(19) DANMARK

(10) **DK/EP 3545904 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***A 61 C 13/00 (2006.01)*** ***A 61 C 9/00 (2006.01)*** ***A 61 C 13/08 (2006.01)*** ***A 61 C 13/34 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2021-11-22**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-10-06**

(86) Europæisk ansøgning nr.: **19165179.3**

(86) Europæisk indleveringsdag: **2019-03-26**

(87) Den europæiske ansøgnings publiceringsdag: **2019-10-02**

(30) Prioritet: **2018-03-29 DE 102018107658**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Shera Werkstoff-Technologie GmbH & Co KG, Espohlstrasse 53, 49448 Lemförde, Tyskland**

(72) Opfinder: **SIEKER, Guido, Kleiberweg 25, 32312 Lübbecke, Tyskland**

(74) Fuldmægtig i Danmark: **Dennemeyer & Associates S.A, P.O. Box 700425, DE-81304 Munich, Tyskland**

(54) Benævnelse: **FREMGANGSMÅDE TIL FREMSTILLING AF EN ARBEJDSMODEL TIL DENTALMEDICINSKE FORMÅL UD FRA ET DIGITALISERET AFTRYK**

(56) Fremdragne publikationer:
WO-A1-2011/103879
WO-A2-2014/018829
DE-A1- 3 824 786
US-A1- 2013 216 980

METHOD FOR PRODUCING A WORKING MODEL FOR DENTAL USE FROM A DIGITISED REPLICATION

The present invention relates to a method for producing a working model for dental use from a digitised impression.

According to the prior art, the following procedure is generally used in the manufacture of single crowns as dental prostheses. A dentist takes an actual impression of a tooth stump to be repaired with its adjacent intact teeth in the mouth of a patient (dental impression). This is done with the aid of impression agents that are introduced into the patient's mouth and harden there. Saliva or blood residues are usually still attached to the dental impression. The dental impression is therefore disinfected.

The dental impression is sent to a dental laboratory by post or a courier service. The dental impression is cleaned. A model made of plaster of Paris or another material such as a hardenable polymer (e.g. made of a polyurethane, polyepoxide or similar) is produced from the dental impression (model 1). Plaster of Paris is preferably used for this. The tooth stump to be restored is prepared from the model (for example sawed out and/or milled out). The result is a removable tooth stump made of plaster of Paris, the shape of which is conical below the preparation margin. The preparation margin of the stump must be machined out very precisely, since this line later (when the dental prosthesis is modelled on it) forms the boundary between the dental prosthesis and the prepared tooth. Gap formations promote bacterial infections.

The tooth stump obtained in this way is provided with a cone (also made of plaster of Paris, for example). The prepared tooth surface is connected to the larger base surface of the cone; it then sits on top of the cone.

Then the surface of the cone with the tooth stump prepared on it is treated with an insulating agent. The tooth stump with the cone is repositioned in the impression (dentist/from the patient). The positioning is carried out in such a way that the row of teeth with the stump is ‘isotactic’. This is a particular piece of craftmanship.

The entire impression (dentist/from the patient) with the tooth stump positioned therein (with the cone) is refilled with plaster (model 2). The plaster hardens and, when the process is successful, the cone with the stump can be pulled out of the newly filled impression. Sometimes, however, small protrusions or tilting arise(s), such that the cone (with the stump) cannot be pulled or pressed out of the model. Then all of the work has to be repeated.

The dental technician models the complete tooth from wax or similar on the tooth stump

(with the cone) and checks his/her modelling success, i.e. the geometric compatibility with the adjacent intact row of teeth as regards height, axial direction, space requirement and the gumline. For this purpose, the dental technician introduces the modelled tooth into model 2 several times, if necessary. For example, in a casting process (e.g. CoCrMo alloy casting), the tooth crown is made from this as a dental prosthesis.

The above descriptions clearly show the numerous operations, the associated time expenditure and the high material cost of using the conventional operations necessary according to the current prior art for the production of a single crown.

US 2017/0049542 A1 describes a method in which a virtual model of a row of teeth is created, wherein the teeth are designed as removable components that fit into corresponding indentations in the gingival region of the virtual model, wherein means for holding and positioning each removable component are provided in the relevant indentation in the virtual model and these means for holding and positioning are designed such that the contact surface in the connection region between the removable component and the wall of the indentation is guided by the shape of the adjacent surfaces. In this document, however, the real model of a tooth stump is not fitted into the real model of the row of teeth with the other teeth by means of a cone.

US 2009/0220916 A1 describes a method for creating a three-dimensional model of a dental impression, in which at least part of an upper or lower jaw impression is scanned, the quality of the impression scan is evaluated and the impression scan is used to create a three-dimensional model for the dental impression. The dental model can be produced here by 3D printing. The orientation and localisation of a dental implant is determined in this case on the basis of previously scanned data.

A method for producing a working model for dental use from a digitised impression is known from WO 2011/103879 A1, in which the tooth stump is mounted on a cylinder. In the case of a cylinder with a columniform geometry, there is a risk of tilting when the tooth stump is inserted into a recess in the model of the row of teeth. Protection against rotation, which prevents any rotation of the tooth stump about its longitudinal axis, is similarly not provided in this known solution.

US 2013/216980 A1 describes a dental model in which the part relating to the row of teeth has a seat for a shaft region on which the tooth stump is disposed, wherein the shaft region can be inserted into the seat. In a variant described in the examples, there is a conical transitional section under the tooth stump, but the actual shaft region lies below this transitional section. This shaft region has a polygonal cross section with angular ribs and several integrally formed balls which protrude outwards and engage in corresponding

spherical indentations in the seat. However, the shaft region is not fitted (form-fit) into the seat, but rather folded springs are used, such that the shaft is held in the seat by the spring force of the compressed spring.

DE 38 24 786 A1 describes a master model for the production of dental prostheses, in which the tooth rests on a conically shaped tooth stump which sits in a correspondingly shaped seat of an insert, wherein the seat is aligned in a receiving opening of a base. The base is in turn inserted into a milling base. Protection against rotation for the cone in the seat is not provided here.

The object of the present invention is to provide a simple and, at the same time, reliable method for producing a working model for dental use which, through precise and targeted positioning of the tooth stump, makes it possible to achieve the desired orientation of the tooth crown to be produced in the dental arch of the patient's teeth adjacent to the tooth crown.

This object is achieved by a method for producing a working model for dental use from a digitised impression having the features of Claim 1.

In the method according to the invention, in order to prevent rotation of the cone on which the model of the tooth stump is disposed, a lateral indentation as protection against rotation is introduced in the cone in a corresponding recess in the model of the row of teeth, wherein a corresponding raised region in the conical recess of the model corresponds to this indentation and engages in the indentation to fit it.

In the method according to the invention:

-- a digital data set is created by means of an intraoral scanner to represent a model of an existing row of teeth including a tooth stump to be provided with a tooth crown,

-- the digital data relating to the tooth stump are separated from the data relating to the row of teeth with the other teeth,

-- a real model of the row of teeth with the other teeth without the tooth stump is created with 3D printing on the basis of the digital data,

-- using the digital data relating to the tooth stump, the tooth stump is first placed virtually on a cone,

-- a real model of the tooth stump placed on the cone is created with 3D printing on the basis of the digital data and, in the region of the extracted tooth stump, is complementary to the real model of the row of teeth with the other teeth,

-- the real model of the tooth stump is fitted into the real model of the row of teeth with the other teeth by means of the cone.

Then, in a manner known per se, a model of the tooth crown to be created can be

modelled on the tooth stump, from which the tooth crown is then produced, wherein the model of the tooth crown is modelled using the complementary models of the row of teeth and the tooth stump such that the model of the tooth crown fits in a precisely defined position into the model of the row of teeth.

Unlike the case in the prior art, according to the invention, a digital image of the dental situation in the patient's mouth is thus first created by means of an intraoral scanner, by means of which digital image the tooth stump that is to be crowned and the adjacent teeth of the dental situation are captured. Then a real model of the row of teeth is created, but the tooth stump is digitally separated from the model, as it were, so that on the one hand data relating to the other teeth of the dental situation are obtained, with a conical hole where the tooth stump was, and on the other hand, data of the digitally separated tooth stump on a cone are obtained. With these data, real models of the dental situation with the other teeth on the one hand and the tooth stump on the cone on the other hand can now be created, wherein these real models according to the invention are created with 3D printing with the aid of the previously obtained data.

This results in two mutually complementary models with a precise mutual fit, which models the dental technician can join and separate as often as required in the subsequent production of the tooth crown on the tooth stump of the model in order to produce the crown on the tooth stump or firstly a model of this crown such that it fits precisely into the situation of the adjacent teeth of the dental situation with respect to axial position and orientation.

Since, when the patient's dental situation is scanned, data are usually obtained only from the scanned surface, it is preferred that the data obtained by means of the intraoral scanner are first converted into data suitable for 3D printing, using suitable software, for example CAD software.

According to a preferred development of the solution according to the invention, the exact axial position of the model of the tooth stump in the model of the row of teeth is specified by the length of the cone and/or the cone angle of the cone. According to this preferred variant of the invention, the tooth stump is positioned in the digital model (i.e. virtually) on a cone, which is separated from the digital model of the dental situation with the other teeth so that a conical indentation remains there. If real models are then created with 3D printing from these digital models of the dental situation on the one hand and the cone with the tooth stump on the other hand, the cone fits exactly into the conical indentation. When the cone is later manually inserted into the conical indentation by the dental technician, the coordinates of the exact position of the cone are defined using more or

less cylindrical coordinates, i.e. the axial position of the tooth stump, firstly, is defined by the length of the cone and the cone angle. The rotational position of the tooth stump is defined by the rotational position of the cone in the conical indentation.

The method according to the invention ensures a high degree of precision, as a cone with defined properties is created with 3D printing, which enables the dental technician to use it to produce a precision implant. For this purpose, a correspondingly shaped cavity (a recess) is constructed in the model of the row of teeth, into which the cone can be inserted. Defined design features are specified for the cone, namely cone angle and cone length, by means of which the exact axial position can be set.

According to a preferred development of the invention, it is proposed that the cone length be in the range of approximately 10 mm to approximately 30 mm. Experience has shown that a cone length in this order of magnitude is sufficient to create a form fit with the model of the dental situation with the other teeth when the cone on which the tooth stump is disposed is inserted into the indentation in the dental situation.

The cone angle (λ) is particularly preferably between approximately 2° and approximately 20°, wherein the tooth stump is mounted on the wider end of the cone. The cone angle is thus preferably relatively small. Since the specified cone angle indicates the angle that the lateral surface of the cone forms with the vertical, a small cone angle produces a comparatively steep cone. Since the cone was previously 'digitally' separated from the model of the row of teeth, the lateral surface exactly matches the surface of the indentation receiving the cone in the model of the row of teeth. The main advantage lies in this absolutely precise fit, due to which the cone fits exactly into the model of the row of teeth and can be removed upwards again from the conical indentation at any time. With a manually produced model (according to the prior art), on the other hand, such accuracy cannot be achieved.

According to a preferred development of the solution according to the invention, the exact axial end position of the model of the tooth stump is defined by means of at least one marking on the cone to which a control window in the model of the row of teeth is assigned. This solution makes it easier for the dental technician to identify whether the cone on which the tooth stump is disposed has been pushed into its intended end position in the conical indentation of the model of the row of teeth.

For example, an indentation can be provided as a marking, preferably an indentation approximately circular in outline in the circumferential region of the cone. The correct position of the indentation and thus of the cone is identified through the control window. The control window should be of the same size as the indentation, which is preferably

disposed in the lower region of the cone, i.e. at its narrower end, so that when the cone is inserted into the conical indentation of the model, the exact position can be identified by the fact that the indentation is aligned with the control window. When fitting the cone into the conical indentation in the model of the dental situation, the dental technician can therefore see through the control window in the latter model and identify, when the indentation in the cone is in alignment with the control window, that the cone has reached its inserted end position exactly.

The problem for the dental technician is that the cone could rotate about its axis when being inserted into the conical indentation, which can result in deviations in the exact positioning of the tooth stump on which the crown is placed. To prevent this, according to the invention,

a lateral indentation as protection against rotation is introduced in the cone in the corresponding cut-out in the model of the row of teeth in order to prevent rotation of the cone on which the model of the tooth stump is disposed, wherein a corresponding raised region in the cut-out of the model of the row of teeth corresponds to the lateral indentation and engages in the indentation to fit it.

This indentation preferably extends in the longitudinal direction of the cone along its lateral surface. This indentation can, for example, have an approximately partially circular cross section. This indentation is assigned a correspondingly shaped region in the conical indentation of the model of the row of teeth, such that when the cone is pushed into the conical indentation, a kind of form fit is produced based on the tongue and groove principle. This gives the cone precise axial guidance when it is pushed into the conical indentation, and rotation of the cone about its longitudinal axis is effectively prevented.

The indentation on the cone can, for example, be designed in such a way that it tapers (conically) from the lower end of the cone in the insertion direction so as to facilitate the insertion of the cone, but, at the same time, as the cone is pushed in further, the fit between the cone on which the tooth stump sits and the row of teeth gradually increases, and the margins between the two components further decrease. This results in a very precise mutual fixing. Unlike the case with hand-made models such as those provided in the prior art, it is possible easily to pull the cone out of the indentation in the model of the row of teeth at any time if, for example, it has been determined that corrections have to be made to the model of the tooth crown. Protrusions or tilting that prevent(s) such pulling out do/does not occur because of the precise production with 3D printing according to a digital model.

According to an exemplary preferred variant of the invention, it is possible for the

indentation on the cone to be approximately partially circular in section and extend along the lateral surface of the cone.

According to a preferred development of the invention, a bore is disposed in the extension of the longitudinal axis of the cone in the model of the row of teeth, below the cut-out into which the cone with the tooth stump can be inserted, such that a tool inserted into the bore can be used to press the cone upwards out of the cut-out. This makes it easier to remove the cone from the indentation, in which it fits very precisely and thus tightly. Even if frictional forces occur as a result, it is easy to remove the cone from the indentation by pressing the cone from the underside through the bore.

According to a preferred development of the invention, the tooth crown is cast in a casting process or is manufactured in a milling process or is manufactured in a 3D printing process according to the model of the tooth crown. To produce the tooth crown itself, various methods known in dental technology can be used as required.

The present invention also relates to a model of a tooth stump placed on a cone for use in a method of the type described above, wherein according to the invention, the model with the cone has been produced in a 3D printing process on the basis of digital data and wherein the cone has at least one marking in its circumferential region, in particular in the form of an indentation in the circumferential region.

According to a preferred development of the invention, the cone has at least one indentation extending along the lateral surface as protection against rotation.

It is also preferably the case that the said indentation in the circumferential region of the cone for protection against rotation has a cross section that tapers continuously in the longitudinal direction along the lateral surface of the cone and/or has a partially circular cross section.

The features mentioned in the dependent claims relate to preferred developments of the solution according to the invention. Further advantages of the invention emerge from the following detailed description.

The present invention is described in more detail below on the basis of exemplary embodiments with reference to the accompanying drawings.

Brief description of the figures:

Figure 1 shows the initial situation of the row of teeth of a patient with a tooth stump to be crowned, digitised by means of an intraoral scanner;

Figure 2 shows a perspective view of a model of the patient's dental situation in which the individual stump has been separated from the model;

Figure 3 shows a schematically simplified view of a cone with the tooth stump of the tooth

to be crowned disposed thereon;

Figure 4 shows a further view of the cone with the tooth stump;

Figure 5 shows a horizontal section through the cone of Figure 4;

Figure 6 shows a further view in which the cone is inserted into the model of the dental situation.

In the following, reference is first made to Figure 1, and the recording of the digital data of the patient's dental situation, which is used to produce a model, is explained in more detail on the basis of this. Figure 1 shows a patient's dental situation 10, of which a digital recording has been made by means of the intraoral scanner. In this dental situation there is a tooth stump 11 which is to be crowned. There are several other teeth 12, 13, 14, 15 neighbouring the tooth stump. The tooth stump 11 has been prepared by a dentist and exposed to below the preparation margin 16. Since, after scanning of the dental situation, initially only data that reproduce the surface of the teeth and the gums are obtained, conversion of these data is then necessary, for example by means of CAD software, in order to obtain, as it were, data of a three-dimensional representation that are suitable for subsequent 3D printing.

Before a model of the dental situation is printed on the basis of the image data obtained in this way, the tooth stump 11 is now virtually, i.e. digitally separated from the model of the dental situation with the other teeth in such a way that a cone 17 is disposed on the underside of the tooth stump 11 and a conical indentation 18 remains in the image of the dental situation 10, which indentation is exactly complementary to the cone 17 that has been separated out. This is possible using data technology, and the result is shown in Figure 2, to which reference is made below.

Figure 2, in perspective from above, shows the digital model of the dental situation 10, from which the cone 17 on which the tooth stump 11 sits has been separated, such that a conical indentation 18 remains between the two teeth 12 and 14, into which indentation the cone 17 fits. The cone 17 with the tooth stump is therefore shown separately in Figure 2.

Using these, as it were, digitally separated data for the cone 17 with the tooth stump on the one hand and for the dental situation 10 with the remaining teeth and the conical indentation 18 created by the removal of the cone, two models are then created with 3D printing, namely the model of the dental situation 10 with the indentation 18 and, on the other hand, the model of the tooth stump 11 sitting on the cone 17.

The latter is shown schematically simplified in Figure 3 in side view. The comparatively slender cone 17 can be seen here, which extends at the upper side up to the preparation

margin 16. The angle that the lateral surface 20 of the cone 17 assumes with the vertical is referred to as λ and is comparatively small; it is in the range from 2° to 20°, for example. The cone is oriented in such a way that the tooth stump 11 rests on its wider upper surface, i.e. the cone becomes narrower from top to bottom in relation to the tooth stump 11.

In Figure 3 it can also be seen that there is an indentation 21 in the lateral surface of the cone 17 approximately in the lower end region, which indentation has a circular outline, for example. This indentation 21 is used to control the correct axial position of the cone 17, when it is reinserted into the indentation 18 in the model of the dental situation 10, in order to test whether the crown produced on the tooth stump is correctly oriented with respect to the neighbouring teeth. This control can be carried out such that a control window 21a (see Figure 2) is located in the conical indentation 18 of the dental situation, so that the dental technician can look through it and then, after inserting the cone 17, see whether the indentation 21 is in alignment with the control window 21a, as the cone 17 is then in its exact axial end position in the conical indentation 18.

In the following, reference is made to Figures 4 and 5, which are used to describe protection against rotation, with the aid of which any rotation of the cone 17 inserted into the conical indentation 18 around its own axis in the indentation can be prevented. For this protection against rotation, an indentation 22 or groove is incorporated into the lateral surface 20 of the cone, which indentation or groove extends in the longitudinal direction from top to bottom along the lateral surface 20 of the cone 17 and extends, for example, to the lower end of the cone, but not to the upper end of the cone, wherein the lower end of the cone is narrower than its upper end on which the tooth stump 11 is disposed. In Figure 5, the indentation or groove 22 can be seen in cross section and it can be seen that it has an approximately partially circular cross section. In Figure 4 it can be seen that the indentation 22 extends in the longitudinal direction along the lateral surface, for example starting from the middle of the cone approximately to its lower end, the indentation 22 itself widening conically from top to bottom.

Figure 6 shows that in the model of the dental situation 10, there is a raised region 23 like a kind of spring in the conical indentation 18, which receives the cone 17, said raised region protruding radially there, such that this raised region 23 engages in the indentation 22 of the cone and creates a guide and a form fit when the cone 17 is pushed into the conical indentation 18 from above. As a result, it is no longer possible for the inserted cone to rotate about its axis, whereby, in addition to the axial end position, the rotational position and orientation of the cone are also defined, such that the cylindrical coordinates of the model of the cone 17 are precisely defined in relation to the model of the dental

situation 10. This results in the exact position of the tooth stump 11 relative to the neighbouring teeth of the dental situation 10, and the dental technician can initially use the position of the neighbouring teeth as a basis when producing a model of the crown on the tooth stump and model the crown such that it fits exactly in the patient's bite.

If this is not the case, the dental technician removes the cone 17, on the top side of which the tooth stump 11 is disposed, from the conical indentation 18. In order to simplify this removal with a precise fit, a bore 24 open at the top to the indentation 18 and at the bottom is provided in the conical indentation 18 at its lower end, so that the cone can be pressed upwards out of the conical indentation 18 by means of a tool inserted into the bore. The bore 24 extends in the axial direction through the model of the dental ridge 10, such that when the tool is inserted into the bore 24, it can be pressed under the lower surface of the cone.

List of reference symbols

10 Dental situation
11 Tooth stump
12 Tooth
13 Tooth
14 Tooth
15 Tooth
16 Preparation margin
17 Cone
18 Conical indentation/recess
20 Lateral surface
21 Circular indentation
21a Control window
22 Indentation, cut-out, groove
23 Raised region
24 Bore

FREMGANGSMÅDE TIL FREMSTILLING AF EN ARBEJDSMODEL TIL DENTALMEDICINSKE FORMÅL UD FRA ET DIGITALISERET AFTRYK

Patentkrav

1. Fremgangsmåde til fremstilling af en arbejdsmodel til dentalmedicinske formål ud fra et digitaliseret aftryk, hvor
--man ved hjælp af en intraoral scanner fremstiller et digitalt datasæt til fremvisning af en model af en eksisterende tandrække (10), der omfatter en tandstump (11), der skal forsynes med en tandkrone,
--man adskiller de digitale data vedrørende tandstumpen (11) fra dataene, der vedrører tandrækken (10) med de resterende tænder,
--man ud fra tandrækken (10) med de resterende tænder uden tandstumpen (11) fremstiller en konkret model i 3D-tryk ved hjælp af de digitale data,
--man ved hjælp af de digitale data vedrørende tandstumpen (11) først anbringer denne virtuelt på en konus (17),
--man ud fra tandstumpen (11), der anbringes på konussen (17), ved hjælp af de digitale data fremstiller en konkret model i 3D-tryk, der i området med den ekstraherede tandstump (11) er komplementær med den konkrete model af tandrækken (10) med de resterende tænder,
--man ved hjælp af konussen (17) indpasser den konkrete model af tandstumpen (11) i den konkrete model af tandrækken (10) med de resterende tænder, kendetegnet ved, at man for at forhindre en rotation af konussen (17), som modellen af tandstumpen (11) befinder sig på, i en tilsvarende konisk udsparing (18) i modellen af tandrækken på konussen (17) indfører en lateral udsparing (22) som drejesikring, som et tilsvarende forhøjet område (23) i den koniske udsparing (18) i modellen af tandrækken (10) svarer til, hvilket forhøjede område griber ind i udsparingen (22), idet det passer til denne.

2. Fremgangsmåde ifølge krav 1, kendetegnet ved, at man ved hjælp af en egnet software konverterer dataene, som er opnået ved hjælp af den intraorale scanner, og som gengiver overfladen af den scannede tandrække (10), til data, der er egnet til 3D-tryk.

3. Fremgangsmåde ifølge krav 1 eller 2, kendetegnet ved, at man fastlægger den nøjagtige aksiale position for modellen af tandstumpen (11) i modellen af tandrækken

(10) via konussens (17) længde og/eller konussens konusvinkel (λ).

4. Fremgangsmåde ifølge krav 3, kendetegnet ved, at konuslængden ligger inden for et område på omtrent 10 mm til omtrent 30 mm.

5. Fremgangsmåde ifølge krav 3 eller 4, kendetegnet ved, at konusvinklen (λ) er mellem 2° og 20°, idet tandstumpen (11) er anbragt på den bredeste ende af konussen (17).

6. Fremgangsmåde ifølge et af kravene 1 til 5, kendetegnet ved, at man fastlægger den nøjagtige aksiale endeposition for modellen af tandstumpen (11) via mindst én markering på konussen (17), som en inspektionsrude i modellen af tandrækken (10) er tilordnet.

7. Fremgangsmåde ifølge krav 6, kendetegnet ved, at der som markering er tilvejebragt en fordybning (21), hvis omrids fortrinsvis er cirkulært, i konussens (17) omfangsområde.

8. Fremgangsmåde ifølge krav 1, kendetegnet ved, at udsparingen (22) på konussen (17) i et snit er udformet delvist cirkulært og strækker sig langs konussens (17) konvekse flade (20).

9. Fremgangsmåde ifølge et af kravene 1 til 8, kendetegnet ved, at der i modellen af tandrækken (10) neden under den koniske udsparing (18), som konussen (17) med tandstumpen (11) kan indsættes i, befinder sig en boring (24), således at man ved hjælp af et værktøj, der indføres i boringen (24), kan presse konussen (17) opad og ud af den koniske udsparing (18).

10. Fremgangsmåde til fremstilling af en tandkrone ud fra en arbejdsmodel til dentalmedicinske formål, kendetegnet ved, at der fremstilles en arbejdsmodel ifølge et af kravene 1 til 9, hvor der på tandstumpen (11) modelleres en model af tandkronen, der skal fremstilles, ud fra hvilken tandkronen efterfølgende fremstilles, hvor modellen af tandkronen modelleres på en sådan måde ved hjælp af den komplementære model af tandrækken (10) og tandstumpen (11), at modellen for tandkronen indføres i modellen af tandrækken (10) i en nøjagtigt defineret position.

11. Fremgangsmåde ifølge krav 10, kendetegnet ved, at tandkronen støbes efter modellen af tandkronen i en støbeproces eller fremstilles i en fræseproces eller fremstilles i en 3D-trykproces.

12. Fremgangsmåde ifølge et af kravene 1 til 9, kendetegnet ved, at udsparingen (22) har et tværsnit, der tilspidses kontinuerligt i længderetningen langs konussens (17) konvekse flade (20).

Figure 1

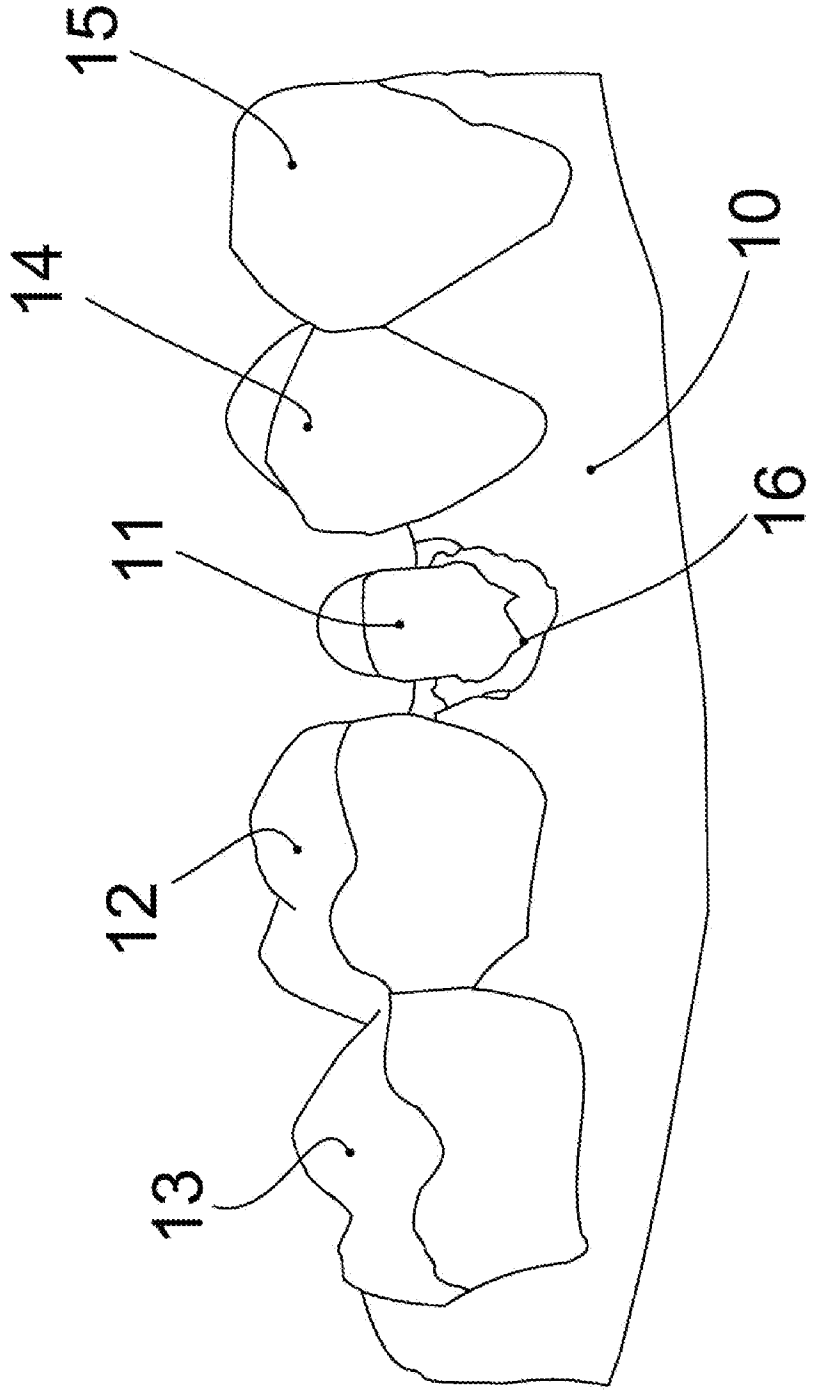

Figure 2

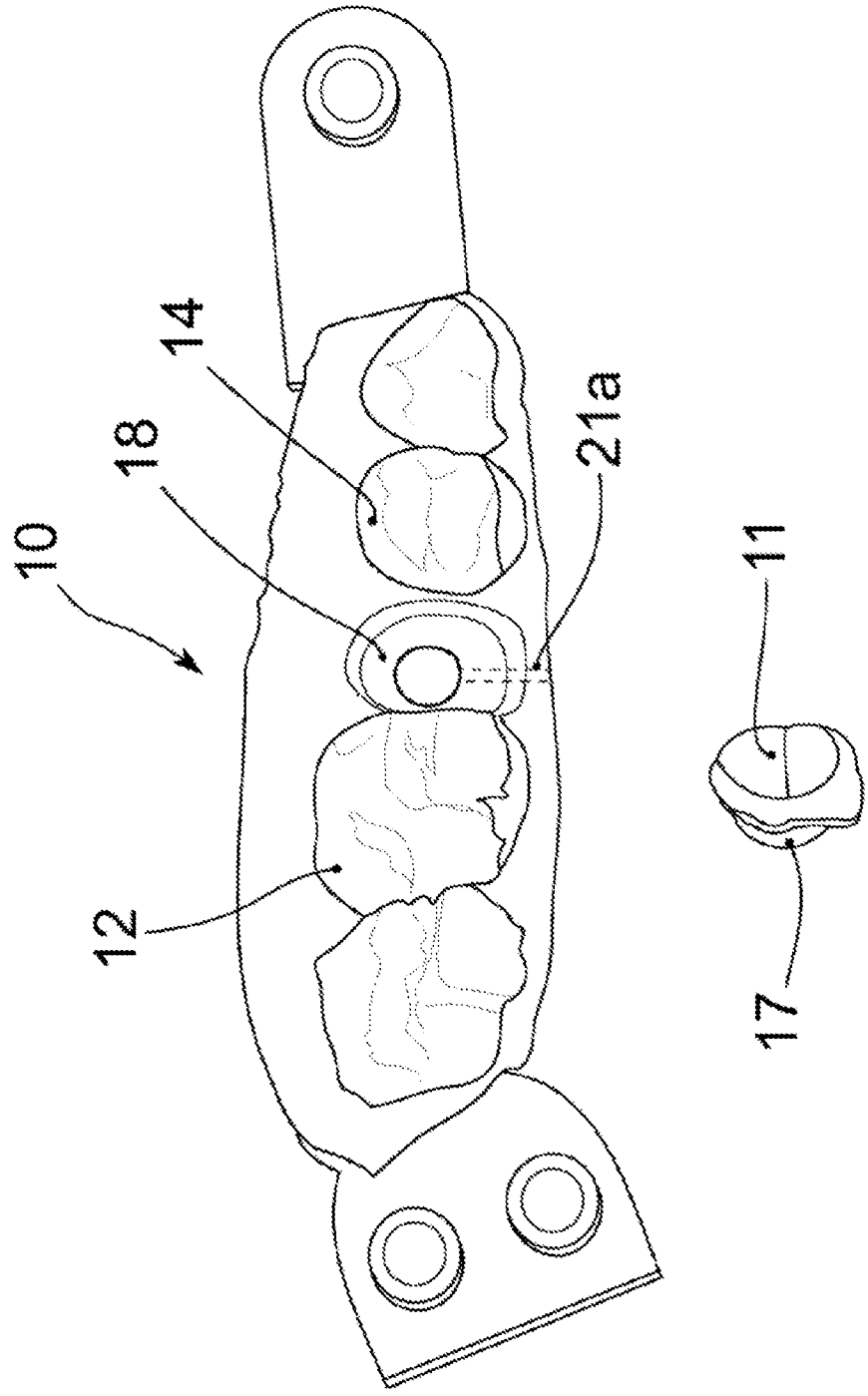

Figure 3

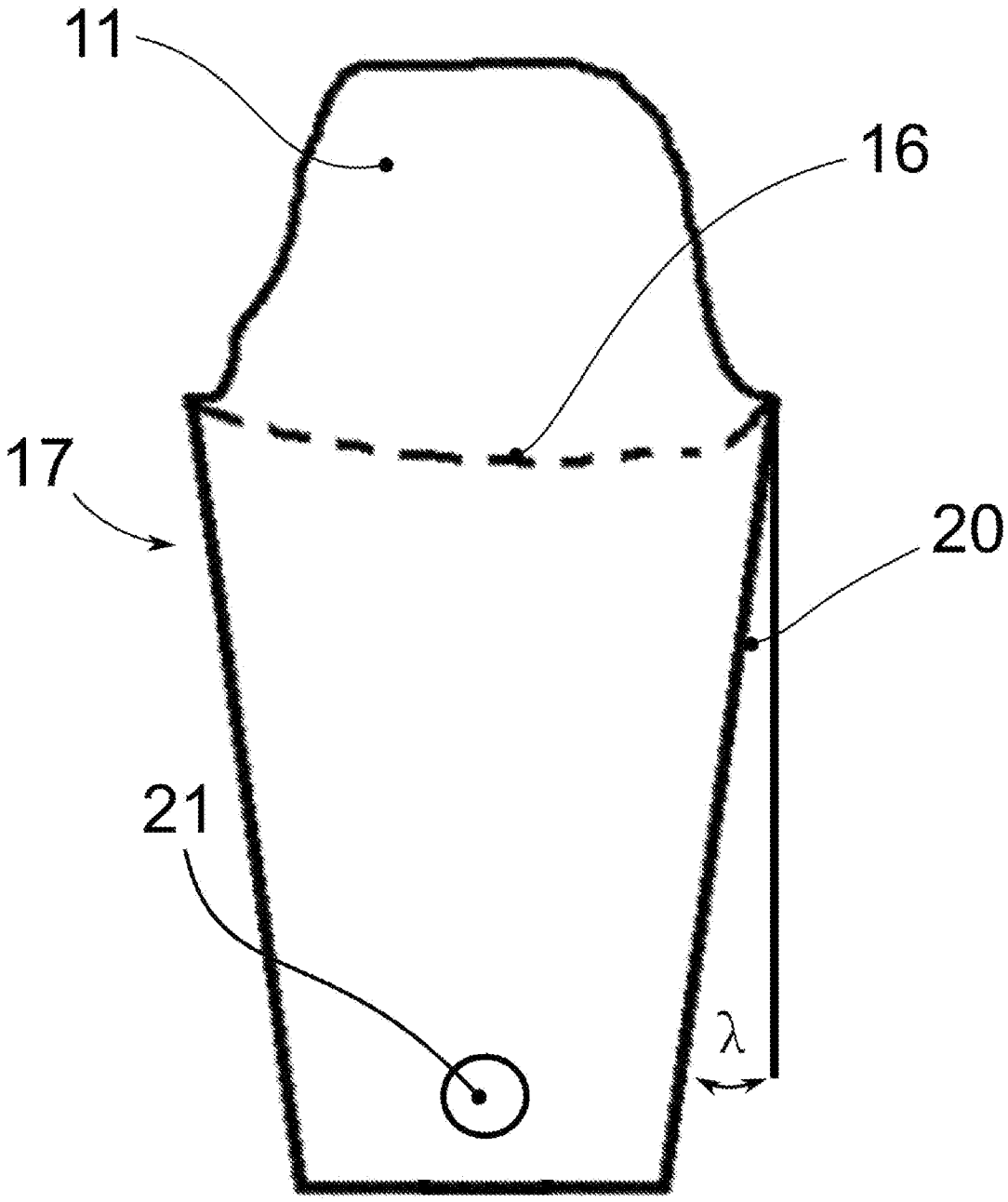

Figure 4

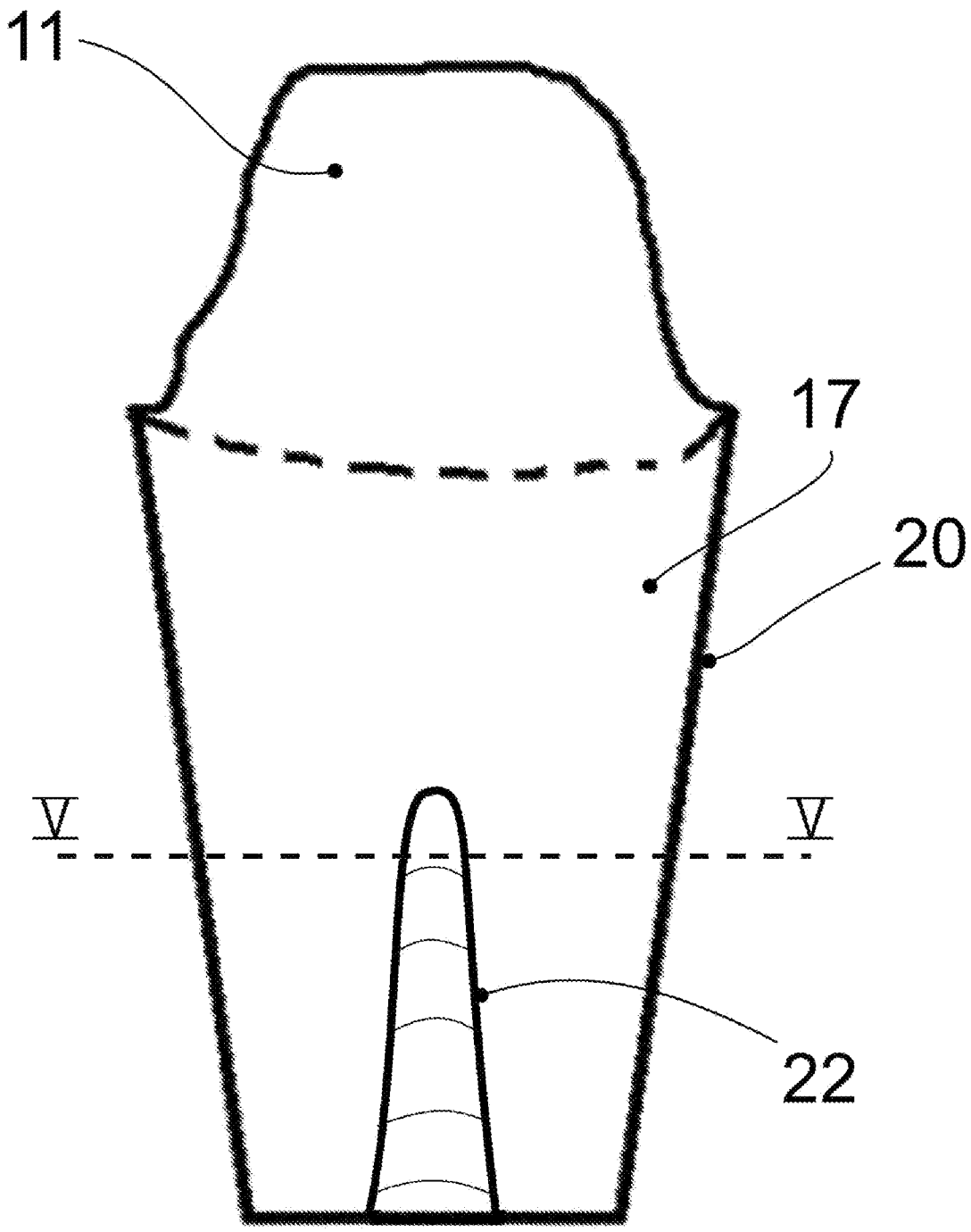

Figure 5

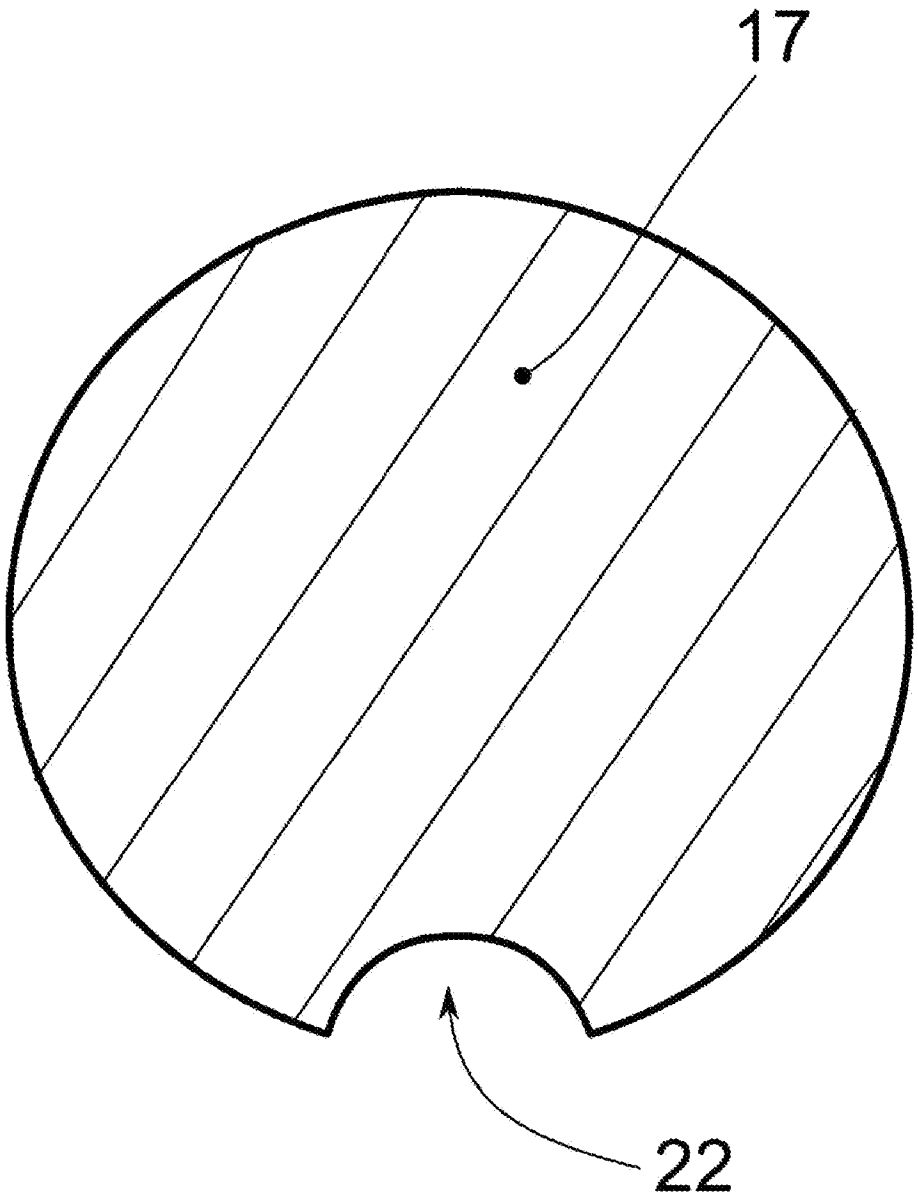

Figure 6