

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

3SHAPE A/S and 3SHAPE INC.,

Petitioners,

v.

DENTAL IMAGING TECHNOLOGIES CORPORATION,

Patent Owner.

Case IPR2024-00549
Patent No. 11,234,798

PATENT OWNER'S PRELIMINARY RESPONSE

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I. INTRODUCTION

Patent Owner Dental Imaging Technologies Corp. (“DITC”) designs and manufactures highly-successful intraoral scanner systems, which are used to create 3D models of patients’ teeth. U.S. Patent No. 11,234,798 (the “’798 Patent”) relates to systems, methods, and computer readable media for generating an intraoral scan of patients’ teeth. Petitioners 3Shape A/S and 3Shape Inc. are DITC’s competitors accused of infringing the ’798 Patent.

Petitioners fail to establish a reasonable likelihood that they would prevail with respect to any challenged claim of the ’798 Patent. All four grounds fail for at least the same three reasons. First, all grounds require modifying Zhang, a reference concerning the global camera path used in three-dimensional reconstruction, with Babayoff’s teachings regarding segregation of soft tissue. But there is no motivation to combine these references because Zhang affirmatively claims *inclusion* of soft tissue and teaches away from its removal.

Second, even if one were to ignore Zhang’s teachings about soft tissue and combine it with Babayoff, the resulting combination would be patentably distinct from the challenged claims in several ways, including fundamental differences in how scans are conducted and how soft tissue is removed.

Third, even if one were to overlook the absence of motivation and distinct result from combination, there would not have been a reasonable expectation of

success. Although Petitioners assert only “software changes” would be needed to modify Zhang to implement Babayoff’s teachings regarding soft tissue, Petitioners overlook that Babayoff’s ability to recognize soft tissue depends entirely on the existence and analysis of color data. Zhang does not mention color at all, nor does it disclose the hardware needed to collect such color data. Petitioners fail to address how or why modification of Zhang with Babayoff’s color-based methods would be reasonably expected to succeed.

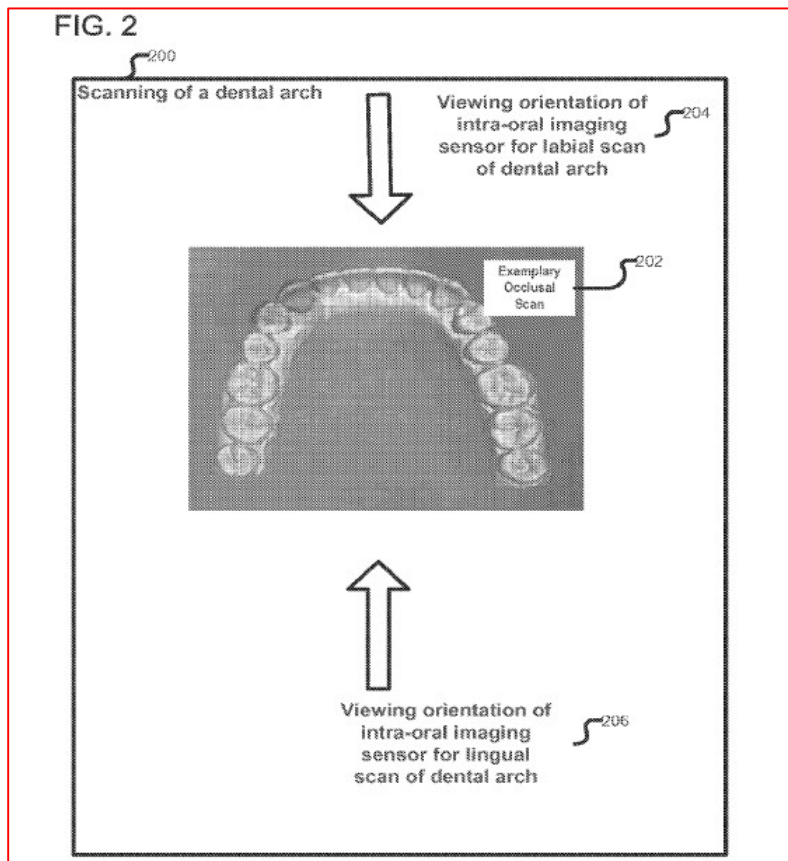
Simply put, there are numerous technical differences between the systems and methods of Zhang and Babayoff. 3Shape does not explain why a person of ordinary skill in the art would have been motivated to combine Zhang and Babayoff with a reasonable expectation of success in view of these differences.

II. THE ’798 PATENT

The ’798 Patent issued from U.S. Appl. 16/160,230, filed on October 15, 2018. Through a continuation application, the ’798 Patent claims priority to U.S. Provisional Application 61/784,535, filed on March 14, 2013. Titled “Scanning Sequence For An Intra-Oral Imaging System,” the ’798 Patent relates to systems, methods, and computer readable media for generating an intra-oral scan of patients’ teeth. EX1001, 1:50-52. It involves, *inter alia*, generating a contiguous scan of an occlusal surface of at least a part of one arch of the dentition, removing soft tissue,

and stitching at least one additional surface (e.g., labial or lingual surfaces) to the contiguous scan of the occlusal surface. *Id.* at 1:52-55.

The '798 Patent frequently recites dental terminology, which can be understood by reference to Figure 2. In Figure 2, the '798 Patent illustrates a diagram that shows scanning of a dental arch. *Id.*, 5:42-43. The viewing orientation for a labial scan is depicted by down-arrow (204). *Id.*, 5:46-48. In the labial scan, the “side surfaces of the teeth that are predominantly faced towards the lips and cheek are imaged.” *Id.*, 5:52-54. The viewing orientation for a lingual scan is depicted by up-arrow (206). *Id.*, 5:48-50. In the lingual scan, “the side surfaces of the teeth that are predominantly faced towards the tongue are imaged.” *Id.*, 5:50-52. Between the labial and lingual surfaces is the occlusal surface, shown as an exemplary occlusal scan (202). *Id.*, 5:43-46. The occlusal surface is the tooth surface which, in a clenched position, occludes with a surface of an opposing tooth in the opposing jaw.



Among other things, the '798 Patent states that it is difficult to obtain images of the labial and lingual surfaces without interruption by the presence of lips, tongue, cheek, etc. EX1001, 4:15-19. It therefore teaches that lingual and labial surfaces are imaged in multiple segments. *Id.* With reference to certain embodiments, the '798 Patent teaches that “the occlusal surface of a dental arch is acquired first via a single uninterrupted motion of the wand 108, followed by the labial and the lingual surfaces that are acquired in multiple segments.” *Id.* at 5:29-40. A model of the occlusal surface is generated from the image frames of the occlusal scan, and then segments of the labial and lingual scans are linked to the occlusal surface. *Id.* The

teachings of the '798 Patent “allow generation of a more accurate three-dimensional surface of the dental arch for real-time display, in comparison to situations in which a contiguous scan is not used.” *Id.*, 4:44-47.

III. LEVEL OF ORDINARY SKILL IN THE ART

3Shape defines a person of ordinary skill in the art (“POSITA”) with respect to the '798 Patent as having “at least (1) a bachelor’s degree in electrical engineering, computer engineering, or computer science (or equivalent course work) and two to three years of work experience in 3D imaging and modeling of physical structures, or (2) a master’s degree in electrical engineering, computer engineering, or computer science (or equivalent course work) with a focus in 3D imaging and modeling of physical structures.” Pet. 7-8.

Patent Owner proposes that a POSITA as of the effective filing date of the '798 Patent would have had a bachelor’s degree in Computer Engineering, Computer Science, Electrical Engineering, Physics, or an equivalent field, as well as at least two years of work experience, or alternatively, at least five years of comparable industry experience in the field of imaging and/or image scanning including 3D imaging systems and 3D modeling techniques. Additional education reduces the threshold for years of experience in the field, and vice versa.

Patent Owner’s substantive arguments in this Preliminary Response apply regardless which proposed level of skill is applied.

IV. CLAIM CONSTRUCTION

The claims in an *inter partes* review are construed using the “plain and ordinary meaning” standard applied in district court proceedings set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Circ. 2005) (en banc). 3Shape contends that “no express constructions of the claims are necessary.” Pet. 8. Without explanation, 3Shape contends that “resolution of this Petition does not depend on which constructions are used because these features of the claims are disclosed by the prior art regardless of the construction.” Pet. 9. However, 3Shape fails to substantiate that assertion.

In particular, 3Shape has not adequately addressed how numerous elements of the challenged claims are disclosed or suggested by the prior art under 3Shape's proposed construction of the phrase “contiguous scan of an occlusal surface.” The term “contiguous scan” appears in at least every independent claim and many dependent claims, including limitations [1.3], [1.4], [1.5], [1.6], [1.9], [1.10], [1.11], 2, [3.1], [3.3], 6, [8.3], 9, [10.1], [10.2], [10.3], [10.4], 11, [14.1], [14.3], 15, 18, 19, and 20.

3Shape contends that “contiguous scan of an occlusal surface” means “a scan of an/the occlusal surface made in a single uninterrupted motion of the scanning wand.” Pet. 8. Yet, 3Shape fails to identify any disclosure or suggestion of a “scan of an occlusal surface made in a single uninterrupted motion of the scanning wand.”

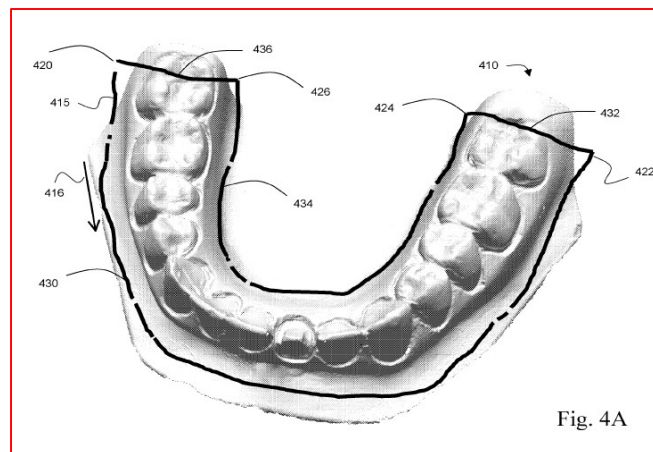
Other than 3Shape's proposed definition, the Petition uses the word "uninterrupted" only once, but even that occurrence of "uninterrupted" is 3Shape's characterization of Zhang's "data acquisition process," not a motion of the scanning wand. *See* Pet. 13. The disclosure being characterized does not refer to an uninterrupted motion of the scanning wand. It simply says that the scanner may use a "continuous acquisition process." *Id.* (citing EX1007, ¶[0043]). Thus, unless DITC's plain and ordinary construction of "contiguous scan" is adopted, the entire Petition fails because Petitioners do not explain how the prior art teaches or suggests an "uninterrupted motion of the scanning wand," which is required under Petitioners' strained definition of "contiguous scan."

V. THE ASSERTED PRIOR ART

A. Int'l Publ. No. WO 2010/077380 A2, Zhang et al. (EX1007)

Zhang, titled "Global Camera Path Optimization," published on July 8, 2010. Its "invention relates generally to three-dimensional imaging and more specifically to optimizing the calculation of a global camera path used in three-dimensional reconstruction." EX1007, ¶[0002]. Zhang explains that "[g]lobal path optimization is employed to refine a camera path that is used to reconstruct a three-dimensional image of dental subject matter." *Id.*, ¶[0005]. The three-dimensional models of Zhang "may include one or more of gums and soft tissue." *Id.*, ¶[0014]; *see also id.*, ¶¶[0038], [0045], [0098]; claim 14.

Zhang explains that “[i]n hand-held dental scanning, spatial links can often be made between non-sequential frames of data, such as between separate camera path segments for buccal [cheek-side] and lingual [tongue-side] tooth surfaces, and these spatial links can be employed to minimize motion estimation parameters in a global optimization process.” *Id.*, ¶[0005]. It provides a scanning approach, with reference to Figure 4A, which depicts “an object 410 for imaging, along with a path 415 that a camera may follow while obtaining a three-dimensional scan of a surface of the object 410.” *Id.*, ¶[0058]. Figure 4A and supporting text teach a scanning path that covers the lip-side surface followed by the tongue-side surface, with segments of the occlusal surface (“segment 432” and “segment 436”). *Id.*, ¶[0058].



B. U.S. Pat. No. 7,698,068, Babayoff (EX1008)

Babayoff, titled “Method For Providing Data Associated With The Intraoral Cavity,” issued on April 13, 2010. Babayoff states that “[t]he present invention relates to color three-dimensional numerical entities representative of tissues,

particularly of the intraoral cavity. In particular, the present invention is concerned with the manipulation of such entities to provide data that is useful in procedures associated with the oral cavity, specially dental surfaces thereof.” EX1008, 1:16-21. Babayoff describes hardware needed to collect the color data for its methods, such as “a tri-color sequence generator,” “tri-color LEDs,” “a plurality of LEDs in three groups, each group providing illumination in one of the desired colors,” and others. *Id.*, 8:45-56, 9:1-3, 12:7-24, 12:56-62. Based on the “color data,” Babayoff teaches “eliminating data associated with the soft tissues, and proceeding with stitching only the hard tissues,” which it asserts makes “the quality of the stitching procedure [] significantly better than when using the full intra-oral data for the stitching procedure.” *Id.*, 5:12-16.¹

VI. ARGUMENT

The Board should deny institution because Petitioners failed to demonstrate a reasonable likelihood that they would prevail as to any challenged claim. There are several independent reasons for denial of Ground 1, which is based on Zhang in view of Babayoff. First, there is no motivation to combine Zhang with the color-based methods for eliminating soft tissue in Babayoff. Zhang embraces soft tissue, teaches

¹ Although Petitioners assert additional prior art references, an understanding of Zhang and Babayoff, which are included in all Grounds, is sufficient to deny institution.

away from its removal, and lacks hardware for color-based methods. Second, even if there were motivation, the resulting combination would be patentably different from the challenged claims in several ways. Third, Petitioners fail to establish a reasonable expectation of success. Their argument rests on the faulty premise that Zhang could be modified only with software changes to Babayoff to achieve the claimed inventions. Yet, Babayoff’s methods require color data, which Zhang lacks. Thus, a combination of Zhang and Babayoff would not work.

Finally, Grounds 2-4 require at least the combination of Zhang and Babayoff and only challenge claims that depend from independent claims challenged in Ground 1. Thus, those grounds fail for at least the same reasons as Ground 1.

A. Ground 1 Fails For Several Independent Reasons.

Asserted References	Alleged Basis	Claims Challenged
Zhang, et al., PCT Publication WO 2010/077380A2 (“Zhang”) (EX1007) in view of Babayoff, U.S. Patent 7,698,068B2 (“Babayoff”) (EX1008)	35 U.S.C. § 103	1–6, 10–15, 17–19

1. A POSITA Would Not Have Been Motivated to Combine Babayoff and Zhang Due to Technical Differences Between the References.

“[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). Petitioners have not identified an adequate rationale to combine the

references to arrive at the challenged claims. Moreover, Petitioners fail to address technical differences between Zhang and Babayoff. Indeed, Petitioners' motivation argument is contradicted by the references themselves; Babayoff's teachings regarding soft tissue are technically incompatible with Zhang.

Petitioners' motivation argument is brief. Pet. 47-48. The argument begins with base reference Zhang, which according to Petitioners, taught that "there was a need in the dental industry for improved techniques to generate high-accuracy three-dimensional reconstructions." *Id.* Zhang noted that "artifacts from camera scans can result in errors" and "that their 3D reconstructions can include gums and soft tissue." *Id.* Following those statements, Petitioners assert that "soft tissue can be problematic" *Id.* (citing only EX1003, ¶235).

Petitioners' assertion that a POSITA would have recognized "soft tissue" as "problematic" relies solely on expert testimony. That statement does not find support in Zhang, because Zhang actually highlights the capture of soft tissue. *See, e.g.,* EX1007, ¶[0014] ("The three-dimensional model of the dental object may include one or more of gums and soft tissue."); ¶[0038] (stating that "dental object" may include "soft tissue"); ¶[0045] ("[T]he scan may capture a digital model of a tooth, a quadrant of teeth, or a full collection of teeth including two opposing arches, as well as soft tissue or any other relevant intraoral structures."); ¶[0045] ("The

object 104 may also, or instead, include a dental model, such as a plaster cast, wax-up, impression, or negative impression of a tooth, teeth, soft tissue, or some combination of these.”).

In fact, Zhang affirmatively ***claimed*** the inclusion of soft tissue. *Id.*, claim 14 (“The method of claim 1 wherein the three-dimensional model of the dental object includes one or more of gums and soft tissue.”). To the extent that Zhang identified a problem with scan artifacts, it proposed to solve that problem through a solution based on the camera path that it recognized as “***particularly useful . . . for scans covering gums, [and] soft tissue . . .***” *Id.*, ¶[0098] (emphasis added). Simply put, Zhang teaches away from removing soft tissue and, thus, provides no reason for a POSITA to look to Babayoff, or any other reference, for the ***removal*** of soft tissue. *See, e.g., Tec Air, Inc. v. Denso Mfg. Michigan Inc.*, 192 F.3d 1353, 1360 (Fed. Cir. 1999) (reference teaches away when a POSITA, “upon reading the reference, . . . would be led in a direction divergent from the path that was taken by the applicant” or if the combination would “render the device inoperable for its intended purpose”).

Indeed, the Petition does not address this technical difference between Zhang and Babayoff. The Petition cites conclusory expert testimony from Dr. Eli Saber, but it also fails to account for this technical difference between the references. Pet. 47-48 (citing EX1003, ¶¶234-235). In paragraph 234, Dr. Saber asserts—without

explanation—that a POSITA would be motivated to combine Zhang with Babayoff to achieve a more accurate representation of the teeth that did not include soft tissue. In connection with his discussion of Zhang, Dr. Saber mirrors the Petition's statement that "soft tissue can be problematic if it blocks or prevents proper reconstruction of the hard surface of the teeth." EX1003, ¶235. But Dr. Saber does not provide any supporting citation to Zhang or any other explanation. This is a textbook example of improperly using hindsight for motivation to combine.

Dr. Saber does not consider or address the fact that Zhang embraces and, in fact, claims the inclusion of soft tissue. *Supra*, p.12. Nor does he address the fact that Zhang proposed a solution based on a camera path that is "particularly useful" for scans covering gums and soft tissue. EX1007, ¶[0098]. Likewise, Dr. Saber identifies nothing in his background, education, or training that would lead him or a POSITA to conclude that soft tissue necessarily should be removed in dental imaging despite the contrary teachings of Zhang. Dr. Saber does not purport to have dental experience that would lead him to that conclusion.

At bottom, his conclusory statement is insufficient to establish a rational underpinning for 3Shape's legal assertion of obviousness. *See In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016) ("To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The

petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.”).

The remainder of Dr. Saber's statements about motivation to combine are found in ¶¶236-239 of his declaration. These paragraphs quote and characterize various provisions of Babayoff, but offer no explanation why a POSITA would have been motivated to modify Zhang with the teachings in Babayoff to remove soft tissue. To the extent any rationale is alleged, it is not based on evidence but hindsight-driven conjecture that modifies Zhang contrary to its expressed, intended purpose. An obviousness analysis before this Board requires more. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) (“A factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning.”); *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1361 (Fed. Cir. 2011) (“[T]he claimed invention is not obvious if a [POSITA] would not select and combine the prior art references to reach the claimed composition or formulation.”).

Furthermore, Dr. Saber's characterizations of Babayoff are unsubstantiated. Citing to Babayoff at 24:25-47, Dr. Saber states that “[r]econstructions that include soft tissue such as a portion of the tongue or cheeks *will* lead to orthodontics and dental prostheses that do not fit properly.” EX1003, ¶236 (emphasis added). But the

cited provision does not make such a sweeping assertion. Rather, it allowed for the removal of soft tissue in a “second embodiment” of the invention. EX1008, 24:25-27. The remainder of Dr. Saber’s paragraphs concerning motivation simply restate this description from Babayoff. Ultimately, Dr. Saber does not provide a sufficient explanation why a POSITA would have been motivated to modify Zhang, with Babayoff or any other reference, to remove soft tissue.

2. Petitioners Fail To Establish A Reasonable Expectation Of Success.

Petitioners argue there would have been a reasonable expectation of success because “[t]he key teachings from Babayoff could be employed in Zhang by only modifying Zhang’s software. Hardware changes would not be necessary.” Pet. 49. According to Petitioners, “[m]odifying Zhang to achieve the claimed invention of the ’798 Patent would only require modification of the existing software to differentiate the soft tissue from the dentition and then remove it” *Id.* But the only support Petitioners offer for these assertions are unsubstantiated statements from their expert that largely track the Petition. EX1003, ¶¶240-243. Conclusory statements are not enough to support a conclusion of obviousness; “a petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *Magnum*, 829 F.3d at 1380.

Furthermore, Petitioners fail to address technical differences between Zhang and Babayoff. Specifically, Petitioners are mistaken that the proposed combination of Babayoff and Zhang could be accomplished only with software changes. Babayoff states that its “present invention relates to color three-dimensional numerical entities representative of tissues.” EX1008, 1:15-21. It teaches the removal of soft tissue based on *color data*. *Id.*, 5:12-16, 21:12-22, 21:23-60, 22:3-10. Petitioners do not identify any teaching in Babayoff of how to remove soft tissue without color data.

Zhang, on the other hand, does not mention color data or the collection thereof. Contrary to Babayoff's teaching of four dimensional data (x, y, z, c), Zhang's teachings rely on three-dimensional representations, such as point clouds. *E.g.*, EX1007, ¶[0055]. Babayoff provides examples of the types of hardware needed to carry out its color-based removal, such as “a tri-color sequence generator,” “tri-color LEDs,” “a plurality of LEDs in three groups, each group providing illumination in one of the desired colors,” and others. EX1008, 8:45-56, 9:1-3, 12:7-24, 12:56-62. Petitioners do not identify any such hardware present in Zhang. And without such color data, the teachings of Babayoff could not be implemented.

3. Zhang And Babayoff, Alone Or In Combination, Do Not Suggest Every Limitation Of The Challenged Claims.

Even if Zhang and Babayoff were combined with a reasonable expectation of success, the result would be patentably different from the claimed inventions. Several elements of the '798 independent claims are not disclosed by Zhang or Babayoff and are not suggested in combination.

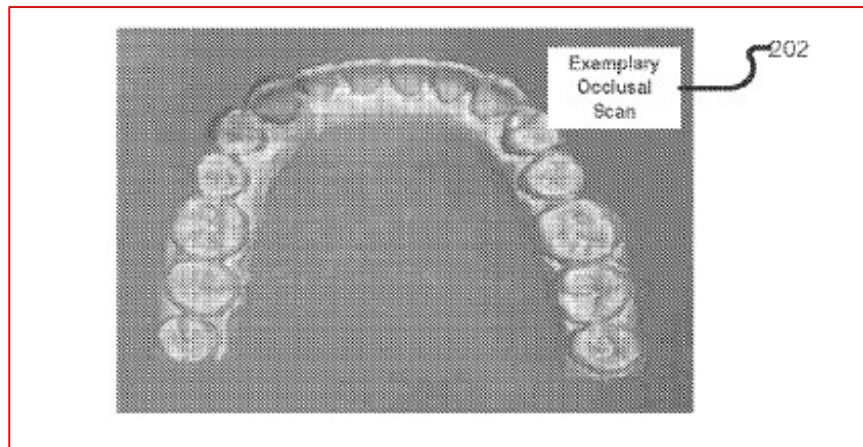
The '798 Patent has two independent claims, *i.e.*, claims 1 and 10, both of which are challenged in Ground 1. As noted further below, Petitioners generally rely on their arguments with respect to claim 1 for claim 10; thus, Patent Owner addresses them together. The following sub-sections (a)-(f) identify and discuss the elements not present, alone or in combination, in the asserted references.

a. limitations [1.3] & [10.1]²: “generate a contiguous scan of an occlusal surface of at least a part of one arch of the dentition”

Petitioners rely only on Zhang for this limitation. Pet. 12-14. But Zhang does not disclose or suggest “generat[ing] a contiguous scan of an occlusal surface of at least a part of one arch of the dentition.”

² Limitation [10.1] includes an additional element (e.g., “by capturing a plurality of partially overlapping image frames of the occlusal surface and stitching the overlapping image frames together to form a 3D model of the occlusal surface”) which is addressed with limitation [1.9].

The occlusal surface refers to the tooth surface that occludes or contacts with an opposing tooth surface of the opposing jaw while the jaws are in a clenched position. An example of an “occlusal scan” is depicted Figure 2 of the '798 Patent.



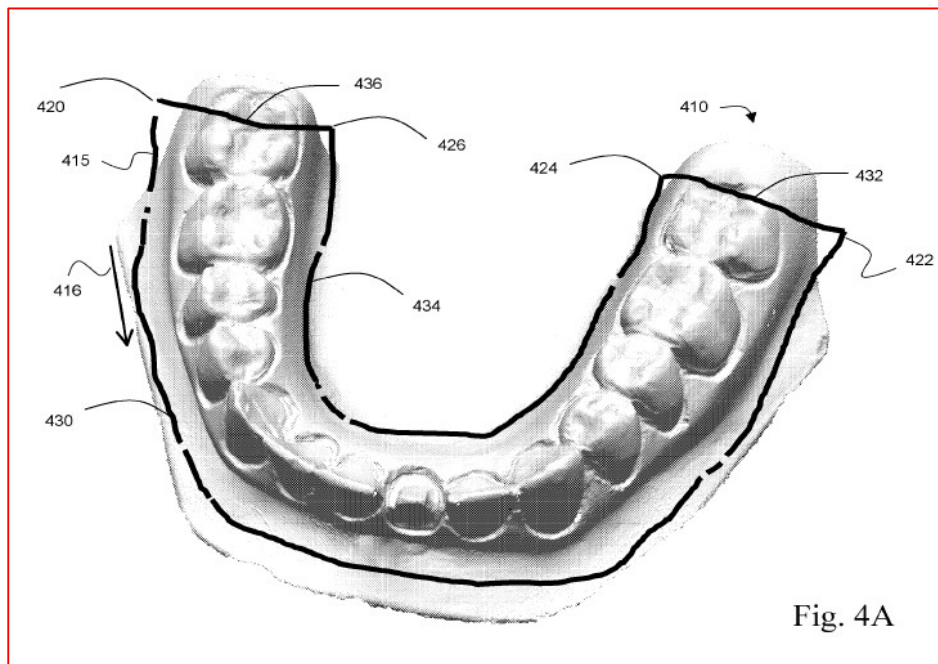
EX1001, Fig. 2 (cropped).

The '798 Patent teaches that it is difficult to obtain images of the labial and lingual surfaces without interruption by the presence of lips, tongue, cheek, etc. EX1001, 4:15-19. It therefore taught an approach in which the lingual and labial surfaces are imaged in multiple segments. *Id.* The '798 Patent teaches, for example, that “a contiguous scan of an occlusal surface of one arch of a dentition is generated” *Id.*, 12:1-4. “Labial and lingual surfaces are scanned . . . in multiple segments by moving the wand 108 in hook shape or some other pattern to include areas of the occlusal surface.” *Id.*, 12:4-7. The application “associates a plurality of labial surfaces of the one arch and a plurality of lingual surfaces of the one arch, to the contiguous scan of the occlusal surface.” *Id.*, 12:8-12. This approach can be thought

of as “middle-out,” as it relies on the detailed surface in between the labial and lingual surfaces as a skeleton from which to build out.³

Zhang teaches the opposite approach, working from the “outside-in.” Instead of generating a “contiguous scan of the occlusal surface” and attaching segments to that contiguous scan, Zhang teaches scanning the labial and lingual surfaces and using segments of the occlusal surface. Specifically, with reference to Figure 4A, it teaches following “path 415.” EX1007, ¶[0058]. The camera begins at “starting point 420” and follows “arc 430” to a “second point 422.” *Id.* The camera then may follow “segment 432 to a third point 424” and then “a second arc 434 to a fourth point 426.” *Id.* The camera may further follow “a second segment 436 to return approximately to the starting point 420.” *Id.* Thus, unlike the '798 Patent, Zhang teaches a scanning path that focuses on the lip-side and tongue-side surfaces, with only segments of the occlusal surface.

³ To be clear, although claim 1 requires a processor configured to associate a scan of at least one additional surface to the contiguous scan of the occlusal surface, claim 1 does not require that the scan data be acquired in a particular order. A scan of at least one additional surface could be obtained first, followed by a contiguous scan of the occlusal surface. If, however, the processor is configured to display in real-time a three-dimensional representation of the dentition as additional surfaces are imaged, then the occlusal surface must be imaged prior to the additional surfaces. *See, e.g.*, EX1001 at 2:1-4, 4:20-24, 5:29-41, claim 4.



Lest there be any doubt, none of the Zhang disclosures identified by Petitioners suggest “generating a contiguous scan of an occlusal surface.” Paragraphs [0041], [0043], [0045], and [046] do not mention an occlusal surface at all. And while paragraphs [0090] and [0098] mention an occlusal surface, they do not disclose a contiguous scan of an occlusal surface. Paragraph [0090] refers to an example “where a scan covers a buccal surface followed by an occlusal or lingual surface” This can be understood as referring to the scan path taught with reference to Figure 4A (above), in which the scan begins with the buccal (cheek) surface and proceeds across a small segment of the occlusal surface to scan the lingual surface. Paragraph [0098] does not add anything, except to note that an occlusal surface can be scanned.

At bottom, Zhang does not teach generating a contiguous scan of an occlusal surface. Even if Zhang and Babayoff were combined, they would not suggest implementing this limitation.

- b. limitations [1.5], [1.6], and [10.4]⁴: “associate a scan of at least one additional surface to the contiguous scan of the occlusal surface by” “analyzing the scan data to identify a portion of the scan of the at least one additional surface that overlaps with a portion of the contiguous scan of the occlusal surface”**

Petitioners rely only on Zhang for these limitations. Pet. 16-18. As discussed above, Zhang does not teach generating a “contiguous scan of the occlusal surface.” *Supra* pp.18-21. Relatedly, it does not teach to “associate a scan of at least one additional surface to the contiguous scan of the occlusal surface.” The ’798 Patent teaches that additional surfaces (*e.g.*, labial and lingual) can be captured in segments and those surfaces can be associated with a contiguous scan of the occlusal surface. *E.g.*, EX1001, 4:15-19, 12:1-12. Zhang, by contrast, teaches scanning the labial and lingual surfaces and associating those surfaces with each other. Although it may use segments of the occlusal surface, Zhang does not teach associating the labial or lingual scans with a contiguous scan of the occlusal surface.

⁴ Petitioners state that limitation [10.4] is “essentially identical to Elements [1.5] and [1.6]” and rely only on incorporation of their arguments as to limitations [1.4] and [1.5]. *See* Pet. 39.

- c. **limitation [1.10]: “wherein the processor is configured to remove the image data of the soft tissue from the contiguous scan by removing the image data of the soft tissue from the overlapping image frames used to generate the occlusal scan”**

This limitation requires that “the processor is configured to remove the image data of the soft tissue from the contiguous scan by removing the image data of the soft tissue *from the overlapping image frames used to generate the occlusal scan.*”

The phrase “the overlapping image frames used to generate the occlusal scan” refers back to the overlapping frames referenced in limitation [1.9], which requires that the “processor is configured to generate the contiguous scan of the occlusal surface by capturing a plurality of partially overlapping image frames of the occlusal surface and *stitching the overlapping image frames together* to form a 3D model of the occlusal surface.” Thus, limitation [1.10] requires removing the image data of the soft tissue from the overlapping image frames used (*i.e.*, that were stitched) to generate the occlusal scan. That soft tissue is removed after the frames have been stitched is equally plain from limitation [1.11], which requires that the “the processor is further configured to update the contiguous scan of the occlusal surface by restitching the overlapping image frames together after removing the image data of the soft tissue” EX1001, claim 1 (emphasis added).

Petitioners do not identify a suggestion of this limitation in the prior art. As previously discussed, they fail to identify a disclosure of generating a contiguous scan of an occlusal surface. As for removal of soft tissue, Petitioners rely only on Babayoff, which does not suggest removal from the image frames that were stitched to form the contiguous scan of an occlusal surface. Rather, Babayoff teaches segregating soft tissue based on color data *before* stitching. This is evident even from the provisions Petitioners cite. *See, e.g.*, EX1008, 5:11-16 (“By eliminating the data associated with the soft tissues, and proceeding with *stitching only the hard tissues* using the color data, the quality of the stitching procedure is significantly better than when using the full intra-oral data for the stitching procedure.”) (emphasis added). Petitioners fail to explain how Babayoff in any way suggests the removal of soft tissue after stitching. And Petitioners’ expert merely states that “Babayoff discloses a procedure that separates or removes soft tissue image data from hard tissue data.” EX1003, ¶117. That, of course, is not sufficient to show limitation [1.10].

Thus, even if a POSITA were to overlook that Zhang teaches away from soft tissue removal and combine it with Babayoff, the result would lack a contiguous scan of the occlusal surface and would not remove soft tissue in the same manner as required by the challenged claims.

- d. **limitation [10.2]: “remove image data of soft tissue from the overlapping image frames used to generate the occlusal scan based at least in part on an analysis of 3D data from the contiguous scan to distinguish between image data of the dentition and the image data of the soft tissue, wherein the soft tissue includes at least one selected from a group consisting of a tongue, a cheek, and a lip;”**

Petitioners provide no independent analysis for this limitation. Rather, they assert that it is “essentially identical to Element [1.4]” and incorporate their analysis with respect to limitation [1.4]. Pet. 38. This is insufficient. Limitation [10.2] is not the same as limitation [1.4], as it requires code that, when executed by a processor, causes a system to “remove image data of soft tissue *from the overlapping image frames used to generate the occlusal scan*,” similar to what is required in limitation [1.10], discussed immediately above.

Again, even if Zhang disclosed a contiguous scan of an occlusal surface—it does not—Babayoff would not suggest removal of image data of soft tissue from overlapping images used (per limitation [10.1] “stitch[ed]”)⁵ to generate a contiguous scan of an occlusal surface. Babayoff discloses segregating soft and hard

⁵ Similar to limitation [1.9], limitation [10.1] requires that code in the computer readable storage medium, when executed by a processor, causes a system to generate a contiguous scan of an occlusal surface “by capturing a plurality of partially overlapping image frames of the occlusal surface and *stitching* the overlapping image frames together to form a 3D model of the occlusal surface.”

tissue prior to stitching, and “proceeding with stitching *only* the hard tissues using the color data” EX1008, 5:12-16. Petitioners do not identify any teaching in Babayoff of removing soft tissue from a contiguous scan of the occlusal surface.

e. Claims 2-6

Claims 2-6 ultimately depend from independent claim 1,⁶ and therefore have at least the same limitations. For at least the reasons discussed with respect to claim 1, none of the asserted references disclose or suggest all limitations of claims 2-6. Thus, even if a POSITA would have been motivated to combine the asserted references, the resulting combination would not render claims 2-6 obvious.

f. Claims 11-15 and 17-19

Claims 11-15 and 17-19 ultimately depend from independent claim 10,⁷ and therefore have at least the same limitations. For at least the reasons discussed with respect to claim 10, none of the asserted references disclose or suggest all limitations of claims 11-15 and 17-19. Thus, even if a POSITA would have been motivated to

⁶ Claim 5 depends from claim 4, which depends from claim 2, which depends from claim 1.

⁷ Claim 13 depends from claim 12, which depends from claim 11, which depends from claim 11. Claim 19 depends from claim 18, which depends from claim 17, which depends from claim 15, which depends from claim 10.

combine the asserted references, the resulting combination would not render claims 11-15 and 17-19 obvious.

B. Ground 2 Fails For All The Reasons Of Ground 1.

Asserted References	Alleged Basis	Claims Challenged
Zhang in view of Babayoff and Fisker, et al., PCT Publication WO 2013/010910A1 (“Fisker”) (EX1009)	35 U.S.C. § 103	7, 16

Ground 2 challenges claims 7 and 16 based on the same prior art of Ground 1, plus an additional reference Fisker.⁸ Claim 7 depends from claim 1, and claim 16 depends from claim 10. Thus, claims 7 and 16 have at least the same limitations as claims 1 and 10, which are addressed in Ground 1. Although Ground 2 adds the Fisker reference, it does so only for the additional limitations of the dependent claims. Ground 2, therefore, fails for at least the same reasons that Ground 1 fails.

C. Ground 3 Fails For All The Reasons Of Ground 1.

Asserted References	Alleged Basis	Claims Challenged
Zhang in view of Babayoff and Dillon, et al., U.S. Patent Publication 2012/0062701A1 (“Dillon”) (EX1010)	35 U.S.C. § 103	8

⁸ DITC disputes that Fisker (EX1009) qualifies as prior art. Even if it is prior art, however, Ground 2 fails for the reasons stated.

Ground 3 challenges claim 8 based on the same prior art of Ground 1, plus an additional reference Dillon (EX1010).⁹ Claim 8 depends from claim 1 and thus has at least the same limitations as claim 1, which is addressed in Ground 1. Although Ground 3 adds the Dillon reference, it does so only for the additional limitations of dependent claim 8. Ground 3 fails for at least the same reasons that Ground 1 fails.

D. Ground 4 Fails For All The Reasons Of Ground 1.

Asserted References	Alleged Basis	Claims Challenged
Zhang in view of Babayoff and Johnson, “Spin-Images: A Representation for 3-D Surface Matching,” 1997 (EX1011)	35 U.S.C. § 103	9, 20

Ground 4 challenges claims 9 and 20 based on the same prior art of Ground 1, plus an additional reference Johnson (EX1011). Claim 9 depends from claim 1, and claim 20 depends from claim 10. Thus, claims 9 and 20 have at least the same limitations as claims 1 and 10, which are addressed in Ground 1. Although Ground 4 adds the Johnson reference, it does so only for the additional limitations of the dependent claims. Ground 4 therefore fails for at least the same reasons that Ground 1 fails.

⁹ DITC disputes that Dillon (EX1010) qualifies as prior art. Even if it is prior art, however, Ground 3 fails for the reasons stated.

VII. CONCLUSION

For the foregoing reasons, Patent Owner respectfully requests that the Board deny institution.

Respectfully Submitted,

Dated: May 21, 2024

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CERTIFICATE OF COMPLIANCE

I hereby certify that the word count for the foregoing Patent Owner's Preliminary Response totals 5,805, excluding the parts which are exempted by 37 C.F.R. § 42.24. Patent Owner has relied on the word count feature of the word processing system used to create this paper in making this certification.

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6, I hereby certify that on May 21, 2024, the foregoing Patent Owner's Preliminary Response was served via email on the following counsel of record for the Petitioner:

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