UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CLEARCORRECT OPERATING LLC,
Petitioner,

v.

ALIGN TECHNOLOGY INC.,
Patent Owner.

Case IPR2025-00815
Patent No. 10,524,879

PETITION FOR *INTER PARTES* REVIEW

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1. [1(pre)] A computer-implemented method comprising: 34

2. [1(a)] determining, by one or more computer processors, a schedule of movement for dental objects during treatment stages, the dental objects being based from output of a scanning device, wherein the schedule of movement indicates whether each of the dental objects moves during each of the treatment stages; 34

3. [1(b)] calculating, by one or more computer processors, a respective route from an initial position toward a final position for each of the dental objects during the treatment stages; and 40

4. [1(c)] modifying, by one or more computer processors, the schedule of movement to avoid a collision or obstruction between two of the dental objects on their respective routes, the modifying comprising: 40

5. [1(d)] delaying initial movement of one of the dental objects; and 45

6. [1(e)] round-tripping one of the dental objects. 46

B. Claim 2: The computer-implemented method of claim 1, wherein determining the schedule of movement comprises selecting a movement pattern from a plurality of predetermined movement patterns. 50

C. Claim 3: The computer-implemented method of claim 1, further comprising recalculating at least one of the respective routes based on the modified schedule of movement. 51

D. Claim 4: The computer-implemented method of claim 1, further comprising manufacturing at least two orthodontic aligners, each of the orthodontic aligners corresponding to a respective one of the treatment stages. 52

E. Claim 5 54

1. [5(a)] The computer-implemented method of claim 4, wherein the manufacturing comprises: fabricating a respective positive mold of the dental objects for at least two of the treatment stages; and....54

2. [5(b)] thermoforming an orthodontic aligner over each respective positive mold. 54

F. Claim 6 57

1. [6(a)] The computer-implemented method of claim 1, wherein the round-tripping comprises: moving a first of the dental objects away from the respective route of a second of the dental objects; and 57

2. [6(b)] moving the first dental object toward its respective final position after the second dental object has sufficiently traversed its respective route to avoid the collision. 57

G. Claim 7 58

1. [7(a)] The computer-implemented method of claim 1, wherein the round-tripping comprises: moving a first of the dental objects away from the respective route of a second of the dental objects; and 58

2. [7(b)] moving the first dental object toward its previous position. 58

H. Claim 8 59

1. [8(a)] The computer-implemented method of claim 1, wherein: the determining of the schedule of movement comprises determining, by one or more computer processors, a total number of the treatment stages; and 59

2. [8(b)] the determining of the total number of the treatment stages comprises: determining, by one or more computer processors, a respective minimum number of treatment stages for each of the dental objects; and 61

3. [8(c)] selecting, by one or more computer processors, a largest of the respective minimum numbers of treatment stages as the total number of the treatment stages. 63

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1. [15(pre)] – [15(c)] 69

2. [15(d)] determining, by the one or more computer processors, that the respective route of a first of the dental objects results in a collision or obstruction with a second of the dental objects; 69

3. [15(e)] altering, by the one or more computer processors in response to the determining, the schedule of movement by delaying initial movement of the first dental object; 70

4. [15(f)] determining, by the one or more computer processors, that the altered schedule of movement still results in a collision or obstruction involving the first dental object; and 71

5. [15(g)] altering, by the one or more computer processors after the determining that the altered schedule of

movement still results in a collision or obstruction, the schedule of movement of the first dental object by moving the first dental object out of the path of the second dental object, and once the second dental object has moved sufficiently, moving the first dental object back to the first dental object previous position before proceeding to a desired final position of the first dental object. 74

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LIST OF EXHIBITS

Exhibit No.	Description
Ex-1001	U.S. Patent No. 10,524,879 to Kitching et al. ("'879 patent")
Ex-1002	Prosecution History of U.S. Patent No. 10,524,879
Ex-1003	Declaration of Dr. Sumit Yadav
Ex-1004	U.S. Patent No. 6,471,511 to Chishti et al. ("Chishti-511")
Ex-1005	U.S. Patent No. 6,729,876 to Chishti et al. ("Chishti-876")
Ex-1006	Adrian Becker, *The Orthodontic Treatment of Impacted Teeth* (Martin Dunitz Ltd. 1998) ("Becker")
Ex-1007	U.S. Patent No. 6,250,918 to Sachdeva et al. ("Sachdeva")
Ex-1008	*ClearCorrect Operating LLC v. Align, Inc.*, IPR2017-01829, Decision Denying Institution, Paper 10 (PTAB Feb. 5, 2018)
Ex-1009	Speaker Profile of Rohit Sachdeva, retrieved from: https://www.emedevents.com/speaker-profile/rohit-sachdeva
Ex-1010	LinkedIn Profile of Ruedger Rubbert, retrieved from: https://www.linkedin.com/in/ruedger-rubbert-6136b119
Ex-1011	LinkedIn Profile of Ian Kitching, retrieved from: https://www.linkedin.com/in/ian-kitching-3961333
Ex-1012	LinkedIn Profile of Alexander Dmitriev, retrieved from: https://www.linkedin.com/in/alexander-dmitriev-5145991
Ex-1013	*Align Technology, Inc. v. ClearCorrect Operating, LLC, et al.*, Case No. 6:24-cv-00187-ADA-DTG, Dkt. 142, Joint Claim Construction Statement (W.D. Tex. Jan. 3, 2025)
Ex-1014	Harold D. Kesling, *The Diagnostic Setup with Consideration of the Third Dimension*, Am. J. Orthodontics, Vol. 42, No. 10, pp. 740-48 (Oct. 1956)

Exhibit No.	**Description**
Ex-1015	H.D. Kesling, *Coordinating the Predetermined Pattern and Tooth Positioner with Conventional Treatment*, presented at the meeting of the Southern Society of Orthodontists, pp. 285-93 (Jan. 28-29, 1946)
Ex-1016	Orhan C. Tuncay (ed.), *The Invisalign System* (Quintessence Publishing Co., Ltd. 2006)
Ex-1017	Declaration of Dr. Paul C. Clark
Ex-1018	U.S. Patent No. 6,702,575 to Hilliard
Ex-1019	U.S. Patent No. 6,309,215 to Phan et al.
Ex-1020	Declaration of Kelley M. Hayes Greenhill Regarding Ex-1006
Ex-1021	Declaration of Kelley M. Hayes Greenhill Regarding Ex-1016
Ex-1022	Stanley A. Alexander, *Levels of root resorption associated with continuous arch and sectional arch mechanics*, Am. J. Orthodontics and Dentofacial Orthopedics, Vol. 110, No. 3, pp. 321-24 (Sept. 1996)
Ex-1023	Vincent DeAngelis, *The Amalgamated Technique, a Mechanically and Biologically Efficient Method for Controlled Tooth Movement*, Angle Orthodontist, Vol. 50, No. 1, pp. 1-15 (Jan. 1980)
Ex-1024	Hyo-Sang Park et al., *Group Distal Movement of Teeth Using Microscrew Implant Anchorage*, Angle Orthodontist, Vol. 75, No. 4, pp. 602-09 (2005)
Ex-1025	RESERVED
Ex-1026	RESERVED
Ex-1027	RESERVED

Exhibit No.	**Description**
Ex-1028	*ClearCorrect Operating, LLC v. Align Technology, Inc.*, IPR2017-01829, Petition for *Inter Partes* Review of U.S. Patent No. 8,038,444, Paper 1 (PTAB July 20, 2017)
Ex-1029	Curriculum Vitae of Dr. Sumit Yadav
Ex-1030	Curriculum Vitae of Dr. Paul C. Clark

LIST OF CHALLENGED CLAIMS

Claim 1	
1(pre)	A computer-implemented method comprising:
1(a)	determining, by one or more computer processors, a schedule of movement for dental objects during treatment stages, the dental objects being based from output of a scanning device, wherein the schedule of movement indicates whether each of the dental objects moves during each of the treatment stages;
1(b)	calculating, by one or more computer processors, a respective route from an initial position toward a final position for each of the dental objects during the treatment stages; and
1(c)	modifying, by one or more computer processors, the schedule of movement to avoid a collision or obstruction between two of the dental objects on their respective routes, the modifying comprising:
1(d)	delaying initial movement of one of the dental objects; and
1(e)	round-tripping one of the dental objects.
Claim 2	
2	The computer-implemented method of claim 1, wherein determining the schedule of movement comprises selecting a movement pattern from a plurality of predetermined movement patterns.
Claim 3	
3	The computer-implemented method of claim 1, further comprising recalculating at least one of the respective routes based on the modified schedule of movement.
Claim 4	
4	The computer-implemented method of claim 1, further comprising manufacturing at least two orthodontic aligners,

	each of the orthodontic aligners corresponding to a respective one of the treatment stages.
Claim 5	
5(a)	The computer-implemented method of claim 4, wherein the manufacturing comprises: fabricating a respective positive mold of the dental objects for at least two of the treatment stages; and
5(b)	thermoforming an orthodontic aligner over each respective positive mold.
Claim 6	
6(a)	The computer-implemented method of claim 1, wherein the round-tripping comprises: moving a first of the dental objects away from the respective route of a second of the dental objects; and
6(b)	moving the first dental object toward its respective final position after the second dental object has sufficiently traversed its respective route to avoid the collision.
Claim 7	
7(a)	The computer-implemented method of claim 1, wherein the round-tripping comprises: moving a first of the dental objects away from the respective route of a second of the dental objects; and
7(b)	moving the first dental object toward its previous position.
Claim 8	
8(a)	The computer-implemented method of claim 1, wherein: the determining of the schedule of movement comprises determining, by one or more computer processors, a total number of the treatment stages; and
8(b)	the determining of the total number of the treatment stages comprises:

	determining, by one or more computer processors, a respective minimum number of treatment stages for each of the dental objects; and
8(c)	selecting, by one or more computer processors, a largest of the respective minimum numbers of treatment stages as the total number of the treatment stages.
Claim 9	
9(pre)	A non-transitory computer-readable medium comprising instructions that, when executed by one or more computer processors, cause at least one of the one or more computer processors to:
9(a)	determine a schedule of movement for dental objects during treatment stages, the dental objects being based from output from a scanning device, wherein the schedule of movement indicates whether each of the dental objects moves during each of the treatment stages;
9(b)	calculate a respective route from an initial position toward a desired final position for each of the dental objects during the treatment stages; and
9(c)	modify the schedule of movement to avoid a collision or obstruction between two of the dental objects on their respective routes, the modifying comprising:
9(d)	delaying initial movement of one of the dental objects; and
9(e)	round-tripping one of the dental objects.
Claim 10	
10	The medium of claim 9, wherein determining the schedule of movement comprises selecting a movement pattern from a plurality of predetermined movement patterns.

Claim 11	
11	The medium of claim 9, wherein the instructions, when executed by the one or more computer processors, further cause at least one of the one or more computer processors to recalculate at least one of the respective routes based on the modified schedule of movement.
Claim 12	
12	The medium of claim 9, wherein the instructions, when executed by the one or more computer processors, further cause at least one of the one or more computer processors to control manufacture of at least two orthodontic aligners, each of the orthodontic aligners corresponding to a respective one of the treatment stages.
Claim 13	
13	The medium of claim 12, wherein the manufacture comprises: fabricating a respective positive mold of the dental objects for at least two of the treatment stages; and thermoforming an orthodontic aligner over each of the respective positive molds.
Claim 14	
14(a)	The medium of claim 9, wherein: the determining of the schedule of movement comprises determining a total number of the treatment stages; and
14(b)	the determining of the total number of the treatment stages comprises: determining a respective minimum number of treatment stages for each of the dental objects; and
14(c)	selecting a largest of the respective minimum numbers of treatment stages as the total number of the treatment stages.
Claim 15	
15(pre)	A computer-implemented method comprising:

15(a)	determining, by one or more computer processors, a schedule of movement for dental objects during treatment stages, the dental objects being based from output of a scanning device, wherein the schedule of movement indicates whether each of the dental objects moves during each of the treatment stages;
15(b)	calculating, by the one or more computer processors, a respective route from an initial position toward a final position for each of the dental objects during the treatment stages; and
15(c)	modifying, by the one or more computer processors, the schedule of movement to avoid a collision or obstruction between two of the dental objects on their respective routes, the modifying comprising:
15(d)	determining, by the one or more computer processors, that the respective route of a first of the dental objects results in a collision or obstruction with a second of the dental objects;
15(e)	altering, by the one or more computer processors in response to the determining, the schedule of movement by delaying initial movement of the first dental object;
15(f)	determining, by the one or more computer processors, that the altered schedule of movement still results in a collision or obstruction involving the first dental object; and
15(g)	altering, by the one or more computer processors after the determining that the altered schedule of movement still results in a collision or obstruction, the schedule of movement of the first dental object by moving the first dental object out of the path of the second dental object, and once the second dental object has moved sufficiently, moving the first dental object back to the first dental object previous position before proceeding to a desired final position of the first dental object.

Claim 16	
16	The computer-implemented method of claim 15, further comprising recalculating at least one of the respective routes based on the modified schedule of movement.
Claim 17	
17	The computer-implemented method of claim 15, further comprising manufacturing at least two orthodontic aligners, each of the orthodontic aligners corresponding to a respective one of the treatment stages.
Claim 18	
18	The computer-implemented method of claim 17, wherein the manufacturing comprises: fabricating a respective positive mold of the dental objects for at least two of the treatment stages; and thermoforming an orthodontic aligner over each of the respective positive molds.
Claim 19	
19(a)	The computer-implemented method of claim 15, wherein: the determining of the schedule of movement comprises determining a total number of the treatment stages; and
19(b)	the determining of the total number of the treatment stages comprises: determining, by one or more computer processors, a respective minimum number of treatment stages for each of the dental objects; and
19(c)	selecting, by one or more computer processors, a largest of the respective minimum numbers of treatment stages as the total number of the treatment stages.
Claim 20	
20(pre)	A non-transitory computer-readable medium comprising instructions that, when executed by one or more computer

	processors, cause at least one of the one or more computer processors to:
20(a)	determine a schedule of movement for dental objects during treatment stages, the dental objects being based from output from a scanning device, wherein the schedule of movement indicates whether each of the dental objects moves during each of the treatment stages;
20(b)	calculate a respective route from an initial position toward a final position for each of the dental objects during the treatment stages; and
20(c)	modify the schedule of movement to avoid a collision or obstruction between two of the dental objects on their respective routes, the modifying comprising:
20(d)	determining that the respective route of a first of the dental objects results in a collision or obstruction with a second of the dental objects;
20(e)	altering, in response to the determining, the schedule of movement by delaying initial movement of the first dental object;
20(f)	determining that the altered schedule of movement still results in a collision or obstruction involving the first dental object; and
20(g)	altering, after the determining that the altered schedule of movement still results in a collision or obstruction, the schedule of movement by round-tripping the first dental object.
Claim 21	
21	The medium of claim 20, wherein determining the schedule of movement comprises selecting a movement pattern from a plurality of predetermined movement patterns.

Claim 22	
22	The medium of claim 20, wherein the instructions, when executed by the one or more computer processors, further cause at least one of the one or more computer processors to recalculate at least one of the respective routes based on the modified schedule of movement.
Claim 23	
23	The medium of claim 20, wherein the instructions, when executed by the one or more computer processors, further cause at least one of the one or more computer processors to control manufacture of at least two orthodontic aligners, each of the orthodontic aligners corresponding to a respective one of the treatment stages.
Claim 24	
24	The medium of claim 23, wherein the manufacture comprises: fabricating a respective positive mold of the dental objects for at least two of the treatment stages; and thermoforming a respective one of the orthodontic aligners over each of the respective positive molds.

I. INTRODUCTION

U.S. Patent No. 10,524,879 ("'879 patent") is directed to software for generating orthodontic treatment plans for use with clear aligners. Ex-1001, Abstract. The '879 patent admits generating a treatment plan for clear aligners was well known at the time of the patent. Ex-1001, 1:37-59. The '879 patent does not assert any technical advancement or any new methods of treatment. Instead, the "need" it purportedly met was "to increase automation of a tooth movement treatment planning process." Ex-1001, 2:5-7. But all the claimed automated techniques were known in the prior art.

The primary reference asserted here (Chishti-511) discloses a computerized system that receives digital representations of a patient's teeth and generates a treatment plan for clear aligners. The other cited references disclose well-known features that would have been obvious components of an automated software treatment-planning system. Chishti-876 discloses a database of established treatment patterns for creating treatment plans. Sachdeva discloses an automated, computerized system that identifies when a treatment plan may have a collision and automatically modifies the plan to avoid any collisions. Finally, Becker, which was not considered during prosecution, discloses the particular collision-avoidance technique that was the basis for allowance of the '879 patent: round-tripping.

Becker shows that round-tripping has long been known and applied by trained orthodontists in the same manner discussed in the ’879 patent.

A person of ordinary skill in the art (“POSITA”) would have been motivated to combine Chishti-511 with the other references—all are analogous art, and the combination involves only combining prior-art elements according to known methods to yield entirely predictable results. In short, the ’879 patent’s claims are invalid as obvious, and Petitioner requests that the Board institute an *inter partes* review and cancel claims 1-24.

II. RELIEF REQUESTED

Petitioner ClearCorrect Operating LLC requests review and cancellation of claims 1-24 of the ’879 patent based on the following prior art and ground:

Exhibit	**Reference**	**Prior-Art Status**[1]
Ex-1004	U.S. Patent No. 6,471,511 to Chishti et al. (“Chishti-511”), issued October 29, 2002	§ 102(b)
Ex-1005	U.S. Patent No. 6,729,876 to Chishti et al. (“Chishti-876”), issued May 4, 2004	§ 102(b)

[1] Prior-art status has been assessed under pre-AIA 35 U.S.C. § 102. The ’879 patent claims priority to a provisional application filed August 30, 2006. Ex-1001, p.2, (60). While Petitioner does not concede that the ’879 patent is entitled to this priority date, all asserted references qualify as prior art under this priority date.

Exhibit	Reference	Prior-Art Status[1]
Ex-1006	Adrian Becker, *The Orthodontic Treatment of Impacted Teeth* (Martin Dunitz Ltd. 1998) ("Becker"), published 1998[2]	§ 102(b)
Ex-1007	U.S. Patent No. 6,250,918 to Sachdeva et al. ("Sachdeva"), issued June 26, 2001	§ 102(b)

Ground	Claims Challenged	35 U.S.C.	References
1	1-24	§ 103	Chishti-511, Chishti-876, Sachdeva, and Becker

III. THE '879 PATENT

A. Overview

The '879 patent describes a computerized system for scheduling the movement of teeth in stages from an initial position to a final position, according to various movement patterns and orthodontic techniques. Ex-1001, 2:15-26. Using a scan of the patient's teeth in an initial state, the computer generates a digital model of the teeth. Ex-1001, 5:48-56. A digital model of the patient's teeth at a final

[2] Becker was publicly available at least as early as April 30, 1998. Ex-1020, ¶¶11-20.

position is then defined. Ex-1001, 3:59-65, 5:33-35. The computer determines a movement path for each of the patient's teeth from initial to final positions. Ex-1001, 3:59-4:8, 5:35-44; Ex-1003, ¶¶ 35-36.

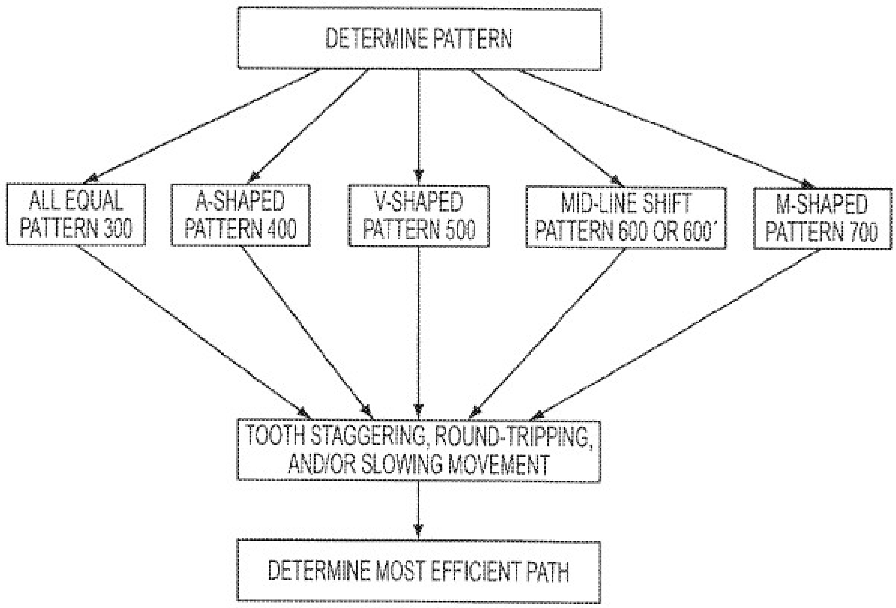

FIG. 2B

Ex-1001, Fig. 2B.

As shown above, one of various patterns of teeth movement is initially selected to be used. Ex-1001, 5:58-61, Figs. 3-9. The '879 patent admits that selecting an orthodontic treatment pattern was disclosed in Chishti-876. Ex-1001, 6:11-17. The system then determines whether the specified teeth movement would result in collisions between teeth. Ex-1001, 6:44-48. The '879 patent admits that collision detection was known in Chishti-876. Ex-1001, 6:48-55; Ex-1003, ¶¶ 37-38.

If a collision is detected, the system modifies the treatment plan by using well-known techniques for avoiding the collision, such as "[s]taggering," "[s]lowing down," and "[r]ound-tripping." Ex-1001, 12:65-13:13. The '879 patent states that staggering, slowing down, and/or round-tripping can be applied "alone or in combination, and in any order." Ex-1001, 13:13-15. But in the only exemplary embodiment incorporating all three techniques, the '879 patent describes using staggering first, followed by "slowing-down," and only using "round-tripping ***as a last resort***." Ex-1001, 13:13-19 (emphasis added); Ex-1003, ¶ 39.

While the '879 patent describes a specific manner of round-tripping (which it defines 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, 13:9-13)), its brief description does not purport to have invented this form (or any form) of round-tripping. Nor does the patent identify any benefits of round-tripping. Instead, as noted above, round-tripping is described in the patent as "a last resort," which indicates that despite the risks that a POSITA would have known to be associated with it, round-tripping may be a clinically necessary and acceptable technique in some circumstances. Ex-1001, 13:13-19; Ex-1003, ¶ 40.

B. Prosecution History

U.S. Application No. 15/834,649 ("'649 application") issued as the '879 patent, and stems from two provisional patent applications filed by Align on August 30, 2006. Align filed the first nonprovisional parent in 2007, and it issued as U.S. Patent No. 8,038,444 ("'444 patent").

Prior to Align filing the '649 application, ClearCorrect filed IPR2017-01829 ("'444 IPR"), challenging the '444 patent's claims in view of Chishti-876 alone and in combination with Chishti-511. Ex-1028. While the '649 application was pending, the Board declined to institute *inter partes* review based on, among other things, the '444 patent specification's definition of "round-tripping," which it determined was not explicitly disclosed in the Chishti references. *See generally* Ex-1008.

During prosecution, the Office initially rejected all claims of the '649 application over two publications to Chishti—Chishti-511 and U.S. Patent Publication No. 2004/0137400 (Chishti-400)—and one to Phan (U.S. Patent No. 6,309,215). Ex-1002, 129-36. In response to the prior-art rejections against the '879 patent, Applicant submitted an IDS listing the Board's decision denying institution of the '444 IPR and argued that the pending claims were allowable under the Board's interpretation in the '444 IPR. *See* Ex-1002, 203-19.

While the Office maintained certain rejections based on the Chishti references and presented a new ground of rejections in view of Muhammad et al. (US 2002/0064746 A1), it allowed certain claims reciting "round-tripping," explaining that the allowability of the claims was "limited to the definition of [round-tripping] found [in] the specification," i.e., "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-1002, 233-34, 223-36.

The claims were allowed after the Applicant authorized an Examiner's amendment that recited round-tripping in the independent claims. Ex-1002, 368-370. The Office never considered Becker, which discloses the specific type of "round-tripping" defined in the '879 patent. Ex-1003, ¶¶ 41-44.

IV. LEVEL OF ORDINARY SKILL IN THE ART

A POSITA pertinent to the '879 patent 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. Ex-1003, ¶¶ 22-25, Ex-1017, ¶¶ 23-25; Ex-1029; Ex-1030.

Previously, in the '444 IPR, ClearCorrect proposed that a POSITA would have had a doctorate in dental science and 3-5 years of training and practical experience in orthodontics. Ex-1028, 13. While this person would qualify as a POSITA, additional information indicates that the level of ordinary skill would include members of an interdisciplinary team. Ex. 1003, ¶ 26.

For example, at least two inventors of the '879 patent (Ian Kitching and Alexander Dmitriev) appear to have backgrounds in computer science, but no dental degree. *See* Ex-1011; Ex-1012. Similarly, Sachdeva—a highly relevant prior-art reference not previously considered by the Office—includes two inventors: Rohit Sachdeva (an orthodontist) and Rudger Rubbert (a mechanical engineer). Ex-1007, Ex-1009, Ex-1010. The level of ordinary skill in the art proposed in this Petition is thus consistent with the '879 patent and the prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (prior art itself may reflect an appropriate skill level); *Tiktok Inc. v. Cellspin Soft, Inc.*, IPR2024-00767, Paper 8, 19 (PTAB Oct. 1, 2024). Ex. 1003, ¶¶ 26-27.

V. CLAIM CONSTRUCTION

The Board construes claims according to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.200(b). The ground presented herein renders the claims obvious under any construction consistent with *Phillips*.[3]

In the related district-court litigation, the parties agreed to the following constructions relevant to the ’879 patent’s claims:

round[-]tripping / round-trip claims 1, 6, 7, 9, 20	[moving / move] a first tooth out of the path of a second tooth, and once the second tooth has moved sufficiently, [moving / move] the first tooth back to its previous position before proceeding to a desired final position of that first tooth

Ex-1013, 8; Ex-1003 ¶¶ 31-33.[4]

VI. PRIOR ART OVERVIEW

A. Chishti-511 (Ex-1004)

Chishti-511 discloses a system for segmenting an orthodontic treatment plan into a sequence of steps. Ex-1004, Abstract. The system generates a digital model

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[3] Petitioner does not concede that any claim term meets the statutory requirements of 35 U.S.C. §§ 101, 112.

[4] While the district court also addressed other terms, this Petition addresses only terms in the ’879 patent claims.

of the patient's teeth and defines a series of treatment steps to be used with aligners, where the steps incrementally move the teeth from an initial position to a final position. Ex-1004, Fig. 1, 3:32-5:6; Ex-1003 ¶¶ 45-46.

Chishti-511 also discloses that tooth path segments should be defined such that "moving from one point to the next in the sequence does not result in a collision of teeth." Ex-1004, 4:7-22. Chishti-511 explains that while round-tripping first moves a tooth in a "direction other than directly toward the desired final position," it "is sometimes necessary to allow teeth to move past each other." Ex-1004, 4:13-16; Ex-1003 ¶¶ 47-48.

Chishti-511 emphasizes that defining tooth paths and calculating aligner shapes is an iterative process, as shown below. Ex-1004, 4:27-50, 5:21-43, 8:42-66, Figs. 1, 2.

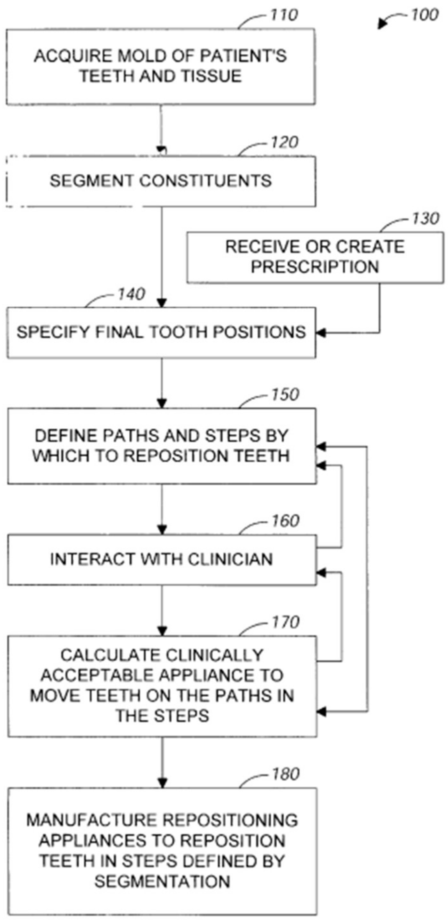


FIG. 1

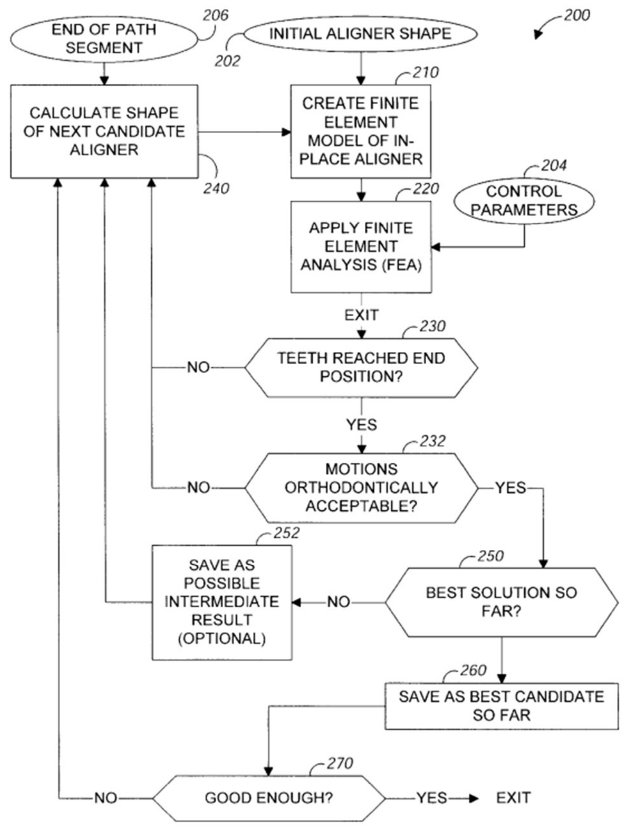


FIG. 2

If the proposed aligner shape does not satisfy the requisite criteria, or changes are made, the subprocess of defining the segmented paths is repeated. Ex-1004, 4:27-35, 8:42-66 ("After the treatment path has been redefined, the outer loop of the overall process is executed again (step **632**)"); Ex-1003 ¶¶ 49-52; Ex-1017 ¶¶ 35-39. This allows for repeated modifications "to redefine those parts of the treatment path having unacceptable aligners." Ex-1004, 8:42-66; Ex-1003, ¶ 49.

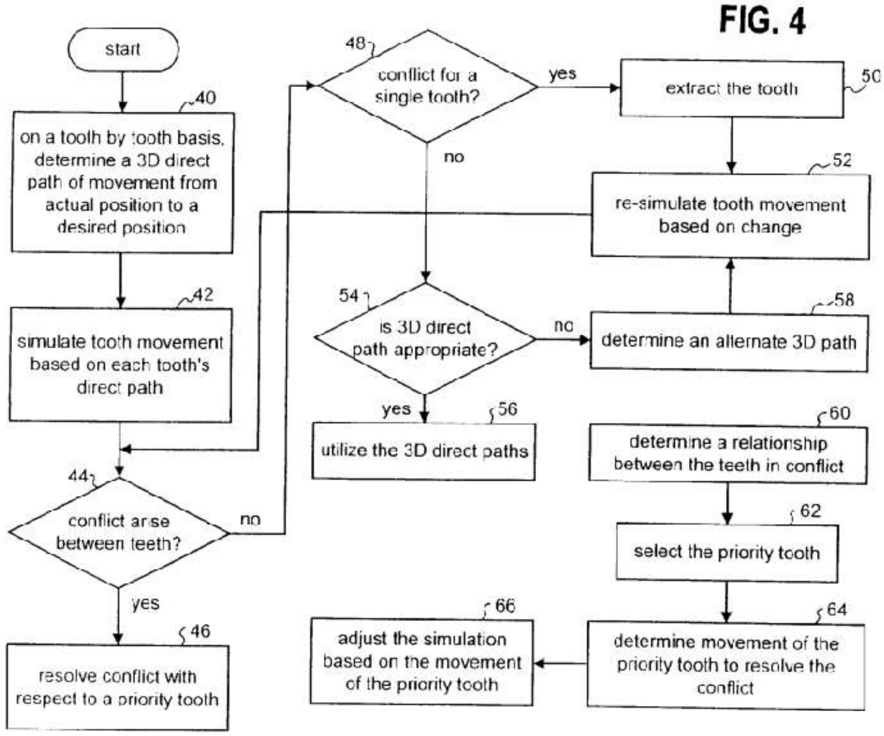
B. Chishti-876 (Ex-1005)

Chishti-876 discloses a system for preparing a treatment plan that involves selecting and using a treatment pattern. Ex-1005, Abstract, 2:15-19. Chishti-876 discloses that its algorithm "draw[s] upon a database of preferred treatments," which is based on prior successful treatments. Ex-1005, 14:63-15:1. The algorithm can "create several alternative paths and present each path graphically to the user." Ex-1005, 15:1-3. Chishti-876 further discloses the well-known, routine method of manufacturing aligners by thermoforming over a positive mold. Ex-1005, 7:54-64; Ex-1003 ¶¶ 53-56; Ex-1017 ¶¶ 40-46.

C. Sachdeva (Ex-1007)

Sachdeva discloses a system for orthodontic treatment planning that simulates tooth movement to identify a "conflict" between two teeth. Ex-1007, Abstract, 4:50-5:8. A "conflict" arises when "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. If a conflict is detected, the computer automatically resolves the conflict by modifying the scheduled tooth movement, for example, by delaying one tooth's movement while moving another tooth, and adjusting the simulation. Ex-1007, 3:43-48, 4:50-5:5, 5:22-32.

FIG. 4



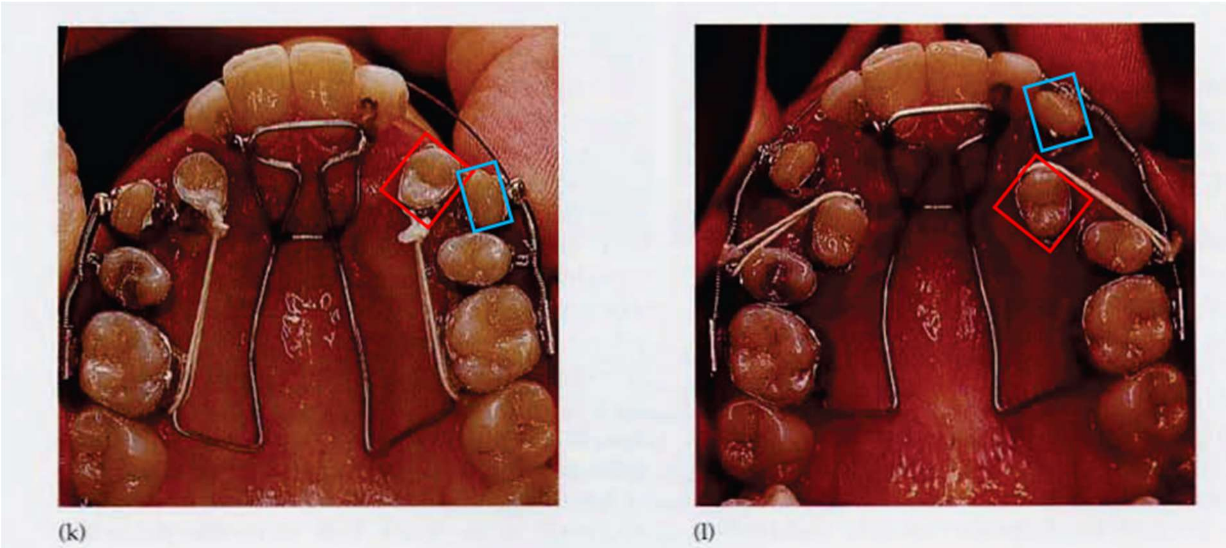
Ex-1007, Fig. 4; Ex-1003 ¶¶ 57-59; Ex-1017 ¶¶ 47-51.

D. Becker (Ex-1006)

Becker discloses repositioning a tooth using a round-tripping technique to avoid collisions between two teeth. Ex-1006, Title, 5. Becker explains that where a patient's teeth are "transposed"—a dental anomaly also known as an ectopic tooth where a tooth is located in a position normally occupied by a different tooth (Ex-1003, ¶¶ 60-61)—the preferred "line of treatment" may include "retranspos[ing] [the teeth] to their ideal position" rather than "align[ing] the teeth in their transposed positions." Ex-1006, 5.

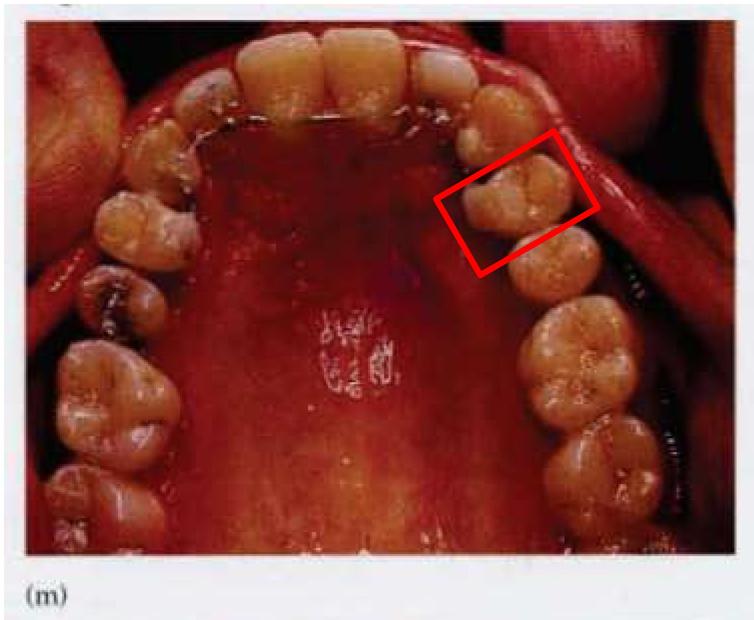
Becker discloses a method for treating this type of malocclusion. Below are images of a patient's teeth, where a more-lingual tooth (i.e., a tooth closer to the tongue in red) is initially transposed with a more-buccal tooth (i.e., a tooth closer to the cheek in blue).[5]

[5] Becker describes the tooth shown in the upper dental arch as a "lingual" tooth and describes movement of that tooth toward the center of the mouth as "lingual" movement (i.e., toward the tongue). Ex-1006, 5. But a POSITA would understand that when referencing teeth in the upper arch, movement to the center of the mouth is generally described as "palatal" movement, and that "lingual" movement is used when referencing teeth in the lower arch. Ex-1003, ¶ 62, n.2. Petitioner uses the "lingual" terminology from Becker, but a POSITA would recognize that Becker's technique applies to teeth in either the upper or lower dental arch. *Id.*



Ex-1006, 7 (Figs. 8.6(k), (l) (annotated)). The more-buccal tooth should be in the position shown on the right, but the more-lingual tooth is blocking the direct movement path for the more-buccal tooth. Ex-1003, ¶¶ 62-63.

Becker discloses using round-tripping, as described in the ’879 patent, to correct the transposition of the teeth. Becker describes “slid[ing]” the more-buccal tooth toward the midline (i.e., “in the mesio-distal plane”). Ex-1006, 5. To allow for this, the more-lingual tooth “must be moved further lingually” “to allow its partner to pass by.” Ex-1006, 5. Finally, the more-lingual tooth “must be moved ***in the opposite mesio-distal direction and back in the line of the arch***.” *Id.* (emphasis added). Moving the more-lingual tooth in the “opposite” direction and “back in the line of the arch” would return the tooth to its previous position, after which the tooth would proceed toward a desired final position. Ex-1003, ¶¶ 63-64. Figure 8.6(m) shows the more-lingual tooth after it is further moved to its final position.



Ex-1003, ¶¶ 63-64 (annotating Ex-1006, 8 (Fig. 8.6(m))).

E. General Overview of Round-Tripping in the Prior Art

Round-tripping—both as a general concept of moving a tooth in a direction other than directly towards its final position, and as the specific type of movement described in the '879 patent where a tooth moves in one direction and then back to its original position before moving to its final position—was a well-known technique at the time of the patent for avoiding collisions between teeth. Ex-1003, ¶ 65. Through such indirect movements, clinicians create sufficient space for a second tooth to move towards its final position while avoiding collisions. *Id.* Round-tripping was understood to be sometimes necessary in cases involving crowding or impacted teeth, like Becker, where direct movement of either the first tooth or second tooth is not otherwise possible without causing a collision. *Id.*

A clinician presented with a patient where direct movement of a tooth towards its final position is not possible without causing a collision would consider various tooth movement techniques, including round-tripping, to avoid a collision. Ex-1003, ¶ 66. A clinician would consider both the risks of round-tripping movement (such as root resorption, loss of periodontal support, and prolonged treatment time caused by the round-tripping movement), as well as the benefit of achieving proper alignment while avoiding a collision. *Id.*

Although it was understood that round-tripping should be avoided if possible, it was also understood to be a necessary option for some patients. Ex-1003, ¶ 67. For example, Chishti-511 explains that moving a tooth in a "direction other than directly toward the desired final position" "***is sometimes necessary*** to allow teeth to move past each other." Ex-1004, 4:9-16 (emphasis added). In some instances, the only alternative to round-tripping might be extraction, which could be even less desirable. Ex-1003, ¶ 67. This is consistent with the '879 patent's disclosure that round-tripping may be used "as a last resort" (Ex-1001, 13:13-19), and with a POSITA's understanding that while it is preferable to avoid ***unnecessary*** indirect movement techniques, for some patients, some indirect movement may be necessary. Ex-1003, ¶ 67.

Other publications also confirm that round-tripping was well known. As discussed previously, Becker discloses that the "preferred line of treatment" may include the type of round-tripping specifically required in the '879 patent. Ex-1006, 5. Becker discloses that a tooth is moved out of the way for another tooth to "pass by" before it is moved to its previous and then final positions. *Id.*; *supra* Section VI.D; *infra* Section IX.A.6; Ex-1003, ¶ 68. Similarly, Park discloses a known movement technique whereby anterior teeth are moved to a forward position and then "retracted back after creating space with the distal movement of the molars and premolars." Ex-1024, 5-6; Ex-1003, ¶ 68. DeAngelis also discloses a known movement technique where a tooth is tipped such that the root apex moves "from point *a* to point *b*'," and then is "brought back through point *a* to the desirable end-point *b*." Ex-1023, 2; *see also* Ex-1023, Fig. 1B; Ex-1003, ¶ 68.

In short, the '879 patent's disclosure regarding round-tripping is neither novel nor nonobvious but rather reflects a widespread consensus at the time of the patent that round-tripping was an option to be considered, with advantages and disadvantages, and that round-tripping would be used as necessary if it was the best (or potentially only) available treatment option. Ex-1003, ¶ 70.

VII. CHISHTI-511, CHISHTI-876, SACHDEVA, AND BECKER ARE ANALOGOUS ART

Each of the cited references is analogous art to the ’879 patent and to each other. Ex-1003, ¶ 71. The ’879 patent “is related generally to the field of orthodontics, and more particularly to staging a path of movement for correcting the position of one or more teeth.” Ex-1001, 1:23-25. Each of Chishti-511, Chishti-876, Sachdeva, and Becker is in the same field of endeavor, as each is directed to orthodontic treatment for repositioning misaligned teeth. *See* Ex-1004, Abstract (“orthodontic treatment path into clinically appropriate substeps for repositioning the teeth of a patient”); Ex-1005, Abstract (“prepar[ing] a malocclusion treatment plan”); Ex-1007, Abstract (“simulating tooth movement for an orthodontic patient” and determining “a three-dimensional direct path of movement”); Ex-1006, 5 (discussing teeth movement); Ex-1003, ¶ 71.

Chishti-511, Chishti-876, Sachdeva, and Becker are also analogous art because they are reasonably pertinent to the problem that the ’879 patent purports to solve. Ex-1003, ¶ 72. The ’879 patent alleges that it addresses the problem of potential collisions of teeth along a path for correcting tooth positions. Ex-1001, 1:23-25, 6:44-55 (the system “is configured to determine[] if the pattern should be modified to accommodate the teeth movement of the current patient to avoid collision”), 6:56-63 (discussing avoiding collisions); Ex-1003, ¶ 72.

The references are reasonably pertinent to this same problem. Ex-1003, ¶ 73. Chishti-511 discloses "defin[ing] a tooth path for the motion of each tooth" such that the movement "does not result in a collision of teeth." Ex-1004, 4:7-9, 4:18-22. Chishti-876 similarly discloses that "determining a tooth path includes finding a collision free shortest path." Ex-1005, 2:21-30. Sachdeva determines a "path of movement," "determines whether a conflict arises between at least two teeth," and resolves that conflict. Ex-1007, Abstract. Finally, Becker shows a known round-tripping technique used to avoid potential collision of teeth. Ex-1006, 5; Ex-1003, ¶ 73.

VIII. MOTIVATION TO COMBINE CHISHTI-511, CHISHTI-876, SACHDEVA, AND BECKER

A POSITA would have been motivated to combine the Ground 1 references with a reasonable expectation of success. Ex-1003, ¶ 74.

A POSITA would have been motivated to use Sachdeva's and Becker's collision identification and avoidance techniques to supplement Chishti-511's treatment planning system. Chishti-511 discloses that its system generates "a clinically viable sequence of tooth positions, so that moving from one point to the next in the sequence does not result in a collision of teeth." Ex-1004, 4:15-22. Considering this express disclosure, a POSITA would have been motivated to look to teachings regarding the identification and avoidance of collisions. Ex-1003, ¶ 75.

Sachdeva provides such a teaching. Ex-1003, ¶ 76. Like Chishti-511, Sachdeva recognizes that collisions are undesirable. *See* Ex-1007, 5:5-8 ("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."). Sachdeva further discloses identifying collisions and resolving them. *See* Ex-1007, 5:3-26, Fig. 4. For example, Sachdeva discloses an automated process for resolving a conflict by giving one tooth priority to move before another tooth (delaying one tooth) and further explains how the changes will cause adjustments or recalculations in the simulated treatment. Ex-1007, 5:3-32; Ex-1003, ¶ 76.

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 the undesirable result of producing a set of aligners that will cause a collision. Ex-1003, ¶ 77. Indeed, the type of collision avoidance disclosed by Sachdeva (delaying an initial movement of a tooth) was a well-known treatment technique at the time of the invention. *See, e.g.*, Ex-1014, 6 (describing a patient's canine teeth are repositioned after "the central and lateral incisors are repositioned"); Ex-1015, 5 ("the mandibular teeth should advance toward the predetermined pattern and stationary anchorage somewhat ahead of the maxillary teeth."); Ex-1016, 124 & Fig. 12-10a (describing a "[h]igh-anchorage pattern" where the anterior teeth are only moved after the posterior teeth have moved)[6]. A POSITA would also have understood that such a system would improve patient results by avoiding unacceptable collisions and increase efficiency by reducing the need for a clinician to manually identify collisions. Ex-1003, ¶ 77.

A POSITA would have had a reasonable expectation of success in combining Chishti-511 and Sachdeva because each uses similar computer-implemented treatment-planning systems that use digital models of teeth to determine movement paths and avoid collisions between teeth. Ex-1017, ¶¶ 55-56 (citing Ex-1004, 3:51-58, 4:7-22, 10:19-51; Ex-1007, 3:36-41, 4:39-49, 5:3-32). Implementing Sachdeva's collision identification and avoidance technique would have merely involved modifying Chishti-511's algorithm for calculating new aligners to include Sachdeva's teachings. Ex-1017, ¶¶ 55-61. Chishti-511 already states that new aligners will be calculated in various circumstances, including where the aligners

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[6] Tuncay (Ex-1016) was publicly available at least by August 17, 2006. Ex-1021, ¶¶ 21-37.

are not acceptable. Ex-1004, 5:25-32, 8:22-65. Figs. 2, 4; Ex-1017, ¶¶ 55-57. A POSITA would understand that aligners producing collisions would not be acceptable, and Sachdeva's collision-identification process may be used when determining the acceptability of aligners (e.g., triggering whether a new aligner should be calculated). Ex-1003 ¶ 78; Ex-1017, ¶¶ 57-58. Chishti-511 explains that changes in teeth motion may be part of the path redefinition, and a POSITA would have understood these changes may include Sachdeva's disclosed collision avoidance process. Ex-1017, ¶¶ 59-61 (citing Ex-1004, 8:42-61, Fig. 6). Sachdeva also provides clear guidance on its collision-avoidance process, (Ex-1007, 5:3-32, Fig. 4), and integrating such a feature into Chishti-511 would have required little more than software modifications involving triggering an aligner recalculation if a collision is identified and modifying Chishti-511's "path definition process," (Ex-1004, 8:54-61), to include the movement technique disclosed in Sachdeva as one option for changing tooth motion, which would have been well within the skill of a POSITA. Ex-1017, ¶¶ 58-61.

A POSITA similarly would have been motivated to combine Chishti-511 with Becker's teachings regarding round-tripping. Chishti-511 already discusses needing collision-free treatment paths (Ex-1004, 4:15-22), and a skilled artisan would have been motivated to look to techniques for avoiding collisions during treatment. Ex-1003, ¶ 79. A POSITA would have recognized that different patients may require different treatments and thus would have been motivated to include multiple treatment methods to avoid potential collisions. *Id.* Becker provides one such teaching, illustrating how round-tripping—as specifically discussed in the ’879 patent—can be used to avoid collisions in cases of patients with transposed teeth. Ex-1006, 5-7. For example, in transposition cases involving canines, a POSITA would have understood that a treatment plan might include repositioning the canine to its proper position, and that for some patients, round-tripping might be preferable over a different treatment (e.g., extracting the tooth) because canine teeth play a critical role in preventing collapse of the dental arch. Ex-1003, ¶ 79.

While the treatment shown for Becker’s patient is one example, a POSITA would have understood that, depending on the specifics of a patient’s malocclusion, there are different ways to implement the concept of round-tripping, such as that disclosed in Becker. Ex-1003, ¶ 80. A POSITA would have also understood that if only minor tooth movement is required to avoid collision with a second tooth, aligners alone may be used to move the first tooth out of the path of a second tooth sufficiently to avoid a collision and then to move the first tooth back to its previous position before moving it towards its final position. *Id.*

A POSITA would also recognize that in other cases, treatment where more significant tooth movement is needed to avoid a collision may utilize aligners with attachments, such as attachments shown in Becker, to achieve the desired movement. Ex-1003, ¶ 81. A POSITA would have understood that using such attachments was well known. *Id.* For example, Chishti-511 describes that its process for computing the shape of an aligner will also take into account hardware attachments if necessary to create the tooth motion. *See* Ex-1004, 8:47-53 ("process 600 proceeds to execute a module that calculates the configuration of a hardware attachment to the subject tooth to which forces can be applied to effect the required motion"); *see also id.* 10:1-6 (discussing its aligners account for "the position and selection of attachments, and the addition or removal of material (e.g., adding wires or creating dimples)."), 6:21-24. State of the art similarly confirms the use of attachments shown in Becker. Ex-1003, ¶ 81; Ex-1016, 26, 30-38, 34, 35 (Fig. 2-24c); Ex-1018, Abstract, 11:45-65; Ex-1019, Abstract, 3:21-48. Thus, a POSITA would have understood that, depending on the type of malocclusion, aligners may be used either alone or with attachments to achieve Becker's round-tripping. Ex-1003, ¶ 81.

Although round-tripping can have disadvantages, a POSITA would have recognized that for some patients, there may be no other option other than to round-trip one or more teeth, particularly if the patient or clinician wishes to avoid extracting one or more teeth. Ex-1003, ¶ 82. Indeed, Chishti-511 expressly discloses that round-tripping "is sometimes necessary to allow teeth to move past each other." Ex-1004, 4:13-15. Chishti-511, Becker, and the '879 patent are thus all consistent in understanding that round-tripping—whether understood more broadly or as specifically defined in the '879 patent—may be required to treat certain patients, even if it is, in the words of the '879 patent, "a last resort." Ex-1004, 4:9-12; Ex-1001, 13:13-19; Ex-1003, ¶ 82.[7]

Accordingly, a POSITA would have been motivated to include round-tripping as one feature in a system with robust software for generating treatment

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[7] The prior art also discloses that some of the reasons clinicians tended to avoid round-tripping may have been based on only anecdotal evidence and were not supported by more rigorous research. *See* Ex-1022, 3 ("'[R]ound tripping' [has] anecdotally been stated as a cause for resorption without any hard evidence." (citations omitted)); Ex-1022, 1 ("Both treatment groups exhibited the same levels of resorption indicating that the side effect of treatment may be due to individual variation and not to the 'round tripping' of teeth so often assumed."); Ex-1003, ¶ 69.

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. Ex-1003, ¶ 82. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) ("[W]hen a patent 'simply arranges old elements with each performing the same function it had been known to perform' and yields no more than one would expect from such an arrangement, the combination is obvious." (citation omitted)); *cf. Honeywell Int'l Inc. v. 3G Licensing, S.A.*, 124 F.4th 1345, 1355-56 (Fed. Cir. 2025) (obviousness "does not require that a particular combination must be the preferred, or the most desirable, combination"; "[r]ather, 'the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness,' of the claimed invention." (citation omitted)).

Moreover, a POSITA would have had a reasonable expectation of success in combining these teachings for the same reasons discussed for Sachdeva. Like Sachdeva's technique, a POSITA would have been motivated to integrate Becker's round-tripping treatment technique as an option in Chishti-511's algorithm for calculating new aligners, such as when it is determined that the aligner is unacceptable (e.g., the treatment plan results in a collision). Ex-1004, 4:15-22; *see also* Ex-1004, 5:25-32, 8:42-61, Fig. 6; Ex-1017 ¶ 62. If a collision is detected, the combined system would have Becker's technique as an option for use in Chishti-511's path redefinition process, which already incorporates other types of changes to tooth movement, to resolve the collision. Ex-1017 ¶ 62. Adding the option to use Becker's technique to round-trip one or more teeth as part of generating a treatment plan would have involved a mere software modification to Chishti-511's algorithm for calculating new aligners and path redefinition process (like that discussed for Sachdeva), which would have yielded predictable results and had a reasonable expectation of success. *Id.*; *see Supra.* Indeed, the '879 patent specification's discussion of round-tripping includes no implementation details, suggesting that including such a feature in treatment planning software was well within a POSITA's skill. Ex-1017 ¶ 62. The prior art cannot be held to a higher disclosure standard than the challenged patent itself.

To the extent that it is argued that the prior art teaches away from utilizing Becker this argument fails because the prior art suggests a similar solution as that disclosed in the'879 patent. *See Adapt Pharma*, 25 F.4th at 1370 ("[A] reference does not teach away if a skilled artisan, upon reading the reference, would *not* be 'discouraged from following the path set out in the reference,' and ***would not be 'led in a direction divergent from the path that was taken by the applicant.***'"). Chishti-511 recognizes some disadvantages of round-tripping and recommends avoiding such movement when possible, but also recognizes that round-tripping may sometimes be necessary. Ex-1004, 4:9-16; Ex-1003, ¶ 83. This is the same teaching as the '879 patent, which refers to round-tripping as a matter of "last resort" when the collision cannot be resolved by other techniques. Ex-1003, ¶ 83; Ex-1001, 13:13-19.

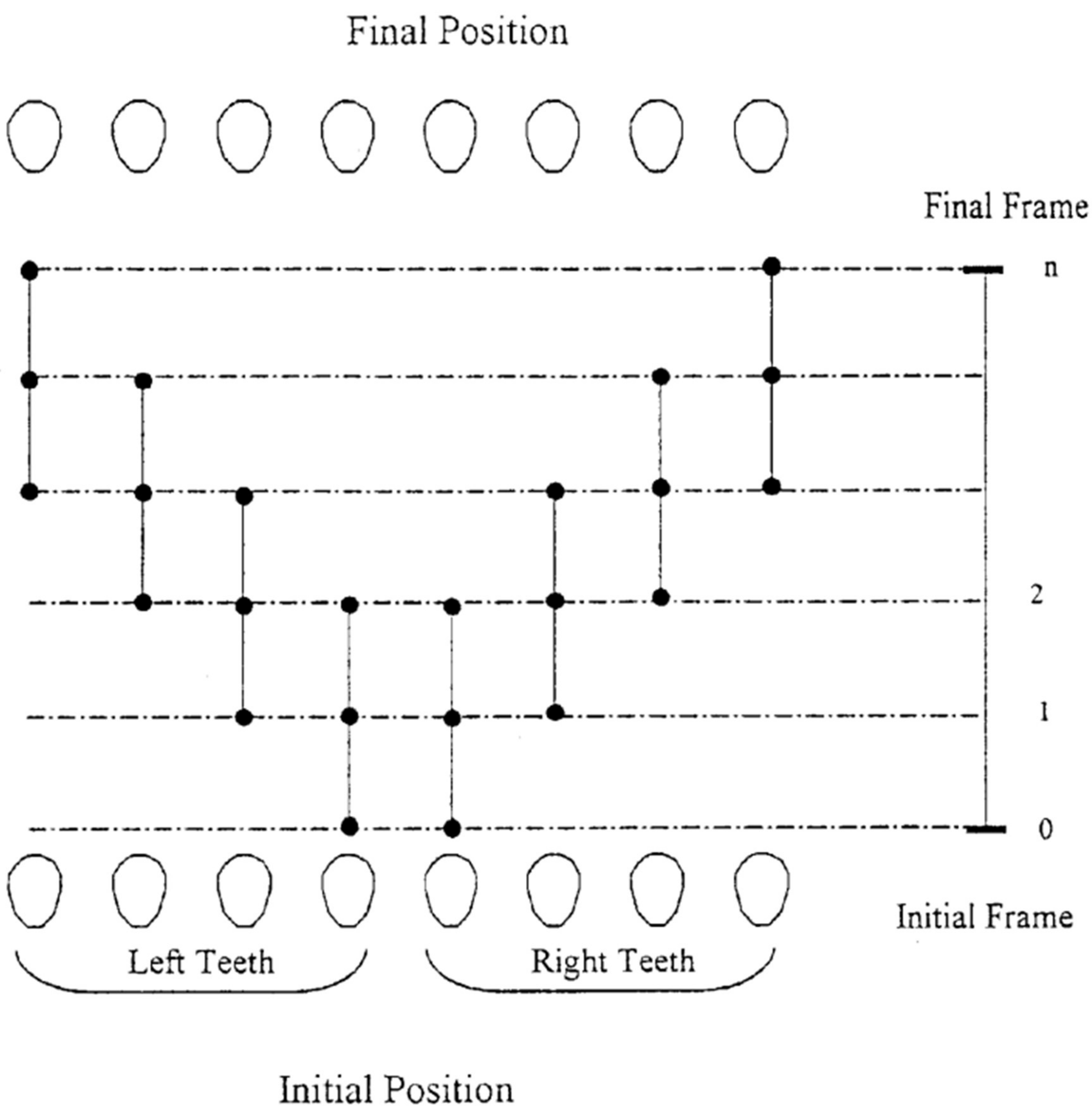
A POSITA also would have been motivated to combine Chishti-876's teachings regarding the use of movement patterns and the generation of schedules of movement with Chishti-511's treatment planning system, as such a modification would improve efficiency by allowing a technician to generate a treatment plan more quickly. Ex-1003, ¶ 84. Chishti-511 already discloses the importance of tailoring the generated treatment plan to a clinician's preferences and proposing treatment plans for a clinician's approval, and the use of predetermined movement patterns would facilitate interactions with a clinician by providing repeatable, known treatment techniques. *See, e.g.*, Ex-1004, 3:59-64 (discussing receiving prescription and constraints from clinicians and allowing clinician interaction through a client), 2:45-53, 4:36-50. A POSITA would have understood that such a modification would improve efficiency by allowing a technician to generate a treatment plan more quickly and with potentially fewer modifications, improve treatment quality by applying treatment techniques that had been used successfully for similar patients, implement clinician preferences, and improve flexibility by providing multiple treatments appropriate for patients' needs. Ex-1003, ¶ 84.

A POSITA also would have had a reasonable expectation of success in combining Chishti-876's pattern features with Chishti-511's system, as both disclose similar computer-implemented systems for patient treatment planning. Ex-1017, ¶¶ 63-64 (citing Ex-1004, 2:45-53; Ex-1005, 15:1-3). Indeed, Chishti-876 and Chishti-511 have common inventors and overlapping details, so a POSITA would have expected that both disclosed systems teach compatible interactive treatment planning tools and software that are readily combinable in a single system. *Id.* Chishti-876 discloses a database of treatment patterns that can be selected, and a POSITA would have recognized this feature is equally applicable to Chishti-511's system. Ex-1017, ¶ 64 (citing Ex-1005, 14:63-15:1). Integrating this feature into Chishti-511 would allow a selection from a plurality of treatment patterns that would affect the schedule of teeth movement, just as in Chishti-876. *Id.* And such a combination would have required only standard, well-known software development techniques that would have yielded predictable results, especially because Chishti-876 itself provides flow charts for calculating movement paths based on patterns, such as the known all-equal, A-shape, or V-shape patterns, which a POSITA would have been able to look to when integrating these features.

Ex-1017, ¶ 65 (citing Ex-1005, Figs. 14, 15, 18, 20A, 20B, 18:1-18:23, 19:15-38, 20:4-60).

A POSITA also would have been motivated to combine Chishti-876's teachings regarding a schedule of movement indicating whether each dental object moves during each of the treatment stages and calculating the total number of treatment stages and minimum stages for each tooth with Chishti-511, as these modifications would help provide transparency and predictability to the patient and clinician, as well as improve treatment efficiency. Ex-1003, ¶ 85. Chishti-511 already discloses calculating the movement of each dental object over the treatment plan to ensure each complies with orthodontically acceptable thresholds, and it further discloses calculating the steps of the treatment plan to accomplish the necessary repositioning in the quickest fashion. *See, e.g.*, Ex-1004, 4:15-22 (explaining that the system calculates a segmented treatment plan), 4:7-12 (explaining that tooth paths are optimized "so that the teeth are moved in the quickest fashion"). A POSITA would thus have been motivated to look to Chishti-876, which explains that the system determines whether teeth move or to not move during each discrete stage of the treatment plan (Ex-1005, 10:11-18), and further determines the total number of treatment stages in the plan by calculating the number of stages for the final tooth to reach its desired final position, and determines the minimum stages for each tooth by finding the "shortest" path. Ex-1003, ¶ 85; Ex-1005, 11:26-40, 17:1-16, Figs. 11-13, Claim 3. Such a change would be beneficial, as it would allow both patients and clinicians to understand whether/when teeth would move during treatment, as well as how many stages would be required for each tooth (determining the number of stages). Determining the minimum number of stages for each tooth would also benefit the system, as it would allow it to compare treatments to see which is "quickest." Ex-1004, 4:7-12; Ex-1003, ¶ 85.

A POSITA would have had a reasonable expectation of success in making this combination, as Chishti-511 already includes data related to segmented paths through which teeth move. Ex-1004, 4:15-22; Ex-1017, ¶¶ 74-76. Integrating Chishti-876's teachings regarding indicating whether dental objects move during treatment stages would merely involve software modifications relating to how existing data is represented in Chishti-511's system, such as graphically representing existing segment data as shown in Chishti-876 below:



Ex-1005, Fig. 11, 17:1-7; Ex-1017, ¶¶ 74-76. Moreover, calculating the total number of stages for a dental object would merely involve calculating the number of segments that a tooth's path has been divided into. Given that this information is already available to Chishti-511, (Ex-1004, 4:15-22), a POSITA would have had a reasonable expectation of success in making any such change. Ex-1017, ¶¶ 72-73.

Finally, for the various features of Chishti-876, Sachdeva, and Becker discussed in this Petition to be combined with Chishti-511, those features would not have interfered with one another when combined with Chishti-511's system. Ex-1003, ¶ 86; Ex-1017, ¶ 79.

IX. CHISHTI-511 IN VIEW OF CHISHTI-876, SACHDEVA, AND BECKER RENDERS OBVIOUS CLAIMS 1-20

A. Independent Claim 1

1. [1(pre)] A computer-implemented method comprising:

To the extent the preamble is limiting, Chishti-511 discloses a computer-processor-implemented method for orthodontic treatment planning. Ex-1004, Abstract; *see also* Ex-1004, 10:19-51, 1:33-39, 2:34-39; Chishti-876 and Sachdeva similarly disclose one or more computer processors for executing instructions to perform their relevant steps. *See* Ex-1005, 13:23-48, 23:7-32; Ex-1007, 4:39-49. Thus, subsequent limitations requiring performance "by one or more computer processors" are met by Chishti-511, Chishti-876, and Sachdeva. Ex-1003, ¶¶ 91-92.

2. [1(a)] determining, by one or more computer processors, a schedule of movement for dental objects during treatment stages, the dental objects being based from output of a scanning device, wherein the schedule of movement indicates whether each of the dental objects moves during each of the treatment stages;

Chishti-511 alone or in view of Chishti-876 renders this feature obvious.

Chishti-511 discloses dental objects being based from output of a scanning device. Chishti-511 gathers data by acquiring "a mold ***or a scan*** of patient's teeth" to create "a digital data set" representative of the patient's dental objects. Ex-1004, 3:40-50 (emphasis added); *see also* Ex-1004, 3:51-58.

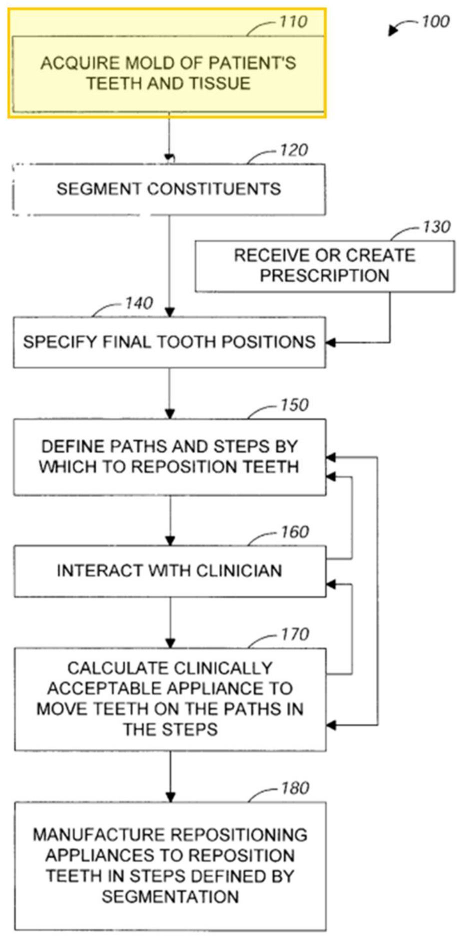


FIG. 1

Ex-1004, Fig. 1 (annotated); Ex-1003, ¶ 93.

Chishti-511 further discloses determining a schedule of movement for dental objects during treatment stages. Chisthi-511discloses that once the beginning and final positions are established for each tooth, the process "defines a tooth path for the motion of each tooth." Ex-1004, 3:59-4:6. Chishti-511 further discloses that the "tooth paths are segmented" such that the "end points of each path segment" represent a "clinically viable repositioning," and "the aggregate of segment endpoints constitute[s] a clinically viable sequence of tooth positions." Ex-1004, 4:7-22.

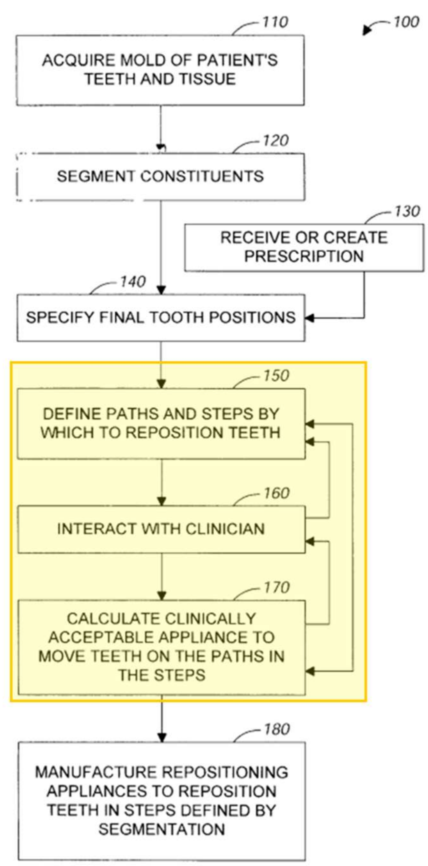


FIG. 1

Ex-1004, Fig. 1 (annotated); Ex-1003, ¶ 94-95.

The segmented tooth paths 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.* 4:51-57. A POSITA would have understood that the sequence of tooth positions and corresponding appliance configurations is a schedule of movement that indicates whether a dental object moves during each of the treatment stages. Ex-1003, ¶¶ 95; *see also id.* ¶ 96 (citing Ex-1004, 6:63-66, noting that some teeth may be identified as immobile, further indicating that the schedule reflects whether a tooth moves).

If it is argued that this feature is not rendered obvious by Chishti-511, Chishti-876 discloses and renders obvious this feature. For the reasons explained in Section VIII, a POSITA would have been motivated to modify Chishti-511 to include Chishti-876's teachings regarding generating a schedule of movement indicating whether each dental object moves during each of the treatment stages. Ex-1003, ¶ 97. Chishti-876 discloses that its system will "define or map the movement of selected individual teeth from the initial position to the final position over a series of successive steps." Ex-1005, 9:13-19; *see also* Ex-1005, 7:13-19, Fig. 3. Chishti-876's system "takes into consideration" "[m]ovement: a detailed, sequential description of how the patient's teeth should be moved in order to accomplish the desired goals for final placement," which is a section of the treatment plan that "specifies an order [of] moving the patient's teeth." Ex-1005, 9:33-45, 10:12-14. Using these teachings, "a plan is generated for moving teeth" (a "schedule of movement"). Ex-1005, 10:29-34; Ex-1003, ¶ 97. Chishti-876 further explains that its system "considers a set of movement constraints which affect the tooth path movement plan," and that such considerations include, for example: "[s]pace," "[t]eeth moving past each other," "[w]hich teeth are moving when?" and "[w]hich teeth need to be moved before others are moved?" Ex-1005, 11:32-65; Ex-1003, ¶ 97.

As shown in the annotated diagram, Chishti-876's schedule of movement shows for each treatment stage whether each tooth is moving (annotated green for the leftmost tooth) or not moving (annotated red for the leftmost tooth).

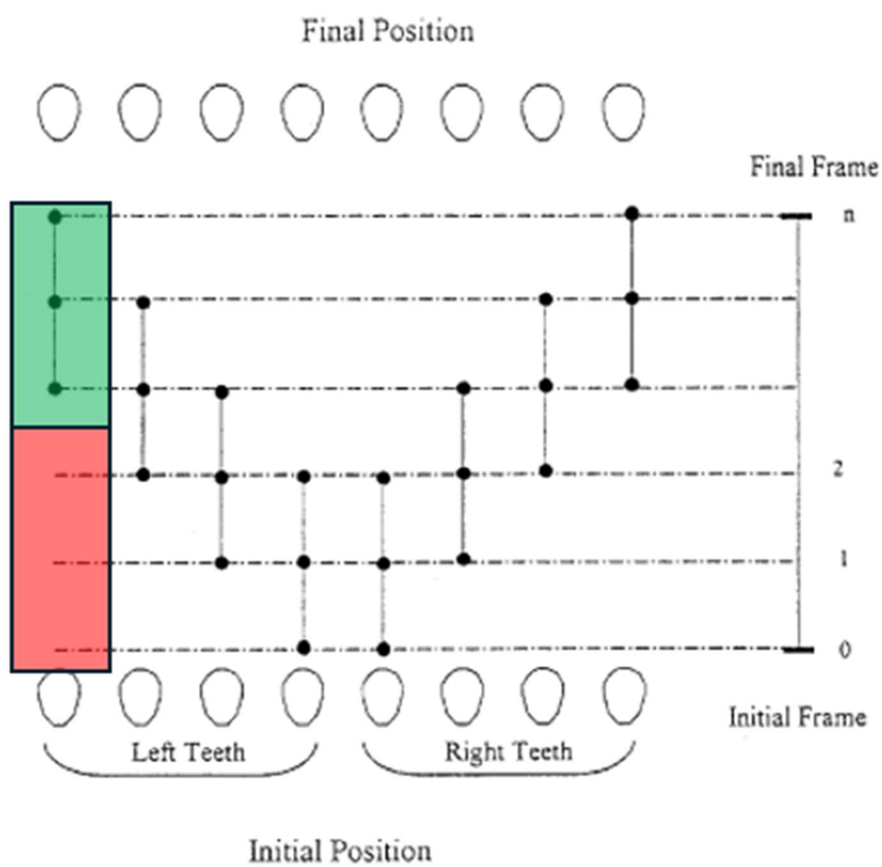


FIG. 11

Ex-1005, Fig. 11 (annotated), 17:1-7. Thus, Chishti-876's schedule of movement indicates whether each of the dental objects moves during each of the treatment stages. Ex-1003, ¶ 98.

3. [1(b)] calculating, by one or more computer processors, a respective route from an initial position toward a final position for each of the dental objects during the treatment stages; and

Chishti-511 discloses this feature, teaching that its computer program (Ex-1004, 2:34-39, 3:31-39, 10:19-51) "defines a tooth path" (a respective route) "for the motion of each tooth," which includes "bring[ing] the teeth from their ***initial positions*** to their desired ***final positions***." Ex-1004, 4:7-22 (emphases added); *see also* Ex-1004, 4:51-67, 11:4-8. Chishti-511 further explains that the segmented tooth paths "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" (during the treatment stages). Ex-1004, 4:51-67; Ex-1003, ¶¶ 99-101.

4. [1(c)] modifying, by one or more computer processors, the schedule of movement to avoid a collision or obstruction between two of the dental objects on their respective routes, the modifying comprising:

Chishti-511 alone or in view of Sachdeva renders this limitation obvious. Chishti-511's system seeks a "clinically viable sequence of tooth positions," that "do[] not result in a collision of teeth." Ex-1004, 4:7-22. Chishti-511 further states that new aligner shapes will be calculated if the system determines teeth motion is not "orthodontically acceptable" or "[i]f an acceptable end position is not reached by the teeth." Ex-1004, 5:25-32. A POSITA would have understood that a schedule of movement resulting in a collision would not be orthodontically acceptable, and that an acceptable end position will likely not be reached if the tooth movement resulted in a collision.

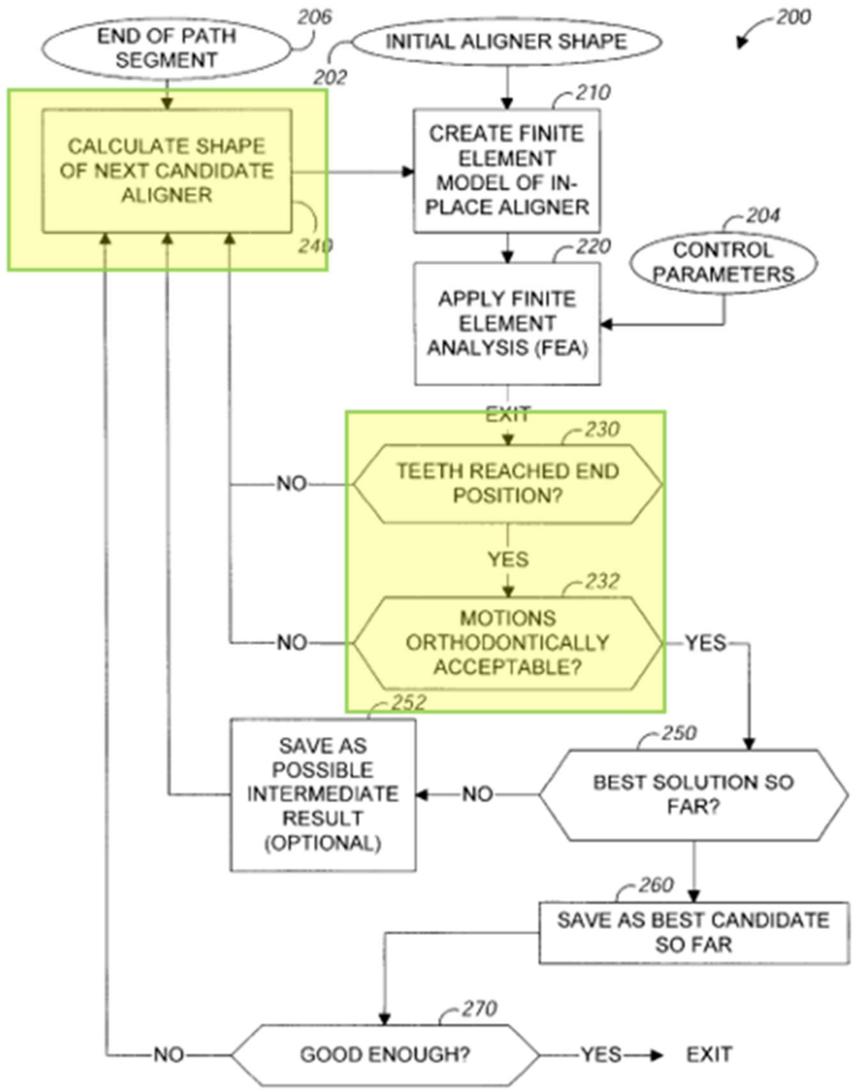


FIG. 2

Ex-1004, Fig 2 (annotated); Ex-1003, ¶¶ 102-104.

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." Ex-1004, 8:42-61. Chishti-511 explains that its modifications include "changing the increments of tooth motion, i.e., changing the segmentation, on the treatment path, changing the path followed by one or more teeth in the treatment path, or both." Ex-1004, 8:54-61.

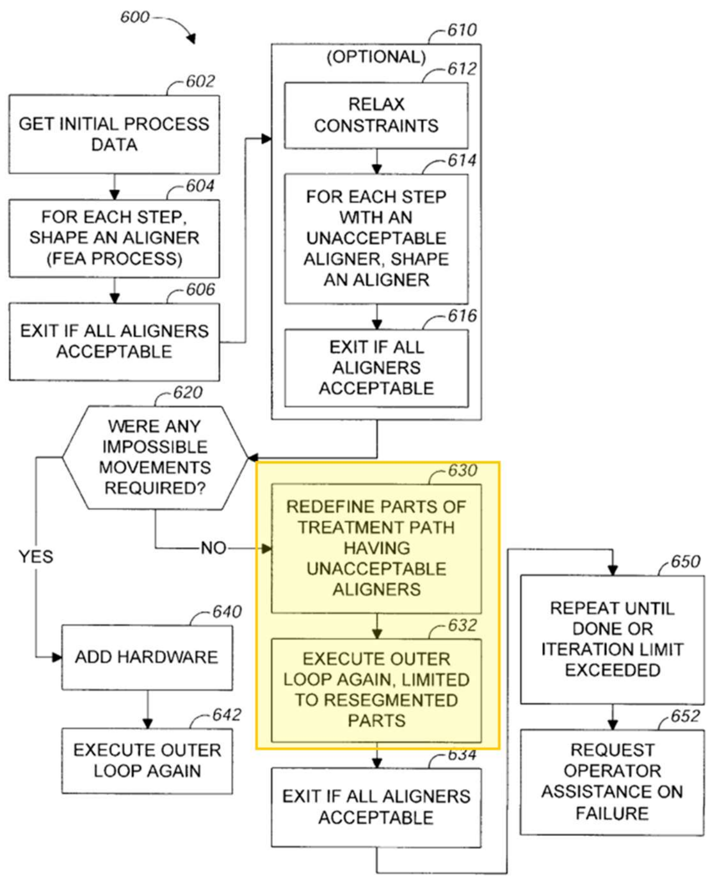
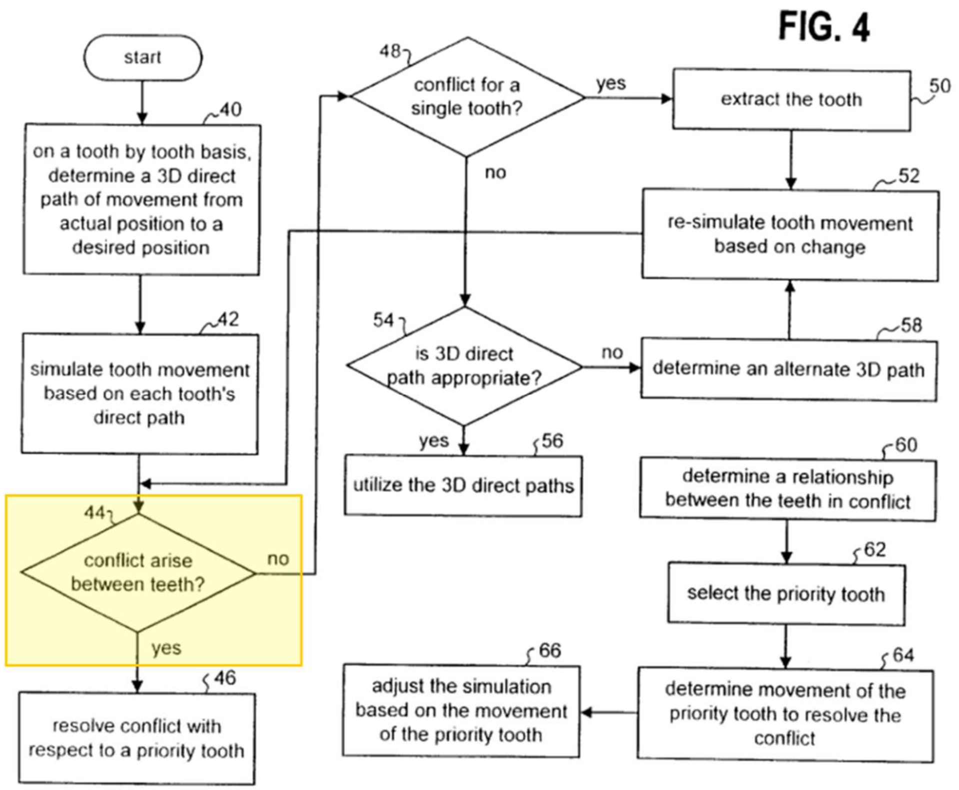


FIG. 6

Ex-1004, Fig. 6 (annotated). Thus, Chishti-511 discloses its software will modify the schedule of movement to avoid a collision or obstruction between two of the dental objects on their respective routes. Ex-1003, ¶¶ 105-106.

To the extent it is argued that Chishti-511 does not disclose this feature, Sachdeva does. And for the reasons discussed in Section VIII, a POSITA would have been motivated to modify Chishti-511 to include Sachdeva's collision avoidance and adjustment teachings. Ex-1003, ¶ 107.

During Sachdeva's treatment planning process, the computer "simulates tooth movement based on each tooth's path" and determines if "a conflict in movement arose between at least two teeth." Ex-1007, 5:3-8, Fig. 4.



Ex-1007, Fig. 4 (annotated); Ex-1003, ¶ 108.

A POSITA would have understood that a conflict arises when there is a collision between two dental objects, as Sachdeva explains that a conflict may arise if the "movement of one tooth interferes with the direct path of another tooth" (i.e., a collision on their respective routes), "causing a particular tooth to not be able to reach its desired position." Ex-1007, 5:3-8; Ex-1003, ¶ 109. The system determines the changes to the movement of the teeth needed to resolve the conflict and then adjusts the overall simulation accordingly. Ex-1007, 5:27-32. As discussed in limitation 1(d), Sachdeva discloses modifying the schedule of movement by delaying. *See* Section IX.A.5. Thus, Sachdeva discloses this feature. Ex-1003, ¶¶ 109-110.

5. [1(d)] delaying initial movement of one of the dental objects; and

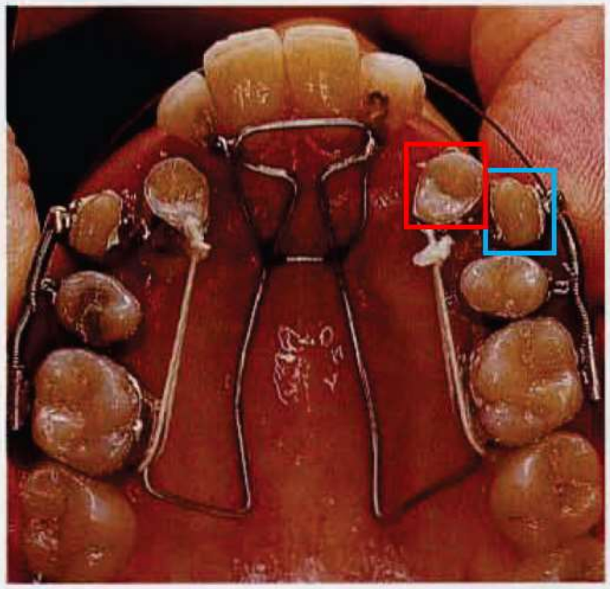
Sachdeva discloses this feature. Sachdeva discloses a method for avoiding a collision explaining that where "the lower tooth protrudes preventing the upper tooth from moving back, the lower tooth must be moved before the upper tooth can be positioned" (delaying the upper tooth). Ex-1007, 5:9-26. "Conversely, if the upper tooth is interfering with the lower tooth from being moved out, the upper tooth must first be moved" (delaying the lower tooth). *Id.* A POSITA would have understood that, normally, teeth will move at the same time if possible. In the examples provided by Sachdeva, however, two teeth are prevented from initially moving together due to interfering with each other. Thus, Sachdeva discloses delaying the initial movement of the blocked tooth until the obstruction has been cleared. Thus, a POSITA would understand that Sachdeva discloses an instance where, to avoid a collision, the initial movement of a dental object must be delayed until another dental object is first moved, as claimed. Ex-1003, ¶¶ 111-112.

For the reasons explained in Section VIII, it would have been obvious to modify Chishti-511 to include Sachdeva's delaying technique to avoid collisions. Ex-1003, ¶ 113.

6. [1(e)] round-tripping one of the dental objects.

Chishti-511 in view of Sachdeva and Becker renders this limitation obvious. "Round-tripping" has been construed to mean "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-1013, 8. For the same reasons discussed in Section VIII, a POSITA would have been motivated to modify the combined system to implement Becker's round-tripping collision avoidance. Ex-1003, ¶¶ 114-115.

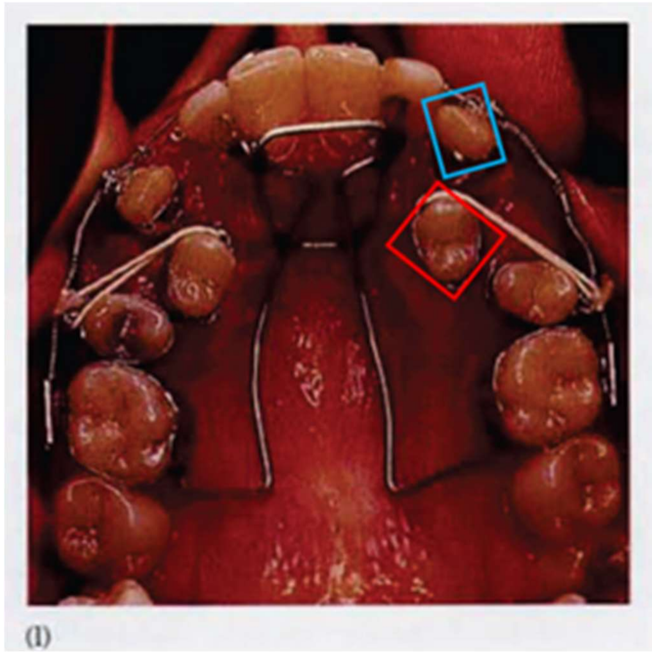
Becker discloses using the claimed round-tripping modification to avoid a collision. Ex-1006, 5; Ex-1003, ¶ 116. Becker presents a malocclusion in which a more lingual tooth ("first tooth," red) is transposed with a more buccal tooth ("second tooth," blue)—such that the more buccal tooth needs to be moved toward the incisors and the midline of the mouth. Ex-1006, 5.



(k)

Ex-1006, 7 (Fig. 8.6(k) (annotated)); Ex-1003, ¶ 116.

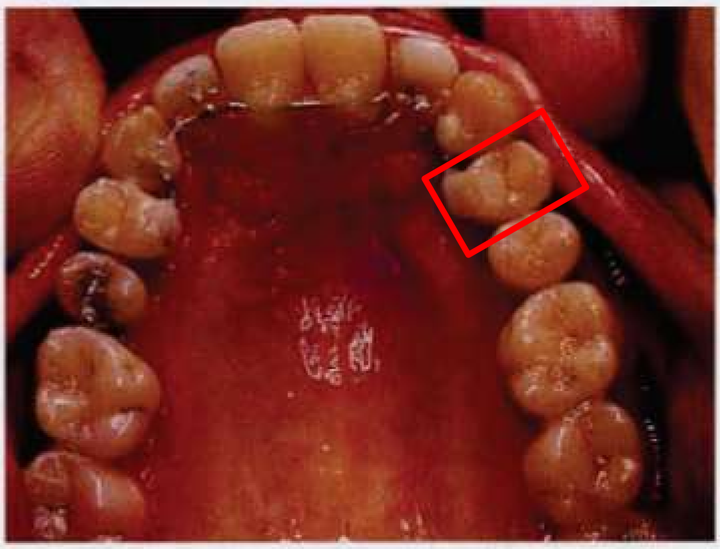
As can be seen in Figure 8.6(k) above, moving the more buccal tooth to its proper position would cause a collision between the two teeth. Ex-1003, ¶ 117. To resolve the transposition, Becker discloses "slid[ing] the more buccal of the transposed teeth" (i.e., the tooth closer to the cheek) "in the medio-distal plane" (i.e., toward the midline or center of the dental arch). Ex-1006, 5. To allow this movement, Becker discloses that the more lingual tooth "must be moved further lingually to allow its partner to pass by" (*id.*) ("moving a first tooth out of the path of a second tooth"). Ex-1003, ¶ 117. Figure 8.6(l) below depicts the more lingual tooth after it has moved lingually and allowed the more buccal tooth to pass by. Ex-1006, 5.



Ex-1006, 7 (Fig. 8.6(l) (annotated)); Ex-1003, ¶ 117.

After the more lingual tooth is moved "to allow its partner [the more buccal tooth] to pass by," the more lingual tooth moves back to its previous position before proceeding to a desired final position of that first tooth. Ex-1006, 5; Ex-1003, ¶ 118. Once the more buccal tooth has moved sufficiently, Becker explains that the more lingual tooth "must be moved in the opposite mesio-distal direction and back in the line of the arch." Ex-1006, 5. A POSITA would understand that moving the more lingual tooth in the "opposite" direction that it previously moved and "back" to where it was before ("in line of the arch") (*id.*) would move the more lingual tooth "back to its previous position." Ex-1003, ¶ 118.

A POSITA would have understood, however, that the more lingual tooth's previous position is not its final position, and thus that further movement is necessary. Ex-1003, ¶ 118. Indeed, Figure 8.6(m) below shows the more lingual tooth after it proceeds to its desired final position.


(m)
.

Ex-1003, ¶ 118 (annotating Ex-1006, 8 (Fig. 8.6(m))).

Such a subsequent movement to a final position also would have been obvious to a POSITA, who would have understood that multiple small adjustments are often necessary to achieve a final satisfactory arrangement of teeth (e.g., removing all gaps, precise alignment with other teeth). Becker's subsequent movement to a final position is also consistent with Sachdeva. Sachdeva explains that its conflict resolution seeks to move a tooth "sufficiently to resolve the conflict"

(Ex-1007, 5:27-30), which would allow a previously blocked tooth to achieve its desired position. Ex-1003, ¶ 119. After a conflict is resolved, its "process then proceeds to step 66 where the simulation is adjusted based on the movement of the priority tooth." Ex-1007, 5:30-32. A POSITA would recognize that subsequent simulation may cause further movement of the previously blocked tooth toward its final position, and thus, Sachdeva similarly recognizes that a treatment plan may include moving the first tooth further again after resolution of the conflict. Ex-1003, ¶¶ 119-120.

B. Claim 2: The computer-implemented method of claim 1, wherein determining the schedule of movement comprises selecting a movement pattern from a plurality of predetermined movement patterns.

Chishti-511 in view of Chishti-876 renders obvious this limitation. For the reasons explained in Section VIII, a POSITA would have been motivated to modify Chishti-511 to include Chishti-876's teachings regarding selecting a movement pattern from a plurality of movement patterns. Ex-1003, ¶ 121. The '879 patent admits that Chishti-876 disclosed movement patterns. Ex-1001, 6:11-17.

Chishti-876 explains that its algorithm draws upon a library of predetermined tooth-treatment patterns and its system allows for the selection of "one teeth treatment pattern from a plurality of predetermined teeth treatment patterns." Ex-1005, Abstract, 2:63-3:10, 3:24-33, 3:38-40, 3:49-51, 14:63-15:4. Each treatment pattern presents a "transformation curve" applied to each tooth in order "to move th[at] tooth from its initial position to its final position." Ex-1005, 12:38-43. Chishti-876 explains that its system "generat[es] the malocclusion treatment plan in accordance with the selected treatment pattern." Ex-1005 2:63-3:5, 2:20-24. Chishti-876 provides several exemplary movement patterns, including how the schedule of movement will be generated based on the selected pattern. Ex-1005, 2:44-62, 3:6-10, 3:24-27, 3:38-40, 3:49-51, 16:48-17:17, Figs. 10-13; Ex-1003, ¶ 122.

C. Claim 3: The computer-implemented method of claim 1, further comprising recalculating at least one of the respective routes based on the modified schedule of movement.

Chishti-511 discloses this limitation. As explained above, Chishti-511's system will modify the schedule of movement if aligners are unacceptable. In that case, the system "transfers control to a redefinition process … to redefine those parts of the treatment path having unacceptable aligners." Ex-1004, 8:54-65. Chishti-511 explains that this step includes "changing the increments of tooth motion, i.e., changing the segmentation, on the ***treatment path***, ***changing the path*** followed by one or more teeth in the treatment path, or both." *Id.* (emphasis added). Chishti-511 further explains that "this ***recalculation***" is performed for "those aligners on the ***redefined*** portions of the ***treatment path***." *Id.* (emphasis added)

Thus, Chishti-511 discloses recalculating at least one respective route based on the modified schedule of movement. Ex-1003, ¶ 123.

D. Claim 4: The computer-implemented method of claim 1, further comprising manufacturing at least two orthodontic aligners, each of the orthodontic aligners corresponding to a respective one of the treatment stages.

Chishti-511 discloses this feature. Chishti-511 explains that each "appliance is intended to be worn until [a] first intermediate arrangement is approached or achieved, and then one or more additional (intermediate) appliances are successively placed on the teeth." Ex-1004, 1:33-58; *see also* Ex-1004, 4:51-67 (explaining that each appliance configuration represents a step or treatment stage along the treatment path); *see also supra* Sections IX.A.2-3 [1(a) and 1(b)] (discussing treatment stages). Thus, the orthodontic appliances (at least two orthodontic aligners) each correspond to a respective one of the treatment stages. Ex-1003, ¶ 124.

Chishti-511 further discloses that the appliances are manufactured, as shown in Figure 1 below:

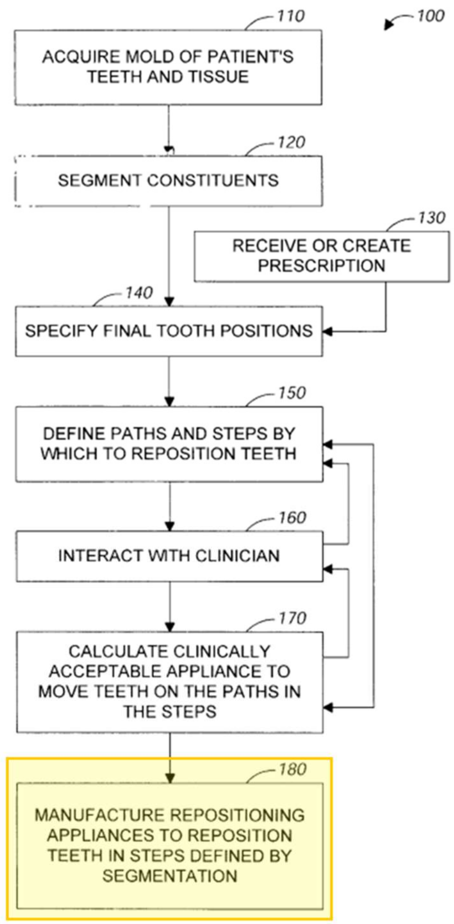


FIG. 1

Ex-1004, Fig. 1 (annotated); *see also* Ex-1004, 5:1-6; *see also id.* 3:36-39 (describing "manufacturing step (step 180)" as the step "in which appliances defined by the process are manufactured."), 10:19-51; Ex-1003, ¶ 125.

E. Claim 5

1. [5(a)] The computer-implemented method of claim 4, wherein the manufacturing comprises: fabricating a respective positive mold of the dental objects for at least two of the treatment stages; and

Chishti-511 discloses this feature, explaining that it generates "positive models to produce the repositioning appliance[s]," and that "adding a wax patch to the digital model will generate a positive mold that has the same added wax patch geometry." Ex-1004, 9:43-56. Each appliance configuration represents one stage (of multiple) along the treatment path. Ex-1004, 4:51-67. A POSITA would have understood that because this manufacturing process produces the aligners for each stage of the movement pattern, this fabrication would be required for at least two of the treatment stages, as claimed. Ex-1003, ¶¶ 126-127.

2. [5(b)] thermoforming an orthodontic aligner over each respective positive mold.

Chishti-511 alone or in view of Chishti-876 renders this feature obvious. Chishti-511 discloses that its aligners are "manufactured by pressure fitting polymeric material over a positive physical model of the digital teeth." Ex-1004, 9:43-56. The claimed "thermoforming" is disclosed by Chishti-511's pressure-fitting manufacturing process. Ex-1003, ¶ 128. A POSITA would have understood that thermoforming is a well-known manufacturing process whereby a plastic sheet is heated to a pliable temperature, shaped into a specific form using a mold, and then cooled to maintain its new shape. Pressure-fitting a polymeric material over a positive physical model of teeth—as disclosed in Chishti-511—would be understood by a POSITA to be a type of thermoforming, as pressure-fitting uses air pressure in conjunction with the heated plastic sheet to help shape the appliance in the form of the mold. Ex-1003, ¶ 128. Indeed, the '879 patent admits this was known—the specification's only mention of a manufacturing technique describes "using a ***conventional pressure molding*** technique to form the appliance around the positive mold." Ex-1001, 3:42-46 (emphasis added). Thus, the '879 patent admits that the required fabrication process was merely "conventional," (*id.*), and a POSITA would have understood that the '879 patent's conventional manufacturing process, which is consistent with and matches Chishti-511's disclosure of pressure fitting, makes this limitation both disclosed and rendered obvious by Chishti-511. *Id.*

To the extent it is argued Chishti-511 does not disclose this feature, this limitation is rendered obvious by Chishti-876, which discloses that its dental appliances may be a "polymeric shell" manufactured "from a thin sheet of a suitable elastomeric polymer, such as Tru-Tain 0.03 in, ***thermal forming*** dental material." Ex-1005, 7:54-64 (emphasis added), 7:1-18; Ex-1003, ¶ 129. A POSITA would understand that the disclosed thermal forming dental material would create Chishti-

876's polymeric shells through the process of thermoforming the dental material over a respective positive mold (as described in Chishti-511). Ex-1003, ¶ 129.

Because Chishti-511 discloses manufacturing dental aligners, (Ex-1004, 9:43-56), a POSITA would have been motivated to look to ways to manufacture the generated aligners, and Chishti-876 discloses known methods for manufacturing these dental appliances. Ex-1005, 7:54-64; Ex-1003, ¶ 130.

Using thermoforming for appliance manufacturing would have had a reasonable expectation of success, as thermoforming is just one of a finite number of identified, predictable solutions, and was a well-known and routine technique for aligner manufacturing at the relevant time. Ex-1003, ¶ 131. The '879 patent specification does not purport to have invented the technique. *See, e.g.*, Ex-1001, 3:38-44. The state of the art also confirms this technique was known at the time. Ex-1016, 198 ("A thermoforming process is used for aligner fabrication."); Ex-1016, 18-23 (describing thermoforming used to fabricate dental appliances in 1959); Ex-1003, ¶ 131. Accordingly, it would have been obvious to a POSITA at the relevant time to combine Chishti-876's disclosure of thermoforming with Chishti-511's disclosure of manufacturing dental aligners. Ex-1003, ¶ 131.

F. Claim 6

1. [6(a)] The computer-implemented method of claim 1, wherein the round-tripping comprises: moving a first of the dental objects away from the respective route of a second of the dental objects; and

Because limitation 6(a) is substantively identical to a portion of the previously applied round-tripping construction, Becker discloses this feature for the same reasons discussed with respect to limitation 1(e). *Supra* Section IX.A.6. Limitation 6(a) merely recites that the first dental object is moved "away" from the route of the second object, which Becker discloses, as it discloses a first tooth moved "out of the path of a second tooth" as required by the round-tripping construction. Ex-1003, ¶ 132.

2. [6(b)] moving the first dental object toward its respective final position after the second dental object has sufficiently traversed its respective route to avoid the collision.

Because limitation 6(b) is substantively identical to a portion of the previously applied round-tripping construction, Becker discloses this feature for the same reasons discussed with respect to limitation 1(e). *Supra* Section IX.A.6. Limitation 6(b) merely recites that the first dental object moves "toward" its final position "after" the second object has sufficiently traversed its respective route "to avoid the collision." As explained with respect to limitation 1(e), this is met by Becker, as it discloses that the first dental object moves "to its previous position" and then moves to its respective final position (and hence toward it). *Id.* Becker similarly discloses that the first tooth will also only move toward its previous and then final position after the second tooth has "allow[ed] its partner to pass by" (after the second dental object has sufficiently traversed its respective route to avoid the collision). *Id.*; Ex-1006, 5; Ex-1003, ¶ 133.

G. Claim 7

1. [7(a)] The computer-implemented method of claim 1, wherein the round-tripping comprises: moving a first of the dental objects away from the respective route of a second of the dental objects; and

Chishti-511 discloses this feature for the same reasons discussed with respect to limitations 1(e) and 6(a). Ex-1003, ¶ 134; *supra* Sections IX.A.6, IX.F.1.

2. [7(b)] moving the first dental object toward its previous position.

Because limitation 7(b) is substantively identical to a portion of the previously applied round-tripping construction, Becker discloses this feature for the same reasons discussed with respect to limitation 1(e). *Supra* Section IX.A.6. Limitation 7(b) merely recites that the first dental object moves "toward" its previous position. As explained with respect to limitation 1(e), this is met by Becker, as it discloses that the first dental object moves "to its previous position" (and hence towards it). *Id.* Ex-1003, ¶ 135.

H. Claim 8

1. [8(a)] The computer-implemented method of claim 1, wherein: the determining of the schedule of movement comprises determining, by one or more computer processors, a total number of the treatment stages; and

Chishti-511 alone or in view of Chishti-876 renders this limitation obvious. As explained for limitation 1(a), Chishti-511 discloses that its "tooth paths are segmented" into a calculated number of segments "so that each tooth's motion within a segment stays within threshold limits of linear and rotational translation." Ex-1003, ¶ 137; Ex-1004, 4:7-22; *supra* Section IX.A.2. The segmented tooth paths are then "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" Ex-1004, 4:51-67. "Each appliance configuration represents a step along the treatment path." *Id.* A POSITA would understand that the number of steps/appliances is the total number of treatment stages. Ex-1003, ¶¶ 136-137.

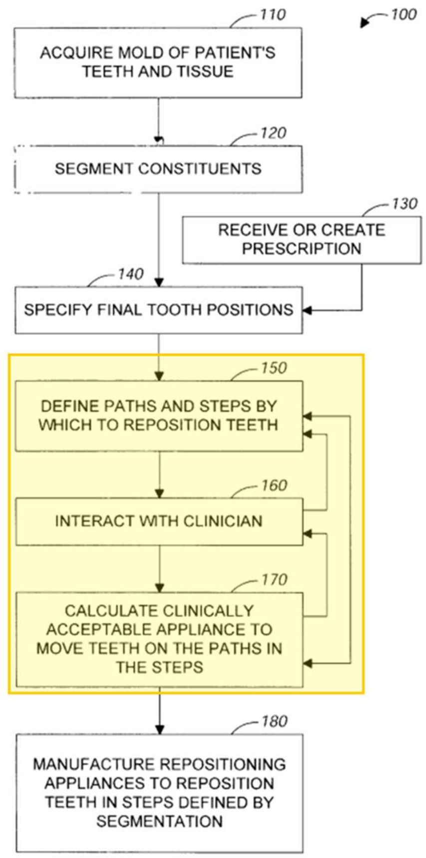


FIG. 1

Ex-1004, Fig. 1 (annotated); *see also* Fig. 6 ("For each step, shape an aligner," which continues until "all aligners" are acceptable), 5:1-6. Thus, a POSITA would have understood that, when calculating the acceptable appliances (and iterating through them), the system determines a total number of treatment stages. Ex-1003, ¶¶ 137-138.

If it is argued that Chishti-511 does not alone disclose determining a total number of treatment stages, this limitation is obvious in view of Chishti-876. Chishti-876 discloses optimizing the movement pattern of each tooth to reduce the movement steps. Ex-1005, 11:26-40. It also indicates it has calculated the treatment stages, noting that one treatment plan includes "about fifty discrete stages," where each stage represents a single aligner in the treatment plan. *Id.* Thus, Chishti-876 expressly discloses calculating the number of treatment states. For the reasons explained in Section VIII, it would have been obvious to modify Chishti-511 to include Chishti-876's teachings regarding this feature. Ex-1003, ¶ 139.

2. [8(b)] the determining of the total number of the treatment stages comprises: determining, by one or more computer processors, a respective minimum number of treatment stages for each of the dental objects; and

Chishti-511 alone or in view of Chishti-876 renders this limitation obvious. Chishti-511 discloses calculating the number of segments necessary to move "the teeth from their initial positions to their desired final positions" in the "quickest fashion." Ex-1004, 4:7-22. And in calculating its aligners, Chishti-511 considers inputs such as "the maximum allowable displacement velocity for each tooth and the maximum allowable force of each kind for each tooth." Ex-1004, 6:38-56. Given that Chishti-511 analyzes the maximum it can move teeth and seeks to move teeth in the "quickest fashion," a POSITA would have understood that to achieve the desired final position of each tooth in the "quickest fashion," while considering the maximum amount the system can move teeth for each aligner, Chishti-511 determines the minimum number of treatment stages for each dental object. Ex-1004, 4:7-22, 6:38-56. Ex-1003, ¶¶ 140-141.

If it is argued that Chishti-511 does not alone disclose this feature, this limitation would have been obvious in view of Chishti-876. Chishti-876 discloses "finding a collision[-]free shortest path between an initial position and a final position for one or more teeth." Ex-1005, claim 3. Chishti-876 also analyzes the "maximum linear or rotational velocity at which a tooth should move, [and] the maximum distance over which a tooth should move between treatment steps." Ex-1005, 13:49-14:4. Because this repositioning happens in the "quickest fashion" and achieves the maximum allowable speed to the desired result, a POSITA would have understood that Chishti-876 determines the minimum number of treatment stages for each tooth. Ex-1003, ¶ 142.

Moreover, Chishti-876 discloses an all-equal movement pattern in which each tooth travels "approximately equal lengths between each adjacent pair of treatment steps." Ex-1005, 13:49-55, 16:57-67, Fig. 10. Chishti-876 explains that "X-type movement[,] … also known as an 'All Equal Movement,'" involves "all teeth in a given group … moving at the same time." Ex-1005, 16:57-67. This is accomplished by taking the overall distance between each of the initial and final positions, and dividing them in half repeatedly until "the moving distance in each frame meets a given criterion." *Id.*; *see also* Ex-1005, Fig. 10. The system also ensures that "each frame does not exceed one or more distance constraints." Ex-1005, 16:57-67. By repeatedly performing this, Chishti-876's system moves the teeth as far as possible without exceeding the distance constraints, which a POSITA would understand would result in a minimum number of treatment stages for each tooth. And for the reasons discussed in Section VIII, a POSITA would have been motivated to combine Chishti-876's disclosed stage calculations and treatment patterns with Chishti-511. Ex-1003, ¶ 143.

3. [8(c)] selecting, by one or more computer processors, a largest of the respective minimum numbers of treatment stages as the total number of the treatment stages.

Chishti-511 in view of Chishti-876 renders this limitation obvious. As explained above, Chishti-511 teaches a process to reposition dental objects in the "quickest fashion" possible. Ex-1004, 4:7-22. This includes analyzing the maximum speed and distance of repositioning in the minimum number of treatment stages for each dental object being moved. *Supra* Section IX.H.2 [8(b)]; Ex-1003 ¶ 144. A POSITA would have understood that to achieve the desired result for each dental object, each tooth must move at least its own minimum number of stages. Ex-1003 ¶ 145. A POSITA would thus recognize that, for the tooth having the largest number of stages, the overall number of treatment stages could not be less than that. *Id.* This would accordingly set the minimum number of stages for the overall treatment plan to the minimum number of stages required to move all teeth to their desired final positions. *Id.* Using less than the largest of the minimum number of stages would result in an incomplete treatment plan, and using more than the largest of the minimum number of stages would add unnecessary time and expense to the overall treatment plan. *Id.* Thus, for example where the most posterior tooth required a minimum of 10 stages, but each other tooth could accomplish its desired movement in 7 stages or less, a POSITA would have understood that 10 stages (as the largest of the respective minimum number of stages) would need to be selected as the total number of stages for the overall plan because selecting anything less than 10 stages would fail to achieve the desired final position for the most posterior tooth. *Id.*

Moreover, Chishti-876 expressly discloses examples where the largest of the respective minimum number of treatment stages is selected as the total number of the treatment stages. Figure 10 below illustrates an X-type movement pattern where each tooth reaches its desired final position in the same number of treatment stages:

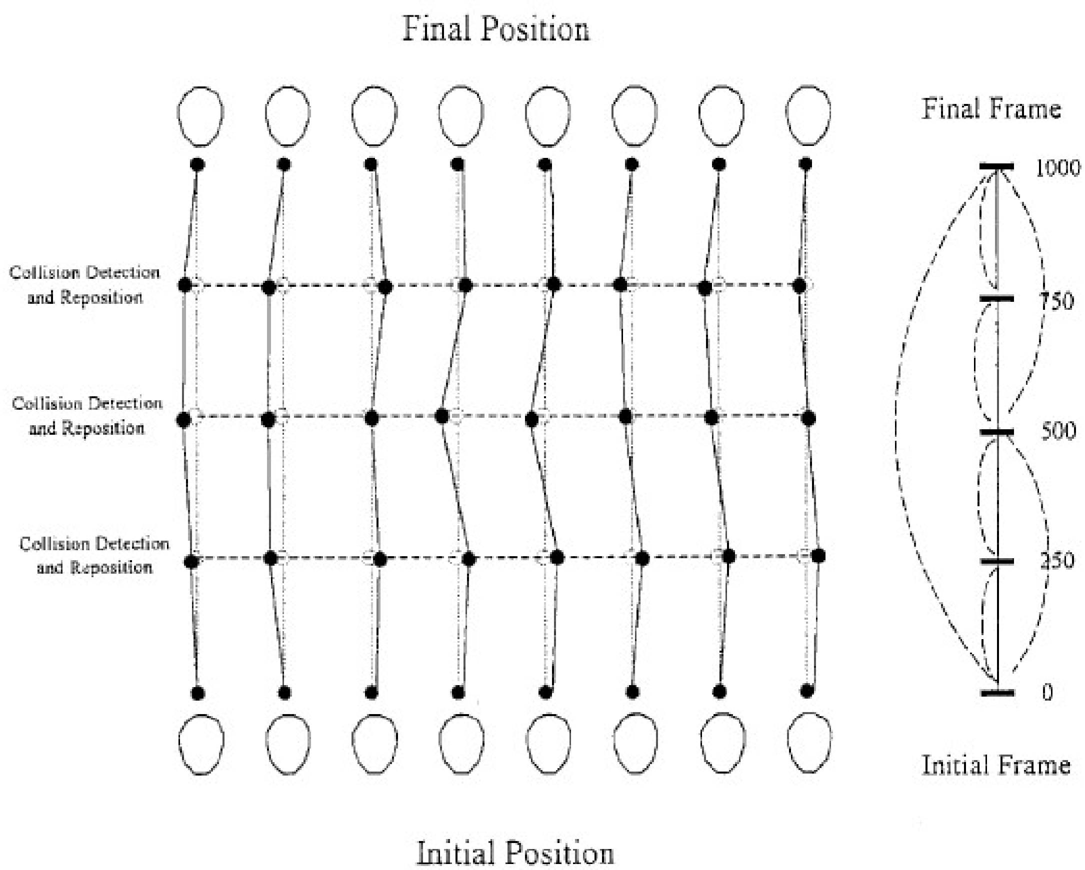


FIG. 10

See Ex-1005, Fig. 10; Ex-1003 ¶ 146.

In this example, Chishti-876 selects the largest of the respective minimum number of treatment stages as the total number of treatment stages for the treatment plan. Ex-1003, ¶ 147. And for the reasons discussed in Section VIII, a POSITA would have been motivated to combine Chishti-876's disclosed treatment patterns with Chishti-511. *Id.*

Regardless of whether, for example, an X-type movement pattern applies, a POSITA would have thus understood that if a certain tooth requires a greater number of steps than other teeth, the number of stages for that tooth dictates the total number of stages needed for the overall treatment plan because that would be the minimum number of stages required to move all teeth and complete the treatment plan. Ex-1003, ¶ 148. Thus, to the extent it is argued that Chishti-876 does not specifically disclose selecting a largest of the respective minimum number of treatment stages as the total number of treatment stages, this limitation is at least rendered obvious by Chishti-876. *Id.*

I. Independent Claim 9

Claim 9 repeats, or recites, features that are substantively identical to features recited in claim 1, with the exception of differing language in the preamble and removal of "by one or more computer processors." *Compare* Ex-1001, 16:9-27, *with* Ex-1001, 17:5-23; *see also* Ex-1003, ¶ 149 (comparing claims).

Limitation 9(pre) discloses "[a] non-transitory computer-readable medium comprising instructions that, when executed by one or more computer processors, cause at least one of the one or more computer processors to: . . . ." To the extent that limitation 9(pre) is limiting, Chishti-511 discloses it. As discussed previously with respect to limitation 1(pre), Chishti-511 discloses that its system may be implemented in "computer programs" that are executed on "at least one programmable processor." Ex-1004, 10:29-43; *supra* Section IX.A.1. Chishti-511 also discloses "[s]torage devices suitable for tangibly embodying computer program instructions" and provides various examples of non-transitory computer-readable medi[a]. *See* Ex-1004, 10:43-51; Ex-1003, ¶ 151.

Accordingly, claim limitations 9(pre)-9(e) are taught or suggested for the reasons discussed here and in Sections IX.A.1-.6 [1(pre)-1(e)], which discuss the corresponding portions of claim 1. Ex-1003, ¶¶ 150-156.

J. Claims 10-14

Claims 10-14 repeat or recite features that are substantively identical to features recited in claims 2-5 and 8, respectively. *Compare* Ex-1001, 16:28-45 and 16:58-17:4, *with* Ex-1001, 17:24-54; *see also* Ex-1003, ¶¶ 157-166 (comparing claims).

For example, the features added by claims 10 and 13 are identical to claims 2 and 5, respectively, except for the preamble. *See* Ex-1003, ¶¶ 157-158, 163-164. See, for example, the following minor differences between claims 10 and 2.

Claim 2	**Claim 10**
The computer-implemented method of claim 1, wherein determining the schedule of movement comprises selecting a movement pattern from a	The medium of claim 9, wherein determining the schedule of movement comprises

plurality of predetermined movement patterns.	selecting a movement pattern from a plurality of predetermined movement patterns.

Claims 11, 12, and 14 have slightly more extensive changes to their wording relative to earlier claims, but they remain substantively identical to claims 3, 4, and 8, respectively, and are met for the same reasons as discussed for the earlier claims. *See* Ex-1003, ¶¶ 159-162, 165-166. For example, claims 11 and 12 are substantively identical to claims 3 and 4, respectively, except for reciting "wherein the instructions, when executed by the one or more computer processors, further cause at least one of the one or more computer processors to …" and claim 14 is substantively identical to claim 8, except that claim 14 does not recite that a claimed feature is performed by one or more computer processors. See, for example, the following minor differences between claims 3 and 11:

Claim 3	**Claim 11**
The computer-implemented method of claim 1, further comprising	The medium of claim 9, wherein the instructions, when executed by the one or more computer processors, further cause at least one of the one or more computer processors to
recalculating at least one of the respective routes based on the modified schedule of movement.	recalculate at least one of the respective routes based on the modified schedule of movement.

Accordingly, claims 10-14 are taught or suggested for the reasons discussed in Sections IX.B-.E and IX.H, which discuss the corresponding portions of claims 2-5 and 8. Ex-1003, ¶¶ 157-166.

K. Independent Claim 15

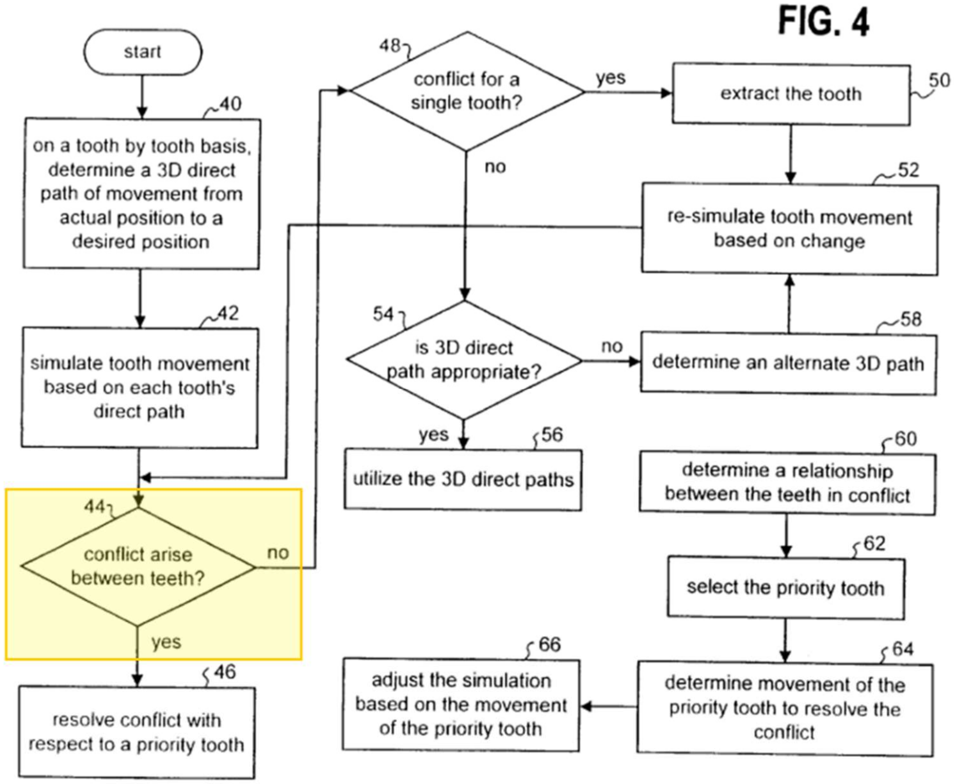
1. [15(pre)] – [15(c)]

Limitations 15(pre)-15(c) repeat or recite features that are substantively identical to features recited in limitations 1(pre)-1(c), respectively. *Compare* Ex-1001, 16:9-24, *with* Ex-1001, 17:55-18:2; *see also* Ex-1003, ¶ 167 (comparing claims). Accordingly, limitations 15(pre)-15(c) are taught or suggested for the reasons discussed in Sections IX.A.1-.4 [1(pre)-1(c)], which discuss the corresponding portions of claim 1. Ex-1003, ¶ 168.

2. [15(d)] determining, by the one or more computer processors, that the respective route of a first of the dental objects results in a collision or obstruction with a second of the dental objects;

Chishti-511 in view of Sachdeva renders this limitation obvious for the same reasons provided for limitation 1(c). *Supra* Section IX.A.4. As described with respect to limitation 1(c), Sachdeva discloses that its system will determine if "a conflict in movement arose between at least two teeth," and will attempt to resolve it. Ex-1007, 5:3-8, Fig. 4. Sachdeva explains that a conflict (a collision) may arise if the treatment path (route) of one tooth interferes with the treatment path (route) of another tooth (i.e., a collision), thereby causing either tooth to be unable to reach its desired position. Ex-1007, 5:3-8; Ex-1003, ¶ 169.

FIG. 4



Ex-1007, Fig. 4 (annotated); Ex-1003, ¶ 169.

3. [15(e)] altering, by the one or more computer processors in response to the determining, the schedule of movement by delaying initial movement of the first dental object;

Limitation 15(e) repeats or recites features that are substantively identical to features recited in claim limitations 1(c) and 1(d). *Supra* Sections IX.A.4-.5; Ex-1003, ¶¶ 170-171 (comparing claims). Limitation 15(e) recites "altering … the schedule of movement by delaying initial movement," whereas 1(c) recites "modifying … the schedule of movement . . . [by] delaying initial movement." Moreover, limitation 15(e) recites altering "in response to the determining" of limitation 15(d), which is "determining . . . that the respective route of a first of the dental objects results in a collision." Limitation 1(c) likewise recites modifying "to avoid a collision or obstruction between two of the dental objects on their respective routes." These are substantively identical, and thus Chishti-511 in view Sachdeva renders this limitation obvious for the same reasons provided for limitations 1(c) and 1(d). *Supra* Sections IX.A.4-.5; Ex-1003, ¶ 172.

4. [15(f)] determining, by the one or more computer processors, that the altered schedule of movement still results in a collision or obstruction involving the first dental object; and

Chishti-511 in view of Sachdeva renders this feature obvious. As explained above for limitations 1(c) and 15(d), the combination will determine if there will be a collision between dental objects and perform a modification, using delaying and round-tripping, to avoid the collision. *Supra* Sections IX.K.2, IX.A.4. Limitation 15(f) recites determining if the "altered schedule of movement" results in a collision, whereas 15(d) recites determining if the "route[s]" result in a collision. This limitation is met for the same reasons discussed for 1(c) and 15(d). *Id.* Indeed, Chishti-511 discloses that its segmented tooth paths 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." Ex-1004, 4:51-67. Thus, the schedule of movement takes into account the routes of teeth, and the combined system will determine if the schedule of movement results in a collision. Ex-1003, ¶ 173. Further, Chishti-511 states that its segments are constructed so that "moving from one point to the next *in the sequence* does not result in a collision of teeth." Ex-1004, 4:7-22. Thus, it determines whether the schedule of movement will result in a collision. Ex-1003, ¶ 173.

Chishti-511 will also determine if the schedule of movement "still results" in a collision. It explains that "[a]fter the treatment path has been redefined" to account for the unacceptable aligners, the process is re-executed to ensure all aligners are now acceptable (i.e., the collision has been resolved and there are no further collisions). Ex-1004, 8:54-9:2, Fig. 6; Ex-1003, ¶¶ 174-175.

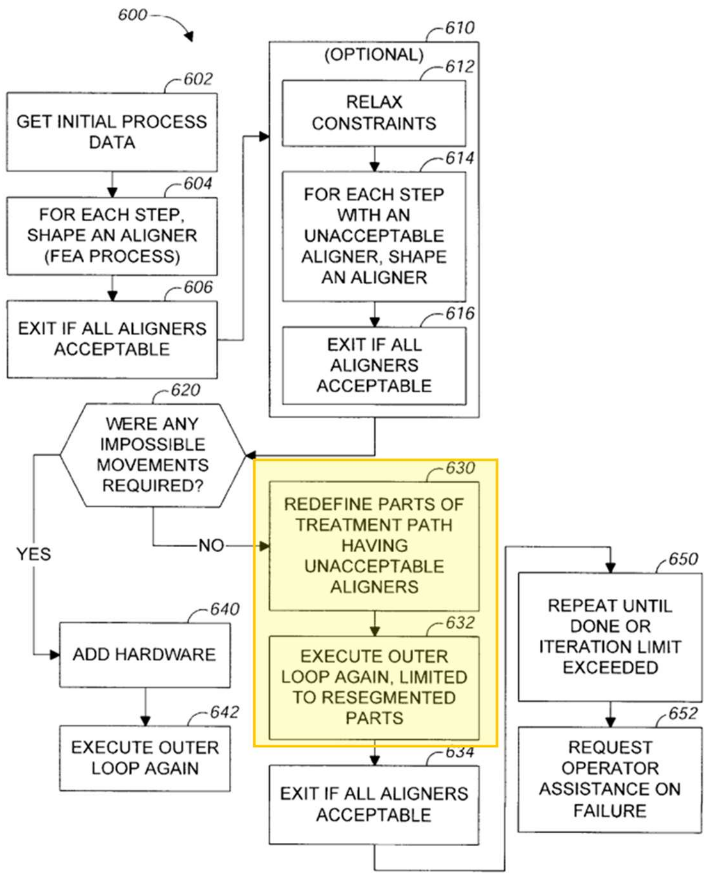


FIG. 6

Ex-1004, Fig. 6 (annotated); Ex-1003, ¶ 175.

As the process re-executes, it will determine whether unacceptable aligners still remain, performing additional determinations of whether of collisions still result, and modifications or redefinitions "until an acceptable set of aligners is found." Ex-1004, 8:54-9:14. This repeated process would include determining the existence of collisions as discussed for limitations 15(d) and 1(c). *Supra* Sections IX.J.2, IX.A.4. Because Chishti-511 (in view of Sachdeva) continues to determine if the aligners are acceptable, its process makes a determination regarding whether the altered schedule of movement still results in a collision or obstruction involving the first dental object. Ex-1003, ¶¶ 176 (also noting that this is consistent with Chishti-876, Ex-1005, 13:10-48).

5. [15(g)] altering, by the one or more computer processors after the determining that the altered schedule of movement still results in a collision or obstruction, the schedule of movement of the first dental object by moving the first dental object out of the path of the second dental object, and once the second dental object has moved sufficiently, moving the first dental object back to the first dental object previous position before proceeding to a desired final position of the first dental object.

Chishti-511 in view of Sachdeva and Becker renders this limitation obvious. As explained above for limitations 1(c) and 1(e), the combination will modify (or alter) the schedule of movement to avoid a collision, including by round-tripping one of the dental objects, and limitation 15(f) explains that the combination will determine if a collision will still result. *Supra* Sections IX.A.4, IX.A.6, IX.K.4. Claim 15(g) merely recites that the system will perform round-tripping of the first dental object if it determines collision will still result, as the alteration of the schedule of movement recited is the construction for round-tripping. *See* Section V. This limitation is met for the same reasons discussed in limitations 1(e) and 15(f). *Supra* Sections IX.A.6, IX.K.4; Ex-1003, ¶ 177.

As discussed previously, Chishti-511 discloses that, following aligner modifications, its process is re-executed to ensure all aligners are now acceptable (e.g., the collision has been resolved and there are no further collisions). Ex-1004, 8:54-9:2, Fig. 6. As the process re-executes, if it determines a collision exists, it will perform additional alterations or redefinitions of the schedule of movement/aligners "until an acceptable set of aligners is found." Ex-1004, 8:54-9:14. As discussed with respect to limitation 1(e), one potential modification for the combination would be to attempt to round-trip the first dental object. *Supra* Section IX.A.6.

Thus, a POSITA would have understood Chishti-511 to disclose an iterative process for altering the schedule of movement until one is found that is acceptable and avoids collisions, which, in view of Becker, would include altering the schedule of movement to round-trip the dental objects. Ex-1003, ¶ 179. A POSITA also would have understood that modifying a schedule of movement to include round-tripping is simply combining prior art elements according to known methods to yield predictable results. *Id.*

L. Claims 16-19

Claims 16-19 repeat or recite features that are substantively identical to features recited in claims 3-5 and 8, respectively. For example, claims 16-18 are substantively identical to claims 3-5, respectively. And claim 19 is identical to claim

8, except for the removal of "by one or more computer processors" in claim 19. *Compare* Ex-1001, 16:33-45 and 16:58-17:4, *with* Ex-1001, 18:26-52; *see also* Ex-1003, ¶¶ 180-187 (comparing claims). Accordingly, claims 16-19 are taught or suggested for the reasons discussed in Sections IX.C-.E and IX.H, which discuss the corresponding portions of claims 3-5 and 8. Ex-1003, ¶¶ 180-187. See, for example, the following minor differences between claims 19 and 8:

Claim 8	**Claim 19**
[8(a)] The computer-implemented method of claim 1, wherein: the determining of the schedule of movement comprises determining, by one or more computer processors, a total number of the treatment stages; and	[19(a)] The computer-implemented method of claim 15, wherein: the determining of the schedule of movement comprises determining a total number of the treatment stages; and
[8(b)] the determining of the total number of the treatment stages comprises: determining, by one or more computer processors, a respective minimum number of treatment stages for each of the dental objects; and	[19(b)] the determining of the total number of the treatment stages comprises: determining, by one or more computer processors, a respective minimum number of treatment stages for each of the dental objects; and
[8(c)] selecting, by one or more computer processors, a largest of the respective minimum numbers of treatment stages as the total number of the treatment stages.	[19(c)] selecting, by one or more computer processors, a largest of the respective minimum numbers of treatment stages as the total number of the treatment stages.

M. Independent Claim 20

Claim 20 repeats or recites features that are substantively identical to features recited in previous independent claims. For example, limitation 20(pre) is substantively identical to limitation 9(pre), limitations 20(a)-20(c) are substantively identical to limitations 1(a)-1(c), and limitations 20(d)-20(f) are substantively identical to limitations 15(d)-15(f). *Compare* Ex-1001, 17:5-8, 16:11-24, and 18:2-15, *with* Ex-1001, 18:53-19:10; *see also* Ex-1003, ¶¶ 188-189 (comparing claims). Accordingly, 20(pre)-20(f) are taught or suggested for the reasons discussed in Sections IX.I, IX.A.2-.4, and IX.K.2-.4. Ex-1003, ¶ 188.

Finally, limitation 20(g) is substantively identical to limitation 15(g). While limitation 20(g) uses the term "round-tripping the first dental object," limitation 15(g) uses the agreed construction for the term "round-tripping" in place of that term, and thus the limitations are substantively identical. *Compare* Ex-1001, 18:16-25, *with* Ex-1001, 19:11-14; *see also* Ex-1003, ¶¶ 190-191 (comparing claims). Accordingly, limitation 20(g) is taught or suggested for the reasons discussed in Section IX.K.5.

N. Claims 21-24

Claims 21-24 repeat or recite features that are substantively identical to features recited in claims 2-5, respectively, except for the preamble and minor changes to their wording relative to earlier claims, but they remain substantively identical and are met for the same reasons as discussed for the earlier claims. *Compare* Ex-1001, 16:28-45, *with* Ex-1001, 19:15-20:17; *see also* Ex-1003, ¶¶ 192-199 (comparing claims).

For example, the features added by claims 21 and 24 are substantively identical to claims 2 and 5, respectively, except for the preamble. Ex-1003, ¶¶ 192-193, 198-199. See, for example, the following minor differences between claims 5 and 24:

Claim 5	**Claim 24**
[5(a)] The computer-implemented method of claim 4, wherein the manufacturing comprises: fabricating a respective positive mold of the dental objects for at least two of the treatment stages; and	[24(a)] The medium of claim 23, wherein the manufacture comprises: fabricating a respective positive mold of the dental objects for at least two of the treatment stages; and
[5(b)] thermoforming an orthodontic aligner over each respective positive mold.	[24(b)] thermoforming a respective one of the orthodontic aligners over each of the respective positive molds.

Claims 22 and 23 are substantively identical to claims 3 and 4, respectively, except for reciting "wherein the instructions, when executed by the one or more computer processors, further cause at least one of the one or more computer processors to …". Ex-1003, ¶¶ 194-197. See, for example, the following minor differences between claims 4 and 23:

Claim 4	Claim 23
[4(a)] The computer-implemented method of claim 1, further comprising	[23(a)] The medium of claim 20, wherein the instructions, when executed by the one or more computer processors, further cause at least one of the one or more computer processors to control
[4(b)] manufacturing at least two orthodontic aligners, each of the orthodontic aligners corresponding to a respective one of the treatment stages.	[23(b)] manufacture of at least two orthodontic aligners, each of the orthodontic aligners corresponding to a respective one of the treatment stages.

Accordingly, claims 21-24 are taught or suggested for the reasons discussed in Sections IX.B-.E, which discuss the corresponding portions of claims 2-5. Ex-1003, ¶¶ 192-199.

X. THE BOARD SHOULD NOT EXERCISE DISCRETION TO DENY INSTITUTION

Petitioner stipulates that if institution is granted for the ’879 patent, it will not pursue in the parallel district court case for the ’879 patent any ground raised or that could have been reasonably raised in this Petition, and all defendants to the litigation have agreed to be bound by this stipulation. *See Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 19 (Dec. 1, 2020) (precedential as to § II.A) (“Petitioner’s stipulation here mitigates any concerns of duplicative efforts between the district court and the Board, as well as concerns of potentially conflicting decisions. . . . Thus, we find that this factor weighs strongly in favor of not exercising discretion to deny institution under 35 U.S.C. § 314(a).”).

Petitioner reserves its right to oppose any argument Patent Owner may make regarding discretionary denial of this petition pursuant to the procedures set out in the Office’s March 26, 2025 Memorandum (“Interim Processes for PTAB Workload Management”).

XI. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Parties-in-Interest

The real parties-in-interest are ClearCorrect Operating, LLC; ClearCorrect Holdings, Inc.; Straumann USA, LLC; and Institut Straumann AG.

B. Related Matters

To the best of Petitioner’s knowledge, the ’879 patent is involved in:

Align Technology, Inc. v. ClearCorrect Operating, LLC, et al., Case No. 6:24-cv-00187-ADA-DTG (W.D. Tex. Apr. 11, 2024).

C. Lead and Back-Up Counsel, and Service Information

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Petitioner consents to electronic service at the email addresses shown above and ClearCorrect-IPR-Attorneys@finnegan.com.

XII. GROUNDS FOR STANDING

The ’879 patent is available for *inter partes* review. Petitioner is not barred or estopped from requesting such review.

XIII. CONCLUSION

For the reasons above, Petitioner requests the Board institute *inter partes* review and find each challenged claim unpatentable.

Respectfully submitted,

Dated: April 12, 2025 By: /Luke McCammon/

Luke McCammon, Lead Counsel
Reg. No. 70,691

CERTIFICATION UNDER 37 C.F.R. § 42.24(D)

Pursuant to 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the foregoing Petition contains 13,730 words, excluding those portions identified in 37 C.F.R. § 42.24(a), as measured by the word-processing system used to prepare this paper.

Respectfully submitted,

Dated: April 12, 2025

By: /Luke McCammon/
Luke McCammon, Lead Counsel
Reg. No. 70,691

CERTIFICATwE OF SERVICE

The undersigned certifies that, in accordance with 37 C.F.R. §§ 42.6(e) and 42.105(a), the **Petition for *Inter Partes* Review of U.S. Patent No. 10,524,879, the associated Power of Attorney, and Exhibits 1001-1024, 1028-1030** were served via FedEx Priority Overnight delivery on April 12, 2025, on the correspondence address of record below indicated in the U.S. Patent Office's Patent Center for U.S. Patent No. 10,524,879:

Douglas J. Clark
Align Technology, Inc. / WSGR
650 Page Mill Road
Palo Alto, CA 94304

A courtesy copy has been concurrently served by the same means on Patent Owner's litigation counsel at:

Brian C. Nash
MORRISON & FOERSTER LLP
300 Colorado Street, Suite 1800
Austin, TX 78701

Dated: April 12, 2025

By: /Lisa C. Hines/
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