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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

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(54) Title: DENTAL FITTING ATTACHABLE TO A DENTAL COMPONENT AND DENTAL ASSEMBLY COMPRISING THE DENTAL FITTING AND THE DENTAL COMPONENT

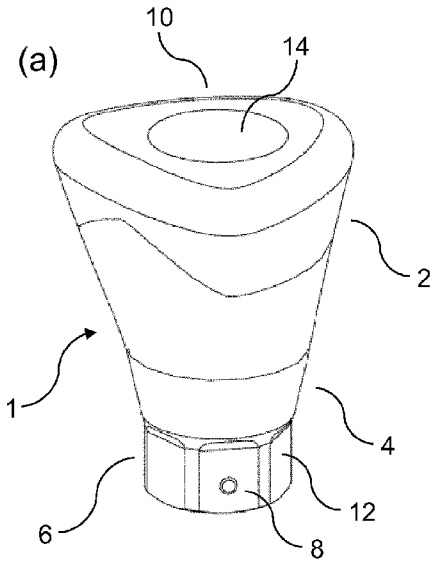

Fig. 1

(57) Abstract: The invention relates to a dental fitting (1, 1', 1") attachable to a dental component (20). The dental fitting (1, 1', 1") comprises a main body (2) comprising a tapering, for example conical, portion (4), and an attachment portion (6) for attaching the dental fitting (1, 1', 1") to the dental component (20). The attachment portion (6) is provided apically to the main body (2). The attachment portion (6) comprises a plurality of projections (8, 8'), each projection (8, 8') extending in one or more directions substantially perpendicular to the direction from the attachment portion (6) towards a coronal end (10) of the main body (2). Each projection (8, 8') is elastically or plastically deformable. The attachment portion (6) is integrally formed with or integrally attached to the main body (2). The body (12) of the attachment portion (6) has a prism shape with a polygonal cross section. A projection (8, 8') of the plurality of projections (8, 8') is provided only on every second side surface of the prism shaped body (12) of the attachment portion (6). The invention further relates to a dental assembly comprising a dental fitting (1, 1', 1") and a dental component (20), wherein the dental fitting (1, 1', 1") is attachable to the dental component (20).

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Dental Fitting Attachable to a Dental Component and Dental Assembly Comprising the Dental Fitting and the Dental Component

Field of the Invention

The present invention relates to a dental fitting, such as an abutment, attachable to a dental component, such as a dental implant. Further, the invention relates to a dental assembly comprising such a dental fitting and the dental component.

Background Art

Dental prostheses, such as dental crowns or dental bridges, are widely used for the treatment of partly or fully edentulous patients. These prostheses are commonly attached to dental implants placed in a patient's jaw bone with the use of an abutment arranged between implant and prosthesis. For this purpose, single-piece abutments, consisting of a single piece, or multi-piece abutments, comprising two or more separate pieces, may be employed.

When providing a patient with a dental prosthesis, the abutment has to be attached to the implant placed in the patient's jaw bone. Further, for the case of a multi-piece abutment, the different pieces of the abutment have to be attached to each other. Moreover, other dental fittings, such as impression taking components, e.g., open or closed tray impression posts, intra-oral scanning or desk top scanning locators, healing caps, temporary restorations etc., may have to be attached to the implant in the treatment process.

In these attachment processes, misfits or misalignments between the dental fitting and the dental component may occur, rendering the attachment complicated and causing the risk of improper placement of the dental fitting.

In particular, when mounting an abutment to a dental implant, it is difficult for a clinician to assess whether the abutment is correctly aligned and properly seated, i.e., fully engaged with the implant. If the abutment is fixed to the implant in an incorrect position, e.g., by engaging and tightening a clinical screw, problems, such as an improper placement of the dental prosthesis, the formation of undesired gaps between different components etc., can arise. For example, the abutment may be unintentionally fixed in a position in which there is a play between abutment and implant.

These difficulties in attaching the abutment to the implant are further aggravated if the implant is placed in the patient's upper jaw bone, due to gravity.

One possible way of verifying whether the abutment is correctly seated in the implant is to take an X-ray image of the patient's jaw bone with the abutment in place. However, this approach renders the attachment process inefficient and expensive.

In order to prevent fixation of the abutment to the implant in an incorrect position, it is known to provide a height lift that prevents a clinical screw from engaging with the implant if the abutment is not fully seated. In this case, the abutment cannot be secured to the implant in an improper position by the clinician. However, this means that the clinician has to repeat the steps of removing the screw, checking the position of the abutment and reinserting the screw until the screw can be engaged, thus rendering the attachment process inefficient and cumbersome. Further, there are several possible reasons why the screw may not properly engage with the implant, such as an incorrect insertion of the screw or damaged threads on the screw and/or the implant. Hence, the fact that the screw cannot be

engaged is not an unambiguous indication of an incorrect placement of the abutment.

US 5,904,483 discloses an impression coping which is attachable to a temporary abutment using a snap fit. The snap fit mechanism comprises projections formed on one of the components and recesses formed on the other of the components. The projections engage the recesses to maintain the components in a desired position relative to each other.

However, the requirement of providing such recesses on one of the components renders the manufacture of the dental systems taught in US 5,904,483 complicated and expensive. Further, the impression copings disclosed in this document can only be used with a particular type of temporary abutment, exhibiting suitably arranged recesses.

Hence, there remains a need for an efficient and versatile approach for attaching a dental fitting, such as an abutment, to a dental component, such as a dental implant, which provides an indication of whether the dental fitting and the dental component are properly attached to each other.

Summary of the Invention

Accordingly, it is an object of the present invention to provide a dental fitting, such as an abutment, attachable to a dental component, such as a dental implant, which, in an efficient and simple manner, provides indication of whether the dental fitting and the dental component are properly located and/or oriented and/or attached to each other. Further, the invention aims to provide a dental assembly comprising such a dental fitting and a dental component.

These goals are achieved by a dental fitting with the technical features of claim 1 and by a dental assembly with the technical features of claim 9.

The invention provides a dental fitting, such as an abutment, attachable to a dental component, such as a dental implant. The dental fitting comprises a main body comprising a tapering, for example conical, portion, and an attachment portion for attaching the dental fitting to the dental component. The attachment portion is provided apically to the main body. Further, the attachment portion comprises a plurality of projections or protrusions, each projection or protrusion extending in one or more directions substantially perpendicular to the direction from the attachment portion towards a coronal end of the main body. Each projection or protrusion is elastically or plastically deformable in the one or more directions substantially perpendicular to the direction from the attachment portion towards the coronal end of the main body. The outer circumference of the tapering portion, in case of a conical portion the diameter of said conical portion, increases with increasing distance from the attachment portion in the direction from the attachment portion towards the coronal end of the main body. The attachment portion is integrally formed with or integrally attached to the main body. The attachment portion comprises a body with an outer side wall extending in parallel to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. The projections or protrusions project from the outer side wall of the body of the attachment portion. The body of the attachment portion has a prism shape with a polygonal cross section perpendicular to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. A projection or protrusion of the plurality of projections or protrusions is provided only on every second side surface of the prism shaped body of the attachment portion.

Each projection or protrusion can thus be elastically or plastically deformed in or along the one or more directions substantially perpendicular to the direction from the

attachment portion towards the coronal end of the main body, i.e., in or along one or more transverse directions of the attachment portion, that is, one or more radial directions of the attachment portion.

The direction from the attachment portion towards the coronal end of the main body is the longitudinal direction of the attachment portion and the dental fitting, i.e., the axial direction thereof.

The attachment portion is integrally formed with or integrally attached to the main body. The attachment portion thus forms an integral part of the dental fitting, such as an abutment for attaching a dental prosthesis, e.g., a dental crown or a dental bridge, to a dental implant.

The dental fitting, such as an abutment, is attached to the dental component, such as a dental implant, by attaching the attachment portion to the dental component.

When attaching the attachment portion to the dental component, each projection is deformed, i.e., compressed, along the one or more transverse directions of the attachment portion, i.e., the radial directions thereof. Thus, each projection presses against an inner side wall of a receiving opening of the dental component. Hence, the attachment portion can be attached to the dental component by friction fit in a reliable and efficient manner.

In this attachment process, a first feedback, in particular, a tactile feedback, is provided to a user when the dental fitting and the dental component are properly aligned with each other, i.e., radially/angularly aligned, and the attachment portion is inserted into the receiving opening of the dental component. In this case, the user experiences a resistance once the projections reach an upper edge of the receiving opening. In order to further introduce the

attachment portion into the receiving opening, the user has to apply an increased pushing force. This increase in the required pushing force provides a clear indication to the user that dental fitting and dental component are correctly oriented relative to each other in the correct manner.

A second feedback, in particular, a tactile feedback, can be provided by the tapering/conical portion of the main body. The outer diameter of the conical portion increases with increasing distance from the attachment portion in the direction from the attachment portion towards the coronal end of the main body. After the attachment portion has been inserted further into the receiving opening, by increasing the pushing force applied by the user as detailed above, the dental fitting can be moved in the apical direction relative to the dental component until the tapering/conical portion reaches an abutting surface of the dental component. When the tapering/conical portion abuts this surface, the movement of the dental fitting relative to the dental component is stopped, indicating to the user that the attachment portion is fully seated within the receiving opening.

Since no recesses or indentations in the inner side wall of the receiving opening for receiving the projections are necessary, the dental fitting of the invention allows for an attachment of the dental fitting, such as an abutment, to the dental component, such as a dental implant, in an efficient and simple manner. Further, a clear indication of whether the dental fitting and the dental component are properly oriented and attached to each other is reliably provided.

A projection of the plurality of projections is provided only on every second side surface of the prism shaped body of the attachment portion. Hence, no projection is provided on the side surfaces of the prism shaped body of the attachment portion which lie between the second side surfaces.

For example, the body of the attachment portion may have a prism shape with a hexagonal cross section perpendicular to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. In this case, the prism shaped body has six side surfaces. The projections may be arranged so that a projection is provided on the second, fourth and sixth side surfaces and no projection is provided on the first, third and fifth side surfaces.

By arranging the projections so that a projection of the plurality of projections is provided only on every second side surface of the prism shaped body of the attachment portion, the alignment feedback and the friction fit are further improved. In particular, in this way, it can be ensured that the dental fitting is efficiently and reliably centered relative to the dental component in the attachment process, enhancing both the feedback effect and the fit of the dental fitting. Further, after attachment of the dental fitting, the fitting is reliably held in its position by friction fit due to the arrangement of the projections.

The attachment portion may be integrally formed with the main body. Herein, the term “integrally formed” denotes that the attachment portion and the main body of the dental fitting are formed as a single piece, i.e., in a one-piece configuration.

Forming the attachment portion and the main body of the dental fitting as a single piece allows for the dental fitting to be manufactured in a particularly simple and efficient manner, e.g., by injection moulding, milling, such as CNC milling, 3D printing, turning, rapid prototyping etc.

The attachment portion may be integrally attached to the main body. Herein, the term “integrally attached” denotes that the attachment portion is attached to the main body of the dental fitting in such a manner that the attachment portion

cannot be detached or separated from the main body without damaging or destroying the attachment portion and/or the main body.

Since the attachment portion is integrally formed with or integrally attached to the main body, a particularly robust and stable configuration of the dental fitting is achieved.

The attachment portion may be provided at an apical end of the dental fitting. The attachment portion may be an apical attachment portion.

Each projection or protrusion of the attachment portion extends in one or more directions substantially perpendicular to the longitudinal direction of the attachment portion, i.e., in one or more transverse directions thereof. In particular, the attachment portion may comprise projections or protrusions, at least one of which extends in plural transverse directions of the attachment portion, i.e., extends along a portion of the outer surface of the remainder of the attachment portion in the circumferential direction of the attachment portion. At least one projection or protrusion may extend along 10% or less, 8% or less, 5% or less, 3% or less, or 1% or less of the outer circumference of the remainder of the attachment portion. Some or all of the projections or protrusions may extend in plural transverse directions of the attachment portion, i.e., extend along a portion of the outer surface of the remainder of the attachment portion in the circumferential direction of the attachment portion. Some or all of the projections or protrusions may extend along 10% or less, 8% or less, 5% or less, 3% or less, or 1% or less of the outer circumference of the remainder of the attachment portion. The projections or protrusions may have the same or different extensions in the circumferential direction of the attachment portion.

The shape of the projections or protrusions is not particularly limited.

For example, one, some or all of the projections or protrusions may have a semi-spherical shape, a cylindrical shape, a prism shape, e.g., with a square or rectangular base area, a pyramidal shape or the like.

One, some or all of the projections or protrusions may be configured so that, in a transverse view, i.e., in a view along a transverse direction of the attachment portion along which a projection or protrusion extends, the projection or protrusion has a circular shape, an elliptical shape, a polygonal shape, such as a triangular shape, a square shape or a rectangular shape, or the like.

The diameter of one, some or all of the projections or protrusions in a transverse view, i.e., a transverse plan view, may be in the range of 0.1 mm to 0.6 mm, preferably 0.2 mm to 0.5 mm and more preferably 0.3 mm to 0.4 mm, e.g., for the case of a circular shape of the one, some or all of the projections or protrusions.

The projecting height of one, some or all of the projections or protrusions, i.e., the extension of one, some or all of the projections or protrusions from the remainder of the attachment portion in the direction substantially perpendicular to the direction from the attachment portion towards the coronal end of the main body, may be in the range of 0.01 mm to 0.10 mm, in the range of 0.02 mm to 0.08 mm or in the range of 0.03 mm to 0.07 mm. The projecting height of one, some or all of the projections or protrusions may be in the range of 0.01 mm to 0.03 mm. Particularly preferably, the projecting height of one, some or all of the projections or protrusions is 0.03 mm.

The projecting height can be designed such that there is an overlapping between a volume passing by the outermost points of the projections or protrusions and an internal volume of a dental component, such as a dental implant, with which the dental fitting is intended to be attached to.

In some particularly preferred embodiments, one, some or all of the projections or protrusions may be made of a polymer, such as polyether ether ketone (PEEK), and the projecting height of the one, some or all of the projections or protrusions may be in the range of 0.03 mm to 0.07 mm. A particularly preferable projecting height is 0.05 mm.

In some particularly preferred embodiments, one, some or all of the projections or protrusions may be made of a metal, such as titanium or a titanium alloy, and the projecting height of the one, some or all of the projections or protrusions may be in the range of 0.01 mm to 0.03 mm. A particularly preferable projecting height is 0.02 mm.

Such dimensions of one, some or all of the projections or protrusions allow for a good insertability of the dental fitting into the dental component, while providing a reliable friction fit and a clear alignment feedback.

A single projection may be provided on every second side surface of the prism shaped body of the attachment portion.

The prism shaped body of the attachment portion may have an even number of side surfaces.

The number of the plurality of projections may be half the number of the side surfaces of the prism shaped body of the attachment portion.

The attachment portion may comprise, for example, two or more projections or protrusions, three or more projections or protrusions, four or more projections or protrusions, five or more projections or protrusions, or six or more projections or protrusions.

The plural projections or protrusions may have the same shapes and/or diameters and/or projecting heights. Alternatively, the projections or protrusions may have different shapes and/or diameters and/or projecting heights from each other.

The dental fitting may be, for example, an abutment, e.g., a single-piece or a multi-piece abutment, a scan abutment, a temporary abutment, an abutment position locator, an impression taking component, such as an open or closed tray impression post or an impression coping, e.g., a screw-less impression coping, an intra-oral scanning or desk top scanning locator, a healing cap, a temporary restoration or a final restoration.

The dental component may be, for example, a dental implant or an implant analogue, e.g., for use in a dental laboratory.

For the case of a multi-piece abutment, e.g., a two-piece abutment, the dental fitting may be one piece of the abutment and the dental component may be another piece of the abutment. In this case, the one piece of the abutment comprises the attachment portion and can be attached to the other piece of the abutment through the attachment portion. Alternatively or in addition thereto, a base piece or unit of the multi-piece abutment may comprise the attachment portion and be attached to a dental implant by the attachment portion.

The dental fitting and/or the dental component may be made of, for example, a metal, such as titanium, a titanium alloy

or stainless steel, a ceramic, a polymer, such as polyether ether ketone (PEEK), or a composite material.

In particular, the dental fitting may be an abutment made of a ceramic, a metal, such as titanium, a titanium alloy or stainless steel, a polymer, such as polyether ether ketone (PEEK), or a composite material. The dental component may be a dental implant made of, for example, a metal, such as titanium, a titanium alloy or stainless steel.

The dental fitting may be made of a material which is radiopaque, i.e., opaque to x-rays, or a material which is transparent to x-rays. For example, the dental fitting may be made of radiopaque polyether ether ketone or of polyether ether ketone which is not radiopaque.

The attachment portion and the main body of the dental fitting may be made from the same material or from different materials. If the attachment portion is made of a material which is different from that of the main body, the retention force, i.e., the friction force, provided by the attachment portion can be set in a particularly simple manner.

The attachment portion comprises a body with an outer side wall extending in parallel to the direction from the attachment portion towards the coronal end of the main body of the dental fitting, and the projections or protrusions project from the outer side wall of the body of the attachment portion.

This configuration of the attachment portion allows for a particularly reliable friction fit and an especially clear alignment feedback.

The body of the attachment portion has a prism shape, e.g., with a triangular, square, rectangular or hexagonal base area. A hexagonal base area is particularly preferred.

The body of the attachment portion has a polygonal cross section perpendicular to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. The polygonal cross section may be a triangular, square, rectangular or hexagonal cross section. A hexagonal cross section is particularly preferred.

Since the body of the attachment portion is configured in this manner, any undesired rotational displacement of the dental fitting and the dental component relative to each other can be particularly reliably prevented.

The body of the attachment portion has a prism shape with a polygonal cross section perpendicular to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. Two or more side surfaces of the prism may each have a single projection or protrusion provided thereon, or at least one side surface of the prism may have two or more projections or protrusions provided thereon.

For the case of a single projection or protrusion on one or more side surfaces of the prism, the single projection or protrusion may be arranged substantially at a center of the respective side surface in the circumferential direction of the attachment portion, i.e., the circumferential direction around the longitudinal direction of the attachment portion.

At least one of the plurality of projections or protrusions may be arranged closer to a coronal end of the attachment portion than to an apical end of the attachment portion. Some or all of the plurality of projections or protrusions may be arranged closer to a coronal end of the attachment portion than to an apical end of the attachment portion.

By choosing such an arrangement of one, some or all of the projections or protrusions, it can be achieved in a simple manner that, in a state in which the attachment portion is received in a receiving opening of the dental component, the one, some or all of the projections or protrusions is arranged closer to a coronal end of the receiving opening than to an apical end of the receiving opening.

This arrangement of the one, some or all of the projections or protrusions thus allows for the attachment portion to be inserted into the receiving opening in an easy manner, while providing a clear alignment feedback.

One, some or all of the projections or protrusions may be arranged in the coronal half of the attachment portion, in the coronal third of the attachment portion or in the coronal quarter of the attachment portion.

The attachment portion may comprise two or more projections or protrusions, each extending in one or more directions substantially perpendicular to the direction from the attachment portion towards the coronal end of the main body.

The two or more projections or protrusions of the attachment portion may be arranged along the circumference of the attachment portion, i.e., sequentially or consecutively arranged in the circumferential direction of the attachment portion. In this case, the two or more projections or protrusions are disposed so that one is arranged after the other in this circumferential direction. The two or more projections or protrusions may be equidistantly spaced from each other or spaced from each other at different intervals in the circumferential direction of the attachment portion.

The projections or protrusions may be arranged on opposite sides of the attachment portion in a radial direction of the attachment portion.

In one embodiment, the body of the attachment portion has a prism shape with a hexagonal cross section perpendicular to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. The attachment portion comprises three projections or protrusions, wherein a single projection or protrusion is provided on every second side surface of the prism shaped body of the attachment portion.

Such arrangements of the projections or protrusions allow for a particularly reliable friction fit and an especially clear alignment feedback.

The two or more projections or protrusions may be arranged at the same height of the attachment portion, i.e., at the same position along the longitudinal direction of the attachment portion, that is, the direction from the attachment portion towards the coronal end of the main body. Alternatively, the two or more projections or protrusions may be arranged at different heights of the attachment portion.

The dental fitting may further comprise a through hole extending through the dental fitting in the direction from a coronal end of the dental fitting to an apical end of the dental fitting. In this case, the dental fitting, such as an abutment, can be fixed to the dental component, such as a dental implant, via the attachment portion by means of a fixing element, such as a screw, that passes through the through hole formed in the dental fitting.

In particular, the dental fitting may be provided with a through hole having a screw seat for retaining a head of the screw. A threaded lower portion of the screw may be inserted into a threaded bore formed in the dental component, so that the dental fitting can be reliably fixed to the dental component via the attachment portion by means of the screw.

By providing the dental fitting with such a through hole, a reversible fixed connection between the dental fitting and the dental component, i.e., a connection that can be easily released, can be obtained.

The tapering/conical portion of the main body may be provided adjacent to the attachment portion, i.e., so that the tapering/conical portion is arranged directly next to the attachment portion in the direction from the attachment portion towards the coronal end of the main body, without any intermediate portions therebetween. Alternatively, one or more intermediate portions may be arranged between the tapering/conical portion and the attachment portion in the direction from the attachment portion towards the coronal end of the main body.

The smallest outer diameter of the tapering/conical portion may be substantially identical to the outer diameter of the attachment portion. If the tapering/conical portion is provided adjacent to the attachment portion, there may be a substantially continuous or stepless transition between tapering/conical portion and attachment portion.

The attachment portion may be made of, for example, a metal, such as titanium, a titanium alloy or stainless steel, a ceramic, a polymer, such as polyether ether ketone (PEEK), or a composite material. Polyether ether ketone and titanium are particularly preferred materials for the attachment portion.

The attachment portion may be made of a material which is radiopaque, i.e., opaque to x-rays, or a material which is transparent to x-rays. For example, the attachment portion may be made of radiopaque polyether ether ketone or of polyether ether ketone which is not radiopaque.

The attachment portion may be manufactured, for example, by injection moulding, milling, such as CNC milling, 3D printing, turning, rapid prototyping etc.

The invention further provides a dental assembly comprising a dental fitting, such as an abutment, and a dental component, such as a dental implant, wherein the dental fitting is attachable to the dental component. The dental fitting comprises a main body and an attachment portion for attaching the dental fitting to the dental component. The dental component comprises a receiving opening for receiving the attachment portion. The attachment portion is provided apically to the main body. The attachment portion comprises a plurality of projections or protrusions, each projection or protrusion extending in one or more directions substantially perpendicular to the direction from the attachment portion towards a coronal end of the main body. Each projection or protrusion is elastically or plastically deformable in the one or more directions substantially perpendicular to the direction from the attachment portion towards the coronal end of the main body. The attachment portion comprises a body with an outer side wall extending in parallel to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. The projections or protrusions project from the outer side wall of the body of the attachment portion. The body of the attachment portion has a prism shape with a polygonal cross section perpendicular to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. A projection or protrusion of the plurality of projections or protrusions is provided only on every second side surface of the prism shaped body of the attachment portion. The receiving opening has an inner side wall with an even surface facing an outer side surface of the attachment portion in the state in which the attachment portion is received in the receiving opening. In the state in which the attachment portion is received in the receiving

opening, the attachment portion is held in position by friction fit between the even surface of the inner side wall and the outer side surface of the attachment portion.

The explanations and definitions provided above for the dental fitting and the dental component also apply to the dental assembly of the invention.

The dental assembly of the invention provides the effects and advantages already described in detail above for the dental fitting of the invention.

The term "even surface" defines that the surface of the inner side wall of the receiving opening is a surface without recesses or indentations, in particular, without recesses or indentations for receiving the projections or protrusions of the attachment portion.

Since no recesses or indentations in the inner side wall of the receiving opening for receiving the projections or protrusions are provided, the dental assembly of the invention allows for an attachment of the dental fitting, such as an abutment, to the dental component, such as a dental implant, in an efficient and simple manner. Further, a clear indication of whether the dental fitting and the dental component are properly oriented and attached to each other is reliably provided.

The dental component may be, for example, a dental implant or an implant analogue, e.g., for use in a dental laboratory.

For the case of a multi-piece abutment, e.g., a two-piece abutment, the dental fitting may be one piece of the abutment and the dental component may be another piece of the abutment. In this case, the one piece of the abutment comprises the attachment portion and can be attached to the other piece of the abutment through the attachment portion.

Alternatively or in addition thereto, a base piece or unit of the multi-piece abutment may comprise the attachment portion and be attached to a dental implant by the attachment portion.

The dental fitting may be made of the same material as the dental component or of a different material.

The dental component, such as a dental implant, may have a threaded bore for receiving a threaded portion of a screw, such as that described above, and the dental fitting may have a through hole extending through the dental fitting in the longitudinal direction of the dental fitting, as has been detailed above. The through hole may have a screw seat for retaining a head of the screw. In this way, the dental fitting can be fixed to the dental component in a reversible manner by means of the screw.

The attachment portion comprises a body with an outer side wall extending in parallel to the direction from the attachment portion towards the coronal end of the main body of the dental fitting, and the projections or protrusions project from the outer side wall of the body of the attachment portion. The inner side wall of the receiving opening may extend in parallel to the direction from a coronal end of the dental component towards an apical end of the dental component.

The even surface of the inner side wall is thus parallel to the longitudinal direction of the dental component, i.e., the direction from the coronal end towards the apical end of the dental component, in particular, in all positions where the inner side wall abuts the attachment portion.

Thus, the attachment portion can be attached to the dental component by friction fit in a particularly reliable and efficient manner.

The body of the attachment portion has a prism shape, e.g., with a triangular, square, rectangular or hexagonal base area. A hexagonal base area is particularly preferred.

The space enclosed by the inner side wall of the receiving opening may have a prism shape, e.g., with a triangular, square, rectangular or hexagonal base area. A hexagonal base area is particularly preferred.

The body of the attachment portion has a polygonal cross section perpendicular to the direction from the attachment portion towards the coronal end of the main body of the dental fitting. The polygonal cross section may be a triangular, square, rectangular or hexagonal cross section. A hexagonal cross section is particularly preferred.

The inner side wall of the receiving opening may have a polygonal cross section perpendicular to the direction from the coronal end of the dental component towards the apical end of the dental component. The polygonal cross section may be a triangular, square, rectangular or hexagonal cross section. A hexagonal cross section is particularly preferred.

An inner diameter of the inner side wall may be substantially the same as an outer diameter of the body of the attachment portion. The inner diameter of the inner side wall is smaller than the sum of the outer diameter of the body of the attachment portion and the projecting height of the at least one projection or protrusion. A base area or cross section of the inner side wall may be substantially the same as a base area or cross section of the body of the attachment portion, respectively.

In one embodiment, the main body of the dental fitting comprises a tapering or conical portion, the outer diameter

of the tapering or conical portion increasing with increasing distance from the attachment portion in the direction from the attachment portion towards the coronal end of the main body, the dental component further comprises a recess with a tapering or conical inner side wall, the recess being provided coronally to the receiving opening, and the recess is configured for receiving the tapering or conical portion of the main body.

In this way, a second feedback as detailed above can be provided in a particularly reliable and simple manner.

The tapering or conical portion of the main body may be provided adjacent to the attachment portion, and/or the recess may be provided adjacent to the receiving opening, i.e., so that the recess is arranged directly next to the receiving opening in the direction from the coronal end of the dental component towards the apical end of the dental component, without any intermediate portions therebetween.

Alternatively, one or more intermediate portions may be arranged between the tapering or conical portion and the attachment portion in the direction from the attachment portion towards the coronal end of the main body, and/or one or more intermediate portions may be arranged between the recess and the receiving opening in the direction from the coronal end of the dental component towards the apical end of the dental component.

In one embodiment, in the state in which the attachment portion is received in the receiving opening, at least one of the projections or protrusions is arranged closer to a coronal end of the receiving opening than to an apical end of the receiving opening. In the state in which the attachment portion is received in the receiving opening, some or all of the plurality of projections or protrusions may be arranged

closer to a coronal end of the receiving opening than to an apical end of the receiving opening.

This arrangement of one, some or all of the projections or protrusions allows for the attachment portion to be inserted into the receiving opening in an easy manner, while providing a clear alignment feedback.

One, some or all of the projections or protrusions may be arranged in the coronal half of the receiving opening, in the coronal third of the receiving opening or in the coronal quarter of the receiving opening.

The dental fitting of the dental assembly of the invention may be the dental fitting of the invention.

There is further provided a method of attaching the dental fitting according to the invention to a dental component, such as a dental implant.

The method may be a method of attaching the dental fitting according to the invention to a dental component, such as a dental implant, outside a human or animal body. For example, the dental fitting of the invention may be attached to a dental component in a dental laboratory, e.g., using a jaw bone model.

The method of attaching the dental fitting to a dental component provides the effects and advantages already described in detail above for the dental fitting of the invention.

Brief Description of the Drawings

Hereinafter, non-limiting examples of the invention are explained with reference to the drawings, in which:

Fig. 1 shows dental fittings according to first and second embodiments of the present invention, wherein Fig. 1(a) is a perspective view of the dental fitting according to the first embodiment, Fig. 1(b) is a perspective view of the dental fitting according to the second embodiment, Fig. 1(c) is a side view of the dental fitting according to the first embodiment, and Fig. 1(d) is a bottom view of the dental fitting according to the first embodiment;

Fig. 2 shows the dental fitting according to the first embodiment of the present invention, wherein Fig. 2(a) is another side view of the dental fitting according to the first embodiment, Fig. 2(b) is a cross-sectional view taken along the line A-A in Fig. 2(a), and Fig. 2(c) is an enlarged view of the encircled region B in Fig. 2(b);

Fig. 3 shows a dental assembly according to an embodiment of the present invention, comprising a dental fitting according to a third embodiment of the present invention and a dental implant, in a state prior to the attachment of the dental fitting to the dental implant, wherein Fig. 3(a) is a side view of the dental assembly, and Fig. 3(b) is a cross-sectional view taken along the line B-B in Fig. 3(a); and

Fig. 4 shows the dental assembly according to the embodiment shown in Fig. 3 in a state in which the dental fitting has been attached to the dental implant, wherein Fig. 4(a) is a side view of the dental assembly, and Fig. 4(b) is a cross-sectional view taken along the line A-A in Fig. 4(a).

Detailed Description of Preferred Embodiments

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings. In the description, the term conical can also mean "tapering", tapered or taper or in other words "a gradual thinning or narrowing towards one end or direction".

Fig. 1 shows dental fittings 1, 1' according to first and second embodiments of the present invention. The dental fittings 1, 1' are healing abutments, namely single-piece healing abutments, attachable to a dental component, such as a dental implant (see Figs. 3 and 4). The dental fitting 1 according to the first embodiment is also shown in Fig. 2.

The dental fitting 1 according to the first embodiment comprises a main body 2 comprising a conical portion 4, and an attachment portion 6 provided apically to the main body 2, as is shown in Figs. 1(a) and (c) and in Figs. 2(a) and (b). The outer diameter of the conical portion 4 increases with increasing distance from the attachment portion 6 in the direction from the attachment portion 6 towards a coronal end 10 of the main body 2.

The attachment portion 6 comprises three projections 8, each projection 8 extending in a direction substantially perpendicular to the direction from the attachment portion 6 towards the coronal end 10 of the main body 2, i.e., along a transverse direction of the attachment portion 6 (see Figs. 1(d), 2(b) and 2(c)). The three projections 8 are elastically or plastically deformable in the directions substantially perpendicular to the direction from the attachment portion 6 towards the coronal end 10 of the main body 2.

The attachment portion 6 is integrally formed with the main body 2. The conical portion 4 is provided adjacent to the attachment portion 6 (see Figs. 1(c), 2(a) and 2(b)).

The dental fitting 1 is made of a polymer material, such as polyether ether ketone (PEEK), or a metal, such as titanium or a titanium alloy. The dental fitting 1 may be manufactured, for example, by injection moulding, milling, such as CNC milling, 3D printing, turning, rapid prototyping etc. In particular, the dental fitting 1 may be formed from a single piece of titanium or a titanium alloy by milling, e.g., CNC milling. Alternatively, the dental fitting 1 may be formed from polyether ether ketone, e.g., by injection moulding.

The attachment portion 6 comprises a body 12 with an outer side wall extending in parallel to the direction from the attachment portion 6 towards the coronal end 10 of the main body 2 of the dental fitting 1, as is shown in Figs. 1(c) and 2(a). The three projections 8 project from the outer side wall of the body 12 of the attachment portion 6.

The body 12 of the attachment portion 6 has a prism shape with a hexagonal cross section perpendicular to the direction from the attachment portion 6 towards the coronal end 10 of the main body 2 of the dental fitting 1 (see Fig. 1 (d)). The three projections 8 are equidistantly arranged along the circumference of the attachment portion 6, so that a single projection 8 is provided on every second side surface of the prism shaped body 12 of the attachment portion 6. On each second side surface of the body 12, the respective projection 8 is arranged substantially at a center of the side surface in the circumferential direction of the attachment portion 6 (see Fig. 1(d)).

The three projections 8 are arranged at the same height of the attachment portion 6, i.e., at the same position along the longitudinal direction of the attachment portion 6, that is, the direction from the attachment portion 6 towards the coronal end 10 of the main body 2 (see Fig. 1(c)).

In a transverse view, i.e., in a view along a transverse direction of the attachment portion 6 along which the respective one of the three projections 8 extends, each of the three projections 8 has a circular shape, as is shown in Fig. 2(a). The diameter of each of the three projections 8 in the transverse view may be in the range of 0.1 mm to 0.6 mm. The projecting height of each of the three projections 8 may be 0.03 mm. The three projections 8 have the same shapes, diameters and projecting heights.

The projections 8 of the attachment portion 6 allow for the dental fitting 1 to be attached to a dental component, such as a dental implant, by friction fit, as will be explained in detail below with reference to Figs. 3 and 4.

The dental fitting 1 further comprises a through hole 14 extending through the dental fitting 1 in the direction from a coronal end of the dental fitting 1 to an apical end of the dental fitting 1, as is shown in Figs 1(a), 1(d) and 2(b). The dental fitting 1 can be fixed to the dental component, such as a dental implant, via the attachment portion 6 by means of a fixing element, such as a screw, that passes through the through hole 14 formed in the dental fitting 1.

The through hole 14 is provided with a screw seat 16 for retaining a head of the screw (see Fig. 2(b)). A threaded lower portion of the screw may be inserted into a threaded bore formed in the dental component, so that the dental fitting 1 can be reliably fixed to the dental component via the attachment portion 6 by means of the screw. By providing the dental fitting 1 with such a through hole 14, a reversible fixed connection between the dental fitting 1 and the dental component can be obtained.

Fig. 1(b) shows the dental fitting 1’ according to the second embodiment of the present invention. The dental fitting 1’

according to the second embodiment differs from the dental fitting 1 according to the first embodiment only in that projections 8' of the dental fitting 1' have shapes which are different from those of the projections 8 of the dental fitting 1. Hence, the same reference signs as for the first embodiment are used for identical elements and a detailed description thereof is omitted.

Specifically, in a transverse view, each of the three projections 8' has a square shape, as is shown in Fig. 1(b). The side length of the square of each of the three projections 8' in the transverse view may be in the range of 0.1 mm to 0.6 mm. The projecting height of each of the three projections 8' may be 0.03 mm. The three projections 8' have the same shapes, side lengths and projecting heights.

Figs. 3 and 4 show a dental assembly according to an embodiment of the present invention, comprising a dental fitting 1'' according to a third embodiment of the present invention and a dental implant 20 as the dental component.

The dental fitting 1'' according to the third embodiment differs from the dental fitting 1 according to the first embodiment only in the shape of the main body 2. Specifically, the main body 2 of the dental fitting 1'' has a first non-conical, e.g., cylindrical, portion 13 arranged coronally to the conical portion 4 and a second non-conical portion 15 arranged between the conical portion 4 and the attachment portion 6, as is shown in Figs. 3(b) and 4(b). Hence, the same reference signs as for the first embodiment are used for identical elements and a detailed description thereof is omitted.

The dental implant 20 is made of a metal, for example, titanium, a titanium alloy or stainless steel.

The dental implant 20 comprises a receiving opening 22 for receiving the attachment portion 6. The receiving opening 22 has an inner side wall with an even surface facing an outer side surface of the attachment portion 6 in the state in which the attachment portion 6 is received in the receiving opening 22 (see Fig. 4(b)). In the state in which the attachment portion 6 is received in the receiving opening 22, the attachment portion 6 is held in position by friction fit between the even surface of the inner side wall and the outer side surface of the attachment portion 6.

The inner side wall of the receiving opening 22 extends in parallel to the direction from a coronal end of the dental implant 20 towards an apical end of the dental implant 20. The inner side wall of the receiving opening 22 has a hexagonal cross section perpendicular to the direction from the coronal end of the dental implant 20 towards the apical end of the dental implant 20. The cross section of the inner side wall is substantially the same as the cross section of the body 12 of the attachment portion 6. The respective inner dimensions of the inner side wall are smaller than the sums of the respective outer dimensions of the body 12 of the attachment portion 6 and the projecting heights of the respective projections 8, as is shown in Fig. 3(b).

The even surface of the inner side wall of the receiving opening 22 is parallel to the longitudinal direction of the dental implant 20, i.e., the direction from the coronal end towards the apical end of the dental implant 20, in particular, in all positions where the inner side wall abuts the attachment portion 6.

The dental implant 20 further comprises a recess 24 with a conical inner side wall, the recess 24 being provided coronally to the receiving opening 22, as is shown in Figs. 3(b) and 4(b). The recess 24 is configured for receiving the

conical portion 4 of the main body 2. The recess 24 is provided adjacent to the receiving opening 22.

As is shown in Fig. 4(b), in the state in which the attachment portion 6 is received in the receiving opening 22, the three projections 8 are arranged closer to a coronal end of the receiving opening 22 than to an apical end of the receiving opening 22. This arrangement of the projections 8 allows for the attachment portion 6 to be inserted into the receiving opening 22 in an easy manner, while providing a clear alignment feedback.

Further, the dental implant 20 has a threaded bore 26 extending below the receiving opening 22 in the apical direction of the implant 20, as is shown in Figs. 3(b) and 4(b). Moreover, the dental implant 20 has an outer threaded portion 28 for screwing the implant 20 into a patient's jaw bone (see Figs. 3(a) and 4(a)).

When attaching the attachment portion 6 of the dental fitting 1'' to the dental implant 20, the three projections 8 are deformed, i.e., compressed, along the transverse directions of the attachment portion 6. Thus, the projections 8 press against the inner side wall of the receiving opening 22 of the dental implant 20. Hence, the attachment portion 6 is attached to the dental implant 20 by friction fit in a reliable and efficient manner.

In this attachment process, a first tactile feedback is provided to a user when the dental fitting 1'' and the dental implant 20 are properly aligned with each other, i.e., radially/angularly aligned, and the attachment portion 6 is inserted into the receiving opening 22 of the dental implant 20. The user experiences a resistance once the projections 8 reach an upper edge of the receiving opening 22. In order to further introduce the attachment portion 6 into the receiving opening 22, the user has to apply an increased pushing force.

This increase in the required pushing force provides a clear indication to the user that dental fitting 1'' and dental implant 20 are oriented relative to each other in the correct manner. Figs. 3(a) and (b) show the relative arrangement of dental fitting 1'' and dental implant 20 just before the attachment portion 6 enters into the receiving opening 22.

A second tactile feedback is provided by the conical portion 4 of the main body 2. After the attachment portion 6 has been inserted further into the receiving opening 22, by increasing the pushing force applied by the user as detailed above, the dental fitting 1'' is moved in the apical direction relative to the dental implant 20 until the conical portion 4 abuts the conical inner side wall of the recess 24.

When the conical portion 4 abuts this inner side wall, the movement of the dental fitting 1'' relative to the dental implant 20 is stopped, indicating to the user that the dental fitting 1'' is fully seated in the dental implant 20. This state, in which the dental fitting 1'' is fully attached to the dental implant 20, is shown in Figs. 4(a) and (b).

After the dental fitting 1'' has been properly attached to the dental implant 20 via the attachment portion 6, the dental fitting 1'' and the implant 20 are securely fixed in the attached state by inserting a screw (not shown) through the coronal opening of the through hole 14 of the dental fitting 1'' and screwing the screw into the threaded bore 26 of the implant 20. In the fully inserted state of the screw, a lower threaded portion of the screw is received within the threaded bore 26 of the implant 20 and a screw head of the screw rests on the screw seat 16 of the through hole 14 of the dental fitting 1'', thereby firmly holding the dental fitting 1'' and the implant 20 in their relative positions.

In the manner detailed above, the dental fitting 1'' can be fixed to an implant placed in a patient's jaw bone.

Specifically, the implant 20 can be screwed into the patient's jaw bone by means of the outer threaded portion 28 of the implant 20. Once the implant 20 is in the jaw bone, the dental fitting 1'' is fixed to the implant 20 through the attachment portion 6 and the screw, as has been detailed above.

Further, the dental fitting 1'' may be attached to a dental component, such as the dental implant 20, outside a human or animal body, e.g., in a dental laboratory. In particular, in the manner detailed above, the dental fitting 1'' can be fixed to a jaw bone model in the dental laboratory, e.g., using an implant analogue instead of the implant 20.

While the dental assembly according to the embodiment of the present invention detailed above comprises a single-piece abutment as the dental fitting and a dental implant as the dental component, the dental fitting and/or the dental component may be various other elements, as has been explained in detail above.

In particular, the dental fitting may be, for example, a multi-piece abutment, a scan abutment, a temporary abutment, an abutment position locator, an impression taking component, such as an open or closed tray impression post or an impression coping, e.g., a screw-less impression coping, an intra-oral scanning or desk top scanning locator, a healing cap, a temporary restoration or a final restoration.

The dental component may be, for example, an implant analogue, e.g., for use in a dental laboratory, as has been explained in detail above.

For the case of a multi-piece abutment, e.g., a two-piece abutment, the dental fitting may be one piece of the abutment and the dental component may be another piece of the abutment. In this case, the one piece of the abutment

comprises the attachment portion and can be attached to the other piece of the abutment through the attachment portion. Alternatively or in addition thereto, a base piece or unit of the multi-piece abutment may comprise the attachment portion and be attached to a dental implant by the attachment portion.

If a dental fitting and a dental component such as those given above are used instead of the dental fitting 1'' and the dental implant 20, these elements are attached to each other through the attachment portion substantially in the same manner as detailed above for the case of the dental fitting 1'' and the dental implant 20.

Claims

1. A dental fitting (1, 1', 1''), such as an abutment, attachable to a dental component (20), such as a dental implant, the dental fitting (1, 1', 1'') comprising:

a main body (2) comprising a tapering portion, such as a conical portion (4); and

an attachment portion (6) for attaching the dental fitting (1, 1', 1'') to the dental component (20); wherein

the attachment portion (6) is provided apically to the main body (2),

the attachment portion (6) comprises a plurality of projections (8, 8'), each projection (8, 8') extending in one or more directions substantially perpendicular to the direction from the attachment portion (6) towards a coronal end (10) of the main body (2),

each projection (8, 8') is elastically or plastically deformable in the one or more directions substantially perpendicular to the direction from the attachment portion (6) towards the coronal end (10) of the main body (2),

the outer circumference of the tapering portion (4) increases with increasing distance from the attachment portion (6) in the direction from the attachment portion (6) towards the coronal end (10) of the main body (2),

the attachment portion (6) is integrally formed with or integrally attached to the main body (2),

the attachment portion (6) comprises a body (12) with an outer side wall extending in parallel to the direction from

the attachment portion (6) towards the coronal end (10) of the main body (2) of the dental fitting (1, 1', 1''),

the projections (8, 8') project from the outer side wall of the body (12) of the attachment portion (6),

the body (12) of the attachment portion (6) has a prism shape with a polygonal cross section perpendicular to the direction from the attachment portion (6) towards the coronal end (10) of the main body (2) of the dental fitting (1, 1', 1''), and

a projection (8, 8') of the plurality of projections (8, 8') is provided only on every second side surface of the prism shaped body (12) of the attachment portion (6).

2. The dental fitting (1, 1', 1'') according to claim 1, wherein a single projection (8, 8') is provided on every second side surface of the prism shaped body (12) of the attachment portion (6).

3. The dental fitting (1, 1', 1'') according to claim 1 or 2, wherein the prism shaped body (12) of the attachment portion (6) has an even number of side surfaces.

4. The dental fitting (1, 1', 1'') according to claim 3, wherein the number of the plurality of projections (8, 8') is half the number of the side surfaces of the prism shaped body (12) of the attachment portion (6).

5. The dental fitting (1, 1', 1'') according to any one of the preceding claims, wherein at least one of the projections (8, 8') is arranged closer to a coronal end of the attachment portion (6) than to an apical end of the attachment portion (6).

6. The dental fitting (1, 1', 1'') according to any one of the preceding claims, wherein the dental fitting (1, 1', 1'')

further comprises a through hole (14) extending through the dental fitting (1, 1', 1'') in the direction from a coronal end of the dental fitting (1, 1', 1'') to an apical end of the dental fitting (1, 1', 1'').

7. The dental fitting (1, 1', 1'') according to any one of the preceding claims, wherein the tapering portion (4) of the main body (2) is provided adjacent to the attachment portion (6).

8. The dental fitting (1, 1', 1'') according to any one of the preceding claims, wherein the attachment portion (6) is made of a metal, a polymer or a composite material.

9. A dental assembly comprising a dental fitting (1, 1', 1''), such as an abutment, and a dental component (20), such as a dental implant, wherein the dental fitting (1, 1', 1'') is attachable to the dental component (20), the dental fitting (1, 1', 1'') comprising:

a main body (2); and

an attachment portion (6) for attaching the dental fitting (1, 1', 1'') to the dental component (20); and

the dental component (20) comprising:

a receiving opening (22) for receiving the attachment portion (6); wherein

the attachment portion (6) is provided apically to the main body (2),

the attachment portion (6) comprises a plurality of projections (8, 8'), each projection (8, 8') extending in one or more directions substantially perpendicular to the

direction from the attachment portion (6) towards a coronal end (10) of the main body (2),

each projection (8, 8') is elastically or plastically deformable in the one or more directions substantially perpendicular to the direction from the attachment portion (6) towards the coronal end (10) of the main body (2),

the attachment portion (6) comprises a body (12) with an outer side wall extending in parallel to the direction from the attachment portion (6) towards the coronal end (10) of the main body (2) of the dental fitting (1, 1', 1''),

the projections (8, 8') project from the outer side wall of the body (12) of the attachment portion (6),

the body (12) of the attachment portion (6) has a prism shape with a polygonal cross section perpendicular to the direction from the attachment portion (6) towards the coronal end (10) of the main body (2) of the dental fitting (1, 1', 1''),

a projection (8, 8') of the plurality of projections (8, 8') is provided only on every second side surface of the prism shaped body (12) of the attachment portion (6),

the receiving opening (22) has an inner side wall with an even surface facing an outer side surface of the attachment portion (6) in the state in which the attachment portion (6) is received in the receiving opening (22), and,

in the state in which the attachment portion (6) is received in the receiving opening (22), the attachment portion (6) is held in position by friction fit between the even surface of the inner side wall and the outer side surface of the attachment portion (6).

10. The dental assembly according to claim 9, wherein

the inner side wall of the receiving opening (22) extends in parallel to the direction from a coronal end of the dental component (20) towards an apical end of the dental component (20).

11. The dental assembly according to claim 10, wherein an inner diameter of the inner side wall is substantially the same as an outer diameter of the body (12) of the attachment portion (6).

12. The dental assembly according to any one of claims 9 to 11, wherein

the main body (2) of the dental fitting (1, 1', 1'') comprises a tapering portion (4), the outer circumference of the tapering portion (4) increasing with increasing distance from the attachment portion (6) in the direction from the attachment portion (6) towards the coronal end (10) of the main body (2),

the dental component (20) further comprises a recess (24) with a tapering inner side wall, the recess (24) being provided coronally to the receiving opening (22), and

the recess (24) is configured for receiving the tapering portion (4) of the main body (2).

13. The dental assembly according to claim 12, wherein the tapering portion (4) of the main body (2) is provided adjacent to the attachment portion (6), and the recess (24) is provided adjacent to the receiving opening (22).

14. The dental assembly according to any one of claims 9 to 13, wherein, in the state in which the attachment portion (6) is received in the receiving opening (22), at least one of

the projections (8, 8') is arranged closer to a coronal end of the receiving opening (22) than to an apical end of the receiving opening (22).

15. The dental assembly according to any one of claims 9 to 14, wherein the dental fitting (1, 1', 1'') is the dental fitting (1, 1', 1'') according to any one of claims 1 to 8.

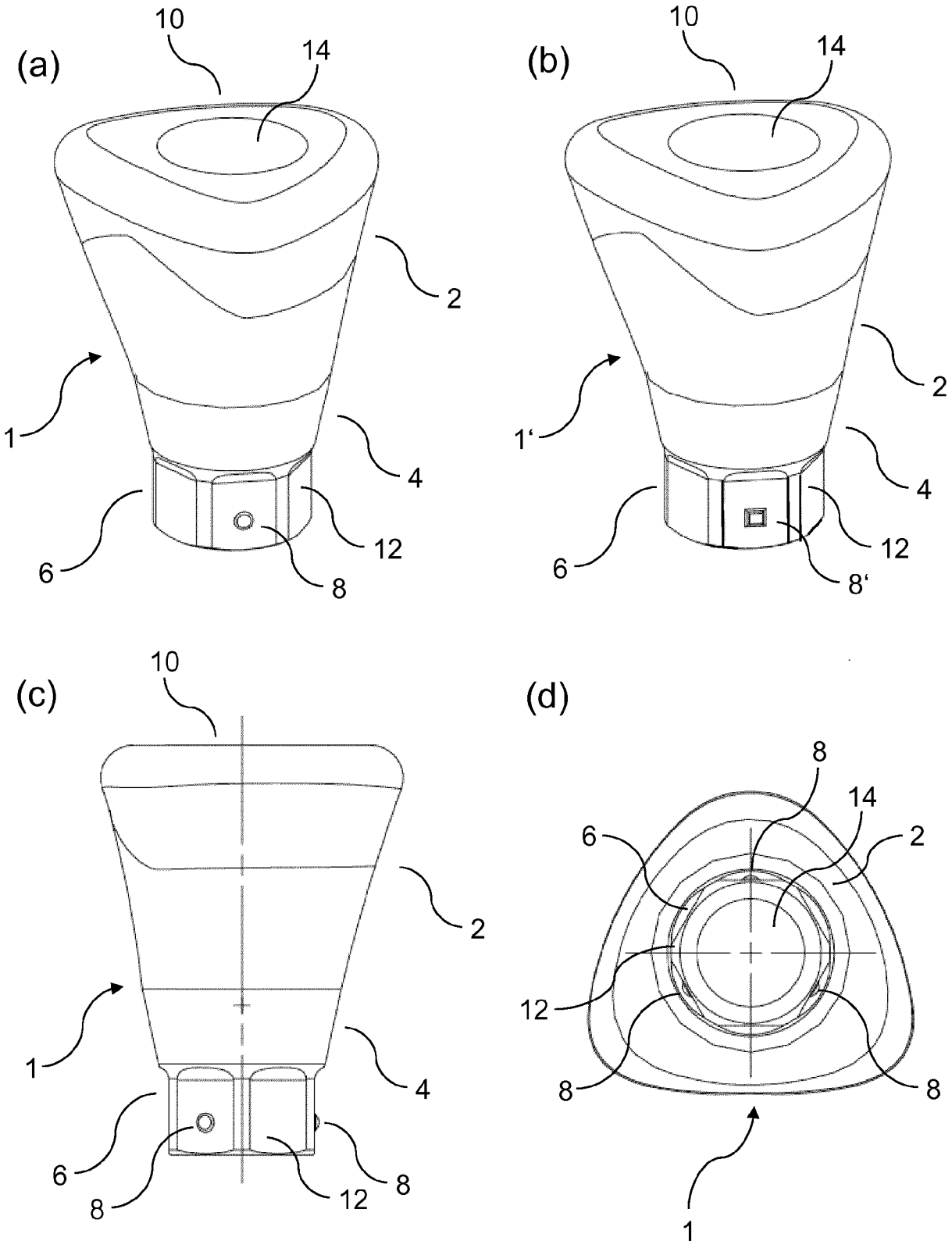

Fig. 1

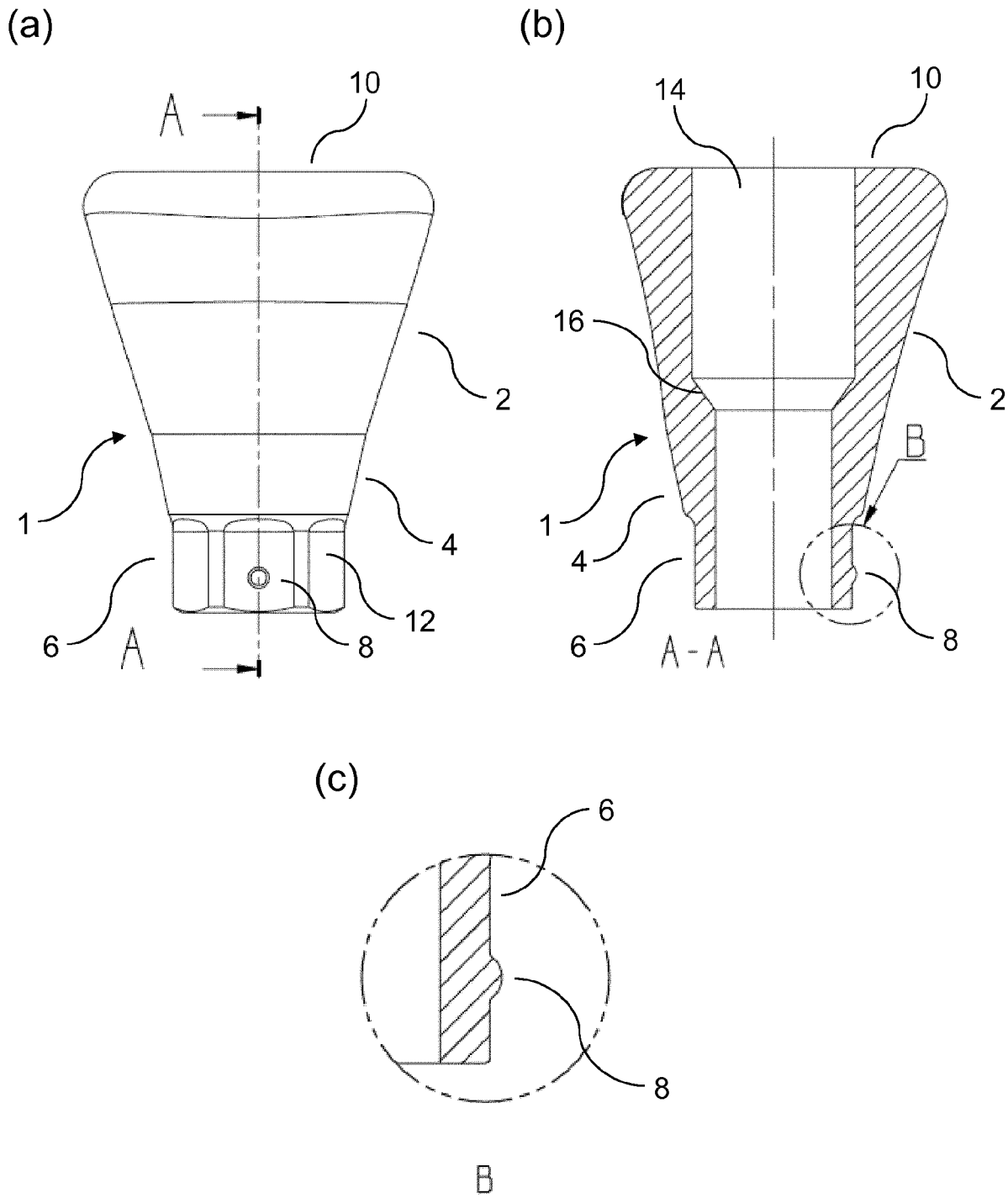

Fig. 2

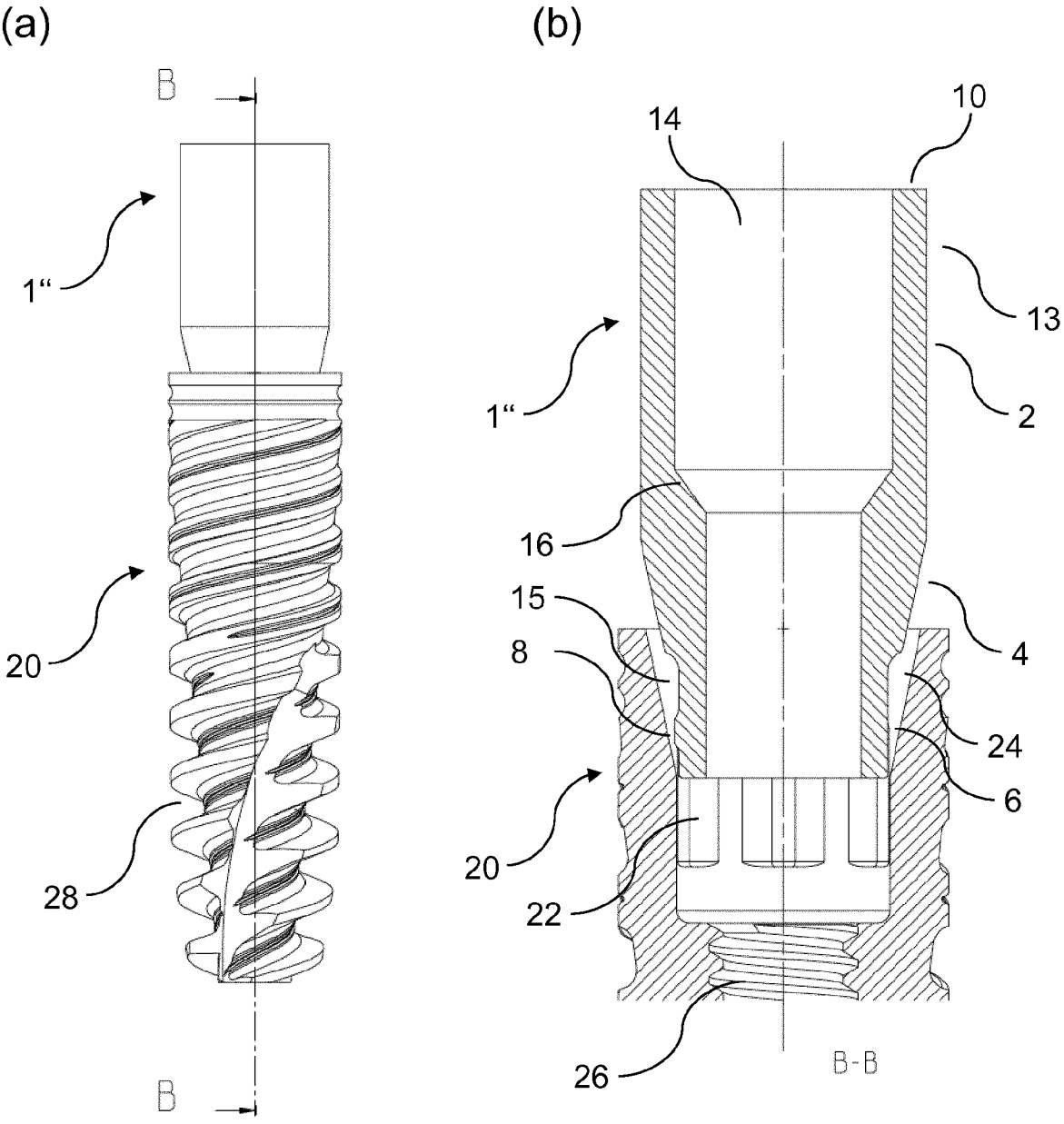

Fig. 3

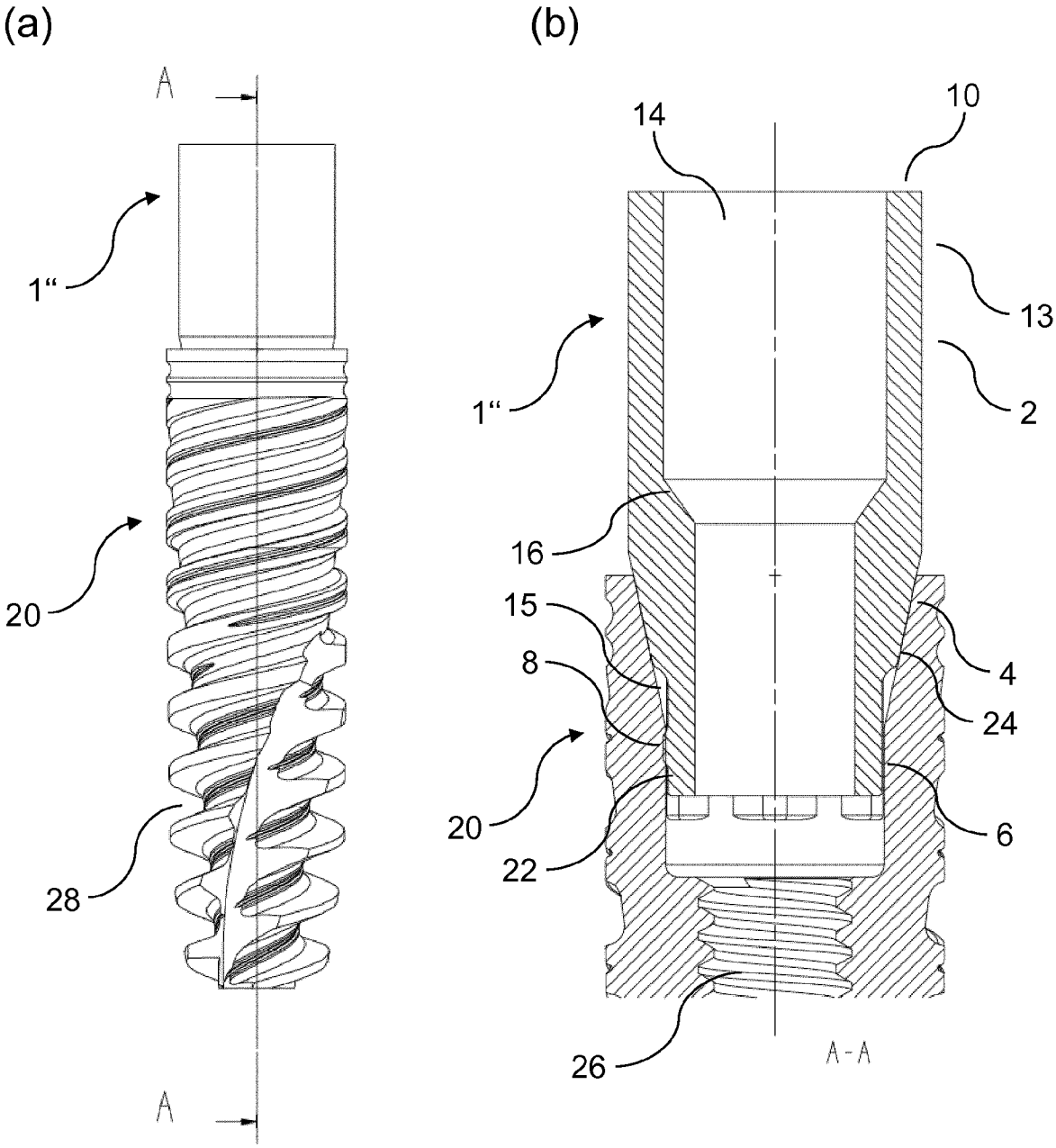

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/053052

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C8/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2012/117025 A1 (ASTRA TECH AB [SE]; HOLMSTROEM JOHAN [SE]; ANDERSIN PER [SE]; MAGNUSSO) 7 September 2012 (2012-09-07) figure 3	1-15
A	US 2013/171584 A1 (BRUN PHILIPP [CH]) 4 July 2013 (2013-07-04) figures 2,5	1-15
A	WO 2011/132007 A2 (SZAKACS ZOLTAN [HU]; STEIGMANN MARIUS [DE]; TRI DENTAL IMPLANTS AG [CH) 27 October 2011 (2011-10-27) page 14, line 12 - line 24; figure 8	1-15
X	EP 1 459 700 A1 (RASSOLI JEFF [US]) 22 September 2004 (2004-09-22) paragraphs [0033], [0035], [0037]; figures 2A, 3A, 5	1-15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 March 2017	11/04/2017

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/053052

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 3 122626 B2 (KAMIKURA TSUTOMU) 9 January 2001 (2001-01-09) figure 2 -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2017/053052

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2012117025 A1	07-09-2012	EP 2494938 A1	05-09-2012
		EP 2680782 A1	08-01-2014
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