

Connection arrangement between an implant and an abutment

Field of application of the invention

The present invention relates to a connection arrangement
5 for fixing an abutment in an implant which can be fitted in
human bones, primarily a dental implant. Opening out at the
top of the implant head is a receiving bore which extends
axially downwards and which is conically widened towards the
top and in which the lower and likewise conical root portion
10 of the abutment sits. For securing the abutment in terms of
rotation, a non-rotationally symmetrical receiving contour
can be provided in the receiving bore. A coaxial, internally
threaded bore extends from the bottom of the receiving bore.
To complement the possible receiving contour in the implant,
15 the root portion of the abutment can have a non-rotationally
symmetrical outer contour.

Connection arrangements of this type are employed when using
a straight or an angled abutment which is secured on the
20 implant by means of a clamping screw, both axially and also
against rotation. The clamping screw is introduced into the
abutment so that the head of the clamping screw is supported
in the abutment, while the threaded shank of the clamping
screw protrudes from the abutment at the bottom and engages
25 in the axial internal thread in the implant head. A special
screwdriver which can be introduced into the inside of the
abutment is provided for tightening and unscrewing the
clamping screw, this screwdriver being used especially in
the case of angled abutments, but also being suitable for
30 straight abutments. The abutment can be fixed in any desired
position of rotation, possible non-rotationally symmetrical
contours on the implant and abutment limiting the selectable
positions of rotation in accordance with the configuration
of the contour of the polygon.

Prior art

In its simplest form, a straight, conical abutment has at the very bottom a threaded plug which is screwed into the
5 internally threaded bore present in the implant. The conical root portion of the abutment then sits in the conical receiving bore, and the head part of the abutment protrudes above the implant shoulder. No separate clamping screw is required here (cf. SCHROEDER, SUTTER, BUSER, KREKELER: Orale
10 Implantologie [Oral implantology], Georg Thieme Verlag, Stuttgart, 2nd ed., 1994, page 122).

Figures 0.1 to 0.4

When using an angled abutment, the connection with the
15 implant 1 has hitherto been based on providing the abutment with a lateral bore which extends vertically towards the seat of the clamping screw head and through which the screwdriver then has access to the clamping screw. The head of the clamping screw can be introduced via a lateral
20 opening into the seat present in the abutment.

It is true that a connection arrangement of this type can be assembled and screwed together in a relatively practical way by means of the lateral bore and the lateral opening; however, as a result of the two material cutouts
25 adjoining one another, a weak point is created in the wall of the abutment. When the connection arrangement is used at a position in the patient's mouth which is at all times under considerable loading, material fatigue could come about after a period of time and could result in a fracture
30 at this weak point. In addition, the lateral bore has to be sealed off provisionally, in preparation for the impression-taking, and then opened again. This entails additional work.

The aforementioned implants 1 are known per se (cf.
35 SCHROEDER, SUTTER, BUSER, KREKELER, ibid.). Such an implant

1 has at the top the implant head 10 and at the bottom the shaft portion 20, the implant head 10 ending at the very top with the radially encircling implant shoulder 11, and it being possible for an external thread 23 to be present on the shaft portion 20 depending on the implant type. The implant shoulder 11 surrounds the opening of the receiving bore 12 which conically narrows axially downwards, as a result of which the inner cone 14 is created. At the bottom 13 of the bore, the receiving bore 12 merges into a coaxial threaded bore 21 which is of reduced diameter and which extends into the shaft portion 20. The internally threaded bore 21 presents the internal thread 22.

In the abovementioned connections made up of implant and abutment, there is the additional problem of rotationally securing the abutment fitted in the implant and the problem of the height tolerance of the head part of the abutment protruding above the implant shoulder. Depending on the depth of insertion of the abutment, a position tolerance is added to the length tolerance of the abutment, so that the head part of the abutment protrudes to a greater or lesser extent above the implant shoulder. When manufacturing the implantology components, the overall resulting height tolerance demands a high and costly level of precision and yet, during further procedures, i.e. on impression-taking, on producing the master model, and on creating the artificial tooth crown, necessitates a high outlay, with, in the final analysis, disturbing tolerances still occurring.

To overcome the disadvantages which to this extent still exist, various constructional solutions have been proposed. The rotational securing of the abutment, which can be fitted into the implant or can be placed on the implant, has been guaranteed by providing at the very bottom of the abutments a non-rotationally symmetrical contour which comes into engagement with a complementary contour present on the



implant head. The implant heads in most cases have an inner receiving contour, while the abutments have an outer counter-contour which can be fitted into the receiving contour (cf. US 4 713 003, 5 000 686, 5 022 860, 5 030 095, 5 195 892 and 5 281 140 and also EP 0 504 119). JP 95-28877 B2 may be mentioned as an example of the reversal of positive locking with an implant head on which there is an outer contour which is complementary to an inner contour arranged on the abutment. However, none of the implants mentioned above is of the type with a conical, axial receiving bore; at best, the implant shoulder has a conical geometry.

CA 1 313 597 discloses a multi-component implant arrangement with an implant, an intermediate piece which can be placed thereon, and an abutment which can be screwed through the intermediate piece and into the implant. An internally threaded bore is provided in the implant head, and the intermediate piece has a conical through-bore into which the conical root portion of the abutment can be fitted. Contours complementary to one another and providing for rotational securing are arranged on the implant head and on the intermediate piece. Here, once again, the implant does not have a conical, axially extending receiving bore. The abutment itself is rotationally secured only to a limited extent by the threaded segment which is to be screwed into the implant head.

An implant with an inner polygon on the inner cone is proposed by WISKOTT, H. W. A. and BELSER, U. C.: Mechanical resistance of cemented post and core buildups for ITI-Bonefit implants. Clinical Oral Implantology Research, 1992, H.3, page 128 et seq. The inner polygon is provided directly at the transition to the internal thread. The associated abutment has an outer polygon which adjoins the root portion

at the bottom and which complements the inner polygon, and from which outer polygon an anchoring pin extends further downwards. The abutment is fitted into the implant so that the outer polygon of the former sits with positive locking
5 in the inner polygon of the implant. For axially fixing the abutment in the implant, the anchoring pin protruding into the internal thread of the implant is cemented in place. This solution is thus restricted to the cementing or bonding of an anchoring pin in the internal thread of the implant.

10 WO-A-94 09717 discloses a largely similar configuration as regards the inner polygon in the implant and the outer polygon on the abutment. The inner polygon is once again located at the transition to the internal thread; the outer polygon is correspondingly provided on the abutment.

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Object of the invention

Given that the functional reliability of the hitherto disclosed connection arrangements is not wholly satisfactory, and that this fact can be attributed to
20 constructional features, the invention is based on the following problem. A connection arrangement between an implant and a straight or angled abutment is to be created which possesses highly reliable stability. In addition, it must be possible for the abutment to be fixed securely and
25 in a practical manner on the implant, and it should not come loose as a result of microscopic movements. What is more, the connection arrangement should consist of the fewest possible simple components and thus should be able to be manufactured inexpensively. Finally, it is desirable that at
30 least some parts of the connection arrangement should have system design features and can therefore be used for different variants of the connection arrangement, i.e. for the combination with different abutments.



Moreover, no wholly satisfactory constructional solution has as yet been made known for an implant with a non-rotationally symmetrical receiving contour on the inner cone and an associated, complementary abutment of the type in question here, which can be joined together using a connection arrangement. The invention thus has at the same time the object of perfecting the implants of the generic type and the complementary abutments, which can be held together by the associated connection arrangement. The abutment, which is fitted into the implant via its conical root portion in a manner as free as possible from clearance, has to be rotationally secured and must not exhibit any axial instability whatsoever. The implant and abutment should be able to be screwed together so that the insertion of the abutment into the implant can be carried out without adhesive binder and so that the connection can be undone again, if need be. For special applications, it is desirable also to be able to fit into the implant abutments which are conventional and have a conical root portion, i.e. with a threaded plug arranged at the very bottom, but without a non-rotationally symmetrical outer counter-contour.

Finally, a screwdriver for establishing the connection between an implant and a straight or an angled abutment is to be developed. With this screwdriver, it should also be possible for screwing to be carried out at an angle.

Nature of the invention

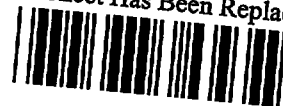
The principle of the proposed connection arrangement between an implant and an abutment consists in the abutment being provided with an inlet, which could be a continuous axial passage. A clamping screw can be fitted head first into this inlet via the root portion, its threaded segment, reduced in diameter compared to the head, being intended to engage in the axially extending internally threaded bore in the implant. Before the clamping screw is fitted into the



abutment, an expanding ring is pushed onto the shank segment of the clamping screw, this segment lying between the head and the threaded segment. The expanding ring snaps into a groove arranged in the inlet of the abutment. For partially
5 receiving the expanding ring on the clamping screw, a radial groove is provided underneath the head.

It has proven expedient to give the expanding ring a slotted configuration. In the head of the clamping screw there is a
10 non-rotationally symmetrical recess which serves for engagement of an insertion tool. When tightening or unscrewing the clamping screw, the insertion tool is passed through the continuous axial passage into the recess in the screw head. In the case of angled abutments, it is expedient
15 to provide, in addition to the likewise angled and continuous inlet, a lateral opening for the insertion tool to pass through. Such a lateral opening is arranged in particular in cases where the inlet is not continuous. In the interest of the system design nature of all the implant
20 elements, it is of advantage if the internally threaded bore in the implant and the internally threaded section in the abutment, as well as the threaded segment of the clamping screw, have dimensions which are similar or complementary.

25 The characterizing feature of the implant according to the invention is that a non-rotationally symmetrical receiving contour is provided in the inner wall of the conical receiving bore, i.e. on the inner cone of the implant head, with a radially uninterrupted section of the inner cone in
30 each case remaining both above the receiving contour and also below it. If a polygon is provided as the receiving contour, then this is designed solidly on the underside, while its points run out towards the top in a parabola shape.



The essential features of the abutment according to the invention are the following: In the case of a continuous inlet, an internally threaded section can be provided at the top, into which section it is possible to insert an occlusal screw for the purpose of fixing the superstructure to be arranged thereon. An outer counter-contour complementary to the receiving contour is provided on the root portion of the abutment and can be designed especially and advantageously as an outer polygon. In analogy to the positioning of the receiving contour present in the implant, the counter-contour is arranged such that a radially uninterrupted segment of the root portion remains both above it and below it, and the circumferential surfaces of both segments are flush with one another. However, the lower segment can also be omitted. In the inlet, inside the area of the root portion, there is a radially encircling groove.

Through the inlet provided in the abutment, if this inlet is continuous, or, if not, through the additional lateral opening, it is possible for a special screwdriver to be engaged with positive locking in the complementary recess in the head of the clamping screw even at an angle. The screwdriver head is multi-edged and presents, in vertical cross-section, a pear-shaped configuration.

By virtue of the invention, a connection arrangement, an implant and a complementary abutment are now available which are distinguished by advantageous assembling and dismantling. Furthermore, the stable and precise holding in the assembled state is guaranteed to be highly reliable. Both straight and angled abutments of the type according to the invention, and conventional straight abutments, can be fitted into the implant modified in accordance with the invention. That is to say, abutments which have a conical



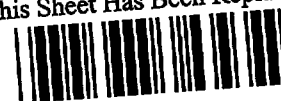
root portion and which do not have a counter-contour can also be fitted into the implant with the special receiving contour in the implant head. These abutments can similarly be fixed using separate clamping screws, or the abutments
5 are in one piece and, in a known manner, have at the very bottom a threaded plug which engages in the internally threaded bore in the implant. The special screwdriver is advantageous for inserting the clamping screw when using an angled abutment without an additional lateral opening, but
10 it can also be used with straight abutments.

Drawings and illustrative embodiment

A number of illustrative embodiments of the connection arrangement according to the invention, of the internal
15 configuration of the implant, of the abutment, and of the special screwdriver, are described in detail hereinbelow, with reference to the attached drawings. Possible modifications are discussed at the end. In the drawings:

- 20 Figure 0.1 shows an implant according to the prior art in partial section;
Figure 0.2 shows the implant according to Figure 0.1 in vertical section;
Figure 0.3 shows an angled abutment, with inserted clamping screw according to the prior art;
25 Figure 0.4 shows the structural components according to Figures 0.1 to 0.3 screwed together;

Figure 1.0 shows a straight abutment in vertical section;
30 Figure 1.1 shows an angled abutment with a lower conical portion;
Figure 1.2 shows an angled abutment with radially encircling collar, which sits on the implant shoulder;



- Figure 1.3 shows a clamping screw;
- Figure 1.4 shows an expanding ring;
- Figure 1.5 shows a centring sleeve in a front view;
- 5 Figure 1.6 shows the centring sleeve according to Figure 1.5 in plan view;
- Figure 2.0 shows a connection arrangement between an implant and the straight abutment according to Figure 1.0;
- 10 Figure 2.1 shows a connection arrangement between an implant and the angled abutment according to Figure 1.1;
- Figure 2.2 shows a connection arrangement between an implant and the angled abutment according to
- 15 Figure 1.2;
- Figure 3.0 shows a clamping screw with expanding ring applied;
- Figure 3.1 shows the clamping screw with expanding ring
- 20 pushed on;
- Figure 3.2 shows the clamping screw with expanding ring when being pushed into an abutment according to Figure 1.1;
- Figure 3.3 shows the clamping screw with expanding ring
- 25 once pushed completely into the abutment according to Figure 1.1;
- Figure 3.4 shows the complete connection arrangement according to Figure 2.1 between implant and abutment, with special screwdriver standing by;
- 30 Figure 4 shows an implant head with the receiving contour in partial section;



- Figure 5.0 shows a perspective view of an abutment with a counter-contour on the conical root portion and a securing surface on the head part;
- Figure 5.1 shows the abutment according to Figure 5.0 in vertical partial section;
- Figure 5.2 shows the abutment according to Figure 5.0 with inserted clamping screw and expanding ring in vertical partial section;
- Figure 6.0 shows the implant according to Figure 4 with inserted abutment according to Figure 5.0;
- Figure 6.1 shows an enlarged representation from Figure 6.0;
- Figure 6.2 shows the representation according to Figure 6.0 with the abutment likewise in partial section;
- Figure 7.0 shows the plan view of the head of the clamping screw according to Figure 1.3;
- Figure 7.1 shows the screwdriver head in front view;
- Figure 7.2 shows the perpendicular engagement of the screwdriver head into the recess provided in the head of the clamping screw;
- Figure 7.3 shows the horizontal section A-A through the screwdriver head; and
- Figure 7.4 shows the angled engagement according to Figure 7.2.

Figure 0.2

- The implant 1 used in the connection arrangement constitutes the basic element thereof and has a structure which is known per se. The upper portion, which is shown alone here, could belong both to a hollow screw implant as well as to a solid screw implant. The connection arrangement is, however, equally suitable for hollow-body implants and solid-body



implants in the straight or angled version. For a further description of the implant 1, reference is made to the description of Figures 0.1 to 0.4 in the Prior Art section.

5 The following statement holds true for the whole of the description which follows. If, for the sake of the clarity of the drawings, reference numbers are included in a Figure, but are not explained in the immediately relevant text of the description, then reference is made to their mention in
10 the preceding Figure descriptions. In the interests of intelligibility, repeated designation of structural parts in succeeding Figures is in most cases dispensed with, as long as it can clearly be discerned from the drawings that "recurring" structural parts are concerned.

15

Figure 1.0

The straight abutment 100 has an upper neck portion 110 tapering conically towards the top, and a lower root portion 120 tapering conically towards the bottom. Extending axially
20 through the abutment 100 is an inlet 130 which at the very top opens out in a screw seat 131. Adjoining the screw seat 131 there is a downwardly extending internally threaded section 132 which ends before the transition 140 between the neck portion 110 and the root portion 120. The internally
25 threaded section 132 merges at a bevelled surface 133 into a widened screwhead section 134. The inlet 130 opens out at the end 121 of the root portion 120, the end 121 having a rounded contour 122, and, before the rounded contour 122 is reached, a radially encircling, band-shaped groove 135 is
30 provided and serves to receive an expanding ring.

Figure 1.1

The straight, rotationally symmetrical abutment 100 is almost identical in construction to the angled abutment 200
35 shown here. The angled abutment 200 also has a neck portion

210 which tapers conically towards the top and which merges at the transition 240 into a root portion 220 tapering conically towards the bottom. However, the neck portion 210 and the root portion 220 are not arranged coaxial to one another, but are instead set at an angle to one another at the transition 240, with the result that the inlet 230 extending through the abutment 200 is also appropriately angled. At the very top, the inlet 230 likewise opens out in a screw seat 231, which is adjoined by an internally threaded section 232 extending downwards. At an asymmetrical bevelled surface 233, the internally threaded section 232 merges into a widened screwhead section 234. The inlet 230 opens out in the root portion 220 at the end 221, which has a rounded contour 222. Here too, before the mouth is reached, a radially encircling groove 235 is provided in the inlet 230.

Figure 1.2

The modified angled abutment 300 differs markedly from the abutment 200. The neck portion 310 is still approximately identical, whereas the root portion 320 shows considerable changes. The transition 340 is also of different design. An angled inlet 330 once again extends through the abutment 300. The neck portion 310 also tapers conically towards the top, and the root portion 320 is set at an angle to the neck portion at the transition 340. Here too, the inlet 330 opens out in a screw seat 331, which is adjoined by an internally threaded section 332 which extends downwards and which merges into a widened screwhead section 334 via an asymmetric bevelled surface 333. The inlet 330 opens out in the root portion 320 with the rounded contour 322 at the end 321. In the shortened root portion 320, i.e. between the transition 340 and the rounded contour 322 terminating at the bottom, the inlet 330 is once again provided with a radially encircling, band-shaped groove 335. The transition



340 acquires its particular configuration by virtue of the fact that a recess 341 is present on the underside of the neck portion 310, and the neck portion 310 continues in the form of a downwardly widening collar 342. This collar 342
5 forms an annular counter-shoulder 343 which, upon assembly with the implant 1, sits on the inner ring part of the implant shoulder 11 (see Figure 0.2).

Figure 1.3

10 For constructing the connection arrangement according to the invention on the implant 1, one of the above-described abutments 100, 200, 300 is alternately necessary; a clamping screw 400 is needed for each of the different connection
15 arrangements. The clamping screw 400 comprises - from the top downwards - the head 410, the adjoining shank segment 420 of reduced diameter, and the lower threaded segment 430. On the upper side of the head 410 there is a recess 411 with an inner contour 412 which is designed to be complementary
20 to the screwdriver head (see Figures 3.4 and 7.0 to 7.4). A bevelled bearing surface 413 forms the transition between the head 410 and the shank segment 420. Approximately in the middle, the shank segment 420 has a radially encircling groove 421 for partial, temporary inclusion of an expanding
25 ring (see Figure 1.4). Bevels 422 and 423 form the respective transitions from the groove 421 to the full diameter of the shank segment 420. The threaded segment 430 has the external thread 431 and is designed complementary to the threaded bore 21 in the implant 1, so that the threaded
30 segment 430 can be screwed into the threaded bore 21.

Figure 1.4

The tyre-like expanding ring 500 has a slot 510 forming an opening in it. It has proven advantageous to arrange the slot 510 obliquely and sloping upwards towards the left. The
35 top edge 520 of the expanding ring 500 has an inwardly

directed bevelled surface 521 which is designed complementary to the bearing surface 413 on the head 410 of the clamping screw 400. The dimensions of the expanding ring 500 are chosen such that it can be pushed onto the clamping
5 screw 400 and snap into the groove 421 of the latter.

Figures 1.5 and 1.6

When constructing a connection arrangement with an angled abutment 300, a centring sleeve 600 which is in principle
10 rotationally symmetrical is additionally inserted. The centring sleeve 600 consists of a tyre-like base portion 610 and an adjoining circumferential continuation 620 extending upwards. Outwardly, the centring sleeve 600 widens conically towards the top. In the base portion 610 there is an axial
15 bore 611 with an internal thread 612, so that the centring sleeve 600 can be screwed onto the threaded segment 430 of the clamping screw 400. The circumferential continuation 620 has a thinner wall than the base portion 610, as a result of which the clearance in the interior of the centring sleeve
20 600 is increased. A number of vertical expansion slots 621 are provided within the circumferential continuation 620 and extend approximately to the level of the base portion 610.

Figure 2

25 A straight abutment 100 is fixed on an implant 1 by means of the clamping screw 400 and the expanding ring 500, the conical root portion 120 of the abutment 100 engaging in the main bore 12, i.e. in the inner cone 14, of the implant 1. The head 410 of the clamping screw 400 sits in the screwhead
30 section 134 inside the inlet 130, and the expanding ring 500 applied on the clamping screw 400 lies with its bevelled surface 521 on the bearing surface 413 of the clamping screw 400. At the same time, the expanding ring 500 is set in the groove 135 of the abutment 100. The threaded segment 430 of
35 the clamping screw 400 is screwed tightly into the threaded

bore 21 of the implant 1; the external thread 431 and the internal thread 21 are in engagement with one another. By means of the tensile force of the clamping screw 400 transmitted to the expanding ring 500, the abutment 100 is
5 fixed securely both axially and also against rotation. The conicity of the root portion 120 and of the inner cone 14 affords reliable stability of the connection arrangement. The internally threaded section 132 is used for fixing additional buildups.

10

Figure 2.1

Here, an angled abutment 200 is fixed on an implant 1 by means of the clamping screw 400 and the expanding ring 500. The structural parts are connected to one another in an
15 analogous manner to that depicted in Figure 2.0.

Figure 2.2

An angled abutment 300 is fixed on the implant 1, its counter-shoulder 343, formed by the collar 342, being
20 supported on the inner ring surface on the implant shoulder 11. In this connection arrangement too, the clamping screw 400 and the expanding ring 500 hold it together and ensure its permanent stability in the chosen positioning, the centring sleeve 600 additionally being inserted. The
25 centring sleeve 600 has been screwed onto the threaded segment 430 of the clamping screw 400 inside the main bore 12 of the implant 1 and bears snugly on the inner cone 14 thereof. The external thread 431 of the clamping screw 400 and the internal thread 612 of the centring sleeve 600 are
30 in engagement with one another. The expanding ring 500 lies in the groove 335 of the root portion 320 of the abutment 300, the end 321 with the rounded contour 322 engaging under the expanding ring 500. The circumferential continuation 620 of the centring sleeve 600 is clamped between the root
35 portion 320 of the abutment 300 and the inner cone 14 of the

implant 1. Here too, the head 410 of the clamping screw 400 sits so closely on the expanding ring 500 that the bearing surface 413 and the bevelled surface 521 are pressed against one another.

5

Figures 3.0 to 3.4

The production of the connection arrangement is now described with reference to this sequence of Figures, using by way of example an angled abutment 200.

10

Figure 3.0

The expanding ring 500 is pushed onto the clamping screw 400 via the threaded segment 430 and first surrounds the external thread 431. In this way, the sufficiently
15 elastically deformable expanding ring 500 bends open, i.e. the slot 510 enlarges.

Figure 3.1

The expanding ring 500 is pushed further in the axial
20 direction onto the clamping screw 400, until the groove 421 on the shank segment 420 is reached, at which point the expanding ring 500 positions itself as a consequence of its inherent stress. Since the groove 421 has a smaller diameter than the threaded segment 430, which has been crossed
25 beforehand, and the lower section of the shank segment 420, the expanding ring 500 can contract slightly, as a result of which the slot 510 narrows.

Figure 3.2

30 Pre-assembled thus far, in the next step the clamping screw 400 with the pushed-on expanding ring 500 is pushed from below into the abutment 200, i.e. via the end 221 into the inlet 230. The rounded contour 222 at the end 221, and the existing play of the expanding ring 500 sitting in the
35 groove 421, permit smooth insertion of the combination of

clamping screw 400 and expanding ring 500 into the abutment 200. The head 410 of the clamping screw 400 thus passes gradually into the screwhead section 234.

5 Figure 3.3

After continued axial pushing, the head 410 approaches the bevelled surface 233 in the abutment 200 and at the same time the expanding ring 500 reaches the groove 235, into which the expanding ring 500 snaps on account of its
10 prestressing. Here, the expanding ring 500 can expand outwards again, as a result of which the slot 510 enlarges again.

Figure 3.4

15 Finally, the abutment 200 is fitted into the implant 1 in the desired position of rotation. The clamping screw 400 is now screwed tight using a special screwdriver 700 passing through the neck portion 210 and the inlet 230. The screwdriver head 710 engages with its outer contour 711,
20 which is complementary to the inner contour 412 of the clamping screw 400. The threaded segment 430 of the clamping screw 400 is screwed gradually into the threaded bore 21 present in the implant 1, and at the same time the upper, cylindrical section of the shank segment 420 is thus screwed
25 into the positioned expanding ring 500. This screwing-in is promoted by the bevel 422. The slotted expanding ring 500 widens and is positioned in the groove 421 with remaining play. When the clamping screw 400 is tightened further, a rigid and secure connection is obtained between the implant
30 1 and the fitted abutment 200.

The same operational steps are required if a connection arrangement with a straight abutment 100 or an angled abutment 300 is to be constructed. When using the special,
35 angled abutment 300, the centring sleeve 600 has to be

screwed onto the clamping screw 400 before fitting the combination of clamping screw 400 and expanding ring 500 into the implant 1.

5 Figure 4

The implant 1 used in the connection arrangement constitutes the basic element thereof and has a structure known per se, except for the special non-rotationally symmetrical receiving contour 15 in the inner cone 14 in the implant
10 head 10. Here, the receiving contour 15 is designed as a radially encircling polygon. This polygon can be created by removal of material, for which purpose a radially encircling groove 17 underneath the receiving contour 15, and likewise in the inner cone 14, is recommended for the machining. By
15 means of the removal of material, steps 16 are created at the bottom of the polygon. On the underside, the polygon is of solid design, whereas it runs out in parabolic points towards the top. The receiving contour 15 advantageously lies in the inner cone 14 in such a way that uninterrupted
20 sections 18, 19 of the inner cone 14 remain, both above the receiving contour 15 and also under it. For as stable and tight a fit as possible of the abutment which is to be inserted, it is advisable to design the upper section 18 with sufficient height.

25

Figure 5.0

The abutment 800 has the neck portion 810 at the top, and the cone portion 820 adjoining it at the bottom. The inlet 830, here in the form of a continuous axial passage, extends
30 through the abutment 800. By way of example, at least one plane surface 811, in principle running vertically, is provided on the neck portion 810 and serves to rotationally secure the crown cap or superstructure which is to be arranged at a later stage on the abutment 800. At the same
35 time, the plane surface 811 can be used for applying a

screwing-in tool. It is an advantageous alternative to provide three plane surfaces 811 each offset by 120°. The plane surface 811 runs out in an arcuate shape in the direction of the cone portion 820.

5

The cone portion 820 has a counter-contour 825 which is complementary to the receiving contour 15 present in the implant 1, so that the abutment 800 can be fitted, rotationally secured, into the implant 1. Analogous to the recessed polygon designed as the receiving contour 15, the counter-contour 825 is likewise designed as a polygon in this example. The counter-contour 825 is arranged on the cone portion 820 in such a way that, in this case too, uninterrupted segments 828, 829 of the cone portion 820 remain. The circumferential surfaces of both segments 828, 829 are flush with one another, in the same way as the sections 18, 19 of the inner cone 14 in the implant head 10 are also flush with one another. Steps 826 are produced at the transitions from the segment 828 to the counter-contour 825, and from the latter to the segment 829. At the very bottom, the abutment 800 and its segment 829 terminate at the end 821. It is also possible to arrange the counter-contour 825 immediately adjoining the end 821.

25 Figure 5.1

Within the inlet 830, an internally threaded section 832 can be provided beginning at the top, and before the lower opening of the inlet 830 there is a radially encircling groove 835. The possible internally threaded section 832 would serve to receive an occlusal screw with which the superstructure could be fastened on. The threaded pin of the occlusal screw extends only partially into the inlet 830. An unthreaded screwhead section 834 remains between the internally threaded section 832 and the groove 835.

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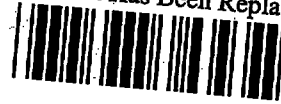


Figure 5.2

For constructing the connection arrangement consisting of implant 1 and abutment 800, a clamping screw 400 is used.

5 The clamping screw 400 comprises - from the top downwards - the head 410, the adjoining shank segment 420 of reduced diameter, and the lower threaded segment 430. On the upper side of the head 410 there is a recess 411 with an inner contour 412 which is designed to be complementary to the tip

10 of the insertion tool used. Underneath the head 410, the shank segment 420 is provided with a radially encircling groove 421 for partial inclusion of the expanding ring 500. The threaded segment 430 is designed complementary to the internally threaded bore 21 in the implant 1, so that the

15 threaded segment 430 can be screwed into the internally threaded bore 21.

The clamping screw 400 with the expanding ring 500, which sits in the groove 421, is pushed into the inlet 830 of the

20 abutment 800 from below, and with the head 410 leading, until the expanding ring 500 - this could be tyre-shaped and slotted - snaps into the groove 835 present in the abutment 800. The head 410 of the clamping screw 400 thus comes to lie inside the screwhead section 834 in the inlet 830 of the

25 abutment 800. The insertion tool can be guided in through the inlet 830 to the head 410 of the clamping screw 400.

Figures 6.0 to 6.2

In the assembled state, the abutment 800 - here provided

30 with a plane surface 811 - sits with its conical root portion 820 in the implant head 10, while the neck portion 810 of the abutment 800 protrudes above the implant shoulder 11. The sections 18, 19 of the inner cone 14 come to lie against the segments 828, 829 of the root portion 820 of the

35 abutment 800. The counter-contour 825 of the abutment 800



sits in the receiving contour 15 of the implant 1. The tightened clamping screw 400 presses via its head 410 on the expanding ring 500, which also sits partially in the groove 835 in the abutment 800. The threaded segment 430 of the clamping screw 400 engages in the internally threaded bore 21 in the implant 1. The abutment 800 is in this way drawn into the implant 1, guaranteeing axial fixing and rotational securing. At the level between the receiving contour 15 and the counter-contour 825 there is a certain play, so that the step 826 of the counter-contour 825 under no circumstances sits on the step 16 in the implant 1. The important factor is that the conical surfaces 18, 19; 828, 829 of both parts 1, 800 lie against one another.

15 Figure 7.0

The head 410 of the clamping screw 400 has, on its upper side, the recess 411 extending axially down and with the four-edged inner contour 412. In each of the corner areas, the inner contour 412, which in principle is square in horizontal cross-section, has a positive, inwardly directed chamfer 414.

Figures 7.1 to 7.3

The screwdriver head 710 has an outer contour 711 which can fit in the recess 411, having the inner contour 412, and which is divided into a lower hemispherical section 712 and an upper waist section 713 which are joined to one another at the section transition 714 - at this point the screwdriver head 710 has the greatest cross-width. At the horizontal section transition 714 the screwdriver head 710 has in principle a square cross-section with chamfers 722 in the corner areas; outwardly, this therefore gives a square 715. The essentially four-edged outer contour 711 of the screwdriver head 710 engages with positive locking in the essentially four-edged inner contour 412 in the head 410 of



the clamping screw 400. Viewed in horizontal cross-section, the quadrate formed by the square 715 merges gradually into a circular surface in the direction towards the screwdriver tip 716, i.e. outwardly, the square 715 harmoniously becomes
5 a spherical dome 717.

The waist section 713 starting at the section transition 714 has, when viewed in vertical section, firstly the configuration of an upwardly tapering spherical disc 718
10 which, at the boundary line 719, merges into an attachment piece 720 narrowed in a hyperbola shape, widens out again from the narrowest waist line 721, and finally adjoins the rod section 750 of the special screwdriver 700. Viewed in horizontal cross-section, the square 715 extends across the
15 section transition 714 upwards in the direction of the waist section 713 approximately to the boundary line 719 and here once again runs out in a harmonious manner, so that the quadrate formed by the square 715 merges gradually into a circular surface towards the attachment piece 720.

20 It is of advantage, from the point of view of production engineering and function, if the blind recess 411 in the head 410 of the clamping screw 400 opens out at the bottom 415 into a wide-angled cone tip 416 which reaches almost to
25 the level of the bearing surface 413 forming the transition to the upper shank segment 420. If a straight abutment 100 is being fixed in an implant 1 by means of the clamping screw 400, then, during the screwing procedure, the special screwdriver 700 engages with its rod section 750 through
30 the inlet 130 and with its screwdriver head 710 vertically into the recess 411. The square 715 of the special screwdriver 700 engages with positive locking in the four-edged inner contour 412 of the clamping screw 400, the screwdriver tip 716 sits on the bottom 415 or comes close to



the latter, and the boundary line 719 coincides approximately with the top edge of the clamping screw 400.

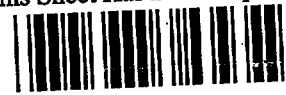
Figure 7.4

5 If an angled abutment 200 or 300 is being fixed in an implant 1 by means of the clamping screw 400, then, during the screwing procedure, the special screwdriver 700 engages with its rod section 750 through the oblique inlet 230 or 330, and with its screwdriver head 710, consequently also
10 obliquely, into the recess 411 of the head 410 of the clamping screw 400. The square 715 is now applied at an angle, but still with positive locking, in the four-edged inner contour 412 of the clamping screw 400; the screwdriver tip 716 is positioned eccentrically with respect to the
15 bottom 415. The boundary line 719, set at an angle to the horizontal, at one end drops into the recess 411 and at the other end protrudes obliquely from the said recess.

In both the straight and the oblique screwing procedures,
20 there must be play available between the inner contour 412 and the outer contour 711, so as to be able to introduce the screwdriver head 710 smoothly into the recess 411 and to withdraw it smoothly therefrom, but also so that, during an oblique screwing procedure, the rotating screwdriver head
25 710 does not jam and cannot roll elliptically with friction on the inner wall of the recess 411.

Further constructional variations of the above-described illustrative embodiments are possible. The following are
30 mentioned here in particular:

- It is also possible, in angled abutments 200, 300, 800 with or without counter-contour 825, to provide a lateral opening for the engagement of a screwdriver for
35 acting on the clamping screw 400. If the inlet 230,



- 330, 830 is continuous and has an internally threaded section 232, 332, 832 at the top, then the inlet and the thread alone have the function of receiving the occlusal screw for fixing the superstructure. If the inlet 230, 330, 830 is not continuous and there is no internally threaded section 232, 332, 832, then the superstructure is cemented on in the conventional manner.
- 10 - Instead of being recessed by means of removal of material, the non-rotationally symmetrical receiving contour 15 provided in the inner cone 14 in the implant head 10 could also be raised, in which case there would then have to be a correspondingly recessed counter-
- 15 contour in the abutment.
- As regards the receiving contour 15 and the complementary counter-contour 825, it is possible to use all practicable, non-rotationally symmetrical geometries, such as polygons, ovals, star shapes and rosette shapes, or else simple wedges, pins and journals with their respective complementary, positive-locking formations.
- 20
- 25 - It is also possible for the internally threaded section 132, 232, 332, 832 to be designed with a diameter which is large enough for the clamping screw 400 to be introduced into the abutment 100, 200, 300, 800 from above. If, in this case, a support shoulder for the head 410 of the clamping screw 400 is formed in the abutment 100, 200, 300, 800, then it would be possible to dispense with the groove 135, 235, 335, 835 in the abutment and with the expanding ring 500.
- 30



- The shape and the presence of outer, rotationally securing contours on the neck portion 810 of the abutment 800 is not obligatory, and the neck portions 810 as such can have any desired, practicable configuration. The plane surfaces 811 could be omitted or replaced by other geometries or formations providing for the rotational securing. On the neck portion 810, an engagement means could be provided for a transverse screwing of the superstructure.
- The neck portions 110, 210, 310, 810 of the abutments 100, 200, 300, 800 can be smoothed to the normal extent for adaptation.
- The lower conical segment 829 on the abutment 800 can be smaller or larger than the upper segment 828. The segment 829 could also be dispensed with entirely, in which case the counter-contour 825 would extend as far as the end 821.
- The abutments 800 can be both straight and angled. In the case of a straight abutment 800 with a continuous inlet 830, the latter extends in a straight line. By contrast, in the case of an angled abutment, whose neck portion is angled in relation to the root portion, a continuous inlet presents a corresponding angled configuration.
- As regards the head 410 of the clamping screw 400, instead of the recess 411 with the inner contour 412, it would also be possible to provide an outer contour onto which an insertion tool can be applied.



- As regards the clamping screw 400, the lower section of the shank segment 420, which adjoins the threaded segment 430, is not absolutely necessary.
- 5 - The slot 510 in the expanding ring 500 could also extend approximately vertically; or a plurality of expansion slots could be provided.
- The recess 411 in the head 410 of the clamping screw
10 400 can also be worked without the chamfer 414, so that an exactly four-edged, square inner contour 412 is obtained. The chamfer 722 on the screwdriver head 710 could likewise be dispensed with.
- 15 - The cone tip 416 sited at the bottom of the recess 411 in the head 410 of the clamping screw 400 is not absolutely necessary for the functioning of the special screwdriver 700.
- As an alternative to the four-edged complementary
20 configuration of the recess 411 in the head 410 of the clamping screw 400 and of the outer contour 711 of the screwdriver head 710, it is also possible for both to be provided with five edges.



Patent Claims

1. Connection arrangement between an implant (1) -
primarily a dental implant - and an abutment (100, 200, 300,
5 800) to be fixed on the implant (1), where:
- a) the implant (1) has a head portion (10) and a downwardly
extending shaft portion (20);
 - b) in the head portion (10) there is a main bore (12) which
ends in the manner of a blind hole at the bottom (13)
10 of the bore, from which there extends an axial,
downwardly running threaded bore (21) with an internal
thread (22);
 - c) the main bore (12) is conically contoured, as a result
of which an upwardly widening inner cone (14) is
15 obtained;
 - d) the implant (1) ends at the very top with an implant
shoulder (11) which can taper upwards;
 - e) the abutment (100, 200, 300, 800) has an upper neck
portion (110, 210, 310, 810) and a lower root portion
20 (120, 220, 320, 820), the former protruding from the
implant (1), and the latter engaging in the inner cone
(14);
 - f) a clamping screw (400) is provided which connects the
abutment (100, 200, 300, 800) to the implant (1) and
25 whose head (410) sits in the abutment (100, 200, 300,
800), while its threaded segment (430) engages in the
threaded bore (21), characterized in that
 - g) the abutment (100, 200, 300, 800) has an inlet (130,
230, 330, 830) beginning at the bottom of the root
30 portion (120, 220, 320, 820), at the end (121, 221,
321, 821);
 - h) in the case of a straight abutment, the inlet (130, 230,
330, 830) is axially continuous;
 - i) in the case of an angled abutment, the inlet (130, 230,
35 330, 830) is angled and either continuous or in the



form of a blind hole, and, in the case of an inlet in the form of a blind hole, a lateral opening is additionally provided;

- 5 j) a radially encircling groove (135, 235, 335, 835) for receiving an expanding ring (500) is present in the inlet (130, 230, 330, 830), in the direction towards the end (121, 221, 321, 821) of the abutment (100, 200, 300, 800);
- 10 k) the clamping screw (400) protrudes through the expanding ring (500), its head (410) sitting on the expanding ring (500), and the clamping screw (400) can be introduced, with its head (410) leading, into the inlet (130, 230, 330, 830) via the root portion (120, 220, 320, 820);
- 15 l) the continuous inlet (130, 230, 330, 830) or the lateral opening provides a screwdriver with access to the head (410) of the clamping screw (400); and
- 20 m) in the case of a continuous inlet (130, 230, 330, 830), an internally threaded section (132, 232, 332, 832) can be present at the top and has the function of receiving an occlusal screw for fixing the superstructure.

2. Connection arrangement according to Claim 1, characterized in that

- 25 a) the clamping screw (400) consists of the head (410), of an adjoining shank segment (420) of reduced diameter, and of the lower threaded segment (430);
- b) a bevelled bearing surface (413) is present at the transition from the head (410) to the shank segment (420);
- 30 c) a radially encircling groove (421) for temporarily receiving the expanding ring (500) is provided on the shank segment (420), as a result of which the shank segment (420) is divided into three sectors, namely an



upper section and a lower section above and below the groove (421) respectively, and the groove (421) itself;

d) the expanding ring (500), in the mounted position on the shank segment (420), sits underneath the head (410) of the clamping screw (400); and

e) the transitions between the groove (421) and the adjoining sections of the shank segment (420) are formed by bevels (422, 423).

10 3. Connection arrangement according to Claim 1 or 2, characterized in that the clamping screw (400) has in the head (410) a recess (411) with an inner contour (412) for engagement of a screwdriver, whose screwdriver head has an outer contour complementary to the inner contour (412).

15 4. Connection arrangement according to Claim 3, characterized in that the inner contour (412) formed by the recess (411) in the head (410) of the clamping screw (400) is a four-edged or five-edged contour which is in the form

20 of a blind hole and which extends from the top side of the head (410) axially into the latter and can open out at the bottom in a wide-angled cone tip (416).

5. Connection arrangement according to Claim 1 or 2, characterized in that

25 a) the expanding ring (500) has a fully continuous slot (510) forming an opening in the expanding ring (500); and

b) on the top edge (520) of the expanding ring (500), a

30 bevelled surface (521) is provided which is complementary to the bearing surface (413) present on the clamping screw (400).

6. Connection arrangement according to Claim 1,

35 characterized in that the clamping screw (400) can be



introduced, with the expanding ring (500) applied, and with the head (410) leading, into the inlet (130, 230, 330, 830) of the abutment (100, 200, 300, 800).

- 5 7. Implant (1), in particular for use in the connection arrangement according to Claim 1, with, at the very top, a radially encircling, annular implant shoulder (11) inside which an axially extending main bore (12) opens out, which main bore (12) widens conically towards the top, 10 forms an inner cone (14) and is intended for the insertion of the conical root portion (120, 220, 820) of an abutment (100, 200, 800), characterized in that
- a) a non-rotationally symmetrical receiving contour (15) is provided on the inner cone (14); and
- 15 b) the receiving contour (15) is designed such that a radially uninterrupted section (18, 19) of the inner cone (14) remains both above it and below it.

8. Implant (1) according to Claim 7, characterized in 20 that the upper section (18) does not have a smaller height than the lower section (19).

9. Implant (1) according to Claim 7 or 8, characterized in that the receiving contour is an inner polygon which is 25 of solid design on the underside and runs out in parabolic points towards the top.

10. Implant (1) according to one of Claims 7 to 9, characterized in that below the receiving contour (15), and 30 directly adjoining the latter, there is a radially encircling groove (17) on the inner cone (14).

11. Abutment (800), in particular for use in the connection arrangement according to Claim 1 and with an 35 implant (1) according to Claim 7, where:



- a) the abutment (800) has an upper neck portion (810) and a lower conical root portion (820);
- b) for retention purposes, a non-rotationally symmetrical, outer counter-contour (825) can be provided on the root portion (820), which counter-contour (825) is complementary to a receiving contour (15) provided in an implant (1), characterized in that
- c) an inlet (830) is provided beginning at the bottom of the root portion (820), at the end (821);
- d) in the case of a straight abutment (800), the inlet (830) is axially continuous;
- e) in the case of an angled abutment (800), the inlet (830) is angled and either continuous or in the form of a blind hole, and, in the case of an inlet in the form of a blind hole, a lateral opening is additionally provided;
- f) a radially encircling groove (835) for receiving an expanding ring (500) is provided in the inlet (830), in the direction towards the end (821) of the abutment (800);
- g) a clamping screw (400) can be introduced, with its head (410) leading, into the inlet (830) via the root portion (820);
- h) the continuous inlet (830) or the lateral opening provides access for a screwdriver;
- i) in the case of a continuous inlet (830), an internally threaded section (832) can be present at the top and has the function of receiving an occlusal screw for fixing the superstructure; and
- j) the neck portion (810) can have on the outside at least one plane surface (811).

12. Abutment (800) according to Claim 11, characterized in that the counter-contour (825) is designed as a polygon such that:



- 5 a) a radially uninterrupted segment (828, 829) of the root portion (820) remains both above it and below it, and the circumferential surfaces of both segments (828, 829) are flush with one another, the lower segment (829) being greater or smaller in height than the upper segment (828); or
- b) the lower segment (829) is dispensed with, as a result of which the counter-contour (825) extends directly to the end (821).
- 10 13. Abutment (100, 200, 300), in particular for use in the connection arrangement according to Claim 1, characterized in that
- 15 a) the abutment (100, 200, 300) is straight or angled and has an upper neck portion (110, 210, 310) and a lower root portion (120, 220, 320);
- b) a continuous inlet (130, 230, 330) is provided, beginning at the bottom of the root portion (120, 210, 310), at the end (121, 221, 321);
- 20 c) a radially encircling groove (135, 235, 335) for receiving an expanding ring (500) is present in the inlet (130, 230, 330), in the direction towards the end (121, 221, 321) of the abutment (100, 200, 300);
- d) a clamping screw (400) can be introduced, with its head (410) leading, into the inlet (130, 230, 330) via the root portion (120, 220, 320);
- 25 e) a screw seat (131, 231, 331) is present at the end of the neck portion (110, 210, 310) inside the inlet (130, 230, 330); and
- 30 f) below the screw seat (131, 231, 331) in the neck portion (110, 210, 310) there is an internally threaded section (132, 232, 332) which extends as far as a bevelled surface (133, 233, 333) and which is adjoined by a widened screwhead section (134, 234, 334).



14. Abutment (300) according to Claim 13, characterized in that the abutment (300) has externally, at the transition between the neck portion (310) and the root portion (320), a
5 recess (341) and a collar (342) which forms a complementary counter-shoulder (343) which, in the assembled state, rests on the inner annular surface of the implant shoulder (11).

15. Abutment (300) according to Claim 14 and when using
10 the connection arrangement according to Claim 1, characterized in that a centring sleeve (600) is fitted into the inner cone (14) of the implant (1) and is screwed onto the threaded segment (430) of the clamping screw (400) and receives within itself the root portion (320) with the
15 expanding ring (500).

16. Centring sleeve according to Claim 15, characterized in that

- a) the centring sleeve (600) consists of a lower, tyre-
20 shaped base portion (610) and of an upwardly extending, thin-walled circumferential continuation (620), the centring sleeve (600) externally widening conically towards the top, complementary to the shape of the inner cone (14);
- 25 b) in the base portion (610) there is an axial bore (611) with an internal thread (612) which can fit the external thread (431); and
- c) a plurality of vertical expansion slots (621) are formed in the circumferential continuation (620) and reach
30 approximately to the level of the base portion (610).

17. Special screwdriver (700), in particular for establishing a connection arrangement according to Claim 1, characterized in that



- 5 a) the screwdriver head (710) located at the very front of a rod section (750) consists of a waist section (713) adjoining the rod section (750), the said waist section (713) widening towards the bottom, and of a hemispherical section (712) which adjoins the waist section at a section transition (714) and which forms the tip of the screwdriver head (710);
- 10 b) the section transition (714) on the screwdriver head (710) constitutes the plane of greatest horizontal extent;
- c) the screwdriver head (710), viewed in horizontal cross-section, is four-edged or five-edged across its main portion on both sides of the section transition (714); and
- 15 d) in the cases of vertical and oblique introduction of the screwdriver head (710) into the recess (411) in the head (410) of the clamping screw (400), this portion comes at least for the most part into engagement with this recess (411) with positive locking.

20

18. Special screwdriver (700) according to Claim 17, characterized in that

- 25 a) in the case of vertical introduction of the screw-driver head (710) into the recess (411), its four-edged or five-edged outer contour extends as far as a boundary line (719) situated above the section transition, and this boundary line coincides approximately with the top edge of the clamping screw (400); and
- 30 b) the waist section (713) has a theoretical, horizontal waist line (721) which lies outside the recess (411) and constitutes the smallest horizontal extent of the screwdriver head (710).



19. Special screwdriver (700) according to Claim 18, characterized in that the screwdriver head (710) has a square (715) and at the very front a spherical dome (717).

E