

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CLEARCORRECT OPERATING, LLC,
Petitioner,

v.

ALIGN TECHNOLOGY, INC.,
Patent Owner.

IPR2025-00816
Patent 11,369,456 B2

Before KEVIN F. TURNER, KRISTINA M. KALAN, and
CYNTHIA M. HARDMAN, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318

I. INTRODUCTION

We have jurisdiction to conduct this *inter partes* review under 35 U.S.C. § 6 and to issue this Final Written Decision pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that ClearCorrect Operating, LLC (“Petitioner”) shows by a preponderance of the evidence that claims 1–9, 11, and 13–17 of U.S. Patent No. 11,369,456 B2 (Ex. 1001, “the ’456 patent”) are unpatentable, but does not show by a preponderance of the evidence that claims 10, 12, 18, and 19 are unpatentable.

Petitioner filed a Petition requesting *inter partes* review of claims 1–19 of the ’456 patent. Paper 1 (“Petition” or “Pet.”).¹ Align Technology, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 10. Pursuant to 35 U.S.C. § 314(a), we instituted *inter partes* review of claims 1–19 on the grounds advanced in the Petition. Paper 14 (“Institution Decision” or “Inst. Dec.”). After institution of trial, Patent Owner filed a Patent Owner Response (“PO Resp.,” Paper 22), Petitioner filed a Reply (“Pet. Reply,” Paper 26), and Patent Owner filed a Sur-Reply (“PO Sur-Reply,” Paper 32).²

¹ Patent Owner filed a Brief in Support of Discretionary Denial (Paper 7), to which Petitioner filed an Opposition (Paper 8), and to which Patent Owner responded with a Reply (Paper 11). Patent Owner’s request for discretionary denial was denied, and the Petition was referred to the Board. Paper 13.

² With Board authorization, Patent Owner filed a Listing of alleged new arguments and evidence in the Reply (Paper 28, “Listing”), to which Petitioner responded (Paper 29, “Listing Resp.”). Petitioner identifies the portions of Patent Owner Response and other evidence to which its arguments reply. Listing Resp. 1–2. Having reviewed Patent Owner’s points and Petitioner’s responses, we are persuaded that the Listing’s identified items are properly responsive, and do not exceed the scope of a proper reply in violation of 37 C.F.R. § 42.23(b).

We held an oral hearing on July 31, 2026, and a transcript is included in the record. Paper 38 (“Tr.”).

A. Real Parties in Interest

Petitioner identifies itself (ClearCorrect Operating, LLC) and ClearCorrect Holdings, Inc., Straumann USA, LLC, and Institut Straumann AG as the real parties in interest. Pet. 87. Patent Owner identifies itself (Align Technology, Inc.) as the real party in interest. Paper 3 (Patent Owner Mandatory Notices), 1. Neither party objects to the other’s identification in this regard.

B. Related Matters

The parties identify as a related matter the following litigation involving the ’456 patent: *Align Technology, Inc. v. ClearCorrect Operating, LLC*, Case No. 6:24-cv-00187-ADA-DTG (W.D. Tex.). Pet. 87; Paper 3, 2. Patent Owner also identifies the following *inter partes* reviews: IPR2025-00814; IPR2025-00815; IPR2025-00817; IPR2025-00818; IPR2025-00819; IPR2025-00820; and IPR2025-00821. Paper 3, 1–2.

The record also reflects Petitioner’s previous challenge to U.S. Patent No. 8,038,444 (“the ’444 patent”), which is a parent of the ’456 patent, in IPR2017-01829 (“the ’444 IPR”). *See, e.g.*, Pet. 5–6; Ex. 1001, code (63). The Board did not institute *inter partes* review in the ’444 IPR. *See generally* Ex. 1008.

C. The ’456 patent

The ’456 patent, titled “Automated Treatment Staging For Teeth,” relates to providing “apparatus, systems, and methods for automated staging of teeth, from an initial position to a final, corrected position.” Ex. 1001, code (54), 2:16–18. “Depending upon the particular needs of the patient,

the patient's teeth are scheduled to move according to various movement patterns, routes, rates, and/or distances," using techniques including "tooth staggering, round-tripping, and/or slowing." *Id.* at 2:18–23.

A computing device generates a representation of the patient's teeth in an initial state and in the desired final position and calculates the planned stages in between the current and desired final positions. Ex. 1001, 5:47–57. We reproduce Figure 2B below.

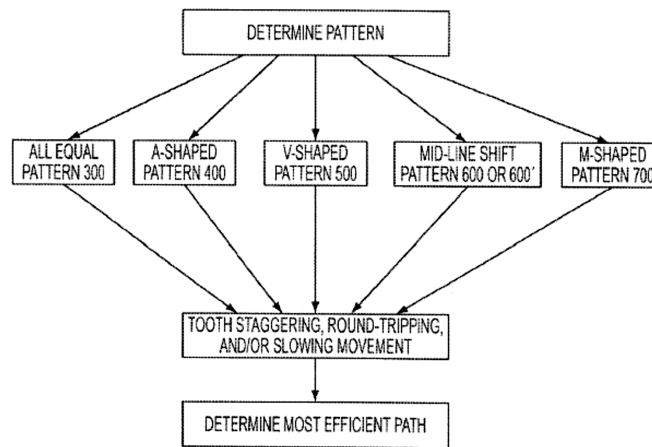


Figure 2B is a flow diagram of patterns and options for optimizing the movement of a patient's teeth during treatment. *Id.* at 2:46–49. The computer program first determines what type of movement pattern is needed, such as an "all-equal" pattern or an "A-shaped" pattern. *Id.* at 5:57–6:16. The computer program then determines "if the pattern should be modified to accommodate the teeth movement of the current patient to avoid collision," e.g., by staggering, round-tripping, and/or slowing the movement of one or more teeth. *Id.* at 6:46–47, 12:64–13:22. Then, a "set of aligners to move the teeth along the route in various stages is manufactured." *Id.* at 5:38–39.

D. Challenged Claims

Petitioner challenges all claims 1–19 of the '456 patent. Claims 1, 8, 11, 12, 13, 17, 18, and 19 are independent. Claim 1, reproduced below with annotations,³ is representative of the challenged claims:

1. [1(pre)] A computer-implemented method comprising:
 - [1(a)] determining a schedule of movement for dental objects during treatment stages of an orthodontic treatment, wherein the schedule of movement indicates whether or not each of the dental objects moves during each of the treatment stages;
 - [1(b)] calculating a respective treatment path for each of the dental objects between their respective initial position and respective final position;
 - [1(c)] identifying a collision between a first of the dental objects and a second of the dental objects based at least on the schedule of movement of the dental objects and the respective treatment paths;
 - [1(d)] performing a first modification of the schedule of movement in response to the identifying, [1(e)] the first modification of the schedule of movement modifying whether or not at least one of the dental objects move during at least one of the treatment stages;
 - [1(f)] determining that the first modification does not avoid a collision between the first of the dental objects and the second of the dental objects; and
 - [1(g)] performing a second modification of the schedule of movement after the determining that the first modification does not avoid a collision, the second modification of the schedule of movement modifying whether or not at least one of the dental objects move during at least one of the treatment stages.

Ex. 1001, 16:7–16:33.

³ For ease of reference, we use the same bracketed notations Petitioner uses in the Petition. *See, e.g.*, Pet. xi–xix (List of Challenged Claims).

E. Asserted Grounds

Petitioner asserts the following grounds of unpatentability:

Ground	Claim(s) Challenged	35 U.S.C. § ⁴	Reference(s)/Basis
1	1–9, 11, 13–17	103(a)	Chishti-511, ⁵ Chishti-876, ⁶ Sachdeva ⁷
2	10, 12, 18, 19	103(a)	Chishti-511, Chishti-876, Sachdeva, Becker ⁸

Pet. 3. Petitioner supports its arguments with Declarations from Dr. Sumit Yadav (Ex. 1003; Ex. 1040) and Dr. Paul C. Clark (Ex. 1017). Patent Owner relies on the Declaration of Dr. Maureen A. Valley. Ex. 2013.⁹

II. ANALYSIS

A. Principles of Law

In an *inter partes* review, “the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.”

⁴ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”) included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Petitioner applies a priority date of August 30, 2006. *See* Pet. 2 n.2. Accordingly, we apply the pre-AIA version of § 103; however, our decision would be the same under the AIA version of the statute.

⁵ U.S. Patent No. 6,471,511 B1 to Chishti et al., issued October 29, 2002 (Ex. 1004, “Chishti-511”).

⁶ U.S. Patent No. 6,729,876 B2 to Chishti et al., issued May 4, 2004 (Ex. 1005, “Chishti-876”).

⁷ U.S. Patent No. 6,250,918 B1 to Sachdeva et al., issued June 26, 2001 (Ex. 1007, “Sachdeva”).

⁸ Adrian Becker, *The Orthodontic Treatment of Impacted Teeth* (Martin Dunitz Ltd. 1998) (Ex. 1006, “Becker”).

⁹ The parties each argue that the other party’s expert’s testimony is entitled to little or no weight. PO Resp. 6–7; Pet. Reply 28–29; PO Sur-Reply 25–26. We acknowledge these arguments and, in our analysis, accord the parties’ declarations and testimony the appropriate weight.

Harmonic Inc. v. Avid Tech., Inc., 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). Petitioner ultimately bears the burden of persuasion to prove unpatentability of each challenged claim by a preponderance of the evidence. 35 U.S.C. § 316(e). This burden never shifts to Patent Owner. See *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).¹⁰ Petitioner must demonstrate unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d); see also *Harmonic Inc.*, 815 F.3d at 1363.

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Obviousness is resolved based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness, i.e., secondary considerations.¹¹ *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966). Subsumed within the *Graham* factors is the requirement that, if all claim limitations are found in a number of prior art references, then the patent challenger must

¹⁰ At times herein we may refer to Patent Owner’s arguments as unpersuasive; however, we do not shift the ultimate burden of proof, and such statements are in the context of the record as a whole.

¹¹ Neither party presents evidence or arguments about objective indicia of nonobviousness.

show that the skilled artisan would have had a reasonable expectation of success in combining the prior art references to achieve the claimed invention. *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007).

B. Level of Ordinary Skill in the Art

Factors pertinent to a determination of the level of ordinary skill in the art include “(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.” *Envtl. Designs, Ltd. v. Union Oil Co. of Cal.*, 713 F.2d 693, 696 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.* at 696–697. We consider the grounds of unpatentability in view of the understanding of a person of ordinary skill in the art at the time the invention was made. *See Graham*, 383 U.S. at 17–18.

Petitioner proposes that a person of ordinary skill in the art (“POSITA”)

as of August 30, 2006 (the earliest claimed priority date) would have been part of an interdisciplinary team. This team would have included a member with an advanced degree related to dentistry (e.g., BDS, MDS, DDS, DMD) with experience in orthodontics, including 1–3 years of orthodontic training or equivalent experience, and experience using clear aligners. The team may have also included members with a degree in a technical area related to software, graphics, computers, or a related discipline. This technical team member would have had 1–3 years of software development experience. For all team members, more education could substitute for experience and vice versa.

Pet. 6 (citing Ex. 1003 ¶ 24; Ex. 1017 ¶ 24; Ex. 1029; Ex. 1030).

In our Institution Decision, we adopted Petitioner’s proposed level of ordinary skill in the art as consistent with the cited prior art and undisputed on the record at that time. Inst. Dec. 8.

Patent Owner argues that Petitioner “now proposes a definition that shifts the level of skill” from its position in the ’444 IPR. PO Resp. 4. Patent Owner further argues that Petitioner’s attempt to “move away from its own previous position before the Board” appears to be “a litigation-driven tactic.” *Id.* at 5. Patent Owner also takes issue with Petitioner’s exclusion of “experience using clear aligners” from its definition, which Patent Owner alleges “is significant” because a person lacking this experience would have failed to appreciate key differences in approaches specifically designed for clear aligners and those specifically designed for braces, and would have been more prone to overlook medical risks and disadvantages. *Id.* at 6.

Petitioner replies that the “Petition set forth a proposed level of skill in the art, including ‘experience using clear aligners.’” Pet. Reply 29 (citing Pet. 6). Regarding Patent Owner’s allegation that a reference to clear aligners is “missing from Dr. Yadav’s level of skill,” Petitioner argues that omission “was merely a typographical error” that is now corrected. *Id.* (citing Ex. 1040 ¶ 3). Dr. Yadav testifies that the sentence in paragraph 24 of his initial declaration (Ex. 1003) “should read as follows, with the unintentionally omitted portion underlined: ‘This team would have included members with an advanced degree related to dentistry (e.g., BDS, MDS, DDS, DMD) with experience in orthodontics, including 1–3 years of orthodontic training or equivalent experience, and experience using clear

aligners.” Ex. 1040 ¶ 3 (also stating: “I applied this level of skill in my analysis.”).

Patent Owner responds that Dr. Yadav’s assertion of “typographical error” is “belied by the evidence.” PO Sur-Reply 23–24. Patent Owner also responds that Dr. Yadav’s testimony that he has experience with clear aligner systems discusses the Essix appliance, which Patent Owner alleges is different than the types of clear aligner systems described in the applied references. *Id.* at 25.

We continue to apply the definition we adopted in the Institution Decision, namely, that a person of ordinary skill in the art at the time of the invention

would have been part of an interdisciplinary team. This team would have included a member with an advanced degree related to dentistry (e.g., BDS, MDS, DDS, DMD) with experience in orthodontics, including 1–3 years of orthodontic training or equivalent experience, and experience using clear aligners. The team may have also included members with a degree in a technical area related to software, graphics, computers, or a related discipline. This technical team member would have had 1–3 years of software development experience. For all team members, more education could substitute for experience and vice versa.

This definition is in line with the ’456 patent Specification and the prior art. We are unpersuaded by Patent Owner’s arguments that Petitioner’s expert’s statement in the original declaration is a material omission. We acknowledge Patent Owner’s arguments regarding a POSITA’s purported understanding of “clear aligners” in connection with its analysis of the Petitioner’s expert testimony (PO Resp. 3–7; PO Sur-Reply 23–26), but those arguments are more properly weighed and considered in

the context of the merits analysis, below, rather than in the definition of a POSITA.

Our ultimate determination, however, would be the same even if we accounted for Patent Owner's arguments. Patent Owner does not appear to disagree substantially about the level of skill in the art proposed by Petitioner, other than to state that it differs from other proposals. Neither party has persuasively explained on this complete record how any of the arguments regarding the level of ordinary skill would change the ultimate analysis in this case. The Board, sitting as a non-jury tribunal with administrative expertise, is well-positioned to determine and assign appropriate weight to evidence presented by each declarant in this case. *Gnosis S.P.A. v. S. Ala. Med. Sci. Found.*, IPR2013-00118, Paper 64 at 43 (PTAB June 20, 2014). Accordingly, we evaluate declarant testimony along with the remainder of the evidence before us to reach our conclusions. We note that an express definition of the level of ordinary skill is not required in all situations, as the level of ordinary skill in the art may be evidenced by the references themselves. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that "specific findings on the level of skill in the art . . . [are not required] 'where the prior art itself reflects an appropriate level and a need for testimony is not shown'" (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))).

Because Petitioner's definition of the level of skill in the art is consistent with the '456 patent and the asserted prior art, we maintain it for purposes of this Final Written Decision.

C. Claim Construction

We construe each claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). Under this standard, claim terms are generally given their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019). “In determining the meaning of [a] disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Petitioner indicates that in the co-pending litigation in the District Court for the Western District of Texas (*see supra* Section I.B), the parties jointly agreed to constructions of “slowing/slow” (claims 9, 11) and “all-equal pattern” (claim 3). Pet. 7–8 (citing Ex. 1013, 8; Ex. 1003 ¶ 33). In the same litigation, Petitioner also proposed constructions for the claim 3 terms “V-shaped pattern,” “A-shaped pattern,” “M-shaped pattern” and “mid-line shift pattern,” and states that the “district court issued preliminary constructions of ‘plain and ordinary meaning’” for those terms. *Id.* at 8. (citing Ex. 1013, 2–3; Ex. 1032, 2–3).

For purposes of the Institution Decision, we adopted the agreed-upon constructions of the terms “slowing/slow” and “all-equal pattern” and, like the District Court, applied the plain and ordinary meaning of the terms “V-shaped pattern,” “A-shaped pattern,” “M-shaped pattern” and “mid-line shift pattern.” Inst. Dec. 9–10.

Patent Owner states: “While Petitioner identifies constructions for certain claim terms, Patent Owner submits that no terms need to be expressly construed in order to reach a final written decision” PO Resp. 8. Neither Petitioner nor Patent Owner discusses claim construction any further. *See generally* Pet. Reply; PO Sur-Reply.

Neither party indicates that any other claim term requires express construction. Only claim terms in controversy need to be construed. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”). The terms discussed by the parties prior to institution and preliminarily construed in our Institution Decision do not impact our determination here. For purposes of this Final Written Decision, therefore, we determine that no claim term requires express construction.

D. Ground 1: Alleged Obviousness Based on Chishti-511, Chishti-876, and Sachdeva

Petitioner asserts that claims 1–9, 11, and 13–17 would have been unpatentable as obvious over Chishti-511, Chishti-876, and Sachdeva. Pet. 19–75.

1. *Chishti-511 (Ex. 1004)*

Chishti-511 is titled “Defining Tooth-Moving Appliances Computationally.” Ex. 1004, code (54). It relates to “methods and apparatus” for “repositioning teeth from an initial tooth arrangement to a final tooth arrangement.” *Id.* at 1:33–36. In particular, a patient’s teeth are repositioned “by making a series of incremental position adjustments” using, for example, “a series of appliances formed as polymeric shells having the tooth-receiving cavities.” *Id.* at 1:39–47. The appliances are used together with a computational orthodontic system that provides “a path definition module that calculates the paths taken by teeth as they are repositioned during treatment.” *Id.* at 1:65–67. We reproduce Figure 1 below.

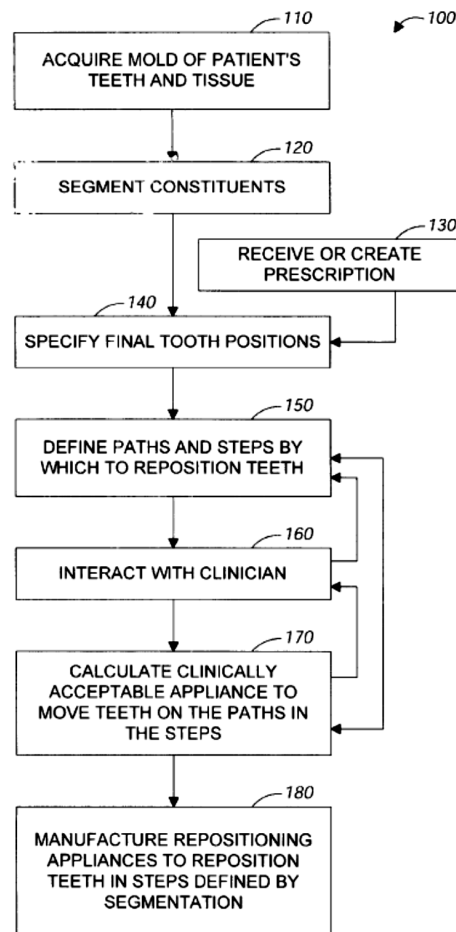


Figure 1 “is a flowchart of a process of specifying a course of treatment including a subprocess for calculating aligner shapes.” *Id.* at 2:65–67.

At step 110, a mold or scan of the patient’s teeth and tissue is acquired (e.g., by taking casts of the patient’s teeth and gums and x-ray imaging) and a digital data set is derived that represents the initial pretreatment arrangement of the patient’s teeth and tissue. *Id.* at 3:40–50. At step 120, data structures that digitally represent individual tooth crowns are produced, and digital models of entire teeth are also produced (including hidden surfaces and root structures). *Id.* at 3:51–58. At step 130, the desired final position of the teeth (intended end result of treatment) is received from a clinician. *Id.* at 3:59–64. At step 140, using the desired final positions (intended) and digital representations (current), the final position and surface geometry of each tooth is specified to form a complete model of the teeth as desired at end of treatment (e.g., orthodontically correct repositioning). *Id.* at 3:64–4:6. At step 150, a subprocess defining segmented paths calculates the paths based on threshold limits of linear and rotational translation (e.g., with default values based on the nature of the appliance to be used) and tailored limit values calculated from patient-specific data. *Id.* at 4:23–35.

At step 160, after the segmented paths have been defined, a client process allows a clinician to display an animation of the positions and paths, to reset the final positions of the teeth, and to specify constraints of the segmented paths (and step 150 is performed again to implement changes to the segmented paths). *Id.* at 4:39–50. At step 170, the segmented tooth paths and associated tooth position data are used to calculate clinically acceptable appliance configurations that will move the teeth on the defined treatment path in the steps specified by the path segments. *Id.* at 4:51–56.

At step 180, appliances defined by the process are manufactured. *Id.* at 5:1–6.

Each appliance configuration represents a step along the treatment path. *Id.* at 4:56–57. Each tooth path has a beginning and final position. *Id.* at 4:7–9. The tooth path segments are calculated so that each tooth’s motion within a segment stays within threshold limits of linear and rotational translation. *Id.* at 4:15–18. Chishti-511 teaches:

The tooth paths are optimized in the aggregate so that the teeth are moved in the quickest fashion with the least amount of round-tripping to bring the teeth from their initial positions to their desired final positions. (Round-tripping is any motion of a tooth in any direction other than directly toward the desired final position. Round-tripping is sometimes necessary to allow teeth to move past each other.)

Id. at 4:9–16.

2. *Chishti-876 (Ex. 1005)*

Chishti-876 is titled “Tooth Path Treatment Plan.” Ex. 1005, code (54). Chishti-876 teaches “[s]ystems and methods . . . to prepare a malocclusion treatment plan by selecting a tooth treatment pattern from a library of predetermined tooth treatment patterns.” *Id.* at code (57). The system “draw[s] upon a database of preferred treatments for exemplary tooth arrangements,” which are based on observations learned from prior successful treatments. *Id.* at 14:63–15:1.

“[D]etermining a tooth path includes finding a collision free shortest path between an initial position and a final position for one or more teeth.” *Id.* at 2:28–30. A path-scheduling algorithm can “create several alternative paths and present each path graphically to the user.” *Id.* at 15:2–3. The “path scheduling algorithm . . . determines the rate at which each

component, i.e., each tooth, moves along the path from the initial position to the final position.” *Id.* at 14:43–46. Chishti-876 teaches that the “path scheduling algorithm determines the treatment path while avoiding ‘round-tripping,’ i.e., while avoiding moving a tooth along a distance greater than absolutely necessary to straighten the teeth. Such motion is highly undesirable, and has potential negative effects on the patient.” *Id.* at 14:46–51.

Chishti-876’s “method can include generating an appliance for each treatment stage,” such as a set of aligners. *Id.* at 2:35–38, 11:34–37.

3. *Sachdeva (Ex. 1007)*

Sachdeva is titled “Method and Apparatus for Simulating Tooth Movement for an Orthodontic Patient.” Ex. 1007, code (54). Sachdeva teaches a method for simulating tooth movement for an orthodontic patient. *Id.* at 3:28–30, 4:39–40. On a tooth-by-tooth basis, a three-dimensional direct path of movement is determined from an actual tooth position in relation to a desired tooth position. *Id.* at 4:50–54. A determination is made whether a conflict in movement arises between teeth during the simulation (e.g., movement of one tooth interferes with the direct path movement of another tooth to its desired position). *Id.* at 5:3–8. If a conflict arises, it is resolved by selecting a priority tooth based on the relationship between the teeth and conflict. *Id.* at 5:9–15. Movement of the priority tooth is determined to resolve the conflict, and the simulation is adjusted based on the movement of the priority tooth. *Id.* at 5:27–32.

4. *Petitioner’s Obviousness Argument*

Petitioner argues that Chishti-511 “discloses a computerized system that generates a treatment plan for clear aligners,” while the “other cited

references disclose well-known features that would have been obvious components of an automated software treatment-planning system.” Pet. 1. In particular, Petitioner argues that “Chishti-876 discloses a database of established treatment patterns for creating treatment plans,” and Sachdeva discloses “modifying whether or not teeth move to avoid collisions.” *Id.*

Regarding motivation to combine, Petitioner argues that a “POSITA would have been motivated to use Sachdeva’s collision identification and avoidance techniques to supplement Chishti-511’s treatment planning system.” Pet. 19. Petitioner argues that Sachdeva discloses identifying and resolving collisions by, e.g., delaying an initial movement of a tooth, and that a “POSITA would have recognized that integrating Sachdeva’s automated collision identification, avoidance, and adjustment features into Chishti-511 would provide implementation details for the features disclosed in Chishti-511 and would help achieve the ‘clinically viable sequence of tooth positions’ sought by Chishti-511,” that is, “helping prevent aligners that might cause a collision,” with a reasonable expectation of success. *Id.* at 20 (citing Ex. 1004, 4:15–22; Ex. 1003 ¶ 79). Petitioner also argues that a “POSITA would have been motivated to combine Chishti-876’s teachings regarding the use of movement patterns and the generation of schedules of movement with Chishti-511’s treatment-planning system,” for reasons of efficiency, transparency, and predictability. *Id.* at 27, 29 (citing Ex. 1003 ¶ 89). Petitioner argues that a “POSITA would have had a reasonable expectation of success in combining Chishti-876’s pattern features with Chishti-511’s system,” because a POSITA would recognize that the Chishti-876 database of treatment patterns “is equally applicable to Chishti-511’s system.” *Id.* at 28 (citing Ex. 1003 ¶ 88).

Petitioner argues that the limitations of claim 1 are met by the asserted prior art, as follows:

[1(pre)] A computer-implemented method comprising:
(Chishti-511, Chishti-876, Sachdeva; Pet. 32; Ex. 1003 ¶ 96)

[1(a)] determining a schedule of movement for dental objects during treatment stages of an orthodontic treatment, wherein the schedule of movement indicates whether or not each of the dental objects moves during each of the treatment stages; (Chishti-511, or Chishti-511 and Chishti-876; Pet. 32–36; Ex. 1003 ¶¶ 97–103)

[1(b)] calculating a respective treatment path for each of the dental objects between their respective initial position and respective final position; (Chishti-511; Pet. 36; Ex. 1003 ¶ 104)

[1(c)] identifying a collision between a first of the dental objects and a second of the dental objects based at least on the schedule of movement of the dental objects and the respective treatment paths; (Chishti-511, or Chishti-511 and Sachdeva; Pet. 36–39; Ex. 1003 ¶¶ 105–107)

[1(d)] performing a first modification of the schedule of movement in response to the identifying, (Chishti-511, or Chishti-511 and Sachdeva; Pet. 39–42; Ex. 1003 ¶¶ 108–111)

[1(e)] the first modification of the schedule of movement modifying whether or not at least one of the dental objects move during at least one of the treatment stages; (Sachdeva; Pet. 42–43; Ex. 1003 ¶¶ 112–115)

[1(f)] determining that the first modification does not avoid a collision between the first of the dental objects and the second of the dental objects; and (Chishti-511, or Chishti-511 and Sachdeva; Pet. 44–48; Ex. 1003 ¶¶ 116–120)

[1(g)] performing a second modification of the schedule of movement after the determining that the first modification does not avoid a collision, the second modification of the schedule of movement modifying whether or not at least one

of the dental objects move during at least one of the treatment stages. (Chishti-511, or Chishti-511 and Sachdeva; Pet. 48–49; Ex. 1003 ¶¶ 121–124).

Petitioner provides additional arguments mapping the limitations of the remaining claims challenged under this ground to the relied-upon prior art, with evidentiary support. Pet. 50–75; Ex. 1003 ¶¶ 125–173.

5. *Patent Owner’s Response*

Patent Owner argues that Petitioner’s obviousness argument “rests on a fundamentally flawed reading of Chishti-511 and Sachdeva that fails to support a finding that the references teach each and every limitation of the claims and fails to support a motivation to combine.” PO Resp. 24.

First, Patent Owner argues that “Petitioner fails to show independent claim 1 is obvious because petitioner misconstrues Chishti-511 and Sachdeva and proposes an illogical combination.” *Id.* Specifically, Patent Owner argues that “Petitioner fails to show that either Chishti-511 alone or Chishti-511 in view of Sachdeva teaches *identifying a collision* between dental objects and *performing a first modification of the schedule of movement in response to the identifying*, as recited in limitations 1(c) and 1(d).” *Id.* at 24–25. Patent Owner asserts that the Petition conflates “two different processes described in Chishti-511—its initial path determination process and its subsequent calculation of aligner acceptability” and that Chishti-511 as a whole does not support Petitioner’s reading. *Id.* at 25–26.

First, when Chishti-511 describes that new aligners will be calculated when the system determines that teeth motion is not “orthodontically acceptable” or “an acceptable end position is not reached,” it means that the system *identif[ies] a collision*. Second, by determining an aligner is unacceptable due to the identified collision, Chishti-511’s system redefines the treatment path having the unacceptable aligner, and thus

perform[s] a first modification to the schedule of movement in response to the identifying. EX2013, ¶83.

Id. at 27–28.

Thus, any modification to the treatment paths due to Chishti-511’s system determining that an aligner is unacceptable is **not** in response to identifying a collision because (1) the aligner calculation process is acting on paths that are already **collision-free** and (2) treatment paths are only recalculated in response to the failure to identify a workable aligner that can acceptably move the teeth along a given path.

Id. at 34.

Regarding the combination with Sachdeva, Patent Owner asserts that “Petitioner fails to show that Sachdeva describes identifying *a collision* and also fails to show that combining Chishti-511 and Sachdeva would satisfy the limitations of the claimed invention.” *Id.* at 35. “Rather than mentioning the word *collision*, Sachdeva instead discusses determining whether “a conflict” exists between teeth.” *Id.* Additionally, Patent Owner asserts that “Petitioner fails to establish that Sachdeva’s ‘conflict’ and its resolution is a modification of the schedule of movement in response to the identification of a collision because the movement identified in Sachdeva is a collision-free movement.” *Id.* at 37–38. Regarding the mapping underlying Petitioner’s motivation to combine, Patent Owner argues that because “Chishti-511 teaches determining clinically viable positions that are **collision-free** before proceeding with the aligner calculation process, Sachdeva’s techniques, at best, would resolve any alleged collisions **before** aligner shapes are assessed.” *Id.* at 39.

Second, regarding limitations 1(f) and 1(g), Patent Owner refers to its parallel arguments for corresponding limitations 1(c) and 1(d). *Id.* at 40–42

(“for the same reasons discussed above with respect to limitations 1(c) and 1(d) . . .”).

Third, regarding motivation to combine, Patent Owner argues that Petitioner’s rationale is “illogical and lacks a rational basis.” *Id.* at 42. Primarily, Patent Owner argues that Petitioner “advances an incoherent rationale to combine” because Petitioner repeatedly confuses “Chishti-511’s discussion of the initial path determination process” with “Chishti-511’s aligner calculation process,” and is unclear about which of these two processes Petitioner proposes combining with Sachdeva. *Id.* at 43. Regardless of which of the two processes Petitioner relies upon, Patent Owner argues, “neither is sufficient to establish obviousness.” *Id.* at 46. Secondly, Patent Owner argues that Petitioner ignores fundamental differences between Chishti-511 and Sachdeva. *Id.* at 49–52. Patent Owner argues that “Sachdeva is concerned with a different type of treatment system—a wire-and-brackets system (or braces)—and thus, seeks to achieve different goals.” *Id.* at 49. Patent Owner also presents arguments with respect to the remaining independent claims and dependent claims challenged under Ground 1. *Id.* at 52–53.

6. Petitioner’s Reply

Regarding asserted obviousness in view of Chishti-511 alone, Petitioner replies that Chishti-511 clearly shows that the “path determination process” and “aligner calculation process” are part of an integrated, iterative loop (Figs. 1 and 6) such that the aligner calculation process can transfer control back to the path definition process if any collisions are detected when the system simulates—during the “aligner calculation process”—actual tooth movement. Pet. Reply 1 (citing Ex. 1004, 8:54–58).

“While Chishti-511’s system attempts to correct for these deviations by adjusting the aligners, Chishti-511 recognizes that there are limits to these adjustments. Ex-1004, 7:37-51; Ex-1040, ¶12. A POSITA would understand that any of these deviations from idealized movements may result in collisions. Ex-1040, ¶12.” *Id.* at 2. Petitioner argues that “the entire point of Chishti-511’s solution is to create a ‘clinically viable sequence of tooth positions’ that ‘do[] not result in a collision of teeth.’” *Id.* at 3 (quoting Ex. 1004, 4:7–22). Thus, argues Petitioner, Patent Owner “attempts to divorce ‘orthodontically acceptable’ from collision avoidance (POR, 30-31), but these concepts are inseparable.” *Id.*

Regarding Sachdeva, Petitioner asserts that although the ’456 patent and Sachdeva use “slightly different terminology (‘conflicts’ vs. ‘collisions’),” both “describe the same practical problem,” i.e., “tooth movement paths interfering such that sequencing or modification is required.” *Id.* at 4–5.

Sachdeva’s “conflict” occurs between two teeth when “one tooth interferes with the direct path movement of another tooth causing a particular tooth to not be able to obtain its desired position.” Ex. 1007, 5:5–8. Petitioner argues that in Sachdeva, “the other tooth would move to its desired position, but it cannot because it would collide with another tooth.” Pet. Reply 6; Ex. 1003 ¶¶ 113–114. Sachdeva avoids collision, according to Petitioner, “by moving a priority tooth first, while movement of the non-priority tooth is delayed until a later stage.” Pet. Reply 6; Ex. 1007, 5:9–25; Ex. 1003 ¶ 114.

Petitioner responds to Patent Owner’s arguments by arguing that (1) Sachdeva contemplates that the tooth has a movement path towards a

desired position and is not merely stationary; (2) Sachdeva’s collision identification results from a simulation of both teeth attempting to move along their respective paths; (3) claim 8 talks about “delay” of a first dental object, like Sachdeva; and (4) U.S. Patent No. 6,632,089 (“Rubbert,” Ex. 1043) incorporates Sachdeva and characterizes Sachdeva as discussing “collisions.” Pet. Reply 6–9.

Regarding Dr. Yadav’s testimony, Petitioner asserts that Patent Owner mischaracterizes the substance of the testimony. Pet. Reply 9–10.

Regarding motivation to combine, Petitioner reemphasizes that the references are compatible, and a POSITA would have been motivated to combine them. *Id.* at 12–16. More particularly, Petitioner argues that both references start with defined “path of movement” (Sachdeva) or “defined tooth paths” (Chishti-511), and both simulate tooth movement. *Id.* at 13–14.

7. Patent Owner’s Sur-Reply

Patent Owner responds that, in Petitioner’s Reply, “Petitioner abandons reliance on this process” of Chishti-511 teaching limitations 1(c) and 1(d), and “now pivots to asserting that Chishti-511 identifies deviations from those collision-free paths during the next step—the aligner calculation process—and that a deviation **could** result in a collision.” PO Sur-Reply 1–2 (citing Pet. Reply 1–2).

Patent Owner reiterates that Petitioner fails to show that Chishti-511 discloses identifying collisions and performing a modification in response. *Id.* at 2. Patent Owner faults Petitioner for allegedly shifting theories regarding Chishti-511 and backing away from the assertions in the Petition. *Id.* at 3–4. Patent Owner also criticizes Petitioner’s reply arguments as unsupported and lacking merit. *Id.* at 7–12. Regarding Sachdeva, Patent

Owner argues that Petitioner fails to show that Sachdeva identifies collisions or teaches collision identification or collision detection. *Id.* at 12–14. Patent Owner particularly faults Petitioner for relying on Rubbert, arguing that this exceeds the scope of a proper reply. *Id.* at 14. Patent Owner reiterates that Petitioner fails to show a POSITA would combine Chishti-511 and Sachdeva as proposed. *Id.* at 15–18.

8. *Analysis*

In view of the arguments and cited evidence, we find on this complete record that Petitioner has demonstrated by a preponderance of the evidence that a person of ordinary skill in the art would have been motivated to combine the teachings of the Chishti patents and Sachdeva to meet the limitations of the claims challenged under this ground. Petitioner persuasively maps the limitations of the challenged claims to the portions of the references relied upon. Pet. 32–75. Petitioner also, on this complete record, provides substantiated statements of motivation to combine with a reasonable expectation of success. *Id.* at 19–22, 27–32.

We disagree with Patent Owner’s argument, with respect to limitations 1(c) and 1(d), that Petitioner “misconstrues Chishti-511 and Sachdeva and proposes an illogical combination.” PO Resp. 24.

First, regarding Patent Owner’s allegation that Chishti-511 or the Chishti-511/Sachdeva combination fail to teach limitations 1(c) and 1(d), i.e., identifying a collision between dental objects and performing a first modification of the schedule of movement in response to the identifying, we are not persuaded that this is the case.

Regarding Petitioner’s reliance on Chishti-511 alone to meet limitations 1(c) and 1(d), we are persuaded by Petitioner’s argument and

evidence that Chishti-511's corrections to the deviations from idealized movements to achieve an "orthodontically acceptable" solution reasonably constitutes identifying a collision and performing a first modification. Pet. Reply 2–3 (citing Ex. 1040 ¶ 12). We are persuaded that this is shown in the integrated, iterative loop in Figures 1 and 6 of Chishti-511, which moves between the aligner calculation process and the path definition process as needed if it is determined that a collision or a solution that is not "orthodontically acceptable" is happening. *See* Pet. 37 ("Chishti-511 further teaches that, when aligners are unacceptable, 'the process transfers control to a path definition process ... to redefine those parts of the treatment path having unacceptable aligners.'" (citing Ex. 1004, 8:42–61, which describes Figure 6 and the point at which control may be transferred to a path definition process such as step 150 in Figure 1)); Pet. Reply 4 ("Chishti-511 shows that path definition and aligner calculation are not sequential, independent silos, but rather are interrelated stages within a closed-loop system. Ex-1004, Figs. 1-2, 6; 4:25-32; 8:42-66.").

Additionally, although Patent Owner argues that Chishti-511's "aligner calculation process is acting on paths that are already collision-free" (PO Resp. 34), Patent Owner also concedes that "Chishti-511 describes avoiding collision of teeth," which appears to support Petitioner's arguments as to limitation 1(c). *Id.* at 29–30 (referencing Step 150, Figure 1). More particularly, Patent Owner agrees that the aligner calculation process can interact with the path definition module, and augment other processes for defining tooth paths. *Id.* at 30 (citing Ex. 1004, 1:59–67, 2:45–53). Thus, Patent Owner's concessions, and the iterative and interactive nature of Chishti-511's processes (i.e. linking the process of Figure 6 with step 150,

Figure 1), support Petitioner's contentions that Chishti-511 discloses limitations 1(c) and 1(d).

Although Patent Owner further argues that “Chishti-511 does not describe identifying collisions in connection with its aligner calculation process because the preceding path determination process outputs collision-free paths” (PO Resp. 30; Ex. 2013 ¶¶ 87–88), we are provided with little persuasive reasoning or evidence that Chishti-511's process definitively “outputs collision-free paths” that would never result in an orthodontically unacceptable motion, or an unacceptable end position. *Cf.* Pet. 36 (citing Ex. 1004, 5:25–32 (discussing what happens if an acceptable end position is not reached and discussing evaluating “the motions of the teeth” “to determine whether they are orthodontically acceptable” or not)). On the other hand, Petitioner's evidence demonstrates that Chishti-511's system “first defines idealized, collision-free tooth paths where teeth are moved ‘in the quickest fashion’” (Pet. Reply 1 (citing Fig. 1, steps 140, 150)) then during the “aligner calculation process” uses “finite element analysis to simulate how it expects a patient's teeth to actually move if they were to use the calculated aligners.” *Id.* (citing Ex. 1004, Figs. 2–4). Petitioner persuasively demonstrates that where there are “deviations from idealized movements” that “may lead to collisions” (*id.* (citing Ex. 1040 ¶¶ 11–12)), Chishti-511's system “transfers control to a path definition process (such as step 150, FIG. 1) to redefine those parts of the treatment path having unacceptable aligners (step 630).” *Id.* at 2 (citing Ex. 1004, 8:42–59, Fig. 6; Ex. 1040 ¶12); *see also* Pet. 37 (citing Ex. 1004, 8:42–61, 8:54–61). Thus, Petitioner persuasively shows that limitations 1(c) and 1(d) are met by Chishti-511's iterative process.

Patent Owner's position effectively tries to read "collision" out of Chishti-511's use of the terms "orthodontically acceptable" and "acceptable end position." Merely because the claims use the term "collision" and Chishti-511 uses the terms "orthodontically acceptable" and "acceptable end position" (as well as the term "collision," Ex. 1004, 4:22), this does not mean that Chishti-511's scenarios do not encompass a collision. On this record, Petitioner persuasively demonstrates that a POSITA could determine a seemingly collision-free path such as that in Chishti-511 that, due to unforeseen circumstances, results in an orthodontically unacceptable collision, and then go back and perform a modification, as Chishti-511 discloses. Petitioner argues, supported by credible testimony, that the circumstances in Chishti-511 may lead to collisions; that there are limits to the adjustments that can be made in Chishti-511 (Ex. 1004, 7:37–51); and that Chishti-511's process can relax constraints on the aligners (*id.* at 8:32–39; Fig. 6). Ex. 1040 ¶¶ 11–12.¹² Chishti-511's "constraints can include a maximum rate of displacement of a tooth, a maximum force on a tooth, and a desired end position of a tooth" and we agree that a POSITA would have understood that changing these parameters may result in a collision. Ex. 1040 ¶ 12. We also disagree with Patent Owner's argument challenging Petitioner's assertion that "a POSITA would have understood an aligner shape that was not 'orthodontically acceptable' or does not reach 'an acceptable end position' means that a schedule of movement results in a collision" (PO Resp. 32, 32 n.3), because the portions of Chishti-511

¹² We disagree with Patent Owner that these paragraphs are improper (Listing, item 3); rather, we find them properly responsive to Patent Owner's arguments about what these terms in Chishti-511 mean.

discussed above indicate that Chishti-511 allows for identifying a collision and making a modification accordingly.

Next, regarding Patent Owner's argument that the combination of Chishti-511 and Sachdeva would not satisfy limitations 1(c) and 1(d) of the claimed invention because Sachdeva discusses "a conflict" rather than "a collision" (PO Resp. 35), we are not persuaded. Sachdeva recognizes that conflicts between teeth are undesirable and provides ways of moving teeth that are free of conflict. Pet. 19 (citing Ex. 1007, 5:3–32; Fig. 4). Sachdeva also provides: "A conflict may arise in that the movement of one tooth interferes with the direct path movement of another tooth causing a particular tooth to not be able to obtain its desired position." Ex. 1007, 5:5–8 (cited at Pet. Reply 6).

Patent Owner argues that Sachdeva's disclosure of "a conflict" does not encompass "a collision." PO Resp. 35 ("[R]ather than mentioning the word *collision*, Sachdeva instead discusses determining whether 'a conflict' exists between teeth."). To the extent that Patent Owner requires the prior art to use the exact terminology as the claims, an obviousness determination is not an *ipsissimis verbis* test. *Cf. In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (addressing similar concept in the context of anticipation). We note, also, that neither party proposed an express construction of the term "collision" (*see* Tr. 13:15–19, 40:18–41:2), nor do we find it necessary to construe the term expressly on this record. *See Vivid Techs.*, 200 F.3d at 803. Moreover, as discussed below, Petitioner's evidence adequately supports that Sachdeva determines whether a collision might exist, notwithstanding Sachdeva's use of non-identical terminology.

Although Patent Owner argues that “Petitioner fails to establish that Sachdeva’s ‘conflict’ and its resolution is a modification of the schedule of movement in response to the identification of a collision because the movement identified in Sachdeva is a collision-free movement” such that the “nonpriority tooth (*e.g.*, the upper tooth) cannot move due to the priority tooth (*e.g.*, the lower tooth) blocking its path, making a collision not possible since no movement is possible” (PO Resp. 37–38), we are not persuaded. Petitioner’s relied-upon portions of Sachdeva do appear to teach stopping a non-priority tooth. Ex. 1007, 5:9–36 (providing that for “an intra-arch conflict, the actual position of the tooth will dictate whether the upper tooth is priority or the lower tooth is priority” in determining if the lower tooth or the upper tooth is moved first). The Petition argues that in Sachdeva’s examples, “two teeth are prevented from initially moving together due to interfering with each other,” and, accordingly, “Sachdeva’s system modifies the schedule of movement for the nonpriority tooth so that instead of moving with the priority tooth, the nonpriority tooth’s initial movement is instead delayed and moved after the priority tooth in a later treatment stage.” Pet. 43 (citing Ex. 1003 ¶ 114). On reply, Petitioner reiterates that in Sachdeva, a “conflict” occurs between two teeth when “one tooth interferes with the direct path movement of another tooth causing a particular tooth to not be able to obtain its desired position” (Ex. 1007, 5:5–8), in other words, “the other tooth *would* move to its desired position, but it cannot because it would collide with another tooth.” Pet. Reply 5–6 (citing Ex. 1007, 5:5–25; Ex. 1003 ¶¶ 113–114). We agree that “Sachdeva avoids this collision by moving a priority tooth first, while movement of the non-priority tooth is delayed until a later stage.” *Id.* (citing Ex. 1007, 5:9–25; Ex. 1003 ¶ 114).

According to Patent Owner, Petitioner's expert agreed that "a collision requires a moving tooth" (PO Resp. 37 (citing Ex. 2015, 47:20–48:6)), but we find that this testimony "was responsive to a question . . . giving an example of one type of collision (one moving tooth striking against another)." Pet. Reply 9. Additionally, Patent Owner's characterization of this testimony overreads the requirements of the claim. The claim does not require an actual collision between moving teeth, it merely requires identifying a prospective collision if teeth were to move in a particular manner. Ex. 1001, 16:16–19; Tr. 39:18–40:2; 46:16–25. Thus, claim 1 does not require an actual collision, nor does Sachdeva have to disclose an actual collision. *See* Ex. 1007, Fig. 4, 42 ("simulate tooth movement based on each tooth's direct path"), 44 ("conflict arise between teeth?").

On this complete record, Petitioner has mapped sufficiently the disclosures of Sachdeva to the limitations of the challenged claims. Without persuasive support from Patent Owner, or persuasive evidence to support the assertion that Sachdeva does not disclose the claimed limitations, we remain unpersuaded by Patent Owner's arguments in this regard.

Regarding Patent Owner's second argument about limitations 1(f) and 1(g), which discuss identifying a second collision and performing a second modification, we refer to our analysis above regarding limitations 1(c) and 1(d), discussing identifying a first collision and performing a first modification.

Regarding Patent Owner's third argument that Petitioner has failed to establish motivation to combine, we find that Petitioner has demonstrated adequate motivation to combine for the reasons of record. Both Sachdeva

and Chishti-511 simulate tooth movement (Pet. 19–22), and Chishti-511 states that its disclosures apply to both conventional braces and aligners. *See* Ex. 1004, 2:4–15. Although Patent Owner argues that combining the Chishti references and Sachdeva results in inconsistencies, and that there are differences between the processes of the references, we agree that the proposed combination of Chishti-511 and Sachdeva is sufficiently motivated and reasonably expected to result in a successful method, for the reasons articulated by Petitioner. *See, e.g.*, Pet. 19–22; Ex. 1003 ¶¶ 76–80. Namely, we agree that a POSITA would have been motivated to look to Sachdeva’s teachings of identifying and avoiding collisions and use these teachings in Chishti-511’s system. *See generally* Ex. 1003 ¶¶ 76–80; *see id.* ¶ 79 (detailing the proposed combination of Chishti-511 and Sachdeva), ¶ 80 (discussing reasonable expectation of success); *see also* ¶¶ 88–90 (discussing combination of Chishti-876 with Chishti-511). Limitations 1(c) and 1(d) can be achieved either by Chishti-511’s disclosures alone, as understood by one of ordinary skill in the art, or by the combination of Sachdeva and Chishti-511, and, as persuasively explained by Dr. Yadav, either would result in “identifying a collision . . .” and “performing a first modification . . .” as in limitations 1(c) and 1(d). *See* Ex. 1003 ¶¶ 105–111.

Having reviewed Petitioner’s proffered motivation to combine arguments as to Chishti-511 and Sachdeva, and Chishti-511 and Chishti-876, we are persuaded on this record that Petitioner has met its burden with respect to motivation to combine the references asserted in this ground, with a reasonable expectation of success. On this complete record, and considering both parties’ arguments and supporting evidence, Patent Owner’s argument does not undermine Petitioner’s showing. Thus,

Petitioner demonstrates by a preponderance of the evidence that claim 1 would have been obvious over the Chishti references and Sachdeva.

9. Claims 2–9, 11, and 13–17

We have also reviewed Petitioner’s contentions for all the remaining limitations of the claims challenged under this ground, i.e., claims 2–9, 11, and 13–17, as well as the supporting evidence. Pet. 50–75 (citing Ex. 1003 ¶¶ 125–173). Patent Owner does not present materially separate arguments in opposition to claims 2–9, 11, and 13–17. *See* PO Resp. 52–53.

Based on the complete record before us, we are persuaded that Petitioner shows that the combination of the Chishti references and Sachdeva teaches all the limitations of claims 2–9, 11, and 13–17, and that one of ordinary skill in the art would have been motivated to make the combination with a reasonable expectation of success. Accordingly, we determine that Petitioner shows, by a preponderance of the evidence, that claims 2–9, 11, and 13–17 would have been obvious over the teachings of the Chishti references and Sachdeva.

10. Conclusion as to Ground 1

Having reviewed the parties’ arguments and evidence, we are persuaded that Petitioner’s discussion of the references, and the explanations in the Declarations, show that the combination of Chishti-511, Chishti-876, and Sachdeva teach all the limitations of claims 1–9, 11, and 13–17, and that one of ordinary skill in the art would have been motivated to make the combination with a reasonable expectation of success. Accordingly, we determine that Petitioner shows, by a preponderance of the evidence, that claims 1–9, 11, and 13–17 would have been unpatentable as obvious over Chishti-511, Chishti-876, and Sachdeva.

E. Ground 2: Alleged Obviousness Based on Chishti-511, Chishti-876, Sachdeva, and Becker

Petitioner asserts that claims 10, 12, 18, and 19 would have been unpatentable as obvious over Chishti-511, Chishti-876, Sachdeva, and Becker. Pet. 75–86.

1. Becker (Ex. 1006)

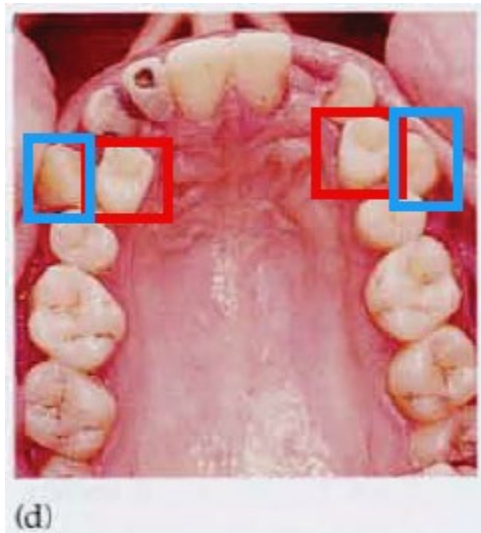
Becker is an excerpt from a book titled “The Orthodontic Treatment of Impacted Teeth.” Ex. 1006, 2. The excerpt is part of a chapter titled “Impacted teeth in the adult.” *See id.* at 4 (table of contents), 5 (chapter heading). Under a subheading titled “Temporary Prosthetic Replacement and Tooth Transposition,” Becker teaches:

Rarely, one or more of the impacted teeth is also transposed. For the most part, it is preferable to align the teeth in their transposed positions, rather than to try to retranspose them to their ideal positions, for reasons already discussed in Chapter 6.^[13] Nevertheless, there are situations in which this may be preferred line of treatment.

Id. at 5.

Using a series of photographs, Becker illustrates a process for moving teeth to correct transposition of a patient’s maxillary canine and first premolar. *Id.* at 6–8. We reproduce below our annotated version of Becker’s Figure 8.6(d).

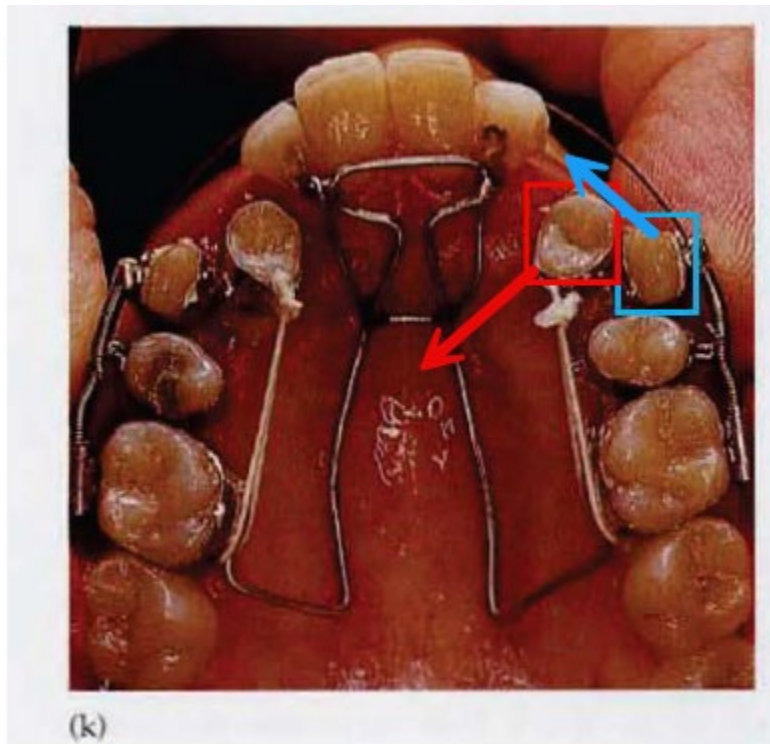
¹³ Becker Chapter 6 is not of record.



Becker's Figure 8.6(d) is a photo showing an occlusal view of a patient's maxillary arch.¹⁴ *Id.* at 6. As highlighted by our annotations, on both sides of the mouth, the patient's maxillary canines (blue boxes) and first premolars (red boxes) are transposed. Although Becker's process carries out transposition bilaterally, for clarity, below we walk through the process on only one side of the mouth.

We reproduce below an annotated version of Becker's Figure 8.6(k).

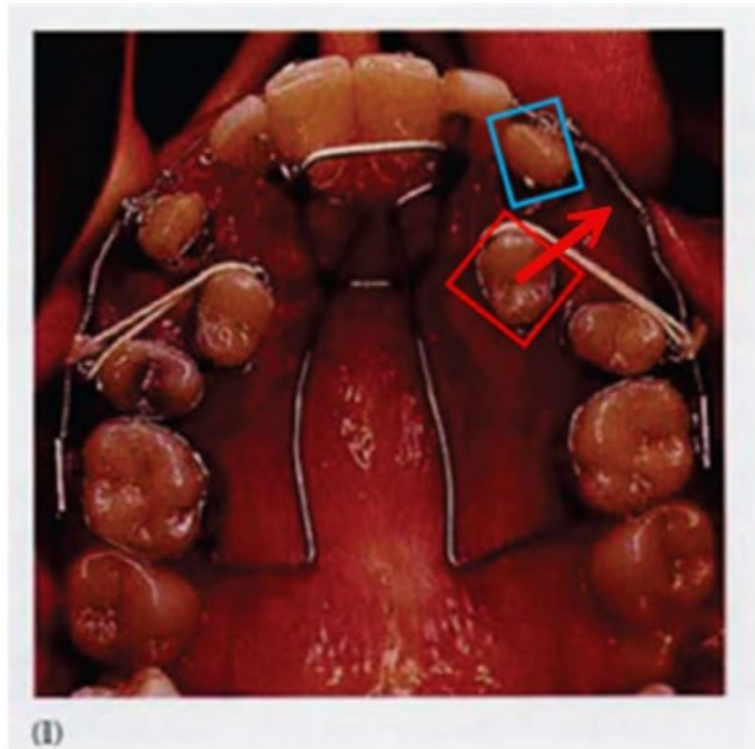
¹⁴ In Figure 8.6(d), the patient's "deciduous canines and right lateral incisor are still present." Ex. 1006, 6. At the start of treatment, these deciduous (or "baby") teeth were extracted. *Id.* As discussed below, a palatal arch was added and used to support lateral incisor pontics (i.e., artificial incisors). *See id.*



Becker's Figure 8.6(k) is a photo showing the patient's maxillary arch during treatment. *Id.* at 7. A labial archwire is spanned from molar to molar, and the archwire is passed through brackets on the lateral incisor pontics (i.e., the artificial teeth flanking the front teeth). *Id.* at 5. Loops, cross-pieces, and elastic thread are disposed on the palatal arch. *Id.*

The photo includes Petitioner's annotations (red and blue boxes) and our annotations (red and blue arrows) for identifying teeth and their movement. *See* Pet. 14. The photo depicts the maxillary canine (blue box) transposed with the first premolar (red box). *Id.* The palatal arch is used to move the premolar through the varying use of elastic thread. Ex. 1006, 5. The hardware directs the premolar (red box) inward (as indicated by the red arrow), so that the canine (blue box) can move toward the incisor (as indicated by the blue arrow). *Id.*

We reproduce below an annotated version of Becker's Figure 8.6(l).



Becker's Figure 8.6(l) is a photo of a patient's teeth mid-transposition. *Id.* at 6. The premolar (red box) was moved inwardly and thereby out of the path of the canine (blue box), and the canine was moved into its desired position next to the incisor pontic. *Id.* at 5–6. As indicated by the red arrow, the premolar will now “be moved in the opposite mesio-distal direction and back in the line of the arch.” *Id.* at 5.

We reproduce Becker's Figure 8.6(m) below.



Becker's Figure 8.6(m) is a photo of the completed transposition. *Id.* at 8.

2. *Petitioner's Obviousness Argument*

Petitioner refers to and relies upon its arguments in Ground 1 and further argues that Becker would have taught or suggested certain portions of the claims challenged in Ground 2. Pet. 75–86 (citing Ex. 1003 ¶¶ 173–199). More particularly, Petitioner focuses on limitations 10(b), 10(c), 18(g), and 19(h) and the proposed combination of Chishti-511 and Becker to disclose these limitations. *Id.*

In an overview, Petitioner discusses “[i]ndirect movement of teeth, as described in Becker,” stating that the “indirect movement of teeth is

sometimes referred to as ‘round-tripping.’”^{15,16} Pet. 15–16. Regarding motivation to combine the references, Petitioner acknowledges that “round-tripping can have disadvantages,” but argues that “a POSITA would have recognized that for some patients, round-tripping may be the only option, particularly if one wishes to avoid extracting one or more teeth.” Pet. 24 (citing Ex. 1003 ¶ 84). Thus, Petitioner argues, “a POSITA would have been motivated to include round-tripping as one feature in a system with robust software for generating treatment plans for a broad range of patients with different needs,” and this “would have been obvious, even if those features are only used in rare cases or as a last resort for patients that might otherwise not be able to be treated.” *Id.* at 24–25 (citing Ex. 1003 ¶ 84). Petitioner asserts that adding “Becker’s technique to round-trip one or more teeth” to Chishti-511’s system “would have involved a mere software modification to Chishti-511’s algorithm for calculating new aligners . . . , which would have yielded predictable results and had a reasonable expectation of success.” *Id.* at 26.

¹⁵ The ’456 patent Specification states that “round-tripping” is “the technique of moving a first tooth out of the path of a second tooth, and once the second tooth has moved sufficiently, moving the first tooth back to its previous position before proceeding to a desired final position of that first tooth.” Ex. 1001, 13:8–12. The same definition is found in the ’444 patent, which was the subject of the ’444 IPR. Ex. 1008, 6 (citing to 12:51–55 of the ’444 patent), 14–15; Ex. 1028, 17.

¹⁶ Although the claims challenged under Ground 2 do not expressly recite “round-tripping,” Petitioner provides arguments based on “Becker’s round-tripping treatment technique” (Pet. 25) to meet the limitations of the challenged claims. We discussed “Becker’s round-tripping technique” in our Institution Decision (Inst. Dec. 29) and Petitioner also discusses and relies upon “round-tripping” in its Reply. *See, e.g.*, Pet. Reply 17–18.

3. *Patent Owner's Response*

Patent Owner argues that “Petitioner relies on the same flawed understanding of Chishti-511 (*i.e.*, improperly conflating its path definition process with its aligner calculation process) to argue that a POSITA would have been motivated to combine Chishti-511 with Becker.” PO Resp. 54. Patent Owner also argues that “the Board has already determined Ground 2 is deficient” based, in part, on “Chishti-876’s disparagement of round-tripping generally,” and a lack of reason to combine. *Id.* at 54–55 (citing Ex. 2013 ¶¶ 130–131 (Dr. Valley stating that Dr. Yadav has not shown that using aligners such in Chishti-511 and Chishti-876 “would be appropriate or even possible to effect Becker’s movement”)). Finally, Patent Owner argues that the Petition “is defective for failing to address Chishti-876’s teaching away from the modification the petition proposes in its combination.” *Id.* at 55–56.

4. *Petitioner's Reply*

Petitioner replies that (A) the prior art does not teach away from necessary indirect movement (Pet. Reply 17–20); and (B) Becker’s teachings are applicable to clear aligner systems (*id.* at 20–23 (citing Pet. 23–24; Ex. 1003 ¶ 83)).

Petitioner explains (A) that “round-tripping was well known in the art,” and “one disparaging statement” does not “forever inoculate future [Patent Owner] patents from challenges to claims reciting that known technique.” *Id.* at 17. Petitioner reiterates that “a POSITA would avoid round-tripping if possible but that it may sometimes be necessary.” *Id.* at 18 (citing Pet. 15–17, 22–24; *Optivus Tech., Inc. v. Ion Beam Applications S.A.*, 469 F.3d 978, 989 (Fed. Cir. 2006)). According to Petitioner, Patent

Owner’s “exclusive focus on one reference fails to consider the prior art as a whole and should be rejected.” *Id.* at 19.

Petitioner further argues (B) that the Petition explained in detail how Becker’s teachings were known to be used with aligners. Pet. Reply 20 (citing Pet. 23–24; Ex. 1003 ¶ 83). Petitioner points to examples from Becker (Ex. 1006, 7), Tuncay (Ex. 1016, 35) and other “aligner-focused references” that “similarly show that using attachments and elastics was well known.” *Id.* at 20–22.

5. *Patent Owner’s Sur-Reply*

Patent Owner responds that Petitioner is attempting to relitigate an issue that has been thoroughly examined by the Board, but that “nothing in the record has changed in Petitioner’s favor.” PO Sur-Reply 19 (citing Inst. Dec. 25–29). Patent Owner criticizes Petitioner’s reliance on *Optivus* to show a “finding of obviousness” where the Federal Circuit declined “to find a teaching away that involved a process that ‘would kill patients rather than cure them.’” *Id.* at 20. Patent Owner states that the “opposite exists here—Chishti-876 explicitly teaches the POSITA to avoid the round-tripping movement of Becker.” *Id.* at 20–21. Patent Owner reiterates that in the ’444 IPR, the “Board has previously addressed Chishti-511’s discussion of round-tripping and found it to be ‘something different’ than the type of round-tripping movement described in the ’456 patent.” *Id.* at 21 (citing Ex. 1008, 15–16).

Patent Owner also argues that Petitioner oversimplifies how Becker was able to accomplish its movement when Petitioner argues that additional attachments like elastics may be used in Becker. *Id.* at 21–23.

6. *Analysis*

We address Petitioner’s Reply arguments that (A) the prior art does not teach away from necessary indirect movement (Pet. Reply 17–20); and (B) Becker’s teachings are applicable to clear aligner systems (*id.* at 20–23).

Preliminarily, we note that that the ’456 patent and the ’444 patent (which uses the same description of round-tripping as the ’456 patent, *see supra* n.15) both describe “round-tripping” as the “technique of moving a first tooth out of the path of a second tooth, and once the second tooth has moved sufficiently, moving the first tooth back to its previous position before proceeding to a desired final position of that first tooth.” Ex. 1001, 13:8–12; Ex. 1008, 6 (discussing the ’444 patent). Chishti-511, on the other hand, provides: “Round-tripping is any motion of a tooth in any direction other than directly toward the desired final position.” Ex. 1004, 4:13–15. In the ’444 IPR, the Board determined that “the record reflects that the ‘round tripping’ described in Chishti ’511 is something different than the ‘round tripping’ required by the ’444 patent.” Ex. 1008, 15–16. This reasoning and finding have not been persuasively rebutted by Petitioner on this record. Thus, the Board’s denial of institution of *inter partes* review in the ’444 IPR, based in part on a determination that Chishti-511’s “round-tripping” is different from the “round-tripping” in the ’444 patent (which shares its definition of “round-tripping” with the ’456 patent), undermines Petitioner’s reliance on Chishti-511’s “round tripping” here in making the combination with Becker to attempt to meet the limitations of the claims challenged under this ground.

Regarding (A), Petitioner’s assertion that the prior art does not teach away or disparage round-tripping, we note again that “round-tripping” is

defined in the Specification as “the technique of moving a first tooth out of the path of a second tooth, and once the second tooth has moved sufficiently, moving the first tooth back to its previous position before proceeding to a desired final position of that first tooth.” Ex. 1001, 13:8–12. In discussing “round-tripping,” Chishti-876 teaches that its “path scheduling algorithm determines the treatment path while avoiding ‘round-tripping,’ i.e., while avoiding moving a tooth along a distance greater than absolutely necessary to straighten the teeth. Such motion is highly undesirable, and has potential negative effects on the patient.” Ex. 1005, 14:46–51.

“A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the [inventor].” *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994); see *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). In our Institution Decision, we stated that “it appears that Chishti-876 teaches away from ‘moving a tooth along a distance greater than absolutely necessary to straighten the teeth,’” based on, *inter alia*, the express teaching in Chishti-876 (Ex. 1005, 14:46–51) and the Board’s finding in the ’444 IPR that this teaching constitutes a teaching away from round-tripping. Inst. Dec. 28. The evidence of record supports a conclusion that an ordinarily skilled artisan attempting to use Becker’s movement and techniques in the proposed system of the Chishti references and Sachdeva would have been discouraged from doing so based on the disclosures of at least Chishti-876. Ex. 1008, 11; Inst. Dec. 25–29; Ex. 2013 ¶¶ 70–72, 128–131.

We also found in our Institution Decision that Chishti-876 disparages “moving a tooth along a distance greater than absolutely necessary to

straighten the teeth” (Ex. 1005, 14:46–51) which we characterized as “a broad statement that appears to encompass the more specific round-tripping movement taught in Becker.” Inst. Dec. 28. On this complete record, we still have before us Petitioner’s concession that “indirect movement was understood to be avoided if possible.” Pet. 17. Although Petitioner attempts to characterize indirect movement or round-tripping as a preferable or necessary option (*see, e.g.*, Pet. 15–17 (“it was also understood to be a necessary option for some patients”), these arguments are insufficiently supported to persuade us that there is no teaching away, notwithstanding the additional argument in this record (*see, e.g.*, Pet. Reply 17–20), which does not persuasively address the disparagement in Chishti-876, or the Board’s findings in the ’444 IPR regarding Chishti-511. *See In re Mouttet*, 686 F.3d 1322, 1333 (Fed. Cir. 2012) (“A reference that properly teaches away can preclude a determination that the reference renders a claim obvious.”).

Regarding (B), we are not persuaded that Becker’s teachings are readily applicable to clear aligner systems. We agree with Patent Owner that Becker’s treatment is for a “rare” orthodontic case using a complex appliance system involving mechanically intricate equipment. PO Resp. 55 (citing Ex. 1005, 14:46–51; Ex. 2013 ¶¶ 130–131). We are not directed to persuasive evidence that using aligners to effect Becker’s tooth transposition “would be appropriate or even possible.” *Id.* (citing Inst. Dec. 28–29). Petitioner points to the testimony of Dr. Yadav (Pet. Reply 20 (citing Ex. 1003 ¶ 83)), but we are not persuaded that this testimony meets Petitioner’s burden on this complete record. *See* PO Sur-Reply 22 (“Aside from generally pointing to the possible use of elastics with aligners, Petitioner provides no evidence that such a system would be appropriate or

possible to effect Becker's tooth transposition."'). Even though elastics can be used with aligners, we are not persuaded that Becker's complex appliance system involving mechanically intricate equipment to solve a "rare" orthodontic situation could be replicated with aligners as Petitioner proposes. On the contrary, Becker uses an abundance of hardware, including fake teeth and a span across the palate. *See* PO Sur-Reply 22; Ex. 2013 ¶ 131. Given these differences, Petitioner has not persuasively explained why a POSITA "would have been motivated to combine Chishti-511 with Becker's teachings regarding avoiding collisions using indirect tooth movement (i.e. round-tripping)." Pet. 22.

On this record, we are not persuaded that a person of ordinary skill in the art would have had an apparent reason to combine Becker's round-tripping technique with aligner treatment systems like those taught in the Chishti patents and Sachdeva, with a reasonable expectation of success, particularly in view of Chishti-876's disparagement of round-tripping generally.

7. Conclusion as to Ground 2

Based on the complete record before us, we are not persuaded that Petitioner's discussion of and evidence supporting the proposed combination of references show that the combination of Chishti-511, Chishti-876, Sachdeva, and Becker teach all the limitations of claims 10, 12, 18, and 19, or that one of ordinary skill in the art would have been motivated to make the combination with a reasonable expectation of success. Accordingly, we determine that Petitioner does not show, by a preponderance of the evidence, that claims 10, 12, 18, and 19 would have been obvious over the teachings of Chishti-511, Chishti-876, Sachdeva, and Becker.

III. CONCLUSION¹⁷

After reviewing the record and weighing the evidence offered by both parties, we determine that Petitioner shows, by a preponderance of the evidence, that claims 1–9, 11, and 13–17 of the '456 patent are unpatentable, but does not show that claims 10, 12, 18, and 19 of the '456 patent are unpatentable.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1–9, 11, 13–17	§ 103	Chishti-511, Chishti-876, Sachdeva	1–9, 11, 13– 17	
10, 12, 18, 19	§ 103	Chishti-511, Chishti-876, Sachdeva, Becker		10, 12, 18, 19
Overall Outcome			1–9, 11, 13– 17	10, 12, 18, 19

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has established by a preponderance of the evidence that claims 1–9, 11, and 13–17 of the '456 patent are unpatentable;

¹⁷ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

ORDERED that Petitioner has not established by a preponderance of the evidence that claims 10, 12, 18, and 19 of the '456 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of this Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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