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(73) Patenthaver: **Gebdi Dental-Products GmbH, 3a, Industriestrasse, 78234 Engen, Tyskland**

(72) Opfinder: **Biskupski, Thomas, Industriestrasse 3, 78234 Engen, Tyskland**

(74) Fuldmægtig i Danmark: **NORDIC PATENT SERVICE A/S, Bredgade 30, 1260 København K, Danmark**

(54) Benævnelse: **FREMGANGSMÅDE TIL FREMSTILLING AF EN TANDPROTESE**

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Technical area

The invention relates to a dental prosthesis.

State of the art

Conventionally, at the installation of prefabricated standard prosthetic teeth these have been adapted to the respective oral situation of the patient and grinded accordingly through the dental technician. Today there are already further procedures such as those set out in the DE 10 2015 100 080 B3 or the DE 40 25 728 A1, in which the total prosthesis is set up digitally and is produced by means of the CAD-CAM process.

In this context, reference is made to the DE 10 2012 007 706 A1. There a method for making an artificial denture is revealed, wherein the artificial denture has a base element which comprises at least two tooth blanks which are processed during the process.

Reference is also made to US 2012/0276502 A1. There a procedure for the production of a dental prosthesis is revealed in which the actual situation of the jaw is recorded in order to then produce prosthesis teeth adapted to the actual situation.

Reference is also made to WO 2013/124452 A1. Here, the 3D data of an actual condition of a jaw is gathered, in order to then produce an adapted dental prosthesis.

However, it is still necessary to adapt the standard denture teeth to the individual circumstances and the situation of the patient as well as to the denture base. For this purpose, the standard denture teeth are fixed or embedded in different holders, as for example proposed in the DE 10 2013 112 747 A1 (Procedure and device for holding prefabricated denture teeth) or in the

DE 10 2011 101 678 A1 (Denture tooth carrier). It is essential that the standard denture teeth, in particular, are also machined and adapted on their basal side.

Object of the invention

The object of the invention is to overcome the disadvantages of the prior art. In particular, a procedure is to be provided with which the fabrication of a dental prosthesis can be improved and automated as far as possible, so that the fabrication of a dental prosthesis from a denture base and from standard denture teeth is as simple, complete and cost-effective as possible.

Solution of the object

The features according to the independent claims 1 and 2 lead to the solution of the object. Advantageous modifications are described in the dependent claims.

Procedure of the inventive method:

First, the data on an oral cavity of a patient to whom a dental prosthesis is to be made and adapted are recorded and stored digitally. This can be done completely digitally or partially digitally.

In the fully digital method, the oral cavity situation of a patient is digitally measured, recorded and stored with the aid of a scanner probe and a computer and program.

In the partially digital method, a classical impression of the oral cavity or the corresponding place in the oral cavity is first taken using an analog procedure. With the help of this impression, a plaster model of the patient's situation is then fabricated in a second step. Based on this plaster model, a digital impression of the oral cavity situation is created and stored using a suitable scanner. This means that in this case, the data of an oral cavity is collected and stored via an

analogue impression. This can be advantageous in some cases, especially with regard to specific oral cavity situations. This also makes it possible to use the procedure described below, even if a dentist does not have the necessary equipment for an oral cavity scan or cannot use it for some other reason.

On the basis of the digitally recorded data of an oral cavity, a digital dental prosthesis is designed using a computer-based computer program. This is a CAD technology (CAD - Computer Aided Design). The most suitable standard denture teeth are automatically selected and digitally arranged in a denture base that is also digitally constructed on the recorded data of the oral cavity. The program is also able to take appropriate tooth staining into account automatically or by a user when making the selection by means of additional data entered by the patient.

Furthermore, in connection with one of the digitally created denture bases and the data of the oral cavity situation, it is calculated individually how the individual selected standard denture teeth have to be processed in order to produce the best possible adapted denture. In particular, the adaptation of the tooth length from the basal side is essential.

A workpiece which, according to the invention, is either a plastic workpiece or a wax workpiece, is fed to a machining device. The workpiece is also referred to as a blank in specialist circles.

A machining device is a device which is suitable for removing material from the workpiece or for removing it in another way. These can be CAM based milling systems or laser based SLM systems (Selective Laser Melting).

Furthermore, the machining device is connected to a computer. This is a CAM technology (CAM - Computer-Aided Manufacturing), whereby the processing equipment is controlled on the basis of the dental prosthesis that has been digitally created and stored in the CAD process.

The data of the respective shaping of the individual available standard denture teeth are stored in the computer.

On the basis of this stored data, one or more occlusal impressions are formed by the machining device on the first machining side of the workpiece. The occlusal impressions made on the first machining side of the workpiece mirror the shape of the occlusal surface of the selected standard denture teeth.

Once the occlusal impressions have been formed into the first processing side of the workpiece, the standard denture teeth intended for the denture are inserted into the occlusal impressions with their occlusal side exactly fitting.

The occlusal impressions incorporated into the workpiece on the first machining side have a respective depth which ensures that the majority of the standard denture teeth inserted there protrude from the workpiece with their basal side. The standard denture tooth used in each case engages in the workpiece or the occlusal impression up to a maximum of one third of its total length.

In order to keep the standard denture teeth inserted in the occlusal impressions reversible for processing by the processing device and still sufficiently resilient for processing, a special adhesive can be placed between the occlusal impressions of the workpiece and the occlusal surface of the standard denture tooth in a design example. Adhesives are used which are already used in the medical field and are adapted to the different materials of the workpieces, such as wax or plastic.

An essential property of these adhesives to be used is that they can be easily removed from the occlusal surface of the standard denture tooth after machining the basal side of the standard denture tooth. Adhesives that are water-soluble or can at least be removed by simple manual cleaning are preferred.

The standard denture teeth, which are connected to the workpiece or the individual occlusal impression by means of the adhesive via their occlusal surface side, are now processed by the processing unit.

The standard prosthetic tooth is machined on its basal side in its height, width and thus in its shape, for example using the CAM process. This processing takes place automatically and is based on the data of the dental prosthesis created in the CAD process. An actual/target comparison between the standard prosthesis tooth to be machined and the digital data is constantly carried out by the program and the machining device.

The shape of the finished standard prosthetic tooth, which corresponds to the digitally calculated shape, is captured and stored by the computer in the form of basal machining data.

During the automatic machining of the basal side of the standard prosthetic tooth, circumferential or differently designed holding grooves can also be machined depending on the necessity and design of the standard prosthetic tooth. The retaining grooves serve to accommodate the adhesive to be used and offer additional attachment surface. The retaining grooves are arranged and shaped in such a way that they disappear into the corresponding alveoli when the standard denture tooth is inserted into the denture base and are not visible. They can vary in shape, arrangement and depth. This variation is adapted to the respective shapes of the different standard denture teeth and also depends on the conditions of the individually fabricated denture base.

The machined standard denture teeth are then removed from the occlusal impression and separated from the workpiece. For this purpose, manually exerted tensile force is sufficient.

The adhesive used for temporary fixing can then be easily removed with a brush or by using a solvent useful for this purpose, such as hot water. It is also conceivable that the adhesive to be removed may be removed by steam or other means.

Based on the digitally stored data of the oral cavity and the digitally created dental prosthesis, a prosthesis base is produced by the processing device on the second processing side of the workpiece using appropriate computer-based commands. For this purpose, the machining device is intended to have a machining depth related to the workpiece of 0 to 50 mm, preferably 0 to 40 mm, or even more preferably 0 to 30 mm.

During the preparation or manufacture of the prosthesis base, so-called alveoli are inserted into the prosthesis base at the same time or one after the other. The alveoli are recesses in which the machined standard denture teeth are inserted with their basal side. The special feature of these alveoli is that they are inserted into the denture base by the computer-controlled processing device in such a shape that the mirrored shape corresponds to the processed basal side of the standard denture tooth to be placed in this position. This ensures an accurate fit of the standard prosthetic tooth. Subsequent manual adjustments to the denture are therefore no longer necessary.

If a plastic workpiece is processed in the processing unit, then the standard denture teeth are inserted into the precisely fitting alveoli with another special adhesive into the denture base produced according to the above procedure, so that a durable and load-bearing connection is created between the standard denture teeth and the denture base made of plastic.

Afterwards, only minor corrections to the resulting denture need to be made by a dental technician.

The plastic used for the workpiece can either already have a colour that corresponds to the colour of the gums, or it can be subsequently coloured and/or surface-treated accordingly.

If a wax workpiece is processed in the processing unit, a wax denture base is first created according to the above procedure, into which the standard denture teeth are inserted with a special adhesive. The resulting wax denture is tested at the dentist's by the patient in order to be able to correct the positions of the artificial denture teeth once again if necessary. This corrected position is then returned to the dental laboratory.

The adapted wax prosthesis is then digitally recorded again in the laboratory using a scanner. The data of the adapted wax prosthesis or the wax prosthesis base recorded in this way are processed with the CAM or CAD method so that a prosthesis base made of plastic is produced in the processing unit.

In the laboratory it is of course also possible to use the manual conventional procedure. The processed standard denture teeth are transferred into a final denture base made of plastic. For this purpose, a hollow mould or casting mould, for example made of plaster, is usually constructed on the basis of the adapted wax prosthesis, in which the prosthetic teeth are already integrated. This means that the standard denture teeth are already inserted into the hollow mould when a gum-coloured plastic is cast into the mould. In this way, the denture teeth are automatically bonded to the denture base without any further adhesive. Afterwards, only minor reworking of the denture by the dental technician is necessary.

When machining the workpiece in the machining facility, the above-mentioned processes can also be carried out - although not in accordance with the invention - in such a way that occlusal impressions are made on both the first machining side and the second machining side of a further workpiece according to the selected standard denture teeth. The standard denture teeth used and

machined there are then inserted into an appropriately manufactured denture base made from a different workpiece.

Furthermore, it is also conceivable that on the basis of the scanned and stored data of the adapted wax prosthesis or wax prosthesis base, a prosthesis base made of plastic is produced using a 3D printer, into which the machined standard dentures are then inserted.

Description of the figures

Further advantages, characteristics and details of the invention result from the following description as well as from the drawings; these show in

Figure 1 an exemplary schematic representation of a workpiece 1, 1.2, 1.3 with a view to a first machining page 2;

Figure 2 an exemplary schematic representation of a standard prosthetic tooth 4 from a lateral angle to a basal side 5.

Figure 1 shows an exemplary and schematic illustration of a workpiece 1, which can be designed as a plastic workpiece or a wax workpiece.

The plastic workpiece consists of a plastic or a plastic mixture.

The wax workpiece consists of a wax or a suitable wax mixture.

In the example shown, workpiece 1 is disc-shaped and has a first machining side 2 and an opposite second machining side 3.

The thickness, i.e. the distance between the first machining side 2 and the second machining side 3, of workpiece 1 can have different characteristics. However, these characteristics are preferably between 15 mm and 80 mm.

Workpiece 1 is also shaped in such a way that it can be accommodated in suitable machining equipment for machining. For this purpose, it is round in the design example.

Figure 2 shows a standard prosthetic tooth 4. This standard prosthetic tooth 4 has a basal side 5 and an opposing occlusal surface 6. The illustrated standard prosthetic tooth 4 is an example of the large variety of different standard

prosthetic teeth which are proposed or selected in this invention by a computer-based program suitable for the respective prosthetic situation of each patient.

In addition, horizontally arranged retaining grooves 7 and vertically arranged retaining grooves 7.2 are shown as examples. Horizontal means essentially parallel to the basal side 5. Vertical means essentially angled to the horizontal. These holding grooves 7, 7.2 are arranged by the machining device on the basal side 5 of the standard prosthetic tooth 4. The respective alignment and shape and depth depend on the respective standard denture tooth 4 and the designed denture base.

Reference list

1 workpiece
2 first processing side
3 second processing side
4 standard prosthetic tooth
5 basal side
6 chewing surface
7 horizontal retaining grooves
7.2 vertical retaining grooves

Patentkrav

1. Fremgangsmåde til fremstilling af en tandprotese bestående af en plast-protesebasis og en forkonfektioneret standard-protesetand (4) i en bearbejdningsanordning, hvor digitalt registrerede data af en mundhule indlæses i en computer forbundet med bearbejdningsanordningen, hvor tandprotesen fremstilles og lagres digitalt på grundlag af de digitalt registrerede data af mundhulen ved hjælp af en CAD-proces, hvor bearbejdningsanordningen styres på grundlag af den digitalt fremstillede og lagrede tandprotese, med følgende trin:

a. tilvejebringelse af et plastemne med en første bearbejdningsside (2) og en anden bearbejdningsside (3);

b. valg af en digitalt registreret forkonfektioneret standard-protesetand (4) ved sammenligning med de digitalt registrerede data af mundhulen;

c. i plastemnets første bearbejdningsside (2) indarbejdes et tyggefladeaftryk ved hjælp af den valgte forkonfektionerede standard-protesetand (4) nøjagtigt, og den forkonfektionerede standard-protesetand (4) isættes, således at en basal side (5) af den forkonfektionerede standard-protesetand (4) rager ud af plastemnet;

d. den basale side (5) af den forkonfektionerede standard-protesetand (4) bearbejdes ved hjælp af bearbejdningsanordningen i en højde (h), en bredde (b) og en form, hvor der kontinuerligt udføres en sammenligning mellem den forkonfektionerede standard-protesetand, der skal bearbejdes, og de digitalt registrerede data af tandprotesen fremstillet i en CAD-proces;

e. højden (h), bredden (b) og formen af den bearbejdede basale side (5) af den forkonfektionerede standard-protesetand (4) lagres på computeren som basal-bearbejdningsdata;

f. plastemnets anden bearbejdningsside (3) bearbejdes ved hjælp af dataene af mundhulen og de digitalt registrerede data af tandprotesen fremstillet i en CAD-proces til protesebasen, hvor der fremstilles en alveole ved hjælp af basal-bearbejdningsdataene;

g. den bearbejdede forkonfektionerede standard-protesetand (4) isættes og fastgøres i alveolen.

2. Fremgangsmåde til fremstilling af en tandprotese bestående af en voks-protesebasis og en forkonfektioneret standard-protesetand (4) i en bearbejdningsanordning, hvor digitalt registrerede data af en mundhule indlæses i en computer forbundet med bearbejdningsanordningen, hvor tandprotesen fremstilles og lagres digitalt på grundlag af de digitalt registrerede data af mundhulen ved hjælp af en CAD-proces, hvor bearbejdningsanordningen styres på grundlag af den digitalt fremstillede og lagrede tandprotese, med følgende trin:

a. tilvejebringelse af et voksemne med en første bearbejdningsside (2) og en anden bearbejdningsside (3);

b. valg af en digitalt registreret forkonfektioneret standard-protesetand (4) ved sammenligning med de digitalt registrerede data af mundhulen;

c. i voksemnets første bearbejdningsside (2) indarbejdes et tyggefladeaftryk ved hjælp af den valgte forkonfektionerede standard-protesetand (4) præcist, og den forkonfektionerede standard-protesetand (4) isættes, således at en basal side (5) af den forkonfektionerede standard-protesetand (4) rager ud af voksemnet;

d. den basale side (5) af den forkonfektionerede standard-protesetand (4) bearbejdes ved hjælp af bearbejdningsanordningen i en højde (h), en bredde (b) og en form, hvor der kontinuerligt udføres en sammenligning mellem den forkonfektionerede standard-protesetand, der skal bearbejdes, og de digitalt registrerede data af tandprotesen fremstillet i en CAD-proces;

e. højden (h), bredden (b) og formen af den bearbejdede basale side (5) af den forkonfektionerede standard-protesetand (4) lagres på computeren som basal-bearbejdningsdata;

f. voksemnets anden bearbejdningsside (3) bearbejdes ved hjælp af dataene af mundhulen og de digitalt registrerede data af tandprotesen fremstillet i en CAD-proces til voks-protesebasen, hvor der fremstilles en alveole ved hjælp af basal-bearbejdningsdataene;

g. den bearbejdede forkonfektionerede standard-protesetand (4) isættes og fastgøres i alveolen på voks-protesebasen.

3. Fremgangsmåde ifølge krav 2, **kendetegnet ved, at** der fremstilles en plast-protesebasis af positivformen af voks-protesebasen.

4. Fremgangsmåde ifølge et af kravene 1 til 3, **kendetegnet ved, at** der før isætning af en tyggeflade (6) af den forkonfektionerede standard-protesetand (4) i tyggefladeaftrykket lægges et klæbemiddel mellem tyggefladeaftrykket og tyggefladen (6).

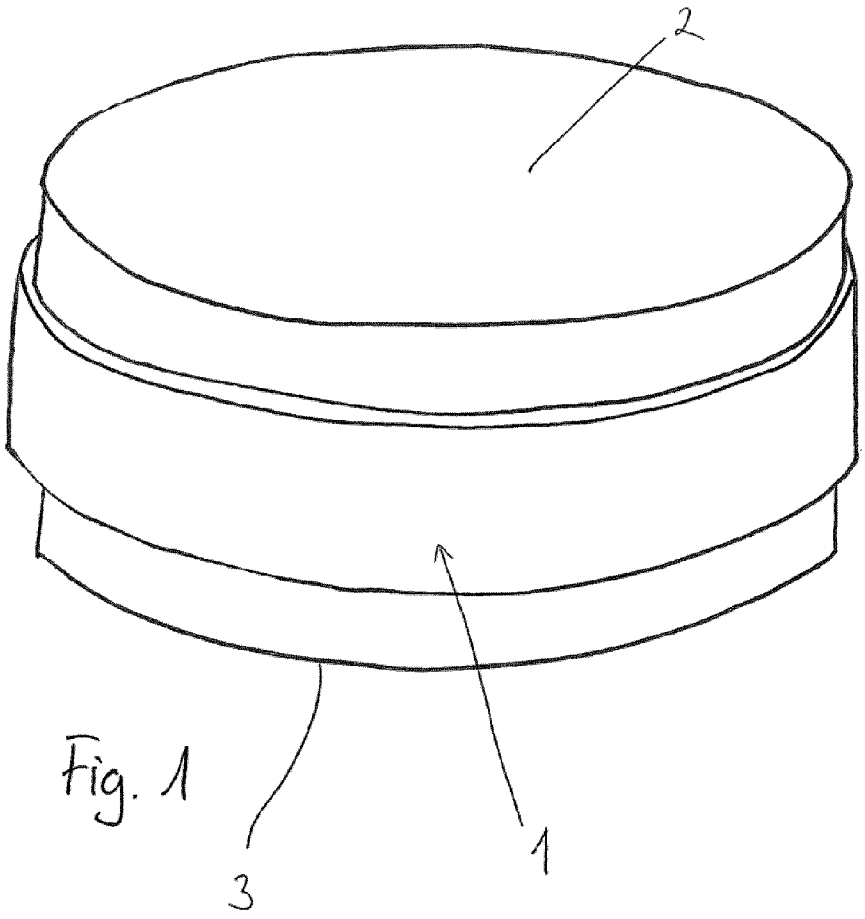

Fig. 1

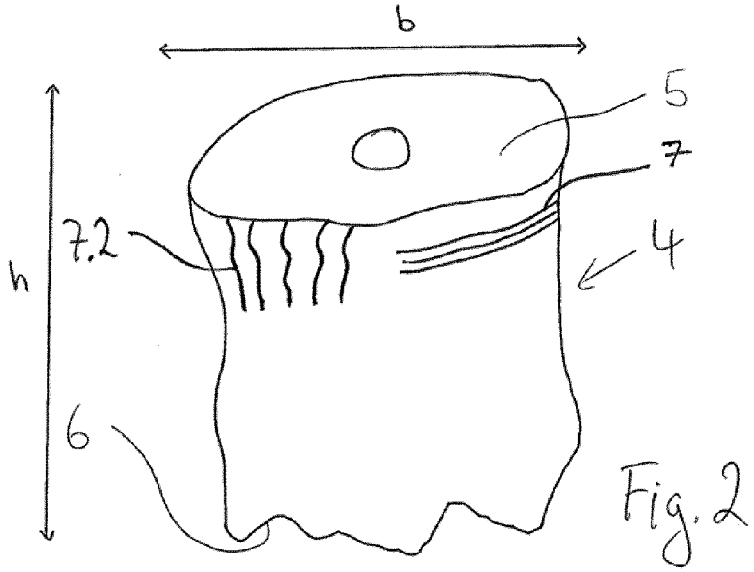

Fig. 2