low- or moderate-risk technique, intentional modification of the implant may be necessary to keep the implant serviceable [82-90]. If the internal aspect of the implant is significantly damaged or the screw fragment is irretrievable, the clinician may choose to remove the implant and place a new one. However, this decision can be influenced by financial factors, patient experience, and patient willingness to undergo additional surgery. An implant in such situations may also be completely buried in soft tissue, an option that may require the fabrication of a new prosthesis, and may compromise function and/or esthetics [90,91]. If the patient is unwilling to sacrifice an irreversibly damaged implant, attempts can be made to maintain the use of this implant by retapping the internal threads once the irretrievable screw fragment is drilled out. This can be accomplished with the use of specific retapping tools and may require alternative or modified parts to successfully restore the implant in question [81,83,86].

If all attempts fail and the patient is still unwilling to sacrifice the implant, a custom cast post and core may be fabricated for the implant .These techniques generally start with the removal of remaining screw fragment, followed by removal of the internal threads of the implant by using a diamond rotary instrument or tungsten carbide bur in a high-speed handpiece under copious irrigation. An autopolymerizing acrylic resin pattern can either be made directly on the prepared implant or indirectly on a stone cast. The pattern is then cast using nickel- or cobalt-chromium alloys, although other types of metal alloys have also been reported [82,83,88,89,90]. Once the seating of the custom cast post and core has been confirmed, it can be cemented. The appropriate restoration can then be fabricated following conventional prosthodontic protocols.

3. Conclusion

In the present review, in order to present a complete picture, various clinical as well as in vitro studies on the mechanics of implant fixture fracture and abutment screw loosening/fracture of a single implant-abutment connection have been reviewed. The incidence of such complications is very small and the literature is still not conclusive concerning the choice of connection and/or crown-retaining system. However, understanding the mechanics of these failures will help the clinicians in formulating a more predictable treatment.

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(54) Universal precision dental transfer for endosseous implants

(57) Disclosed is a dental device that precisely transfers the location and axial orientation of one or more dental implants in the oral cavity by impression to a laboratory model. The device is a three component assembly of a transfer cuff, a locating sleeve, and a retaining screw that secures to an implant in the mouth. The cuff and locating sleeve engages the anti-rotational feature of the implant. After an impression material has completely surrounded the device secured to an implant, the retaining screw is unscrewed and the internal locating sleeve retracted to such that the connection with the implant anti-rotational feature is disengaged. The impression is then removed from the mouth, retaining the transfer cuff therein, precisely located and accessible for making a stone model thereof for a restoration construct for securing to the implant. The universal transfer device and impression method of the invention precisely transfer locations of multiple implants and their anti-rotational features, even where the implants are not in parallel axial alignment.

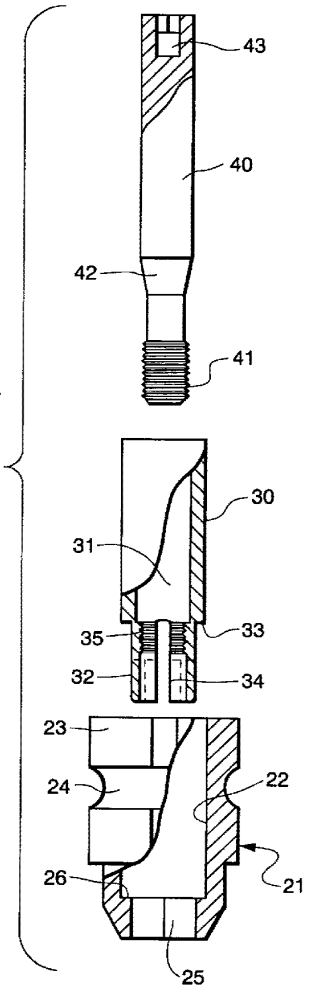


Fig. 4

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Description

BACKGROUND OF THE INVENTION

The invention relates to endosseous implants and associated devices for making restorations to be secured thereto. More particularly, the invention relates to devices for transferring relative locations and axial orientations of multiple implants that may not be in parallel alignment into impressions and models such that precise dental restorations result.

Presently, there are several dental implant location and orientation transferring systems and methods in the marketplace. The primary methods are known as direct and indirect transfer systems. The indirect transfer method retains the transfer components in the mouth fixed to the implant after an impression is taken. The transfer components are then detached from their implants, removed from the mouth and extra-orally reinserted into the cavities created in the impression material. The impression is then used for preparing a laboratory model which leads to preparation of the restorative construct, as is well known and conventionally done. A drawback of this method is that human error is introduced into the restoration through the inaccuracy inherent in reinserting the transfer components into the impression material prior to pouring of the laboratory model.

A direct impression transfer method was devised to combat the indirect method's potential for error propagation. The direct transfer method retains transfer device components embedded in the impression material when the impression is removed from the mouth. Since key transfer device components are never separated from the impression material a significant potential for human error is substantially decreased.

Of these direct implant transfer system devices and methods available, several can directly transfer the location of both the implant and orientation of its anti-rotational feature, which is typically an internal bore or external projection having a hexagonal cross-section. However, all of the known devices remain engaged to the anti-rotational feature of the typical implant just prior to separation of the impression from the patient's mouth. Separation requires a substantially vertical force to be exerted with respect to the implant anti-rotational feature in order to disengage the transfer elements from the implant. When there is more than one implant and the implants are not aligned axially in parallel, which is a typical situation for multiple implants for many reasons, there will be an axial draw or binding between the implants' anti-rotational features and it will be extremely difficult to remove the impression from the patient's mouth. This limitation has confined direct transfer devices and methods to transferring one implant location at a time.

It is desirable to overcome the present deficiencies of prior art transfer devices and methods by providing a device and method that allow precise multiple implant location transfers into impressions and laboratory models that are independent of implant anti-rotational elements and any non-parallel axial orientations of the implants.

It is also an object of the invention to provide transfer components that are adaptable to a variety of useful designs and sizes for attachment to a wide variety of available implants.

SUMMARY OF THE INVENTION

The invention is a universal dental implant transfer device for acquiring and transferring the radial location of single or multiple implants. In addition, the device is capable of directly transferring multiple implant locations including their anti-rotational features and axial orientations, even where the implants are not in parallel axial alignment.

The device of the invention incorporates: (1) a transfer cuff that attaches to each implant to be in an impression; (2) a removable locating sleeve, that fits inside the cuff and locks the location of the anti-rotational feature of the implant into register with a similar anti-rotational feature in the direct transfer cuff; and (3) a retaining screw that secures the cuff and sleeve to the implant during taking of an impression. After making the impression in the mouth, the retaining screw and the locating sleeve are removed from the impression. Thus, the locating sleeve element which spans the cuff and implant anti-rotational features during the impression process is retracted or removed, sufficiently to disengage the connection between the transfer cuff and the implant. The impression, including the direct transfer cuff embedded therein, may then be easily removed.

The dental implant device of the invention for transferring location and axial orientation of one or more dental implants into an impression material for use in making dental restorations for attachment to said implants, said implants of having an internal or external anti-rotational means and an internally threaded central bore, comprises, as noted above, a transfer cuff, locating sleeve and a retaining screw. The transfer cuff, which may be in the form of a coping or abutment or other desired functional shape, includes an axial bore including an internal anti-rotational means that substantially exactly matches that of said implant or at least one surface thereof such that when the cuff is secured to the implant, the anti-rotational feature of the implant is in register with that of the cuff. The cuff also includes external mechanical surfaces for resisting movement in said impression material.

The locating sleeve that is fitted into the central bore of said cuff, has a positioning shoulder that is received by a cuff seating surface. Where the dental implant includes internal anti-rotational means, for example in the form of a bore having a hexagonal cross-section, the sleeve distal end includes an external anti-rotational

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means that extends in register with and through said cuff internal anti-rotational means into and in register with the internal anti-rotational means of said implant, spanning both internal anti-rotational means. Where the dental implant includes an external anti-rotational means, said sleeve distal end includes an internal anti-rotational means that extends in register with and through said cuff in to engagement with the external anti-rotational feature of the implant. A surface of said internal anti-rotational means of the locating sleeve is removed such that an implant surface engages the transfer cuff sufficiently to fix said cuff into anti-rotational alignment with the implant. For example, where the implant includes, as an anti-rotational means, a projection having typically a hexagonal cross-section, the transfer cuff will include a surface for engaging a hexagonal side of the implant and said sleeve will have a surface removed such that upon attachment to the implant, the implant anti-rotational surface will be in register with and contact with the transfer cuff surface.

The retaining screw component of the device of the invention has at its distal end, external threads that register with the internal threads of the implant internal bore, said screw of such diameter to pass through said sleeve and cuff. The screw engages surfaces of the locating sleeve such that, when said screw threads are engaged into the implant internally threaded bore, the device is secured to said implant.

The invention further comprises a method for making a dental impression that accurately transfers the location and axial alignment of a dental implant in a patient's oral cavity into said impression and then to a stone casting for making a dental restoration for attachment to said implant, said implant including unthreaded anti-rotational surfaces and threaded bore portions. The method comprises:

(a) securing to said implant a dental device of the invention comprising,

(i) a transfer cuff axially bored having at least an internal anti-rotational surface that is substantially identical to and in register with said implant anti-rotational surfaces,
(ii) a locating sleeve that includes anti-rotational surfaces that simultaneously engage both implant and cuff surfaces such that said cuff and implant anti-rotational means are fixed in register, and
(iii) a retaining screw that includes a distal externally threaded portion that engages the central axial threaded bore of the implant and has surfaces that bear on said sleeve and cuff, whereby the device is securely held together in non-rotational alignment by said tightened screw on said implant;

(b) applying an impression material to a patient's tooth and gum surfaces in which said implant is fixed, including to said dental device such that the retaining screw of such implant device is exposable;
(c) loosening, after said impression material has set, said implant retaining screw from said implant whereby the anti-rotational means of the transfer cuff and implant are disengaged; and
(d) separating said impression from patient surfaces whereby said transfer cuff remains securely positioned in said impression material.

The method is particularly useful wherein the impression includes more than one implant, said implants having non-parallel axial orientation, comprising:

applying an impression material that includes a plurality of said implants, including said dental devices secured thereto;
loosening the retaining screw in each implant in the impression sufficiently such that the locating sleeve is retractable to disengage anti-rotational means in register between said locating cuff and implant; and
separating said impression from said patient.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial sectional view of a typical implant of the prior art with which the dental device of the invention may be used.

Figure 2 is a partial sectional elevational view of the device of the invention assembled for attachment to an implant similar to Figure 1.

Figure 3 is an end view of the transfer cuff of the invention.

Figure 4 is an exploded elevational assembly view in partial section, of the Universal Precision Transfer Dental Device of the invention for use with an implant having an internal anti-rotational means.

Figure 5 is an exploded elevational assembly view in partial section, of the universal precision transfer dental device of the invention for use with an implant having an external anti-rotational means.

Figure 6 is an end view of the transfer cuff component shown in figure 5.

Figure 7 is a partial sectional elevational view of the device of the invention assembled for attachment to an implant having an external hexagonal anti-rotational projection.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to Figure 1, a conventional dental implant 10 comprises an elongated cylinder having external threads 11 for threading into bone tissue to receive the implant. The distal end of the implant 10 includes open-

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ings and penetrations 12 to permit bone tissue to grow into it for securing the implant in place. The implant 10 typically includes an axial bore 13 having an internally thread portion 14 and a non-threaded anti-rotational surfaces portion 15 for securing a restoration superstructures or the like in a non-rotational configuration. The typical implant 10 is constructed of commercially-pure titanium and alloys, generally having an outside thread diameter of not less than about 3 mm, wherein the implant has a length of about 5 to 20 mm.

Referring now to Figures 2-4, the universal precision transfer dental device 20 is shown. Referring to Figure 4, the universal direct transfer dental device 20 includes three components: a transfer cuff 21; a locating sleeve 30; and a retaining screw 40. In Figure 2, the device 20 is shown assembled for attachment to, for example, an implant 10 as shown in Figure 1.

Referring to Figures 3 and 4, the transfer cuff 21 is generally cylindrical in shape and includes an axial bore 22. The transfer cuff 21 is designed to remain fixed in the impression material during the direct transfer procedure and may be constructed in a number of desired cuff sizes or diameters to match various implant structures and the alike. The cuff includes mechanical retaining features to prevent the cuff once embedded in the impression material from shifting position. As shown in Figure 3, the generally cylindrical shape may include surface portions, for example milled flat surfaces 23, such that a generally rectangular or square cross-section portion is provided. In addition, the cuff is preferably provided with at least one circumferential groove 24 to provide a second mechanical retaining feature of the cuff. A principal feature of the cuff is an anti-rotational element 25 that is hexagonal in cross-section and formed in the cuff distal end. The anti-rotational feature 25 is substantially identical and registerable with the anti-rotational internal hexagonal surfaces 15 of implant 10. The axial bore 22 of the cuff 21 is counterbored to form a seating surface 26 adjacent to the anti-rotational hexagon 25.

Referring to Figures 2 and 4, the locating sleeve 30 is generally cylindrical in shape, provided with an axial bore 31. The distal end of the locating sleeve is provided with external surfaces 32 that substantially duplicate the internal anti-rotational surfaces 25 of the cuff 21 and the anti-rotational feature 15 of implant 10. The dimensions of the anti-rotational feature 32 are such that when the sleeve is inserted in the cuff, bearing surfaces 33 milled into the locating sleeve contact the cuff seating surfaces 26, and the external anti-rotational surfaces 32 extend through the anti-rotational surfaces 25 of the cuff into the anti-rotational surfaces 15 of implant 10, spanning and joining the two anti-rotational surfaces 25, 15. The locating sleeve 30 is further provided with a slot 34 longitudinally cut through the wall of the sleeve surfaces. Additionally, the internal bore surfaces adjacent to the anti-rotational feature 32 are provided with internal threads 35 that are substantially identical to the threads 14 of the implant 10. The axial bore 31 and threads 35 are dimensioned such that the retaining screw 40 will pass through the locating sleeve 30, threading through threads 35 into contact with implant 10.

The retaining screw 40 is substantially cylindrical in shape and of sufficient length to extend through the cuff and sleeve assembly into locking contact with the implant 10. The screw 40 is provided with external threads 41 that are substantially identical to those of the sleeve internal threads 35 and the internal threads 14 of the implant 10. The retaining screw 40 is provided with a tapered section 42 and a internal slot 43, typically a hexagon in cross-section, for driving the screw into secure contact with the implant.

In operation, the assembled device 20 of the invention, as shown in Figure 2, includes the sleeve 30 seated in the cuff 21 with the retaining screw 40 threaded therethrough. The device 20 is then contacted with the implant 10 such that the external anti-rotational feature 32 engages and seats in the anti-rotational feature 15 of the implant 10. The retaining screw is then advanced such that its threads 41 thread into implant threads 14 and the device is tightened securely to the implant 10. As the retaining screw nears its secured position, the tapered surfaces 42 of the retaining screw 40 engage the interior surfaces of the locating sleeve 30 and, in cooperation with slot 34, cause the anti-rotational surfaces 32 to deflect slightly outwards, further locking the transfer cuff 21 and implant 10 together. This feature significantly improves the accuracy of positioning and transferring of implant locations to improve the resulting restoration.

In taking an impression where there are multiple implant supports that are to be a part of the restoration, an individual transfer device 20 of the invention is fixed and secured to each implant. Impression material is then placed in the mouth in contact with the implants and their secured transfer devices 20. The impression is made such that the retaining screws 40 are assessable, after an impression tray holding the impression material is removed or the molding process completed. After the impression material has hardened, the retaining screw 40 for each implant is loosened to disengage the retaining screw threads 41 from the implant threads 14. The screw is retracted sufficiently to be free of the implant and, if desired, may engage the internal threads 35 of the locating sleeve 30. A vertical force is then applied to each retaining screw 40 at each implant to disengage the locating sleeve's anti-rotational feature 32 from the implant anti-rotational surface 15, thereby separating the connection or bridge between the anti-rotational feature 25 of the cuff 21 and the anti-rotational feature 15 of the implant. The impression is then removed from the patient's mouth with the transfer cuffs remaining embedded in the impression material. Since the anti-rotational connection and interlock between the transfer cuff 21 and the implant 10 are disengaged, the impression is easily removable, even where there are multiple im-

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plants and they are not in parallel axial alignment.

Referring to figures 5-7, an alternative embodiment 20' of the invention is shown that is particularly suitable for use with an implant 80 (Figure 7) that includes as an anti-rotational feature, a projection 81, typically hexagonal in cross-section.

The universal dental implant transfer device 20' is substantially similar in its components and function as described above with respect to the device for attachment onto an implant having an internal anti-rotational feature. Thus, the device 20' includes as shown in Figure 5 a transfer cuff 50, a locating sleeve 60 and a retaining screw 70, differing only in those portions of the components that engage the external anti-rotational feature 81 of the implant 80, as herein below described.

Referring to Figures 5 and 6, the transfer cuff 50 is axially bored to receive the locating sleeve 60, cuff seating surfaces 53 retaining said locating sleeve 60 therein, by engaging the sleeve bearing surfaces 61. The transfer cuff 50 is provided with a distal end bore 51 that is shaped to match that of the distal end 62 of the locating sleeve 60. The boring 51 includes at least one anti-rotational surface 52 which is registerable with a corresponding surface on the anti-rotational feature 81 of the implant, wherein, engagement of said surface 52 with the corresponding external surface of the implant 80 locks the cuff 70 in anti-rotational alignment with the implant.

Referring to Figure 5 and 7, the locating sleeve 60 at distal end 62 is provided with an internal boring 63 that in cross-section is substantially identical to the external anti-rotational surfaces 81 of the implant 80, such that the surfaces 63 fit over and engage the external anti-rotational feature 81 of the implant. A portion of the wall at the distal end 62 of the locating sleeve 60 is removed forming a milled edge or surface 64 to correspond with and accommodate the anti-rotational surface 52 of the transfer cuff 50.

In operation, the device 20' is assembled as described above wherein the assembly attaches to the implant with the locating sleeve surface 63 engaging the external anti-rotational feature of the implant, except at the milled edge 64. The locating sleeve retaining surfaces 61 engage the seating surface 53 of the transfer cuff 50, said sleeve 60 rotated to advance through opening 51, wherein the surface 52 of the transfer cuff coincides with the missing locating sleeve wall portion at edge 64. Upon mounting the device 20' onto the implant, the external anti-rotational feature surfaces 52 of the transfer cuff engage portions of the implant anti-rotational feature 81. The balance of the anti-rotational feature 81 of the implant is engaged by the surfaces 63 of the locating sleeve 60.

The retaining screw 70 is advanced into securing contact with the internal threaded bore (not shown) of the implant 80, securely holding the device 20' to the implant 80 with both the transfer cuff 50 and locating sleeve 60 engaging the anti-rotational feature 81 of the implant. The implant device 20' is then ready for impression taking as described above.

After the impression material is hardened, the retaining screw 70 is loosened and a vertical force exerted thereon sufficient to extract the locating sleeve 60 and surfaces 63 from engagement with the implant external anti-rotational surfaces 81. The impression may then be removed easily, independently of multiple implants, even where they are not in parallel axial alignment.

Claims

1. A dental implant device for transferring location and axial orientation of one or more dental implants into an impression material for use in making dental restorations for attachment to said implants, each of said implants having an anti-rotational means and an internally threaded central bore, comprising:

   (a) a transfer cuff having a central bore and an internal anti-rotational means that substantially exactly matches at least one anti-rotational surface of said implant, said cuff including external mechanical surface means for resisting movement in said impression material;

   (b) a locating sleeve that is fitted into the central bore of said cuff, retained by cuff bore surfaces, said sleeve distal end having anti-rotational means that extend in register with and through said cuff in register with the anti-rotational means of said implant, said sleeve including an axial bore; and

   (c) a retaining screw having at its distal end, external threads that register with the internal threads of the implant internal central bore, said screw of such diameter that passes through the external bores of and engaging said sleeve and cuff, wherein said screw threads engaging the implant internally threaded bore secures said device to said implant, wherein anti-rotational surfaces of both cuff and sleeve are fixed in register with the anti-rotational surfaces of said implant and its axial orientation.

2. The dental implant device of claim 1 wherein implant includes an external anti-rotational means.

3. The dental implant device of claim 2 wherein said external anti-rotational means comprises an axial projection from said implant that is substantially hexagonal in cross-section.

4. The dental implant device of claim 3 wherein said transfer cuff comprises a distal end bore to receive the distal end of said locating sleeve, said bore in-

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cluding at least one anti-rotational surface that is registerable with a corresponding surface on the anti-rotational feature of the implant, said locating sleeve distal end including an internal bore that is substantially identical to the external anti-rotational feature of said implant, the external surfaces of the distal end engagable with the transfer cuff bore, extending therethrough for engagement with said implant, said internal surfaces having at least one surface removed such that the cuff and sleeve assembled both engage said anti-rotational feature of such implant when said retaining screw secures the assembled device to said implant.

5. A dental implant device for transferring location and axial orientation of one or more dental implants into an impression material for use in making dental restorations for attachment to said implants, said implants having an anti-rotational means and an internally threaded central bore, comprising:

(a) a transfer cuff having a central bore and an internal anti-rotational means that substantially exactly matches at least one anti-rotational surface of said implant, said cuff including external mechanical surface means for resisting movement in said impression material;

(b) a locating sleeve that is fitted into the central bore of said cuff, retained by cuff bore surfaces, said sleeve distal end having anti-rotational means that extend in register with and through said cuff into and in register with the anti-rotational means of said implant, said sleeve including an axial bore; and

(c) a retaining screw having at its distal end, external threads that register with the internal threads of the implant internal central bore, said screw of such diameter to pass through and engaging said sleeve and cuff, wherein said screw threads engaged into the implant internally threaded bore secures said device to said implant, wherein anti-rotational surfaces of both cuff and sleeve are fixed in register with the anti-rotational surfaces of said implant and its axial orientation.

6. The device of claim 5 wherein:

said locating sleeve distal end having external anti-rotational means is slotted longitudinally such that said longitudinal surfaces are radially displaceable; and
said retaining screw comprises a tapered relief portion located such that when the device is fixed to the implant the split means is displaced outwardly by the tapering portion as the screw is advanced, tightly locking the external anti-rotational means into the internal anti-rotational means of the implant.

7. The device of claim 5 wherein said locating sleeve includes internal threads adjacent to said abutment seating surfaces, whereupon withdrawal of the screw engages the distal threads of the screw with the sleeve internal threads, providing an aid to withdrawal of the sleeve and screw from the cuff by applying, while the implant and cuff are no longer locked together at the anti-rotational means, an axial pulling force.

8. The device of claim 5 wherein said anti-rotational means are substantially hexagonal in cross-section.

9. The dental device of claim 5 wherein the cuff external mechanical surface means comprise an external shape having substantially flat and lateral surfaces and at least one longitudinal circumferential groove.

10. The device of claim 5 wherein the retaining screw includes, at its end opposite said distal threads, a slot or hex bore for driving said device into said implant.

11. A dental device for transferring the location of an implant into an impression material, said implants having an central axial bore, including non-threaded anti-rotational surface means and a threaded axial bore portion, comprising:

(a) a transfer cuff axially bored having internal anti-rotational means surfaces that are substantially identical to and in register with said implant anti-rotational surfaces;

(b) a locating sleeve that includes anti-rotational surfaces that simultaneously engage and span, both the implant and cuff anti-rotational means surfaces; and

(c) a retaining screw that includes a distal externally threaded portion that engages the central axial threaded bore of the implant and has surfaces that bear on said sleeve and cuff, whereby the device is securely held together in non-rotational alignment by said tightened screw on to said implant.

12. A method for making a dental impression that accurately transfers the location and axial alignment of a dental implant in a patient's oral cavity into said impression and then to a stone casting for making a dental restoration for attachment to said implant,

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said implant including an internal central axial bore having unthreaded internal anti-rotational surfaces and threaded bore portions, comprising:

(a) securing to said implant a dental device comprising,

(i) a transfer cuff axially bored having internal anti-rotational means surfaces that are substantially identical to and in register with said implant anti-rotational surfaces,
(ii) a locating sleeve that includes anti-rotational surfaces that simultaneously engage and span, both the implant and cuff anti-rotational mean surfaces, and
(iii) a retaining screw that includes a distal externally threaded portion that engages the central axial threaded bore of the implant and has surfaces that bear on said sleeve and cuff, whereby the device is securely held together in non-rotational alignment by said tightened screw on said implant;

(b) applying an impression material to a patient's tooth and gum surfaces in which said implant is fixed, including to said dental device such that the retaining screw of such implant device is exposable;

(c) removing said implant retaining screw and locating sleeve from said implant whereby the anti-rotational means between the transfer cuff and implant is disengaged; and

(d) separating said impression from patient surfaces whereby said transfer cuff remains securely positioned in said impression material.

13. The method of claim 12 wherein the impression includes more than one implant, said implants having non-parallel axial orientation, comprising:

applying an impression material that includes a plurality of said implants, including said dental devices;
removing from each implant in the impression said retaining screw and locating sleeve to disengage said anti-rotational means between said locating cuff and implant; and
separating said impression from said patient.

14. The dental implant device of claim 1 wherein said transfer cuff is in the form of a coping or abutment for attachment to said implant.

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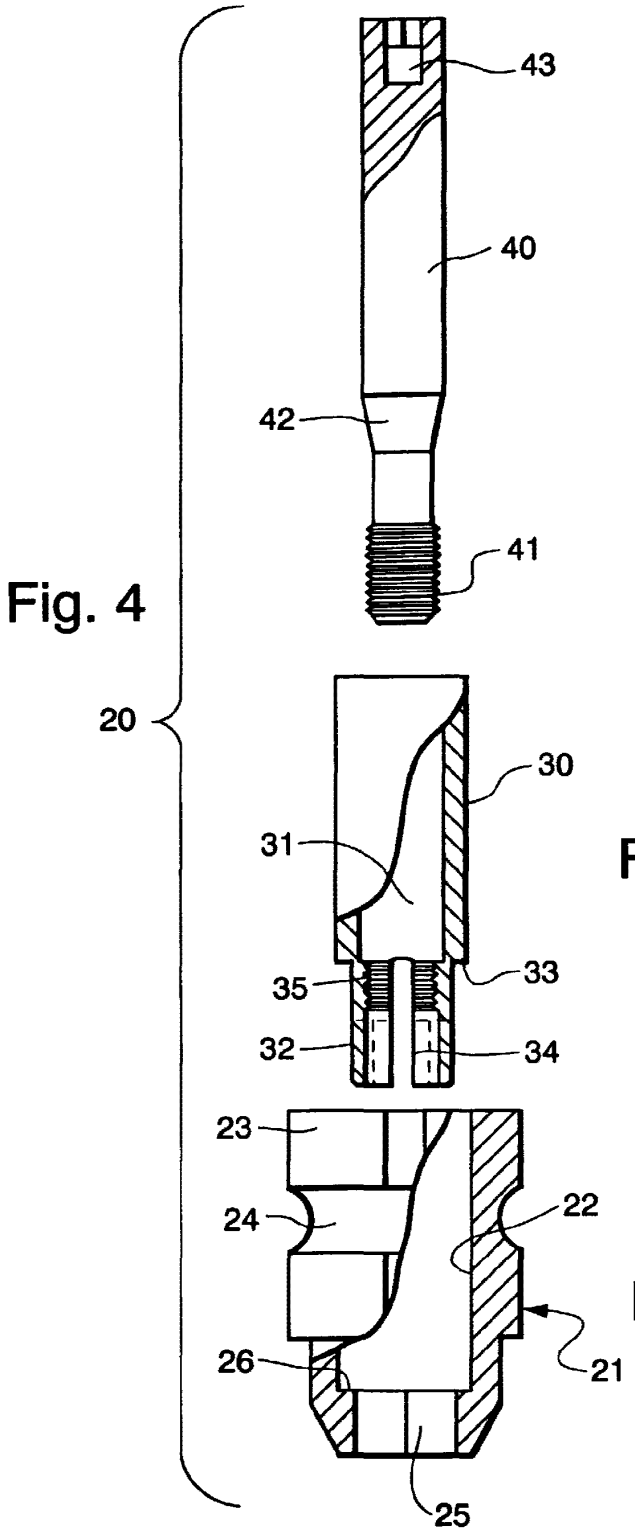


Fig. 4

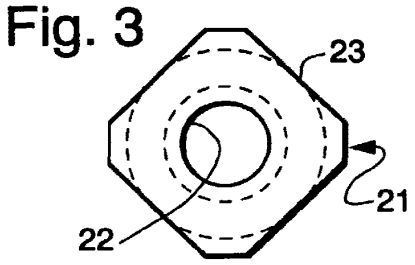


Fig. 3

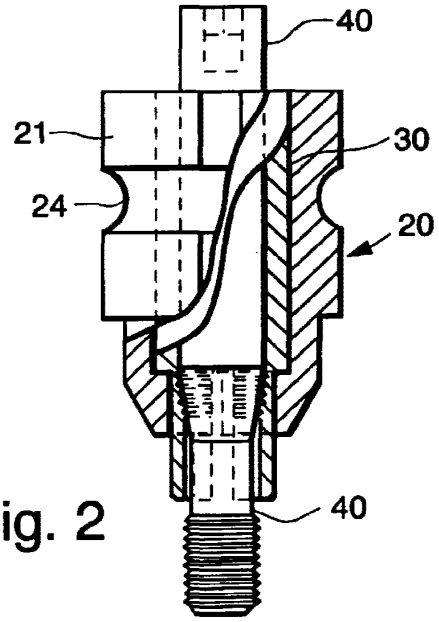


Fig. 2

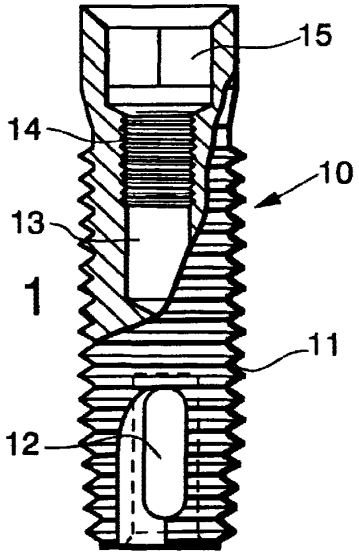


Fig. 1

Fig. 5

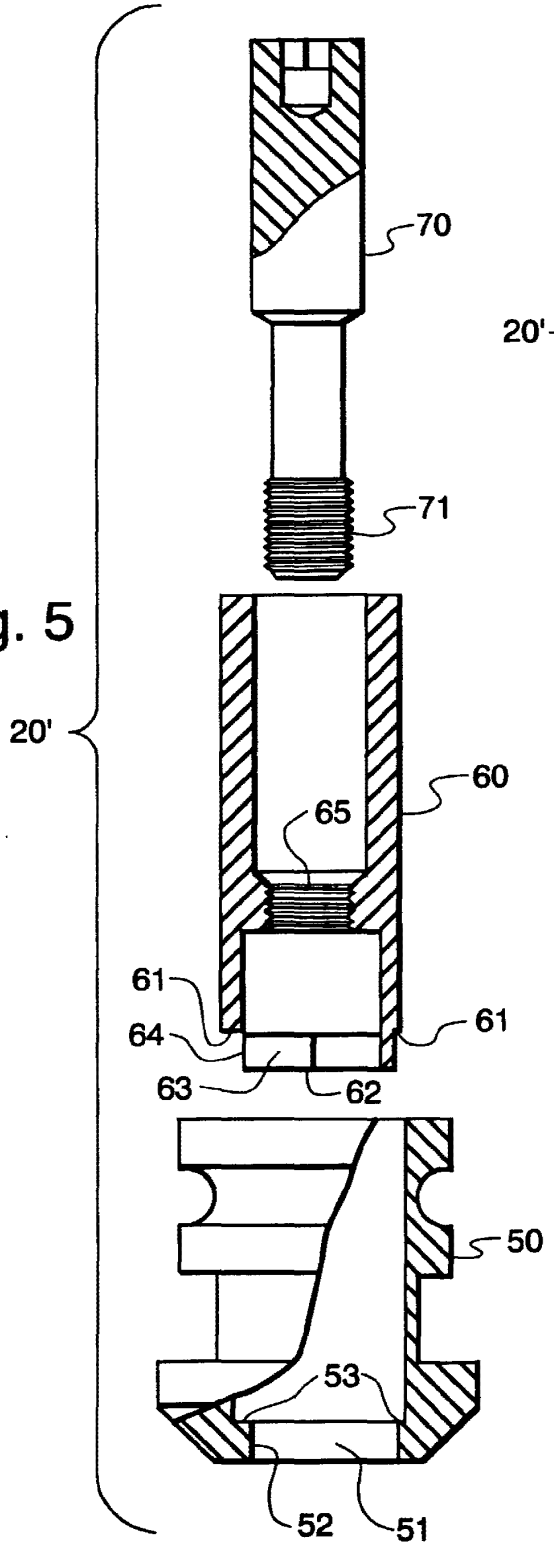


Fig. 7

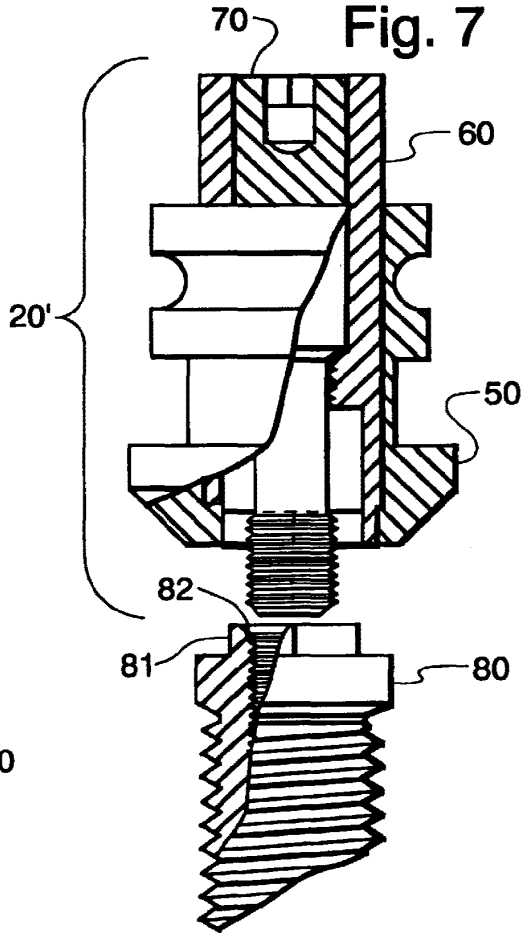
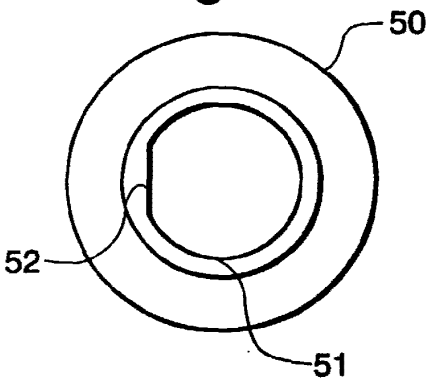


Fig. 6



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 2385

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO-A-93 20774 (ASHER) * the whole document *	1,5,7, 10,12,13	A61C9/00 A61C8/00
A		6,9,11	
A	US-A-5 055 047 (NAMES) * column 3, line 65 - column 4, line 16; figure 1B *	1-5,8,9, 11,12	
A	DE-A-35 39 764 (THE INSTITUTE FOR APPLIED BIOTECHNOLOGY) * page 13, line 12 - line 21; figure 5A *	1-5,8,9, 11,12	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A61C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 June 1996	Vanrunxt, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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(54) **Title:** CONNECTION SYSTEM FOR A DENTAL IMPLANT

(54) **Bezeichnung:** VERBINDUNGSSYSTEM FÜR EIN DENTALIMPLANTAT

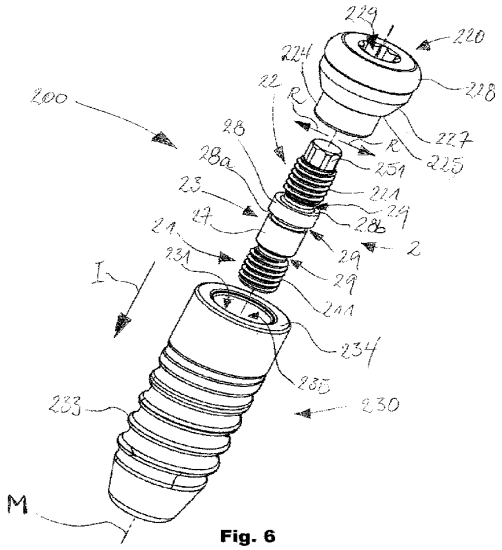


Fig. 6

(57) **Abstract:** The present invention relates to a connector (1, 1', 1", 2, 3) for connecting ceramic components of a dental implant (100, 100', 200, 300). The invention further relates to a prosthesis (120, 120', 220, 320) for a dental implant (100, 100', 200, 300). The invention moreover relates to a base body (130, 230, 330) for a dental implant (100, 100', 200, 300), with an inner thread (132, 232, 332), which is designed to match a base thread (111, 111', 111", 211, 311) of a connector (1, 1', 1", 2, 3), and/or with a receiver (135, 235, 325), which is designed to match a prosthesis (120, 120', 220, 320). Finally, the invention relates to a connection System for a dental implant (100, 100', 200, 300). In order to provide dental implants (100, 100', 200, 300) which satisfy the general requirements for successful Implantation and use and can easily adapt to bone variations and implant availability, provision is made according to the invention that the connector (1, 1', 1", 2, 3) has a base portion (11, 11', 11", 21, 31), on which a bäse thread (111, 111', 111", 211, 311) is formed for screwing the connector (1, 1', 1", 2, 3) into a base body (130, 230, 330) of the dental implant (100, 100', 200, 300), and a holding portion (12, 12', 12", 22, 32), on which a holding thread (121, 131, 131', 221, 321) is formed for screwing a prosthesis (120, 120', 220, 320) of the dental implant (100, 100', 200, 300) onto the connector (1, 1', 1", 2, 3) orthat the prosthesis (120, 120', 220, 320) is provided with a mating holding thread (2102, 3102) for screwing the prosthesis (120, 120', 220, 320) onto a connector (1, 1', 1", 2, 3) of the dental implant (100, 100', 200, 300).

(57) **Zusammenfassung:** Die vorliegende Erfindung betrifft einen Verbinder (1, 1', 1", 2, 3) zum Verbinden keramischer Komponenten eines Dentalimplantats (100, 100', 200, 300). Des Weiteren betrifft

[Fortsetzung auf der nächsten Seite]

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(84) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart):* ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, RU, TJ, TM), europäisches (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

die Erfindung eine Prothetik (120, 120', 220, 320) für ein Dentalimplantat (100, 5 100', 200, 300). Ferner betrifft die Erfindung einen Basiskörper (130, 230, 330) für ein Dentalimplantat (100, 100', 200, 300), mit einem Innengewinde (132, 232, 332), das komplementär zu einem Basisgewinde (111, 111', 111", 211, 311) eines Verbinders (1, 1', 1", 2, 3) ausgestaltet ist und/oder mit einer Aufnahme (135, 235, 325), die komplementär zu einer Prothetik (120, 120', 220, 320) ausgestaltet ist. Schliesslich 10 betrifft die Erfindung ein Verbindungssystem für ein Dentalimplantat (100, 100', 200, 300). Um Dentalimplantate (100, 100', 200, 300) bereitzustellen, die den allgemeinen Anforderungen für eine erfolgreiche Implantation sowie Verwendung genügen und sich einfach an Knochenvariationen und Implantatangebot anpassen lassen ist erfindungsgemäss vorgesehen, dass der Verbinder (1, 1', 1", 2, 3) einen Basisabschnitt 15 (11, 11', 11", 21, 31), an dem ein Basisgewinde (111, 111', 111", 211, 311) zum Einschrauben des Verbinders (1, 1', 1", 2, 3) in einen Basiskörper (130, 230, 330) des Dentalimplantats (100, 100', 200, 300) ausgeformt ist, und einen Halteabschnitt (12, 12', 12", 22, 32), an dem ein Haltegewinde (121, 131, 131', 221, 321) zum Aufschrauben einer Prothetik (120, 120', 220, 320) des Dentalimplantats (100, 100', 200, 300) auf den 20 Verbinder (1, 1', 1", 2, 3) ausgeformt ist, besitzt bzw. dass die Prothetik (120, 120', 220, 320) mit einem Gegenhaltegewinde (2102, 3102) zum Aufschrauben der Prothetik (120, 120', 220, 320) auf einen Verbinder (1, 1', 1", 2, 3) des Dentalimplantats (100, 100', 200, 300) versehen ist.

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Verbindungssystem für ein Dentalimplantat

Die vorliegende Erfindung liegt auf dem Gebiet der Dentalimplantate. Sie betrifft einen Verbinder zum Verbinden keramischer Komponenten eines Dentalimplantats. Des Weiteren betrifft die Erfindung eine Prothetik für ein Dentalimplantat. Ferner betrifft die Erfindung einen Basiskörper für ein Dentalimplantat. Schliesslich betrifft die Erfindung ein Verbindungssystem für ein Dentalimplantat.

Technologischer Hintergrund

Dentalimplantate können einteilig und mehrteilig ausgestaltet sein. Heutzutage haben sich die mehrteiligen gegenüber den einteiligen Dentalimplantaten durchgesetzt, da mehrteilige Dentalimplantate bessere Anpassungsfähigkeit und Schutz vor unerwünschten Belastungen während des Einheilungsprozesses bieten als einteilige Dentalimplantate.

Eine grosse Anzahl von aus dem Stand der Technik bekannten mehrteiligen Dentalimplantaten ist dreiteilig aufgebaut und umfasst somit einen in einen Kieferknochen einzusetzenden Basiskörper, ein am Basiskörper zu befestigendes Abutment und eine auf das Abutment aufzusetzende Suprakonstruktion. Der auch als Implantatkörper bekannte Basiskörper soll die Zahnwurzel ersetzen und ist meistens zylindrisch oder konisch geformt. In der Regel weist der Basiskörper ein Gewinde auf, über welches der Basiskörper durch Einschrauben im Kieferknochen befestigt werden kann und dadurch eine primäre Festigkeit im Kieferknochen erreicht. Während Basiskörper und Abutment in den Kiefer eingebettet bzw. von der Suprakonstruktion abgedeckt sind, liegt letztere im Mundraum frei und stellt den eigentlichen Zahnaufbau dar. Das auch als Implantataufbau bekannte Abutment dient gewissermassen als Zwischenglied zwischen Basiskörper und Suprakonstruktion und wird in den Basiskörper üblicherweise eingeschraubt und/oder eingeklebt.

Der Basiskörper sollte aus einem möglichst bioinerten Material gefertigt sein, um für den Patienten weitgehend verträglich und komplikationsfrei eingesetzt werden zu können

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und eine Rückbildung des Zahnfleisches zu unterbinden. Sowohl Material als auch Struktur des Basiskörpers sollen einen hohen Osseointegrationsgrad ermöglichen. Diese Anforderungen an die so genannte Biokompatibilität sowie an eine hohe Periointegration gelten auch für das Abutment und die Suprakonstruktion. Als Material mit vorteilhaften Verarbeitungseigenschaften sowie hoher Biokompatibilität hat sich mehrheitlich Keramik, insbesondere Zirkoniumoxid, durchgesetzt. Als Alternative zur Keramik wird oft Titan eingesetzt, das jedoch keine so gute Biokompatibilität und Periointegration wie Keramik aufweist.

Für den Langzeiterfolg einer Implantation ist eine verlässliche und gegen Knochen sowie Zahnfleisch abgedichtete Verbindung von Abutment und Basiskörper entscheidend. Eine mangelhafte Verbindung zwischen Abutment und Basiskörper kann zur Lockerung des Dentalimplantats und zur Beschädigung des Dentalimplantats führen. Undichte Verbindungen können das Eindringen von Bakterien in das Implantat zulassen, die zu Periimplantitis führen und somit u.a. Kieferknochenschwund herbeiführen können. Weiter stellen im Gebiss auftretende Kräfte für einen Langzeiterfolg von Implantaten hohe Anforderungen an deren Material und Konstruktion. So müssen die Implantate sämtliche im Gebiss auftretenden Kräfte aufnehmen können, ohne zu brechen, einzureissen oder sich zu lockern. Daher ist es sowohl beim Einsetzen als auch über die gesamte Lebensdauer des Dentalimplantates wesentlich, wo und wie genau eine Krafteinleitung in die einzelnen Komponenten des Implantates stattfindet.

Je nach Position des einzusetzenden Dentalimplantats im Kiefer und Knochenangebot an der Position können verschiedene Implantattypen sowie insbesondere verschiedene Längen bzw. Grössen der Dentalimplantate erforderlich sein. Aufgrund der je nach Kiefersituation variierenden geeigneten Grösse des Dentalimplantats kommen in der Regel Serien mit Bestandteilen verschiedener Grössen zum Einsatz, welche für einen hohen Langzeiterfolg wie eingangs genannt eine verlässliche Verbindung zwischen Abutment und Basiskörper bereitstellen sollten. So können die Serien beispielsweise mehrere Basiskörper verschiedener Grösse beinhalten, zum Beispiel mit Längen von 6, 8, 10, 12, 14 oder 16 mm bei unterschiedlichen Durchmessern von beispielsweise 3.3, 4.1 oder 4.8 mm sowie verschiedenartige Abutments, die geradlinig oder abgewinkelt ausgestaltet sind und ebenfalls in verschiedenen Grössen vorliegen können.

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Zusammenfassend haben Dentalimplantate hohen Anforderungen an Biokompabilität, Dichtigkeit, Krafteinleitung und Systemflexibilität zu genügen.

Beispielsweise beschreibt die von der Anmelderin eingereicht europäische Patentanmeldung mit der Veröffentlichungsnummer EP 2 735 279 A1, deren Offenbarungsgehalt durch Bezugnahme vollständig hierin mit aufgenommen wird, ein Dentalimplantat mit einem in einem Kieferknochen verankerbaren Basiskörper aus Keramik und einem mittels einer Schraube am Basiskörper befestigbaren Implantataufbau, wobei in einem zusammengesetzten Zustand des Dentalimplantats ein Gewindeabschnitt der Schraube in ein in einem Sackloch des Basiskörpers ausgebildetes Innengewinde eingreift. Die Schraube drückt den Implantataufbau gegen den Basiskörper. Ein formschlüssiger Eingriff zwischen dem Gewindeabschnitt der Schraube und dem Innengewinde des Loches besteht ausschliesslich in einer dem Implantataufbau abgewandten, unteren Hälfte des Basiskörpers, die sich über die Hälfte der Länge des Basiskörpers erstreckt.

Damit soll gemäss der EP 2 735 279 A1 erreicht werden, dass mechanische Spannungen homogen über eine gesamte Länge des Basiskörpers verteilt werden. Das Innengewinde, in das die Spannungen direkt über die Schraube eingeleitet werden, ist relativ weit vom Kontaktbereich zwischen Basiskörper und Implantataufbau entfernt tief im Fuss des Basiskörpers angeordnet. Um eine verlässliche Befestigung des Basiskörpers mit dem Implantataufbau mittels der Schraube zu erreichen, muss die Länge der Schraube mit der Länge des Sacklochs des Basiskörpers sowie eines Teils des Implantataufbaus übereinstimmen. Für verschieden lange Dentalimplantate sind dementsprechend jeweils unterschiedliche Schrauben vorzusehen. Die Bereitstellung unterschiedlicher Schrauben ist nicht nur kostspielig, sondern darüber hinaus auch in der Anwendung mühsam, führt also zu unerwünschten Mehrkosten und Aufwänden.

Darstellung der Erfindung

Es ist daher eine Aufgabe der Erfindung, Dentalimplantate bereitzustellen, die den allgemeinen Anforderungen für eine erfolgreiche Implantation sowie Verwendung genügen und sich zumindest einfacher an Knochenvariationen und Implantatangebot anpassen lassen als aus dem Stand der Technik bekannte Dentalimplantate.

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Diese Aufgabe wird erfindungsgemäss durch einen Verbinder gemäss unabhängigem Anspruch 1, einer Prothetik gemäss unabhängigen Anspruch 10, einem Basiskörper gemäss Anspruch 13 und durch ein Verbindungssystem gemäss Anspruch 14 gelöst. Bevorzugte Ausgestaltungen der Erfindung sind in den abhängigen Ansprüchen und in der vorliegenden Offenbarung angegeben.

Insbesondere wird die Aufgabe durch einen Verbinder zum Verbinden keramischer Komponenten eines Dentalimplantats gelöst, mit einem Basisabschnitt, an dem ein Basisgewinde zum Einschrauben des Verbinders in einen Basiskörper des Dentalimplantats ausgeformt ist, und mit einem Halteabschnitt, an dem ein Haltegewinde zum Aufschrauben einer Prothetik des Dentalimplantats auf den Verbinder ausgeformt ist.

Insbesondere wird die Aufgabe mit einer Prothetik für ein Dentalimplantat gelöst, mit einem Gegenhaltegewinde zum Aufschrauben einer Prothetik auf einen Verbinder des Dentalimplantats.

Insbesondere wird die Aufgabe mit einem Basiskörper für ein Dentalimplantat gelöst, mit einem Innengewinde, das komplementär zu einem Basisgewinde eines erfindungsgemässen Verbinders ausgestaltet ist und/oder mit einer Aufnahme, die komplementär zu einer erfindungsgemässen Prothetik ausgestaltet ist.

Insbesondere wird die Aufgabe durch einen Verbindungssystem für ein Dentalimplantat gelöst, mit wenigstens einem erfindungsgemässen Verbinder und/oder mit wenigstens einer erfindungsgemässen Prothetik und/oder mit wenigstens einem erfindungsgemässen Basiskörper.

Die erfindungsgemässe Lösung hat gegenüber dem Stand der Technik den Vorteil, dass Verbinder und Prothetik an den jeweiligen Basiskörper angepasst ausgewählt werden können. Beispielsweise können eine Vielzahl verschiedener Prothetiken durch die Verwendung des Verbinders auf den Basiskörper aufgeschraubt werden. Dabei können die Verbinder ebenfalls an die jeweiligen Gegebenheiten angepasst sein oder es kann ein an die Gegebenheiten anpassbarer Einheitsverbinder verwendet werden.

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Somit hilft die Erfindung als Verbindungssystem eine Art Systembaukasten für Zahnaufbauten und andere Bestandteile von Dentalimplantaten bereitzustellen, die von der Einheilphase des Implantats bis zu seinem gebrauchsfertigen Aufbau Verwendung finden. So kann es sich bei der Prothetik beispielsweise um einen Gingivaformer zur Anpassung des Zahnfleisches an eine Form einer später verwendeten Abutments handeln. Alternativ oder zusätzlich können Prothetik und Verbinder gemeinsam als Implantatschraube in Form einer Einheilschraube zur Abdichtung des Basiskörpers bzw. Implantates gegen Bakterien während der Einheilung dienen.

Erfindungsgemässe Einheitsverbinder bzw. Verbinder können folglich zusammen mit erfindungsgemässen Abutments und/oder Prothetiken verwendet werden. Die Abutments und/oder Prothetiken können als Kopf bzw. Kopfteil von zusammen mit dem Verbinder bzw. Einheitsverbinder gebildeten Schrauben verwendet werden bzw. zumindest abschnittsweise einen Kopf oder Kopfteil einer Schraube bilden, beispielsweise einer Implantat- oder Einheilschraube. Mit anderen Worten können Abutment, Prothetik und/oder Kopfteil äquivalent mit einem erfindungsgemässen Verbinder bzw. Einheitsverbinder zusammenwirken und dementsprechend dazu erforderliche Ausgestaltungsformen und Merkmale aufweisen, wie sie hierin unter Bezug auf Abutment, Prothetik und/oder Kopfteil beschrieben sind.

Die erfindungsgemässe Lösung kann durch die folgenden weiteren, jeweils für sich vorteilhaften Ausführungsformen beliebig ergänzt und weiter verbessert werden, wobei ein Fachmann ohne Weiteres klar und eindeutig erkennen wird, dass Vorrichtungsmerkmale von Komponenten eines erfindungsgemässen Verbindungssystems entsprechende Schritte erfindungsgemässer Verfahren zur Herstellung und zum Einsatz eines erfindungsgemässen Verbindungssystems und seiner Komponenten begründen und umgekehrt.

So ist gemäss einer ersten weiteren Ausführungsform vorgesehen, dass der Verbinder aus einem Metall oder einer Metalllegierung, vorzugsweise zumindest anteilig aus Titan, gefertigt ist. Somit weist der Verbinder eine höhere Elastizität als die aus Keramik gefertigten Komponenten des Dentalimplantates, wie beispielsweise der Basiskörper, die Prothetik und das Abutment auf. In Anbetracht dessen, dass diese keramischen Komponenten aufgrund entsprechender Werkstoffeigenschaften insbesondere Zugkräfte, Biegemomente und Scherspannungen schlechter aufnehmen können als

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metallische Komponenten, hilft der Einsatz des metallischen Verbinders, dem gesamten Dentalimplantat eine vorteilhafte Dauerfestigkeit und Widerstandsfähigkeit zu verleihen, indem es einerseits von der Druckfestigkeit, Abriebfestigkeit und Biokompatibilität der Keramik und andererseits der Elastizität und Zähigkeit des metallischen Verbinders profitiert.

Durch eine derartige Kombination von Keramik und Metall stellt ein erfindungsgemässes Verbindungsystem sozusagen ein hybrides Dentalimplantatsystem dar. Dabei ist es für das Zahnfleisch Ideal, keinen Kontakt zu metallischen Verbinder zu haben. Dies wird erfindungsgemäss dadurch erreicht, dass der Verbinder vorteilhafterweise innerhalb eines von Basiskörper und Prothetik gebildeten Innenraums des Dentalimplantats oder zumindest durch Basiskörper und/oder Prothetik vom Zahnfleisch beabstandet angeordnet ist. Der Innenraum ist vorteilhafterweise hermetisch abgeschlossen, indem eine Kontaktfläche der Prothetik abdichtend auf einer Kontaktfläche des Basiskörpers aufliegt.

Gemäss einer weiteren vorteilhaften Ausführungsform ist vorgesehen, dass der Verbinder zwischen dem Basisabschnitt und dem Halteabschnitt wenigstens ein Schulterelement aufweist, dass in einer radialen Richtung des Verbinders zumindest abschnittsweise über einen Aussenumfang des Basisabschnitts und/oder des Halteabschnitts hinweg ragt. Das Schulterelement kann sowohl zur Handhabung des Verbinders als solchen dienen als auch einen Anschlag für den Verbinder ausbilden. So kann der Verbinder bis zum Schulterelement als Anschlag am Basiskörper in den Basiskörper eingeschraubt werden. Das Schulterelement hilft also, den Verbinder präzise und unter taktiler und/oder optischer Rückmeldung im Basiskörper zu befestigen. Mit dem Basisgewinde in den Basiskörper eingeschraubt, kann der Verbinder durch das Haltegewinde eine Anbringungsmöglichkeit für vielerlei Prothetiken bzw. für Austauschprothetiken aus Verschleiss- oder ästhetischen Gründen bereitstellen.

Gemäss einer weiteren vorteilhaften Ausführungsform ist vorgesehen, dass das wenigstens eine Schulterelement an einem Ringbund ausgeformt ist, dessen Aussendurchmesser grösser ist als ein Aussendurchmesser des Basisabschnitts und/oder des Halteabschnitts. Der Ringbund kann konzentrisch zum Basisgewinde und/oder Haltegewinde angeordnet sein. Somit trägt der Ringbund zu einer

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gleichmässigen Kräfteübertragung zwischen Verbinder und Prothetik und/oder zwischen Verbinder und Basiskörper bei.

Gemäss einer weiteren vorteilhaften Ausführungsform ist vorgesehen, dass am Verbinder wenigstens ein Eingriffsmittel ausgeformt ist zum betätigen des Verbinders mit einem Werkzeug. Das Eingriffsmittel hilft, ein vorteilhafterweise komplementär zum Eingriffsmittel ausgestaltetes Werkzeug präzise am Verbinder anzusetzen und den jeweiligen Anforderungen entsprechend Kräfte und/oder Momente vom Werkzeug auf den Verbinder zu übertragen.

Gemäss einer weiteren vorteilhaften Ausführungsform ist vorgesehen, dass das wenigstens eine Eingriffsmittel zumindest abschnittsweise mit einer Aussenprofilierung versehen ist. Beispielsweise kann die Aussenprofilierung als Aussensechskant ausgeformt sein. Ein Aussendurchmesser der Aussenprofilierung kann beispielsweise kleiner sein als ein Aussendurchmesser von Basisgewinde und/oder Haltegewinde. Dies ermöglicht ein radiales Spiel zwischen Eingriffsmittel und anderen Komponenten des Dentalimplantats, insbesondere jeweiliger Innenumfänge von Basiskörper und/oder Prothetik. Ein derartiges radiales Spiel hilft, eine Überbestimmung von Toleranzen der Komponenten des Dentalimplantates zu vermeiden sowie gewisse Freiheitsgrade bei der Handhabung der Komponenten sowie deren Montage bereitzustellen.

Gemäss einer weiteren vorteilhaften Ausführungsform ist vorgesehen, dass ein Kopfende des Verbinders als das wenigstens eine Eingriffsmittel ausgestaltet ist. Somit bleibt das Eingriffsmittel des in den Basiskörper eingesetzten Verbinders gut zugänglich. Die Zugänglichkeit kann beispielsweise verbessert werden, indem das Kopfende des Verbinders in einem vollständig in den Basiskörper eingesetzten Zustand des Verbinders entgegen einer Einsetzrichtung über eine Oberkante des Basiskörpers hinaus ragt. Alternativ oder zusätzlich kann das Eingriffsmittel an einem Ringbund oder als solcher am Verbinder ausgeformt sein.

Gemäss einer weiteren vorteilhaften Ausführungsform ist vorgesehen, dass wenigstens eine Ringnut zwischen dem Basisabschnitt und dem Halterabschnitt ausgeformt ist, an der sich der Aussenumfang des Verbinders gegenüber den jeweils umliegenden Abschnitten verjüngt. Eine derartige Ringnut hilft zum einen, ungewünschtes Verkanten, Reiben oder Anschlagen des Verbinders beim Einsetzen des Verbinders in den

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Basiskörper oder beim Aufsetzen der Prothetik auf den Verbinder zu verhindern. Zum anderen helfen derartige Ringnuten, dem Verbinder gezielt gewünschte Elastizitäten zu verleihen bzw. seine Biegsamkeit an gewünschter Stelle zu erhöhen, damit beispielsweise eher der Verbinder nachgibt, als dass die Kontaktflächen zwischen Verbinder und Keramik und/oder Kontaktflächen zwischen Keramiken durch unausgewogene Belastungen überstrapaziert werden.

Gemäss einer weiteren vorteilhaften Ausführungsform ist vorgesehen, dass das Basisgewinde und/oder das Haltegewinde als Linksgewinde ausgestaltet sind bzw. ist. Gewinde von Implantaten sind in der Regel als Rechtsgewinde ausgestaltet. Einer Ausgestaltung des Basisgewindes und/oder des Haltegewindes als Linksgewinde hilft zu verhindern, dass sich eine Verschraubung ungewünscht löst. Wenn beispielsweise das Haltegewinde als Rechtsgewinde und das Basisgewinde als Linksgewinde ausgestaltet ist, dann kann die Prothetik vom Haltegewinde abgeschraubt werden, ohne dass die Verschraubung zwischen Verbinder und Basiskörper dabei gelöst wird.

Bei einer erfindungsgemässen Prothetik kann die erfindungsgemässe Lösung gemäss einer ersten weiteren vorteilhaften Ausführungsform dadurch verbessert werden, dass der Gegenhalteabschnitt mit einem Sackloch versehen ist, in dem das Gegenhaltegewinde angeordnet ist. Durch die Anordnung des Gegenhaltegewindes im Sackloch kann das Gegenhaltegewinde bzw. ein oberer Endabschnitt des Verbinders von der Prothetik umschlossen sein. Mit anderen Worten kann die Prothetik kappenartig auf den Verbinder aufgesetzt werden. Dies hilft, einen hermetisch abgeschlossenen Innenraum des Dentalimplantates zwischen Prothetik und Basiskörper zu bilden. In diesem Innenraum kann der Verbinder von der Umgebung des Dentalimplantates, sprich Zahnfleisch und Mundraum, abgeschirmt aufgenommen sein.

Gemäss einer weiteren vorteilhaften Ausführungsform ist vorgesehen, dass das Gegenhaltegewinde zumindest abschnittsweise entlang eines Fortsatzes der Prothetik verläuft, der dazu ausgestaltet ist, in eine Aufnahme eines Basiskörpers des Dentalimplantats einzugreifen. Somit kann die Prothetik sich in radialer Richtung mit dem Basiskörper überdecken. Dies hilft zum einen bei der Montage der Prothetik, diese gegenüber dem Basiskörper zu positionieren bzw. zentrieren. Zum anderen hilft die Überdeckung, eine hohe Stabilität des Dentalimplantats und eine Abdichtung dessen Innenraumes zu gewährleisten.

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Bei einem erfindungsgemässen Verbindungsystem kann die erfindungsgemässe Lösung gemäss einer ersten weiteren vorteilhaften Ausführungsform dadurch verbessert werden, dass in einem Endmontagezustand des Dentalimplantats der Verbinder in einem von Prothetik und Basiskörper umschlossenen Innenraum des Dentalimplantats aufgenommen ist. Somit können insbesondere aus Metallen oder Metalllegierungen gefertigte Verbinder bzw. Einheitsverbinder im Innenraum angeordnet von vorzugsweise aus keramischen Werkstoffen gefertigten Basiskörpern und Prothetiken umgeben sein, um einen Kontakt der Verbinder zum Zahnfleisch zu vermeiden. Dabei ist es weiterhin von Vorteil, wenn der Innenraum hermetisch abgedichtet ist. Dazu sollte die Prothetik im Endmontagezustand bündig abdichtend am Basiskörper anliegen.

Vor dem Endmontagezustand kann der Verbinder in einem Vormontagezustand des Dentalimplantates entweder zuerst mit dem Basiskörper oder mit der Prothetik verbunden sein. Wenn der Verbinder im Vormontagezustand mit dem Basiskörper verbunden ist, dann kann er mit seinem Basisgewinde in den Basiskörper eingesetzt sein, während sein Haltegewinde von Aussehalb des Basiskörpers zugänglich angeordnet ist, um die Prothetik daran zu befestigen und somit das Dentalimplantat vom Vormontagezustand in den Endmontagezustand zu überführen. Wenn der Verbinder im Vormontagezustand mit der Prothetik verbunden ist, dann lassen sich diese wie eine Implantatschraube handhaben, die zum Überführen des Dentalimplantats vom Vormontagezustand in den Endmontagezustand in den Basiskörper eingeschraubt wird.

Alternativ oder zusätzlich wird die Aufgabe durch eine Implantatschraube für ein Dentalimplantat, mit einem keramischen Kopfteil und mit einem in einen Basiskörper des Dentalimplantats einschraubbaren nicht-keramischen Basisgewinde, gelöst.

Diese erfindungsgemässe Lösung hat gegenüber dem Stand der Technik den Vorteil, dass Kopfteil und Basisgewinde an den jeweiligen Basiskörper angepasst ausgewählt werden können. Beispielsweise insbesondere können eine Vielzahl verschiedener Kopfteile durch die Verwendung des Basisgewindes auf den Basiskörper aufgeschraubt werden. Dabei kann das Basisgewinde ebenfalls an die jeweiligen Gegebenheiten angepasst sein oder es kann ein an die Gegebenheiten anpassbarer Verbinder bzw. Einheitsverbinder verwendet werden, an dem das Basisgewinde ausgeformt ist.

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Der Kopfteil besteht beispielsweise aus Keramik, um eine möglichst hohe Biokompatibilität einer erfindungsgemässen Implantatschraube zu gewährleisten. Der Kopfteil kann unverlierbar mit einer Prothetik verbunden oder an einer Prothetik bzw. als Prothetik ausgeformt sein. Beispielsweise ist der Kopfteil bzw. die Prothetik rotationssymmetrisch ausgestaltet. An Kopfteil bzw. Prothetik kann eine Kontaktfläche ausgeformt sein, die dazu ausgebildet ist, bündig auf dem Basiskörper aufzuliegen. Somit kann das Basisgewinde zwischen Kopfteil bzw. Prothetik und Basiskörper eingeschlossen aufgenommen sein. Das Basisgewinde besteht beispielsweise aus einem nicht-keramischen Werkstoff. Als nicht keramischer Werkstoff kann vorzugsweise ein Metall oder eine Metalllegierung verwendet werden, um einer erfindungsgemässen Implantatschraube eine möglichst hohe Zähigkeit zu verleihen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der Kopfteil über einen Formschluss zur Übertragung eines um eine Mittelachse der Implantatschraube wirkenden Drehmoments mit dem Basisgewinde verbunden ist. Der Formschluss hilft, Relativdrehungen zwischen Kopfteil und Basisgewinde zumindest um die Mittelachse herum zu verhindern. Durch den Formschluss können Drehmomente präzise und sicher vom Kopfteil auf das Basisgewinde übertragen werden und umgekehrt. Durch den Formschluss können erfindungsgemässe zweiteilige Implantatschrauben aus Kopfteil und Basisgewinde gehandhabt werden, wie es bei einteiligen Implantatschrauben möglich ist.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der Kopfteil mit einer Ausnehmung versehen ist, in der wenigstens abschnittsweise ein Verbinder aufgenommen ist, an dem das Basisgewinde ausgeformt ist. Die Ausnehmung ist beispielsweise sacklochartig ausgestaltet. Die Ausgestaltung der Ausnehmung als Sackloch hilft, den Verbinder bzw. ein oberes Ende des Verbinders vorzugsweise mit der Ausnehmung zu umschliessen. Zum einen lässt sich somit eine möglichst innige und feste Verbindung zwischen Kopfteil und Verbinder herstellen. Zum anderen ist eine zumindest abschnittsweise Einbettung des nicht-keramischen Verbinders in das keramische Material des Kopfteils begünstigt. Der Verbinder kann den jeweiligen Anforderungen entsprechend ausgestaltet bzw. ausgewählt sein. Beispielsweise ist der Verbinder bolzenförmig und/oder zumindest abschnittsweise zylindrisch ausgeformt. Das Basisgewinde kann dementsprechend die Form eines Gewindebolzens aufweisen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass in der Ausnehmung ein Gegenhaltegewinde zum Aufschrauben des Kopfteils auf den Verbinder angeordnet ist. Das Gegenhaltegewinde ermöglicht, den Verbinder in den Kopfteil einzuschrauben, um somit eine formschlüssige Verbindung zwischen Kopfteil und Verbinder herzustellen. Kopfteil und Verbinder können daher einfach miteinander kombiniert werden.

Gemäss einerweiteren Ausführungsform ist vorgesehen, dass dem Gegenhaltegewinde eine mit dem Kopfteil verbundene Verzahnung zugeordnet ist. Beispielsweise ist die Verzahnung an der Prothetik bzw. dem Kopfteil ausgeformt. Die Verzahnung kann beispielsweise beim Zusammenführen des Kopfteils bzw. der Prothetik mit dem Verbinder in dessen Material eindringen und eine form- und/oder kraftschlüssige Verbindung zwischen Kopfteil bzw. Prothetik und Verbinder herbeiführen helfen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass die Verzahnung das Gegenhaltegewinde umkränzt. Mit anderen Worten umgibt die Verzahnung kranzförmig das Gegenhaltegewinde und/oder überlappt sich mit diesem. Beispielsweise kann die Verzahnung eine Öffnung zur Ausnehmung bzw. dem darin angeordneten Gegenhaltegewinde umgeben. Dies begünstigt einen möglichst symmetrischen und daher ausgeglichenen Eingriff der Verzahnung in das Material des Verbinders.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass die Verzahnung flache Zahnflanken und/oder steile Zahnflanken aufweist, wobei die flachen Zahnflanken in eine Schraubrichtung des Gegenhaltegewindes Weisen bzw. die steilen Zahnflanken entgegen der Schraubrichtung weisen. Bei der Schraubrichtung handelt es sich beispielsweise um diejenige Richtung, in der das Gegenhaltegewinde und folglich das Kopfteil bzw. die Prothetik auf den Verbinder aufschraubbar ausgestaltet ist. Indem die flachen Zahnflanken in Richtung der Schraubrichtung weisen, begünstigen sie selbst nach ihrem Kontakt mit dem Verbinder ein weiteres Aufschrauben des Kopfteils bzw. der Prothetik auf den Verbinder, da sie über das Material des Verbinders gleiten. Hingegen bewirken die steilen Zahnflanken, dass die Verzahnung sich beim Bewegen des Kopfteils bzw. der Prothetik relativ zum Verbinder entgegen der Schraubrichtung in das Material des Verbinders graben bzw. dieses derart verdrängen, dass ein inniger Form- und/oder Kraftschluss zwischen Kopfteil bzw. Prothetik und Verbinder bewirkt ist. Ein derartiger Form- und/oder Kraftschluss verhindert insbesondere ein ungewolltes Lösen der Schraubverbindung zwischen Kopfteil bzw. Prothetik und Verbinder.

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Gemäss einer weiteren Ausführungsform ist vorgesehen, dass eine mit dem Kopfteil verbundene Stirnseite in Richtung zum Basisgewinde hin weist und/oder wenigstens abschnittsweise am Verbinder anliegt. Beispielsweise kann die Stirnseite an Kopfteil bzw. Prothetik ausgeformt sein und weist vorzugsweise in axialer Richtung, d. h. in eine im Wesentlichen parallel zur Mittelachse verlaufende Richtung. Eine derartige Stirnseite begünstigt eine Kraft- und/oder Momentenübertragung zwischen Kopfteil bzw. Prothetik und Verbinder einerseits sowie zwischen Implantatschraube und Basiskörper andererseits.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass die Stirnseite ringförmig ausgebildet ist. Die Stirnseite kann beispielsweise eine Öffnung zur Ausnehmung bzw. dem Basisgewinde umschliessen bzw. einen Rand der Öffnung ausbilden. Eine ringförmige ausgestaltete, vorzugsweise rotationssymmetrisch zur Mittelachse angeordnete Stirnseite begünstigt eine möglichst gleichmässige Kraft- und/oder Momentenübertragung zwischen Kopfteil bzw. Prothetik und Verbinder einerseits sowie zwischen Implantatschraube und Basiskörper andererseits.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass wenigstens ein Zahn an der Stirnseite ausgeformt ist, an dem eine von der Stirnseite weg weisende Zahnspitze ausgeformt ist. Beispielsweise kann die Verzahnung aus einer Vielzahl derartiger Zähne gebildet sein. Die Zahnspitzen können von der Stirnseite hervorragen und somit in das Material des Verbinders eindringen, um eine möglichst innige kraft- und/oder formschlüssige zwischen Kopfteil bzw. Prothetik und Verbinder zu bewirken.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der wenigstens eine Zahn zumindest abschnittsweise die Verzahnung ausbildet. Mit anderen Worten umfasst die Verzahnung den von der Stirnseite weg weisenden Zahn. Der wenigstens eine Zahn kann entsprechend eine flache und eine steile Zahnflanke aufweisen, wie oben beschrieben ist. Vorteilhafterweise ist eine Vielzahl von die Verzahnung bildenden Zähnen rotationssymmetrisch zur Mittelachse entlang der Stirnseite angeordnet, um eine möglichst gleichmässige Kraftübertragung zwischen Kopfteil bzw. Prothetik und Verbinder zu gewährleisten.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der Verbinder einem Halteabschnitt aufweist, an dem ein Haltegewinde zum Aufschrauben des Kopfteils auf

den Verbinder ausgeformt ist. Das Haltegewinde ist vorzugsweise komplementär zum Gegenhaltegewinde ausgestaltet. Dies begünstigt, eine möglichst spielfreie zuverlässige Schraubverbindung zwischen Kopfteil bzw. Prothetik und Verbinder herzustellen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der Verbinder einen Ringbund aufweist, der zumindest abschnittsweise in Richtung zum Kopfteil hin weist. Am Ringbund kann der Kopfteil bzw. die Prothetik, insbesondere deren Stirnseite, zur Anlage kommen. Dies begünstigt zum einen eine innige Verbindung zwischen Kopfteil bzw. Prothetik und Verbinder. Zum anderen kann durch eine bündige Auflage des Kopfteils bzw. der Prothetik am Ringbund des Verbinders eine ordnungsgemässe Vereinigung von Kopfteilbeziehung Prothetik und Verbinder optisch und/oder haptisch einfach verifiziert werden.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass wenigstens ein Eingriffsmittel zum Ansetzen eines Werkzeugs zum Einschrauben des Verbinders am Ringbund ausgeformt ist. Beispielsweise kann eine Aussenkontur des Ringbundes als Eingriffsmittel ausgestaltet sein. Vorzugsweise ist die Aussenkontur als Aussensechskant ausgeformt. Das Eingriffsmittel des Verbinders vereinfacht es, möglichst materialschonend Kräfte und/oder Drehmomente über ein Werkzeug auf den Verbinder zu übertragen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass wenigstens ein Eingriffsmittel zum Ansetzen eines Werkzeugs zum Einschrauben der Implantatschraube am Kopfteil ausgeformt ist. Beispielsweise kann eine Innenkontur des Eingriffsmittels des Kopfteils bzw. der Prothetik als Innensechskant oder Innensechsrund ausgeformt sein. Das Eingriffsmittel des Kopfteils bzw. der Prothetik vereinfacht es, möglichst materialschonend Kräfte und/oder Drehmomente über ein Werkzeug auf den Kopfteil bzw. die Prothetik einerseits und andererseits auf die Implantatschraube zu übertragen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der Kopfteil über eine Klebeverbindung mit dem Basisgewinde verbunden ist. Beispielsweise ist der Kopfteil bzw. die Prothetik mit dem Verbinder verklebt. Die Verklebung kann alternativ oder zusätzlich zu einer oben beschriebenen Schraubverbindung zwischen Kopfteil bzw. Prothetik und Verbinder eingesetzt werden, um diese innig miteinander zu verbinden. In

Kombination mit einer Schraubverbindung kann die Verklebung wie eine Schraubensicherung wirken. Zwischen Kopfteil bzw. Prothetik und Verbinder kann eine Kavität ausgeformt sein, in die ein Kleber eindringen bzw. die vom Kleber aufgefüllt sein kann. Zur Bereitstellung der Kavität kann beispielsweise eine Ringnut am Basisgewinde bzw. in dessen Nähe vorzugsweise am Verbinder ausgeformt sein.

Ferner betrifft die Erfindung einen Einheitsverbinder zum Verbinden eines Abutments eines Dentalimplantats mit einem Basiskörper des Dentalimplantat, umfassend einen entlang einer Einsetzrichtung in den Basiskörper einsetzbaren und darin fixierbaren Basisabschnitt und einen Abutmenthalteabschnitt zum Halten des Abutments am Basiskörper, wobei der Abutmenthalteabschnitt wenigstens zwei entlang der Einsetzrichtung voneinander beabstandete Haltepositionen für das Abutment bereitstellt.

Die Erfindung betrifft weiter ein Einheitsverbindungssystem für Dentalimplantate umfassend mindestens einen erfindungsgemässen Einheitsverbinder. Mit Hilfe des Einheitsverbinders kann das Einheitsverbinder System für eine Vielzahl verschieden grosser und verschiedenartiger Dentalimplantate verwendet werden. Neben wenigstens einem Einheitsverbinder kann das Einheitsverbindungssystem noch weitere Elemente, wie Halteelemente, Zusatzhalteelemente sowie mit diesen und/oder dem Einheitsverbinder zusammenwirkende Werk und/oder Messzeuge beinhalten.

In der Regel weisen sowohl der Basiskörper als auch das Abutment Bohrungen auf, welche den Einheitsverbinder aufnehmen können, wobei im zusammengesetzten Zustand des Dentalimplantats ein unterer Bereich des Einheitsverbinders sich im Basiskörper befindet und ein oberer Bereich des Einheitsverbinders sich im Abutment befindet. Der Einheitsverbinder kann je nach Länge des Basiskörpers als auch des Abutments oben aus dem Abutment herausragen. Bevorzugt ist der erste Endbereich beim Einsetzen des Einheitsverbinders in den Basiskörper mit dem Basiskörper verbindbar, vorzugsweise fest verankerbar. Optional kann der Einheitsverbinder in den Basiskörper eingeklebt oder alternativ bajonettverschlussartig verbunden werden.

Der Einheitsverbinder bietet den Vorteil, dass er dank der veränderbaren Länge für Dentalimplantate von verschiedener Grösse verwendet werden kann. Bei herkömmlichen Lösungen mit konventionellen Schrauben hingegen müssen die Grössen bzw. Längen der Bestandteile mit der Schraube genau abgestimmt sein, um

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eine verlässliche Verbindung von Basiskörper und Abutment zu gewährleisten. Indem der erfindungsgemässe Einheitsverbinder wenigstens zwei Haltepositionen bereitstellt, ermöglicht er es sowohl bei verschieden grossen Basiskörper als auch verschieden grossen Abutments eingesetzt zu werden. Somit kann beispielsweise bei gesamten Serien für Dentalimplantate eine formschlüssig abgedichtete Verbindung des Basiskörpers mit dem Abutment durch den gleichen Einheitsverbinder erzielt werden, der vorteilhafterweise möglichst tief im Basiskörper verankert sein kann. Dies hilft zum einen, einen stabilen Aufbau des Dentalimplantates zu gewährleisten. Zum anderen lassen sich durch eine gegenüber dem Stand der Technik erhöhte Variabilität Produktionskosten für Dentalimplantate senken und deren Anwendung vereinfachen.

Durch die Wirkverbindung des zweiten Endbereichs des Einheitsverbinders mit dem Abutment kann der Einheitsverbinder den Basiskörper mit dem Abutment, vorzugsweise kraft und formschlüssig abdichtend, verbinden. Die Wirkverbindung kann u.a. formschlüssig, kraftschlüssig und/oder stoffschlüssig, u.a. auch indirekt über ein Halte- bzw. Verbindungsmittel, wie z.B. in Ausgestaltung einer Hülse, erfolgen. Formschlüssig ist im dem Fachmann bekannten Rahmen der Fertigung der Bestandteile des Dentalimplantats zu verstehen. Abdichtend ist im Zusammenhang mit der Verbindung zwischen dem Abutment und dem Basiskörper so zu verstehen, dass die Kontaktflächen zwischen dem Basiskörper und dem Abutment so dicht sind, dass z.B. keine Bakterien zwischen Basiskörper und Abutment eindringen können, was dabei hilft Periimplantitis zu vermeiden.

Ein erfindungsgemässer Einheitsverbinder lässt sich insbesondere durch die Abdichtung bei mehrteiligen Dentalimplantaten aus Keramik besonders vorteilhaft einsetzen. Bei derartigen Dentalimplantaten ist in der Regel ein Innenraum bzw. eine Kavität zwischen Basiskörper und Abutment gebildet. Bei ordnungsgemässer Montage des Abutments am Basiskörper ist der Innenraum hermetisch gegenüber Kieferknochen und Zahnfleisch abgedichtet. Der Einheitsverbinder kann daher von Kieferknochen und Zahnfleisch isoliert im Innenraum aufgenommen sein. Somit kann der Einheitsverbinder auch aus anderen Materialien als Keramik, beispielsweise rostfreier Stahl und/oder Titan o.ä., gefertigt sein, ohne Abstriche bei der Biokompatibilität des Dentalimplantates machen zu müssen, weil diese durch die keramische Beschaffenheit der den Einheitsverbinder umhüllenden Komponenten des Implantates gewährleistet ist.

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Die erfindungsgemässe Lösung lässt sich mit den folgenden weiteren, jeweils für sich vorteilhaften erfindungsgemässen Ausführungsformen beliebig kombinieren und weiter verbessern.

Gemäss einer ersten weiteren Ausführungsform sind die Haltepositionen stufenlos variabel wählbar. Eine stufenlos variable Wählbarkeit der Haltepositionen erlaubt es, eine Vielzahl verschiedenartiger Basiskörper und Abutments mit dem gleichen Typ Einheitsverbinder miteinander zu verbinden. Auch hilft die stufenlos variable Wählbarkeit der Haltepositionen dabei, etwaige Fertigungstoleranzen sowie Abweichungen oder Ungleichmässigkeiten beim implantieren bzw. Aufbauen des Implantats auszugleichen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der Basisabschnitt ein erstes Aussengewinde aufweist, welches mit einem Innengewinde des Basiskörpers in Eingriff bringbar ausgestaltet ist und die wenigstens zwei Haltepositionen bereitstellt. Durch das Aussengewinde kann der Einheitsverbinder auf einfache Weise in den Basiskörper eingeschraubt und somit form- sowie kraftschlüssig damit verbunden werden. Entlang des Aussengewindes können die Haltepositionen stufenlos variabel wählbar bereitgestellt sein.

Gemäss einerweiteren Ausführungsform eines erfindungsgemässen Einheitsverbinders ist vorgesehen, dass eine parallel zur Einsetzrichtung gemessene Länge des ersten Aussengewindes im Wesentlichen mit einer parallel zur Einsetzrichtung gemessene Länge des Innengewindes übereinstimmt oder zumindest lediglich geringfügig die Länge des Innengewindes unterschreitet. Somit können Innengewinde und Aussengewinde sich im Wesentlichen vollständig überdecken. Zum einen hilft dies, durch die Dimensionierung der Gewinde selber einen unteren Anschlag für den Einheitsverbinder bereitzustellen und somit seinen Einsetzweg in Einsetzrichtung zu begrenzen. Zum anderen ist die form- und kraftschlüssige Verbindung zwischen Einheitsverbinder und Basiskörper präzise auf den Bereich besagter Gewinde beschränkt und darin konzentriert. Unnötige Gewindegänge und damit verbundene Materialschwächungen sind vermieden.

Gemäss einerweiteren Ausführungsform eines erfindungsgemässen Einheitsverbinders ist vorgesehen, dass der Einheitsverbinder zwischen dem Basisabschnitt und dem Abutmenthalteabschnitt einen zylinderförmigen Schaftabschnitt aufweist. Somit kann der

Einheitsverbinder als eine Art Stehbolzen mit je einem Gewinde an jedem Ende hergestellt werden. Der Schaftabschnitt begünstigt eine möglichst spielfreie Aufnahme des Einheitsverbinders sowohl im Basiskörper als auch im Abutment. Etwaige Querkräfte oder Momente können über möglichst mit geringem Spiel bzw. spielfrei dimensionierte Anlageflächen zwischen Schaftabschnitt und Basiskörper einerseits sowie zwischen Schaftabschnitt und Abutment andererseits übertragen werden, was dabei hilft, die Robustheit und Langlebigkeit des gesamten Dentalimplantats zu verbessern.

Gemäss einer weiteren Ausführungsform weist der Schaftabschnitt wenigstens teilweise einen grösseren Durchmesser als der Basisabschnitt auf. Im Bereich der Durchmesseränderung kann ein Anschlag bzw. eine Abstufung gebildet sein, welcher hilft, einen Einsetzweg des Einheitsverbinders in Einsetzrichtung zu begrenzen. Darüber hinaus ermöglicht diese Ausführungsform, den Schaftabschnitt derart stabil auszugestalten, dass in Querrichtung bzw. radial zur Mittelachse des Schaftabschnittes bzw. Einheitsverbinders wirkende Kräfte sicher aufgenommen und abgetragen werden können. Im Gegensatz dazu können Gewinde im Basisabschnitt und im Abutmenthalteabschnitt zur Aufnahme von parallel zur Einsetzrichtung wirkenden Zugkräften ausgestaltet sein, was dabei hilft, die Abmasse der einzelnen Bestandteile des Dentalimplantates zu optimieren. Des Weiteren bietet diese Ausführungsform den Vorteil, dass ein Kontakt zwischen Basisabschnitt und der Innenwand der Bohrung des Basiskörpers bei der Einführung des Einheitsverbinders in die Bohrung des Basiskörpers minimiert werden kann. Bei einem Gewinde im Basisabschnitt kann zum Beispiel ein Kontakt zwischen dem Gewinde und der Innenwand der Bohrung des Basiskörpers bei der Einführung des Einheitsverbinders zu Beschädigungen führen, was insbesondere für Basiskörper aus Keramik kritisch sein kann. Durch eine Abstufung kann somit vorteilhafterweise eine Führung des Einheitsverbinders durch den Schaft sichergestellt und eine nachteilhafte Beschädigung des Basiskörpers durch Kontakt der Innenwand mit dem Basisabschnitt minimiert werden. Vorzugsweise weist die Bohrung des Basiskörpers im unteren Bereich anschliessend eine dem ersten Endbereich des Einheitsverbinders entsprechende verengte Bohrung auf, in welche der Basisabschnitt des Einheitsverbinders eingreifen bzw. möglichst bündig damit abschliessend eingesetzt werden kann.

Gemäss einer weiteren Ausführungsform ist ein mit den Abutmenthalteabschnitt umgreifendes Halteelement vorgesehen, das dazu ausgestaltet ist, zum Halten des Abutments mit dem Abutmenthalteabschnitt zusammenzuwirken. Das Halteelement kann in den wenigstens zwei Haltepositionen am Einheitsverbinder fixierbar bzw. arretierbar ausgestaltet sein oder zumindest derart mit dem Einheitsverbinder zusammenwirken, dass es im Wesentlichen parallel zur Einsetzrichtung wirkende Kräfte vom Einheitsverbinder aufnehmen und an diesen übertragen kann. Verschiedene Halteelemente können mit jeweils dem gleichen Einheitsverbinder kombiniert werden, um diesen mit verschiedenartigen Basiskörpern und/oder Abutments zusammen verwenden zu können.

Gemäss einer weiteren Ausführungsform des Einheitsverbinders ist vorgesehen, dass das Halteelement wenigstens eine zumindest teilweise entgegen der Einsetzrichtung weisende Haltefläche zum Halten des Abutments aufweist. Die Haltefläche kann den jeweiligen Anforderungen gemäss ausgestaltet sein, um im Wesentlichen parallel zur Einsetzrichtung wirkende Kräfte zu übertragen. Die Ausgestaltung der Haltefläche kann für den jeweiligen Basiskörper bzw. das jeweilige Abutment optimiert sein.

Gemäss einer weiteren Ausführungsform des Einheitsverbinders ist vorgesehen, dass der Abutmenthalteabschnitt mit wenigstens einem Haltegewinde zum form- und kraftschlüssigen Zusammenwirken mit dem Halteelement versehen ist. Somit kann das Halteelement einfach am Haltegewinde auf den Einheitsverbinder geschraubt werden. Das Halteelement ist mit einem entsprechenden Gewinde ausgestattet, dass komplementär zum Haltegewinde ausgestaltet ist. Dies ermöglicht es, eine Vielzahl weitestgehend frei variabel wähl und justierbare Haltepositionen bereitzustellen. Sobald der Einheitsverbinder ordnungsgemäss in den Basiskörper eingesetzt ist, kann das Abutment mit Hilfe des Halteelements einfach in gewünschter Position am Basiskörper fixiert werden, indem das Halteelement mit einem angemessenen Drehmoment auf das Haltegewinde des Einheitsverbinders geschraubt wird. Vorteilhafterweise können somit auch insbesondere im Bereich des Basisabschnitts bzw. der Verbindung zwischen Basiskörper und Einheitsverbinder auftretende Fertigungs- und Montagetoleranzen ausgeglichen und eine möglichst bündige, stabile und abgedichtete Verbindung zwischen Abutment und Basiskörper hergestellt werden.

Gemäss einer weiteren Ausführungsform ist das Halteelement hülsenartig mit einer im Wesentlichen zylinderförmigen Aussenkontur ausgestaltet. Über eine derartige Hülse ist der Einheitsverbinder mit dem Abutment zur formschlüssig abgedichteten Verbindung des Abutments und des Basiskörpers auf einfache und effektive Art und Weise verbindbar. In einer vorteilhaften Ausgestaltung wird die Hülse in den Abutmenthalteabschnitt eingreifend über diesen geschoben und drückt beim Eingreifen das Abutment formschlüssig abdichtend gegen den Basiskörper. Unter Schieben versteht der Fachmann in diesem Zusammenhang nicht nur eine transversale Geleitsbewegung, sondern im Allgemeinen eine Positionierung, wobei ein Bestandteil in oder an einem anderen aufgenommen wird. Ein Verschieben kann daher auch ein Verschrauben umfassen bzw. eine Kombination zwischen transversale Geleitbewegung und Verschraubung darstellen, wenn die Hülse zum Beispiel zuerst auf den Abutmenthalteabschnitt gesteckt und nach dem Eingreifen in ein daran vorgesehenes Haltegewinde geschraubt wird.

In der Regel ist die Hülse in einen Hülsenaufnahmebereich der Bohrung des Abutments einführbar und bündig mit diesem abschliessend ausgestaltet. In einer Ausgestaltung beträgt eine im Wesentlichen parallel zur Einsteckrichtung gemessene Länge der Hülse mindestens 50%, vorzugsweise mindestens 75%, besonders vorzugsweise mindestens 85%, der ebenfalls im Wesentlichen parallel zur Einsteckrichtung gemessenen Länge eines Hülsenaufnahmebereichs der Durchgangsbohrung des Abutments. In einer alternativen Ausführung kann die Hülse auch länger als der Hülsenaufnahmebereich der Durchgangsbohrung des Abutments ausgeführt sein. Die Hülse steht dann über das Abutment raus, was eine zusätzliche Stabilität erzeugt.

Gemäss einerweiteren Ausführungsform ist wenigstens ein den Abutmenthalteabschnitt umgreifendes Zusatzhalteelement vorgesehen, das dazu ausgestaltet ist, zum Halten des Abutments mit dem Abutmenthalteabschnitt zusammenzuwirken. Das Zusatzhalteelement kann dazu dienen, das Halteelemente bzw. dessen Wirkbereich zu verlängern bzw. es zu stabilisieren oder kontern. Insbesondere kann das Zusatzhalteelement zusätzlich zum Halteelemente Stützfunktionen ausüben. Somit hilft das Zusatzhalteelement dabei, den Einheitsverbinder noch flexibler in Verbindung mit verschiedenen Basiskörpern und/oder Abutments einzusetzen.

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Ein Zusatzhalteelement bietet für Ausgestaltungen mit Abutments, welche eine Bohrung mit einem Halteelement bzw. Hülsenaufnahmebereich aufweisen, welcher wesentlich länger (z.B. mehr als doppelt so lang) als das Halteelement ist, den Vorteil, dass nach Einsetzen des Halteelementes der verbliebene Zwischenraum zwischen dem Abutmenthalteabschnitt und der Innenwand des Halteelements bzw. Hülsenaufnahmebereichs der Bohrung des Abutments durch das Zusatzhalteelement besetzt werden kann. Dadurch kann die Stabilität des Dentalimplantats erhöht werden, da die Abstützfläche zwischen Abutment und Einheitsverbinder vergrössert wird.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass das Halteelement und/oder das Zusatzhalteelement als eine Art Rundmutter mit einem inneren Gewinde versehen sind bzw. ist. Das innere Gewinde ist jeweils komplementär zum am Abutmenthalteabschnitt ausgeformten Gewinde ausgestaltet. Somit lassen sich Halteelement und Zusatzhalteelement einfach auf den Abutmenthalteabschnitt aufschrauben.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass das Halteelement und/oder das Zusatzhalteelement ein Eingriffsmittel aufweisen bzw. aufweist, an dem ein Werkzeug zum betätigen des Halteelements und/oder des Zusatzhalteelements abstützbar ist. Insbesondere kann das Eingriffsmittel komplementär zu einem Gegeneingriffsmittel eines Spezialwerkzeugs ausgestaltet sein, mit welchem Halteelement bzw. Zusatzhalteelement betätigbar sind. Bei auf den Abutmenthalteabschnitt aufschraubbarem Halteelement bzw. Zusatzhalteelement ist das Eingriffsmittel so ausgestaltet, dass ein Drehmoment zum Aufschrauben von Halteelement bzw. Zusatzhalteelement auf diese übertragbar ist. Eingriffsmittel können in einer Ausgestaltung an einem Ende des Halteelementes bzw. Zusatzhalteelements, vorzugsweise axialsymmetrisch daran angeordnete und ausgeformte Nuten sein.

Gemäss einer zusätzlichen Ausführungsform ist vorgesehen, dass eine im Wesentlichen parallel zur Einsetzrichtung gemessene Länge des Einheitsverbinders veränderbar ist. Dies bietet den Vorteil, dass der Einheitsverbinder bei verschieden grossen Dentalimplantaten mit einer für den Einheitsverbinder zu grossen oder zu kleinen Länge gekürzt bzw. verlängert werden kann.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der Einheitsverbinder in Abhängigkeit der Grösse des Dentalimplantats an vorgegebenen Ablängmarkierungen ablängbar ausgestaltet ist. Die Ablängmarkierungen erlauben es, den Einheitsverbinder vor, während oder nach seinem Einsetzen auf die gewünschte Länge präzise abzulängen. Insbesondere bietet dies den Vorteil, dass der Einheitsverbinder für kleine Dentalimplantate, für welche der Basiskörper kurz ist, angepasst werden kann, indem die Länge des Einheitsverbinders gekürzt wird. Bevorzugt ist der Basisabschnitt und/oder der Abutmenthalteabschnitt von einer ausreichenden Länge, so dass nach einer Kürzung des Einheitsverbinders der Basisabschnitt und/oder der Abutmenthalteabschnitt noch eine ausreichende Länge aufweisen, um eine Verbindung mit dem Basiskörper und/oder eine Wirkverbindung mit dem Abutment sicherzustellen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass die Ablängmarkierungen als Sollbruchstellen ausgeformt sind. Die Sollbruchstellen vereinfachen ein präzises Ablängen des Einheitsverbinders und verhindern unerwünschte Beschädigungen beim Ablängen. In Ausgestaltungen, bei welchen der Basisabschnitt und/oder der Abutmenthalteabschnitt ein Gewinde aufweisen, erstreckt sich das Gewinde vorteilhafterweise über eine derart ausreichende Länge entlang der Einsetzrichtung, dass auch nach einer Kürzung ein ausreichendes Gewindestück verbleibt, um eine Verbindung mit dem Basiskörper und/oder mit dem Abutment sicherzustellen. In einer besonders vorteilhaften Ausgestaltung ist der Abutmenthalteabschnitt länger als der Basisabschnitt. Wenn dann der Einheitsverbinder im Bereich des Abutmenthalteabschnitts abgelängt wird, bleiben Basisabschnitt und Basiskörper davon unberührt.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass der Abutmenthalteabschnitt und/oder der Basisabschnitt mit einer Verbinderverlängerung, vorzugsweise in Form einer Bolzenverlängerung oder Schraubenverlängerung, in Eingriff bringbar ausgestaltet ist. Vorzugsweise kann zum Verlängern eine Bolzenverlängerung oder Schraubenverlängerung vorgesehen sein, die einen Aussendurchmesser aufweist, welcher mit dem Aussendurchmesser des Einheitsverbinders übereinstimmt, so dass sich bezüglich der Führung des Abutments und/oder eines Halteelementes und der radialen Positionierung des Einheitsverbinders in der Durchgangsbohrung des Abutments keine Änderungen ergeben. Bei Ausgestaltungen mit einem Aussengewinde im Basisabschnitt und einem Haltegewinde

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im Abutmenthalteabschnitt bietet die Verbinderverlängerung den Vorteil, dass der Einheitsverbinder auf flexible Weise je nach Erfordernis an beiden Enden verlängert werden kann. Bei Ausgestaltungen mit einem zylinderförmigen Schaftabschnitt ist der Aussendurchmesser der Rundmutter vorteilhafterweise gleich dem Aussendurchmesser des Schaftabschnittes, so dass ein stufenloser Übergang zwischen Schaftabschnitt und der Verbinderverlängerung ermöglicht wird. Ausserdem kann der Einheitsverbinder bei grossen Dentalimplantaten mit einer ansonsten für den Einheitsverbinder zu grossen Länge angepasst bzw. verlängert werden kann. Vorzugsweise weist die Bolzenverlängerung oder Schraubenverlängerung einen Aussendurchmesser auf, welche mit dem Aussendurchmesser des Einheitsverbinders übereinstimmt, so dass sich bezüglich der Führung des Einheitsverbinders und der radialen Positionierung in der Bohrung des Basiskörpers keine Änderungen ergeben.

Ein erfindungsgemässer Einheitsverbinder samt etwaigen Halte und/oder Verlängerungselementen kann gemäss einer weiteren Ausführungsform wendbar ausgestaltet sein, sodass die Funktion von Basis und Abutmenthalteabschnitt den jeweiligen Anforderungen gemäss beliebig miteinander getauscht werden kann. Die Dimensionen von Basis und Abutmenthalteabschnitt können so auf verschiedenartigen Basiskörper bzw. Abutments abgestimmt sein, dass beispielsweise für gewisse Grössen und Typen der Basiskörper der Basisabschnitt und bei anderen Grössen und Typen der Abutmenthalteabschnitt darin eingesetzt und somit zum Basishalteabschnitt wird, während dieser dann die Funktion des Abutmenthalteabschnitt erfüllt. Durch eine derartige Wendefunktion lässt sich die Variabilität des Einheitsverbinders erhöhen.

Beim erfindungsgemässen Einheitsverbindungssystem kann die erfindungsgemässe Lösung dadurch weiter verbessert werden, dass das Einheitsverbindungssystem des Weiteren wenigstens einen in einen Kieferknochen einsetzbaren Basiskörper und/oder wenigstens ein Abutmenthalteabschnitt umfasst, die dazu ausgestaltet sind, mit dem Einheitsverbinder zusammenzuwirken. Einen in einen Kieferknochen einsetzbaren Basiskörper, ein mit dem Basiskörper formschlüssig verbindbares Abutment, und einen Einheitsverbinder gemäss der vorliegenden Offenbarung erlauben es, besonders kostengünstig flexibel einsetzbare Serien von Dentalimplantaten bereitzustellen, die modulartig miteinander kombinierbare Bestandteile umfassen.

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Gemäss einer weiteren Ausführungsform eines erfindungsgemässen Einheitsverbindungssystems ist vorgesehen, dass der Basiskörper eine Bohrung zur Aufnahme des Einheitsverbinders aufweist bzw. dass das Abutment eine im Wesentlichen parallel zur Einsetzrichtung verlaufende Durchgangsbohrung aufweist, in der wenigstens eine Schulter angeordnet ist, die einen entgegen der Einsetzrichtung weisenden Anschlag für den Einheitsverbinder ausbildet. Das Abutment weist also in der Regel eine durchgehende Bohrung und auf der Innenseite der Bohrung eine Schulter, beispielsweise in Form einer Abstufung, auf, über welche das Abutment an den Basiskörper abdichtend anpressbar ist.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass die Bohrung des Basiskörpers in einer Abutment abgewandten Hälfte des Basiskörpers ein mit dem Basisabschnitt in Eingriff bringbares Innengewinde aufweist. Somit kann der Einheitsverbinder einfach in den Basiskörper eingeschraubt werden. Die Anordnung des Innengewindes in der vom Abutment abgewandten Hälfte des Basiskörpers ermöglicht es bei gleichzeitiger seitlicher AbStützung des Einheitsverbinders in oberhalb des Innengewindes liegenden Abschnitten des Basiskörpers, im Wesentlichen lediglich parallel zur Einsetzrichtung verlaufende Zug oder Druckkräfte am Innengewinde vorliegen zu haben, wodurch die Gefahr von Beschädigungen, beispielsweise Brüchen oder Rissen, im Bereich des Innengewindes vermieden werden, die insbesondere dann auftreten können, wenn Gewindegänge und ungünstige Krafteinleitungen zu unerwünschten Kerbwirkungen führen.

Mit anderen Worten bietet eine Anordnung des Innengewindes in der dem Abutment abgewandten Hälfte des Basiskörpers den Vorteil, dass die auftretenden Kräfte am Innengewinde in den unteren Bereich des Basiskörpers geleitet und daher vom Kontaktbereich zum Abutment entfernt gehalten werden können. Dies führt vorteilhafterweise dazu, dass Zug und Scherspannungen im Kontaktbereich zwischen Abutment und Basiskörper, insbesondere an Auflageflächen, im Wesentlichen vermieden werden können. Vorteilhafterweise verbleiben im Kontaktbereich hauptsächlich Druckspannungen, was insbesondere für Keramikbestandteile vorteilhaft ist, da das Keramikmaterial zwar druckkraftstabil, aber eher zugkraftinstabil ist. Diese Anordnung bietet daher den Vorteil, dass die Stabilität und somit der Langzeiterfolg des Dentalimplantats erhöht werden kann.

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Gemäss einer weiteren Ausführungsform ist vorgesehen, dass ein grösster Aussendurchmesser des Einheitsverbinders zumindest in einer unteren Hälfte des Einheitsverbinders derart auf einen kleinsten Innendurchmesser der Bohrung des Basiskörpers abgestimmt ist, dass der Einheitsverbinder beim Einsetzen in die Bohrung im Wesentlichen spielfrei im Basiskörper geführt ist. Die spielfreie Führung hilft dabei, den Einbau des Einheitsverbinders zu vereinfachen und die Langzeitstabilität des gesamten Implantats zu erhöhen.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass ein kleinster Innendurchmesser der Durchgangsbohrung des Abutments derart auf einen grössten Aussendurchmesser des Halteelementes und/oder des Zusatzhalteelements abgestimmt ist, dass das Halteelement und/oder das Zusatzhalteelement im Wesentlichen spielfrei im Abutment geführt sind bzw. ist. Bevorzugt weist die Bohrung des Abutments einen dem Basiskörper zugewandten unteren Bereich mit einem kleineren Durchmesser als dem Durchmesser eines dem Basiskörper abgewandten oberen Bereichs der Bohrung des Abutments auf, welcher einen Aufnahmebereich für das Halteelement und/oder das Zusatzhalteelement bildet, wobei die beiden Bereiche über die Abstufung so aneinander angrenzen, dass das Abutment durch Anschlag der Hülse an der Abstufung in axialer Richtung des Dentalimplantats in den Basiskörper formschlüssig abdichtend anpressbar ist. In Ausgestaltungen des Abutments mit einer Abstufung beträgt die Länge der Hülse vorzugsweise mindestens 50%, besonders vorzugsweise mindestens 75%, ganz besonders vorzugsweise mindestens 85%, der Länge des oberen Bereichs, bzw. des Hülsenaufnahmebereichs, der Bohrung des Abutments.

Gemäss einer weiteren Ausführungsform ist vorgesehen, dass die Bohrung im Basiskörper als eine durchgehende Bohrung ausgestaltet ist und am unteren Ende eine Kappe aufweist, welche die Bohrung wenigstens teilweise abdeckt und welche mit einem Teil des Basisabschnitts des Einheitsverbinders in Eingriff bringbar und beim Einsetzen des Einheitsverbinders vom Basiskörper derart abtrennbar ausgestaltet ist, dass in einem vollständig in den Kieferknochen eingesetzten Zustand von Basiskörper und Einheitsverbinder das untere Ende des Einheitsverbinders die Kappe in den Kieferknochen presst. Mit der vom Basiskörper trennbaren Kappe kann vorteilhafterweise die Flexibilität des Dentalimplantats weiter erhöht werden. Bei einem zu langen Einheitsverbinder in Bezug auf den Basiskörper kann der Einheitsverbinder

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so weit in den Basiskörper eingeführt, bzw. eingeschraubt (in Ausgestaltungen mit einem ersten Gewinde im ersten Endbereich) werden, bis der Einheitsverbinder an der Kappe anschlägt, die Kappe schliesslich vom Basiskörper trennt und weiter in den Kieferknochen presst. Die Stabilität der Verankerung des Dentalimplantats kann mit der weiter in den Kieferknochen gepressten Kappe mit Vorteil erhöht werden. Mit Vorteil kann die durch die getrennte Kappe entstehende zusätzliche Fläche den Osseointegrationsgrad erhöhen helfen.

Alternativ ist die Bohrung des Basiskörpers als Sackloch ausgebildet. Bevorzugt beträgt die Länge des Sackloches mindestens 80%, besonders bevorzugt mindestens 90% der Gesamtlänge des Basiskörpers. Dies bietet den Vorteil, dass die gesamte Länge des Basiskörpers zur Aufnahme von Kräften, z.B. Schraubkräften, bei der Verbindung des Einheitsverbinders mit dem Basiskörper dienen kann.

Gemäss einerweiteren Ausführungsform ist vorgesehen, dass zwischen einem grössten Aussendurchmesser des Halteelementes und/oder des Zusatzhalteelementes und dem kleinsten Innendurchmesser der Durchgangsbohrung des Abutments ein Spalt gebildet ist, dessen Breite vorzugsweise zwischen 0.001 mm und 0.1 mm beträgt. Der Spalt dient dazu, ein ausreichendes Spiel in radialer Richtung zwischen der Hülse und dem Abutment bereitzustellen, so dass eine Überbestimmung vermieden werden kann. Das Spiel ist mit Vorteil aber ausreichend klein, dass die Hülse die Stabilität dadurch erhöhen kann, dass sich das Abutment bei auftretenden Querkräften an der Hülse abstützen kann.

In einer Ausgestaltung ist der Basiskörper aus Keramik, vorzugsweise Zirkoniumoxid oder auf Zirkoniumoxid-Basis, gefertigt. In einer Ausgestaltung ist das Abutment aus Keramik, vorzugsweise aus Zirkoniumoxid oder auf Zirkoniumoxid-Basis, gefertigt. Bevorzugt werden der Basiskörper und/oder das Abutment in Ausgestaltungen aus Keramik durch Pulverspritzgiessverfahren hergestellt. Dies bietet den Vorteil einer kostengünstigen Herstellung. Das Keramikmaterial bietet den Vorteil einer hohen Biokompatibilität sowie eines hohen Osseointegrationsgrads. Weiter bietet das Keramikmaterial im Vergleich zu Titan einen kosmetischen Vorteil bei Zahnfleischrückgang, was bei Dentalimplantaten oft eintritt.

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In Ausgestaltungen des Basiskörpers aus Keramik und mit einem Innengewinde ist das Innengewinde vorzugsweise als Rundgewinde ausgebildet. In einer vorteilhaften Variante weist in diesen Ausgestaltungen der erste Endbereich des Einheitsverbinders ein Trapezgewinde auf. Dies bietet den Vorteil, dass die Gewindegänge des Innengewindes beim Einschrauben des Einheitsverbinders geschont werden können. Im Vergleich zu Spitzgewinden, welche sich in das Innengewinde schneiden und somit das Keramikmaterial beschädigen können, kann ein solcher Einheitsverbinder mit einem Trapezgewinde daher den Langzeiterfolg des Dentalimplantats erhöhen.

In einer Ausgestaltung ist der Einheitsverbinder aus Metall, vorzugsweise aus rostfreiem Stahl und/oder Titan, gefertigt.

In einer Ausgestaltung entspricht der grösste Querdurchmesser des Einheitsverbinders in der unteren Hälfte des Einheitsverbinders dem grössten Querdurchmesser der Bohrung des Basiskörpers derart, dass der Einheitsverbinder bei der Aufnahme in die Bohrung führbar ist.

Optional besteht zwischen dem Bereich des Einheitsverbinders, welcher sich nach dem Einsetzen im Basiskörper befindet, und der Innenwand der Bohrung des Basiskörpers ein Spiel, so dass bei der Einführung des Einheitsverbinders in den Basiskörper Beschädigungen aufgrund von Reibung minimiert werden können. Das Spiel ist vorteilhafterweise aber so klein, dass eine zuverlässige Führung bzw. Zentrierung des Einheitsverbinders bereitgestellt wird.

In einer Ausgestaltung entspricht ein Querdurchmesser des Einheitsverbinders dem kleinsten Querdurchmesser der Bohrung des Abutments derart, dass das Abutment beim Einsetzen auf den Basiskörper durch den Einheitsverbinder führbar ist.

Der Einheitsverbinder bietet daher den Vorteil, dass das Abutment beim Positionieren auf den Basiskörper geführt bzw. zentriert werden kann. Vorzugsweise besteht zwischen dem Einheitsverbinder und der Innenwand der Bohrung des Abutments ein Spiel, so dass bei der Positionierung des Abutments auf den Basiskörper Beschädigungen aufgrund von Reibung minimiert werden können. Das Spiel ist vorteilhafterweise aber so klein, dass eine zuverlässige Führung bzw. Zentrierung des Abutments bereitgestellt wird.

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In einer Ausgestaltung entspricht der grösste Querdurchmesser der Bohrung des Abutments dem Querdurchmesser der Hülse derart, dass das Abutment in Querrichtung an der Hülse abstützbar ist.

In Ausgestaltungen mit einer abgestuften Bohrung des Abutments und einem Einheitsverbinder mit einem zylindrischen Schaft und einer Hülse entspricht mit Vorteil der kleinere Durchmesser der Bohrung im dem Basiskörper zugewandten unteren Bereich des Abutments dem Aussendurchmesser des zylindrischen Schafts des Einheitsverbinders. Der grössere Durchmesser der Bohrung im dem Basiskörper abgewandten oberen Bereich des Abutments, welcher den Hülsenaufnahmebereich bildet, entspricht mit Vorteil dem Aussendurchmesser der Hülse, so dass sich das Abutment an der Hülse abstützen kann und bei auftretenden Querkräften die Stabilität des Dentalimplantats erhöht werden kann. Im unteren Bereich der Bohrung des Abutments kann sich das Abutment bei auftretenden Querkräften mit Vorteil am zylindrischen Schaft oder teilweise am zweiten Endbereich des Einheitsverbinders abstützen.

In einer Ausgestaltung weist das Abutment einen Fortsatz und der Basiskörper eine Aussparung auf, wobei der Fortsatz in die Aussparung einsteckbar ist. Bevorzugt wird durch den Fortsatz des Abutments und der Aussparung des Basiskörpers ein verdrehsicherer Formschluss bereitgestellt. In einer Variante wird der verdrehsichere Formschluss durch eine radial ungleichmässige Struktur des Fortsatzes (d.h. in tangentialer Richtung) bereitgestellt. In einerweiteren Variante weist der Fortsatz radiale Vorsprünge auf, welche in tangentialer Richtung weisende Anlageflächen ausbilden und in radiale Nuten der Aussparung des Basiskörpers eingreifen können.

Figurenbeschrieb

Die Erfindung soll nachfolgend anhand von Ausführungsbeispielen im Zusammenhang mit den Figuren und der dazugehörigen Beschreibung näher erläutert werden. Es zeigen:

Fig. 1 eine Schnittdarstellung einer ersten Ausführungsform eines erfindungsgemässen Einheitsverbinders;

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Fig. 2 eine Schnittdarstellung einer zweiten Ausführungsform eines erfindungsgemässen Einheitsverbinders;

Fig. 3 eine Schnittdarstellung eines Dentalimplantats mit einer ersten Ausführungsform eines erfindungsgemässen Einheitsverbindungssystems;

Fig. 4 eine Schnittdarstellung eines Dentalimplantats mit einer zweiten Ausführungsform eines erfindungsgemässen Einheitsverbindungssystems;

Fig. 5 eine Schnittdarstellung des in Fig. 3 gezeigten Dentalimplantats entlang der in Fig. 3 eingezeichneten Schnittlinie A-A;

Fig. 6 eine schematische Explosionsdarstellung einer weiteren Ausführungsform eines erfindungsgemässen Dentalimplantats;

Fig. 7 eine schematische Querschnittsansicht entlang einer Längsachse des in Fig. 6 gezeigten Dentalimplantates in einem Vormontagezustand;

Fig. 8 eine schematische Querschnittsansicht entlang der Längsachse des in Figs. 6 und 7 gezeigten Dentalimplantates in einem Endmontagezustand;

Fig. 9 eine schematische Explosionsdarstellung einer zusätzlichen Ausführungsform eines erfindungsgemässen Dentalimplantats;

Fig. 10 ein Detail IX des in Fig. 9 gezeigten Dentalimplantates;

Fig. 11 eine schematische Querschnittsansicht entlang einer Längsachse des in Fig. 9 und 10 gezeigten Dentalimplantates in einem Vormontagezustand;

Fig. 12 ein Detail XI des in Figs. 9 bis 11 gezeigten Dentalimplantates; und

Fig. 13 eine schematische Querschnittsansicht entlang der Längsachse des in Figs. 9 bis 12 gezeigten Dentalimplantates in einem Endmontagezustand.

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Ausführung der Erfindung

Im Folgenden ist die Erfindung beispielhaft anhand möglicher Ausführungsformen mit Bezug auf die beigefügten Zeichnungen genauer beschrieben. Die bei diesen Ausführungsformen dargestellten Merkmalskombinationen dienen lediglich Anschauungszwecken. Einzelne Merkmale können nach Massgabe ihrer oben beschriebenen Vorteile auch weggelassen werden, wenn es bei bestimmten Anwendungen auf den Vorteil des jeweiligen Merkmals nicht ankommt. In der Beschreibung der Ausführungsformen sind der Einfachheit halber gleiche Merkmale und Elemente mit gleichen Bezugszeichen versehen. Bei unterschiedlichen Ausführungsformen können Merkmale und Elemente mit gleicher oder ähnlicher Funktion mit einem oder mehreren Apostrophen versehen sein, um sie darstellungshalber einer Ausführungsform zuzuordnen, wobei diese Zuordnung nicht als auf die jeweilige Ausführungsform einschränkend aufzufassen ist.

Figur 1 zeigt eine Schnittdarstellung einer ersten Ausführungsform eines erfindungsgemässen Einheitsverbinders 1. Der Einheitsverbinder 1 weist einen Basisabschnitt 11 mit einem ersten Aussengewinde 111 sowie einen Abutmenthalteabschnitt 12 mit einem Haltegewinde 121 auf. Zwischen den Abschnitten 11, 12 weist der Einheitsverbinder einen zylindrischen Schaftabschnitt 13 auf, so dass der Einheitsverbinder 1 die Form eines Stehbolzens mit einer Mittelachse M_1 aufweist, entlang welcher der Einheitsverbinders 1 in einer Einsetzrichtung I einzusetzen bzw. einzuschrauben ist.

Der Einheitsverbinder 1 besitzt eine parallel zur Einsetzrichtung I gemessene Gesamtlänge L_1. Der Basisabschnitt 11 und das Aussengewinde 111 besitzen eine parallel zur Einsetzrichtung I gemessene Länge L_{11} bzw. L_{111}, die das 0.2 bis 0.3-fache, vorzugsweise das 0.25-fache entsprechend einem Viertel der Gesamtlänge L_1 betragen. Der Abutmenthalteabschnitt 12 und das Haltegewinde 121 besitzen eine parallel zur Einsetzrichtung I gemessene Länge L_{12} bzw. Ln_2, die das 0.3 bis 0.6-fache, vorzugsweise das 0.4 bis 0.5-fache, höchst vorzugsweise das 0.41 6-fache entsprechend fünf Zwölftel der Gesamtlänge Li betragen. Der Schaftabschnitt 13 besitzt eine parallel zur Einsetzrichtung I gemessene Länge Li_3, die das 0.3 bis 0.4-fache, vorzugsweise das 0.333-fache entsprechend einem Drittel der Gesamtlänge Li beträgt.

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Der Einheitsverbinder 1 ist beispielsweise aus rostfreiem Stahl, Titan und/oder Keramik gefertigt. In bestimmten Ausführungsformen kann es besonders vorteilhaft sein, den Einheitsverbinder aus rostfreiem Stahl und/oder Titan zu fertigen, insbesondere wenn er innerhalb eines ansonsten keramischen Implantats hermetisch abgeschlossen von Kiefer und Zahnfleisch isoliert aufgenommen ist, so dass die Frage der Biokompatibilität für den Einheitsverbinder 1 selber von eher zweitrangiger Bedeutung und einer Optimierung seiner mechanischen Eigenschaften nachstehen kann.

Figur 2 zeigt eine Schnittdarstellung einer zweiten Ausführungsform eines Einheitsverbinders 1' mit einem Basisabschnitt 11' und einem ersten Aussengewinde 111' sowie einem Abutmenthalteabschnitt 12' und einem Haltegewinde 121'. An den Basisabschnitt 11' anschliessend ist eine Bolzenverlängerung 14' in geeigneter weise angebracht. Beispielsweise kann die Bolzenverlängerung 14' mit dem Basisabschnitt 11' mittels einer Schraubverbindung in einer Ausnehmung an der Mittelachse des Basisabschnitts 11' oder mittels einer Klebeverbindung an dessen Stirnfläche verbunden sein. Die Bolzenverlängerung 14' weist ein Verlängerungsgewinde 141 auf, welche mit einem Innengewinde eines Basiskörpers eines Dentalimplantats in Eingriff bringbar ist. Mittels der Bolzenverlängerung 14' ist der Einheitsverbinder 1' verlängerbar und kann daher für lange Dentalimplantate verwendet werden. Alternativ oder zusätzlich kann die Bolzenverlängerung 14' in analoger Art und Weise auch am Abutmenthalteabschnitt 12' angebracht sein, um diesen zu verlängern.

Der Einheitsverbinder 1' besitzt ähnlich wie der Einheitsverbinder 1 eine parallel zur Einsetzrichtung I gemessene Gesamtlänge $L_{1'}$, die beispielsweise einer Summe der Gesamtlänge L_1 des Einheitsverbinders 1 zuzüglich einer parallel zur Einsetzrichtung I gemessenen Länge $L_{14'}$ der Bolzenverlängerung 14' betragen kann. Der Basisabschnitt 11' und das Aussengewinde 111' besitzen eine parallel zur Einsetzrichtung I gemessene Länge $L_{11'}$ bzw. $L_{111'}$, die ebenfalls das 0.2 bis 0.3-fache, vorzugsweise das 0.25-fache entsprechend einem Viertel der Gesamtlänge Li betragen. Der Abutmenthalteabschnitt 12' und das Haltegewinde 121' besitzen eine parallel zur Einsetzrichtung I gemessene Länge $L_{12'}$ bzw. $L_{112'}$, die das 0.3 bis 0.6-fache, vorzugsweise das 0.4 bis 0.5-fache, höchst vorzugsweise das 0.41 6-fache entsprechend fünf Zwölftel der Gesamtlänge Li betragen. Der Schaftabschnitt 13' besitzt eine parallel zur Einsetzrichtung I gemessene Länge $L_{13'}$, die das 0.3 bis 0.4-fache, vorzugsweise das 0.333-fache entsprechend einem Drittel der Gesamtlänge Li beträgt.

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Mit Hilfe der Bolzenverlängerung 14' können die oben genannten vom Einheitsverbinder 1' abgeleiteten Längenverhältnisse zwischen den einzelnen Abschnitten des Einheitsverbinders 1' bezogen auf seine Gesamtlänge l_r den jeweiligen Anforderungen gemäss verschoben bzw. angepasst sein. Die Verschiebung bzw. Anpassung der Längenverhältnisse ergibt sich aus der Länge $L1_4$' der Bolzenverlängerung 14', wobei die Gesamtlänge $L1$ des Einheitsverbinders 1 eine Art Grundlänge darstellt, die mit Hilfe verschiedener Typen der Bolzenverlängerung 14' variiert werden kann.

Im vorliegenden Ausführungsbeispiel des Einheitsverbinders 1' mit Bolzenverlängerung 14' beträgt die Länge $L1_4$' das 0.3 bis 0.4-fache, vorzugsweise das 0.333-fache entsprechend einem Drittel der Gesamtlänge Li. Somit kann die Länge des Verlängerungsgewindes wiederum der Länge $L111$' des Aussengewindes entsprechen. Der Einheitsverbinder 1 bzw. 1' kann somit durch Bolzenverlängerungen 14' jeweils inkrementell um das 0.3 bis 0.4-fache, vorzugsweise das 0.333-fache entsprechend einem Drittel der Gesamtlänge Li verlängert oder wahlweise verkürzt werden, wenn er ursprünglich mit wenigstens einer Bolzenverlängerung 14' versehen und durch ein Abnehmen der wenigstens einen Bolzenverlängerung 14' ablängbar ausgestaltet ist.

Figur 3 zeigt eine Schnittdarstellung eines Dentalimplantats 100 mit einer ersten Ausführungsform eines erfindungsgemässen Einheitsverbindungssystems. Das Dentalimplantat 100 umfasst einen Basiskörper 130, ein Abutment 120 und einen Zahnaufbau 110. Die Einsetzrichtung I des Dentalimplantats 100 ist mit einem Pfeil dargestellt. Der Basiskörper 130 und das Abutment 120 sind vorzugsweise aus einem Keramikmaterial gefertigt. Der Basiskörper 130 weist ein Aussengewinde 133 in Form eines Rundgewindes auf. Weiter weist der Basiskörper 130 eine Bohrung 131 in Form eines Sackloches auf, wobei die Bohrung 131 in der dem Abutment 120 abgewandten unteren Hälfte des Basiskörpers 130 ein Innengewinde 132 aufweist. Um die Angaben „oben" oder „unten" zu verdeutlichen, ist in der Figur das Koordinatensystem eingezeichnet. Das Innengewinde 132 ist mit einem ersten Aussengewinde 111" im Basisabschnitt 11" eines Einheitsverbinders 1", der in die Bohrung 131 eingeführt ist, in Eingriff gebracht.

Die Länge $L111$ des ersten Aussengewindes 111" unterschreitet geringfügig eine parallel zur Einsetzrichtung I gemessene Länge $L132$ des Innengewindes 132. Das Innengewinde 132 ist als Rundgewinde ausgebildet. Der Durchmesser der Bohrung 131 entspricht dem

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Durchmesser des Einheitsverbinders 1", sodass der Einheitsverbinder 1" beim Einsetzen in den Basiskörper 130 geführt wird. Das Abutment 120 weist eine Durchgangsbohrung 1200 mit oberem Bereich 1201 und unterem Bereich 1202 auf, wobei der Durchmesser der Durchgangsbohrung 1200 im oberen Bereich 1201 grösser als der Durchmesser der Durchgangsbohrung 1200 im unteren Bereich 1202 ist. Der obere Bereich 1201 grenzt an den unteren Bereich 1202 über eine Schulter 1203 an.

Der Durchmesser der Durchgangsbohrung 1200 im unteren Bereich 1202 entspricht dem Durchmesser des zylindrischen Schaftabschnitts des Einheitsverbinders 1", so dass das Abutment 120 beim Aufsetzen auf den Basiskörper 130 durch den zylindrischen Schaftabschnitt 13" des Einheitsverbinders 1" geführt wird. Die Länge L_{13} des zylindrischen Schaftabschnitts 13" ist vorteilhafter Weise so bemessen, dass er sowohl das Abutment 120 als auch den Basiskörper optimal seitlich stützt und etwaige Quer und/oder Scherkräfte möglichst weit von Basisabschnitt 11" und Abutmenthalteabschnitt 12" entfernt aufnimmt sowie abgibt.

In die Durchgangsbohrung 1200 ist im oberen Bereich 1201 ein Halteelement 15 eingesetzt, welche mit dem Haltegewinde 121" im Abutmenthalteabschnitt 12" des Einheitsverbinders 1" in Eingriff gebracht ist, bzw. über ein Innengewinde 152 des Halteelements 15 aufgeschraubt ist. Der Abutmenthalteabschnitt 12" weist eine Länge L_{12} auf. Das Halteelement 15 ist ebenfalls aus rostfreiem Stahl, Titan und/oder Keramik gefertigt. Der Aussendurchmesser des Halteelements 15 entspricht dem Durchmesser des oberen Bereichs 1201 der Durchgangsbohrung 1200 des Abutments 120, welche den Hülsenaufnahmebereich bildet, so dass das Abutment 120 bei auftretenden Querkräften an das Halteelement 15 anliegen kann, was die Stabilität des Dentalimplantats 100 erhöht. Zwischen der seitlichen Aussenfläche des Halteelements 15 und der seitlichen Innenfläche des oberen Bereichs 1201 der Durchgangsbohrung 1200 besteht ein Spalt, welcher ein Spiel sicherstellt. Das Halteelement 15 weist Eingriffsmittel 151 in Form von Kerben auf, welche mit einem geeigneten Schlüssel (nicht gezeigt) in Eingriff gebracht werden können.

Mit dem geeigneten Werkzeug bzw. Schlüssel kann das Halteelement 15 mittels der Eingriffsmittel 151 auf den Abutmenthalteabschnitt 121" des Einheitsverbinders 1" aufgeschraubt werden. Das Halteelement 15 weist ein Innengewinde 152 auf, welche mit dem Haltegewinde 121" des Einheitsverbinders 1" in Eingriff gebracht ist. Durch das

Aufschrauben des Halteelements 15 wird eine Wirkverbindung zwischen dem Einheitsverbinder 1" und dem Abutment 120 derart hergestellt, dass das Abutment 120 durch das Halteelement 15 über die Schulter 1203 auf den Basiskörper 130 gepresst wird und so eine abgedichtete formschlüssige Verbindung zwischen dem Abutment 120 und dem Basiskörper 130 hergestellt wird. Beim Aufschrauben des Halteelements 15 liegt dabei die Kontaktfläche 125 des Abutments 120 auf der Kontaktfläche 134 des Basiskörpers 130 an.

Das Abutment 120 weist weiter einen Fortsatz 124 a,b auf, welcher in eine formpassende Aufnahme 135 in Form einer Vertiefung des Basiskörpers 130 aufgenommen ist. Der Fortsatz 124 a,b ist in radialer Richtung asymmetrisch ausgebildet, so dass ein verdrehsicherer Formschluss sichergestellt wird. In Querschnitt (in y-Richtung) weist der Fortsatz 124 a,b Vorsprünge auf, welche in Fig. 5 im Querschnitt gezeigt sind. In der Figur 3 oder 4 ist zu sehen, dass der Abutmenthalteabschnitt 12" des Einheitsverbinders 1" über das Abutment 120 hinausragt. Vor dem Aufsetzen des Zahnaufbaus 110 kann der Einheitsverbinder 1" bei Bedarf im Abutmenthalteabschnitt 12" abgelängt werden, falls der Überstand zu gross sein sollte. Alternativ oder in Ergänzung kann eine Ausnehmung 1101 im Zahnaufbau 110, wie in der Figur gezeigt, genutzt werden, welche den Überstand des Abutmenthalteabschnitts 12" aufnimmt.

Figur 4 zeigt eine zweite Ausführungsform eines erfindungsgemässen Dentalimplantats 100'. Im Unterschied zum in Figur 3 gezeigten Dentalimplantat 100 besitzt das Dentalimplantat 100' ein Abutment 120', dessen parallel zur Einsetzrichtung I gemessene Länge grösser ist als die parallel zur Einsetzrichtung I gemessene Länge des Abutments 120. Dementsprechend ragt ein oberes Ende eines Einheitsverbinders 1" des Dentalimplantats 100' weniger aus der Durchgangsbohrung 1200' heraus über dem oberen Rand des Abutments 120' hervor als beim Dentalimplantat 100.

Das Dentalimplantat 100' ist mit einem Zusatzhalteelement 16 versehen. Das Zusatzhalteelement 16 ist an das Halteelement 15' anliegend auf das Haltegewinde 121" des Einheitsverbinders 1" aufgeschraubt. Das Zusatzhalteelement 16 weist ein Innengewinde auf, welche mit dem Haltegewinde 121" des Einheitsverbinders 1" in Eingriff gebracht ist. Das Zusatzhalteelement 16 weist Eingriffsmittel 161 auf, mittels welchen das Zusatzhalteelement 16 auf das Haltegewinde 121" aufgeschraubt werden kann.

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Das Zusatzhalteelement 16 erhöht die Stabilität des Dentalimplantats 100', da die Fläche, über welche das Abutment 120' abgestützt werden kann, erhöht wird. Die Länge des Halteelements 15' und die Länge des Zusatzhalteelements 16 entspricht fast der Länge des oberen Bereichs 1201' der Durchgangsbohrung 1200'. Somit kann das Abutment 120' bei auf das Zahnimplantat 100' einwirkenden Querkräften sowohl am vorzugsweise hülsenförmigen Halteelement 15' als auch am ebenfalls vorzugsweise hülsenförmigen Zusatzhalteelement 16 seitlich anliegen.

Illustrativ ist in der Figur 4 der Doppelpfeil F gezeigt, welcher auftretende Querkräfte darstellen soll. Die Kräfte F können zu Drehmomenten führen, welche ohne Halteelemente oder mit kurzen Halteelementen im Wesentlichen auf den unteren Bereich der Durchgangsbohrung 1200' des Abutments 120' konzentriert sein würden. Lange Halteelemente 15' oder Zusatzhalteelemente 16 ermöglichen bei Querkräften F ein seitliches Abstützen des Abutments 120', so dass die auftretenden Drehmomente im Wesentlichen entlang der gesamten Länge der Durchgangsbohrung 1200' verteilt und aufgenommen werden können.

Figur 5 zeigt das in der Figur 3 gezeigte Dentalimplantat 100 in einer schematischen Querschnittsansicht entlang der in Figur 3 eingezeichneten Schnittlinie A-A in einem Bereich, in welchem der Fortsatz 124 a, b in die Aufnahme 135 eingreift. Am Fortsatz 124 a, b aussen sind sich radial vom Fortsatz 124 a, b weg erstreckende vorsprungartige Positivelemente 126 ausgeformt, die parallel zur Einsetzrichtung I verlaufen. Die Aufnahme 135 ist mit ebenfalls parallel zur Einsetzrichtung I verlaufenen Negativelementen 136 versehen, die komplementär zu den Positivelementen 126 ausgestaltet sind.

Die Positivelemente 126 wirken derart formschlüssig mit den Negativelementen 136 zusammen, dass im zusammengesetzten Zustand Relativbewegungen, insbesondere Drehbewegungen, des Abutments 120 gegenüber dem Basiskörper 130 unterbunden sind. Zugleich definieren Positivelemente 126 und Negativelemente 136 gemeinsam ein kreisförmiges Raster von Drehpositionen, entlang denen eine Rotationsausrichtung von Abutment 120 und Basiskörper 130 vor dem Zusammensetzen relativ zueinander in inkrementellen Schritten frei gewählt werden kann.

Entsprechend der Beschaffenheit der Haltegewinde 121, 121' als solche sowie durch Ihre variable Positionierbarkeit entlang der Einsetzrichtung I dank der beschriebenen Verlänger- und/oder Verkürzbarkeit stellen erfindungsgemässe Einheitsverbinder 1, 1' eine Vielzahl von entlang der Einsetzrichtung I voneinander beabstandeten Haltepositionen für das Abutment 120, 120' bereit.

Fig. 6 zeigt eine schematische Explosionsdarstellung einer weiteren Ausführungsform eines erfindungsgemässen Dentalimplantats 200. Das Dentalimplantat 200 umfasst einen vorzugsweise aus einem Metall oder einer Metalllegierung, wie beispielsweise Titan oder einer Titanlegierung gefertigten Verbinder 2, eine vorzugsweise aus Keramik, wie beispielsweise Zirkoniumoxid gefertigte Prothetik 220, hier beispielsweise in Form eines Kopfes einer Einheilschraube, und einen vorzugsweise ebenfalls aus Keramik, wie beispielsweise Zirkoniumoxid, gefertigten Basiskörper 230. Verbinder 2, Prothetik 220 und Basiskörper 230 sind konzentrisch zu einer parallel zur Einsetzrichtung I verlaufenden Mittelachse M des Dentalimplantats 200 angeordnet.

Der Verbinder 2 besitzt einen Basisabschnitt 21, einen Halteabschnitt 22 und einen Schaftabschnitt 23. Am Basisabschnitt 21 ist ein Basisgewinde 211 ausgeformt, das dazu ausgestaltet ist, in Einsetzrichtung I in den Basiskörper 230 eingeschraubt zu werden. Um den Halteabschnitt 22 ist wie beim Abutmenthalteabschnitt 12, 12', 12" ein Haltegewinde 221 ausgeformt (s. Figuren 1 bis 3). Das Haltegewinde 221 ist dazu ausgestaltet, entgegen der Einsetzrichtung I in die Prothetik 220 eingeschraubt zu werden sowie mit dem Halteelement 15, 15' zusammenzuwirken (s. Figuren. 3 und 4). Der Schaftabschnitt 23 ist zylinderförmig ausgestaltet sowie rotationssymmetrisch zur Mittelachse angeordnet und bietet durch seine zylindrische Aussenumfangsfläche eine Stützfläche 27, die in eine radial von der Mittelachse M weg verlaufenden radialen Richtung R des Verbinders 2 weist.

Ein Ringbund 28 des Verbinders 2 ist ebenfalls zylinderförmig ausgestaltet und zwischen dem Halteabschnitt 22 und dem Schaftabschnitt 23 liegend rotationssymmetrisch zur Mittelachse M angeordnet. Ein parallel zur radialen Richtung R gemessener Durchmesser des Ringbundes 28 ist grösser als ein ebenfalls parallel zur radialen Richtung R gemessener Durchmesser des Schaftabschnittes 23. Somit überragt der Ringbund 28 den Schaftabschnitt 23 in radialer Richtung R und bildet ein in

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Einsetzrichtung I weisendes Schulterelement 28a und ein entgegen der Einsetzrichtung I weisendes Schulterelement 28b.

Des Weiteren ist der Verbinder 2 mit Ringnuten 29 versehen, die jeweils zwischen Basisabschnitt 21 bzw. Basisgewinde 211 und Schaftabschnitt 23, zwischen Schaftabschnitt 23 und Ringbund 28 sowie zwischen Ringbund 28 und Halteabschnitt 22 bzw. Haltegewinde 221 angeordnet sind. An den Ringnuten 29 ist der Verbinder 2 verjüngt bzw. eingeschnürt, sodass ein parallel zur radialen Richtung R gemessener Durchmesser des Verbinders 2 wenigstens am Boden der Ringnuten 29 kleiner ist als der entsprechende Durchmesser der jeweils an die Ringnuten 29 angrenzenden Abschnitte des Verbinders 2.

Ferner ist ein oberer, vom Halteabschnitt 22 entgegen der Einsetzrichtung I Weg verlaufender Endabschnitt des Verbinders 2 als Eingriffsmittel 251 ausgeformt, an dem mit einem Werkzeug (nicht gezeigt) ein um die Mittelachse M wirkendes Drehmoment auf den Verbinder 2 übertragen werden kann. Ein parallel zur radialen Richtung R gemessener Durchmesser des Eingriffsmittel 251 ist kleiner als eine in radialer Richtung R gemessener Durchmesser des Haltegewindes 221 . Im vorliegenden Beispiel weist das Eingriffsmittel 251 an seinem äusseren Umfang eine Aussenkontur auf, die im vorliegenden Ausführungsbeispiel als Sechskant ausgestaltet ist.

Die Prothetik 220 ist beispielsweise rotationssymmetrisch zur Mittelachse M ausgestaltet und besitzt einen Fortsatz 224, eine Kontaktfläche 225, einen kegelstumpfförmigen Übergangsabschnitt 227, einen Kopfteil 228 und ein Eingriffselement 229. Alternativ kann die Prothetik 220 auch asymmetrisch zur Mittelachse M ausgestaltet sein. Der Fortsatz besitzt einen parallel zur radialen Richtung R gemessenen Durchmesser, der kleiner als der ebenfalls parallel zur radialen Richtung R gemessene Durchmesser des Übergangsabschnittes 227, wodurch zwischen Fortsatz 224 und Übergangsabschnitt 227 die in Einsetzrichtung I weisende Kontaktfläche 225 ausgebildet ist. Das im Kopfteil 228 ausgeformte Eingriffselement 229 ist beispielsweise als Innensechskant oder wie vorliegend als Innensechsrund ausgestaltet und erlaubt, mit Hilfe eines Werkzeugs (nicht gezeigt) ein um die Mittelachse M wirkendes Drehmoment auf die Prothetik 220 zu übertragen.

Der Basiskörper 230 besitzt wie der Basiskörper 130 eine Bohrung 231, in der ein Innengewinde 232 (s. Fig. 7) ausgeformt ist. Aussenumfangsseitig ist der Basiskörper 230 wie der Basiskörper 130 mit einem Aussengewinde 233 versehen. Ebenfalls ist am Basiskörper 230 wie am Basiskörper 130 eine entgegen der Einsetzrichtung I weisende Kontaktfläche 234 ausgeformt, welche die Bohrung 231 bzw. deren Öffnung umgibt. Ein oberer Teil der Bohrung 231 dient als Aufnahme 235 für den Fortsatz 224 der Prothetik 220.

Fig. 7 zeigt eine schematische Querschnittsansicht entlang der Mittelachse M des Dentalimplantates 200 in einem Vormontagezustand V. Im Vormontagezustand V ist der Verbinder 2 in den Basiskörper 230 eingesetzt, wobei der Basisabschnitt 21 mit dem Basisgewinde 211 in einem unteren Bereich der Bohrung 231 angeordnet ist, wo in dieser das Innengewinde 232 ausgeformt ist. Oberhalb des Innengewindes 232 des Basiskörpers 230 ist der Schaftabschnitt 23 des Verbinders 2 angeordnet. Zwischen der Stützfläche 27 des Schaftabschnitts 23 und dem Innenumfang des den Schaftabschnitt 23 umgebenden Teils der Bohrung 231 befindet sich ein möglichst geringes bis vorzugsweise kaum oder kein Spiel, beispielsweise indem Schaftabschnitt 23 und Bohrung 231 in diesem Bereich mit einer Spielpassung oder Übergangspassung ausgelegt sind. Somit stützt der Schaftabschnitt 23 den Verbinder 2 in der Bohrung 231 oberhalb des Innengewindes 232 vorzugsweise ringsherum ab, was dabei hilft, in radialer Richtung R wirkende Querkräfte sowie Biegemomente vom Innengewinde 232 fernzuhalten, sodass dort im Wesentlichen lediglich in Richtung der Mittelachse M wirkende Normalkräfte auftreten.

Der Ringbund 28 bzw. das von ihm bereitgestellte Schulterelement 28a liegt auf einem Gegenschulterelement 236 auf, das in der Bohrung 231 ausgeformt ist. Das Gegenschulterelement 236 ist zwischen dem unteren Teil der Bohrung 231 und der Aufnahme 235 gebildet und begrenzt die Aufnahme 235 in Einsetzrichtung I. Mit anderen Worten ist ein parallel zur radialen Richtung R gemessener Durchmesser des unteren Teils der Bohrung 231 kleiner als ein parallel zur radialen Richtung R gemessener Durchmesser der Aufnahme 235. Der Halteabschnitt 22 mit dem Haltegewinde 221 ist vollständig innerhalb der Aufnahme 235 angeordnet. Das Eingriffsmittel 251 ragt entgegen der Einsetzrichtung I über die Kontaktfläche 234 hinweg aus der Aufnahme 235 hinaus und steht somit vom Dentalimplantat 200 im Vormontagezustand V vor, sodass das Eingriffsmittel 251 für ein Werkzeug einfach zugänglich angeordnet ist.

Fig. 8 zeigt eine schematische Querschnittsansicht entlang der Mittelachse des Dentalimplantates 200 in einem Endmontagezustand E. Das Dentalimplantat 200 ist vom Vormontagezustand V in den Endmontagezustand E zu überführen, indem die Prothetik 220 in Einsetzrichtung I auf den Verbinder 2 geschraubt wird. Dazu ist die Prothetik 220 analog zur Bohrung 231 des Basiskörpers 230 mit einer konzentrisch zur Mittelachse M angeordneten sacklochartigen Ausnehmung 2101. In einem unteren Teil der Ausnehmung 2101, der sich im Wesentlichen in Einsetzrichtung I entlang des Fortsatzes 224 erstreckt, ist die Ausnehmung 2101 mit einem Gegenhaltegewinde 2102 versehen, das sich im Eingriff mit dem Haltegewinde 221 befindet. Das Eingriffsmittel 251 ist unter einem gewissen radialen Spiel gegenüber der Ausnehmung 2101 in der Ausnehmung 2101 aufgenommen und darin vom Kopfteil 228 umschlossen.

Im Endmontagezustand E liegt die Kontaktfläche 225 der Prothetik 2 auf der Kontaktfläche 234 des Basiskörpers 230 bündig abdichtend auf. Folglich ist die Aufnahme 235 hermetisch abgedichtet. Somit kann sichergestellt werden, dass der Verbinder 2 nicht in Kontakt mit dem Zahnfleisch gelangt bzw. vom gesamten Mundraum abgeschirmt ist. Der Fortsatz 224 ragt in Einsetzrichtung I in die Aufnahme 235, wobei zwischen einem Aussenumfang des Fortsatzes 224 und einem Innenumfang der Aufnahme 235 vorzugsweise ein möglichst geringes bis vorzugsweise kaum oder kein Spiel vorhanden ist, beispielsweise indem Fortsatz 224 und Aufnahme 235 in diesem Bereich mit einer Spielpassung oder Übergangspassung ausgelegt sind. In radialer Richtung R überdecken sich eine die Aufnahme 235 bildende Wandung des Basiskörpers 230 mit Prothetik 220 und Verbinder 2, wodurch sie einen kompakte und hochstabile Baugruppe bilden. Eine in Einsetzrichtung I weisende Stirnseite 240 am Fortsatz der Prothetik 220 ist am Fortsatz 224 gebildet und von dem Schulterelement 28b in Einsetzrichtung I beabstandet angeordnet.

Fig. 9 zeigt eine schematische Explosionsdarstellung einer zusätzlichen Ausführungsform eines erfindungsgemässen Dentalimplantats 300. Das Dentalimplantat 300 umfasst wie das Dentalimplantat 200 einen vorzugsweise aus einem Metall oder einer Metalllegierung, wie beispielsweise Titan oder einer Titanlegierung, gefertigten Verbinder 3, eine vorzugsweise aus Keramik, wie beispielsweise Zirkoniumoxid gefertigte Prothetik 320, auch hier beispielsweise in Form eines Kopfes einer Einheilschraube, und einen vorzugsweise ebenfalls aus Keramik, wie beispielsweise Zirkoniumoxid, gefertigten Basiskörper 330, der im vorliegenden Beispiel

identisch zum Basiskörper 230 ausgeformt ist. Verbinder 3, Prothetik 320 und Basiskörper 330 sind konzentrisch zu Mittelachse M des Dentalimplantats 300 angeordnet. Im Folgenden wird der Kürze halber hauptsächlich auf die Unterschiede zwischen dem Dentalimplantat 300 und dem Dentalimplantat 200 eingegangen.

Der Verbinder 3 besitzt einen Basisabschnitt 31, einen Halteabschnitt 32 und einen Schaftabschnitt 33. Am Basisabschnitt 31 ist ein Basisgewinde 311 ausgeformt, das dazu ausgestaltet ist, in Einsetzrichtung I in den Basiskörper 330 eingeschraubt zu werden. Am Halteabschnitt 32 ist wie beim Abutmenthalteabschnitt 12, 12', 12", 22 ein Haltegewinde 321 ausgeformt. Das Haltegewinde 321 ist dazu ausgestaltet, entgegen der Einsetzrichtung I in die Prothetik 320 eingeschraubt zu werden sowie mit dem Halteelement 15, 15' zusammenzuwirken (s. Figuren. 3 und 4). Der Schaftabschnitt 33 ist zylinderförmig ausgestaltet sowie rotationssymmetrisch zur Mittelachse M angeordnet und bietet somit durch seine zylindrische Aussenumfangsfläche eine Stützfläche 37.

Ein Ringbund 38 des Verbinders 3 ist zwischen dem Halteabschnitt 32 und dem Schaftabschnitt 33 liegend rotationssymmetrisch zur Mittelachse M angeordnet und zumindest abschnittsweise als Eingriffsmittel 351 ausgeformt. Das Eingriffsmittel 351 besitzt ähnlich wie das Eingriffsmittel 251 des Verbinders 2 eine Außenkontur, die dazu ausgestaltet ist, mit einem Werkzeug zusammen zu wirken, um mit Hilfe des Werkzeugs ein Drehmoment auf den Verbinder 3 zu übertragen. Vorzugsweise ist das Eingriffsmittel 351 als Aussensechskant ausgestaltet. Ein parallel zur radialen Richtung R gemessener Durchmesser von Ringbund 38 samt Eingriffsmittel 351 ist größer als ein ebenfalls parallel zur radialen Richtung R gemessener Durchmesser des Schaftabschnittes 33. Somit überragt der Ringbund 38 den Schaftabschnitt 33 und bietet daher ein entgegen der Einsetzrichtung I weisendes Schulterelement 38b.

Des Weiteren ist der Verbinder 3 mit Ringnuten 39 versehen, die jeweils zwischen Basisabschnitt 31 bzw. Basisgewinde 311 und Schaftabschnitt 33, zwischen Schaftabschnitt 33 und Ringbund 38 sowie zwischen Ringbund 38 und Halteabschnitt 32 bzw. Haltegewinde 321 angeordnet sind. An den Ringnuten 39 ist der Verbinder 3 verjüngt bzw. eingeschnürt, sodass ein parallel zur radialen Richtung R gemessener Durchmesser des Verbinders 3 am Boden der Ringnuten 39 kleiner ist als ein Durchmesser jeweils an die Ringnuten 39 angrenzender Abschnitte des Verbinders 3.

Die Prothetik 320 ist rotationssymmetrisch zur Mittelachse M ausgestaltet und besitzt ähnlich wie die Prothetik 220 einen Fortsatz 324, eine Kontaktfläche 325, einen kegelstumpfförmigen Übergangsabschnitt 327, einen Kopfteil 328 und ein Eingriffselement 329 (siehe Fig. 11). Der Fortsatz 324 besitzt einen parallel zur radialen Richtung R gemessenen Durchmesser, der kleiner als der ebenfalls parallel zur radialen Richtung R gemessene Durchmesser des Übergangsabschnittes 327 ist, wodurch zwischen Fortsatz 324 und Übergangsabschnitt 327 die in Einsetzrichtung I weisende Kontaktfläche 325 ausgebildet ist. Das im Kopfteil 328 ausgeformte Eingriffselement 329 ist beispielsweise als Innensechskant oder wie vorliegend als Innensechsrund ausgestaltet und erlaubt, mit Hilfe eines Werkzeugs (nicht gezeigt) ein um die Mittelachse M wirkendes Drehmoment auf die Prothetik 320 zu übertragen. Im Unterschied zur Prothetik 220 besitzt die Prothetik 330 eine spezielle ausgeformte Stirnseite 340, auf die weiter unten im Detail eingegangen wird.

Der Basiskörper 330 besitzt wie die Basiskörper 130 und 230 eine Bohrung 331 , in der ein Innengewinde 332 (s. Fig. 13) ausgeformt ist. Aussenumfangsseitig ist der Basiskörper 330 wie die Basiskörper 130 und 230 mit einem Aussengewinde 333 versehen. Ebenfalls ist am Basiskörper 330 wie an den Basiskörpern 130 und 230 eine entgegen der Einsetzrichtung I weisende Kontaktfläche 334 ausgeformt, welche die Bohrung 331 umgibt. Ein oberer Teil der Bohrung 331 dient als Aufnahme 335 für den Fortsatz 324 der Prothetik 320 (s. Fig. 13).

Fig. 10 zeigt ein Detail IX des in Fig. 9 gezeigten Dentalimplantats 300, insbesondere die Stirnseite 340 der Prothetik 320. Die Stirnseite 340 bildet einen ringförmigen Rand um eine Ausnehmung 3101 der Prothetik 320, die ähnlich wie die Ausnehmung 2101 der Prothetik 220 ausgebildet und mit einem Gegenhaltegewinde 3102 versehen ist. An der Stirnseite 340 ist eine Verzahnung 341 ausgeformt. Die Verzahnung 341 ist aus einer Vielzahl von Zähnen 342 gebildet, welche die Ausnehmung 3101 kranzartig umgeben.

Die Zähne 342 ragen ähnlich wie bei einer sogenannten Hirth-Verzahnung in Einsetzrichtung I von der Stirnseite 340 vor. Zahnspitzen 343 der Zähne 342 bilden im Wesentlichen parallel zur radialen Richtung R verlaufende Kanten aus. Die Zähne 342 sind entgegen einer in einer Projektion entlang der Einsetzrichtung I im Uhrzeigersinn um die Mittelachse herum verlaufende Schraubrichtung S der Prothetik 320 geneigt. Durch die Neigung weisen die Zähne 342 jeweils eine in Schraubrichtung S weisende

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flache Zahnflanke 344 und eine entgegen der Schraubrichtung S weisende steile Zahnflanke 345 auf.

Fig. 11 zeigt eine schematische Querschnittsansicht entlang einer Mittelachse M des in Fig. 9 und 10 gezeigten Dentalimplantates 300 in einem weiteren Vormontagezustand V. Im weiteren Vormontagezustand V ist die Prothetik 320 mit dem in ihrer Ausnehmung 3101 ausgeformten Gegenhaltegewinde 3102 in Einsetzrichtung I auf das Haltegewinde 321 des Halteabschnitts 32 des Verbinders 3 geschraubt. Die Stirnseite 340 der Prothetik 320 ist in Kontakt mit dem Schulterelement 38b gebracht. Im Bereich der zwischen dem Haltebereich 32 und dem Ringbund 38 angeordneten Ringnut 39 ist eine Kavität 50 gebildet. Die Kavität 50 kann zum Beispiel mindestens teilweise mit einem Klebstoff 51 gefüllt sein.

Fig. 12 zeigt ein Detail XI des in Figs. 9 bis 11 gezeigten Dentalimplantates 300. Hier wird deutlich, dass die Zähne 342 beim Aufschrauben der Prothetik 320 auf den Verbinder 3 dessen Material verdrängt haben und somit ein Formschluss zwischen Prothetik 320 und Verbinder 3 herbeigeführt ist. Durch die Neigung der Zähne 342 entgegen der Schraubrichtung S ist dieser Formschluss insbesondere bei entgegen der Schraubrichtung S auf die Prothetik 320 relativ zum Verbinder 3 wirkenden Drehmomente um die Mittelachse M wirksam, sodass eine innige Verbindung zwischen Prothetik 320 und Verbinder 3 besteht.

Die flachen Zahnflanken 344 begünstigen eine Relativbewegung zwischen Prothetik 320 und Verbinder 3 beim Aufschrauben der Prothetik 320, wenn die Stirnseite 340 auf das Schulterelement 38b trifft. Die steilen Zahnflanken 345, die beispielsweise im Wesentlichen parallel zur Einsetzrichtung I verlaufen oder sogar einen Hinterschnitt aufweisen können, verhindern hingegen ein Lösen der Verschraubung zwischen Prothetik 320 und Verbinder 3, indem sie sich beim Versuch, die Prothetik 320 entgegen der Schraubrichtung S relativ zum Verbinder 3 zu drehen in dessen Material graben und somit die Relativdrehung hemmen oder bestenfalls Prothetik 320 und Verbinder 3 gegeneinander sperren.

Der Klebstoff 51 begünstigt eine innige Verbindung zwischen Prothetik 320 und Verbinder 3 und kann beispielsweise auf Haltegewinde 321 und/oder Gegenhaltegewinde 3102 aufgetragen und/oder, wie gezeigt, in der Kavität 50

angeordnet sein. Verzahnung 341 und/oder Klebstoff 51 können also erfindungsgemäß dazu genutzt werden, um die Prothetik 320 hochfest bzw. möglichst unlösbar mit dem Verbinder 3 zu verbinden. Verzahnung 341 und/oder Klebstoff 51 helfen somit, eine hybride Implantatschraube 4 zu bilden, die wenigstens eine metallische Komponente, wie den Verbinder 3, und wenigstens eine keramische Komponente, wie die Prothetik 320 umfasst.

Fig. 13 zeigt eine schematische Querschnittsansicht entlang der Längsachse des in Figs. 9 bis 12 gezeigten Dentalimplantates in einem weiteren Endmontagezustand E'. Im Endmontagezustand E' sind Verbinder 3 und Prothetik 320 gemeinsam bzw. als hybride Implantatschraube 4 in den Basiskörper 330 eingesetzt. Zum Einsetzen ist der Basisabschnitt 31 mit dem Basisgewinde 311 des Verbinders 3 bzw. der hybriden Implantatschraube 4 unter Verwendung des Eingriffselements 329 der Prothetik zum Ansetzen eines Werkzeugs (nicht gezeigt) in das Innengewinde 332 des Basiskörpers 330 eingeschraubt. Der Schaftabschnitt 33 des Verbinders 3 bzw. der hybriden Implantatschraube 4 ist in einem oberhalb des Innengewindes 332 angeordneten Abschnitt der Bohrung 331 aufgenommen.

Zwischen der Stützfläche 37 des Schaftabschnitts 33 und dem Innenumfang der Bohrung 331 befindet sich ein möglichst geringes bis vorzugsweise kaum oder kein Spiel, beispielsweise indem Schaftabschnitt 33 und Bohrung 331 in diesem Bereich mit einer Spielpassung oder Übergangspassung ausgelegt sind. Somit stützt der Schaftabschnitt 33 den Verbinder 3 in der Bohrung 331 oberhalb des Innengewindes 332 ab, was dabei hilft, in radialer Richtung R wirkende Querkräfte sowie Biegemomente vom Innengewinde 332 fernzuhalten, sodass dort im Wesentlichen lediglich in Richtung entlang der Mittelachse M wirkende Normalkräfte auftreten.

Im Endmontagezustand E' liegt die Kontaktfläche 325 der Prothetik 320 auf der Kontaktfläche 334 des Basiskörpers 330 bündig abdichtend auf, wodurch die Aufnahme 335 hermetisch abgedichtet ist. Somit kann sichergestellt werden, dass der Verbinder 3 nicht in Kontakt mit dem Zahnfleisch gelangt bzw. vom gesamten Mundraum abgeschirmt ist. Der Fortsatz 324 ragt in Einsetzrichtung I in die Aufnahme 335, wobei zwischen einem Außenumfang des Fortsatzes 324 und einem Innenumfang der Aufnahme 335 vorzugsweise ein möglichst geringes bis vorzugsweise kaum oder kein Spiel vorhanden ist, beispielsweise indem Fortsatz 324 und Aufnahme 335 in diesem

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Bereich mit einer Spielpassung oder Übergangspassung ausgelegt sind. In radialer Richtung R überdecken sich eine die Aufnahme 335 bildende Wandung des Basiskörpers 330 mit Prothetik 320 und Verbinder 3, wodurch sie einen kompakte und hochstabile Baugruppe bilden. Durch die Verwendung von Prothetik 320 und Verbinder 3 als hybride Implantatschraube 4 ist das Dentalimplantat 300 wie ein zweiteiliges Dentalimplantat handhabbar.

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Bezugszeichenliste

1, *V*, 1", 2, 3	Einheitsverbinder oder Verbinder
4	hybride Implantatschraube
I I , 11', 11", 21, 31	Basisabschnitt
I I I , 111', 111", 211, 311	Basisgewinde / unteres Aussengewinde
12, 12', 12", 22, 32	Abutmenthalteabschnitt/Halteabschnitt
121 , 121', 121 ", 221 , 321	Haltegewinde / oberes Aussengewinde)
13, 13', 13", 23, 33	Schaftabschnitt
14'	Bolzenverlängerung
141	Verlängerungsgewinde
100, 100', 200, 300	Dentalimplantat
110	Zahnaufbau
1101, 2101, 3101	Ausnehmung
2102, 3102	Gegenhaltegewinde
120, 120', 220, 320	Abutment / Prothetik
1200, 1200'	Durchgangsbohrung
1201 , 1201 '	oberer Bereich der Durchgangsbohrung
1202	unterer Bereich der Durchgangsbohrung
1203	Schulter
124a, b, 224	Fortsatz
125, 225	Kontaktfläche
126	Positivelement
130, 230, 330	Basiskörper
131 , 231 , 331	Bohrung
132, 232, 332	Innengewinde
133, 233, 333	Aussengewinde
134, 234, 334	Kontaktfläche
135, 235, 335	Aufnahme
236, 336	Gegenschulterelement
136	Negativelement
227, 327	Übergangsabschnitt
228, 328	Kopfteil
229, 329	Eingriffselement
240, 340	Stirnseite
341	Verzahnung
342	Zahn
343	Zahnspitzen
344	flache Zahnflanke

345	steile Zahnflanke
15, 15'	Halteelement
151 , 151', 251 , 351	Eingriffsmittel
152, 152'	Innengewinde
153	Haltefläche
16	Zusatzhalteelement
161	Eingriffsmittel
27, 37	Stützfläche
28, 38	Ringbund
28a, 28b, 38b	Schulterelement
29, 39	Ringnut
50	Kavität
51	Klebstoff
E	Endmontagezustand
I	Einsetzrichtung
L_{11}, $L_{11'}$	Länge des Basisabschnitts
L_{12}, L_{12}	Länge des Abutmenthalteabschnitts
L_{13}, L_{13}	Länge des Schaftabschnitts
L_{14}"	Länge der Bolzenverlängerung
L_{n1}, L_{111}-	Länge des ersten Aussengewindes
L_{112}, $L_{112'}$	Länge des Abutmenthalteabschnitts
L_{132}	Länge des Innengewindes
L_{141}	Länge des Verlängerungsgewindes
M	Mittelachse
S	Schraubrichtung
R	radiale Richtung
V, V	Vormontagezustand

Patentansprüche

1. Verbinder (1, 1', 1", 2, 3) zum Verbinden keramischer Komponenten eines Dentalimplantats (100, 100', 200, 300),

mit einem Basisabschnitt (11, 11', 11", 21, 31), an dem ein Basisgewinde (111, 111', 111", 211, 311) zum Einschrauben des Verbinders (1, 1', 1", 2, 3) in einen Basiskörper (130, 230, 330) des Dentalimplantats (100, 100', 200, 300) ausgeformt ist, und

mit einem Halteabschnitt (12, 12', 12", 22, 32), an dem ein Haltegewinde (121, 131, 131', 221, 321) zum Aufschrauben einer Prothetik (120, 120', 220, 320) des Dentalimplantats (100, 100', 200, 300) auf den Verbinder (1, 1', 1", 2, 3) ausgeformt ist.

2. Verbinder (1, 1', 1", 2, 3) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Verbinder (1, 1', 1", 2, 3) aus einem Metall oder einer Metalllegierung gefertigt ist.

3. Verbinder (1, 1', 1", 2, 3) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Verbinder (1, 1', 1", 2, 3) zwischen dem Basisabschnitt (11, 11', 11", 21, 31) und dem Halteabschnitt (12, 12', 12", 22, 32) wenigstens ein Schulterelement (28a, 28b, 38b) aufweist, das zumindest abschnittsweise über einen Aussenumfang des Basisabschnitts (11, 11', 11", 21, 31) und/oder des Halteabschnitts (12, 12', 12", 22, 32) in einer radialen Richtung (R) des Verbinders (1, 1', 1", 2, 3) hinweg ragt.

4. Verbinder (1, 1', 1", 2, 3) nach Anspruch 3, **dadurch gekennzeichnet, dass** das wenigstens eine Schulterelement (28a, 28b, 38b) an einem Ringbund (28, 38) ausgeformt ist, dessen Aussendurchmesser grösser ist als ein Aussendurchmesser des Basisabschnitts (11, 11', 11", 21, 31) und/oder des Halteabschnitts (12, 12', 12", 22, 32).

5. Verbinder (1, 1', 1", 2, 3) nach wenigstens einem der oben genannten Ansprüche, **dadurch gekennzeichnet, dass** das am Verbinder (1, 1', 1", 2, 3) wenigstens ein Eingriffsmittel (251, 351) ausgeformt ist zum Betätigen des Verbinders (1, 1', 1", 2, 3) mit einem Werkzeug.

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6. Verbinder (1, 1', 1", 2, 3) nach Anspruch 5, **dadurch gekennzeichnet, dass** das wenigstens eine Eingriffsmittel (251, 351) zumindest abschnittsweise mit einer Aussenprofilierung versehen ist.

7. Verbinder (1, 1', 1", 2, 3) nach Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** ein Kopfende des Verbinders (1, 1', 1", 2, 3) als das wenigstens eine Eingriffsmittel (251, 351) ausgestaltet ist.

8. Verbinder (1, 1', 1", 2, 3) nach wenigstens einem der oben genannten Ansprüche, **dadurch gekennzeichnet, dass** das wenigstens eine Ringnut (29, 39) zwischen dem Basisabschnitt (11, 11', 11", 21, 31) und dem Halteabschnitt (12, 12', 12", 22, 32) ausgeformt ist, an der sich der Aussenumfang des Verbinders (1, 1', 1", 2, 3) gegenüber den jeweils umliegenden Abschnitten verjüngt.

9. Verbinder (1, 1', 1", 2, 3) nach wenigstens einem der oben genannten Ansprüche, **dadurch gekennzeichnet, dass** das Basisgewinde (111, 111', 111", 211, 311) und/oder das Haltegewinde (121, 131, 131', 221, 321) als Linksgewinde ausgestaltet sind bzw. ist.

10. Prothetik (120, 120', 220, 320) für ein Dentalimplantat (100, 100', 200, 300), mit einem Gegenhaltegewinde (2102, 3102) zum Aufschrauben der Prothetik (120, 120', 220, 320) auf einen Verbinder (1, 1', 1", 2, 3) des Dentalimplantats (100, 100', 200, 300).

11. Prothetik (120, 120', 220, 320) nach Anspruch 10, **dadurch gekennzeichnet, dass** die Prothetik (120, 120', 220, 320) mit einem Sackloch versehen ist, in dem das Gegenhaltegewinde (2102, 3102) angeordnet ist.

12. Prothetik (120, 120', 220, 320) nach Anspruch 10 oder 11, **dadurch gekennzeichnet, dass** das Gegenhaltegewinde (2102, 3102) zumindest abschnittsweise entlang eines Fortsatzes (224, 324) der Prothetik (120, 120', 220, 320) verläuft, der dazu ausgestaltet ist, in eine Aufnahme (135, 235, 335) eines Basiskörpers (130, 230, 330) des Dentalimplantats (100, 100', 200, 300) einzugreifen.

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13. Basiskörper (130, 230, 330) für ein Dentalimplantat (100, 100', 200, 300), mit einem Innengewinde (132, 232, 332), das komplementär zu einem Basisgewinde (111, 111', 111", 211, 311) eines Verbinders (1, 1', 1", 2, 3) nach wenigstens einem der Ansprüche 1 bis 9 ausgestaltet ist und/oder mit einer Aufnahme (135, 235, 335), die komplementär zu einer Prothetik (120, 120', 220, 320) nach einem der Ansprüche 10 bis 12 ausgestaltet ist.

14. Verbindungssystem für ein Dentalimplantat (100, 100', 200, 300), mit wenigstens einem Verbinder (1, 1', 1", 2, 3) nach einem der Ansprüche 1 bis 9 und/oder mit wenigstens einer Prothetik (120, 120', 220, 320) nach einem der Ansprüche 10 bis 12 und/oder mit wenigstens einem Basiskörper (130, 230, 330) nach Anspruch 13.

15. Verbindungssystem für ein Dentalimplantat (100, 100', 200, 300), **dadurch gekennzeichnet, dass** in einem Endmontagezustand (E, E') des Dentalimplantats (100, 100', 200, 300) der Verbinder (1, 1', 1", 2, 3) in einem von Prothetik (120, 120', 220, 320) und Basiskörper (130, 230, 330) umschlossenen Innenraum des Dentalimplantats (100, 100', 200, 300) aufgenommen ist.

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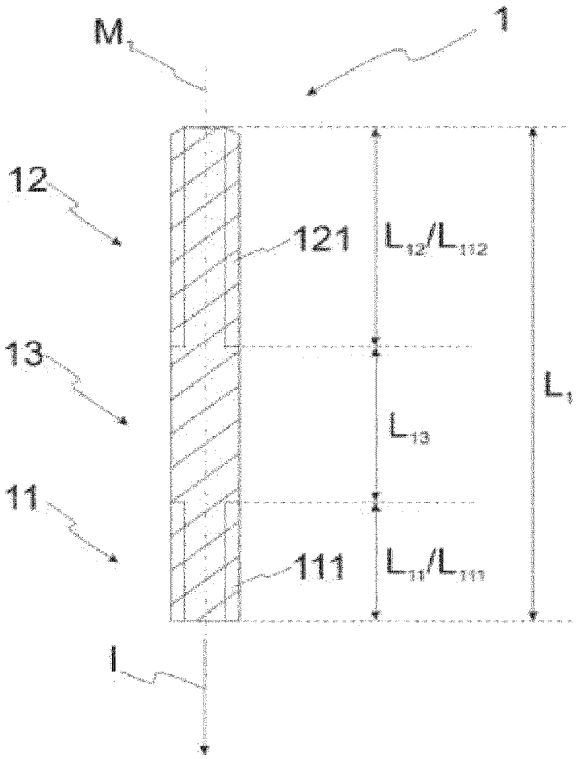

M1
1
12
121
L12/L112
13
L13
L1
11
111
L11/L111
I

Fig. 1

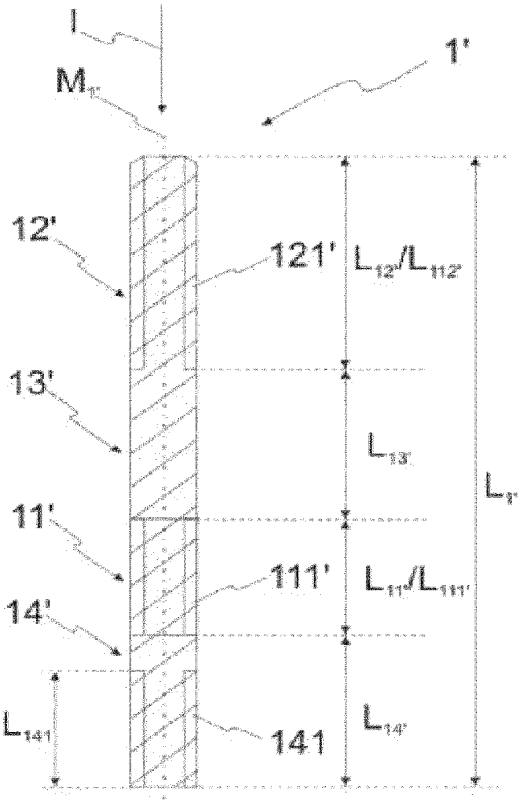

I
M1'
1'
12'
121'
L12'/L112'
13'
L13'
L1'
11'
111'
L11'/L111'
14'
L141'
141
L14'

Fig. 2

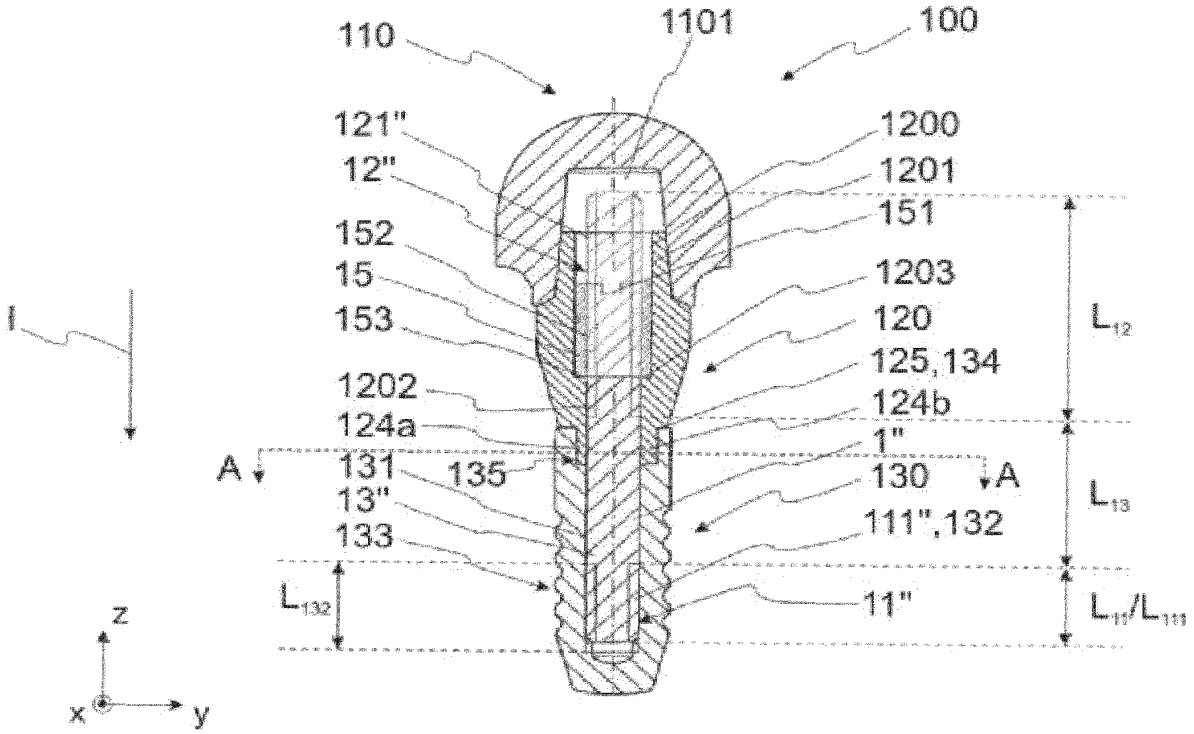

110
1101
100
121"
12"
152
15
153
1202
124a
131
135
13"
133
1200
1201
151
1203
120
125,134
124b
1"
130
111",132
11"
A
A
I
L_{12}
L_{13}
L_{132}
L_{11}/L_{111}
z
x
y

Fig. 3

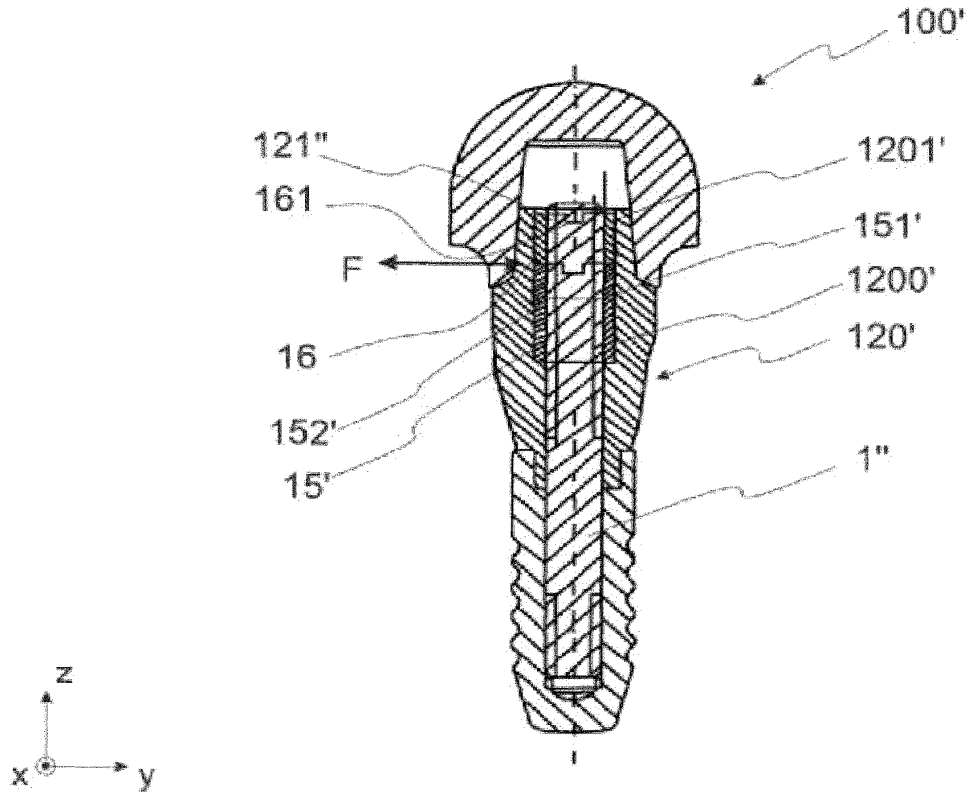

100'
121"
161
F
16
152'
15'
1201'
151'
1200'
120'
1"
I
z
x
y

Fig. 4

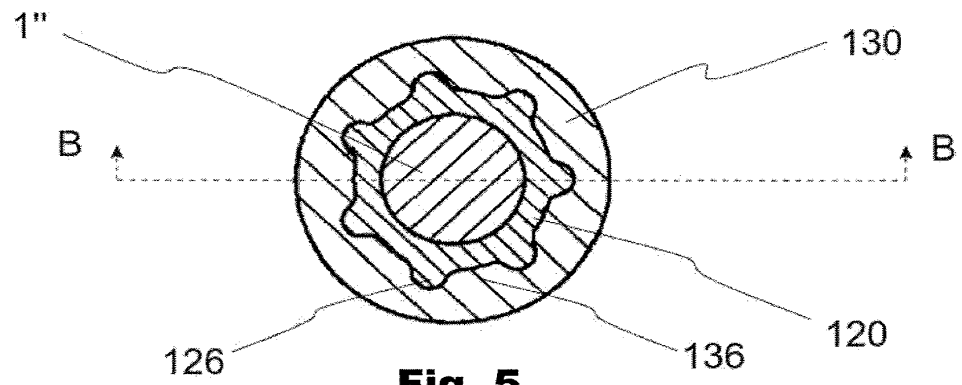

1"
130
B
B
120
126
136

Fig. 5

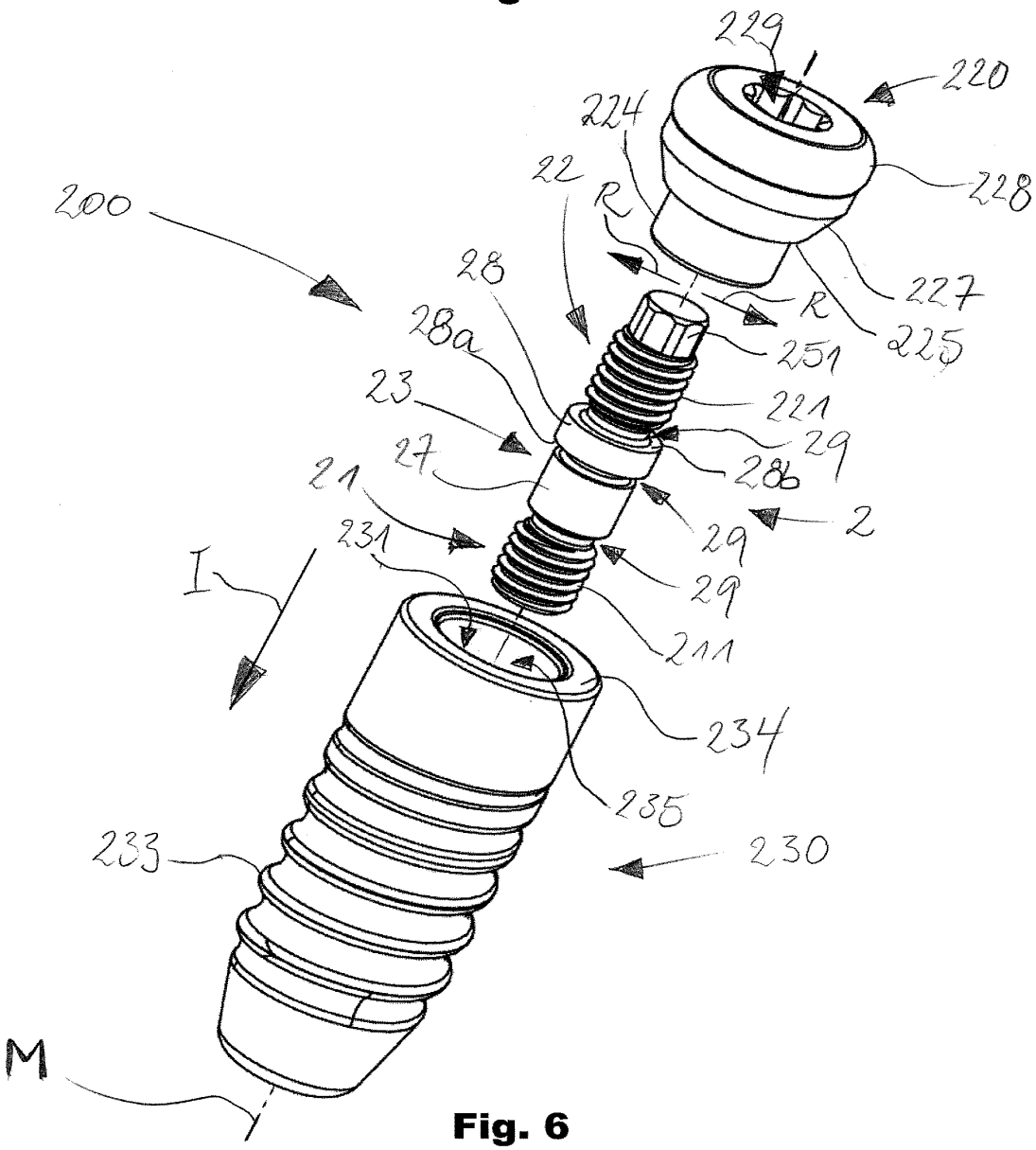

229
220
224
228
22
R
200
28
227
R
28a
251
225
23
221
29
27
28b
21
2
29
231
I
29
211
234
235
233
230
M

Fig. 6

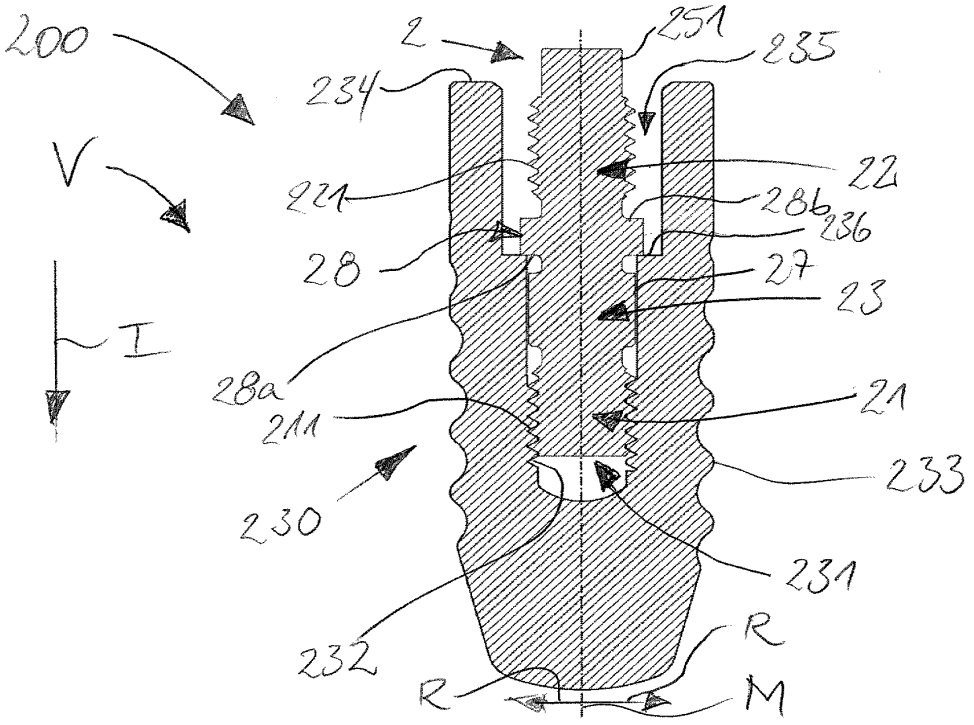

200
2
251
235
234
V
22
221
286
236
28
27
23
I
28a
21
211
233
230
231
232
R
R
M

Fig. 7

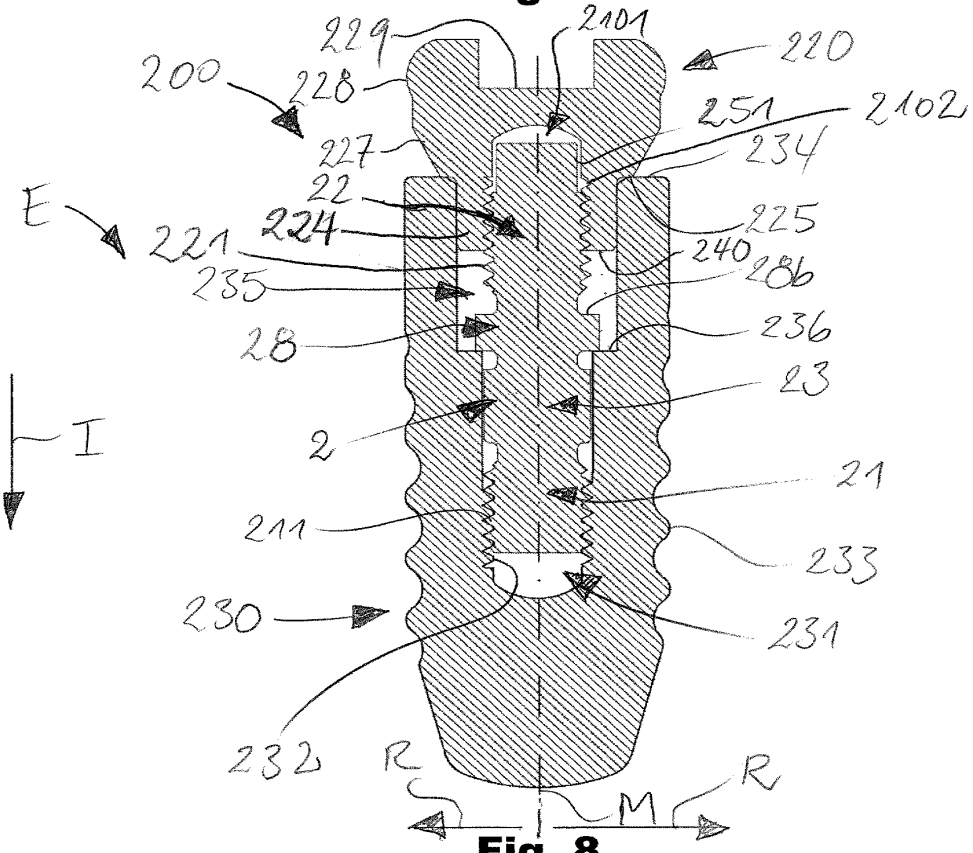

229
2101
220
200
228
251
2102
227
234
22
E
224
225
221
240
235
286
28
236
23
I
2
21
211
233
230
231
232
R
R
M

Fig. 8

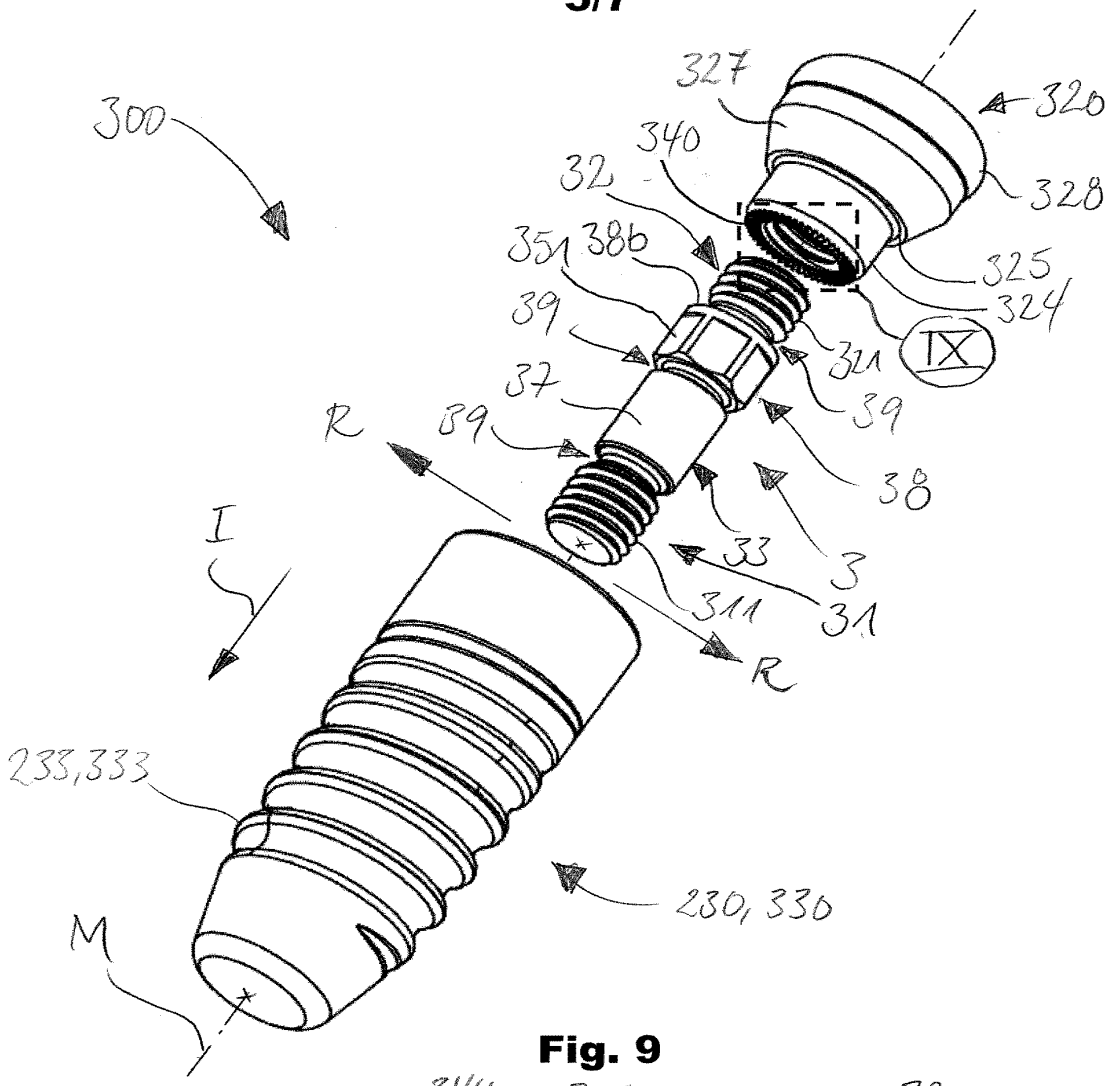

300
327
320
340
328
32
351
386
325
324
39
IX
321
37
39
R
89
38
I
33
3
311
31
R
233,333
230, 330
M

Fig. 9

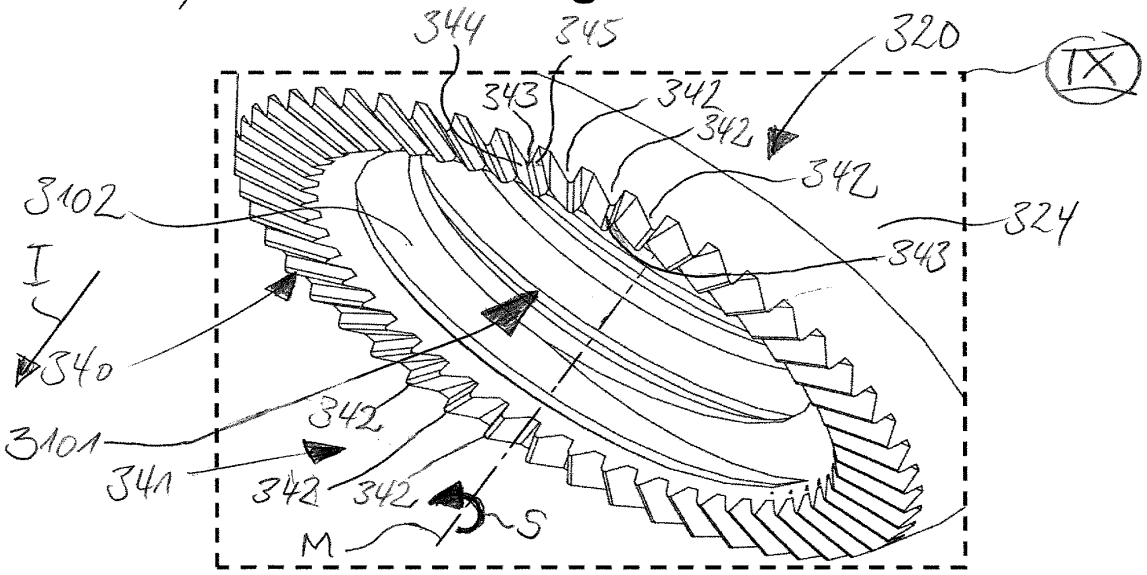

344
345
320
IX
343
341
342
342
342
3102
324
343
I
340
3101
342
341
342
342
M
S

Fig. 10

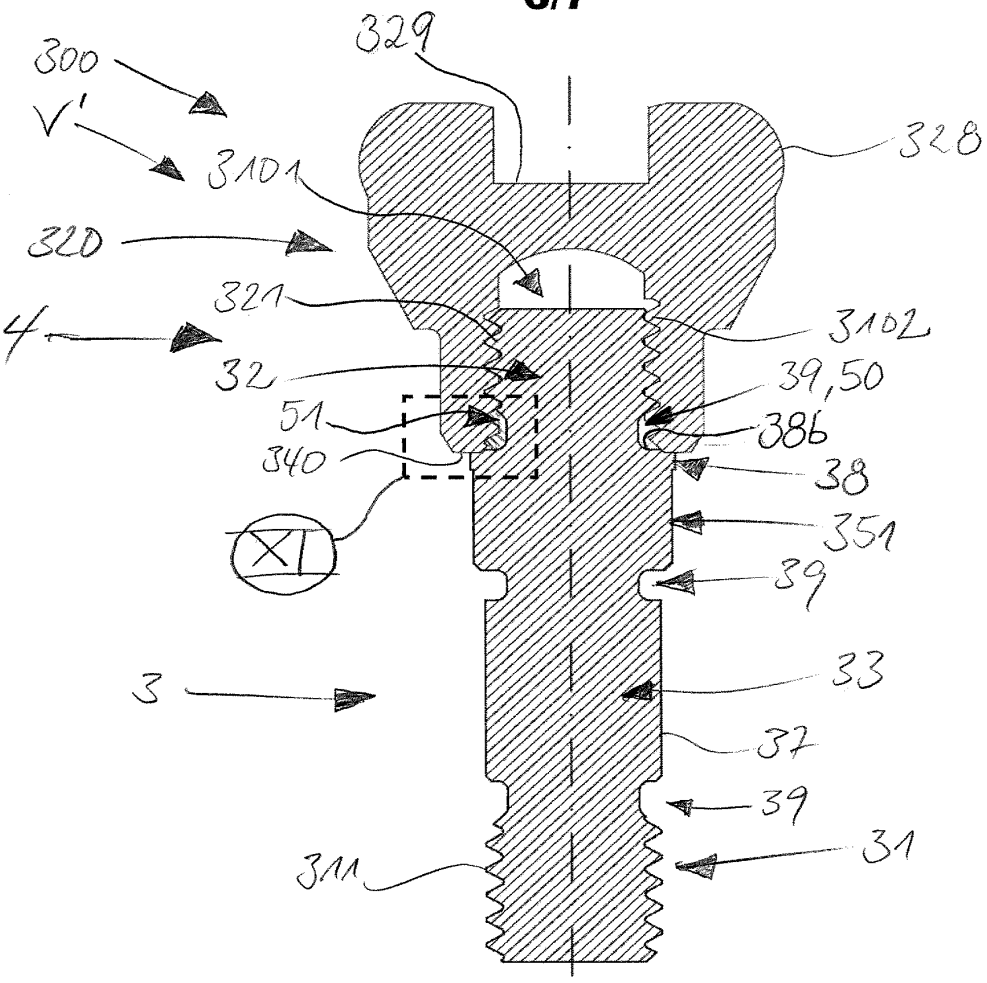

329
300
V'
328
3101
320
321
4
3102
32
39,50
51
386
340
38
XI
351
39
3
33
37
39
311
31

Fig. 11

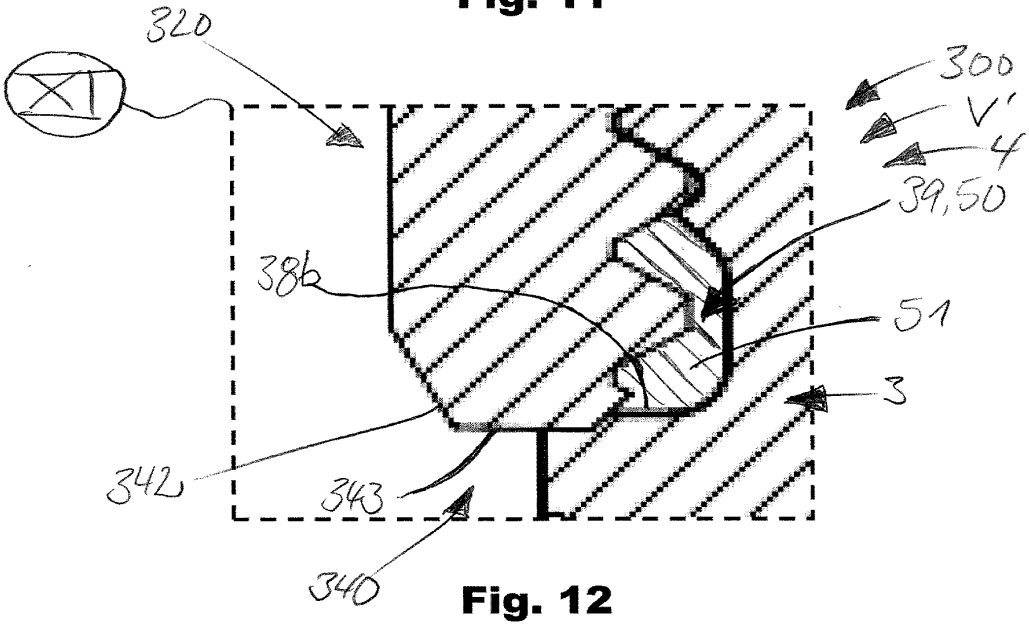

320
XI
300
V'
4
39,50
386
51
3
342
343
340

Fig. 12

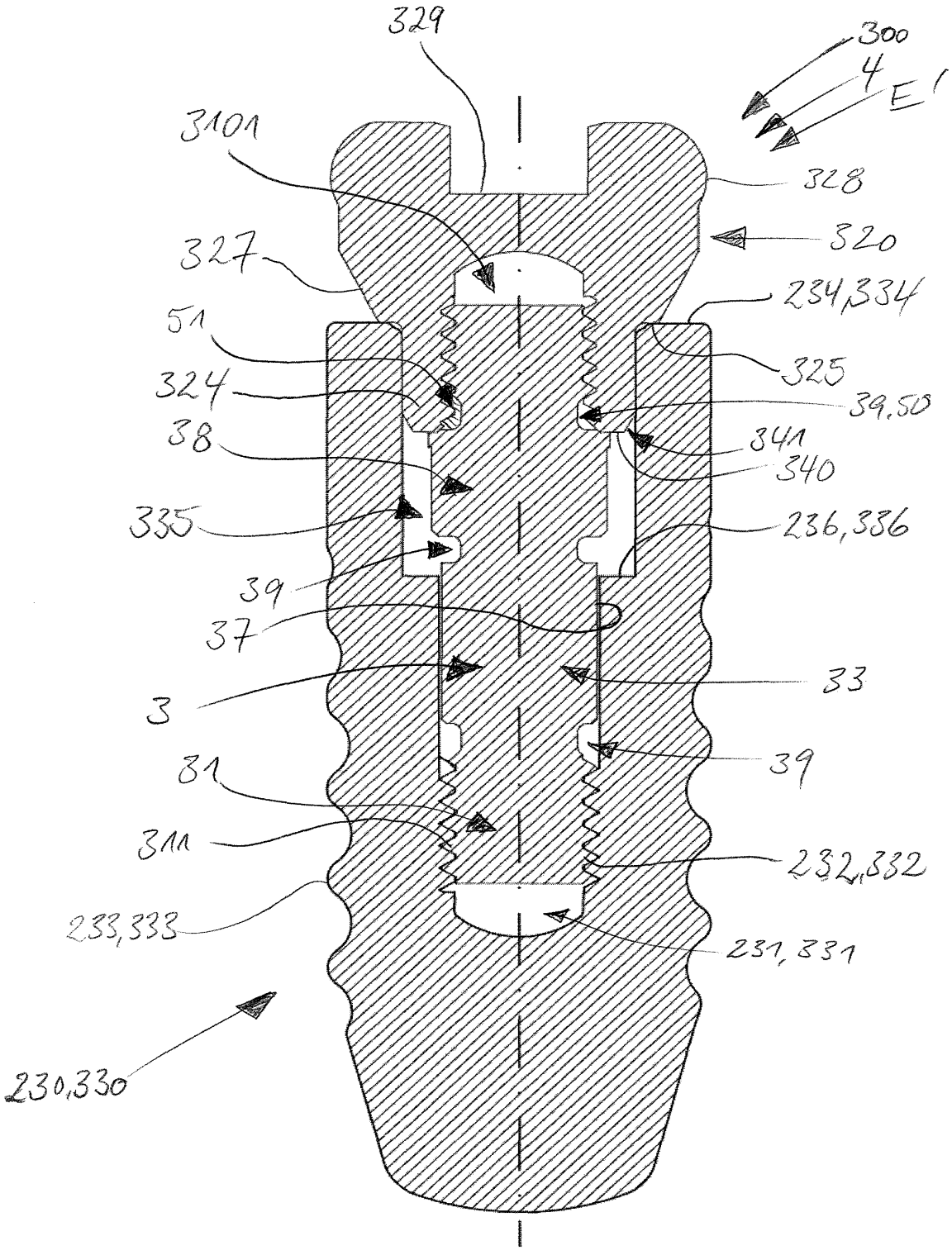

329
300
4
E1
3101
328
320
327
234,334
51
325
324
39,50
38
341
340
335
236,336
39
37
3
33
39
31
311
232,332
233,333
231,331
230,330

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/054916

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C8/00
ADD.

According to International Patent Classification (IPC) orto both national Classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (Classification System followed by Classification Symbols)
A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X Y	US 2008/233538 A1 (HUG THOMAS SILVAN [CH] ET AL) 25 September 2008 (2008-09-25) page 1, paragraph 33 - page 3, paragraph 35; figures 1-3D	1-8, 10-15 9

X A	DE 28 36 152 A1 (LEITZ ERNST GMBH) 28 February 1980 (1980-02-28) page 13 - page 27; figures 1, 2, 11, 12	1-7,10, 13,14 8,9,11, 12,15

X A	DE 44 43 051 A1 (SCHMITT FRIEDRICH [DE]; MOHR PETER DR [DE]) 2 October 1996 (1996-10-02) column 1 - column 4; figure 1	1,5-7, 10,11, 13-15 2-4,8,9, 12

	-/-- -	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 September 2017	11/10/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Wirth, Christian

2

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/054916

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	JP 2015 146927 A (IKASHIKA SOLUTIONS CO LTD) 20 August 2015 (2015-08-20)	9
A	Paragraph [0032]	1-8, 10-15

2

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2017/054916

Patent document cited in search report	Publioation date	Patent family member(s)	Publioation date
US 2008233538 AI	25-09-2008	EP 1972297 AI ES 2557555 T3 US 2008233538 AI	24-09-2008 27-01-2016 25-09-2008
DE 2836152 AI	28-02- 1980	N0NE	
DE 4443051 AI	02-10- 1996	N0NE	
JP 2015146927 A	20-08- 2015	JP 6124815 B2 JP 2015146927 A	10--05 -2017 20--08 -2015

Form PCT/ISA/210 (patent family annex) (April 2005)

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/IB2017/054916

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
INV. A61C8/00
ADD.

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter MindestprUfstoff (Klassifikationssystem und Klassifikationssymbole)
A61C

Recherchierte, aber nicht zum MindestprUfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal , WPI Data

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X Y	US 2008/233538 AI (HUG THOMAS SI LVAN [CH] ET AL) 25. September 2008 (2008-09-25) Seite 1, Absatz 33 - Seite 3, Absatz 35; Abbildungen 1-3D	1-8, 10-15 9

X A	DE 28 36 152 AI (LEITZ ERNST GMBH) 28. Februar 1980 (1980-02-28) Seite 13 - Seite 27; Abbildungen 1, 2, 11, 12	1-7,10, 13,14 8,9,11, 12,15

X A	DE 44 43 051 AI (SCHMITT FRI EDRICH [DE]; MOHR PETER DR [DE]) 2. Oktober 1996 (1996-10-02) Spalte 1 - Spalte 4; Abbildung 1	1,5-7, 10,11, 13-15 2-4,8,9, 12

	-/-- -	

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen [X] Siehe Anhang Patentfamilie

* Besondere Kategorien von angegebenen Veröffentlichungen :
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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
29. September 2017	11/10/2017

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Wirth , Christian

2

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/IB2017/054916

C. (Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
Y	JP 2015 146927 A (IKASHIKA SOLUTIONS CO LTD) 20. August 2015 (2015-08-20)	9
A	Absatz [0032]	1-8, 10-15

Straumann USA Exhibit 1015

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/IB2017/054916

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
US 2008233538 A1	25-09-2008	EP 1972297 A1 ES 2557555 T3 US 2008233538 A1	24-09-2008 27-01-2016 25-09-2008
DE 2836152 A1	28-02-1980	KEINE	
DE 4443051 A1	02-10-1996	KEINE	
JP 2015146927 A	20-08-2015	JP 6124815 B2 JP 2015146927 A	10-05-2017 20-08-2015

Formblatt PCT/ISA/210 (Anhang Patentfamilie) (April 2005)

WO2018029650A1

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Applicants

LAKEVIEW INNOVATION LTD [CH]

Inventors

SAMSFORT PETER [DE]; ZIMMERMANN DIRK [DE]

Classifications

IPC

A61C8/00;

CPC

A61C8/0012 (EP,US); A61C8/0022 (EP,US); A61C8/005 (EP,US); A61C8/0054 (CH); A61C8/0063 (US); A61C8/0066 (EP,US); A61C8/0068 (EP,US); A61C8/0074 (CH);

Priorities

CH10402016A·2016-08-12

Application

IB2017054916W·2017-08-11

Publication

WO2018029650A1·2018-02-15

CONNECTION SYSTEM FOR A DENTAL IMPLANT

Abstract

The present invention relates to a connector (1, 1', 1'', 2, 3) for connecting ceramic components of a dental implant (100, 100', 200, 300). The invention further relates to a prosthesis (120, 120', 220, 320) for a dental implant (100, 100', 200, 300). The invention moreover relates to a base body (130, 230, 330) for a dental implant (100, 100', 200, 300), with an inner thread (132, 232, 332), which is designed to match a base thread (111, 111', 111'', 211, 311) of a connector (1, 1', 1'', 2, 3), and/or with a receiver (135, 235, 325), which is designed to match a prosthesis (120, 120', 220, 320). Finally, the invention relates to a connection system for a dental implant (100, 100', 200, 300). In order to provide dental implants (100, 100', 200, 300) which satisfy the general requirements for successful implantation and use and can easily adapt to bone variations and implant availability, provision is made according to the

invention that the connector (1, 1', 1'', 2, 3) has a base portion (11, 11', 11'', 21, 31), on which a base thread (111, 111', 111'', 211, 311) is formed for screwing the connector (1, 1', 1'', 2, 3) into a base body (130, 230, 330) of the dental implant (100, 100', 200, 300), and a holding portion (12, 12', 12'', 22, 32), on which a holding thread (121, 131, 131', 221, 321) is formed for screwing a prosthesis (120, 120', 220, 320) of the dental implant (100, 100', 200, 300) onto the connector (1, 1', 1'', 2, 3) or that the prosthesis (120, 120', 220, 320) is provided with a mating holding thread (2102, 3102) for screwing the prosthesis (120, 120', 220, 320) onto a connector (1, 1', 1'', 2, 3) of the dental implant (100, 100', 200, 300).

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DESCRIPTION WO2018029650A1

[0001]

Connection system for a dental implant

[0002]

The present invention is in the field of dental implants.

It relates to a connector for connecting ceramic components of a dental implant. Furthermore, the invention relates to prosthetics for a dental implant. Furthermore, the invention relates to a base body for a dental implant. Finally, the invention relates to a connection system for a dental implant.

[0003]

Technological background

[0004]

Dental implants can be designed in one piece or in multiple pieces.

Nowadays, multi-piece dental implants have prevailed over one-piece dental implants because multi-piece dental implants offer better conformability and protection from unwanted stresses during the healing process than one-piece dental implants.

[0005]

A large number of multi-part dental implants known from the prior art are constructed in three parts and thus comprise a base body to be inserted into a jawbone, an abutment to be fastened to the base body and a superstructure to be placed on the abutment.

The base body, also known as the implant body, is intended to replace the tooth root and is usually cylindrical or conical in shape.

As a rule, the base body has a thread, via which the base body can be fixed in the jawbone by screwing it in, thereby achieving primary strength in the jawbone. While the base body and abutment are embedded in the jaw or covered by the superstructure, the latter is exposed in the oral cavity and represents the actual tooth structure. The abutment, also known as an implant abutment, serves to a certain extent as an intermediate link between the base body and superstructure and is usually screwed and/or glued into the base body.

[0006]

The base body should be made of a material that is as bioinert as possible so that it can be used largely tolerably and without complications for the patient and to prevent the gums from receding.

Both the material and the structure of the base body should enable a high degree of osseointegration. These requirements for what is known as biocompatibility and high periointegration also apply to the abutment and superstructure. Ceramic, in particular zirconium oxide, has prevailed as a material with advantageous processing properties and high biocompatibility. Titanium is often used as an alternative to ceramics, but it does not have as good biocompatibility and periointegration as ceramics.

[0007]

A reliable connection between the abutment and the base body that is sealed against bone and gums is crucial for the long-term success of an implantation.

A poor connection between the abutment and the base body can lead to loosening of the dental implant and damage to the dental implant. Leaking connections can allow bacteria to enter the implant, leading to peri-implantitis and thus i.a. can cause jaw bone loss. Furthermore, the forces occurring in the teeth place high demands on the material and construction of implants for long-term success. The implants must be able to absorb all forces occurring in the teeth without breaking, tearing or loosening. It is therefore important, both when inserting and over the entire service life of the dental implant, where and how exactly a force is introduced into the individual components of the implant.

[0008]

Depending on the position of the dental implant to be inserted in the jaw and bone availability at the position, different implant types and, in particular, different lengths or widths can be used.

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Sizes of the dental implants may be required. Due to the varying suitable size of the dental implant depending on the jaw situation, series with components of different sizes are usually used, which should provide a reliable connection between the abutment and base body for a high level of long-term success, as mentioned at the beginning. For example, the series can contain several base bodies of different sizes, for example with lengths of 6, 8, 10, 12, 14 or 16 mm with different diameters of for example 3.3, 4.1 or 4.8 mm as well as different types of abutments that are straight or angled and can also be in different sizes. In summary, dental implants have to meet high requirements in terms of biocompatibility, tightness, force transmission and system flexibility.

[0009]

For example, the European patent application filed by the applicant with the publication number EP 2 735 279 A1, the disclosure of which is incorporated herein by reference in its entirety, describes a dental implant with a ceramic base body that can be anchored in a jawbone and an implant structure that can be fastened to the base body by means of a screw, wherein When the dental implant is in an assembled state, a threaded section of the screw engages in an internal thread formed in a blind hole in the base body.

The screw presses the implant abutment against the base body. A form-fit engagement between the threaded section of the screw and the internal thread of the hole exists exclusively in a lower half of the base body that faces away from the implant structure and extends over half the length of the base body.

[0010]

According to EP 2 735 279 A1, this is intended to ensure that mechanical stresses are distributed homogeneously over the entire length of the base body.

The internal thread, into which the tension is introduced directly via the screw, is located relatively far away from the contact area between the base body and the implant abutment, deep in the foot of the base body. In order to achieve reliable attachment of the base body to the implant abutment using the screw, the length of the screw must match the length of the blind hole in the base body and part of the implant abutment. Accordingly, different screws are to be provided for dental implants of different lengths. The provision of different screws is not only expensive, but also tedious to use, so it leads to unwanted additional costs and effort.

[0011]

Presentation of the invention

[0012]

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It is therefore an object of the invention to provide dental implants that meet the general requirements for successful implantation and use and can at least be more easily adapted to bone variations and implant availability than dental implants known from the prior art.

According to the invention, this object is achieved by a connector according to independent claim 1 , a prosthesis according to independent claim 10 , a base body according to claim 13 and by a connection system according to claim 14 .

Preferred developments of the invention are given in the dependent claims and in the present disclosure.

[0013]

In particular, the object is achieved by a connector for connecting ceramic components of a dental implant, with a base section on which a base thread for screwing the connector into a base body of the dental implant is formed, and with a holding section on which a holding thread for screwing on a prosthesis of the dental implant molded onto the connector.

[0014]

In particular, the task is solved with a prosthesis for a dental implant, with a counter-retaining thread for screwing a prosthesis onto a connector of the dental implant.

[0015]

In particular, the object is achieved with a base body for a dental implant, with an internal thread designed to complement a base thread of a connector according to the invention and/or with a receptacle designed to complement a prosthesis according to the invention.

[0016]

In particular, the object is achieved by a connection system for a dental implant, with at least one connector according to the invention and/or with at least one prosthesis according to the invention and/or with at least one base body according to the invention.

[0017]

The solution according to the invention has the advantage over the prior art that connectors and prosthetics can be selected to match the respective base body.

For example, a large number of different prostheses can be screwed onto the base body by using the connector.

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The connectors can also be adapted to the respective circumstances, or a unit connector that can be adapted to the circumstances can be used.

Thus, the invention as a connection system helps to provide a kind of modular system for tooth structures and other components of dental implants, which are used from the healing phase of the implant to its ready-to-use structure.

For example, the prosthetics can be a gingiva former for adapting the gums to a shape of an abutment that will be used later.

Alternatively or additionally, the prosthesis and connector can be used together as an implant screw in the form of a healing screw to seal the base body or implant against bacteria during healing.

[0018]

Unit connectors according to the invention

Connectors can consequently be used together with abutments and/or prosthetics according to the invention. The abutments and/or prosthetics can be used as a head or Head part of together with the connector or Unit connector formed screws are used or at least partially form a head or head part of a screw, such as an implant or healing screw. In other words, the abutment, prosthesis and/or head part can be equivalently connected to a connector or Unit connectors work together and accordingly have the configurations and features required for this, as are described herein with reference to the abutment, prosthetics and/or head part.

[0019]

The solution according to the invention can be supplemented and further improved as desired by the following additional embodiments, each of which is advantageous in itself, with a person skilled in the art clearly and unequivocally recognizing that device features of components of a connection system according to the invention correspond to steps according to the invention methods for producing and using a connection system according to the invention Justify connection system and its components and vice versa.

[0020]

According to a first further embodiment, it is provided that the connector is made of a metal or a metal alloy, preferably at least partially made of titanium.

Thus, the connector has a higher elasticity than the components of the dental implant made of ceramic, such as the base body, the prosthetics and the abutment.

In view of the fact that these ceramic components are less able to absorb tensile forces, bending moments and shearing stresses than metal components due to the corresponding material properties, the use of the metal connector helps to give the entire dental implant an advantageous fatigue strength

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and resilience by benefiting from compressive strength, abrasion resistance on the one hand and biocompatibility of the ceramic and, on the other hand, the elasticity and toughness of the metallic connector.

[0021]

With such a combination of ceramic and metal, a connection system according to the invention represents a hybrid dental implant system, so to speak.

It is ideal for the gums not to have any contact with metallic connectors. According to the invention, this is achieved in that the connector is advantageously arranged within an interior space of the dental implant formed by the base body and prosthesis or at least spaced apart from the gums by the base body and/or prosthesis. The interior is advantageously hermetically sealed in that a contact surface of the prosthesis rests sealingly on a contact surface of the base body.

[0022]

According to a further advantageous embodiment it is provided that the connector has at least one shoulder element between the base section and the holding section, which at least partially protrudes in a radial direction of the connector beyond an outer circumference of the base section and/or the holding section.

The shoulder element can serve both to handle the connector as such and form a stop for the connector. The connector can thus be screwed into the base body up to the shoulder element as a stop on the base body. The shoulder element therefore helps to fasten the connector in the base body precisely and with tactile and/or visual feedback. Screwed into the base body with the base thread, the connector can provide an attachment option for a variety of prosthetics or for replacement prosthetics for wear or aesthetic reasons through the retaining thread.

[0023]

According to a further advantageous embodiment, it is provided that the at least one shoulder element is formed on an annular collar, the outside diameter of which is larger than an outside diameter of the base section and/or the holding section.

The annular collar can be arranged concentrically to the base thread and/or retaining thread. The annular collar thus contributes to an even transmission of forces between the connector and the prosthesis and/or between the connector and the base body.

[0024]

According to a further advantageous embodiment it is provided that at least one engagement means is formed on the connector for actuating the connector with a tool.

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The means of engagement helps to position a tool, which is advantageously designed to be complementary to the means of engagement, precisely on the connector and to transmit forces and/or moments from the tool to the connector in accordance with the respective requirements.

[0025]

According to a further advantageous embodiment it is provided that the at least one engagement means is provided with an external profile at least in sections.

For example, the external profile can be formed as an external hexagon. An outside diameter of the outside profiling can, for example, be smaller than an outside diameter of the base thread and/or retaining thread. This enables radial play between the engagement means and other components of the dental implant, in particular the respective inner circumferences of the base body and/or prosthesis. Such radial play helps to avoid overdetermining tolerances of the components of the dental implant and to provide certain degrees of freedom when handling the components and when assembling them.

[0026]

According to a further advantageous embodiment it is provided that a head end of the connector is designed as the at least one engagement means.

The means of engagement of the connector inserted into the base body thus remains easily accessible. Accessibility can be improved, for example, by the head end of the connector protruding beyond an upper edge of the base body, counter to an insertion direction, when the connector is fully inserted into the base body. Alternatively or additionally, the means of engagement can be formed on an annular collar or as such on the connector.

[0027]

According to a further advantageous embodiment, it is provided that at least one annular groove is formed between the base section and the holder section, at which the outer circumference of the connector tapers in relation to the respectively surrounding sections.

Such an annular groove helps on the one hand to prevent undesired canting, rubbing or hitting of the connector when inserting the connector into the base body or when placing the prosthesis on the connector. On the other hand, annular grooves of this type help to give the connector the desired elasticity or to increase its flexibility at the desired point so that, for example, the connector yields rather than the contact surfaces between the connector and ceramic and/or contact surfaces between ceramics being overstrained by unbalanced loads.

[0028]

According to a further advantageous embodiment, it is provided that the base thread and/or the retaining thread is/are designed as a left-hand thread.

Threads of implants are usually designed as right-hand threads. A configuration of the base thread and/or the retaining thread as a left-hand thread helps to prevent a screw connection from loosening undesirably. If, for example, the retaining thread is designed as a right-hand thread and the base thread as a left-hand thread, then the prosthesis can be unscrewed from the retaining thread without loosening the screw connection between the connector and the base body.

[0029]

In a prosthesis according to the invention, the solution according to the invention can be improved according to a first further advantageous embodiment in that the counter-holding section is provided with a blind hole in which the counter-holding thread is arranged.

By arranging the counter-retaining thread in the blind hole, the counter-retaining thread or an upper end section of the connector can be surrounded by the prosthesis. In other words, the prosthesis can be placed on the connector like a cap. This helps to form a hermetically sealed interior of the dental implant between the prosthesis and the base body. The connector can be accommodated in this interior space, shielded from the area surrounding the dental implant, that is to say the gums and oral cavity.

[0030]

According to a further advantageous embodiment, it is provided that the counter-retaining thread runs at least in sections along an extension of the prosthesis, which is designed to engage in a receptacle of a base body of the dental implant.

The prosthesis can thus overlap with the base body in the radial direction. On the one hand, this helps to position and center the prosthesis in relation to the base body during assembly. On the other hand, the covering helps to ensure high stability of the dental implant and sealing of its interior. In a connection system according to the invention, the solution according to the invention can be improved according to a first further advantageous embodiment in that, in a final assembly state of the dental implant, the connector is accommodated in an interior space of the dental implant surrounded by the prosthesis and base body. In this way, connectors or Unit connectors arranged in the interior should be surrounded by base bodies and prosthetics preferably made of ceramic materials in order to prevent the connectors from coming into contact with the gums. It is also advantageous if the interior is hermetically sealed.

For this purpose, the prosthetics should be flush and sealed against the base body in the final assembly state.

[0031]

In a pre-assembly state of the dental implant, the connector can either first be connected to the base body or to the prosthesis before the final assembly state.

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If the connector is connected to the base body in the pre-assembly state, then it can be inserted with its base thread into the base body, while its holding thread is arranged so that it is accessible from the outside of the base body in order to attach the prosthesis to it and thus move the dental implant from the pre-assembly state to the final assembly state convict. If the connector is connected to the prosthesis in the pre-assembly state, then these can be handled like an implant screw, which is screwed into the base body to transfer the dental implant from the pre-assembly state to the final assembly state.

[0032]

Alternatively or additionally, the object is achieved by an implant screw for a dental implant, with a ceramic head part and with a non-ceramic base thread that can be screwed into a base body of the dental implant.

[0033]

This solution according to the invention has the advantage over the prior art that the head part and base thread can be selected to match the respective base body.

For example, in particular, a large number of different head parts can be screwed onto the base body by using the base thread.

The base thread can also be adapted to the respective circumstances, or a connector or connector that can be adapted to the circumstances can be used. Unit connector can be used on which the base thread is formed. The head part is made of ceramic, for example, in order to ensure the highest possible biocompatibility of an implant screw according to the invention. The head part can be permanently connected to a prosthesis or formed on a prosthesis or as a prosthesis. For example, the head part or the prosthesis is designed to be rotationally symmetrical. on the headboard or A contact surface can be formed in the prosthesis, which is designed to lie flush on the base body. Thus, the base thread between the head part or Be included included prosthetics and base body. The base thread consists, for example, of a non-ceramic material. A metal or a metal alloy can preferably be used as the non-ceramic material in order to give an implant screw according to the invention the highest possible toughness.

[0034]

According to a further embodiment, it is provided that the head part is connected to the base thread via a form fit for the transmission of a torque acting about a central axis of the implant screw.

The form fit helps to prevent relative rotations between the head part and the base thread, at least around the central axis. Due to the form fit, torques can be transferred precisely and safely from the head part to the base thread and vice versa. Due to the form fit, two-part implant screws according to the invention consisting of a head part and a base thread can be handled as is possible with one-part implant screws.

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[0035]

According to a further embodiment, it is provided that the head part is provided with a recess, in which a connector is accommodated at least in sections, on which the base thread is formed.

The recess is designed in the manner of a blind hole, for example. The design of the recess as a blind hole helps to preferably enclose the connector or an upper end of the connector with the recess. On the one hand, a connection that is as intimate and firm as possible can be established between the head part and the connector. On the other hand, at least partial embedding of the non-ceramic connector in the ceramic material of the head part is favored. The connector can be designed or selected according to the respective requirements. For example, the connector is bolt-shaped and/or at least partially cylindrical. Accordingly, the base thread can have the form of a threaded bolt. According to a further embodiment it is provided that a counter-retaining thread for screwing the head part onto the connector is arranged in the recess. The counter-retaining thread allows the connector to be screwed into the head part in order to create a positive connection between the head part and the connector.

The head part and connector can therefore be easily combined with one another.

[0036]

According to a further embodiment, provision is made for the counter-retaining thread to be assigned teeth connected to the head part.

For example, the toothing is formed on the prosthesis or the head part. For example, when the head part or the prosthesis is brought together with the connector, the toothing can penetrate the material of the connector and form a positive and/or non-positive connection between the head part or the prosthesis. Help bring about prosthetics and connectors.

[0037]

According to a further embodiment it is provided that the toothing encircles the counter-retaining thread.

In other words, the toothing surrounds the counter-holding thread in the form of a ring and/or overlaps with it. For example, the teeth can surround an opening to the recess or the counter-retaining thread arranged therein. This favors the most symmetrical and therefore balanced engagement of the teeth in the material of the connector.

[0038]

According to a further embodiment it is provided that the toothing has flat tooth flanks and/or steep tooth flanks, the flat tooth flanks pointing in a screwing direction of the retaining thread or the steep tooth flanks pointing counter to the screwing direction.

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The screwing direction is, for example, the direction in which the counter-retaining thread and consequently the head part or the prosthesis can be screwed onto the connector. Since the flat flanks of the teeth point in the direction of screwing, they promote further screwing of the head part or the prosthesis onto the connector, even after they have come into contact with the connector, since they slide over the material of the connector. On the other hand, the steep tooth flanks cause the toothing to dig into the material of the connector when the head part or the prosthesis is moved relative to the connector in the opposite direction to the screwing direction, or displace it in such a way that an intimate positive and/or non-positive connection between the head part or Prosthetics and connectors is effected. Such a positive and/or non-positive connection prevents in particular an unintentional loosening of the screw connection between the head part or prosthetics and connectors. According to a further embodiment, it is provided that an end face connected to the head part points in the direction of the base thread and/or bears against the connector at least in sections.

For example, the front side of the headboard or Be formed prosthetics and preferably has in the axial direction, d. H. in a direction substantially parallel to the central axis. Such a front end favors the transmission of force and/or torque between the head part or Prosthetics and connectors on the one hand and between the implant screw and base body on the other.

[0039]

According to a further embodiment, it is provided that the end face is ring-shaped.

The end face can, for example, enclose an opening to the recess or the base thread or form an edge of the opening. A ring-shaped end face, preferably arranged rotationally symmetrically to the central axis, promotes the most uniform possible transmission of force and/or torque between the head part or Prosthetics and connectors on the one hand and between the implant screw and base body on the other.

[0040]

According to a further embodiment, it is provided that at least one tooth is formed on the end face, on which a tooth tip pointing away from the end face is formed.

For example, the toothing can be formed from a large number of such teeth. The tips of the teeth can protrude from the front side and thus penetrate into the material of the connector in order to achieve the most intimate possible non-positive and/or positive connection between the head part or to effect prosthetics and connectors.

[0041]

According to a further embodiment, it is provided that the at least one tooth forms the toothing at least in sections.

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In other words, the toothing comprises the tooth pointing away from the end face. The at least one tooth can correspondingly have a flat and a steep tooth flank, as described above. Advantageously, a large number of teeth forming the toothing are arranged rotationally symmetrically to the central axis along the end face in order to ensure the most uniform possible transmission of force between the head part and to ensure prosthetics and connectors.

[0042]

According to a further embodiment, it is provided that the connector has a holding section on which a holding thread for screwing the head part onto the connector is formed.

The retaining thread is preferably designed to be complementary to the counter retaining thread. This promotes a reliable screw connection with as little play as possible between the head part and the manufacture prosthetics and connectors.

[0043]

According to a further embodiment, it is provided that the connector has an annular collar which, at least in sections, points in the direction of the head part.

The head part or the prosthesis, in particular its front side, can come into contact with the ring collar. On the one hand, this promotes an intimate connection between the headboard and prosthetics and connectors. On the other hand, by fitting the head part or the prosthesis flush to the ring collar of the connector, a proper union of the head part relationship between the prosthesis and the connector can be easily verified optically and/or haptically.

[0044]

According to a further embodiment, it is provided that at least one engagement means for attaching a tool for screwing in the connector is formed on the annular collar.

For example, an outer contour of the ring collar can be designed as an engagement means. The outer contour is preferably formed as an external hexagon. The means of engagement of the connector makes it easier to transmit forces and/or torques to the connector using a tool in a way that is as gentle on the material as possible.

[0045]

According to a further embodiment, it is provided that at least one engagement means for attaching a tool for screwing in the implant screw is formed on the head part.

For example, an inner contour of the engagement means of the head part or the prosthesis can be formed as a hexagon socket or a hexalobular socket. The engagement means of the head part or the

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prosthesis makes it easier to transmit forces and/or torques via a tool to the head part or the prosthesis on the one hand and to the implant screw on the other hand in a way that is as gentle on the material as possible.

[0046]

According to a further embodiment, it is provided that the head part is connected to the base thread via an adhesive connection.

For example, the head part or the prosthesis is glued to the connector. The adhesive can be used as an alternative or in addition to a screw connection between the head part or Prosthetics and connectors are used to intimately connect them. In combination with a screw connection, the adhesive can act like a screw lock. between the headboard and A cavity can be formed in the prosthesis and connector, into which an adhesive can penetrate or which can be filled by the adhesive. To provide the cavity, for example, an annular groove can be formed on the base thread or in its vicinity, preferably on the connector.

[0047]

Furthermore, the invention relates to a unit connector for connecting an abutment of a dental implant to a base body of the dental implant, comprising a base section that can be inserted into the base body along an insertion direction and fixed therein and an abutment holding section for holding the abutment on the base body, the abutment holding section being at least two apart along the insertion direction spaced holding positions for the abutment.

[0048]

The invention further relates to a unitary connection system for dental implants comprising at least one unitary connector according to the invention.

With the help of the unit connector, the unit connector system can be used for a large number of different sizes and types of dental implants.

In addition to at least one unit connector, the unit connection system can also contain other elements, such as holding elements, additional holding elements and tools and/or measuring tools that interact with these and/or the unit connector.

[0049]

As a rule, both the base body and the abutment have bores which can accommodate the unit connector, with a lower area of the unit connector being located in the base body and an upper area of the unit connector being located in the abutment when the dental implant is assembled.

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Depending on the length of the base body and the length of the abutment, the unit connector can protrude from the top of the abutment. The first end region can preferably be connected to the base body when the unitary connector is inserted into the base body, preferably firmly anchored. Optionally, the unit connector can be glued into the base body or alternatively connected in the manner of a bayonet catch.

[0050]

The unit connector offers the advantage that it can be used for dental implants of different sizes thanks to the variable length.

In the case of conventional solutions with conventional screws, on the other hand, the sizes or The lengths of the components must be precisely matched to the screw in order to ensure a reliable connection between the base body and the abutment. Since the unitary connector according to the invention provides at least two holding positions, it can be used both with base bodies of different sizes and with abutments of different sizes. Thus, for example, in entire series for dental implants, a positively sealed connection of the base body to the abutment can be achieved by the same unit connector, which can advantageously be anchored as deeply as possible in the base body. On the one hand, this helps to ensure a stable structure of the dental implant. On the other hand, production costs for dental implants can be reduced and their use simplified by increased variability compared to the prior art.

[0051]

Due to the operative connection of the second end region of the unit connector to the abutment, the unit connector can connect the base body to the abutment, preferably in a force-fitting and form-fitting manner.

The active connection can, among other things, be positive, non-positive and/or cohesive, including indirectly via a holding or fasteners, such as B. in the form of a sleeve. Form-fitting is to be understood within the scope of the production of the components of the dental implant, which is known to the person skilled in the art. In connection with the connection between the abutment and the base body, sealing is to be understood as meaning that the contact surfaces between the base body and the abutment are so tight that z. B. no bacteria can penetrate between base body and abutment, which helps to avoid peri-implantitis.

[0052]

A unitary connector according to the invention can be used in a particularly advantageous manner, in particular due to the sealing in multi-part dental implants made of ceramic.

In the case of such dental implants, an interior space or cavity is generally formed between the base body and the abutment. If the abutment is properly installed on the base body, the interior is hermetically sealed against the jawbone and gums. The unitary connector can therefore be accommodated in the interior, isolated from the jawbone and gums. Thus, the unit connector can also

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be made of materials other than ceramic, for example stainless steel and/or titanium or the like, without having to compromise on the biocompatibility of the dental implant, because this is limited by the ceramic nature of the components of the implant encasing the unit connector is guaranteed. The solution according to the invention can be combined and further improved as desired with the following additional embodiments according to the invention, each of which is advantageous in its own right.

[0053]

According to a first further embodiment, the holding positions can be selected in an infinitely variable manner.

An infinitely variable selectability of the holding positions makes it possible to connect a large number of different base bodies and abutments with one another using the same type of unit connector. The infinitely variable selectability of the holding positions also helps to compensate for any manufacturing tolerances as well as deviations or irregularities during implantation or to compensate for the build-up of the implant.

[0054]

According to a further embodiment, it is provided that the base section has a first external thread, which is designed such that it can be brought into engagement with an internal thread of the base body and which provides at least two holding positions.

Due to the external thread, the unit connector can be easily screwed into the base body and thus connected to it in a positive and non-positive manner. The holding positions can be provided in an infinitely variable manner along the external thread.

[0055]

According to a further embodiment of a unitary connector according to the invention, it is provided that a length of the first external thread measured parallel to the direction of insertion essentially corresponds to a length of the internal thread measured parallel to the direction of insertion or is at least only slightly shorter than the length of the internal thread.

Internal threads and external threads can thus essentially completely overlap. On the one hand, this helps to provide a lower stop for the unitary connector through the dimensioning of the thread itself and thus to limit its insertion path in the direction of insertion. On the other hand, the positive and non-positive connection between the unit connector and the base body is precisely limited to the area of said thread and concentrated therein. Unnecessary threads and the associated weakening of the material are avoided.

[0056]

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According to a further embodiment of a unitary connector according to the invention, it is provided that the unitary connector has a cylindrical shaft section between the base section and the abutment holding section.

Thus, the unitary connector can be manufactured as a type of stud with a thread at each end. The shank section favors receiving the unitary connector with as little play as possible, both in the base body and in the abutment. Any transverse forces or moments can be transmitted via contact surfaces dimensioned with as little or no play as possible between the shaft section and base body on the one hand and between the shaft section and abutment on the other hand, which helps to improve the robustness and longevity of the entire dental implant.

[0057]

According to a further embodiment, the shank section has at least partially a larger diameter than the base section.

A stop or a gradation can be formed in the area of the change in diameter, which helps to limit an insertion path of the unitary connector in the insertion direction. In addition, this embodiment makes it possible to design the shank section in such a stable manner that in the transverse direction or radially to the central axis of the shank section or Unit connector acting forces can be safely absorbed and removed. In contrast to this, threads in the base section and in the abutment holding section can be designed to absorb tensile forces acting parallel to the direction of insertion, which helps to optimize the dimensions of the individual components of the dental implant. Furthermore, this embodiment offers the advantage that contact between the base section and the inner wall of the bore of the base body can be minimized when the unit connector is inserted into the bore of the base body. With a thread in the base section, for example, contact between the thread and the inner wall of the bore of the base body during the insertion of the unitary connector can lead to damage, which can be particularly critical for ceramic base bodies.

A gradation can thus advantageously ensure that the unitary connector is guided through the shank and disadvantageous damage to the base body through contact of the inner wall with the base section can be minimized. Preferably, the bore of the base body in the lower area then has a narrowed bore corresponding to the first end area of the unit connector, in which the base section of the unit connector can engage or be inserted as flush as possible with it. According to a further embodiment, a holding element is provided which engages around the abutment holding section and is designed to interact with the abutment holding section in order to hold the abutment. The holding element can be designed to be fixable or lockable in the at least two holding positions on the unit connector or at least interact with the unit connector in such a way that it can absorb forces from the unit connector that act essentially parallel to the direction of insertion and transmit them to it.

Different holding elements can each be combined with the same unit connector in order to be able to use it together with different types of base bodies and/or abutments.

[0058]

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According to a further embodiment of the unit connector, it is provided that the holding element has at least one holding surface, pointing at least partially counter to the direction of insertion, for holding the abutment.

The holding surface can be designed according to the respective requirements in order to transmit forces acting essentially parallel to the direction of insertion. The configuration of the holding surface can be optimized for the respective base body or the respective abutment.

[0059]

According to a further embodiment of the unit connector, it is provided that the abutment holding section is provided with at least one holding thread for positive and non-positive interaction with the holding element.

The holding element can thus be simply screwed onto the unit connector at the holding thread. The retaining element is equipped with a corresponding thread that is designed to be complementary to the retaining thread. This makes it possible to provide a large number of largely freely variable selectable and adjustable holding positions. Once the unitary connector is properly inserted into the base body, the abutment can be easily fixed in the desired position on the base body using the retaining element by screwing the retaining element onto the retaining thread of the unitary connector with an appropriate torque. Manufacturing and assembly tolerances occurring in particular in the area of the base section or the connection between the base body and the unit connector can thus advantageously also be compensated for and a connection that is as flush, stable and sealed as possible between the abutment and the base body can be produced. According to a further embodiment, the holding element is designed like a sleeve with an essentially cylindrical outer contour.

The unit connector can be connected to the abutment in a simple and effective manner via a sleeve of this type for a form-fitting, sealed connection of the abutment and the base body. In an advantageous embodiment, the sleeve is pushed over the abutment holding section so that it engages and, when engaging, presses the abutment against the base body in a form-fitting and sealing manner. In this context, the person skilled in the art understands sliding not only to be a transversal accompanying movement, but also, in general, to be positioned, with one component being accommodated in or on another. Shifting can therefore also include screwing or represent a combination of transversal sliding movement and screwing if the sleeve, for example, is first placed on the abutment holding section and screwed into a holding thread provided thereon after engaging.

[0060]

As a rule, the sleeve can be inserted into a sleeve receiving area of the bore of the abutment and is designed to be flush with it.

In one embodiment, a length of the sleeve measured essentially parallel to the direction of insertion is at least 50%, preferably at least 75%, particularly preferably at least 85% of the length of a sleeve receiving area of the through hole of the abutment, also measured essentially parallel to the direction of insertion. In an alternative embodiment, the sleeve can also be made longer than the sleeve receiving

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area of the through hole of the abutment. The sleeve then sticks out over the abutment, which creates additional stability.

[0061]

According to a further embodiment, at least one additional holding element is provided which encompasses the abutment holding section and is designed to interact with the abutment holding section in order to hold the abutment.

The additional holding element can be used to lengthen the holding element or its effective area or to stabilize or counter it. In particular, the additional holding element can perform support functions in addition to the holding element. The additional holding element thus helps to use the unitary connector even more flexibly in connection with different base bodies and/or abutments. An additional holding element is available for configurations with abutments that have a bore with a holding element or Have sleeve receiving area, which is much longer (z. g. more than twice as long) than the holding element, has the advantage that after inserting the holding element, the remaining space between the abutment holding section and the inner wall of the holding element or Sleeve receiving area of the bore of the abutment can be occupied by the additional holding element. As a result, the stability of the dental implant can be increased since the support surface between the abutment and the unit connector is enlarged.

[0062]

According to a further embodiment, it is provided that the holding element and/or the additional holding element is/are provided as a type of round nut with an internal thread.

The inner thread is designed in each case to complement the thread formed on the abutment holding section. Thus, the holding element and additional holding element can be easily screwed onto the abutment holding section.

[0063]

According to a further embodiment it is provided that the holding element and/or the additional holding element has an engagement means on which a tool for actuating the holding element and/or the additional holding element can be supported.

In particular, the engagement means can be designed to be complementary to a counter-engagement means of a special tool, with which holding element or Additional holding element can be actuated. In the case of a holding element that can be screwed onto the abutment holding section or additional holding element, the engagement means is designed in such a way that a torque for screwing on the holding element or Additional holding element can be transferred to this. In one embodiment, engagement means can be located at one end of the holding element or Additional retaining element, preferably be axially symmetrically arranged and formed grooves.

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[0064]

According to an additional embodiment, it is provided that a length of the unitary connector, measured essentially parallel to the direction of insertion, can be changed.

This offers the advantage that the unit connector can be shortened or lengthened in the case of dental implants of different sizes with a length that is too large or too small for the unit connector. According to a further embodiment, it is provided that the unit connector is designed so that it can be cut to length at predetermined cutting markings, depending on the size of the dental implant. The cutting marks allow the unit connector to be precisely cut to the desired length before, during or after its insertion. In particular, this offers the advantage that the unit connector can be adapted for small dental implants, for which the base body is short, by shortening the length of the unit connector. The base section and/or the abutment holding section is preferably of sufficient length so that after the unit connector has been shortened, the base section and/or the abutment holding section still have a sufficient length to ensure a connection to the base body and/or an operative connection to the abutment.

[0065]

According to a further embodiment, it is provided that the cutting marks are formed as predetermined breaking points.

The predetermined breaking points simplify precise cutting to length of the unit connector and prevent unwanted damage when cutting to length. In configurations in which the base section and/or the abutment holding section have a thread, the thread advantageously extends over such a sufficient length along the direction of insertion that, even after a shortening, a sufficient threaded piece remains to establish a connection with the base body and/or with secure the abutment. In a particularly advantageous embodiment, the abutment holding section is longer than the base section. If the unit connector is then cut to length in the area of the abutment holding section, the base section and base body remain unaffected.

[0066]

According to a further embodiment it is provided that the abutment holding section and/or the base section is designed such that it can be brought into engagement with a connector extension, preferably in the form of a bolt extension or screw extension.

Preferably, a bolt extension or screw extension can be provided for lengthening, which has an outer diameter that matches the outer diameter of the unit connector, so that there are no changes with regard to the guidance of the abutment and/or a holding element and the radial positioning of the unit connector in the through hole of the abutment result. In configurations with an external thread in the base section and a holding thread in the abutment holding section, the connector extension offers the advantage that the unitary connector can be flexibly extended at both ends as required. In configurations with a cylindrical shank section, the outside diameter of the round nut is advantageously

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equal to the outside diameter of the shank section, so that a smooth transition between the shank section and the connector extension is made possible. In addition, the unit connector can be adjusted or lengthened in the case of large dental implants with a length that would otherwise be too great for the unit connector.

The bolt extension or screw extension preferably has an outer diameter which corresponds to the outer diameter of the unit connector, so that there are no changes with regard to the guidance of the unit connector and the radial positioning in the bore of the base body.

[0067]

According to a further embodiment, a unitary connector according to the invention together with any holding and/or extension elements can be designed to be reversible, so that the function of the base and abutment holding section can be interchanged as desired according to the respective requirements.

The dimensions of the base and abutment holding section can thus be based on different types of base bodies or Abutments be matched that, for example, for certain sizes and types of the base body of the base section and used in other sizes and types of the abutment holding section and thus becomes the base holding section, while this then fulfills the function of the abutment holding section. Such a turning function allows the variability of the unit connector to be increased.

[0068]

In the unitary connection system according to the invention, the solution according to the invention can be further improved in that the unitary connection system further comprises at least one base body that can be inserted into a jawbone and/or at least one abutment holding section, which are designed to interact with the unitary connector.

A base body that can be inserted into a jawbone, an abutment that can be positively connected to the base body, and a unit connector according to the present disclosure make it possible to provide series of dental implants that can be used flexibly in a particularly cost-effective manner and that include components that can be combined with one another in a modular manner. According to a further embodiment of a unitary connection system according to the invention, it is provided that the base body has a borehole for receiving the unitary connector or that the abutment has a through borehole running essentially parallel to the direction of insertion, in which at least one shoulder is arranged, which has a stop pointing counter to the direction of insertion forms for the unit connector. The abutment therefore generally has a continuous bore and on the inside of the bore a shoulder, for example in the form of a step, via which the abutment can be pressed against the base body in a sealing manner.

[0069]

According to a further embodiment, it is provided that the bore of the base body in a half of the base body facing away from the abutment has an internal thread that can be brought into engagement with the base section.

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Thus, the unit connector can be easily screwed into the base body. The arrangement of the internal thread in the half of the base body facing away from the abutment makes it possible, with simultaneous lateral support of the unit connector in sections of the base body lying above the internal thread, to have tensile or compressive forces on the internal thread essentially only running parallel to the direction of insertion, which increases the risk of damage , such as fractures or cracks, are avoided in the area of the internal thread, which can occur in particular when threads and unfavorable introduction of force lead to undesirable notch effects.

[0070]

In other words, arranging the internal thread in the half of the base body facing away from the abutment offers the advantage that the forces occurring on the internal thread can be conducted into the lower area of the base body and can therefore be kept away from the contact area with the abutment.

This advantageously means that tensile and shearing stresses in the contact area between the abutment and the base body, in particular on the bearing surfaces, can be essentially avoided. Advantageously, mainly compressive stresses remain in the contact area, which is particularly advantageous for ceramic components, since the ceramic material is stable under compressive force, but tends to be unstable under tensile force. This arrangement therefore offers the advantage that the stability and thus the long-term success of the dental implant can be increased. According to a further embodiment, it is provided that a largest outer diameter of the unit connector is matched to a smallest inner diameter of the bore of the base body, at least in a lower half of the unit connector, such that the unit connector is guided in the base body essentially without play when it is inserted into the bore. The play-free guidance helps simplify the installation of the unit connector and increase the long-term stability of the entire implant.

[0071]

According to a further embodiment, it is provided that a smallest inner diameter of the through hole of the abutment is matched to a largest outer diameter of the holding element and/or the additional holding element such that the holding element and/or the additional holding element are or is guided in the abutment essentially without play.

The bore of the abutment preferably has a lower area facing the base body with a smaller diameter than the diameter of an upper area of the bore of the abutment facing away from the base body, which forms a receiving area for the holding element and/or the additional holding element, the two areas being connected via the Graduation adjoin one another in such a way that the abutment can be pressed in a form-fitting, sealing manner into the base body by striking the sleeve against the gradation in the axial direction of the dental implant. In configurations of the abutment with a gradation, the length of the sleeve is preferably at least 50%, particularly preferably at least 75%, very particularly preferably at least 85% of the length of the upper area or the sleeve receiving area of the bore of the abutment.

[0072]

According to a further embodiment, it is provided that the bore in the base body is configured as a continuous bore and has a cap at the lower end which at least partially covers the bore and which can be engaged with a part of the base section of the unit connector and when inserting the unit connector from the The base body is designed to be separable in such a way that when the base body and unit connector are fully inserted into the jawbone, the lower end of the unit connector presses the cap into the jawbone.

With the cap that can be separated from the base body, the flexibility of the dental implant can advantageously be further increased. If the unit connector is too long in relation to the base body, the unit connector can be inserted or screwed into the base body (in configurations with a first thread in the first end region) until the unit connector strikes the cap, finally separating the cap from the base body and presses further into the jawbone. The stability of the anchoring of the dental implant can advantageously be increased with the cap pressed further into the jawbone. Advantageously, the additional surface created by the separate cap can help increase the degree of osseointegration.

[0073]

Alternatively, the bore of the base body is designed as a blind hole.

The length of the blind hole is preferably at least 80%, particularly preferably at least 90%, of the total length of the base body. This offers the advantage that the entire length of the base body for absorbing forces such. B. screw forces, in the connection of the unit connector can be used with the base body.

[0074]

According to a further embodiment, a gap is formed between a largest outer diameter of the holding element and/or the additional holding element and the smallest inner diameter of the through hole of the abutment, the width of which is preferably between 0.001 mm and 0.1 mm.

The gap serves to provide sufficient play in the radial direction between the sleeve and the abutment so that overdetermination can be avoided. However, the play is advantageously small enough for the sleeve to be able to increase the stability in that the abutment can be supported on the sleeve when transverse forces occur.

[0075]

In one embodiment, the base body is made of ceramic, preferably zirconium oxide or is based on zirconium oxide.

In one embodiment, the abutment is made of ceramic, preferably made of zirconium oxide or based on zirconium oxide. The base body and/or the abutment are preferably manufactured from ceramics by powder injection molding processes in configurations. This offers the advantage of cost-effective production. The ceramic material offers the advantage of high biocompatibility and a high degree of

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osseointegration. In addition, the ceramic material offers a cosmetic advantage compared to titanium in the case of receding gums, which often occurs with dental implants. In configurations of the base body made of ceramic and with an internal thread, the internal thread is preferably designed as a round thread. In an advantageous variant, the first end area of the unitary connector has a trapezoidal thread in these configurations. This offers the advantage that the thread turns of the internal thread can be protected when screwing in the unit connector. In comparison to pointed threads, which can cut into the internal thread and thus damage the ceramic material, such a unit connector with a trapezoidal thread can therefore increase the long-term success of the dental implant.

[0076]

In one embodiment, the unitary connector is made of metal, preferably stainless steel and/or titanium.

[0077]

In one embodiment, the largest transverse diameter of the unit connector in the lower half of the unit connector corresponds to the largest transverse diameter of the bore of the base body in such a way that the unit connector can be guided into the bore when receiving it.

[0078]

Optionally, there is a clearance between the portion of the unit connector that is in the base body after insertion and the inner wall of the bore of the base body, so that damage due to friction when the unit connector is inserted into the base body can be minimized.

However, the play is advantageously so small that reliable guidance or

centering of the unitary connector is provided.

[0079]

In one embodiment, a transverse diameter of the unit connector corresponds to the smallest transverse diameter of the bore of the abutment in such a way that the abutment can be guided through the unit connector when it is inserted onto the base body.

[0080]

The unit connector therefore offers the advantage that the abutment can be guided or centered when positioning on the base body.

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There is preferably a clearance between the unit connector and the inner wall of the bore of the abutment, so that damage due to friction can be minimized when the abutment is positioned on the base body.

However, the play is advantageously so small that reliable guidance or

centering of the abutment is provided. In one embodiment, the largest transverse diameter of the bore of the abutment corresponds to the transverse diameter of the sleeve in such a way that the abutment can be supported on the sleeve in the transverse direction.

[0081]

In configurations with a stepped bore of the abutment and a unit connector with a cylindrical shaft and a sleeve, the smaller diameter of the bore in the lower area of the abutment facing the base body advantageously corresponds to the outside diameter of the cylindrical shaft of the unit connector.

The larger diameter of the bore in the upper area of the abutment facing away from the base body, which forms the sleeve receiving area, advantageously corresponds to the outer diameter of the sleeve, so that the abutment can be supported on the sleeve and the stability of the dental implant can be increased in the event of transverse forces occurring. In the lower area of the bore of the abutment, the abutment can advantageously be supported on the cylindrical shaft or partially on the second end area of the unit connector when transverse forces occur.

[0082]

In one embodiment, the abutment has an extension and the base body has a recess, the extension being able to be inserted into the recess.

A twist-proof form fit is preferably provided by the extension of the abutment and the recess of the base body. In one variant, the anti-twist form fit is provided by a radially non-uniform structure of the extension (i.e. in the tangential direction). In a further variant, the extension has radial projections, which form contact surfaces pointing in the tangential direction and can engage in radial grooves of the recess of the base body.

[0083]

character description

[0084]

The invention is to be explained in more detail below using exemplary embodiments in connection with the figures and the associated description.

Show it:

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[0085]

1 shows a sectional illustration of a first embodiment of a unitary connector according to the invention; a sectional view of a second embodiment of a unitary connector according to the invention; a sectional view of a dental implant with a first embodiment of a unitary connection system according to the invention; a sectional view of a dental implant with a second embodiment of a unitary connection system according to the invention; a sectional view of the dental implant shown in FIG. 3 along the section line A-A drawn in FIG. 3; a schematic exploded view of a further embodiment of a dental implant according to the invention; a schematic cross-sectional view along a longitudinal axis of the dental implant shown in FIG. 6 in a pre-assembly state; a schematic cross-sectional view along the longitudinal axis of the in Figs. 6 and 7 shown dental implant in a final assembly state; a schematic exploded view of an additional embodiment of a dental implant according to the invention; a detail IX of the dental implant shown in Figure 9; a schematic cross-sectional view along a longitudinal axis of the dental implant shown in Figures 9 and 10 in a pre-assembly state; a detail XI of the one shown in Figs. 9 to 11 shown dental implant; and a schematic cross-sectional view along the longitudinal axis of the in Figs. 9 to 12 shown dental implant in a final assembly state.

implementation of the invention

[0086]

In the following, the invention is described in more detail by way of example on the basis of possible embodiments with reference to the accompanying drawings.

The feature combinations shown in these embodiments are for illustrative purposes only.

Depending on the advantages described above, individual features can also be omitted if the advantage of the respective feature is not important in certain applications. In the description of the embodiments, the same features and elements are provided with the same reference symbols for the sake of simplicity. In different embodiments, features and elements with the same or similar function can be provided with one or more apostrophes in order to assign them to an embodiment for the sake of illustration, whereby this assignment is not to be construed as limiting to the respective embodiment.

[0087]

FIG. 1 shows a sectional illustration of a first embodiment of a unitary connector 1 according to the invention.

The unit connector 1 has a base section 11 with a first external thread 111 and an abutment holding section 12 with a holding thread 121 . Between the sections 11, 12, the unit connector has a cylindrical shank section 13, so that the unit connector 1 has the shape of a stud with a central axis Mi, along which the unit connector 1 is to be inserted or screwed in an insertion direction I.

[0088]

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The unit connector 1 has an overall length measured parallel to the insertion direction I.

The base section 1 1 and the external thread 1 1 1 have a length l_n or Lm, which are 0.2 to 0.3 times, preferably 0.25 times, corresponding to a quarter of the total length U. The abutment holding section 12 and the holding thread 121 have a length L12 or Ln2 which are 0.3 to 0.6 times, preferably 0.4 to 0.5 times, most preferably 0.416 times corresponding to five twelfths of the total length Li. The shaft section 13 has a length Li3 measured parallel to the insertion direction I, which is 0.3 to 0.4 times, preferably 0.333 times, corresponding to one third of the total length Li. The unit connector 1 is made of, for example, stainless steel, titanium and/or ceramics. In certain embodiments, it may be particularly advantageous to fabricate the unitary connector from stainless steel and/or titanium, particularly when received within an otherwise ceramic implant hermetically sealed from the jaw and gums, so that the issue of biocompatibility for the unitary connector 1 itself of rather secondary importance and may be subordinate to an optimization of its mechanical properties.

[0089]

Figure 2 shows a sectional view of a second embodiment of a unit connector 1 'with a base portion 1 1' and a first external thread 1 1 1 'and an abutment holding portion 12' and a holding thread 121 '.

A bolt extension 14' is attached in a suitable manner to the base section 11'. For example, the bolt extension 14' can be connected to the base section 11' by means of a screw connection in a recess on the central axis of the base section 11' or by means of an adhesive connection on its end face. The bolt extension 14' has an extension thread 141 which can be brought into engagement with an internal thread of a base body of a dental implant. The unit connector 1' can be lengthened by means of the bolt extension 14' and can therefore be used for long dental implants. Alternatively or additionally, the bolt extension 14' can also be attached to the abutment holding section 12' in an analogous manner in order to lengthen it.

[0090]

Similar to the unit connector 1, the unit connector 1' has a total length Lr measured parallel to the direction of insertion I, which can be, for example, a sum of the total length Li of the unit connector 1 plus a length Li4* of the bolt extension 14' measured parallel to the direction of insertion I.

The base section 1 1 'and the external thread 1 1 1' have a length measured parallel to the insertion direction I Lir and Luv, which are also 0.2 to 0.3 times, preferably 0.25 times, corresponding to a quarter of the total length Li. The abutment holding section 12' and the holding thread 121' have a length Li2* or lm; which are 0.3 to 0.6 times, preferably 0.4 to 0.5 times, most preferably 0.416 times, corresponding to five twelfths of the total length Li. The shaft section 13' has a length Li3', measured parallel to the insertion direction I, which is 0.3 to 0.4 times, preferably 0.333 times, corresponding to one third of the total length Li. With the help of the bolt extension 14', the above-mentioned length ratios derived from the unit connector 1' between the individual sections of the unit connector 1' in relation to its overall length l_r can be shifted or adjusted according to the respective requirements.

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The shift or Adaptation of the length ratios results from the length Li4* of the bolt extension 14', the overall length Li of the unit connector 1 representing a type of basic length which can be varied using different types of bolt extension 14'.

[0091]

In the present exemplary embodiment of the unit connector 1' with bolt extension 14', the length Li4* is 0.3 to 0.4 times, preferably 0.333 times, corresponding to one third of the total length Li.

The length of the extension thread can thus in turn correspond to the length Lu v of the external thread. The unit connector 1 or 1' can thus be incrementally lengthened or optionally shortened by bolt extensions 14' by a factor of 0.3 to 0.4, preferably 0.333 times, corresponding to a third of the total length Li, if it was originally provided with at least one bolt extension 14' and is designed to be cut to length by removing the at least one bolt extension 14'.

[0092]

FIG. 3 shows a sectional illustration of a dental implant 100 with a first embodiment of a unitary connection system according to the invention.

The dental implant 100 comprises a base body 130, an abutment 120 and a tooth structure 110. The insertion direction I of the dental implant 100 is shown with an arrow. The base body 130 and the abutment 120 are preferably made of a ceramic material. The base body 130 has an external thread 133 in the form of a round thread. Furthermore, the base body 130 has a bore 131 in the form of a blind hole, the bore 131 having an internal thread 132 in the lower half of the base body 130 facing away from the abutment 120 . In order to clarify the information "above" or "below", the coordinate system is drawn in the figure. The female thread 132 is engaged with a first male thread 1 1 1" in the base portion 1 1" of a unitary connector 1" inserted into the bore 131.

[0093]

The length Lm of the first external thread 111" is slightly less than a length L132 of the internal thread 132 measured parallel to the insertion direction I.

The internal thread 132 is designed as a round thread. The diameter of the bore 131 corresponds to the diameter of the unit connector 1", so that the unit connector 1" is guided when it is inserted into the base body 130. The abutment 120 has a through hole 1200 with an upper area 1201 and a lower area 1202 , the diameter of the through hole 1200 in the upper area 1201 being larger than the diameter of the through hole 1200 in the lower area 1202 . The upper portion 1201 abuts the lower portion 1202 via a shoulder 1203 .

[0094]

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The diameter of the through hole 1200 in the lower area 1202 corresponds to the diameter of the cylindrical shaft section of the unit connector 1", so that the abutment 120 is guided through the cylindrical shaft section 13" of the unit connector 1" when placed on the base body 130.

The length 3 of the cylindrical shaft section 13" is advantageously dimensioned such that it optimally supports both the abutment 120 and the base body laterally and absorbs and releases any transverse and/or shearing forces as far as possible from the base section 11" and abutment holding section 12".

[0095]

A holding element 15 is inserted into the through hole 1200 in the upper region 1201 and is engaged with the holding thread 121" in the abutment holding section 12" of the unit connector 1" or is screwed on via an internal thread 152 of the holding element 15.

The abutment holding section 12" has a length L12. The holding element 15 is also made of stainless steel, titanium and/or ceramics. The outer diameter of the holding element 15 corresponds to the diameter of the upper area 1201 of the through hole 1200 of the abutment 120, which forms the sleeve receiving area, so that the abutment 120 can bear against the holding element 15 when transverse forces occur, which increases the stability of the dental implant 100. There is a gap between the lateral outer surface of the holding element 15 and the lateral inner surface of the upper region 1201 of the through hole 1200, which ensures play. The retaining element 15 has engagement means 151 in the form of notches which can be engaged with a suitable key (not shown).

[0096]

With the right tool or

Key, the holding element 15 can be screwed onto the abutment holding section 121 "of the unit connector 1" by means of the engagement means 151. The retaining member 15 has an internal thread 152 which is engaged with the retaining thread 121" of the unit connector 1". By screwing on the holding element 15, an operative connection is established between the unit connector 1" and the abutment 120 in such a way that the abutment 120 is pressed by the holding element 15 over the shoulder 1203 onto the base body 130, thus creating a sealed form-fitting connection between the abutment 120 and the base body 130 is produced. When the holding element 15 is screwed on, the contact surface 125 of the abutment 120 rests on the contact surface 134 of the base body 130 .

[0097]

The abutment 120 also has an extension 124a,b, which is accommodated in a form-fitting receptacle 135 in the form of a depression in the base body 130.

The extension 124a,b is designed asymmetrically in the radial direction, so that a non-rotating form fit is ensured. In cross section (in the y-direction) the extension 124a,b has projections which are shown in cross section in FIG. It can be seen in FIG. 3 or 4 that the abutment holding section 12” of the unit

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connector 1″ projects beyond the abutment 120. Before putting on the tooth structure 110, the unit connector 1" can be cut to length in the abutment holding section 12" if the overhang should be too large. Alternatively or in addition, a recess 1101 in the tooth structure 110, as shown in the figure, can be used, which accommodates the overhang of the abutment holding section 12".

[0098]

FIG. 4 shows a second embodiment of a dental implant 100' according to the invention.

In contrast to the dental implant 100 shown in FIG. 3, the dental implant 100' has an abutment 120', the length of which, measured parallel to the direction of insertion I, is greater than the length of the abutment 120, measured parallel to the direction of insertion I. Accordingly, an upper end of a unit connector 1″ of the dental implant 100′ protrudes less out of the through hole 1200′ over the upper edge of the abutment 120′ than in the dental implant 100.

[0099]

The dental implant 100' is provided with an additional holding element 16.

The additional retaining element 16 is screwed onto the retaining thread 121" of the unit connector 1" adjacent to the retaining element 15'. The auxiliary holding member 16 has an internal thread which is engaged with the holding thread 121'' of the unit connector 1''. The additional holding element 16 has engagement means 161, by means of which the additional holding element 16 can be screwed onto the holding thread 121″. The additional support element 16 increases the stability of the dental implant 100' since the area over which the abutment 120' can be supported is increased. The length of the holding element 15' and the length of the additional holding element 16 almost corresponds to the length of the upper region 1201' of the through hole 1200'. In this way, the abutment 120′ can rest laterally both on the preferably sleeve-shaped holding element 15′ and on the likewise preferably sleeve-shaped additional holding element 16 when transverse forces are acting on the dental implant 100′.

[0100]

The double arrow F is shown in FIG. 4 as an illustration, which is intended to represent transverse forces that occur.

The forces F can lead to torques which, without retaining elements or with short retaining elements, would essentially be concentrated on the lower area of the through hole 1200' of the abutment 120'. Long holding elements 15′ or additional holding elements 16 enable lateral support of the abutment 120′ in the event of transverse forces F, so that the torques that occur can be distributed and absorbed essentially along the entire length of the through hole 1200′.

[0101]

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FIG. 5 shows the dental implant 100 shown in FIG. 3 in a schematic cross-sectional view along the section line A-A drawn in FIG.

Projection-like positive elements 126 are formed on the outside of the extension 124a, b and extend radially away from the extension 124a, b and run parallel to the insertion direction I. The receptacle 135 is provided with negative elements 136, which also run parallel to the insertion direction I and are designed to be complementary to the positive elements 126.

[0102]

The positive elements 126 interact in a form-fitting manner with the negative elements 136 in such a way that, in the assembled state, relative movements, in particular rotary movements, of the abutment 120 in relation to the base body 130 are prevented.

At the same time, positive elements 126 and negative elements 136 together define a circular grid of rotational positions along which a rotational alignment of abutment 120 and base body 130 relative to one another can be freely selected in incremental steps before they are assembled. Depending on the nature of the retaining threads 121, 121' as such and due to their variable positionability along the direction of insertion I thanks to the described ability to lengthen and/or shorten, unit connectors 1, 1' according to the invention provide a large number of retaining positions for the abutment 120 spaced apart from one another along the direction of insertion I , 120' ready.

[0103]

Fig. 6 shows a schematic exploded view of a further embodiment of a dental implant 200 according to the invention.

The dental implant 200 comprises a connector 2 preferably made of a metal or a metal alloy, such as titanium or a titanium alloy, a prosthesis 220 preferably made of ceramic, such as zirconium oxide, here for example in the form of a head of a healing screw, and a preferably also made of ceramic , such as zirconium oxide, manufactured base body 230. Connector 2, prosthesis 220 and base body 230 are arranged concentrically to a central axis M of the dental implant 200 running parallel to the insertion direction I.

[0104]

The connector 2 has a base portion 21, a holding portion 22 and a shank portion 23.

A base thread 21 1 is formed on the base section 21 and is designed to be screwed into the base body 230 in the direction of insertion I. As with the abutment holding section 12, 12', 12'', a holding thread 221 is formed around the holding section 22 (see Fig. Figures 1 to 3). The retaining thread 221 is designed to be screwed into the prosthesis 220 counter to the insertion direction I and to interact with the retaining element 15, 15' (see Fig. Characters. 3 and 4). The shank section 23 is cylindrical and arranged rotationally symmetrically to the central axis and, thanks to its cylindrical outer peripheral

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surface, offers a support surface 27 which points in a radial direction R of the connector 2 running radially away from the central axis M.

[0105]

An annular collar 28 of the connector 2 is also configured cylindrically and is arranged rotationally symmetrically to the central axis M lying between the holding section 22 and the shaft section 23 .

A diameter of the annular collar 28 measured parallel to the radial direction R is greater than a diameter of the shank section 23 also measured parallel to the radial direction R. The annular collar 28 thus protrudes beyond the shank section 23 in the radial direction R and forms a shoulder element 28a pointing in the insertion direction I and a shoulder element 28b pointing counter to the insertion direction I.

[0106]

Furthermore, the connector 2 is provided with annular grooves 29, each between the base section 21 and

Base thread 21 1 and shank section 23, between shank section 23 and annular collar 28 and between annular collar 28 and holding section 22 or Holding threads 221 are arranged. The connector 2 is tapered or constricted at the annular grooves 29, so that a diameter of the connector 2 measured parallel to the radial direction R, at least at the bottom of the annular grooves 29, is smaller than the corresponding diameter of the sections of the connector 2 adjoining the annular grooves 29.

[0107]

Furthermore, an upper end section of the connector 2 running away from the holding section 22 counter to the insertion direction I is formed as an engagement means 251, on which a torque acting about the central axis M can be transmitted to the connector 2 with a tool (not shown).

A diameter of the engagement means 251 measured parallel to the radial direction R is smaller than a diameter of the retaining thread 221 measured in the radial direction R. In the present example, the engagement means 251 has an outer contour on its outer circumference, which is designed as a hexagon in the present exemplary embodiment.

[0108]

The prosthesis 220 is designed, for example, rotationally symmetrically to the central axis M and has an extension 224, a contact surface 225, a truncated cone-shaped transition section 227, a head part 228 and an engagement element 229.

Alternatively, the prosthesis 220 can also be configured asymmetrically to the central axis M. The extension has a diameter measured parallel to the radial direction R, which is smaller than the diameter of the transition section 227, also measured parallel to the radial direction R, whereby between the extension 224 and the transition section

[0109]

227

the contact surface 225 pointing in the insertion direction I is formed. That in the headboard

[0110]

228

The molded engagement element 229 is designed, for example, as a hexagon socket or, as in the present case, as a hexalobular socket and allows a torque acting about the central axis M to be transmitted to the prosthesis 220 with the aid of a tool (not shown). Like the base body 130, the base body 230 has a bore 231 in which an internal thread 232 (see Fig. Fig. 7) is formed. Like the base body 130 , the base body 230 is provided with an external thread 233 on the outer circumference. Also formed on the base body 230 as on the base body 130 is a contact surface 234 pointing counter to the direction of insertion I, which surrounds the bore 231 or its opening. An upper part of the bore 231 serves as a receptacle 235 for the extension 224 of the prosthesis 220.

[0111]

Fig. 7 shows a schematic cross-sectional view along the central axis M of the dental implant 200 in a pre-assembly state V. In the pre-assembly state V, the connector 2 is inserted into the base body 230, the base section 21 with the base thread 21 1 being arranged in a lower region of the bore 231 , where the internal thread 232 is formed in this.

The shaft section 23 of the connector 2 is arranged above the internal thread 232 of the base body 230 . Between the support surface 27 of the shank section 23 and the inner circumference of the part of the bore 231 surrounding the shank section 23, there is as little play as possible, preferably hardly any or no play at all, for example in that the shank section 23 and the bore 231 are designed with a clearance fit or transition fit in this area. Thus, the shank section 23 preferably supports the connector 2 in the bore 231 above the internal thread 232 all around, which helps to keep lateral forces acting in the radial direction R and bending moments away from the internal thread 232, so that normal forces essentially only acting in the direction of the central axis M occur there .

[0112]

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The annular collar 28 or the shoulder element 28a provided by it rests on a counter-shoulder element 236 which is formed in the bore 231 .

The counter-shoulder element 236 is formed between the lower part of the bore 231 and the seat 235 and delimits the seat 235 in the insertion direction I. In other words, a diameter of the lower part of the bore 231 measured parallel to the radial direction R is smaller than one parallel to the radial direction R measured diameter of the mount 235. The holding section 22 with the holding thread 221 is arranged completely within the receptacle 235 . The engagement means 251 projects beyond the contact surface 234 out of the receptacle 235 counter to the insertion direction I and thus projects from the dental implant 200 in the pre-assembly state V, so that the engagement means 251 is arranged so that it is easily accessible for a tool. Fig. 8 shows a schematic cross-sectional view along the central axis of the dental implant 200 in a final assembly state E. The dental implant 200 can be transferred from the pre-assembly state V to the final assembly state E by screwing the prosthesis 220 onto the connector 2 in the insertion direction I.

For this purpose, the prosthesis 220 is analogous to the bore 231 of the base body 230 with a blind hole-like recess 2101 arranged concentrically to the central axis M. In a lower part of the recess 2101 , which extends essentially in the insertion direction I along the extension 224 , the recess 2101 is provided with a counter-retaining thread 2102 which is in engagement with the retaining thread 221 . The engagement means 251 is accommodated in the recess 2101 with a certain radial play relative to the recess 2101 and is enclosed therein by the head part 228 .

[0113]

In the final assembly state E, the contact surface 225 of the prosthesis 2 rests flush and sealingly on the contact surface 234 of the base body 230 .

Consequently, the receptacle 235 is hermetically sealed. It can thus be ensured that the connector 2 does not come into contact with the gums or is shielded from the entire oral cavity. The extension 224 protrudes into the receptacle 235 in the direction of insertion I, with the smallest possible to preferably hardly any or no play being present between an outer circumference of the extension 224 and an inner circumference of the receptacle 235, for example in the extension 224 and receptacle 235 in this area with a Clearance fit or transition fit are designed. In the radial direction R, a wall of the base body 230 that forms the receptacle 235 overlaps with the prosthesis 220 and the connector 2, as a result of which they form a compact and highly stable assembly. An end face 240 on the extension of the prosthesis 220 pointing in the direction of insertion I is formed on the extension 224 and arranged at a distance from the shoulder element 28b in the direction of insertion I.

[0114]

Fig. 9 shows a schematic exploded view of an additional embodiment of a dental implant 300 according to the invention.

Like the dental implant 200, the dental implant 300 comprises a connector 3 preferably made of a metal or a metal alloy, such as titanium or a titanium alloy, a prosthesis 320 preferably made of ceramic, such

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as zirconium oxide, here also for example in the form of a head of a healing screw, and a base body 330, preferably also made of ceramic, such as zirconium oxide, which is shaped identically to base body 230 in the present example. Connector 3, prosthesis 320 and base body 330 are arranged concentrically to the central axis M of the dental implant 300. In the following, for the sake of brevity, the differences between the dental implant 300 and the dental implant 200 will mainly be discussed.

[0115]

The connector 3 has a base portion 31, a holding portion 32 and a shank portion 33.

A base thread 31 1 is formed on the base section 31 and is designed to be screwed into the base body 330 in the insertion direction I. As in the case of the abutment holding section 12, 12', 12'', 22, a holding thread 321 is formed on the holding section 32. The retaining thread 321 is designed to be screwed into the prosthesis 320 counter to the insertion direction I and to interact with the retaining element 15, 15' (see Fig. Characters. 3 and 4). The shaft section 33 is cylindrical and arranged rotationally symmetrically to the central axis M and thus offers a support surface 37 due to its cylindrical outer peripheral surface.

[0116]

An annular collar 38 of the connector 3 is arranged between the holding section 32 and the shaft section 33 lying rotationally symmetrically to the central axis M and is formed at least in sections as an engagement means 351 .

Similar to the engagement means 251 of the connector 2, the engagement means 351 has an outer contour which is designed to interact with a tool in order to transmit a torque to the connector 3 with the aid of the tool. The engagement means 351 is preferably designed as an external hexagon. A diameter of annular collar 38, including engagement means 351, measured parallel to radial direction R is larger than a diameter of shaft section 33, also measured parallel to radial direction R. The annular collar 38 thus protrudes beyond the shank section 33 and therefore offers a shoulder element 38b pointing counter to the insertion direction I.

[0117]

Furthermore, the connector 3 is provided with annular grooves 39, each between the base section 31 and

Base thread 31 1 and shank section 33, between shank section 33 and annular collar 38 and between annular collar 38 and holding section 32 or Holding threads 321 are arranged. The connector 3 is tapered or constricted at the annular grooves 39, so that a diameter of the connector 3 measured parallel to the radial direction R at the bottom of the annular grooves 39 is smaller than a diameter of sections of the connector 3 adjoining the annular grooves 39. The prosthesis 320 is rotationally symmetrical to the central axis M and, like the prosthesis 220, has an extension 324, a contact surface 325, a transition section 327 in the shape of a truncated cone, a head part 328 and an engagement element 329 (see Fig.

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1). The extension 324 has a diameter measured parallel to the radial direction R, which is smaller than the diameter of the transition section 327, also measured parallel to the radial direction R, whereby the contact surface 325 pointing in the insertion direction I is formed between the extension 324 and the transition section 327. The engagement element 329 formed in the head part 328 is designed, for example, as a hexagon socket or, as in the present case, as a hexalobular socket and allows a torque acting about the central axis M to be transmitted to the prosthesis 320 with the aid of a tool (not shown). In contrast to the prosthesis 220, the prosthesis 330 has a specially shaped end face 340, which will be discussed in detail further below.

[0118]

Like the base bodies 130 and 230, the base body 330 has a bore 331 in which an internal thread 332 (see Fig.

Fig. 13) is formed. Like the base bodies 130 and 230 , the base body 330 is provided with an external thread 333 on the outer circumference. Also formed on the base body 330 as on the base bodies 130 and 230 is a contact surface 334 pointing counter to the direction of insertion I, which surrounds the bore 331 . An upper part of the bore 331 serves as a receptacle 335 for the extension 324 of the prosthesis 320 (see Fig. 13).

[0119]

Fig. 10 shows a detail IX of the dental implant 300 shown in Fig. 9, in particular the end face 340 of the prosthesis 320.

The end face 340 forms an annular edge around a recess 3101 of the prosthesis 320 which is designed similarly to the recess 2101 of the prosthesis 220 and is provided with a retaining thread 3102 . A toothing 341 is formed on the end face 340 . The toothing 341 is formed from a multiplicity of teeth 342 which surround the recess 3101 like a ring.

[0120]

The teeth 342 protrude from the end face 340 in the insertion direction I, similar to a so-called Hirth toothing.

Tooth tips 343 of the teeth 342 form edges running essentially parallel to the radial direction R. The teeth 342 are inclined counter to a screwing direction S of the prosthesis 320 running clockwise around the central axis in a projection along the direction of insertion I. Due to the inclination, the teeth 342 each have a flat tooth flank 344 pointing in the screwing direction S and a steep tooth flank 345 pointing counter to the screwing direction S.

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[0121]

Fig. 1 1 shows a schematic cross-sectional view along a central axis M of the dental implant 300 shown in Fig. 9 and 10 in a further pre-assembly state V. In the further pre-assembly state V, the prosthesis 320 with the counter-retaining thread 3102 formed in its recess 3101 is in the direction of insertion I on the Retaining thread 321 of the retaining portion 32 of the connector 3 is screwed.

The face 340 of the prosthesis 320 is brought into contact with the shoulder member 38b. A cavity 50 is formed in the area of the annular groove 39 arranged between the holding area 32 and the annular collar 38 . The cavity 50 can be at least partially filled with an adhesive 51, for example.

[0122]

Fig. 12 shows a detail XI in Figs. 9 to 11 shown dental implant 300.

It is clear here that the teeth 342 have displaced the material of the prosthesis 320 when screwing it onto the connector 3 and thus a form fit between the prosthesis 320 and the connector 3 is brought about. Due to the inclination of the teeth 342 against the screwing direction S, this form fit is particularly effective when torques about the central axis M act against the screwing direction S on the prosthesis 320 relative to the connector 3, so that there is an intimate connection between the prosthesis 320 and the connector 3.

[0123]

The flat tooth flanks 344 promote a relative movement between the prosthesis 320 and the connector 3 when the prosthesis 320 is screwed on when the end face 340 meets the shoulder element 38b.

The steep tooth flanks 345, which, for example, run essentially parallel to the direction of insertion I or can even have an undercut, prevent the screw connection between the prosthesis 320 and connector 3 from loosening by moving the prosthesis 320 counter to the screwing direction S relative to the connector when attempting to do so 3 to rotate in its material and thus inhibit the relative rotation or at best lock the prosthesis 320 and connector 3 against each other.

[0124]

The adhesive 51 promotes an intimate connection between the prosthesis 320 and the connector 3 and can, for example, be applied to the retaining thread 321 and/or counter-retaining thread 3102 and/or, as shown, be arranged in the cavity 50 .

Indentation 341 and/or adhesive 51 can thus be used according to the invention to connect the prosthesis 320 to the connector 3 with high strength or as inseparably as possible. Serration 341 and/or adhesive 51 thus help to form a hybrid implant screw 4 comprising at least one metallic component such as connector 3 and at least one ceramic component such as prosthetic 320 .

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[0125]

Fig. 13 shows a schematic cross-sectional view along the longitudinal axis of the in Figs. 9 to 12 shown dental implant in a further final assembly state E '.

In the final assembly state E', the connector 3 and the prosthesis 320 are inserted into the base body 330 together or as a hybrid implant screw 4 . For insertion, the base section 31 with the base thread 31 1 of the connector 3 or the hybrid implant screw 4 is screwed into the internal thread 332 of the base body 330 using the engagement element 329 of the prosthesis for applying a tool (not shown). The shank section 33 of the connector 3 or of the hybrid implant screw 4 is accommodated in a section of the bore 331 arranged above the internal thread 332 .

[0126]

Between the support surface 37 of the shank section 33 and the inner circumference of the bore 331 there is as little as possible to preferably little or no play, for example by the shank section 33 and bore 331 being designed with a clearance fit or transition fit in this area.

Thus, the shaft section 33 supports the connector 3 in the bore 331 above the internal thread 332, which helps to keep lateral forces acting in the radial direction R and bending moments away from the internal thread 332, so that there essentially only normal forces acting in the direction along the central axis M occur.

[0127]

In the final assembly state E', the contact surface 325 of the prosthesis 320 lies flush and sealed on the contact surface 334 of the base body 330, as a result of which the receptacle 335 is hermetically sealed.

It can thus be ensured that the connector 3 does not come into contact with the gums or is shielded from the entire oral cavity. The extension 324 protrudes into the receptacle 335 in the direction of insertion I, with preferably little or preferably hardly any play between an outer circumference of the extension 324 and an inner circumference of the receptacle 335, for example in the extension 324 and receptacle 335 in this area with a Clearance fit or transition fit are designed. In the radial direction R, a wall of the base body 330 that forms the receptacle 335 overlaps with the prosthesis 320 and the connector 3, as a result of which they form a compact and highly stable assembly. Through the use of prosthesis 320 and connector 3 as a hybrid implant screw 4, the dental implant 300 can be handled like a two-part dental implant.

[0128]

Reference List

[0129]

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I, V, 1", 2, 3 unit connector or connector 4 hybrid implant screw

[0130]

II, 11', 11", 21, 31 base section

[0131]

III, 111', 111", 211, 311 base thread / lower external thread

[0132]

12, 12', 12", 22, 32 abutment holding section/holding section 121, 121', 121", 221, 321 holding thread/upper external thread)

[0133]

13, 13', 13", 23, 33 shank section

[0134]

14' bolt extension

[0135]

141 extension thread

[0136]

100, 100', 200, 300 dental implant

[0137]

110 tooth structure

[0138]

1101, 2101, 3101 recess

[0139]

2102, 3102 counter thread

[0140]

120, 120', 220, 320 abutment / prosthetics

[0141]

1200, 1200' through hole

[0142]

1201, 1201' upper area of the through hole 1202 lower area of the through hole 1203 shoulder

[0143]

124a, b, 224 process

[0144]

125, 225 contact surface

[0145]

126 positive element

[0146]

130, 230, 330 base body

[0147]

131, 231, 331 drilling

[0148]

132, 232, 332 inner thread

[0149]

133, 233, 333 external thread

[0150]

134, 234, 334 contact surface

[0151]

135, 235, 335 admission

[0152]

236, 336 counter shoulder element

[0153]

136 negative element

[0154]

227, 327 transition section

[0155]

228, 328 headboard

[0156]

229, 329 engagement element

[0157]

240, 340 face

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[0158]

341 gearing

[0159]

342 tooth

[0160]

343 tooth tips

[0161]

344 flat tooth flank 345 steep tooth flank

[0162]

15, 15' holding element

[0163]

151 , 151', 251, 351 engaging means

[0164]

152, 152' inner thread

[0165]

153 holding surface

[0166]

16 additional holding element

[0167]

161 means of intervention

[0168]

27, 37 support surface

[0169]

28, 38 ring collar

[0170]

28a, 28b, 38b shoulder element

[0171]

29, 39 ring groove

[0172]

50 cavity

[0173]

51 adhesive

[0174]

E final assembly state

[0175]

I direction of insertion

[0176]

L11 , Li r Length of base section

[0177]

Ll2, Ll2' length of the abutment holding section Ll3, Ll3' length of the shaft section Ll4" length of the bolt extension

[0178]

Ln i , Li i i- length of the first external thread

[0179]

Ll 12, Ll 12' length of the abutment holding section

[0180]

Ll32 length of internal thread

[0181]

Ll 41 length of extension thread

[0182]

M central axis

[0183]

s screw direction

[0184]

R radial direction

[0185]

V, V Pre-assembly condition

CLAIMS WO2018029651A1

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1.

patent claims

1.

Implant screw (4) for an implant, in particular for a dental implant (100, 100', 200, 300),

with a ceramic head part (228, 328) and

with a non-ceramic base thread (111, 111', 111", 211, 311) which can be screwed into a base body (130, 230, 330) of the dental implant (100, 100', 200, 300).

2.

Implant screw (4) according to claim 1, characterized in that the

The head part (228, 328) is connected to the base thread (111, 111', 111", 211, 311) via a form fit for transmitting a torque acting about a central axis (M) of the implant screw (4).

3.

Implant screw (4) according to Claim 1 or 2, characterized in that the head part (228, 328) is provided with a recess (1101, 2101, 3101) in which a connector (1, 1', 1", 2nd , 3) on which the base thread (111, 111', 111", 211,311) is formed.

4.

Implant screw (4) according to claim 3, characterized in that in the

Recess (1101, 2101, 3101) a retaining thread (2102, 3102) for screwing the head part (228, 328) onto the connector (1, 1', 1", 2, 3) is arranged.

5.

Implant screw (4) according to claim 4, characterized in that the

A counter-holding thread (2102, 3102) is associated with a toothing (341) connected to the head part (228, 328).

6.

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Implant screw (4) according to claim 5, characterized in that the

Toothing (341) encircles the retaining thread (2102, 3102).

7.

Implant screw (4) according to Claim 5 or 6, characterized in that the teeth (341) have flat tooth flanks (344) and/or steep tooth flanks (345), the flat tooth flanks (344) pointing in a screwing direction (S) of the counter-retaining thread (2102, 3102) or the steep tooth flanks (345) point in the opposite direction to the screwing direction (S).

8.

Implant screw (4) according to at least one of the above claims 3 to 7, characterized in that an end face (240, 340) connected to the head part (228, 328) points in the direction of the base thread (1 1 1 , 1 1 1 ', 1st 1 1 ", 21 1 , 31 1) points out and/or bears against the connector (1, 1', 1", 2, 3) at least in sections.

9.

Implant screw (4) according to claim 8, characterized in that the

End face (240, 340) is annular.

10.

Implant screw (4) according to Claim 8 or 9, characterized by at least one tooth (342) formed on the face (240, 340) and on which a tooth tip (343) pointing away from the face is formed.

1 1

.

Implant screw according to at least one of Claims 5 to 7 and Claim 10, characterized in that the at least one tooth (342) forms the toothing (341) at least in sections.

12.

Implant screw (4) according to at least one of Claims 3 to 11, characterized in that the connector (1, 1', 1", 2, 3) has a holding section (12, 12', 12", 22, 32), on which a retaining thread (121, 131, 131', 221, 321) for screwing the head part (228, 328) onto the connector (1, 1', 1", 2, 3) is formed.

13.

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Implant screw (4) according to at least one of Claims 3 to 12, characterized in that the connector (1, 1', 1", 2, 3) has an annular collar (28, 38) which extends at least in sections in the direction of the head part (228 , 328).

14.

Implant screw (4) according to at least Claim 13, characterized in that at least one engagement means (151, 151', 251, 351) for attaching a tool for screwing in the connector (1, 1', 1", 2, 2') on the collar (28.38) is formed.

15.

Implant screw (4) of at least one of the above claims, characterized in that at least one engagement element (229, 329) for attaching a tool for screwing in the implant screw (4) is formed on the head part (228, 328).

16.

Implant screw (4) according to at least one of the above claims, characterized in that the head part (228, 328) is bonded to the base thread (111, 111', 111", 211, 311).

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 18/328,730	Filing Date 06/03/2023	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $40 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $192 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	12/05/2023	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0		x $40 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $192 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/JAMES W TUNSTALL/
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The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

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NOTICE OF ALLOWANCE AND FEE(S) DUE

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EXAMINER	
HUYNH, COURTNEY NGUYEN	
ART UNIT	PAPER NUMBER
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/328,730	06/03/2023	Brandon Dale Kofford	SDC010	2867

TITLE OF INVENTION: Screw-attached Pick-up Dental Coping System and Methods

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0.00	$0.00	$480	04/17/2024

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

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I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

112823 7590 01/17/2024

Daniel J Whittle
1229 Modoc Dr
Bellingham, WA 98229

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via the USPTO patent electronic filing system or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/328,730	06/03/2023	Brandon Dale Kofford	SDC010	2867

TITLE OF INVENTION: Screw-attached Pick-up Dental Coping System and Methods

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0.00	$0.00	$480	04/17/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS
HUYNH, COURTNEY NGUYEN	3772	433-173000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required)

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via the USPTO patent electronic filing system ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

❑ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/328,730	06/03/2023	Brandon Dale Kofford	SDC010	2867

112823 7590 01/17/2024

Daniel J Whittle
1229 Modoc Dr
Bellingham, WA 98229

EXAMINER	
HUYNH, COURTNEY NGUYEN	
ART UNIT	PAPER NUMBER
3772	

DATE MAILED: 01/17/2024

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013).
https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf

Routine uses of the information in this record may include disclosure to:

1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
2) a federal, state, local, or international agency, in response to its request;
3) a contractor of the USPTO having need for the information in order to perform a contract;
4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;
5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));
9) the Office of Personnel Management (OPM) for personnel research purposes; and
10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Notice of Allowability	Application No. 18/328,730	Applicant(s) Kofford et al.	
	Examiner COURTNEY N HUYNH	Art Unit 3772	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the response filed 05 December 2023.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 18-29 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☑ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☑ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date X .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 22 Sept 2022, 05 Dec 2023.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☑ Interview Summary (PTO-413), Paper No./Mail Date. X.
5. ☑ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/C.N.H./ Examiner, Art Unit 3772	/Cris L. Rodriguez/ Supervisory Patent Examiner, Art Unit 3772

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: post threads 181 and abutment threads 182 in Specification paragraph [0134] are not present in Fig. 4.

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: reference character 150 in Fig. 9.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Election/Restrictions

4. Claims 18-29 are allowable. The restriction requirement of claims 19 and 23, as set forth in the Office action mailed on 07 September 2023, has been reconsidered in view of the allowability of claims to the elected invention pursuant to MPEP § 821.04(a). **The restriction requirement is hereby withdrawn as to any claim that requires all the limitations of an allowable claim.** Claim 19, directed to a dental system further comprising a temporary screw

torque driver, and claim 23, directed to a dental system wherein the distal shaft portion of the temporary screw has a first portion with a smaller width, are no longer withdrawn from consideration because the claims requires all the limitations of an allowable claim.

In view of the above noted withdrawal of the restriction requirement, applicant is advised that if any claim presented in a divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

Once a restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. See In re Ziegler, 443 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

EXAMINER'S AMENDMENT

5. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Attorney Daniel Whittle on 03 January 2024.

The application has been amended as follows:

Claim 27 line 4: -- different than a pitch angle of the threads of the female threading of the implant abutment and --.

REASONS FOR ALLOWANCE

6. Claims 18-29 are allowed.

7. The following is an examiner's statement of reasons for allowance:

In regard to independent claim 18, the prior art of record fails to teach or fairly suggest a dental system comprising: a definitive screw having a proximal head end having a tool interface and a distal post portion having threads; a coping having a proximal end with an aperture larger than the distal post portion of the definitive screw and smaller than the proximal head end of the definitive screw; and a temporary screw comprising: a proximal head portion with a width larger than the aperture of the coping; and a distal shaft portion with threads in a pattern that is shaped differently from a pattern of the threads of the definitive screw, wherein the temporary screw is rotatable in a distal direction whereby the distal shaft portion of the temporary screw engages the threads of the implant abutment to a predetermined torque which causes the proximal head portion of the temporary screw to hold the coping in alignment with the implant abutment, and wherein an axial force in a proximal direction from pick-up processing releases the coping and the temporary screw from the implant abutment, and in combination with other limitations set forth in the claim.

In regard to independent claim 26, the prior art of record fails to teach or fairly suggest a dental system comprising: an implant abutment having female threading having an implant abutment thread profile; a definitive screw comprising: a shaft with male threading, wherein the male threading has a male threading profile that matably threadably engages and which matches the female threading of the implant abutment; and a head with a definitive screw drive interface; a coping having a proximal end with an aperture sized to allow the definitive screw shaft to pass through; and a temporary screw comprising: a post comprising male threading, wherein the male threading has a male threading profile that is different from the male threading profile of the shaft of the definitive screw, and wherein the aperture of the coping is sized to allow the post to pass through; and a head with a temporary screw drive interface, wherein the

head is integral to or coupled to the post, wherein the temporary screw holds the coping in position against the implant abutment for pick-up processing, wherein the male threading of the post of the temporary screw is configured to enter the implant abutment and rotatably engage the female threading of the implant abutment to a predetermined pick-up processing torque, and wherein threads of the male threading of the post release from threads of the female threading of the implant abutment with a predetermined axial pick-up force in a proximal direction in response to and/or during pick-up processing, and in combination with other limitations set forth in the claim.

~~8.~~ The closest prior art is the following:

a. Lannan (US 20080206709 A1) discloses a dental system comprising: a definitive screw having a proximal head end having a tool interface and a distal post portion having male threading; a coping having a proximal end with an aperture larger than the distal post portion of the definitive screw; and a temporary screw comprising: a proximal head portion with a width larger than the aperture of the coping; and a distal shaft portion with male threading, wherein the temporary screw is rotatable in a distal direction whereby the distal shaft portion of the temporary screw engages the threads of the implant abutment which causes the proximal head portion of the temporary screw to hold the coping in alignment with the implant abutment. Lannan is silent to a threaded implant abutment having female threading, a definitive screw shaft with male threading that matably threadably engages and which matches the female threading of the implant abutment; a coping having a proximal end with an aperture smaller than the proximal head end of the definitive screw; a temporary screw distal shaft portion with threads in a pattern that is shaped differently from a pattern of the threads of the definitive screw, wherein the threading of the temporary screw has a male threading profile that is different from the male threading profile of the definitive screw, the distal shaft portion of the temporary screw engages the threads of the implant abutment to a predetermined

torque, wherein the temporary screw holds the coping in position against the implant abutment for pick-up processing, wherein an axial force in a proximal direction from pick-up processing releases the coping and the temporary screw from an implant abutment, and wherein threads of the male threading of the post release from threads of the female threading of the implant abutment with a predetermined axial pick-up force in a proximal direction in response to and/or during pick-up processing,

b. Lazzara et al (US 4850870 A) discloses a dental system comprising: an implant abutment having female threading having an implant abutment thread profile, a definitive screw having a proximal head end having a tool interface and a distal post portion having threads, wherein the threads have a male threading profile that matably threadably engages and which matches the female threading of the implant abutment; a coping having a proximal end with an aperture larger than the distal post portion of the definitive screw and smaller than the proximal head end of the definitive screw. Lazzara et al is silent to a temporary screw comprising a proximal head portion with a temporary screw drive interface and a distal shaft portion with threads which have a different male threading profile from the shaft of the definitive screw, wherein the temporary screw engages the threads of the implant abutment to a predetermined torque, wherein the temporary screw holds the coping in position against the implant abutment, wherein an axial force in a proximal direction from pick-up processing releases the coping and the temporary screw from the implant abutment.

c. Neuhengen (US 20020094255 A1) discloses a screw comprising asymmetric threading. Neuhengen is silent to a dental system comprising an implant abutment, a definitive screw, a coping, and a temporary screw, wherein the temporary screw holds the coping in position against the implant abutment for pick-up processing.

d. Berrevoets et al (US 6517543 B1) discloses an implant having threading and a screw having a distal shaft portion shaped for engagement with the implant threading

wherein the screw distal shaft portion comprises a hollow portion, wherein the threading deforms under axial force. Berrevoets et al is silent to a dental system comprising a coping and a temporary screw, wherein the temporary screw holds the coping in position against the implant abutment for pick-up processing.

e. Otaki (US 4040327 A) discloses screw threads which are symmetrical. Otaki is silent to a dental system comprising an implant abutment, a definitive screw, a coping, and a temporary screw, wherein the temporary screw holds the coping in position against the implant abutment for pick-up processing.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to COURTNEY N HUYNH whose telephone number is (571)272-7219. The examiner can normally be reached M-F 7:30AM-5:00PM (EST) flex, 2nd Friday off.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cris Rodriguez can be reached on (571) 272-4964. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available

to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C.N.H./
Examiner, Art Unit 3772

/Cris L. Rodriguez/
Supervisory Patent Examiner, Art Unit 3772

Examiner-Initiated Interview Summary	**Application No.** 18/328,730	**Applicant(s)** Kofford et al.		
	Examiner COURTNEY N HUYNH	**Art Unit** 3772	**AIA (First Inventor to File) Status** Yes	**Page** 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
COURTNEY N HUYNH	Examiner	Telephonic
Daniel Whittle	Attorney of Record	

Date of Interview: 03 January 2024

Issues Discussed:

Proposed Amendment(s)

Attached Examiner's Amendment was discussed, and Applicant's representative gave authorization for the Examiner's Amendment.

/COURTNEY N HUYNH/ Examiner, Art Unit 3772	/Cris L. Rodriguez/ Supervisory Patent Examiner, Art Unit 3772

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/328,730	Kofford et al.
	Examiner	**Art Unit**
	COURTNEY N HUYNH	3772

CPC						
Symbol					**Type**	**Version**
A61C	/	8	/	0068	F	2013-01-01
A61C	/	8	/	0074	I	2013-01-01
A61C	/	8	/	0066	I	2013-01-01
A61C	/	8	/	0078	I	2013-01-01
A61C	/	8	/	0001	I	2013-01-01
A61C	/	2008	/	0084	A	2013-01-01
A61C	/	2201	/	00	A	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

/COURTNEY N HUYNH/ Examiner, Art Unit 3772	03 January 2024	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/Cris L. Rodriguez/ Supervisory Patent Examiner, Art Unit 3772	05 January 2024	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4, 75

U.S. Patent and Trademark Office — Part of Paper No.: 20231229

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/328,730	Kofford et al.
	Examiner	**Art Unit**
	COURTNEY N HUYNH	3772

INTERNATIONAL CLASSIFICATION					
CLAIMED					
A61C8/00	/	8	/	00	
NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

/COURTNEY N HUYNH/ Examiner, Art Unit 3772	03 January 2024	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/Cris L. Rodriguez/ Supervisory Patent Examiner, Art Unit 3772	05 January 2024	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4, 75

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/328,730	Kofford et al.
	Examiner	**Art Unit**
	COURTNEY N HUYNH	3772

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	18	10	27												
2	19	11	28												
3	20	12	29												
4	21														
5	22														
6	23														
7	24														
8	25														
9	26														

/COURTNEY N HUYNH/ Examiner, Art Unit 3772	03 January 2024	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/Cris L. Rodriguez/ Supervisory Patent Examiner, Art Unit 3772	05 January 2024	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4, 75

U.S. Patent and Trademark Office

Part of Paper No.: 20231229

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/328,730	Kofford et al.
	Examiner	Art Unit
	COURTNEY N HUYNH	3772

CPC - Searched*		
Symbol	**Date**	**Examiner**
A61C8/0001	08/16/2023	CNH
A61C8/0007	08/18/2023	CNH
A61C11/088	08/22/2023	CNH
A61C8/0001, A61C8/0007, A61C11/088	12/29/2023	CNH

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
411	419, 414	08/23/2023	CNH
411	419, 414	12/29/2023	CNH

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/328,730	Kofford et al.
	Examiner	Art Unit
	COURTNEY N HUYNH	3772

Considered IDS	08/14/2023	CNH
Searched patent family on Global Dossier, Espacenet, Patentscope	08/14/2023	CNH
Inventor name search in PE2E and PDP	08/14/2023	CNH
PE2E Search -A61C8/0082,006 8,0087,0066,0074,0078, A61C2008 /0084, A61C13/225,2255,265, 2656,275, A61C2201/00, USPC 433/ 173 -with text, see attached search history	08/16/2023	CNH
Search in IP.com		CNH
Consulted Examiner Heidi Eide regarding search	08/17/2023	CNH
PE2E Search - A61C8/0007,0082,006 8,0087,0066,0074,0078, $ A61C2008/0084, A61C13/225,2255,265, 2656,275, A61C2201/00, USPC 433/173 -with text, see attached search history	08/18/2023	CNH
Search in IP.com	08/18/2023	CNH
Consulted Examiner Matthew Saunders regarding search	08/22/2023	CNH
PE2E Search - A61C11/088, F16B37/14 -with text, see attached search history	08/22/2023	CNH
Consulted Examiner Flemming Saether (AU 3677) regarding search	08/23/2023	CNH
PE2E Search - F16B35/06, F16B35/041, F16B33/02, USPC 411/ 396,397,411 -with text, see attached search history	08/23/2023	CNH
PE2E Search - A61C8/00,005,008, A61C2008/0084 -with text, see attached search history	09/06/2023	CNH
Consulted Examiner Ed Moran regarding allowability	09/06/2023	CNH
Considered IDS of 22 September 2023	12/28/2023	CNH
Updated patent family search in Global Dossier, Espacenet, Patentscope	12/29/2023	CNH
Inventor name search in PE2E Search and DAV	12/29/2023	CNH
PE2E Search - CPCs A61C8/00, 005, 008, 0082, 0068, 0087, 0066, 0074, 0078, A61C2008/0084, A61C13/225,2255,265, 2656,275, A61C2201/00, F16B37/14, F16B35/06,041, F16B33/02, USPCs 433/ 173, 396, 397, 411- with text, see attached search history	01/02/2024	CNH
Considered IDS of 05 December 2023	01/02/2024	CNH
Search in IP.com	01/02/2024	CNH
Consulted Examiner Ed Moran regarding allowability	01/03/2024	CNH

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/328,730	Kofford et al.
	Examiner	Art Unit
	COURTNEY N HUYNH	3772

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	See attached search history	01/02/2024	CNH

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L49	64	((("KOFFORD") near3 ("Brandon")) OR (("RUDISILL") near3 ("Charles"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2023/12/29 01:30 PM
L50	6545	(A61C8/0001).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2023/12/29 01:30 PM
L51	620	(A61C8/0007).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2023/12/29 01:40 PM
L52	949	(A61C11/088).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2023/12/29 01:40 PM

L53	10728	(A61C8/0068).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2023/12/29 01:41 PM
L54	6399	(A61C8/0066).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2023/12/29 01:41 PM
L55	260	((411/419).ccls. OR (411/414).ccls.)	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2023/12/29 01:42 PM
L56	335	((411/419).ccls. OR (411/414).ccls.)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2023/12/29 01:42 PM
L57	1	("9568037").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/29 01:46 PM
L58	91	("10368964" OR "20020039718" OR "20040121287" OR "20040180308" OR	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/29 01:48 PM

		"20060141418" OR "20080014555" OR "20080114403" OR "20080233538" OR "20090123891" OR "20100143870" OR "20100159417" OR "20100209877" OR "20110086327" OR "20110306014" OR "20120122057" OR "20130304136" OR "20150147721" OR "20160045290" OR "20170151038" OR "20170202649" OR "20170340417" OR "20180185123" OR "20180200030" OR "20180344434" OR "20190223986" OR "20190298497" OR "3115804" OR "5135395" OR "5145372" OR "5213502" OR "5238405" OR "5350297" OR "5350302" OR "5538426" OR "5538428" OR "5622500" OR "5681167" OR "5733124" OR "5782918" OR "5829977" OR "5904483" OR "5938443" OR "6030219" OR "6068478" OR "6142782" OR "6168436" OR "6283753" OR "6299447" OR "6312260" OR "6315562" OR "6325628" OR "6332777" OR "6382977" OR "6416324" OR "6488501" OR "6540516" OR "6592370" OR "6619958" OR "6626911" OR "6663388" OR "6666684" OR "6733291" OR					

		"6769913" OR "6824386" OR "6981871" OR "7234940" OR "7314374" OR "7338286" OR "7632095" OR "7785107" OR "8002547" OR "8033826" OR "8075313" OR "8187000" OR "8465281" OR "8469710" OR "8608473" OR "8628327" OR "8827702" OR "8864494" OR "8888486" OR "8920170" OR "8944816" OR "8944817" OR "9033709" OR "9161825" OR "9314318" OR "9364299" OR "9408677" OR "9737380" OR "9844425").pn.					
L59	91	("10368964" OR "20020039718" OR "20040121287" OR "20040180308" OR "20060141418" OR "20080014555" OR "20080114403" OR "20080233538" OR "20090123891" OR "20100143870" OR "20100159417" OR "20100209877" OR "20110086327" OR "20110306014" OR "20120122057" OR "20130304136" OR "20150147721" OR "20160045290" OR "20170151038" OR "20170202649" OR "20170340417" OR "20180185123" OR "20180200030" OR "20180344434" OR "20190223986" OR "20190298497" OR "3115804" OR "5135395" OR "5145372" OR	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 08:04 AM

		"5213502" OR "5238405" OR "5350297" OR "5350302" OR "5538426" OR "5538428" OR "5622500" OR "5681167" OR "5733124" OR "5782918" OR "5829977" OR "5904483" OR "5938443" OR "6030219" OR "6068478" OR "6142782" OR "6168436" OR "6283753" OR "6299447" OR "6312260" OR "6315562" OR "6325628" OR "6332777" OR "6382977" OR "6416324" OR "6488501" OR "6540516" OR "6592370" OR "6619958" OR "6626911" OR "6663388" OR "6666684" OR "6733291" OR "6769913" OR "6824386" OR "6981871" OR "7234940" OR "7314374" OR "7338286" OR "7632095" OR "7785107" OR "8002547" OR "8033826" OR "8075313" OR "8187000" OR "8465281" OR "8469710" OR "8608473" OR "8628327" OR "8827702" OR "8864494" OR "8888486" OR "8920170" OR "8944816" OR "8944817" OR "9033709" OR "9161825" OR "9314318" OR					

		"9364299" OR "9408677" OR "9737380" OR "9844425").pn.					
L60	9495	((A61C8/0001,0082,0068,0087,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C13/225,2255,265,2656,275).cpc. OR (A61C2201/00).cpc. OR (433/173).ccls.) AND (cap OR head OR top OR washer OR cover OR disc OR cover) AND (post OR strut OR rod OR pillar OR shaft OR column OR stake)	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:28 AM
L61	1568	((A61C8/0001,0082,0068,0087,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C13/225,2255,265,2656,275).cpc. OR (A61C2201/00).cpc. OR (433/173).ccls.) AND (cap OR head OR top OR washer OR cover OR disc OR cover) AND (post OR strut OR rod OR pillar OR shaft OR column OR stake) AND coping	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:28 AM
L62	605	((A61C8/0001,0082,0068,0087,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C13/225,2255,265,2656,275).cpc. OR (A61C2201/00).cpc. OR (433/173).ccls.) AND (cap OR head OR top OR washer OR cover OR disc OR cover) AND (post OR strut OR rod OR pillar OR shaft OR column OR stake) AND ((pick near3 up) OR (open near3 tray))	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:28 AM
L63	3854	(A61C8/$).cpc. AND (asymmetrical OR uneven OR different OR skew OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2024/01/02 09:28 AM

		unsymmetrical OR skewed OR lopsided) WITH (threads OR threading OR threaded)	CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L64	1373	(A61C8/$).cpc. AND ((pick near3 up) OR (open near3 tray) OR (closed near3 tray))	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:28 AM
L65	7796	(A61C13/225,2255,265, 2656,275).cpc. OR (A61C2201/00).cpc. OR (433/173).ccls. AND (cap OR head OR top OR washer OR cover OR disc OR cover) AND (post OR strut OR rod OR pillar OR shaft OR column OR stake) AND coping	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:28 AM
L66	529	((A61C13/225,2255,265 ,2656,275).cpc. OR (A61C2201/00).cpc. OR (433/173).ccls.) AND (cap OR head OR top OR washer OR cover OR disc OR cover) AND (post OR strut OR rod OR pillar OR shaft OR column OR stake) AND coping	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN,	OR	ON	ON	2024/01/02 09:28 AM

			WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L67	4985	(F16B37/14).cpc. AND (slid$6 OR remov$5 OR movab$5 OR detach$5 OR separat$5)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:28 AM
L68	5371	((411/396).ccls. OR (411/397).ccls. OR (F16B35/06).cpc.) AND (slid$6 OR remov$5 OR movab$5 OR detach$5 OR separat$5)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:28 AM
L69	1894	((411/411).ccls. OR (F16B35/041).cpc. OR (F16B33/02).cpc.) AND (symmetric$5 OR asymmetric$5)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:29 AM
L70	167	(411/419).ccls. OR (411/414).ccls. AND asymmetric	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2024/01/02 09:29 AM

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L71	25938	(A61C8/00,005,008).cpc. OR (A61C2008/0084).cpc. AND (coping)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:29 AM
L72	25961	(A61C8/00,005,008).cpc. OR (A61C2008/0084).cpc. AND ((cap OR head OR top OR washer OR cover OR disc OR cover) WITH (slid$6 OR remov$5 OR movab$5 OR detach$5 OR separat$5))	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 09:29 AM
L73	5117	((A61C8/00,005,008).cpc. OR (A61C2008/0084).cpc.) AND ((cap OR head OR top OR washer OR cover OR disc OR cover) WITH (slid$6 OR remov$5 OR movab$5 OR detach$5 OR separat$5))	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2024/01/02 09:29 AM

			IBM_TDB)				
L74	5	"6283752".pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/01/02 02:36 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	686	((A61C8/0068,0001,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C2201/00).cpc.) AND (implant$5) AND (abut$5) AND (screw OR thread OR thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping)	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:11 AM
N2	604	((A61C8/0068,0001,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C2201/00).cpc.) AND (implant$5) AND (abut$5) AND (screw OR thread OR thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5)	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:12 AM
N3	273	((A61C8/0068,0001,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C2201/00).cpc.) AND (implant$5) AND (abut$5) AND (screw OR thread OR	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:14 AM

		thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5) AND (align$5 OR straight$5) AND ((male OR female OR compliment$5 OR match$5 OR correspond$5) WITH (screw OR thread$5))					
N4	271	((A61C8/0068,0001,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C2201/00).cpc.) AND (implant$5) AND (abut$5) AND (screw OR thread OR thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5) AND (align$5 OR straight$5) AND ((male OR female OR compliment$5 OR match$5 OR correspond$5) WITH (screw OR thread$5)) AND (temporar%6 OR interim OR (short near3 term) OR brief$5 OR limit$5)	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:20 AM
N5	268	((A61C8/0068,0001,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C2201/00).cpc.) AND (implant$5) AND (abutment) AND (screw OR thread OR thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5) AND (align$5 OR straight$5) AND ((male OR female OR compliment$5 OR match$5 OR correspond$5) WITH (screw OR thread$5)) AND (temporar%6 OR	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:22 AM

		interim OR (short near3 term) OR brief$5 OR limit$5)					
N6	262	((A61C8/0068,0001,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C2201/00).cpc.) AND (implant$5) AND (abutment) AND (screw) AND (thread OR thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5) AND (align$5 OR straight$5) AND ((male OR female OR compliment$5 OR match$5 OR correspond$5) WITH (screw OR thread$5)) AND (temporar%6 OR interim OR (short near3 term) OR brief$5 OR limit$5)	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:22 AM
N7	233	((A61C8/0068,0001,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C2201/00).cpc.) AND (implant$5) AND (abutment) AND (screw) AND (thread OR thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5) AND (align$5 OR straight$5) AND ((male OR female OR compliment$5 OR match$5 OR correspond$5) WITH (screw OR thread$5)) AND (temporar%6 OR interim OR (short near3 term) OR brief$5 OR limit$5) AND (tool OR driver)	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:23 AM
N8	114	((A61C8/0068,0001,0066,0074,0078).cpc. OR (A61C2008/0084).cpc. OR (A61C2201/00).cpc.)	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:23 AM

		AND (implant$5) AND (abutment) AND (screw) AND (thread OR thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5) AND (align$5 OR straight$5) AND ((male OR female OR compliment$5 OR match$5 OR correspond$5) WITH (screw OR thread$5)) AND (temporar%6 OR interim OR (short near3 term) OR brief$5 OR limit$5) AND (tool OR driver) AND (torque)					
N9	22	(dental OR orthodontic) AND (implant$5 near3 (teeth OR tooth OR oral)) AND (abutment) AND (screw) AND ((male OR female) near3 (thread OR thread$5)) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5) AND (align$5 OR straight$5) AND ((male OR female OR compliment$5 OR match$5 OR correspond$5) WITH (screw OR thread$5)) AND (temporar%6 OR interim OR (short near3 term) OR brief$5 OR limit$5) AND (tool OR driver) AND (torque)	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:25 AM
N10	111	(dental OR orthodontic) AND (implant$5 near3 (teeth OR tooth OR oral)) AND (abutment) AND (screw) AND (thread OR thread$5) AND (head OR top OR cap OR washer OR disc OR cover) AND (coping) AND (force OR pull OR separat$5) AND (align$5 OR straight$5) AND ((male	(US-PGPUB; USPAT)	OR	ON	ON	2024/01/02 11:26 AM

		OR female OR compliment$5 OR match$5 OR correspond$5) WITH (screw OR thread$5)) AND (temporar%6 OR interim OR (short near3 term) OR brief$5 OR limit$5) AND (tool OR driver) AND (torque)					

Search History 18328730

Report Run Date: 2024-01-03 UTC
Searches: 3
Markers: 0

Search #	Timestamp	Results	Page
1	2024-01-02 19:35 UTC	30,775,818	3
2	2024-01-02 19:48 UTC	7,241,615	3
3	2024-01-02 19:55 UTC	585,836	4

Content: Patent Publications (169)

US Patents | US Designs | US Applications | EPO Patents | EPO Applications | China Patents | China Applications | Japan Patents | Japan Applications | Korea Patents | Korea Applications | WIPO Applications | Argentina Patents | Argentina Applications | Brazil Patents | Brazil Applications | Canada Patents | Canada Applications | Chile Patents | Chile Applications | Colombia Applications | Costa Rica Applications | Cuba Patents | Cuba Applications | Dominican Republic Applications | Ecuador Patents | Ecuador Applications | El Salvador Applications | Guatemala Applications | Honduras Applications | Mexico Patents | Mexico Applications | Nicaragua Patents | Panama Applications | Peru Applications | Trinidad & Tobago Patents | Uruguay Applications | Austria Patents | Austria Applications | Belarus Patents | Belgium Patents | Belgium Applications | Bosnia & Herzegovina Patents | Bosnia & Herzegovina Applications | Bulgaria Patents | Bulgaria Applications | Croatia Patents | Croatia Applications | Czech Republic Patents | Czech Republic Applications | Czechoslovakia Patents | Czechoslovakia Applications | Denmark Patents | Denmark Applications | Estonia Patents | Estonia Applications | EUIPO Patents | Finland Patents | Finland Applications | France Patents | France Applications | Germany Patents | Germany Applications | Great Britain Patents | Great Britain Applications | Greece Patents | Greece Applications | Hungary Patents | Hungary Applications | Iceland Patents | Iceland Applications | Ireland Patents | Ireland Applications | Italy Patents | Italy Applications | Latvia Patents | Latvia Applications | Lithuania Patents | Lithuania Applications | Luxembourg Patents | Luxembourg Applications | Malta Patents | Monaco Patents | Montenegro Patents | Montenegro Applications | Netherlands Patents | Netherlands Applications | Norway Patents | Norway Applications | Poland Patents | Poland Applications | Portugal Patents | Portugal Applications | Republic of Moldova Patents | Republic of Moldova Applications | Romania Patents | Romania Applications | San Marino Patents | San Marino Applications | Serbia Patents | Serbia Applications | Slovakia Patents | Slovakia Applications | Slovenia Patents | Spain Patents | Spain Applications | Sweden Patents | Sweden Applications | Switzerland Patents | Switzerland Applications | Ukraine Patents | Yugoslavia/Serbia and Montenegro Patents | Yugoslavia/Serbia and Montenegro Applications | Armenia Patents | Australia Patents | Australia Applications | Cyprus Patents | Gulf Cooperation Council Patents | Hong Kong Patents | India Patents | India Applications | Indonesia Patents | Indonesia Applications | Israel Patents | Israel Applications | Jordan Patents | Jordan Applications | Kyrgyzstan Patents | Macao Applications | Malaysia Patents | Mongolia Patents | New Zealand Patents | Philippines Patents | Philippines Applications | Saudi Arabia Patents | Saudi Arabia Applications | Singapore Patents | Singapore Applications | Taiwan Patents | Taiwan Applications | Tajikistan Patents | Tajikistan Applications | Thailand Patents | Thailand Applications | Uzbekistan Patents | Vietnam Patents | Algeria Patents | ARIPO Patents | ARIPO Applications | Egypt Patents | Kenya Patents | Malawi Patents | Morocco Patents | Morocco Applications | OAPI Patents | South Africa Patents | Tunisia Applications | Zambia Patents | Zimbabwe Patents | EAPO Patents | EAPO Applications | Georgia Patents | Georgia Applications | Kazakhstan Patents | Kazakhstan Applications | Russia Patents | Russia Applications | Turkey Patents | Turkey Applications

1 **2024-01-02 19:35 UTC | 30,775,818 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Text
pickup dental impression coping with screw system with a temporary screw or screw post and a cap which is pulled away

Concept Modifiers: None

Filters: None

2 **2024-01-02 19:48 UTC | 7,241,615 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Text
dental impression coping, abutment, and implant with cap or top or cover removable during the impression

Concept Modifiers: None

Filters: None

3 **2024-01-02 19:55 UTC | 585,836 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Text
screw with asymmetrical screw threads for implant

Concept Modifiers: None

Filters: None

Bibliographic Data

Application No: 18/328,730

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /COURTNEY N HUYNH/ Examiner's Signature | Initials

Title: Screw-attached Pick-up Dental Coping System and Methods

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
06/03/2023	433	3772	
RULE			

APPLICANTS

INVENTORS

Brandon Dale Kofford, Apex, NC, UNITED STATES

Charles Albert Rudisill, Apex, NC, UNITED STATES

CONTINUING DATA

This application is a CON of 17691108 03/09/2022

This application is a CON of 16596361 10/08/2019 PAT 11311354

This application has PRO of 62818082 03/13/2019

This application has PRO of 62774402 12/03/2018

This application has PRO of 62742942 10/09/2018

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

06/22/2023

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

ADDRESS

FILING FEE RECEIVED

$2,992

Straumann USA Exhibit 1015

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	18328730
	Filing Date	06/03/2023
	First Named Inventor	Kofford, Brandon Dale
	Art Unit	3772
	Examiner Name	Huynh, Courtney Nguyen
	Attorney Docket Number	SDC010

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
		9568037	B2	02/14/2017	Staniszewski	
If you wish to add additional U.S. Patent citation information please click the Add button.						

U.S.PATENT APPLICATION PUBLICATIONS						
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
If you wish to add additional U.S. Published Application citation information please click the Add button.						

FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
								☐
If you wish to add additional Foreign Patent Document citation information please click the Add button								

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.N.H./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	
	Art Unit	
	Examiner Name	
	Attorney Docket Number	

			☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature	/COURTNEY N HUYNH/	Date Considered	12/29/2023

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Filing Date	
	First Named Inventor	
	Art Unit	
	Examiner Name	
	Attorney Docket Number	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Daniel John Whittle/	Date (YYYY-MM-DD)	2023-09-21
Name/Print	Daniel John Whittle	Registration Number	54,037

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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Filing Date	2023-06-03
First Named Inventor	Kofford, Brandon Dale
Art Unit	3772
Examiner Name	Huynh, Courtney Nguyen
Attorney Docket Number	SDC010

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	3115804	A	1963-12-31	Johnson	
	2	5135395	A	1992-08-04	Marlin	
	3	5213502	A	1993-05-25	Daftary	
	4	5238405	A	1993-08-24	Marlin	
	5	5350302	A	1994-09-27	Marlin	
	6	5538426	A	1996-07-23	Harding et al.	
	7	5622500	A	1997-04-22	Niznick	
	8	5681167	A	1997-10-28	Lazarof	

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	9	5782918	A	1998-07-21	Klardie et al.	
	10	5829977	A	1998-11-03	Rogers et al.	
	11	5938443	A	1999-08-17	Lazzara et al.	
	12	6030219	A	2000-02-29	Zuest et al.	
	13	6068478	A	2000-05-30	Grande et al.	
	14	6168436	B1	2001-01-02	O'Brien	
	15	6283753	B1	2001-09-04	Willoughby	
	16	6299447	B1	2001-10-09	Zuest et al.	
	17	6312260	B1	2001-11-06	Kumar et al.	
	18	6332777	B1	2001-12-25	Sutter	
	19	6663388	B1	2003-12-16	Schar et al.	

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	20	6382977	B1	2002-05-07	Kumar	
	21	6416324	B1	2002-07-09	Day	
	22	6488501	B1	2002-12-03	Harding	
	23	6540516	B1	2003-04-01	Ziegler	
	24	6592370	B2	2003-07-15	Morgan	
	25	6619958	B2	2003-09-16	Beaty et al.	
	26	6626911	B1	2003-09-30	Engman et al.	
	27	6666684	B1	2003-12-23	Names	
	28	6733291	B1	2004-05-11	Hurson	
	29	6769913	B2	2004-08-03	Hurson	
	30	6824386	B2	2004-11-30	Halldin et al.	

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	31	6981871	B2	2006-01-03	Mullaly et al.	
	32	7234940	B2	2007-06-26	Weissman	
	33	7314374	B2	2008-01-01	Augthun et al.	
	34	7338286	B2	2008-03-04	Porter et al.	
	35	7632095	B2	2009-12-15	Östman et al.	
	36	7785107	B2	2010-08-31	Niznick	
	37	8002547	B2	2011-08-23	Porter et al.	
	38	8033826	B2	2011-10-11	Towse et al.	
	39	8075313	B2	2011-12-13	Ranck et al.	
	40	8187000	B2	2012-05-29	Schaub	
	41	8469710	B2	2013-06-25	Bondar	

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	Attorney Docket Number	SDC010

	42	8608473	B2	2013-12-17	Kennard	
	43	8827702	B2	2014-09-09	Mamraev	
	44	8864494	B2	2014-10-21	Guenter et al.	
	45	8888486	B2	2014-11-18	Goodman et al.	
	46	8920170	B2	2014-12-30	Krivoruk	
	47	8944816	B2	2015-02-03	Robb et al.	
	48	8944817	B2	2015-02-03	Fischler et al.	
	49	9033709	B1	2015-05-19	Allen et al.	
	50	9161825	B2	2015-10-20	Nardi	
	51	9314318	B2	2016-04-19	Mullaly et al.	
	52	9408677	B2	2016-08-09	Kalman et al.	

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	53	9737380	B2	2017-08-22	Hogan et al.	
	54	9844425	B2	2017-12-19	Thomke et al.	
	55	10368964	B2	2019-08-06	Robb et al.	
	56	6325628	B1	2001-12-04	Morgan	
	57	5904483	A	1999-05-18	Wade	
	58	7314374	B2	2008-01-01	Augthun et al.	
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	62	6142782	A	2000-11-07	Lazarof	
	63	5145372	A	1992-09-08	Daftary	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18328730
	Filing Date	2023-06-03
	First Named Inventor	Kofford, Brandon Dale
	Art Unit	3772
	Examiner Name	Huynh, Courtney Nguyen
	Attorney Docket Number	SDC010

	64	5350297	A	1994-09-27	Cohen	
	65	5538428	A	1996-07-23	Staubli	
	66	5733124	A	1998-03-31	Kwan	
	67	6315562	A	2001-11-13	Kumar	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020039718	A1	2002-04-04	Kwan	
	2	20040121287	A1	2004-06-24	Morgan	
	3	20060141418	A1	2006-06-29	Heo	
	4	20080014555	A1	2008-01-17	Cippiciani	
	5	20080233538	A1	2008-09-25	Hug et al.	

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	Attorney Docket Number	SDC010

	6	20100143870	A1	2010-06-10	Kahdemann	
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	8	20100209877	A1	2010-08-19	Hogan et al.	
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	13	20170151038	A1	2017-06-01	Fan et al.	
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	16	20180185123	A1	2018-07-05	Kaup et al.	

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	Attorney Docket Number	SDC010

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	Art Unit	3772
	Examiner Name	Huynh, Courtney Nguyen
	Attorney Docket Number	SDC010

	1	2014153487	WO	A2	2014-09-25	Poovey		☐
	2	2016012581	WO	A1	2016-01-28	Bernhard et al.		☐
	3	2018029650	WO	A1	2018-02-15	Samsfort et al.		☒
	4	2019007852	WO	A1	2019-01-10	Andersen et al.		☐
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	7	20140080313	KR	A	2014-06-30	Hojun		☒
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	Attorney Docket Number	SDC010

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	MCGLUMPHY et al., "The combination Implant Crown: A Cement- and Screw-Retained Restoration", Compend Contin Educ Dent, Feb. 1992, pp. 34, 36,38, 40-42, Vol. XIII, No. 1.	☐
	2	CHEE et al., "Impression techniques for implant dentistry", British Dental Journal, October 7, 2006, pp. 429-432, Vol. 201.	☐
	3	NISSAN et al., "The Press-fit Implant Impression Coping Technique", J. Prosthet Dent, 2009, pp. 413-414, Vol. 101.	☐
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	9	WINKLER et al. “Implant screw mechanics and the settling effect: an overview”, Journal of Oral Implantology 2003;29 (5):242-5.	☐

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	Art Unit	3772
	Examiner Name	Huynh, Courtney Nguyen
	Attorney Docket Number	SDC010

	10	TESMER "Bacterial colonization of the dental implant fixture-abutment interface: an in vitro study", J Periodontol. 2009 Dec;80(12):1991-7.	☐
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EXAMINER SIGNATURE

Examiner Signature	/COURTNEY N HUYNH/	Date Considered	01/02/2024

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Filing Date	2023-06-03
	First Named Inventor	Kofford, Brandon Dale
	Art Unit	3772
	Examiner Name	Huynh, Courtney Nguyen
	Attorney Docket Number	SDC010

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Daniel John Whittle, #54,537/	Date (YYYY-MM-DD)	2023-12-05
Name/Print	Daniel John Whittle	Registration Number	54,537

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Document Description: Transmittal Letter

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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission	5

Application Number	18328730
Filing Date	06/03/2023
First Named Inventor	Kofford, Brandon Dale
Art Unit	3772
Examiner Name	Huynh, Courtney Nguyen
Attorney Docket Number	SDC010

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☑ Amendment/Reply
  - ☑ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☑ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) (please Identify below):

Remarks

RULE 312 Amendment in response to drawing objections

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature	/Daniel John Whittle, #54,537/		
Printed name	Daniel John Whittle		
Date	January 18, 2024	Reg. No.	54,537

CERTIFICATE OF TRANSMISSION/MAILING

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Typed or printed name		Date	

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0031. Public burden for this form is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. If filing this completed form by mail, send to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Routine uses of the information in this record may include disclosure to: 1) law enforcement, in the event that the system of records indicates a violation or potential violation of law; 2) a Federal, state, local, or international agency, in response to its request; 3) a contractor of the USPTO having need for the information in order to perform a contract; 4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record; 5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record; 6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations; 7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals; 8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)); 9) the Office of Personnel Management (OPM) for personnel research purposes; and 9) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Additional Uses

Additional USPTO uses of the information in this record may include disclosure to: 1) the International Bureau of the World Intellectual Property Organization, if the record is related to an international application filed under the Patent Cooperation Treaty; 2) the public i) after publication of the application pursuant to 35 U.S.C. 122(b), ii) after issuance of a patent pursuant to 35 U.S.C. 151, iii) if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections, or an issued patent, or iv) without publication of the application or patent under the specific circumstances provided for by 37 CFR 1.14(a)(1)(v)-(vii); and/or 3) the National Archives and Records Administration, for inspection of records.

Attorney Docket No. SDC010

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Kofford et al. Confirmation No.: 2867
Serial No.: 18/328,730 Group Art Unit: 3772
Filing Date: June 3, 2023 Examiner: HUYNH, COURTNEY NGUYEN
For: **SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEM AND METHODS**

Date: January 18, 2024

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER NOTICE OF ALLOWANCE

Commissioner:

This response is submitted in reply to the Notice of Allowance dated January 17, 2024 ("the Action").

If any extension of time for the accompanying response or submission is required, Applicant requests that this be considered a petition therefor.

Amendments to the Specification begin on page 2 of this document.

Amendments to the Drawings are reflected in Replacement Sheet 2

Remarks begin on page 3 of this document.

CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on January 18, 2024.

Signature: /Daniel John Whittle #54,537/
Name: Daniel John Whittle

Straumann USA Exhibit 1015

Amendments to the Specification:

Please replace ¶ [0139] with the following amended paragraph:

Once clearance hole 174 for the definitive screw has been made from the top of the prosthesis, the prosthesis is ready for mounting to the implant with definitive screw 175 as shown in FIG. 9. The male threads 150 of the definitive screw are shown filling the female threads of the abutment over an engagement depth extending from a first end of the thread engagement 163 to the second end of abutment thread engagement 164 of the implant abutment threading 18. Once the most distal thread of the definitive screw 175 is engaged in an abutment thread, the engagement depth will increase by a distance equal to the thread pitch for each complete revolution of the definitive screw 175. As shown in FIG. 4, a screw clearance hole 174 is large enough to accommodate the definitive screw head 151. A residual portion 161 of the cap 11 is shown in FIG. 9 for aligning the coping 9 to the prosthesis 3 in the closed tray pick-up process. After the definitive screw 175 is torqued into position, ~~T~~the screw clearance hole 174 in the prosthesis 3 may be filled with Teflon tape and color-matching composite materials for aesthetic purposes. In the illustrated embodiment, the coping bore 16 has a shoulder 152 to engage a flat surface on the underside of the definitive screw head 151 of the definitive screw 175 to pull the coping 9 into proper seating on the implant abutment 8. Alternate configurations are possible without deviating from the temporary screw system for coping pick-up disclosed.

REMARKS

Applicant acknowledges the thorough review of the claims and application and appreciates the rejoinder and allowance of pending claims in the referenced Action. The Action included two objections to Drawings:

FIG. 4 for failing to include reference signs 181 and 182 found in paragraph [0134]. Replacement Sheet 2 is provided with this amendment to address this objection.

FIG. 9 for including reference sign 150 not found in the Specification. Applicant appreciates the courtesy provided by the Examiner in a phone call today in being receptive to considering overcoming this drawing objection by amending the Specification to add the reference sign 150 in the discussion of FIG. 9. Paragraph [0139] with this amendment is proposed in this response.

Applicant notes that reference sign 150 was identified on the first line of Page 14 of the Response dated 05 December 2023 as follows:

> As shown in FIG. 9, the male definitive screw threads (callout 150 for these threads added to the replacement figure) essentially fill the female abutment threads (callout 18 for the female abutment threads added to FIG. 9 as well)...

Applicant apologizes for these errors leading to the Drawing objections and respectfully requests that the amendments to FIG. 4 in Replacement Sheet 2 and Specification paragraph [0139] be accepted to overcome them under Rule 312. The Examiner is encouraged to telephone the undersigned at 360-714-0777 for expeditious handling of any matters outstanding of resolution.

Respectfully submitted,

/Daniel John Whittle/

Daniel John Whittle
Registration No. 54,537

Straumann USA Exhibit 1015

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PATENT AND TRADEMARK OFFICE

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Alexandria, VA 22313 - 1450
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/328,730	**01/18/2024 03:17:42 PM Z ET**	**SDC010**

Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	2867	FILED BY	Daniel Whittle
PATENT CENTER #	64001917	FILING DATE	06/03/2023
CUSTOMER #	112823	FIRST NAMED INVENTOR	Brandon Dale Kofford
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 3

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
SDC010_Amendent_After_Allowance-APP.TEXT.docx	3	Application body structured text document	1851 KB
Warning: Bookmarks were found and have been removed.			
replacementsheet-p2-fig4-18jan2024-b.pdf	1	Drawings-only black and white line drawings	31 KB
sb0021_Jan2024.pdf	2	Transmittal Letter	468 KB

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DOCUMENT	MESSAGE DIGEST(SHA-512)

SDC010_Amendent_After_Allowance-APP.TEXT.docx	D344A118DA9B08E194277D53541186FFA5DB7EDCFB94D283D899390CA53A2A2CC39B6E98B6980FC4987717CC8C9F56D7941A9ECD964583A6496AC3C3FBD7ABF0
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

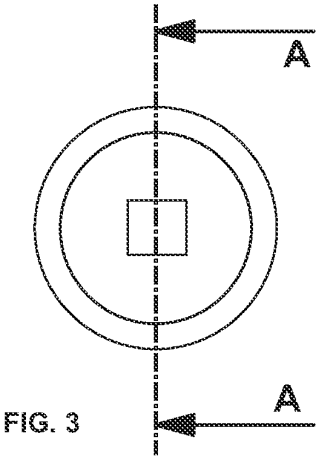


FIG. 3

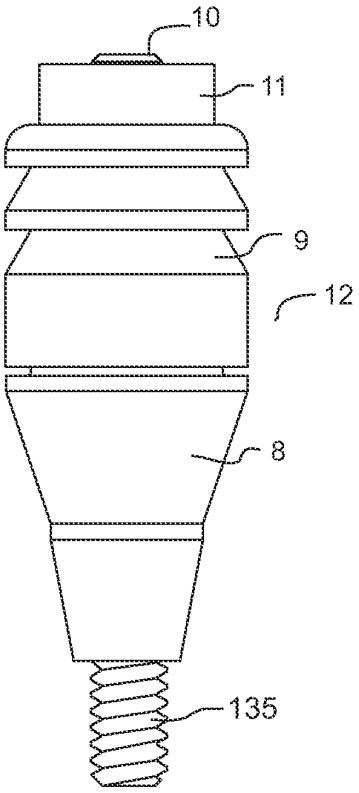


FIG. 2

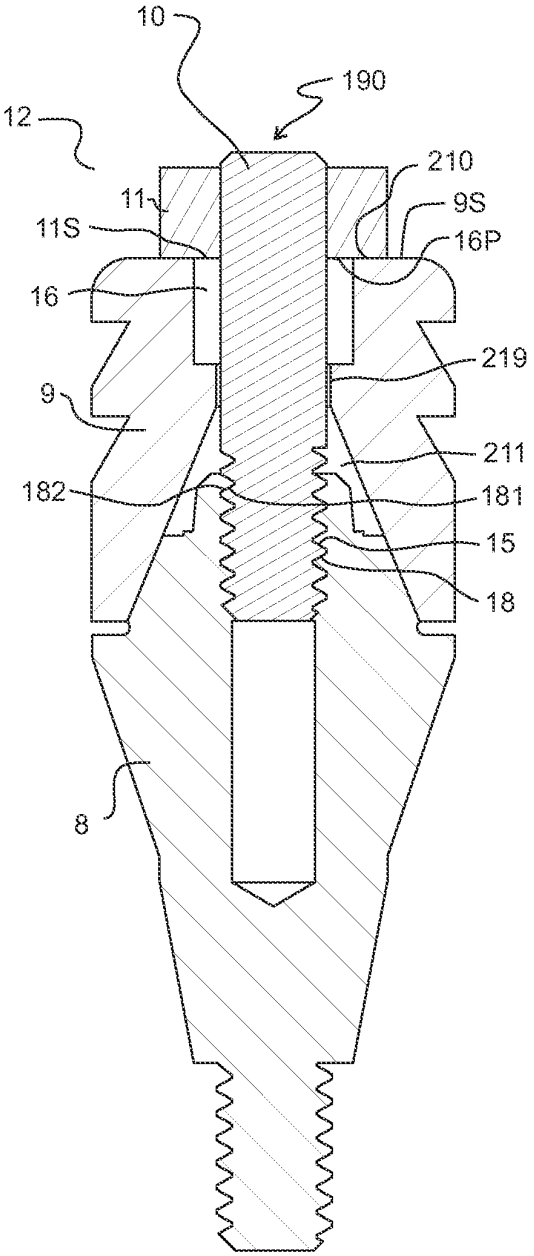


FIG. 4

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/328,730	**01/28/2024 03:59:01 PM Z ET**	**SDC010**

Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	2867	FILED BY	Daniel Whittle
PATENT CENTER #	64113048	FILING DATE	06/03/2023
CUSTOMER #	112823	FIRST NAMED INVENTOR	Brandon Dale Kofford
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
SDC010_Comment.pdf	3	Post Allowance Communication - Incoming	117 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
SDC010_Comment.pdf	D17A292C831564DB177D0ED55B40149F6CFDF036BAE308B2 E0F2DD07B67847444D9B8D2EEDDB86BC1B930D768A7666A0 C30CBF5BAA0C3C0B71538347EF65033C

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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Attorney Docket No. SDC010

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Kofford et al. Confirmation No.: 2867
Serial No.: 18/328,730 Group Art Unit: 3772
Filing Date: June 3, 2023 Examiner: HUYNH, COURTNEY NGUYEN
For: **SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEM AND METHODS**

Date: January 28, 2024

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Commissioner:

This response is submitted in reply to the Notice of Allowance dated January 17, 2024 ("the Action").

If any extension of time for the accompanying response or submission is required, Applicant requests that this be considered a petition therefor.

Remarks begin on page 2 of this document.

CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on January 28, 2024.

Signature: /Daniel John Whittle #54,537/
Name: Daniel John Whittle

Straumann USA Exhibit 1015

Remarks

Applicant acknowledges, with appreciation, the Examiner's statements confirming that the allowed claims are patentable over the cited references.

Several patent documents were identified as the closest prior art by the Examiner whereby the Examiner provided some brief statements on the reasons for allowance. Without acquiescing as to these statements, Applicant provides comments regarding these references below.

Briefly, Lazarra et al. (US4850870 A) discloses an implant abutment and coping alignment system for screw-attached dental prostheses in which tightening a prosthetic screw provides a force on the coping in a predominantly axial direction into a seating position on a threaded implant abutment ('870@3:52-59 and FIG. 1). Lazzara et al. describes how tightening the screw can apply pressure to the coping to mate it with the implant abutment for mechanical stability and for sealing ('870@3:16-26). Lazarra et al. also describes how differences in gum thickness in patients may be accommodated by changing the length of the implant abutment ('870@2:40-60). This is stated to preserve mechanical stability and sealing.

Lannon (US 2008026709A1) discloses a gingival support sleeve with a definitive screw ('709 FIG. 5) and an elongated securing member for open tray processing (FIG. 8). The gingival support sleeve is initially free to slide axially and rotate to some extent on a dental implant chimney that is held to the implant with either the elongated securing member or the definitive screw. ('709 ¶[0052-53]). When oriented in the proper position, the sleeve is held in place with adhesive. Subsequently, the sleeve can only be axially removed from the implant by unscrewing the definitive screw or elongated securing member that is holding the chimney to the implant. The elongated securing member is designed to extend through an impression tray to allow unscrewing it from the implant as known for open tray impression processing ('709 ¶[[0058]).

Straumann USA Exhibit 1015

Neuhengen (US20020094255 A1) is entitled "High profile thread forming screw" and discloses a self-tapping or thread forming screw especially for hard plastic materials. Objectives are to not cause cracking of the plastic and to have increased resistance to pullout ('255@¶¶[0001], [0007]-[0008]). In embodiments of the present application, threads are pre-formed in the implant abutment specifically to mate with the threading of the definitive screw and providing a temporary screw configured to function without causing damage to implant abutment threads.

Berrevoets (US6517543 B) is entitled "Bone connector system with anti-rotation feature". This patent "relates to bone fixation and fusion systems, for example for the fusing together of toe bones or the like, by firmly locking them in abutting relation to permit good healing ('543@1:16-19). Although the parts may be initially aligned through mutual rotation, joinder results from axial movement ('543@3:61-4:6). The axial engagement of the parts allows fixing over a series of discrete insertion depth positions. The one-time permanent use of this connector system is evident from the description of FIG. 5 in which "separation of the connector members 50 and 70 by pulling the boss axially back out of the bone will be extremely difficult, if not impossible, without damage to or destruction of the parts" ('543@5:19-22).

Otaki (US4040327 A) discloses symmetric screw threads, which are prevalent in commercially available threaded fasteners and associated international standards found in conventional implant abutment systems.

Respectfully submitted,

/Daniel John Whittle/

Daniel John Whittle
Registration No. 54,537

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/328,730	**01/28/2024 04:06:57 PM Z ET**	**SDC010**

Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	2867	FILED BY	Daniel Whittle
PATENT CENTER #	64113072	FILING DATE	06/03/2023
CUSTOMER #	112823	FIRST NAMED INVENTOR	Brandon Dale Kofford
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
web85b.pdf	3	Issue Fee Payment (PTO-85B)	58 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
web85b.pdf	88662336A1E3A21D7B4D22C375FDCCF56763C8CD4387D86D 3C76310D216AA81A836F6FB2782DA7D1219EAEA742DA122F0 49B717CDBA6C814DF09D23A6215C0E5

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/328,730	**01/28/2024 04:06:57 PM Z ET**	**SDC010**

Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	2867	FILED BY	Daniel Whittle
PATENT CENTER #	64113072	AUTHORIZED BY	-
CUSTOMER #	112823	FILING DATE	06/03/2023
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Brandon Dale Kofford

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 5436	**E20241RG08459906**	**Daniel Whittle**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
2501	UTILITY ISSUE FEE	480.00	1	480.00
			TOTAL AMOUNT:	**$480.00**

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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ISSUE FEE TRANSMITTAL FORM

APPLICATION #	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET #
18328730	**06/03/2023**	**Brandon Kofford**	**SDC010**

Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

Application Information

APPLICATION TYPE	Nonprovisional Application under 35 USC 111(a)	**DATE DUE**	04/17/2024
CONFIRMATION #	2867	**ISSUE FEE DUE**	$ 480
EXAMINER	COURTNEY HUYNH	**PUBLICATION DUE**	$ 0
GROUP ART UNIT	3772	**TOTAL FEES DUE**	$480
CLASS - SUBCLASS	433/173000	**PREV. PAID FEE**	$ 0
ENTITY STATUS	Small		

1. CHANGE OF CORRESPONDENCE ADDRESS AND/OR INDICATION OF FEE ADDRESS (37 CFR 1.33 & 1.363)

Correspondence Address

CURRENT ADDRESS

Maintenance Fee Address

CURRENT ADDRESS

☐ Change of correspondence address requested,system generated AIA/122-PC form attached

☐ Fee address indication requested, system generatedSB/47-PC form attached

2. ENTITY STATUS

Change in Entity Status

NEW STATUS

3. THE FOLLOWING FEES ARE SUBMITTED

☑ Issue Fee

☑ Publication Fee

4. FEE AUTHORIZATION

☐ I authorize USPTO to apply my previously paid issue fee to the current fees due

☐ The Director is herby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number:

☐ If in addition to the payment of the issue fee amount submitted with this form, there are any discrepencies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number:

5. FIRM AND/OR ATTORNEY NAMES TO BE PRINTED

NOTE: If no name is listed, no name will be printed
For printing on the patent front page, list to be displayed as entered

Patent Leverage LLC

6. ASSIGNEE NAME(S) AND RESIDENCE DATA TO BE PRINTED

NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a susbstitute for filing an assignment.

Smart Denture Conversions, LLC	Apex, NC UNITED STATES	Corporation

Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via Patent Center on the date indicated below.

Signature	Name	Registration #	Date
/Daniel John Whittle/	Daniel Whittle	54537	01/28/2024

PRINTER RUSH
(PTO ASSISTANCE)

Application: 18328730	**Examiner:** HUYNH	**GAU:** 3772
From:	**Location:** RTFM	**Creation Date:** 02/07/2024

Week Date: 1/15/2024

DOC CODE	DOC DATE	MISCELLANEOUS
[ ] 1449		[ ] Continuing Data
[ ] IDS		[ ] Foreign Priority
[ ] CLM		[ ] Document Legibility
[ ] IIFW/FWCLM		[ ] Fees
[ ] SRFW		[ ] Petition (TC)
[ ] DRW		[ ] Other
[ ] OATH		
[X] 312	01/18/2024	
[ ] SPEC		

[RUSH] Message:

Please respond to the 01/18/2024 A.na

Thank you

[XRUSH] Response:

Initials: _____

Examiner: PUBS contact - James Leija, (703) 756-1197
NOTE: This form will be included as part of the official USPTO record with the response document coded as XRUSH.
REV: AUG 16

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/328,730	06/03/2023	Brandon Dale Kofford	SDC010	2867

112823 7590 02/14/2024

Daniel J Whittle
1229 Modoc Dr
Bellingham, WA 98229

EXAMINER	
HUYNH, COURTNEY NGUYEN	

ART UNIT	PAPER NUMBER
3772	

MAIL DATE	DELIVERY MODE
02/14/2024	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Response to Rule 312 Communication	Application No.	Applicant(s)	
	18/328,730	Kofford et al.	
	Examiner	Art Unit	AIA (FITF) Status
	COURTNEY N HUYNH	3772	Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☑ The amendment filed on 18 January 2024 under 37 CFR 1.312 has been considered, and has been:
   a) ☐ entered.
   b) ☑ entered as directed to matters of form not affecting the scope of the invention.
   c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
      Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.
   d) ☐ disapproved. See explanation below.
   e) ☐ entered in part. See explanation below.
   f) ☐ not entered because the supplemental or corrected Application Data sheet (ADS)
      ☐ was not accompanied by a petition to accept an unintentionally delayed claim under 37 CFR 1.55 or 27 CFR 1.78;
      ☐ did not identify the information being changed in accordance with 37 CFR 1.76(c)(2);
      ☐ was not properly signed in accordance with 37 CFR 1.76(e) (or 37 CFR 1.33(b) for applications filed prior to September 16, 2012).

The drawings filed on 18 January 2024 are accepted.

/COURTNEY N HUYNH/ Examiner, Art Unit 3772	/Cris L. Rodriguez/ Supervisory Patent Examiner, Art Unit 3772

02/08/2024

APPROVED: /C.N.H./

Attorney Docket No. SDC010

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Kofford et al. Confirmation No.: 2867
Serial No.: 18/328,730 Group Art Unit: 3772
Filing Date: June 3, 2023 Examiner: HUYNH, COURTNEY NGUYEN
For: **SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEM AND METHODS**

Date: January 18, 2024

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER NOTICE OF ALLOWANCE

Commissioner:

This response is submitted in reply to the Notice of Allowance dated January 17, 2024 ("the Action").

If any extension of time for the accompanying response or submission is required, Applicant requests that this be considered a petition therefor.

Amendments to the Specification begin on page 2 of this document.

Amendments to the Drawings are reflected in Replacement Sheet 2

Remarks begin on page 3 of this document.

CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on January 18, 2024.

Signature: /Daniel John Whittle #54,537/
Name: Daniel John Whittle

Straumann USA Exhibit 1015

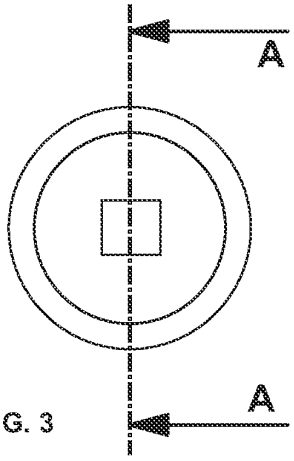


FIG. 3

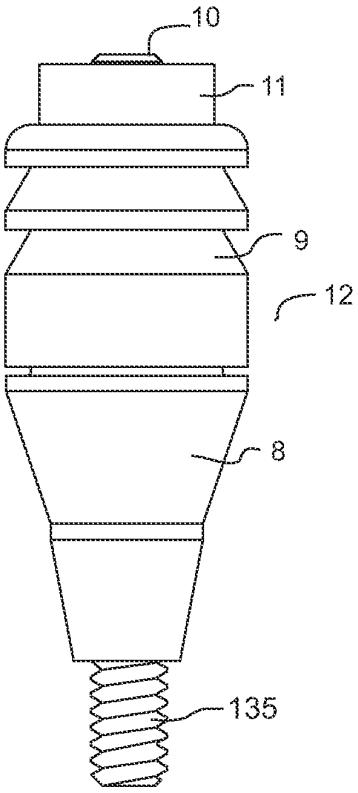


FIG. 2

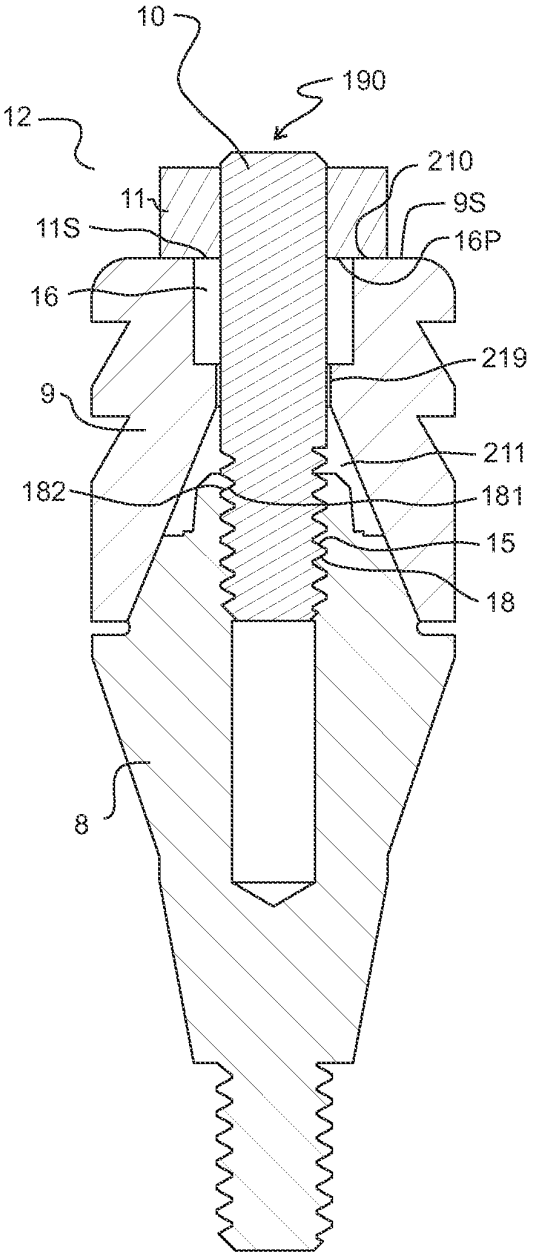


FIG. 4

PRINTER RUSH
(PTO ASSISTANCE)

Application: 18328730	**Examiner:** HUYNH	**GAU:** 3772
From:	**Location:** RTFM	**Creation Date:** 02/07/2024

Week Date: 1/15/2024

DOC CODE	DOC DATE	MISCELLANEOUS
☐ 1449		☐ Continuing Data
☐ IDS		☐ Foreign Priority
☐ CLM		☐ Document Legibility
☐ IIFW/FWCLM		☐ Fees
☐ SRFW		☐ Petition (TC)
☐ DRW		☐ Other
☐ OATH		
☒ 312	01/18/2024	
☐ SPEC		

[RUSH] Message:

Please respond to the 01/18/2024 A.na

Thank you

[XRUSH] Response:

312 Amendment form included.

Initials:/C.N.H./

Examiner: PUBS contact - James Leija, (703) 756-1197
NOTE: This form will be included as part of the official USPTO record with the response document coded as XRUSH.
REV: AUG 16

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/328,730	03/26/2024	11937992	SDC010	2867

112823 7590 03/06/2024

Daniel J Whittle
1229 Modoc Dr
Bellingham, WA 98229

ISSUE NOTIFICATION

The projected patent number and issue date are specified above. The patent will issue electronically. The electronically issued patent is the official patent grant pursuant to 35 U.S.C. § 153. The patent may be accessed on or after the issue date through Patent Center at https://patentcenter.uspto.gov/. The patent will be available in both the public and the private sides of Patent Center. Further assistance in electronically accessing the patent, or about Patent Center, is available by calling the Patent Electronic Business Center at 1-888-217-9197.

The USPTO is implementing electronic patent issuance with a transition period, during which period the USPTO will mail a ceremonial paper copy of the electronic patent grant to the correspondence address of record. Additional copies of the patent (i.e., certified and presentation copies) may be ordered for a fee from the USPTO's Certified Copy Center at https://certifiedcopycenter.uspto.gov/index.html. The Certified Copy Center may be reached at (800)972-6382.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Center (https://patentcenter.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional inventors):

Brandon Dale Kofford, Apex, NC;
Charles Albert Rudisill, Apex, NC;

APPLICANT(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional applicants):

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

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Please find below and/or attached an Office communication concerning this application or proceeding.

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