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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

3SHAPE A/S and 3SHAPE INC.
Petitioners

v.

ALIGN TECHNOLOGY, INC.
Patent Owner

Case No. IPR2019-00132
Patent 7,112,065

PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 7,112,065 B2 UNDER 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq*.

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I. INTRODUCTION

3Shape A/S and 3Shape Inc. ("3Shape" or "Petitioners") respectfully request *inter partes* review for claims 1-9 and 11 of U.S. Patent No. 7,112,065, issued on September 26, 2006 to Avi Kopelman et al. ("the '065 Patent") (Ex.1001) in accordance with 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq*.

The challenged claims of the '065 Patent would have been obvious over the cited prior art. As discussed in detail below, the challenged claims are merely directed to a well-known, obvious method and device for defining a finish line.

II. MANDATORY NOTICES PURSUANT TO 37 C.F.R. § 42.8(A)(1)

A. Real Party-In-Interest

Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioners certify that 3Shape A/S, 3Shape Inc., 3Shape Holding A/S, 3Shape Trios A/S, and 3Shape Poland sp. z.o.o. are real parties-in-interest. Out of an abundance of caution, 3Shape Medical A/S, 3Shape Germany GmbH, 3Shape France SAS, 3Shape Italy SRL, 3Shape S.A.S., 3Shape (Shanghai) Co., Ltd., 3Shape Do Brasil Soluções Tecnologicas Para Saude Ltda, 3Shape Australia Pty Ltd., 3Shape Trios Sociedad Limitade, 3Shape Japan GK, 3Shape Ukraine Ltd., 3Shape (UK branch), SC Investment Company, LLC, FULLCONTOUR, LLC, Full Contour USA, FULLCONTOUR S.R.L., Full Contour Limitada, Full Contour Costa Rica Limitada, BOSQUES HUMEDOS DEL SUR S.A., FullContour Bosques, Full Contour Costa Rica Boscues, SHENZHEN FULLCONTOUR DESIGN COMPANY LTD., Full Contour China,

DROPDENTAL LLC, 3Shape Medical Equipment Manufacture Shanghai Ltd., 3Shape Korea Ltd., 3Shape Manufacturing US LLC, Clausen Engineering APS, Tais Clausen, Deichmann Media APS, Nikolaj Hoffmann Deichmann, and the individuals listed in Appendix B are also identified as real parties-in-interest, for purposes of compliance with 35 U.S.C. § 312(a)(2).

B. Identification of Related Matters Under 37 C.F.R. § 42.8(b)(2)

The following is a list of any judicial or administrative matters that would affect, or be affected by, a decision in this proceeding:

Align Technology, Inc. v. 3Shape A/S, Civil Action No. 1:17-cv-01646 (D. Del.) (Complaint filed November 14, 2017);

U.S. Patent Application No. 11/504,588, filed on August 16, 2006, which issued as U.S. Patent No. 7,488,174 on February 10, 2009; and

U.S. Provisional Application No. 60/397,672, filed on July 22, 2002.

C. Lead and Backup Counsel

Pursuant to 37 C.F.R. §§ 42.8(b)(3) and 42.10(a), Petitioners hereby identify their lead and backup counsel as follows:

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Powers of Attorney are being filed concurrently herewith in accordance with 37 C.F.R. § 42.10(b).

D. Service Information Under 37 C.F.R. § 42.8(b)(4)

Petitioners consent to e-mail service at the addresses listed above.

III. PAYMENT OF FEES

The undersigned authorizes the Office to charge Deposit Account No. 02-4800 for the fees required by 37 C.F.R. § 42.15(a).

IV. REQUIREMENTS UNDER 37 C.F.R. § 42.104

A. Grounds for Standing

Pursuant to 37 C.F.R. § 42.104(a), Petitioners hereby certify that the '065 Patent is available for *inter partes* review in accordance with 37 C.F.R. § 42.102(a)(2), and that Petitioners are not barred or estopped from requesting *inter partes* review challenging the claims of the '065 Patent on the grounds identified in this Petition.

This Petition is filed within one year from the date on which Petitioner 3Shape A/S was served a Complaint by Patent Owner in the related litigation, *Align Technology, Inc. v. 3Shape A/S*, Civil Action No. 1:17-cv-01646 (D. Del.), which asserted infringement of the '065 Patent.

Neither Petitioners nor any privies of Petitioners have received a final written decision under 35 U.S.C. § 318(a) with respect to any claim of the '065 Patent on any ground that was raised or could have been raised by Petitioners or privies of Petitioners in any *inter partes* review, post grant review, or covered business method patent review.

B. Identification of Challenges and Precise Relief Requested

Pursuant to 37 C.F.R. § 42.104(b), Petitioners challenge claims 1-9 and 11 of the '065 Patent, and request that these claims be found unpatentable over the prior art for the reasons given herein. The following table provides Petitioners' grounds for challenging the patentability of claims 1-9 and 11 of the '065 Patent.

Ground	References	Basis	Claims Challenged
1	U.S. Patent No. 5,417,572 ("Kawai") (Ex.1003) in view of U.S. Patent No. 6,049,743 ("Baba") (Ex.1004)	35 U.S.C. § 103	1-9 and 11

In addition to the above prior art, Petitioners rely upon the evidence listed in the Exhibit List, including the Declaration and *Curriculum Vitae* of Eli Saber. (Exs. 1012, 1013).

C. Prior Art Qualification of Asserted References

The '065 Patent claims benefit of priority of U.S. Provisional Application No. 60/397,672 filed on July 22, 2002. Even if the '065 Patent receives its earliest possible priority date of July 22, 2002, all the applied references are prior art.[1]

Kawai issued on May 23, 1995, and thus is prior art at least under 35 U.S.C. § 102(b). Baba issued on April 11, 2000, and thus is prior art at least under 35 U.S.C. § 102(b).

[1] Petitioners do not concede that any challenged claim is entitled to an effective filing date of July 22, 2002.

V. BACKGROUND

A. The '065 Patent and Technical Background

The '065 Patent describes methods and systems for enabling a dental practitioner to define a finish line between an artificial dental prosthesis (*e.g.*, a crown) and a surface of a tooth upon which the prosthesis is to be placed ("abutment tooth"). *See, e.g.,* Ex.1001 at Abstract; 1:19-30; 2:18-34. The background of the '065 Patent explains that "there are times when the finish line is not clear and the transition between the cut area to the biological area is not well defined." *Id*. at 2:6-8. The purported invention of the '065 Patent requires using three-dimensional ("3D") data to adjust a finish line in the same manner as the '065 Patent itself describes was previously done manually. *See id.* at 1:47-58. Moreover, the '065 Patent discloses that it was known to use "computer-based" methods of virtual 3D modelling for defining the finish line on an abutment tooth. *Id.* at 1:64-2:5. Ex.1012, ¶32.

1. The '065 Patent States that Techniques for Defining a Finish Line Were Well-Known.

The '065 Patent is directed to defining a finish line. Ex.1001 at 2:18-23. The '065 Patent explains that "[t]he finish line, by definition, is the apical limit of the abutment tooth model (the 'preparation') and the margin of the reconstruction must end on it." *Id*. at 1:38-41. The term "apical" pertains to a direction towards the root of a tooth. *See, e.g.*, Ex.1017 at 1:22-25 ("Apical suggests towards the

root"), Ex.1018 at 2:30-31 ("apically (toward the root)"). The '065 Patent discloses that the apical limit "represents the points of transition between biologic and artificial parts." Ex.1001 at 1:38-41. An example of a finish line in the '065 Patent is depicted below (for context -- the upper jaw is depicted and the finish line 74 is toward the root of the tooth 70):

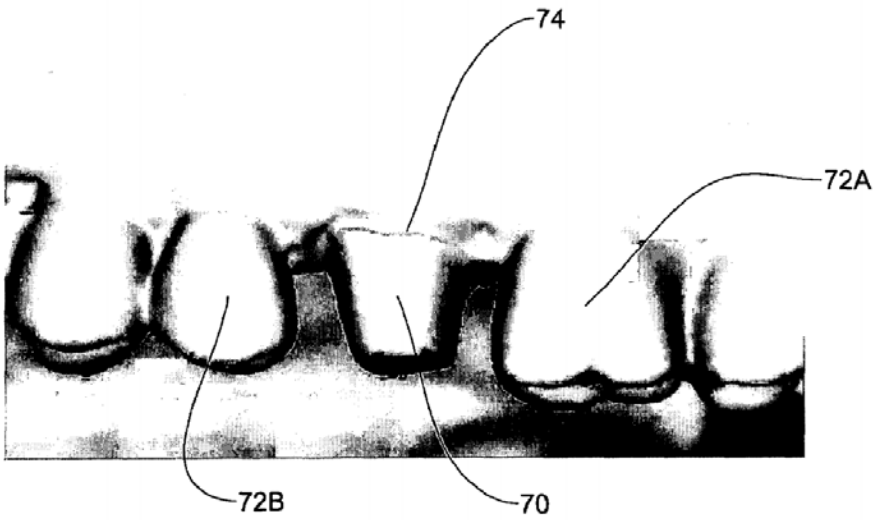

Fig. 4 of the '065 Patent

Id. at Fig. 4, 4:49-52. Defining the zone around the finish line with "absolute precision is fundamentally important" in order to properly fit the artificial component (e.g., a crown) onto the abutment tooth. *Id.* at 1:42-46. Ex.1012, ¶¶33-34.

The'065 Patent explains that manual marking of a finish line on a plaster model of a patient's dentition is a well-known practice. *Id.* at 1:47-58 (describing the "current practice" at the time of the alleged invention). In this conventional

practice, a dentist first cuts the tooth that is to receive the crown (thus creating an abutment tooth) and takes two impressions and a wax bite of the patient's jaws. *Id.* at 1:46-50. These impressions and the wax bite data are sent to a technician, so that the technician can cast a plaster mold. *Id.* at 1:50-52. The technician manually marks the finish line on the abutment tooth (or "preparation"). *Id.* at 1:52-57. This finish line is ultimately used as an input parameter to construct the crown. *Id.* at 1:57-58. The '065 Patent refers to Kawai, which discloses a prior art example of a finish line:

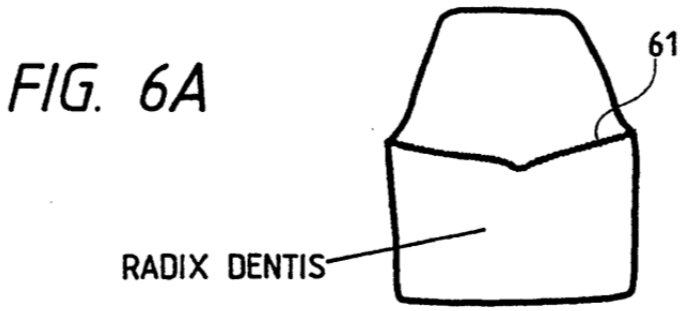

Fig. 6A of Kawai

Ex.1001 at 1:64-65, 5:30-32 (stating that Kawai disclosing obtaining a "finish line"); Ex.1003 at 1:21-22, Fig. 6A. Ex.1012, ¶35.

The '065 Patent then explains that sometimes the finish line is unclear because the transition between the cut area and the biological area is not well defined. Ex.1001 at 2:6-8. When this occurred, the technician had two options – estimate the finish line himself/herself or return the cast to the dentist to complete

the finish line. *Id.* at 2:8-14. The dentist would then adjust and/or fill in the missing portion of the finish line. *Id.* at 2:10. The '065 Patent also acknowledges that computer-based methods for generating finish line data was known. *Id.* at 5:30-32 (citing Kawai). Ex.1012, ¶36.

Thus, the basic idea of superimposing a finish line on a model of a patient's jaws and adjusting the finish line was well known in the art, as explicitly acknowledged in the '065 Patent. Ex.1001 at 1:15-2:14. Having a dental practitioner such as a dentist participate in determining the finish line was also well-known. *Id.*, Ex.1003 at 1:15-44. Using the finish line to construct a crown was also well-known. Ex.1001 at 1:55-58. All of the steps recited in the method of claims 1-9, and the computer-based storage device that executes a method as recited in claim 11, are part of the well-known practice as described in the background of the '065 Patent itself. Ex.1012, ¶37.

Indeed, Judge Stark of the District Court of Delaware recognized that the background of the '065 Patent itself fully discloses the techniques for defining a finish line recited in claim 1. Ex.1005 at 25:15-18 ("The '065 Patent itself describes the exact scenario embodied by claim 1, but instead of the technician marking the cast (or, as also disclosed in the specification, marking a 3D model) and returning the cast to the dentist to have her then provide a mark for the finish line, the same is done on a computer") (internal citation removed).

However, even if claim 1 requires the use of a computer to implement steps of the method, the '065 Patent itself also discloses that this was known in the art as explained in the following section. Ex.1012, ¶38.

2. Methods for Using Virtual 3D Models to Model Dental Structures and Dental Prostheses Were Well-Known Prior to the '065 Patent.

As further recognized in the background of the '065 Patent, providing a virtual 3D image of a patient's dentition was known in the art. Ex.1001 at 1:58-60. For example, the '065 Patent discloses "[a]lternatively, a virtual three-dimensional (3D) image of the working cast is obtained e.g. in a manner as described in" Exhibits 1006 and 1007. *Id.* at 1:58-60. Exhibit 1006 discloses a three step process to produce the final 3D digital image of a dentition. Ex.1006 at Abstract; 3:25-4:4. Exhibit 1007 discloses that the 3D structure of a teeth segment 26 can be imaged and modelled for the purpose of designing and/or manufacturing a prosthesis (e.g., a crown). *Id.* at 8:12-17. The imaged 3D structure of the teeth segment 26 can be shown on a display 84 and can "be used for the design and subsequent manufacture of a crown or any other prosthesis to be fitted into this segment." *Id.* at 12:1-4; 12:16-20. Ex.1012, ¶39.

The background of the '065 Patent discloses that it was previously known in the art to use computer modelling to define a finish line. Ex.1001 at 1:64-66. *See also* Ex.1005 at 24:7-8 (discussing that the background of the '065 Patent

acknowledges that it was known to make a virtual 3D image of the cast of the abutment tooth and to have the technician then mark the finish line on the 3-D version). The computer-modelled/computer-defined finish line was then used to design an artificial crown. Ex.1001 at 1:64-66. Ex.1012, ¶40.

Moreover, 3D virtual modelling of dental structures and dental prostheses was well known in the art. For example, it was known to create 3D digital data representing a patient's dentition and then to subsequently use 3D virtual modelling to design a prosthesis as evidenced by U.S. Patent No. 6,915,178 ("O'Brien") (Ex.1008).[2] O'Brien discloses scanning a physical model of a patient's dentition to produce 3D digital data to virtually model the patient's dentition. Ex.1008 at Abstract; 2:44-62; 4:14-29. It was further well known to adjust the marginal ridges of the 3D image 14 of the crown 50a to be attached to the tooth stump 32. *Id.* at 4:30-47. Ex.1012, ¶41.

In addition, using computer aided design (CAD) to 3D virtually model prostheses (e.g., a crown) and a patient's dentition were conventional technologies at the time of the purported invention as evidenced by Exhibits 1009-1011.

[2] O'Brien published on January 31, 2002, and thus constitutes prior art with respect to the '065 Patent at least under 35 U.S.C. § 102(a).

Exhibit 1009 describes using CAD/CAM technology to model and manufacture dental restorations (e.g., a crown), which includes modelling the finish line. Ex.1009 at 347-48. Exhibit 1010 shows that using computer technology to model a dental prosthesis relative to adjacent and occlusive teeth has been practiced since the 1980s. Ex.1010 at Abstract; 2:41-3:31. Exhibit 1011 shows that 3D modelling a scanned dentition to manufacture an orthodontic appliance was well-known. *See e.g.*, Ex.1011 at Abstract. Ex.1012, ¶42.

3. Prosecution History of the '065 Patent

Application No. 10/623,707 (which issued as the '065 Patent) was originally filed with thirteen claims. Ex.1002 at 204-08. In the first Office Action, original claim 11 was rejected as being anticipated and original claim 13 was rejected as being indefinite. *Id.* at 93-94. All other claims were allowed. *Id.* at 94. Applicant canceled the rejected claims. *Id.* at 88. A Notice of Allowance issued on May 18, 2006, and the '065 Patent issued on September 26, 2006. *Id.* at 73; Ex.1001; Ex.1012, ¶43.

During prosecution of the '065 Patent, neither Kawai nor Baba were ever applied or substantively discussed by the Examiner. In fact, other than the anticipation rejection of claim 11, which was simply cancelled, no prior art rejection was made during prosecution.

B. Person of Ordinary Skill in the Art ("POSITA")

A POSITA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity. With respect to the '065 patent, it is my opinion that one of ordinary skill in this art would have at least: (1) a bachelor's degree in electrical and/or computer engineering, or computer science (or equivalent course work) with two to three years of work experience in computer modelling of physical structures or (2) a master's degree in electrical and/or computer engineering, or computer science (or equivalent course work) with a focus in computer modelling of physical structures. Ex.1012, ¶25.

C. Overview of the Prior Art

1. Kawai

Kawai issued on May 23, 1995. Kawai was filed on September 28, 1994, and claims priority to U.S. Ser. No. 32,248 filed on March 17, 1993. Kawai qualifies as prior art under 35 U.S.C. § 102(b).

Kawai describes a method and system for extracting the margin line to design an artificial crown.[3] Ex.1003 at 1:10-13. Kawai explains that an artificial

[3] The '065 Patent discloses that Kawai discloses "a computer-based method for extracting a finish line." Ex.1001 at 1:64-65.

crown is conventionally prepared by creating a plaster cast from an impression of an abutment tooth. *Id.* at 1:15-21. FIG. 6A shows the plaster cast of an abutment tooth.

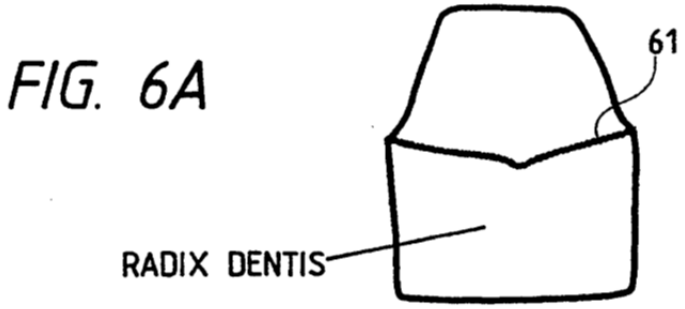

Fig. 6A of Kawai

Ex.1012, ¶45.

In this conventional manual method, a dental technician physically draws a margin line (e.g., labeled "61" of FIG. 6A) on the plaster cast of the abutment tooth. Ex.1003 at 1:21-25. Molten wax is then applied to the abutment tooth to form an impression for the artificial crown. *Id.* at 1:26-33. The margin line is used during the forming of the impression to try to ensure that the artificial crown will properly fit with the abutment tooth. *Id.* at 1:26-30; FIGS. 6B-6C. An artificial crown is thereafter prepared based on the wax impression. *Id.* at 1:34-35. Ex.1012, ¶46.

Kawai explains that the manual method relies on the skill of the technician and sometimes requires adjustment by the dentist. Ex.1003 at 1:36-44. That is, it is conventional for a dentist and a dental technician to determine the margin line.

Id. at 1:15-44. *See also* Ex.1019 at 1:41-44 ("the dentist/dental technician prepared the model which was dispatched to the manufacturer"). Kawai thus provides a computer-aided method using CAD/CAM to define the margin line for preparing the crown. *Id.* at 1:45-48. Setting the margin line and designing the artificial crown based on the margin line using CAD/CAM methods can simplify the extraction of the margin line, improve accuracy, reduce designing time, and improve productivity. *Id.* at 4:31-39. Ex.1012, ¶47.

To define the margin line, Kawai discloses scanning a plaster cast of the abutment tooth to obtain three-dimensional shape data. Ex.1003 at 2:28-35. FIG. 2A illustrates the three-dimensional shape 21 of the abutment tooth and shows one embodiment of how the margin line is extracted.

FIG. 2A

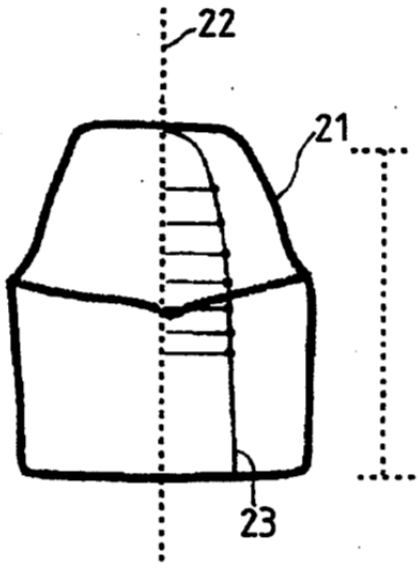

Fig. 2A of Kawai

Ex.1012, ¶48.

A train of points in the margin area is extracted from this three-dimensional shape data, and points on the margin line are calculated by determining the inclination Si between adjacent points on the crossing line 23. Ex.1003 at 2:36-3:12. The train of points representing the margin area is then displayed on a display unit. *Id.* at 3:13-14. FIG. 1A shows an example of the train of points 11 superimposed on a development view (a view that reflects the 3D shape data as a 2D depiction) of the abutment tooth.

FIG. 1A

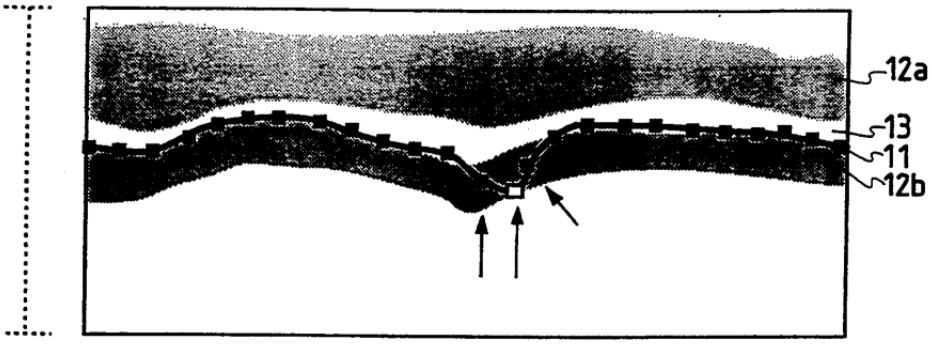

Fig. 1A of Kawai

Ex.1012, ¶49.

The train of points 11 are connected by lines to form the margin line. Ex.1003 at 3:24-30. Kawai explains that some of the calculated train of points 11 may deviate from the actual margin line. *Id.* at 3:51-56. Kawai's method thus involves a "correction operation" where the person determining the margin line

(which Kawai teaches is conventionally a "dentist" or "dental technician") may use a mouse cursor or key operations to adjust the position of the deviated margin line point(s) 11. *Id.* at 3:36-60, 1:21-25 ("position of said margin line is determined by the dental technician"), 1:38-44 ("inadequate margin requires additional adjustment by the dentist"). For example, FIG. 1A shows three points of the point train 11 that deviate from where the actual margin line should be placed (i.e., the three arrows of FIG. 1A point to these three points). *Id.* at 3:51-56. Kawai explains that the "correction can be achieved by hitting a point to be corrected with a mouse and moving said point to a desired position by setting the amount of movement, for example by keys or a dial." *Id.*; *see also id.* at 3:37-40. Ex.1012, ¶50.

When the person determining the margin line corrects a point of the point train 11 (e.g., by clicking and dragging the point), an updated finish line is generated and superimposed on the abutment tooth. *See e.g.*, Ex.1003 at 3:35-50; 4:5-12. Kawai also discloses that the margin line can be shown on both the three-dimensional abutment tooth and in the development view in a separate frame. *Id.* at 3:61-68; FIG. 5.

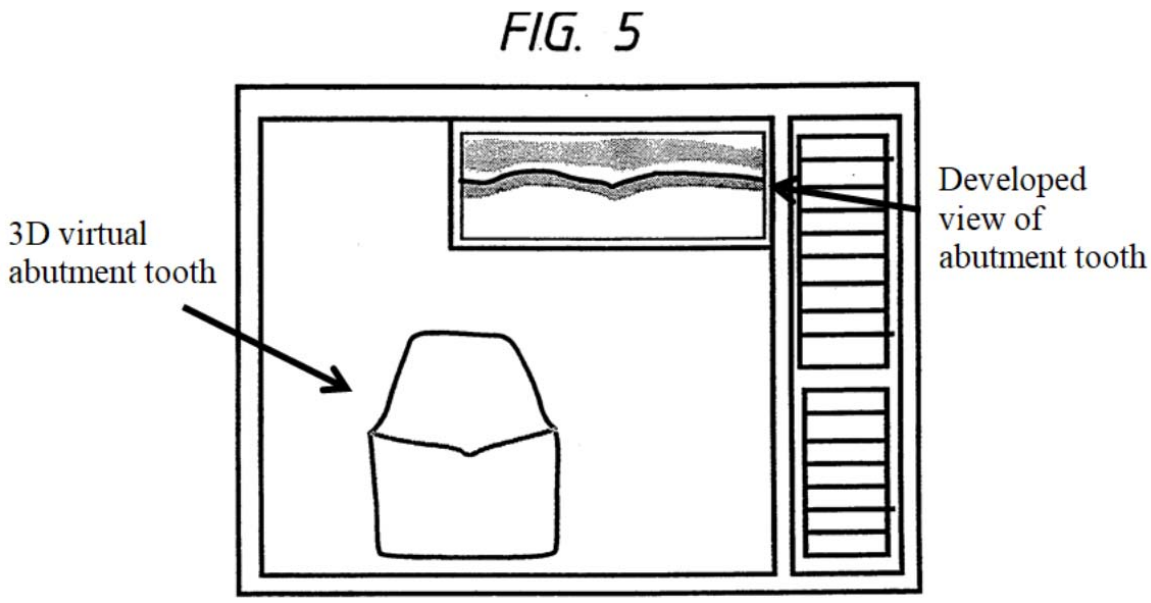

Fig. 5 of Kawai (Annotated)

Ex.1012, ¶51.

Kawai explains "[t]he point train and the connecting lines, representing the margin area, can be displayed both in the three-dimensional shape and in the developed view." Ex.1003 at 3:66-68. "The amount of movement of the point for correction is reflected both on the developed data and on the three-dimensional data. Consequently, when the point is moved on the developed view, the corresponding point in the display of the three-dimensional shape may also be moved in corresponding manner." *Id.* at 4:5-10. Ex.1012, ¶52.

Kawai further discloses that "[t]he above-mentioned correcting operation for the points may be conducted on the display of the three-dimensional shape, but is more easily conducted on the two-dimensional developed view." *Id.* at 3:68-4:4.

Several of Kawai's claims involve superimposing a margin line on a three-dimensional shape and adjusting the margin line. *See, e.g., id.* at Claims 4 and 6-13. Ex.1012, ¶53.

Kawai thus discloses: (i) obtaining a 3D digital data representation of an abutment tooth; (ii) superimposing a margin line on a three-dimensional representation of the abutment tooth; (iii) allowing a person (conventionally, a dentist or dental technician) to adjust the margin line on the three-dimensional representation of the abutment tooth; and (iv) superimposing the updated margin line on the three-dimensional representation of the abutment tooth. Ex.1012, ¶54-55.

2. Baba

Baba issued on April 11, 2000. Baba was filed on September 5, 1997. Baba qualifies as prior art under 35 U.S.C. § 102(b).

Baba describes a method of designing a dental prosthesis using virtual modelling on a computer. Ex.1004 at Abstract; 1:8-10. Baba discloses that it was known to utilize CAD/CAM modelling to model the configurations of abutment teeth, adjacent and pairing teeth, and to then design the prosthesis. *Id.* at 1:20-30. Baba's focus is to streamline the database that stores prosthesis models (e.g., crown and bridge models). *Id.* at 1:44-47. Ex.1012, ¶56.

Baba discloses a method wherein the patient's upper and lower jaws are scanned and a dentition configuration diagram is displayed on a display device. *See e.g.,* Ex.1004 at 3:48-54; 5:21-31; 6:61-67. Baba discloses that a pontic (an artificial tooth) model database may be used to select an appropriate pontic model and a corresponding crown model. *Id.* at 3:54-61; 4:9-28; and 7:1-7. The selected crown and pontic models are subsequently superimposed on the dentition configuration diagram. *Id.* at 3:62-67; 7:8-13. The crown and pontic models may then be manipulated/deformed by a user to avoid interference with adjacent teeth and/or gum surfaces. *Id.* at 4:1-5; 7:14-18. A physical prosthesis (e.g., crown or bridge) can then be manufactured based on the digital model. *Id.* at 1:23-27; 10:19-20. Ex.1012, ¶57.

In an exemplary embodiment, Baba illustrates the digital modelling of a bridge with two adjacent crowns. As shown in FIG. 8A, configurations of teeth surrounding the teeth to which the bridge is to be attached are displayed.

Fig.8A

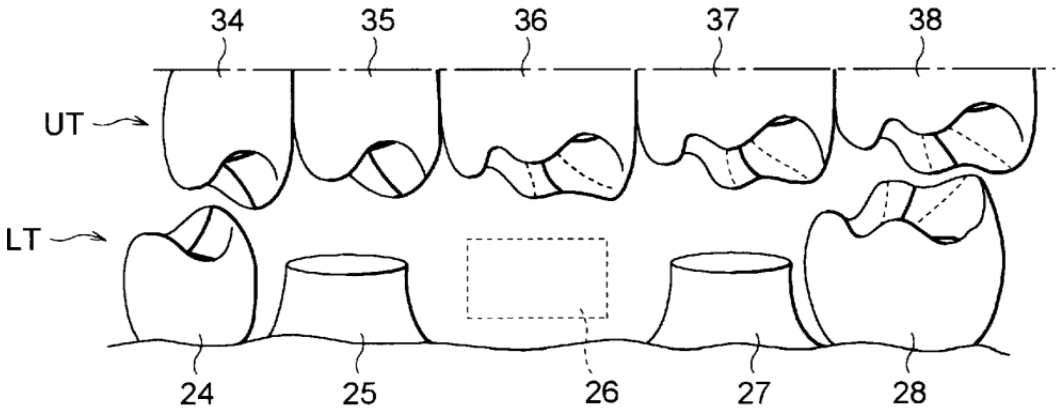

Fig. 8A of Baba

Ex.1012, ¶58.

One tooth 26 is missing and the adjacent teeth 25, 27 have been prepared as abutment teeth to receive crowns. Ex.1004 at 8:63-67. Pontic model data is then retrieved from the database 3a, and crown models $C_{m(5)}$ and $C_{m(7)}$ are generated by removing the area of the selected pontic models $P_{m(5)}$ and $P_{m(7)}$ below the margin line so that the appropriate crown models $C_{m(5)}$ and $C_{m(7)}$, respectively, are created. *Id.* at 9:1-19. FIG. 9 shows these modified crown models $C_{m(5)}$ and $C_{m(7)}$ with the base region $B_{(n)}$ of each model below the margin line removed.

Fig.9

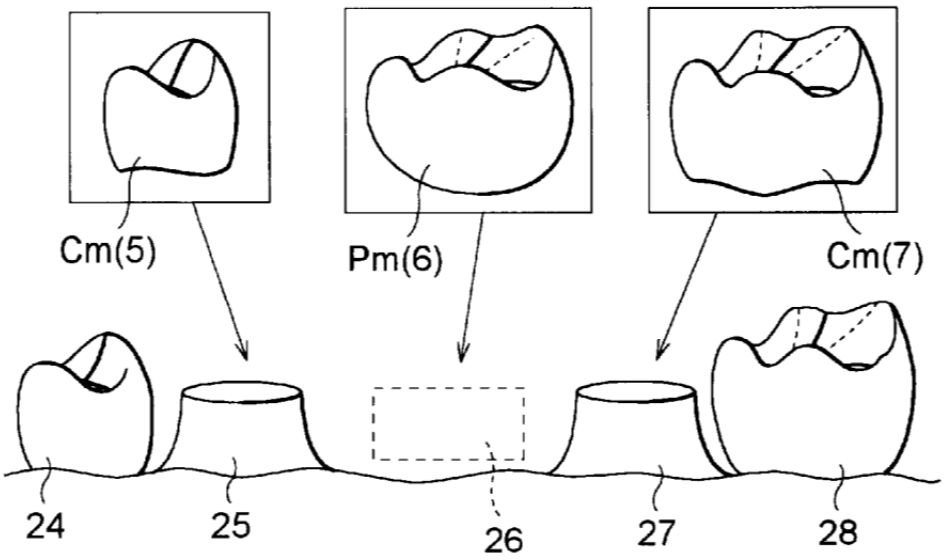

Fig. 9 of Baba

Ex.1012, ¶59.

As shown by the arrows in FIG. 9, the formed crown models $C_{m(5)}$ and $C_{m(7)}$ and the pontic model $P_{m(6)}$ are then superimposed on the abutment teeth 25, 27 and the missing tooth 26. *Id.* at 9:20-27. FIG. 10 shows the various models $C_{m(5)}$, $P_{m(6)}$, and $C_{m(7)}$ being displayed overlaying the 3D model of the patient's actual dental configuration so that the interferences and clearances between each of the models and their respective teeth.

Fig.10

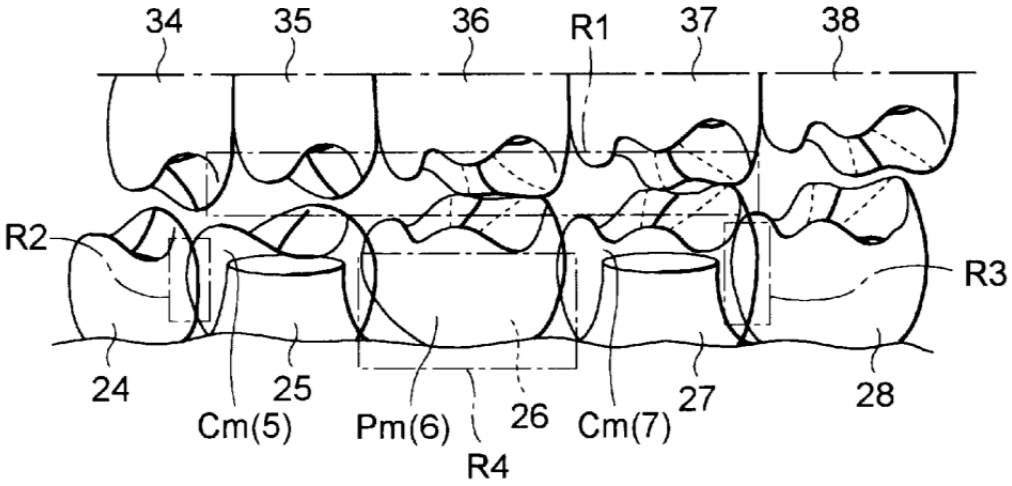

Fig. 10 of Baba

Ex.1012, ¶60.

Baba goes on to discuss aligning the margin lines ML' of the crown models $C_{m(5)}$ and $C_{m(7)}$ with the margin lines ML of the corresponding abutment teeth 25, 27. Ex.1004 at 9:56-67; FIG. 12. Although the example discussed above relates to a bridge and crown configuration, Baba further discloses that a crown model alone may be virtually modelled and created in a similar manner. *Id.* at 10:27-30. Ex.1012, ¶61.

VI. HOW THE CHALLENGED CLAIMS ARE TO BE CONSTRUED

In an *inter partes* review, claim terms of the unexpired '065 Patent are interpreted according to their broadest reasonable interpretation (BRI) in light of the specification. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, No.

136 S.Ct. 2131, 2142 (2016). The following claim terms from the claims of the '065 Patent require construction for this proceeding. Ex.1012, ¶63. Any claim terms not addressed below should be interpreted according to their plain and ordinary meaning.

A. "finish line"

The '065 Patent states that "[t]he finish line, by definition, is the apical limit of the abutment tooth model (the 'preparation') and the margin of the reconstruction must end on it, i.e. it represents the point of transition between the biologic and artificial parts." Ex.1001 at 1:38-41. The '065 Patent states that the finish line is "(also referred to at times by the term 'chamfer line' and 'marginal line'), etc." *Id.* at 1:32-37. Kawai discloses a "method for extracting a margin line." Ex.1003 at title, 1:10-13. The '065 Patent states that Kawai discloses "a computer-based method for extracting a finish line" and that "[t]he finish line data can be also obtained in a fully automated manner, for example as described in [Kawai]." Ex.1001 at 1:64-65, 2:4-5, 5:30-32. Thus, the term "finish line" should be construed as being synonymous with a "chamfer line", a "marginal line", or a "margin line", and refers to the apical limit of the abutment tooth model (the "preparation") and the margin of the reconstruction must end on it, i.e., it represents the point of transition between the biologic and artificial parts. The

term "finish line" should be construed as encompassing the "margin line" disclosed in Kawai. *Id.* Ex.1012, ¶64.

B. "dental practitioner"

The '065 Patent discloses that an example of a dental practitioner is a dentist. Ex.1001 at 2:20, 3:51 ("dental practitioner (e.g. a dentist)"). Thus, the term "dental practitioner" encompasses, but is not limited to, a dentist. *Id.* A "practitioner" is "[o]ne who practices something, esp. an occupation, a profession, or a technique." Ex.1016. Thus, a "dental practitioner" should be construed to encompass one who practices dentistry or techniques related to dentistry. Ex.1012, ¶65.

Patent Owner may argue that "dental practitioner" should require a "dentist" and exclude a "dental technician." Such construction is inconsistent with the '065 Patent which states that a dentist is one example of a dental practitioner. Ex.1001 at 2:20, 3:51. In addition, the provisional application to which the '065 Patent claims priority discloses that "[i]n accordance with the present invention, rather than drawing or marking by a lab technician…, the finish line is drawn by a dentist." Ex.1015 at 8. Patent Owner omitted this disclosure from the '065 Patent (broadening the language to disclose "dental practitioner (e.g., dentist)" in lieu of the term "dentist" used in the provisional). *Compare* Ex.1001 at 2:18-22, *with* Ex.1015 at 8. The term "dental practitioner" should not be construed to be limited to a dentist because Patent Owner omitted from the '065 Patent the disclosure

requiring the finish line to be determined by a dentist that was originally presented in the provisional application. *See MPHJ Tech. Invs., LLC v. Ricoh Ams. Corp.*, 847 F.3d 1363, 1369 (Fed. Cir. 2017).

C. "tooth preparation"

The '065 Patent equates a "tooth preparation" to an "abutment tooth." Ex.1001 at 1:22-25 ("[i]n preparing artificial crowns, best mechanical compatibility between the abutment tooth (hereinafter referred to as the preparation) and the crown is desired."), 1:38-39 ("the abutment tooth model (the 'preparation')". In the above disclosures, the "preparation" is of a tooth. *Id.* Thus, the term "tooth preparation" should be construed as being synonymous with "abutment tooth", and refers to a physical tooth or portion thereof that receives a prosthesis such as a crown. *Id.* Ex.1012, ¶66.

VII. PETITIONERS HAVE A REASONABLE LIKELIHOOD OF PREVAILING

Obviousness under 35 U.S.C. § 103 is determined by first evaluating several factual inquiries, namely the scope and content of the prior art, ascertaining the differences between the claimed invention and the prior art, and resolving the level of ordinary skill in the relevant art, as well as considering any objective evidence of "secondary considerations" relevant to obviousness. *Graham v. John Deere Co.*, 383 U.S. 1 (1966). The scope and content of the prior art is set forth below for the statutory ground of rejection upon which this Petition is based. Any differences

between the prior art and the invention claimed in the '065 Patent are addressed below. The claims of the '065 Patent are nothing more than the combination of known elements, in known ways to perform a predictable result. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

The following discussion explains why the claims of the '065 Patent are unpatentable over the prior art asserted in Ground 1.

A. Claims 1-9 and 11 Would Have Been Obvious Based on the Combined Disclosures of Kawai and Baba.

Section 1 below provides examples of where each element of claims 1-9 and 11 is found in the prior art. Section 2 below provides an explanation of why claims 1-9 and 11 as a whole would have been obvious.

1. Reference to Where the Elements of Claims 1-9 and 11 Are Found in the Prior Art

The following sections provide reference to where the elements of claims 1-9 and 11 are found in the prior art, in light of the claim constructions set forth in section VI. above.

a. Claim 1 (preamble): A computer-based prosthodontic method for enabling a dental practitioner to define a finish line of a dental prosthesis of at least one tooth to be fitted over a tooth preparation, comprising:

Kawai discloses the preamble of claim 1.[4] Ex.1012, ¶68.

"prosthodontic method for enabling a dental practitioner"

Kawai discloses "a method for extracting the margin line for the designing of an artificial crown." Ex.1003 at 1:10-13. The method is a prosthodontic method because an "artificial crown" is a dental prosthesis. Ex.1001 at 1:15 ("artificial dental prosthesis such as a crown"), Ex.1004 at 1:13-14. Kawai discloses that it is conventional for a "dentist" or "dental technician" to determine the position of the margin line. Ex.1003 at 1:23-25. A "dentist" is an example of a dental practitioner. *See* Section VI.B. Ex.1012, ¶69.

"to define a finish line of a dental prosthesis of at least one tooth to be fitted over a tooth preparation"

Kawai discloses defining a finish line ("margin line") of a dental prosthesis of at least one tooth ("artificial crown") to be fitted over a tooth preparation ("abutment tooth"). Ex.1003 at 1:15-22. The "margin line" of Kawai is synonymous with "finish line." *See* Section VI.A. The '065 Patent describes Kawai's "margin line" as a "finish line." Ex.1001 at 1:64-2:5. *See also id.* at 5:30-

[4] Petitioners do not concede that any preamble of the challenged claims is limiting.

32 ("The finish line data can be also obtained in a fully automated manner, for example as described in [Kawai]"). In addition, Kawai's "margin line" is a finish line because the margin line is the point of transition between the biologic and artificial parts. *See* Section VI.A., Ex.1003 at 3:41-47 ("The actual margin line is considered present in…area 13" between areas 12a and 12b), Fig. 1A.

FIG. 1A

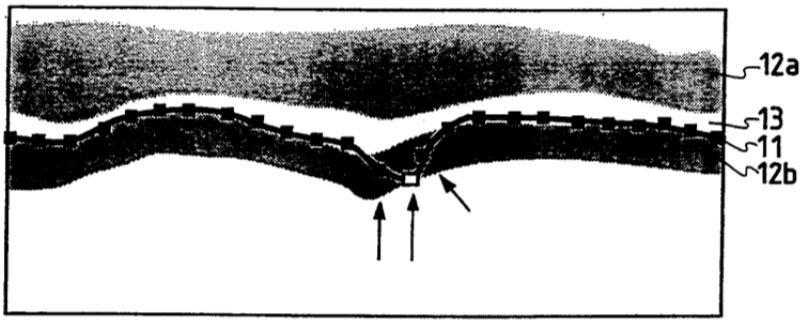

Fig. 1A of Kawai

Ex.1012, ¶70.

Kawai discloses a dental prosthesis of at least one tooth ("artificial crown") to be fitted over a tooth preparation ("abutment tooth"). *See* Section VI.C. ("tooth preparation" is synonymous with "abutment tooth"), Ex.1003 at 1:38-44 (artificial crown is intended to be attached to abutment tooth). Ex.1012, ¶71.

FIG. 6A depicts a conventional margin line 61 drawn on a plaster cast of the abutment tooth (labeled "Radix Dentis," meaning "root of the tooth").

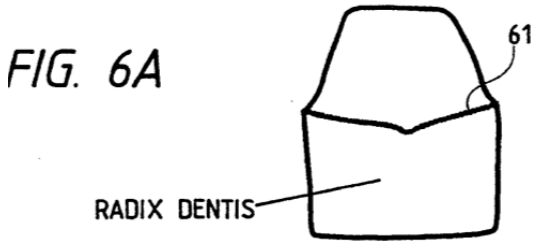

Fig. 6A of Kawai

This conventional margin line, as well as the margin line determined in Kawai's method, correspond to the claimed finish line. *See* Section VI.A. Ex.1012, ¶72.

"computer-based"

Kawai's method is "computer-based" because it employs a "computer", "CAD/CAM", "display unit", and "mouse." Ex.1003 at 1:45-48, 1:51-54, 3:13-15, 3:30, 3:57-58. Kawai's method is "computer-based" because Kawai discloses that the method is for use with "CAD/CAM preparation of artificial crown in the near future." *Id.* at 1:51-54; *see also id.* at 1:55-68 (discussing the method for extracting the margin line and plotting a train of points on a development view), 2:36-38, 3:13-15 (discussing virtually modelling the margin line and the abutment tooth). A POSITA would have understood that the CAD modelling of Kawai on a display unit to design the margin line for a prosthetic is a computer-based prosthodontic method. Ex.1012, ¶73.

i. Element [1.1] (One) providing a three-dimensional (3D) digital data relating to the patient's dentition, said 3D data includes data representative of the surface topology of said preparation and its surroundings;

The combined disclosures of Kawai and Baba disclose Element [1.1]. Ex.1012, ¶74.

Kawai

Kawai discloses providing 3D digital data relating to the patient's dentition. Kawai's method includes obtaining a 3D scan of at least the abutment tooth (tooth preparation):

> At first, the shape of a plaster cast of the abutment tooth…is measured ***to obtain shape data of said abutment tooth***. Said measurement can be achieved by a known technology, such as ***by CT scanning or by a three-dimensional measuring instrument***. Thus the data indicating the three-dimensional shape of the abutment tooth are obtained from the measurement data. [Emphases added.]

Ex.1003 at 2:24-35. Ex.1012, ¶75.

The "shape data of said abutment tooth" of Kawai includes data representative of the surface topology ("shape") of said preparation. FIG. 2A of Kawai illustrates an example of a 3D shape 21 of the abutment tooth.

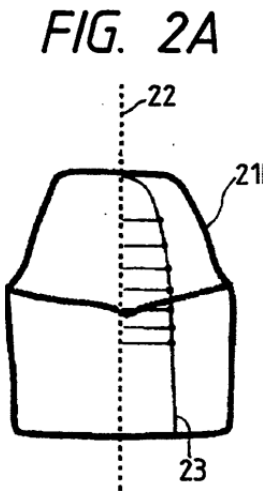

Fig. 2A of Kawai

Kawai's shape data is 3D digital data relating to the patient's dentition that is representative of the surface topology of the abutment tooth (tooth preparation). Ex.1003 at 2:28-35. Ex.1012, ¶76.

Baba

Baba discloses providing 3D digital data relating to the patient's dentition. Ex.1004 at Abstract ("The method includes measuring a three-dimensional configuration of a dentition of a subject in order to obtain configuration data of upper and lower jaw dentitions of a subject."). Ex.1012, ¶77.

The data in Baba is digital data because it is used with a computer system and is stored on media for storing digital data. Ex.1004 at 5:46-49, 7:24-36 ("flexible disk, CD-ROM, magnetic tape"), 10:32-40 ("data of this model may be directly stored as the crown model data."), Ex.1021 at 4:10-19.

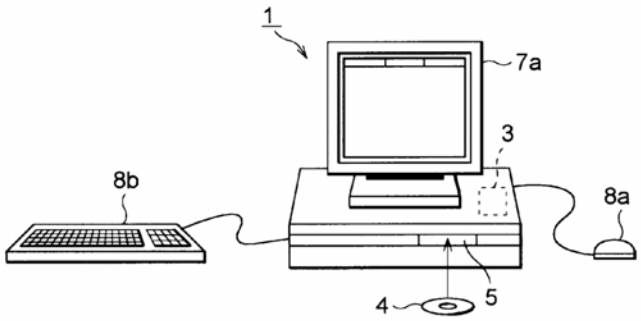

Fig. 1 of Baba

Ex.1012, ¶78.

"said preparation and its surroundings"

Baba's 3D digital data relating to the dentition includes data representative of the surface topology of said preparation and its surroundings. FIG. 8A of Baba shows 3D digital data that includes a preparation (i.e., abutment tooth 25 and/or 27) and its surroundings, such as the adjacent teeth 24, 28 and gum(s).

Fig.8A

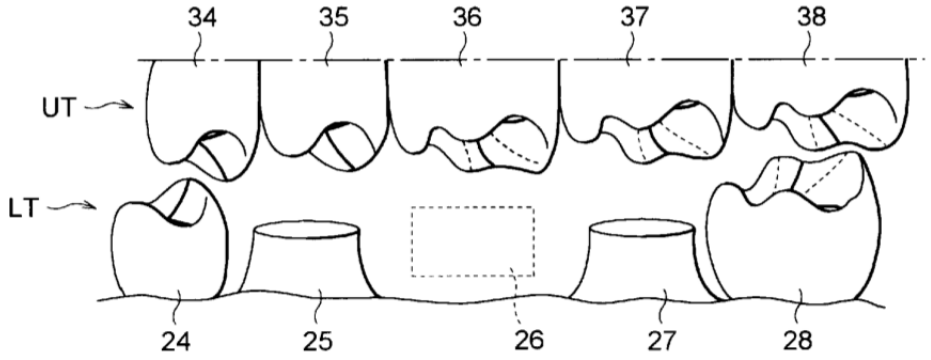

Fig. 8A of Baba

Ex.1012, ¶79.

Baba discloses scanning gypsum casts or scanning teeth directly to obtain image data representing the patient's dentition. Ex.1004 at 8:47-58; 10:51-54. Baba thus teaches providing 3D digital data relating to the patient's dentition by disclosing various ways to obtain image data representing the patient's dentition, which are subsequently displayed to the user. *See, e.g.*, *id.* at 3:8-14, 3:48-53, 6:61-67. Ex.1012, ¶80.

ii. Element [1.2]: (Two) generating first finish line data representative of at least a portion of said finish line and superimposing an image of said finish line on an image of said dentition;

The combined disclosures of Kawai and Baba disclose Element [1.2]. Ex.1012, ¶81.

Kawai

Kawai discloses generating first margin line data representative of at least a portion of said finish line and superimposing an image of said finish line on an image of an abutment tooth. The "margin line" of Kawai is synonymous with "finish line." *See* Section VI.A. Kawai discloses a method for obtaining the margin line (using a "train of points") and further that "the train of points representing the margin area…is displayed on…a development view of the shape of the abutment tooth" with "said point train of the margin area…superposedly displayed." *Id.* at 2:40-3:17. Ex.1012, ¶82.

FIG. 1A of Kawai shows the connected point train of the margin area displayed on the 2D developed view of the abutment tooth. Ex.1003 at 3:26-30.

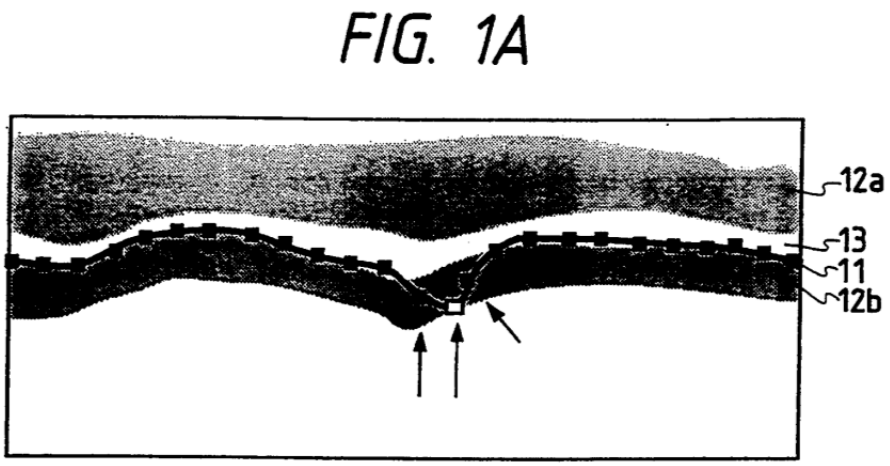

Fig. 1A of Kawai

Kawai also discloses "[t]he developed view of the abutment tooth and the three-dimensional shape thereof can be simultaneously displayed as shown in FIG. 5…. The point train and the connecting lines, representing the margin area, can be displayed ***both in the three-dimensional shape and in the developed view***. [Emphasis added.]" *Id.* at 3:61-68. Additionally, Kawai discloses that the "correcting operation for the points may be conducted on the display of the three-dimensional shape". *Id.* at 4:1-3. Kawai thus discloses superimposing a finish line on a 3D shape as well as a 2D image of the abutment tooth. Ex.1012, ¶83.

The '065 Patent states that "[t]he finish line data can be also obtained in a fully automated manner, for example as described in U.S. Pat. No. 5,417,572 [Kawai]." Ex.1001 at 5:30-32. *See also id.* at 5:23-46. ***The '065 Patent thus***

explicitly states that the method of generating a finish line disclosed by Kawai can be used in the purported invention of the '065 Patent. *Id.* Ex.1012, ¶84.

Baba

Baba teaches various 3D modelling operations to superimpose dental objects on an image of a dentition. Baba discloses superimposing virtual dental model components and adjusting the margin line of the virtual model components on an image of a dentition. Ex.1004 at 7:8-13 ("a superimposition displaying program 404 for displaying…[a] crown model and [a] pontic model [] superimposed on the dentition configuration diagram."). *See also* 9:8-19; FIGS. 9-10 (disclosing and depicting superimposing crown models $C_{m(5)}$ and $C_{m(7)}$ on the image of a dentition).

Fig.9

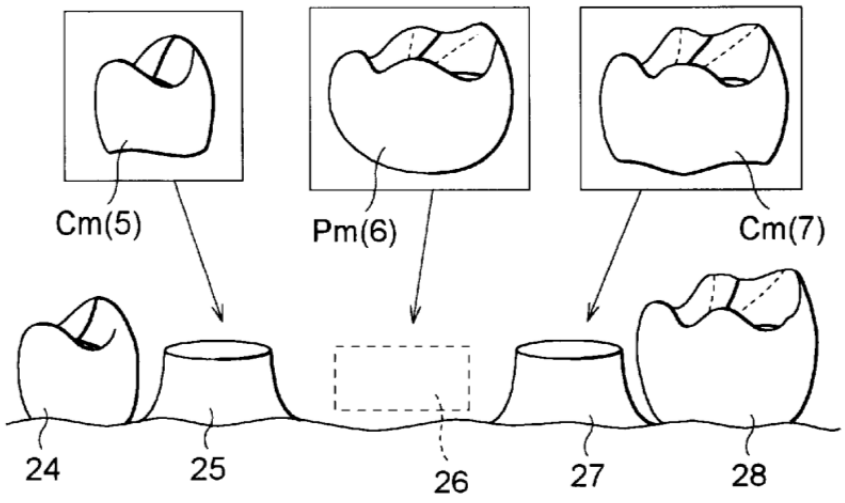

Fig. 9 of Baba

As shown by the arrows in FIG. 9, the formed crown models $C_{m(5)}$ and $C_{m(7)}$ are superimposed on the abutment teeth 25, 27. *Id.* at 9:20-27. The interference and clearances between each of the models and their respective teeth, adjacent surfaces, and gums may thereafter be visually checked and modified by the user. FIG. 10 shows the crown models $C_{m(5)}$ and $C_{m(7)}$ being displayed overlaying the 3D model of the patient's teeth.

Fig.10

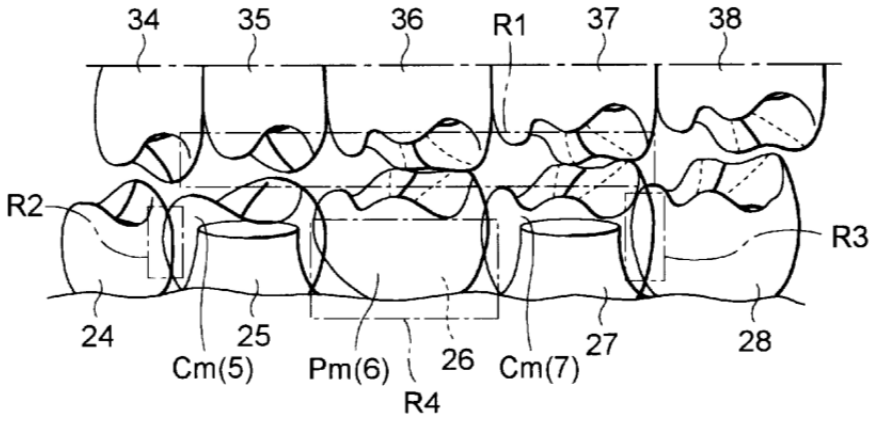

Fig. 10 of Baba

Baba also discloses aligning the margin lines ML' of the crown models $C_{m(5)}$ and $C_{m(7)}$ with the margin lines ML of the corresponding abutment teeth 25, 27. *Id.* at 9:56-67; FIG. 12. Baba thus discloses 3D modelling operations to superimpose dental objects (e.g., a crown $C_{m(5)}$ with a margin line ML' designed to match the margin line ML of an abutment tooth 25) on an image of a dentition. Ex.1012, ¶85.

iii. Element [1.3]: (Three) obtaining second finish line data determined on the basis of input received from a dental practitioner; and

Kawai discloses Element [1.3]. Ex.1012, ¶86.

Kawai discloses "a correction operation for the point train of the margin area ['finish line']…conducted by hitting a displayed point and moving said point by giving an amount of variation by keys or a dial." Ex.1003 at 3:35-40. The "correction operation" occurs after the initial ("first") finish line is obtained. *Id.* at 3:35-60. The "correction operation" allows the finish line to be correctly defined by clicking and dragging select points of the point train (e.g., the points identified by arrows in FIG. 1A). *Id.* at 3:35-60.

FIG. 1A

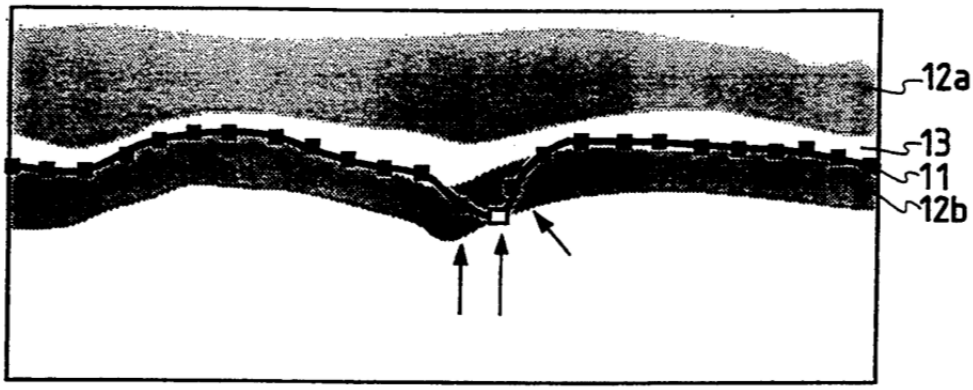

Fig. 1A of Kawai

Ex.1012, ¶87.

When the display point is moved, Kawai's computer-based method obtains "second" finish line data on the basis of the input ("hitting a displayed point and moving said point by giving an amount of variation by keys or a dial") received from a dental practitioner. Ex.1003 at 3:35-40. The new positions of the points after being moved in the "correction operation" constitute new, "second" finish line data. *Id.* The '065 Patent discloses providing input in the same manner. Ex.1001 at 5:23-67 (discussing ways that a dentist provides input to obtain second finish line data, such as moving a cursor or indicating a series of dots that are then connected into a finish line). Kawai further explains that "[t]he above-mentioned correcting operation for the points may be conducted on the display of the three-dimensional shape." Ex.1003 at 3:68-4:3. Ex.1012, ¶88.

Kawai discloses that it is conventional for a "dentist" or "dental technician" to determine the position of the margin line. Ex.1003 at 1:23-25. A dentist is an example of a dental practitioner. *See* Section VI.B. Ex.1012, ¶89.

In view of the above, Kawai's method includes obtaining second finish line data determined on the basis of input received from a dental practitioner when the dental practitioner clicks on a point of the point train and moves the point. Ex.1012, ¶90.

iv. Element [1.4]: (Four) using said second finish line data to update said first finish line data and superimposing the updated data on the dentition image.

The combined disclosures of Kawai and Baba disclose Element [1.4]. Ex.1012, ¶91.

Kawai

Kawai discloses using the second finish line data to update said first finish line data and superimposing the updated data on the abutment tooth image. In Kawai, the input received from the dental practitioner generates "second" data (e.g., of the new position of moved points) that is used to update the "first" finish line data. Ex.1003 at 3:35-60. The resulting updated data (the finish line with the "corrected" points) is superimposed on the 3D image because, other than the "corrected" points, the updated data is displayed in the same manner as the initial data. *Id.* at 3:61-68, 4:1-3. Ex.1012, ¶92.

The '065 Patent discloses that an example of updating the finish line is "changing a portion of the first finish line" (Ex.1001 at 4:63-5:3) and Kawai discloses changing a portion of the first finish line. Ex.1003 at 3:35-60.

Kawai discloses:

> The developed view of the abutment tooth and the three-dimensional shape thereof can be simultaneously displayed as shown in FIG. 5…. The point train and the connecting lines, representing the margin area, ***can be displayed both in the three-dimensional shape*** and in the

> developed view. The above-mentioned correcting operation for the points ***may be conducted on the display of the three-dimensional shape***. [Emphases added.]

Ex.1003 at 3:61-4:3. Kawai also discloses:

> The amount of movement of the point for correction is reflected both on the developed data and on the ***three-dimensional data***. Consequently, when the point is moved on the developed view, the corresponding point in the display of the three-dimensional shape may also be moved in corresponding manner. ***After the points are corrected in position, they are again connected with straight lines***. [Emphases added.]

Id. at 4:5-12. In view of the above, Kawai discloses processing the input received from a dental practitioner to update the original point train data into corrected point train data, which is superimposed on the 3D abutment tooth image. Ex.1012, ¶93.

Baba

Baba teaches superimposing virtual dental model components on an image of a dentition. FIG. 9 of Baba shows that the modified crown models $C_{m(5)}$ and $C_{m(7)}$ are to superimposed on the tooth preparations 25, 27 (i.e., the arrows of FIG. 9 denote the superimposition, FIG. 10 shows the final superimposed position).

Fig.9

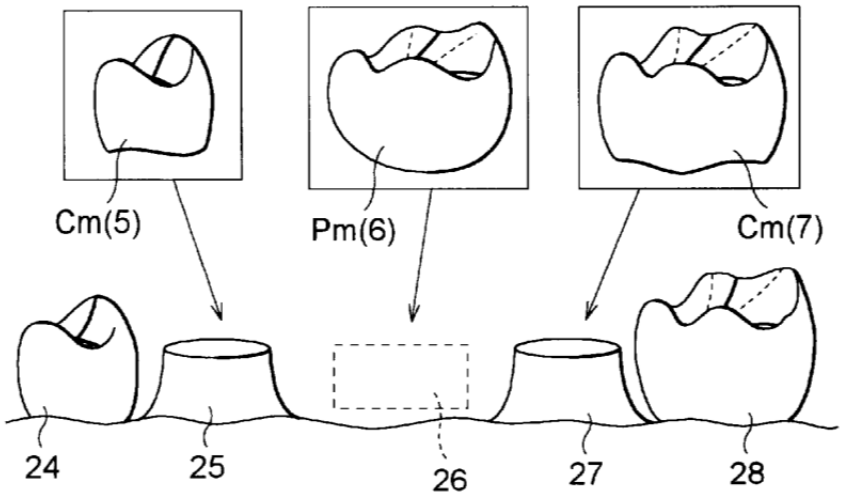

Fig. 9 of Baba

FIG. 10 shows the crown models $C_{m(5)}$ and $C_{m(7)}$ being displayed overlaying the 3D model of the patient's actual dental configuration.

Fig.10

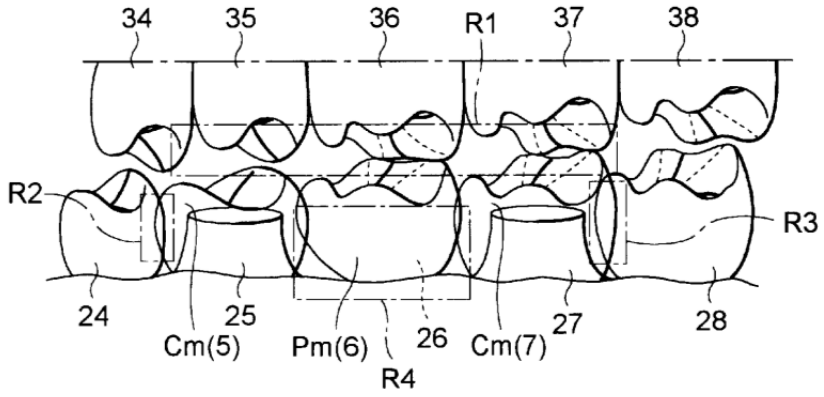

Fig. 10 of Baba

Baba discloses aligning the margin lines ML' of the crown models Cm(5) and Cm(7) with the margin lines ML of the abutment teeth 25, 27. Ex.1004 at 9:56-67; FIG. 12. *See also id.* at 6:14-17 (describing FIG. 10 as "showing an example, represented on a display in a superimposition displaying step, of upper and lower jaw dentitions to which pontic and crown models are attached"). Therefore, Baba discloses superimposing modified virtual dental model components on an image of a dentition. Ex.1012, ¶94.

b. Claim 2: A method according to claim 1, wherein the updating of the first finish line data comprises defining a portion of the finish line not defined in said first finish line data or changing a portion of said first finish line data.

Kawai discloses the subject matter of claim 2. *See* Section VII.A.1.a. Ex.1012, ¶95.

Kawai discloses executing "a correction operation for the point train of the margin area extracted by calculation and the lines connecting the points. Said correction is conducted by hitting a displayed point and moving said point by giving an amount of variation by keys or a dial." Ex.1003 at 3:35-40.

FIG. 1A

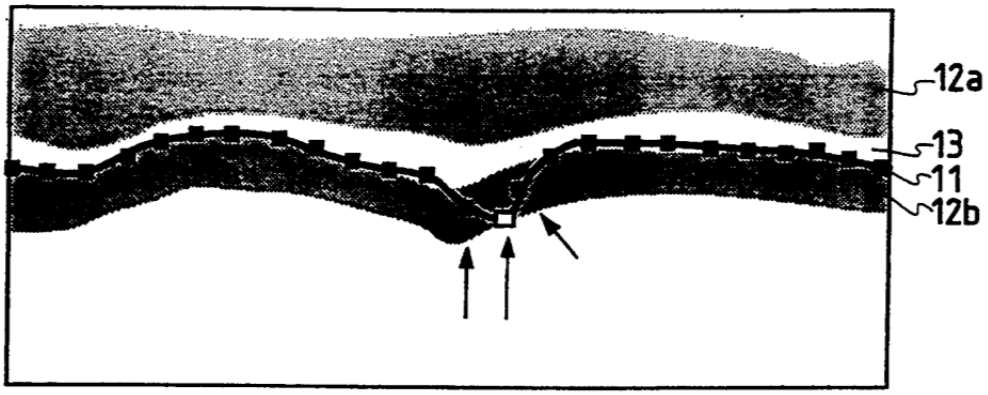

Fig. 1A of Kawai

The clicking and dragging of a displayed point to correct the position of the point updates the first finish line data by "changing a portion of said first finish line data." *Id.* Ex.1012, ¶96.

The '065 Patent discloses that an example of updating the finish line is "changing a portion of the first finish line" (Ex.1001 at 4:63-5:3) and Kawai discloses changing a portion of the first finish line. Ex.1003 at 3:35-60. Ex.1012, ¶97.

c. Claim 3: A method according to claim 1, wherein the second finish line data is generated by virtually drawing a line at the apical limit of the preparation.

Kawai discloses the subject matter of claim 3. *See* Section VII.A.1.a. Ex.1012, ¶98.

The corrected "point train 11" is a virtually drawn line at the apical limit of the tooth abutment. Ex.1003 at 3:47-49 ("point train 11 in FIG. 1A indicates the

margin area"). The "point train 11" is a virtually drawn line because it is calculated, virtually displayed, and changed "by hitting a point to be corrected with a mouse and moving said point to a desired position." *Id.* at 2:36-3:12, 3:52-60. Kawai discloses that the margin line pertains to a line at the apical limit of the preparation. *Id.* at Fig. 6A. Ex.1012, ¶99.

Kawai's margin line is at the apical limit of the abutment tooth as shown in the disclosed calculation for the train points, which relies on examining where the angle of inclination "crosses zero or where the variation of the inclination exceeds a certain value." Ex.1003 at 2:59-66. Ex.1012, ¶100.

d. Claim 4: A method according to claim 3, wherein the line is drawn in a continuous fashion.

Kawai discloses the subject matter of claim 4. *See* Section VII.A.1.c. Ex.1012, ¶101.

The finish line (point train 11 in Kawai) is connected in a continuous fashion. *See, e.g.*, Ex.1003 at FIG. 1A, 3:27-29.

FIG. 1A

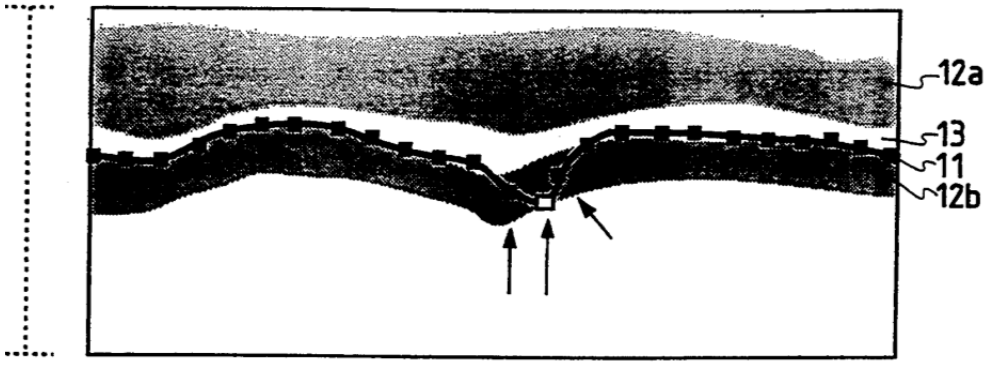

Fig. 1A of Kawai

Kawai also discloses continuous margin lines in FIGS. 3, 4, and/or 5.

FIG. 3

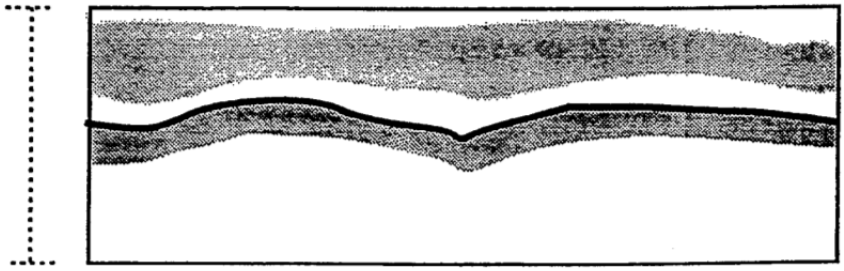

Fig. 3 of Kawai

FIG. 4

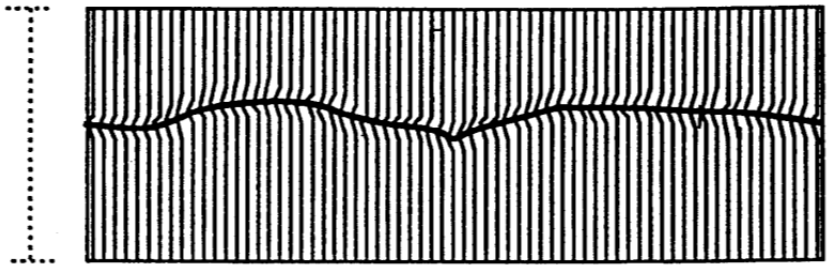

Fig. 4 of Kawai

FIG. 5

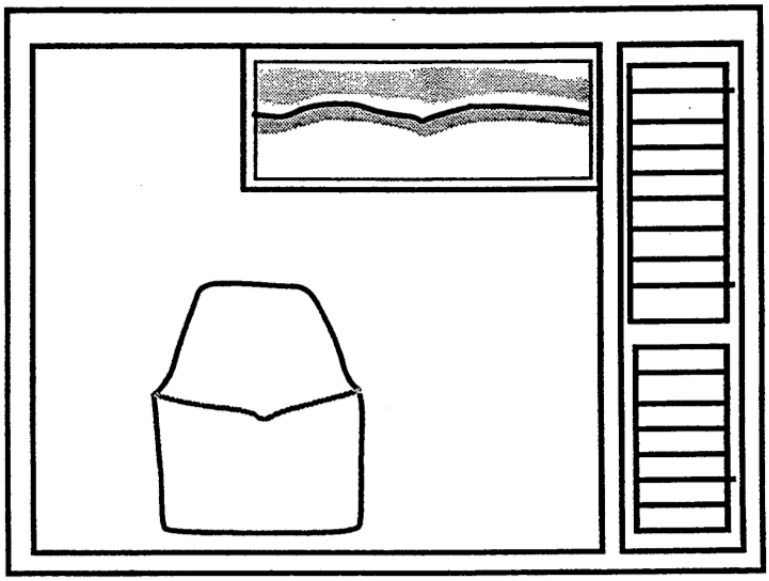

Fig. 5 of Kawai

Ex.1012, ¶102.

In addition, Kawai also discloses "[a]fter the points are corrected in position, they are again connected with straight lines. FIG. 3 shows a state in which the corrected points are again connected by the lines, and FIG. 4 shows a bent line

display corresponding to the state shown in FIG. 3. Of course, a display as shown in FIG. 4 may be employed for the correction of point positions, instead of the display as shown in FIG. 1A." Ex.1003 at 4:11-19. Ex.1012, ¶103.

e. Claim 5: A method according to claim 3, wherein the line is drawn by marking dots in small intervals and then forming a line by automatically connecting the dots to one another.

Kawai discloses the subject matter of claim 5. *See* Section VII.A.1.c. Ex.1012, ¶104.

Fig. 1A of Kawai shows the finish line is drawn by marking dots ("points") in small intervals and then forming a line by connecting the dots to one another.

FIG. 1A

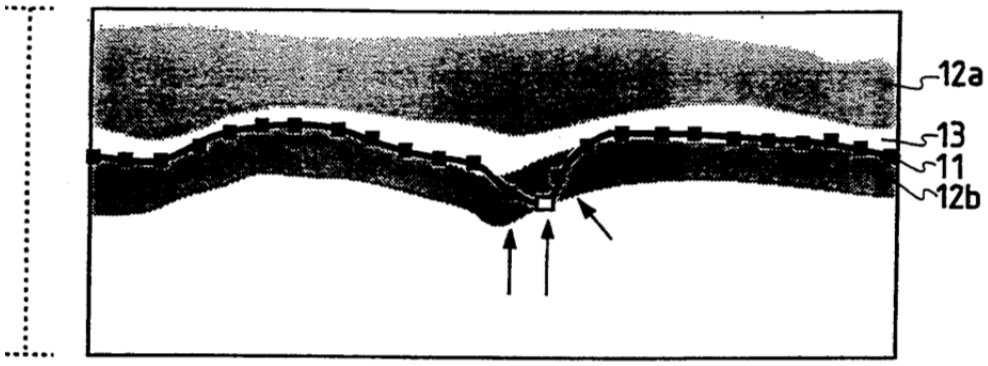

Fig. 1A of Kawai

Kawai discloses:

> Then the train of points representing the margin area…is displayed on a display unit. In this state, a development view of the shape of the abutment tooth is displayed, and said point train of the margin area is

> superposedly displayed.… The train of points representing the margin area is displayed on the corresponding position on said development view. FIG. 1A shows the display of said point train of the margin area on the developed view, wherein said points are connected by straight lines, and such connection can be made by hitting the points with a mouse."

Ex.1003 at 3:13-30. The points are "automatically" connected because the connection automatically occurs when the points are hit with a mouse. *Id.* By disclosing that the connection "can" be made by hitting the points with a mouse, Kawai also envisions other ways of forming the connection, which a POSITA familiar with CAD/CAM technology would readily understand to include simply automatically connecting the points without operation of a mouse. Ex.1012, ¶105.

Kawai also discloses "[a]fter the points are corrected in position, they are again connected with straight lines. FIG. 3 shows a state in which the corrected points are again connected by the lines." Ex.1003 at 4:11-14. Ex.1012, ¶106.

f. Claim 6: A method according to claim 1, wherein the defined finish line is used as an input in constructing a crown.

Kawai discloses the subject matter of claim 6. *See* Section VII.A.1.a. Ex.1012, ¶107.

Kawai discloses:

> The designing of the artificial crown can be made based on the shape data of the abutment tooth, in which thus determined margin line is

> registered. The margin line of the artificial crown to be designed can be made to coincide with the margin line registered in said shape data of the abutment tooth.

Ex.1003 at 4:25-30. Kawai's margin line is used as an input for constructing a crown because the crown design is based on the margin line. *Id.* Ex.1012, ¶108.

g. Claim 7 (preamble): A computer-based method for constructing a crown to be fitted on a tooth preparation in a subject, the method comprising defining a finish line on said preparation to obtain finish line data and employing said data in constructing the crown; the method being characterized in that defining the finish line comprises:

The combined disclosures of Kawai and Baba disclose the preamble of claim 7. Ex.1012, ¶109.

Kawai

"computer-based method for constructing a crown to be fitted on a tooth preparation"

Kawai discloses "a method for extracting the margin line for the designing of an artificial crown." Ex.1003 at 1:10-13. Kawai's method is "computer-based" because it employs a "computer", "CAD/CAM", "display unit", and "mouse." *Id.* at 1:45-48, 1:51-54, 3:13-15, 3:30, 3:57-58. Kawai's method is "computer-based" because Kawai discloses that the method is for use with "CAD/CAM preparation of artificial crown in the near future." *Id.* at 1:51-54; *see also id.* at 1:55-68, 2:36-38, 3:13-15. Ex.1012, ¶110.

Kawai discloses a dental prosthesis of at least one tooth ("artificial crown") to be fitted over a tooth preparation ("abutment tooth"). *See* Section VI.A. and VII.A.1.a. ("tooth preparation" is synonymous with "abutment tooth"), Ex.1003 at 1:38-44 (artificial crown is intended to be attached to abutment tooth). Ex.1012, ¶111.

"defining a finish line"

Kawai discloses defining a finish line ("margin line") of a dental prosthesis of at least one tooth ("artificial crown") to be fitted over a tooth preparation ("abutment tooth"). Ex.1003 at 1:15-22. *See* Section VI.A and VII.A.1.a. (e.g., the '065 Patent uses "margin line" and "finish line" interchangeably). Ex.1012, ¶112.

"employing [finish line] data in constructing the crown"

Kawai's margin (finish) line is used as an input for constructing a crown. "The designing of the artificial crown can be made based on the shape data of the abutment tooth, in which thus determined margin line is registered. The margin line of the artificial crown to be designed can be made to coincide with the margin line registered in said shape data of the abutment tooth." Ex.1003 at 4:25-30. Ex.1012, ¶113.

Baba

"employing [finish line] data in constructing the crown"

Baba discloses a method of designing a crown using finish line data and employing the finish line data in constructing the crown. Ex.1004 at Abstract. Baba's method "relates to a method of designing a dental prosthesis model of crown, bridge, or the like by using a computer; and a computer program product storing a program for executing this method." *Id.* at 1:8-10. Baba further explains that there is a known "method in which configurations of abutment teeth, their adjacent and pairing teeth, and the like are fed into a computer, a dental prosthesis model conforming thereto is made on the computer, and a dental prosthesis is machined on the basis of thus made model, i.e., method of making a dental prosthesis by means of CAD/CAM (computer aided design/computer aided manufacture) technique." *Id.* at 1:20-30; *see also* 10:19-20 (discussing manufacturing another type of dental prosthesis, a bridge, based on the digital data). Ex.1012, ¶114.

i. Element [7.1]: (One) providing a three-dimensional (3D) digital data relating to the patient's dentition, said 3D data includes data representative of the surface topology of said preparation and its surroundings;

The combined disclosures of Kawai and Baba disclose the subject matter of Element [7.1]. *See* Section VII.A.1.a.i. Ex.1012, ¶115.

ii. Element [7.2]: (Two) generating first finish line data representative of at least a portion of said finish line and superimposing an image of said finish line on an image of said dentition;

The combined disclosures of Kawai and Baba disclose the subject matter of Element [7.2]. *See* Section VII.A.1.a.ii. Ex.1012, ¶116.

iii. Element [7.3]: (Three) obtaining second finish line data on a finish line determined on the basis of input received from a dental practitioner; and

Kawai discloses the subject matter of Element [7.3]. *See* Section VII.A.1.a.iii. Ex.1012, ¶117.

iv. Element [7.4]: (Four) using said second finish line data to update said first finish line data and superimposing the updated data on the dentition image.

The combined disclosures of Kawai and Baba disclose the subject matter of Element [7.4]. *See* Section VII.A.1.a.iv. Ex.1012, ¶118.

h. Claim 8: A method according to claim 7, wherein a virtual image of the preparation with a defined finish line is presented on a suitable display medium.

Kawai discloses the subject matter of claim 8. *See* Section VII.A.1.g. Ex.1012, ¶119.

Kawai discloses a virtual image of the preparation with a defined finish line is presented on a suitable display medium ("display unit"). Ex.1003 at 3:13-17. The display unit is a suitable display medium. *Id.* Ex.1012, ¶120.

i. Claim 9 (preamble): A method according to claim 7, comprising:

Baba discloses the preamble of claim 9. *See* Section VII.A.1.g. Ex.1012, ¶121.

i. Element [9.1]: constructing a virtual crown and virtually fitting said crown on said preparation in said virtual teeth;

Baba discloses Element [9.1]. Ex.1012, ¶122.

Baba discloses constructing a virtual crown and virtually fitting the crown on the preparation in the virtual teeth. Ex.1004 at Abstract, 1:8-10 ("invention relates to a method of designing a dental prosthesis model of crown…by using a computer"). Baba further explains that "there has been proposed and being realized a method in which configurations of abutment teeth, their adjacent and pairing teeth, and the like are fed into a computer, a dental prosthesis model conforming thereto is made on the computer, and a dental prosthesis is machined on the basis of thus made model, i.e., method of making a dental prosthesis by means of CAD/CAM…technique." *Id.* at 1:20-30. Ex.1012, ¶123.

FIG. 10 of Baba shows virtually fitting the virtual crowns $C_{m(5)}$ and $C_{m(7)}$ onto the tooth preparations 25, 27, respectively, of the virtual teeth. Ex.1004 at 6:14-17.

Fig.10

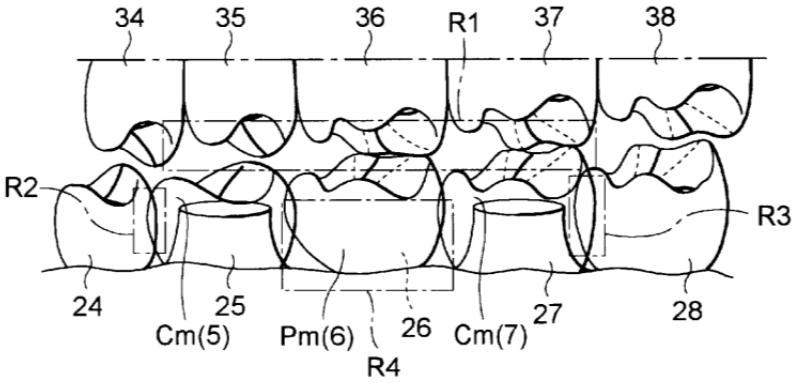

Fig. 10 of Baba

Ex.1012, ¶124.

ii. Element [9.2]: generating digital data representing the three dimensional structure of the virtual crown;

Baba discloses Element [9.2]. Ex.1012, ¶125.

Baba discloses generating digital data representing the three dimensional structure of the virtual crown. Baba discloses "a method of designing a dental prosthesis model of crown, bridge, or the like by using a computer; and a computer program product storing a program for executing this method." Ex.1004 at 1:8-10. Ex.1012, ¶126.

Baba further discloses "[feeding] configurations of abutment teeth, their adjacent and pairing teeth, and the like [] into a computer" and then making a prosthesthis model using CAD/CAM.Ex.1004 at 1:20-30. Baba's processing thus

involves generating digital data representing the three-dimensional structure of the virtual crown. Ex.1012, ¶127.

iii. Element [9.3]: employing said digital data to construct a physical crown for fitting on a tooth preparation in a patient.

Baba discloses Element [9.3]. Ex.1012, ¶128.

Baba discloses that "there has been proposed and being realized a method in which configurations of abutment teeth, their adjacent and pairing teeth, and the like are fed into a computer, a dental prosthesis model conforming thereto is made on the computer, and ***a dental prosthesis is machined on the basis of thus made model***, i.e., method of making a dental prosthesis by means of CAD/CAM…technique. [Emphasis added.]" Ex.1004 at 1:20-30; *see also id.* at 10:19-20 (discussing manufacturing another type of dental prosthesis, a bridge, based on the digital data). Thus, Baba discloses employing the digital data to construct a physical crown for fitting on a tooth preparation in a patient. Ex.1012, ¶129.

j. Claim 11 (Preamble): A computer-based program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for constructing a crown to be fitted on a tooth preparation in a subject, the method comprising defining a finish line on said preparation to obtain finish line data and employing said data in constructing the crown; the method being characterized in that defining the finish line comprises:

The combination of Kawai and Baba discloses the preamble of claim 11. *See* Section VII.A.1.g. Ex.1012, ¶130.

The computer-based methods of Kawai and Baba are executed by a computer-based program storage device readable by machine, tangibly embodying a program of instructions executable by the machine. Ex.1003 at 1:45-54 (discussing the CAD method; Ex.1004 at 1:44-57, 2:58-67 (discussing a computer program product executed by a computer with a storage device), Fig. 1, 5:47-50 ("computer system performing the method of designing a dental prosthesis model"). Ex.1012, ¶131.

Baba discloses that a computer system is used to perform the method of designing a dental prosthesis model. Ex.1004 at 5:46-49, 10:32-40, 7:24-36. Baba discloses "a medium driving device 6 which can accommodate and drive a dental prosthesis model designing Storage medium (computer program product) 5 storing a dental prosthesis model designing program 4. *Id.* at 6:45-58.

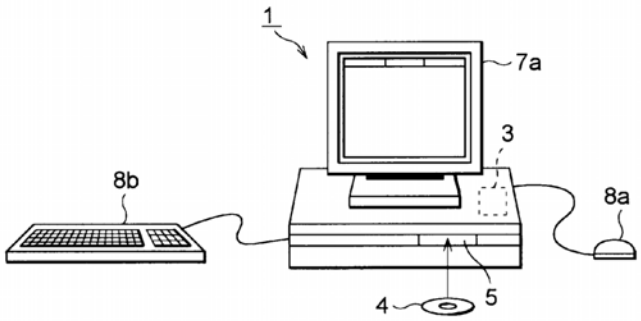

Fig. 1 of Baba

Ex.1012, ¶132.

i. Element [11.1]: (a) providing a three-dimensional (3D) digital data relating to the patient's dentition, said 3D data includes data representative of the surface topology of said preparation and its surroundings;

The combined disclosures of Kawai and Baba disclose the subject matter of Element [11.1]. *See* Section VII.A.1.a.i. Ex.1012, ¶133.

ii. Element [11.2]: (b) generating first finish line data representative of at least a portion of said finish line and superimposing an image of said finish line on an image of said dentition;

The combined disclosures of Kawai and Baba disclose the subject matter of Element [11.2]. *See* Section VII.A.1.a.ii. Ex.1012, ¶134.

iii. Element [11.3]: (c) obtaining second finish line data on a finish line determined on the basis of input received from a dental practitioner; and

Kawai discloses the subject matter of Element [11.3]. *See* Section VII.A.1.a.iii. Ex.1012, ¶135.

iv. Element [11.4]: (d) using said second finish line data to update said first finish line data and superimposing the updated data on the dentition image.

The combined disclosures of Kawai and Baba disclose the subject matter of Element [11.4]. *See* Section VII.A.1.a.iv. Ex.1012, ¶136.

2. Explanation of Why Claims 1-9 and 11 Would Have Been Obvious

Claims 1-9 and 11 would have been obvious over Kawai in view of Baba. Patent Owner may argue that Kawai does not disclose: (a) obtaining second finish line data determined on the basis of input received from a "dental practitioner" (Elements [1.3], [7.3], [11.3]); (b) providing 3D data that includes data representative of the surface topology of said preparation "and its surroundings" (Elements [1.1], [7.1], [11.1]), providing a 3D digital data relating to a patient's "dentition" (Elements [1.1], [7.1], [11.1]), superimposing an image of said finish line on an image of said "dentition" (Elements [1.2], [7.2], [11.2]), and superimposing the updated data on the "dentition image" (Elements [1.4], [7.4], [11.4]); (c) virtually modelling the 3D structure of the virtual crown (as recited in

claim 9); and (d) using a computer-based program storage device (as recited in claim 11). Nonetheless, a POSITA would have understood that it is conventional and well-known for a dentist and/or a dental technician to determine the margin line. Ex.1003 at 1:15-44. Ex.1012, ¶¶138-143. *See* Section VII.A.2.a. A POSITA would further have appreciated the benefits of modifying Kawai to model and visualize the abutment tooth (i.e., a tooth preparation) in relation to its surroundings as well as an additional portion of the patient's dentition. Ex.1012, ¶¶144-153. *See* Section VII.A.2.b. It also would have been obvious to modify Kawai to virtually model the artificial crown as taught by Baba. *See* Ex.1012, ¶¶154-157. Section VII.A.2.c. It would further have been obvious to conduct Kawai's method using a computer-based program storage device. *See* Ex.1012, ¶158. Section VII.A.2.d.

a. It would have been obvious for the user in Kawai's method to be a dental practitioner (claims 1-9 and 11)

As discussed in Section VII.A.1., Kawai discloses that a person provides input (*e.g.*, via a mouse) used to obtain the second finish line data, but Kawai does not explicitly identify such person as being a "dental practitioner." However, Kawai teaches it is conventional and well-known for a dentist to provide input for determining the margin line. Ex.1003 at 1:36-44 ("inadequate margin requires additional adjustment by the dentist"), (describing a "convention method"). Patent Owner itself admits this in the '065 Patent. Ex.1001 at 2:10 ("dentist…

complete[s] the finish line"). As such, it would have been obvious for the person that provides input used to obtain the second finish line data in Kawai's method to be a dentist (which is an example of a "dental practitioner", *see* Section VI.B.), because determining a finish line is a well-known, conventional activity performed by a dentist. Ex.1012, ¶138.

Thus, a POSITA would have been motivated to have a dentist act as the user in Kawai's process and provide the input used to obtain the second finish line data (*e.g.*, by manipulating the train of points on the 3D model of the abutment tooth to correctly set the finish line as taught by Kawai). *Id.* The selection of the dentist would have yielded predictable results given that it is well-known that dentists conventionally and routinely provide input (*e.g.*, "additional adjustment", "written instructions") for determining the finish line. *See, e.g.,* Ex.1003 at 1:38-44, Ex.1001 at 1:50-58. Further, it is well-known and conventional that dentists operate and provide input to computers and computer-aided equipment for dental image processing purposes. *See also* Ex.1019 at title, abstract, 1:65-67 (disclosing the use of "computer-aided equipment" for image processing by dentists and dental technicians in 1999); Ex.1020 at 11:14-16 ("dentist or dental technician may instruct the computer to display a desired tooth preparation on monitor"), 11:66-12:5 ("the dentist instructs the computer to modify the displayed three-dimensional shape…. [T]he dentist…input[s] a command that a predefined tooth preparation, in

graphic form, be overlaid on the three-dimensional graphic representation of the tooth"). Thus, a POSITA would have had a reasonable expectation of success of having a dentist act as the user in Kawai's method because dentists were known to provide input for determining a finish line and use computer-aided image processing. Ex.1012, ¶139.

In addition, Kawai recognizes the problem of relying "greatly on the skill of the technician" and the problem of back and forth between the dentist and dental technician that "necessitat[es] a longer time of treatment." Ex.1003 at 1:36-44. Thus, a POSITA would have recognized that having the dentist provide some or all of the input used to obtain the second finish line data would reduce reliance on the skill of the technician, which Kawai explicitly teaches is desirable. *Id.* A POSITA would also have had a reason to have the dentist provide the input in order to reduce or avoid back and forth between the dentist and dental technician. *Id.* Setting the finish line correctly is important to ensure that the artificial crown correctly matches the abutment tooth, and this is further reason why it would have been obvious for a dentist to act as the user in Kawai's method. *Id.* Ex.1012, ¶140.

Further, Kawai recognizes the benefit of "reduc[ing] the designing time" and "improv[ing] productivity". Ex.1003 at 4:33-35. Thus, a POSITA would have recognized that having the dentist provide some or all of the input used to obtain

the second finish line data would reduce the designing time and/or improve productivity because having the dentist provide the input would reduce the back and forth between the dentist and dental technician. Kawai recognizes that this back and forth undesirably "necessitat[es] a longer time of treatment." *Id.* at 1:36-44. Ex.1012, ¶141.

Kawai identifies two persons that are capable of determining a finish line: a dentist and a dental technician. Ex.1003 at 1:15-44. Given the small and finite number of alternatives (two) taught by Kawai, it would have been obvious to have the dentist act as the user in Kawai's method and provide some or all of the input used to obtain the second finish line data. The selection of the dentist would have yielded predictable results given that it was well-known that dentists conventionally and routinely provide input (*e.g.*, "additional adjustment", "written instructions") for determining the finish line. *See, e.g.,* Ex.1003 at 1:38-44, Ex.1001 at 1:50-58. There was a design need (selecting a person to provide the input) and market pressure ("reduc[ing] the designing time", "improv[ing] productivity", reducing reliance on "skill of the technician") for selecting the dentist as the person providing some or all of the input. Ex.1003 at 4:33-35, 1:36-44. Ex.1012, ¶142.

In addition, if "dental practitioner" is construed to encompass a "dental technician" (*See* Section VI.B.), it also would have been obvious for the user of

Kawai's method to be a dental technician. Kawai discloses that a dental technician conventionally and routinely determines a finish line. Ex.1003 at 1:23-25. As such, it would have been obvious for the person that provides input used to obtain the second finish line data in Kawai's method to be a dental technician, because determining a finish line is a well-known, conventional activity performed by a dental technician. *Id.* Ex.1012, ¶143.

b. It would have been obvious to provide 3D data of the preparation and its surroundings and superimpose finish line data on a dentition image (claims 1-9 and 11)

Kawai discloses providing a 3D virtual model of an abutment tooth (i.e., a tooth preparation), superimposing a finish line on the abutment tooth, receiving input to adjust the finish line on the 3D virtual model of an abutment tooth, and updating the finish line on the 3D virtual model of the abutment tooth based on the user's input. *See* Section VII.A.1.a.i.-iv. The challenged claims recite the terms "its surroundings", "image of said dentition", and "dentition image." Fig. 4 of the '065 Patent, which depicts an "example" of a "dentition image", depicts only the "neighboring teeth." Ex.1001 at 4:47-52, Fig. 4. Thus, a portion of the patient's teeth, *e.g.*, the tooth preparation disclosed by Kawai, satisfies the claim term "dentition." Ex.1012, ¶144.

Patent Owner may allege that the terms "its surroundings" and "dentition" requires more than the tooth preparation disclosed by Kawai. However, Baba

discloses providing data of the tooth preparation together with its surroundings (as well as data of more than the tooth preparation itself) and superimposing prosthesis models (such as a crown model) on such displayed data. Ex.1004 at 1:56-65, 2:5-7, 8:47-67, 9:20-27, Figs. 9 and 10.

Fig.9

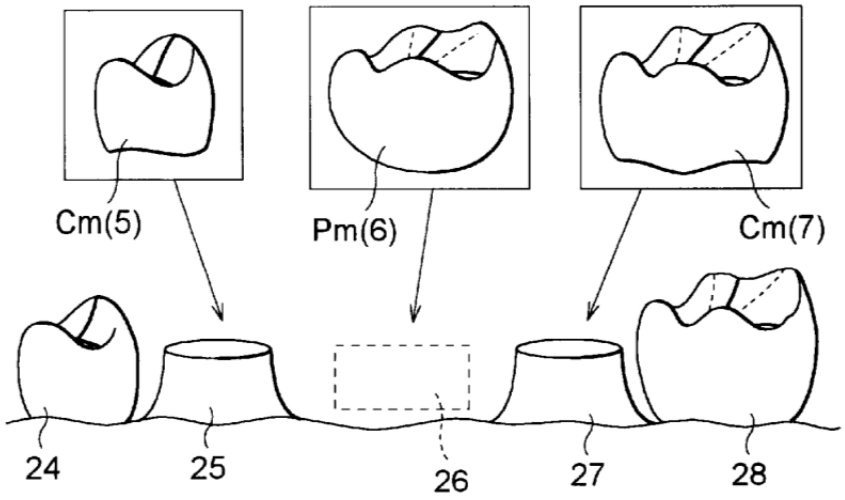

Fig. 9 of Baba

Fig.10

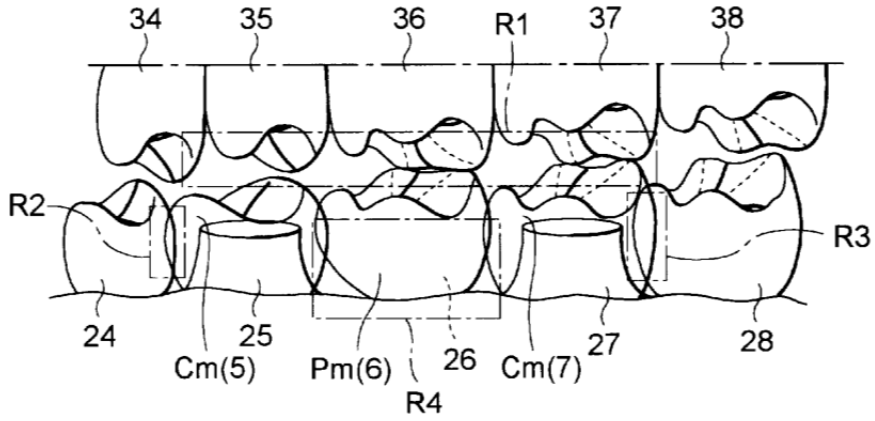

Fig. 10 of Baba

Baba discloses "displaying a dentition configuration diagram" and "displaying a crown model…so that the crown model is ***superimposed*** on the ***dentition*** configuration diagram. [Emphases added.]" *Id.* at 1:56-65, 2:5-7. Even if the term "dentition" somehow requires more than the tooth preparation, Baba disclosures such feature. *Id.* Ex.1012, ¶145.

Modifying Kawai to provide data of the abutment tooth together with surrounding teeth (instead of in isolation) would have been obvious to a POSITA in view of Kawai and Baba. It also would have been obvious to modify Kawai to superimpose the prosthesis model (including the finish line) on such data of the abutment tooth and its surrounding teeth. A POSITA would have been motivated to combine Kawai with Baba because Baba is in the same field of endeavor—CAD/CAM prosthodontics. Ex.1003 at Abstract; Ex.1004 at Abstract. A POSITA

would have had a reason to display surrounding teeth (together with an abutment tooth) because Baba recognizes that dental prostheses (e.g., crowns, bridges) are designed based on the "abutment teeth and their surrounding teeth." Ex.1004 at 1:13-16. A POSITA would have included the surrounding teeth (together with the abutment teeth) in the image upon which the finish line data is superimposed because Baba teaches that the teeth surrounding abutment teeth are considered when designing a dental prosthesis. *Id.* A POSITA would have been motivated to combine the references at least because Baba virtually models the crown $C_{m(n)}$ in relation to the adjacent virtual teeth and gum(s) to beneficially allow the user to easily view and adjust the interferences and desired gaps between the virtual crown model $C_{m(n)}$ and adjacent virtual teeth and gum. Ex.1004 at 2:8-10, 9:28-40, 8:60-63 ("configurations of teeth surrounding the teeth to which the bridge is attached…are measured and, as shown in FIG. 8A, are represented on the display"). Ex.1012, ¶¶146-147.

A POSITA would have reasonably expected the method of Kawai (which, as discussed above, superimposes the image of the finish line on an image of the abutment tooth) to be successfully applied to superimposing an image of the finish line on dentition that includes the abutment tooth ***and*** surrounding teeth. Ex.1003 at 1:45-54, 3:1-4:3; Ex.1004 at 1:44-57, 2:58-67, 6:14-17, FIG. 10. *See also* Ex.1019 1:65-67, Ex.1020 at 11:14-16, 11:66-12:5. The substitution of an image

of an abutment tooth with an image of the abutment tooth and surrounding teeth would have yielded predictable results, i.e., superimposing an image of the finish line on an image of the abutment tooth and surrounding teeth. A POSITA would have had a reasonable expectation of successfully combining Kawai and Baba because a POSITA would have readily applied the same basic computer-based method of Kawai to model the margin line on the abutment tooth to instead model the margin line on an abutment tooth and surrounding teeth. Ex.1012, ¶148.

Additionally, Baba beneficially allows the margin line ML' of the virtual crown model $C_{m(n)}$ to be virtually aligned with the margin line ML of the virtual abutment teeth 25, 27. Ex.1004 at 9:57-62. Modifying Kawai to include some of the surrounding dental structures, as in Baba, would thus allow the dental practitioner to define the margin line and design the dental prosthesis (e.g., a crown) to properly fit in the patient's mouth in relation to the adjacent physical dental structures. Ex.1012, ¶149.

A POSITA would have been motivated to modify Kawai's virtual modelling to show the abutment tooth in relation to other dental structures such as neighboring teeth at least because virtually modelling the crown $C_{m(n)}$ in relation to the adjacent virtual teeth and gum would have beneficially allowed the user to easily view and adjust the interferences and desired gaps between the virtual crown model $C_{m(n)}$ and adjacent virtual teeth and gum(s). Ex.1004 at 2:8-10; 9:28-40.

Similarly, setting the margin line of the abutment tooth while also allowing a user to view the surrounding surfaces of adjacent teeth and/or gum(s) would beneficially allow the user to adjust the interferences and desired gaps between the margin line of the virtual crown model $C_{m(n)}$ and the adjacent dental structures (e.g., teeth and gums). *See id.* Ex.1012, ¶150.

A POSITA would have readily understood that Kawai's defined margin line would be used to construct a crown that properly fits on the tooth abutment. *See e.g.*, Ex.1003 at 1:32-35. Indeed, properly constructing a crown is the very purpose of Kawai. *Id.* at Abstract, 1:10-13 ("[t]he present invention relates to a method for extracting the margin line ***for the designing of an artificial crown*** [emphasis added]"). Kawai further describes how the margin line created by Kawai's invention is to be used when designing the artificial crown. *Id.* at 4:25-30 ("The designing of the artificial crown can be made based on the shape data of the abutment tooth, in which thus determined margin line is registered. The margin line of the artificial crown to be designed can be made to coincide with the margin line registered in said shape data of the abutment tooth."). A POSITA would have recognized how to use Kawai's finish line for constructing a crown and would have appreciated the benefits of modifying Kawai to superimpose the margin line on the abutment tooth of a dentition based on Baba's teachings of modelling the

dentition and superimposing the virtual crown model $C_{m(n)}$ and margin line ML' on the dentition. Ex.1004 at 2:8-10; 9:28-40. Ex.1012, ¶¶151-152.

As such, a POSITA would have had a reason with rational underpinnings to combine the disclosures of Kawai and Baba to provide a 3D virtual model of a dentition and superimpose the image of the finish line data on the image of the dentition. Ex.1012, ¶153.

c. It would have been obvious to 3D virtually model a crown (claim 9)

Kawai discloses setting a margin line for the purpose of properly manufacturing an artificial crown using the margin line as an input. Ex.1003 at Abstract, 1:32-35, 1:10-13. Patent Owner may argue that Kawai does not explicitly disclose 3D modelling of the crown itself in the manner recited in dependent claim 9. As discussed in Section VII.A.1., Baba discloses the features of claim 9. To the extent that Kawai does not provide an explicit disclosure of virtually modelling a crown, the claimed features would have been obvious modifications to Kawai's disclosure to a POSITA in view of Baba, which discloses 3D virtual modelling a crown in relation to a virtual abutment tooth of a virtual dentition. Ex.1012, ¶154.

Baba discloses superimposing a virtual crown model $C_{m(n)}$ on virtual abutment tooth 25 or 27 of an image of a dentition. *See e.g.*, Ex.1004 at 1:62-65; 2:6-38. Baba also discloses deforming (i.e., adjusting) the margin line ML' of the

virtual crown model $C_{m(n)}$ to match the margin line ML of the corresponding virtual abutment teeth 25, 27. *Id.* at 9:57-67. Baba thus is directed to solving the same problem as Kawai, i.e., virtually modelling a finish line of an abutment tooth so that an artificial crown can be properly designed. Baba simply takes Kawai one step further by also describing the virtual modelling of the artificial crown in relation to the virtual abutment tooth. Ex.1012, ¶155.

A POSITA would have been motivated to modify Kawai by virtually modelling the crown and virtually fitting the crown on the preparation to ensure an accurate margin line between the crown and preparation, as well as ensuring an appropriate fit of the crown with adjacent teeth. *See e.g.*, Ex.1003 at 4:25-39 (describing the designing of the artificial crown based on the shape data of the abutment tooth); Ex.1004 at 1:13-27 and 9:30-40 (discussing modelling the crown models with adjacent teeth to ensure that interferences are precluded and gaps are appropriately sized). Both of these references relate to virtually modelling an abutment tooth and designing an artificial crown to match the virtually-modelled abutment tooth. *See e.g.*, Ex.1003 at FIGS. 1A, 2A, and 5 and/or at 3:61-4:3; Ex.1004 at FIGS. 8A-10; 1:62-65; 2:6-38; 9:24-26. A POSITA would have had a reasonable expectation of successfully combining Kawai and Baba because a POSITA would readily apply the 3D crown modelling techniques taught in Baba to Kawai's modelling program to simply effectuate Kawai's end goal of

manufacturing an artificial crown based on digital data. Ex.1003 at 1:45-57, Ex.1004 at 6:14-17, FIG. 10. Ex.1012, ¶156.

Therefore, a POSITA would have been motivated to modify Kawai to also virtually model the crown because the fit between the crown and the abutment tooth and adjacent teeth would be easily compared using CAD/CAM modelling technology. *See e.g.,* Ex.1004 at 1:13-27, 9:30-40 (discussing modelling the crown models with adjacent teeth to ensure that interferences are precluded and gaps are appropriately sized). A POSITA would have readily understood the benefits to modelling both the abutment tooth (with the margin line) and the crown (that fits to the margin line). This collective modelling helps ensure accurate margin line placement to achieve Kawai's the stated goal of properly constructing the artificial crown. Ex.1003 at 1:10-13. Additionally, modelling the artificial crown in conjunction with other adjacent teeth provides an alignment fit benefit, as recognized in Baba. Ex.1004 at 1:13-27, 9:30-40. Ex.1012, ¶157.

d. It would have been obvious to conduct Kawai's method using a computer-based program storage device (claim 11)

As discussed in Section VII.A.1., Kawai discloses a computer-based method. It would have been obvious to modify Kawai by conducting its computer-based method using a computer-based program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to

perform method steps. The use of such a computer-based program storage device readable by machine to implement computer-based methods is well-known. Ex.1022 at 13:22-35 ("computer having...a program storage device readable by a machine, tangibly embodying a program of instructions executable by...the machine to perform method steps"). Baba discloses using a computer which "accommodate[s] and drive[s] a dental prosthesis model designing storage medium (computer program product)." Ex.1004 at 6:45-58. A POSITA would have had reason to use such a computer-based program storage device because it would have allowed for implementation of Kawai's computer-based method. A POSITA would have had a reasonable expectation of success because Kawai's method is intended to be implemented using a computer. Ex.1012, ¶158.

The purported invention of the '065 Patent is nothing more than "[t]he combination of familiar elements according to known methods [and] does no more than yield predictable results." *KSR*, 550 U.S. at 416. As such, the combination of Baba and Kawai renders obvious claim 1-9 and 11 of the '065 Patent. Ex.1012, ¶¶159-161.

VIII. OTHER CONSIDERATIONS

A. Any Purported Secondary Considerations Evidence Does Not Overcome the Strong Evidence of the Obviousness

Petitioners are not aware of any secondary considerations evidence. As illustrated above, all the elements of claims 1-9 and 11 are known in the art, and

any differences between the claims of the ’065 Patent and Kawai would have been obvious to a POSITA based on the disclosures of the applied references and the knowledge in the art. Any secondary considerations evidence Patent Owner may offer in this proceeding would be insufficient to overcome the strong evidence of obviousness of claims 1-9 and 11.

B. Discretion to Institute

The PTAB should not deny this Petition under § 314(a) for at least two reasons. First, Petitioners have not challenged the ’065 Patent in any prior AIA trial proceeding. Based on a review of Docket Navigator® data, the ’065 Patent has not been challenged in any prior AIA trial proceeding. This Petition is not a “follow-on” petition as was the case in *General Plastic Co., Ltd. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 (PTAB Sep. 6, 2017) (precedential as to Section II.B.4.i.).

Second, events in the parallel district court litigation do not warrant denial. Trial in the parallel district court litigation is scheduled to begin on April 20, 2020 (Ex.1014 at 14), well after institution, patent owner discovery, petitioner discovery, and oral argument is likely to occur in this IPR proceeding. Moreover, denial is not warranted given the likelihood of a stay in the parallel district court litigation if this IPR is instituted. Further, the claim construction standard

employed in this IPR proceeding is the broadest reasonable interpretation,[5] which is different from the standard employed in the parallel district court litigation. As such, the issues presented in this IPR are not co-extensive with the issues in the parallel district court litigation. Thus, the economy, the integrity of the patent system, and the efficient administration of the Office do not warrant denial.

This Petition should not be denied under § 325(d) for at least four reasons. First, Kawai is mentioned in the background of the '065 Patent and was made of record during prosecution. Ex.1001 at 1:64-2:5, Ex.1002 at 96. However, the Examiner did not address or apply Kawai in any respect during prosecution of the '065 Patent. *Id.* at 75-78; 91-95.

Second, Baba was made of record during prosecution of the '065 Patent. *Id.* at 97. However, the Examiner did not address or apply Baba in any respect during prosecution of the '065 Patent. *Id.* at 75-78; 91-95.

Third, there is no indication anywhere in the file history of the '065 Patent that the Examiner considered an argument based on the *combination* of Kawai and Baba now presented in this Petition. *Id.*

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[5] This Petition is filed before November 13, 2018. Challenged claims are to be given their broadest reasonable interpretation.

Fourth, the background section of the ’065 Patent provides an incomplete summary of Kawai. The ’065 Patent discloses:

> “U.S. Pat. No. 5,417,572 [Kawai] discloses a computer-based method for extracting a finish line for designing an artificial crown. Amounts of variation of data representing the shape of an abutment tooth are determined, and a train of points is extracted from the amounts of variation. Then a developed view of the surface shape of the abutment tooth is displayed, and the obtained train of points is also displayed in the developed view. The finish line for designing the artificial crown is determined, based on thus displayed train of points.”

Ex.1001 at 1:64-2:5. This summary of Kawai omits pertinent disclosures of the reference relied upon herein.

The summary in the ’065 Patent fails to acknowledge that Kawai discloses that the finish line may be **manipulated by a user** to correct the position of the margin line. *See* Ex.1003 at 3:35-40 (explaining that the train points 11 with the arrows pointing to them of FIG. 1A can be clicked and dragged by a user to be moved to a desired position to correct the finish line). The summary of Kawai provided in the ’065 Patent also fails to acknowledge that Kawai discloses that it is conventional for a dentist or dental technician to determine the finish line. *Id.* at 1:15-44.

In addition, the ’065 Patent states that Kawai discloses placing a train of points on the “developed view”. But Kawai’s disclosure is not limited to placing the train of points only on the developed view. Rather, Kawai also discloses that the train of points and the margin line may be simultaneously shown on the 3D model of the abutment tooth and the developed view. Ex.1003 at 3:61-68 (“The point train and the connecting lines, representing the margin area, can be displayed both in the three-dimensional shape and in the developed view.”). Kawai additionally discloses that the correcting operation for the points may be conducted on the display of the three-dimensional shape. *Id.* at 3:68-4:3 (“The above-mentioned correcting operation for the points may be conducted on the display of the three-dimensional shape”).

Consideration of the six factors set forth in *Becton, Dickinson & Company v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 (PTAB Dec. 15, 2017) (informative) does not warrant denial under § 325(d). Concerning factor (1), the only reference applied by the Examiner (U.S. Patent No. 6,575,751 to Lehmann) was cited for generally disclosing a dental machine with a processor and a display and was not relied on for disclosing any of the aspects related to defining a finish line disclosed by Kawai and Baba cited in this Petition (*see* Section VII.A.1.). Ex.1002 at 92-93. Concerning factor (2), the disclosures of Kawai and Baba discussed above are not cumulative to Lehmann or how the Examiner may have

understood Kawai based on the incomplete background discussion in Kawai discussed above. Concerning factor (3), the examiner during prosecution did not apply Kawai or Baba in a rejection or otherwise substantively treat Kawai or Baba. Concerning factor (4), Applicant made no substantive argument in response to prior art during examination. *See* Section V.A.3. Concerning factor (5), there is no record that the Examiner substantively evaluated Kawai and Baba. Petitioners have shown there is a reasonable likelihood that claims 1-9 and 11 would have been obvious over Kawai in view of Baba, thus demonstrating that the Examiner erred in allowing the application which issued as the '065 Patent. Concerning factor (6), the incomplete description of Kawai in the background of the '065 Patent does not warrant denial of the grounds presented herein. As explained above, the description of Kawai in the background of the '065 Patent fails to acknowledge key disclosures of Kawai. Nor was the Patent Office ever previously presented with an argument based on the combination of Kawai and Baba as presented in this Petition.

IX. CONCLUSION

For at least the reasons given above, claims 1-9 and 11 of the '065 Patent are unpatentable. Petitioners have shown a likelihood of success on the merits. Therefore, this Petition should be granted and the Board should institute trial.

Respectfully submitted,

Date: November 7, 2018

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APPENDIX A - LIST OF EXHIBITS

EXHIBIT	DESCRIPTION
1001	U.S. Patent No. 7,112,065, issued on September 26, 2006 to A. Kopelman *et al.* ("the '065 Patent")
1002	File History of U.S. Patent No. 7,112,065
1003	U.S. Patent No. 5,417,572, issued on May 23, 1995 to M. Kawai *et al.* ("Kawai")
1004	U.S. Patent No. 6,049,743, issued on April 11, 2000 to M. Baba ("Baba")
1005	Memorandum Opinion issued September 7, 2018 in C.A. No. 17-1646-LPS-CJB
1006	PCT International Application Publication No. WO 97/03622, published on February 6, 1997 ("Kopelman")
1007	PCT International Application Publication No. WO 00/08415, published on February 17, 2000 ("Babayoff")
1008	U.S. Patent No. 6,915,178, issued on July 5, 2005 to M. O'Brien *et al.* ("O'Brien")
1009	Willer, J. et al., *Computer-Assisted Milling Of Dental Restorations Using A New CAD/CAM Data Acquisition System*, J Prosthet Dent. Sep; 80(3):346-53 (1998)
1010	U.S. Patent No. 4,742,464, issued on May 3, 1988 to F. Duret *et al.* ("Duret")
1011	U.S. Patent No. 6,648,640, issued on November 18, 2003 to R. Rubbert *et al.* ("Rubbert")
1012	Declaration of Eli Saber
1013	*Curriculum Vitae* of Eli Saber
1014	Scheduling Order filed May 18, 2018 in *Align Technology, Inc. v. 3Shape A/S*, Civil Action No. 1:17-cv-01646 (D. Del.)

EXHIBIT	DESCRIPTION
1015	U.S. Provisional Application No. 60/397,672 filed Jul. 22, 2002
1016	The American Heritage College Dictionary, 3rd Edition, 1997, Houghton Mifflin Company, p. 1074 (definition of "practitioner")
1017	U.S. Patent No. 5,350,297 issued on September 27, 1994 to R. Cohen ("Cohen")
1018	U.S. Patent No. 4,531,916 issued on July 30, 1985 to T. Scantlebury *et al.* ("Scantlebury")
1019	U.S. Patent No. 5,880,962 issued on Mar. 9, 1999 to M. Andersson *et al.* ("Andersson")
1020	U.S. Patent No. 5,562,448 issued on Oct. 8, 1996 to D. Mushabac ("Mushabac")
1021	U.S. Patent No. 5,212,563 issued on May 18, 1993 to H. Sato ("Sato")
1022	U.S. Patent No. 5,564,113 issued on Oct. 8, 1996 to D. Bergen *et al.* ("Bergen")

APPENDIX B – ADDITIONAL REAL PARTIES-IN-INTEREST

Allan Junge Hyldal	Lars Henrik Jakobsen
Anders Gaarde	Lars Henriksen
Anders Kjær-Nielsen	Lei Zhang
Anja Engblad	Lene Nørgaard
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CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

I hereby certify that the word count for the foregoing Petition totals 13,714 words, excluding the parts which are exempted by 37 C.F.R. § 42.24(a)(1).

Date: November 7, 2018

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CERTIFICATE OF FILING AND SERVICE

The undersigned hereby certifies that on this 7th day of November, 2018, a true and correct copy of the foregoing **PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 7,112,065 B2 UNDER 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq*.** and **EXHIBITS 1001-1022** were filed via PTAB E2E and served by overnight UPS on the correspondence address of record for **U.S. Patent No. 7,112,065** as follows:

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