Title: DENTAL IMPLANT FOR AXIAL INSERTION TO PROVIDE A CRESTAL DISTRACTION

Abstract: The present invention relates to a dental implant for axial insertion, characterized in that it comprises at least one upper distraction portion (1) essentially conical in shape, provided with a microthread (3) with a depth of 0.05 to 0.13 millimeter, and at least one lower portion (2) provided with a macrothread (4), the upper portion (1) representing 50% to 65% of the height of the implant. The intended application of the invention is in the field of dental surgery, particularly for the fitting of a denture in edentate patients having a narrow bone ridge.
Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM), TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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"Dental implant for axial insertion to provide a crestal distraction"

The present invention relates to a dental implant for axial insertion to provide a crestal distraction.

Its intended application is in the field of dental surgery, particularly for the fitting of dentures in edentate patients having a narrow bone ridge, more precisely having a thickness of between three and five millimeters. For this type of patient the fitting of a dental implant cannot be considered without bone grafting. One technique of particular interest is the expansion of the bone ridge. In fact, the jaw bones have elasticity properties that allow an increase in the thickness of the bone ridge. This stage of crestal expansion is classically carried out prior to implant placement, generally inserted in a vertical axial direction in the bone ridge. First of all the bone ridge is drilled at the site of implant placement. Osteotomes, or expanders, or even distractors, with increasing diameters, are inserted in the drilling. They progressively widen the bone ridge by acting on its elasticity. The crestal expansion must stop when the diameter of the drilling is slightly less than that of the implant to be placed.

More than three drilling and expansion tools are generally used. Finishing the site of implant placement may also require tapping prior to placement. The successive use of six tools until placement of the implant is unusual, therefore. The use of these
multiple tools suffers from the disadvantage that the length of surgical intervention is
extended. Moreover, problems with alignment of the axes of the successive tools are
presented, and there are risks of ovalization, heating or jamming.

Moreover, standard expanders are not particularly suited for the implant to be
anchored, and no inspection enables the size of the receiving bed to be determined in
relation to the implant to prevent excessive widening of the bone ridge. Now a poorly
managed expansion may be considered traumatizing and counterproductive in terms of
the objective sought, which is to improve the volume and structure of the receiving
bone bed.

There is therefore a need to improve the dental surgery tools used for bone ridge
distraction.

For this purpose the present invention relates to a dental implant for axial
insertion by limiting the use of expansion tools. For placement of the implant according
to the invention only one drilling tool is required to form a hole at the site of placement.
More precisely, the dental implant for axial insertion comprises an upper essentially
conical distraction portion provided with a microthread, and a lower portion provided
with a macrothread.

The lower portion preferably performs the task of anchoring the implant, whilst
the upper portion is configured to exert an action of distraction of the bone ridge. The
applicant noted with surprise that the combination of the essentially conical shape and
the microthread enables the thickness of the bone ridge to be widened very
progressively and very effectively during the actual insertion of the implant.

In fact, the microthread provides optimum contact with the bone for a traumatism
of perfectly distributed forces, thus avoiding the concentration of stresses that could
damage the bone. Because of the simultaneity of the expansion and implantation
stages, the surgical operating time is reduced whilst its safety, and hence its reliability,
are increased. There is no longer any risk of excessive expansion relative to the
implant.

Moreover, the upper section provided with the microthread represents more than
50%, preferably from 50 to 65%, of the total height of the implant and this, combined
with a microthread of a predetermined depth of the order of 0.05 to 0.13 millimeter,
allows progressive distraction and surprisingly satisfactory anchorage of the implant.

The implant according to the invention exhibits particularly satisfactory
maintenance qualities despite a lower portion provided with the macrothread intended
for anchorage limited to less than half the height of the implant, more preferably of the
order of one third of the height.
According to an advantageous variant of the invention the implant comprises a self-drilling section arranged in the lower section of the lower portion. This self-drilling section shapes the receiving bed of the implant whilst allowing optimum evacuation of the bone debris to prevent jamming of the receiving bed.

The whole, consisting of the lower and upper portions and the drilling section, is preferably essentially in the shape of a right circular cone. This right circular cone shape is particularly effective for distraction of the bone ridge in that it acts as a wedge.

Moreover, it is advantageous for the conical surfaces to be continuous, without any discontinuity in diameter, thereby facilitating the smooth insertion of the implant.

Furthermore, the applicant noticed that this continuity gave rise to progressive expansion, thus enabling the elasticity of the bone ridge to be taken into consideration. There is no longer any risk of accidental fracture or cracking.

Other objectives and advantages will become apparent in the course of the following description of a preferred embodiment of the invention, which is not exhaustive however.

Before this the reader is reminded that the present invention relates to a dental implant for axial insertion characterized in that it comprises at least one upper essentially conical distraction portion provided with a microthread, and at least one lower portion provided with a macrothread.

According to the preferred, but not exhaustive variants of the invention, the implant is designed so that:

- the lower portion is conical in shape,
- the conical shape of the upper portion and/or the lower portion is a right circular cone,
- the lower portion is connected to the upper portion of distraction without any discontinuity in diameter,
- the device has at least partially a mirror polished surface condition,
- the device comprises a cylindrical collar surmounting the upper distraction portion,
- the cylindrical collar has a mirror-polished surface,
- the microthread has a depth of between 0.05 millimeter and 0.13 millimeter,
- the macrothread has a depth of between 0.2 millimeter and 0.4 millimeter,
- the microthread has a pitch of between 0.15 and 0.35 millimeter and a thread flank angle of between 50° and 70°,
- the macrothread has a pitch of between 0.70 and 1 millimeter and a thread flank angle of between 20° and 40°,
- the upper portion represents at least approximately 50% of the height of the implant,
- the device has a nano-rough surface condition on at least one section of its outer surface,
- asperities are formed by sanding with glass grains,
- the roughness average Ra is between 0.9 micrometer and 0.7 micrometer,
- the device comprises a cavity emerging into the upper section of the implant,
- the cavity is provided with inner threading,
- part of the height of the cavity has an internal polygonal shape,
- the inner threading is arranged below the internal polygonal shape.

The attached drawings are given by way of examples of the invention, which are not exhaustive. They only represent one embodiment of the invention and will enable it to be easily understood.

Figure 1 shows, on its right, a general view of the implant and on its left a longitudinal section of the implant.

Figure 2 shows a longitudinal section of the envelope of the implant without threading.

Figure 3 shows a perspective view of the implant.

Figures 4 and 5 are detailed views of the microthread and macrothread respectively.

Figure 6 shows the self-drilling section of the implant.

Figure 7 shows a top view of the implant.

The implant according to the invention is intended to be inserted in a vertical axial direction in the bone ridge of the jaw of a patient awaiting a denture. It rotates independently whilst it is being inserted.

The lower end 13 of the implant is understood to be the end that first penetrates the receiving bed and is buried to the greatest depth in the bone ridge.

On the contrary, the upper end 12 of the implant is the end that is closest to the surface of the receiving bed.

The implant is advantageously manufactured of titanium without welding or addition.

The implant comprises an upper distraction portion 1 and a lower portion 2. Upper portion 1 is essentially conical in shape and provided with a microthread 3. Lower portion 2 is provided with a macrothread 4.
Lower portion 2 is advantageously intended to anchor the implant in the bone ridge, whilst upper portion 1 is intended to expand the bone ridge, i.e. widen it. Thanks to this upper portion 1 the implant acts as an expansion wedge.

Microthread 3, arranged on upper portion 1, conical in shape, allows progressive expansion of the bone ridge without jolting, which enables it to act on the elasticity of the jawbone without damaging it. Microthread 3 preferably has a pitch of the order of 0.15 to 0.35 millimeter and a thread flank angle of between 50° and 70°. In Figures 1 and 4, microthread 3 shown is characterized by a pitch of 0.25 millimeter for a thread flank angle of 60°. The depth of the thread is preferably between 50 micrometers and 130 micrometers, advantageously of the order of 70 micrometers. The shape of the thread of microthread 3 is preferably of the symmetrical trapezoidal type.

Lower portion 2 is preferably essentially conical in shape. Therefore all upper 1 and lower portions 2 are conical in shape.

The conical shapes are advantageously right circular cones that facilitate the insertion of the implant whilst rotating. In order to confer upon the implant a distraction function the cones are arranged with the vertex directed towards the lower end of the implant.

According to a preferred variant, upper portion 1 is connected to lower portion 2 without discontinuity of diameter, thus allowing continuity of the displacement of the implant in the receiving bed. Upper portion 1 and lower portion 2 have the same conicity. By way of example, the angle of divergence of upper portion 1 is identical to that of lower portion 2, with the exception of self-drilling section 9. This angle is between 4 and 15°, preferably of the order of 5°.

According to the embodiment shown in all the figures, upper 1 and lower 2 portions are directly connected to each other. However, according to another embodiment a conical or cylindrical median zone may be arranged between upper portion 1 and lower 2 portion.

Macrothread 4 enables the receiving bed to be pushed and generates slight compression of the bone of the receiving bed, thus allowing correct wedging and anchorage of the implant. The macrothread preferably has a pitch of the order of 0.70 millimeter to 1 millimeter and a thread flank angle of between 20° and 40°. Macrothread 4, shown in Figures 1 and 5, is characterized by a pitch of 0.84 millimeter and a thread flank angle of 30°. The depth of the thread is preferably between 200 micrometers and 400 micrometers, preferably of the order of 300 micrometers. In the same way as for microthread 3, macrothread 4 is advantageously of the symmetrical trapezoidal type.
Microthread 3 and macrothread 4 are preferably continuous. As shown in Figure 1 there is therefore no discontinuity in threading between upper portion 1 and lower 2 portion.

Microthread 3 generates a controlled axial displacement in rotation of the implant for progressive widening of the bone ridge. Moreover, the presence of this threading increases the surface of contact between the biological tissues and the implant, thus improving the fixation of the implant and stimulating bone regeneration.

Lower portion 2 advantageously comprises a self-drilling section 9 in its lower section. This self-drilling section 9 comprises cutting edges 10, advantageously three in number, more precisely arranged at 120° from each other. This self-drilling section 9 facilitates the introduction of the implant in the receiving bed by shaping it. The orientation of these cutting edges 10 feeds the debris and other irrigation fluids to the outside of the hole in the receiving bed, thus avoiding all risk of jamming.

Above upper portion 1 the implant advantageously comprises a cylindrical collar 6. This cylindrical collar 6 has a mirror polished surface condition. Cylindrical collar 6 is advantageously in the mirror polished surface condition on its axial outer surface 11. The radial upper surface of cylindrical collar 6 may also have a mirror polished surface condition. A mirror polished surface condition having an arithmetic average roughness Ra less than 0.2 micrometer, which may extend to 0.06 micrometer, gives perfect satisfaction. The term mirror polished refers to the surface property of a material capable of reflecting light radiation because of its low roughness.

The mirror polished surface condition of cylindrical collar 6 on its axial and/or radial periphery contributes to atraumatic positioning of the implant on the bone ridge. In fact, it is preferably at the level of cylindrical collar 6 that the implant emerges from the bone ridge. Therefore the mirror polished surface condition which has a very low roughness, as described above, is atraumatic because it causes no damage, tearing or abrasion of the surrounding biological tissues. The upper section of the bone ridge is therefore intact and will readily heal.

According to one embodiment the implant comprises a cavity 5 emerging into the upper section of the implant. Depending on the embodiments cavity 5 emerges into the upper part of upper portion 1 or into the upper section of cylindrical collar 6. Cavity 5 preferably extends throughout upper portion 1. This cavity 5 has at least partially an internal polygonal shape, e.g. octagonal, preferably at the level of cylindrical collar 6. This octagonal shape 8 advantageously constitutes a zone of engagement of the driving means of the rotating implant used for its placement.
Furthermore, cavity 5 may be provided with an inner thread 7. Inner thread 7 is preferably arranged more deeply into cavity 5 than octagonal shape 8. Inner thread 7 contributes, for example, to fixing a denture.

The applicant noticed that it was advantageous for upper portion 1 to represent at least 50% of the height of the implant, and in particular between 50% and 65%. According to this configuration the bone distraction is carried out deep into the bone ridge, thus enabling the entire height of the bone ridge to be acted upon. Moreover, the anchorage of the implant is still satisfactory.

An advantageous example of a selection of dimensions relating to the implant is given below.

- Height of cylindrical collar 6: 0.7 millimeter.
- Height of upper portion 1: 5.8 millimeters.
- Height of lower portion 2: 5.5 millimeters, 2.4 millimeters of which in self-drilling section 9.
- Diameter at the lower end of the implant: 0.15 millimeter.
- Diameter at the junction between self-drilling section 9 and the rest of lower portion 2: 2.45 millimeters.
- Diameter at the junction between lower portion 2 and upper portion 1: 2.7 millimeters.
- Diameter at the junction between upper portion 1 and cylindrical collar 6: 3.6 millimeters.
- Diameter of cylindrical collar 6: 3.6 millimeters.
- Total height of the implant: 12 millimeters.

It is advantageous to arrange for the implant to be self-tapping over its entire height, again enabling the number of tools to be used to be limited. In fact, it is not necessary, with the implant according to the invention, to tap the receiving bed before placement.

According to a preferred variant, the implant has a nano-rough surface, at least on upper portion 1, and possibly on upper 1 and lower 2 portions. The arithmetic average roughness Ra is preferably between 0.7 micrometer and 0.9 micrometer, more precisely 0.8 micrometer. By way of example, asperities are formed on the surface of the implant after its production. These asperities are preferably produced by sanding with glass grains of a size of between 100 and 200 micrometers. This nano-roughness is highly advantageous to allow the osteo-reconstruction of the bone ridge. In fact, these asperities allow the positioning of stem cells, and hence the bone regeneration of the biological tissue surrounding the implant.
REFERENCES

1. Upper portion
2. Lower portion
3. Microthread
4. Macrothread
5. Cavity
6. Cylindrical collar
7. Inner thread
8. Octagonal shape
9. Self-drilling section
10. Cutting edge
11. Axial outer surface
12. Upper end
13. Lower end
CLAIMS

1. A dental implant for axial insertion, characterized in that it comprises at least one upper distraction portion (1), essentially conical in shape, provided with a microthread (3) having a depth of 0.05 to 0.13 millimeter, and at least one lower portion (2) provided with a macrothread (4), the upper portion (1) representing 50% to 65% of the height of the implant.

2. The implant according to Claim 1, wherein the lower portion (2) is conical in shape.

3. The implant according to Claim 1 or 2, wherein the conical shape of the upper portion (1) and/or of the lower portion (2) is a right circular cone.

4. The implant according to any one of the preceding claims, wherein the lower portion (2) is connected to the upper distraction portion (1) without discontinuity of diameter.

5. The implant according to any one of the preceding claims, having at least partially a mirror polished surface condition.

6. The implant according to any one of the preceding claims, having a cylindrical collar (6) surmounting the upper distraction portion (1).

7. The implant according to Claim 6, wherein the cylindrical collar (6) has a mirror polished surface condition.

8. The implant according to any one of the preceding claims, wherein the macrothread (4) has a depth of between 0.2 and 0.4 millimeter.

9. The implant according to any one of the preceding claims, wherein the microthread (3) has a pitch of between 0.15 and 0.35 millimeter and a thread flank angle of between 50° and 70°.

10. The implant according to any one of the preceding claims, wherein the macrothread (4) has a pitch of between 0.70 and 1 millimeter and a thread flank angle of between 20° and 40°.

11. The implant according to any one of the preceding claims having a nano-rough surface condition over part of its outer surface.

12. The implant according to Claim 11, wherein asperities are formed by sanding with glass grains.

13. The implant according to Claim 11 or 12, wherein the roughness average Ra is between 0.9 and 0.7 micrometer.

14. The implant according to any one of the preceding claims, comprising a cavity (5) emerging into the upper section of the implant.
15. The implant according to Claim 14, wherein the cavity (5) is provided with an inner thread (7).
16. The implant according to Claim 14 or 15, wherein part of the height of the cavity (5) has an inner polygonal shape (8).
17. The implant according to Claims 15 and 16, wherein the inner thread (7) is arranged below the inner shape (8).
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 practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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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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Date of the actual completion of the international search
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Date of mailing of the international search report
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