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(54) Title: POROUS DENTAL IMPLANT

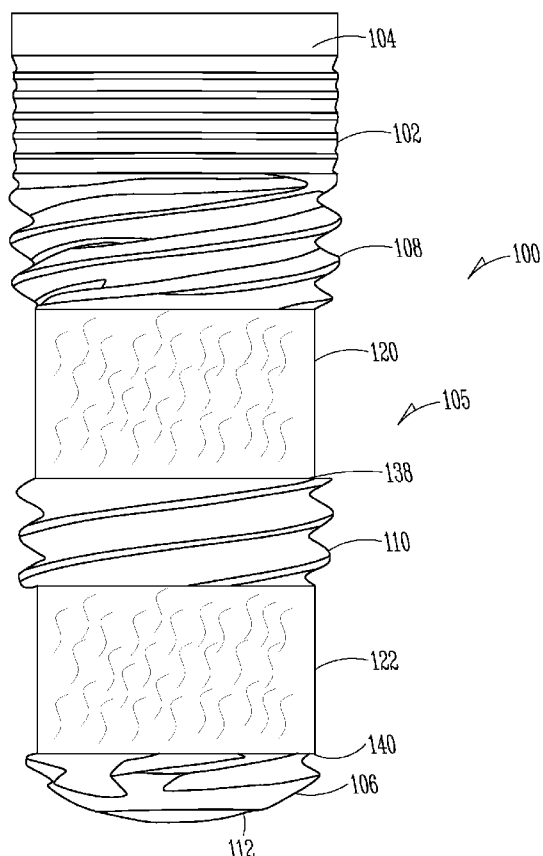


FIG. 1

(57) Abstract: An implant can include a core having a head portion and a stem portion extending from the head portion. The stem portion can include an intermediate threaded section, a first porous section located along the stem portion, and a second porous section located along the stem portion, wherein the intermediate threaded section of the stem separates the first porous section from the second porous section.



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POROUS DENTAL IMPLANT

CLAIM OF PRIORITY

5 This application claims the benefit of U.S. Provisional Patent Application Serial No. 61/675,491, filed on July 25, 2012, the benefit of priority of which is claimed hereby, and is incorporated by reference herein in its entirety.

FIELD

10 The present subject matter relates to an orthopedic system and specifically to a porous implant.

BACKGROUND

15 Often it can be desirable to replace lost, missing, injured, or diseased teeth using dental devices. Prosthetic dental devices can include dental implants, which can be inserted into the mandible or maxilla of a patient, and abutments, which can be attached to the implant to serve as a mount for a prosthetic tooth, and provisional and temporary devices, which can be used during the healing process.

20 The dental implant can be threaded into a bore which can be drilled into the patient's mandible or maxilla at an edentulous site. Over a period of several months, the patient's jaw bone grows around the implant to securely anchor the implant in the surrounding bone, a process known as osseointegration. The implant provides an anchoring member for a dental abutment, which, in turn, provides an interface between the implant and a dental restoration. For example, U.S. Patents
25 5,989,027 and 8,075,312 discuss dental implants.

OVERVIEW

30 In Example 1, an implant includes a core, having a head portion and a stem portion extending from the head portion, the stem portion including an intermediate threaded section, a first porous section located along the stem portion, and a second porous section located along the stem portion, wherein the intermediate threaded section of the stem separates the first porous section from the second porous section.

In Example 2, the implant of Example 1 optionally includes the first porous section and the second porous section respectively including first and second porous sleeves disposed around the stem portion.

5 In Example 3, the implant of any of Examples 1 or 2 optionally includes the first porous section having a greater diameter than the second porous section.

In Example 4, the implant of any of Examples 1 through 3 optionally includes the first porous section located toward a coronal end of the implant and the second porous section located toward an apical end of the implant.

10 In Example 5, the implant of any of Examples 1 through 4 optionally includes a third porous section located along the stem portion.

In Example 6, the implant of Example 5 optionally includes the stem including a second, intermediate threaded section separate from the intermediate threaded section and the second intermediate threaded section separating the third porous section from the second porous section.

15 In Example 7, the implant of any of Examples 1 through 6 includes the intermediate threaded section being non-porous.

In Example 8, the implant of any of Examples 1 through 7 optionally includes the first porous section including a porous tantalum sleeve disposed around the stem portion and the second porous section including a porous tantalum sleeve
20 disposed around the stem portion.

In Example 9, the implant of any of Examples 1 through 8 optionally includes the stem portion including a first, coronal threaded section, the intermediate threaded section, and a third apical threaded section.

25 In Example 10, the implant of any of Examples 1 through 9 optionally includes the first porous section and the second porous section respectively including first and second porous metallic sleeves disposed around the stem portion.

In Example 11, the implant of Example 10 optionally includes the first and second porous metallic sleeves including porous tantalum, porous titanium, or porous niobium sleeves.

30 In Example 12 an implant includes a core, having a head portion, including an abutment interface, and a stem portion, extending from the head portion, the stem

portion including a first, coronal threaded section, an intermediate threaded section, and a third, apical threaded section, a first porous metallic sleeve disposed around the stem portion, a second porous metallic sleeve disposed around the stem portion, wherein the intermediate threaded section of the stem portion separates the first
5 porous metallic sleeve from the second porous metallic sleeve, and wherein the first porous metallic sleeve is located toward a coronal end of the implant and the second porous metallic sleeve is located toward an apical end of the implant.

In Example 13, the implant of Example 12 optionally includes the first porous metallic sleeve having a greater diameter than the second porous metallic
10 sleeve.

In Example 14, the implant of any of Examples 12 or 13 optionally includes a third porous metallic sleeve disposed around the stem portion.

In Example 15, the implant of Example 14 optionally includes the stem portion including a second, intermediate threaded section separate from the
15 intermediate threaded section, and wherein the second intermediate threaded section separates the third porous metallic sleeve from the second porous metallic sleeve.

In Example 16, the implant of any of Examples 12 through 15 optionally includes the first, coronal threaded section, the intermediate threaded section, and the third, apical threaded section being non-porous.

In Example 17, the implant of any of Examples 12 through 16 optionally includes the first porous metallic sleeve including a porous tantalum sleeve and the second porous metallic sleeve including a porous tantalum sleeve.
20

In Example 18, the implant of any of Examples 12 through 17 optionally includes the first, coronal threaded section having a greater diameter than the intermediate threaded section, and the intermediate threaded section having a
25 greater diameter than the third, apical threaded section.

In Example 19, the implant of any of Examples 12 through 18 optionally includes the first and second porous metallic sleeves including porous tantalum, porous titanium, or porous niobium sleeves.

In Example 20 a method includes inserting a dental implant into a mouth such that a first threaded apical section contacts an osteotomy wall, further inserting
30

the dental implant such that an apical porous section contacts the osteotomy wall, further inserting the implant such that an intermediate threaded section contacts the osteotomy wall, and further inserting the implant such that a coronal porous section contacts the osteotomy wall.

5 In Example 21, the method of Example 20 optionally includes the apical porous section having a smaller diameter than the coronal porous section.

 These examples can be combined in any permutation or combination. This overview is intended to provide an overview of subject matter of the present patent application. It is not intended to provide an exclusive or exhaustive explanation of
10 the invention. The detailed description is included to provide further information about the present patent application.

BRIEF DESCRIPTION OF THE DRAWINGS

 In the drawings, which are not necessarily drawn to scale, like numerals may
15 describe similar components in different views. Like numerals having different letter suffixes may represent different instances of similar components. The drawings illustrate generally, by way of example, but not by way of limitation, various embodiments discussed in the present document.

20 FIG. 1 shows a side view of a dental implant.

 FIG. 2 shows a cross-section view of the dental implant of FIG. 1.

 FIG. 3 shows a side view of a dental implant.

 FIG. 4 shows a side view of the dental implant of FIG.1 during implantation.

 FIG. 5 shows the dental implant of FIG. 1 after being implanted.

25

DETAILED DESCRIPTION

 FIG. 1 shows a side view of an example of a dental implant 100, and FIG. 2 shows a cross-section view of the dental implant 100. The dental implant 100 can
30 include a core 102 that can have a head portion 104 that can include an abutment interface 103, and a stem portion 105 extending from the head portion 104. The

stem portion 105 can include a first, coronal threaded section 108, an intermediate threaded section 110, and a third, apical threaded section 112; each of these threaded sections can be separated from adjacent threaded section(s) by a non-threaded region. The core 102 can be made of a suitable biocompatible material, such as titanium. The threaded sections 108, 110, and 112 can have a tapered structure such that apical threaded section 112 has a smaller diameter than threaded sections 108 and 110, and intermediate threaded section 110 has a smaller diameter than coronal threaded section 108. The threaded sections 108, 110, and 112 can be non-porous. An internal hex 232 and an internally threaded bore 234 can be provided, such as for attaching a dental abutment. The core 102 can be solid or have at least a partially hollow structure.

The dental implant 100 can include a first porous section 120 and a second porous section 122 located along the stem portion 105, forming a stratified structure. The intermediate threaded section 110 of the stem portion 105 can separate the first porous section 120 from the second porous section 122, such that the first porous section 120 can be located towards the coronal end of the dental implant 100 and the second porous section 122 can be located towards the apical end of the dental implant 100.

The first and second porous sections 120, 122 can include or can be formed of a porous material, such a porous metallic material, such as porous tantalum. The first and second porous sections 120, 122 can include porous metallic sleeves, such as porous tantalum sleeves that can be disposed along the length of the stem portion 105.

For example, the first and second porous sections 120, 122 can be formed of highly porous biomaterial useful as a bone substitute and/or cell and tissue receptive material. An example of such a material can be produced using Trabecular Metal ® technology generally available from Zimmer, Inc., of Warsaw, Ind. Trabecular Metal ® is a trademark of Zimmer Technology, Inc. Such a material can be formed from a reticulated vitreous carbon foam substrate, which can be infiltrated and coated with a biocompatible metal, such as tantalum, etc., such as using a chemical vapor deposition (“CVD”) process, such as in the manner disclosed in detail in U.S.

Pat. No. 5,282,861, the disclosure of which is incorporated herein by reference.

One or more other metals such as niobium, titanium, or one or more alloys of tantalum and niobium with each other or with one or more other metals can also be used.

5 The porous tantalum structure of the porous sections 120, 122 can include a large plurality of ligaments defining open spaces therebetween, with an individual ligament generally including a carbon core covered by a thin film of metal, such as tantalum, for example. The open spaces between ligaments can form a matrix of continuous channels, such that growth of cancellous bone through the porous
10 tantalum structure can be uninhibited. The porous tantalum can include up to 75%-85% or more void space therein. Porous tantalum can provide a lightweight, strong porous structure, which can be substantially uniform and consistent in composition, and can closely resemble the structure of natural cancellous bone, and thereby can provide a matrix into which cancellous bone can grow, such as to anchor the dental
15 implant 100 into the surrounding bone of a patient's jaw.

 The porous tantalum structure can be made in a density that can be selected from variety of available densities, such as to selectively tailor the structure for a particular application. In particular, such as discussed in the above-incorporated U.S. Pat. No. 5,282,861, the porous tantalum can be fabricated to a desired porosity
20 and pore size, and can thus be matched with the surrounding natural bone, such as to provide a matrix that can facilitate bone ingrowth and mineralization.

 As the dental implant 100 is being inserted into a patient's jaw, the first and second porous sections 120, 122 can be considered to be "dead zones" where the dental clinician cannot feel what the surrounding bone feels like. There is a tactile
25 difference between the porous sections 120, 122 and the threaded sections 110, 112, and 108, during insertion of the dental implant 100. Dental clinicians may rely on tactile resistance during implant placement, such as to determine bone quality or to determine the speed of restoration. Here, the dental implant 100 allows for multiple tissue regions to be evaluated as the dental implant 100 is being placed, due to the
30 tactile resistance of threaded sections 108, 110, 112. This can give the clinician additional information, such as regarding bone quality.

The dental implant 100 can reduce the continuous distance of the collective dead zone of the porous sections 120, 122, such as by using the intermediate threaded section 110 between the porous sections 120, 122. This structure can also help during implantation because a long continuous dead zone creates a section of the implant that cannot be effectively driven or backed out of the osteotomy.

Should there be a need to reposition or re-drill the osteotomy, the clinician will be hindered from withdrawing such an implant. In contrast, in the present implant 100, when the porous sections 120 or 122 are contacting bone, the intermediate threaded section 110 can allow the clinician to agitate or otherwise manipulate the dental implant 100, such as to reengage the threaded section 110 into bone. This can help allow the clinician to resume control during the implantation. The present implant 100 can improve surgical control and initial stability of the implant 100 while providing sufficient porous volume from porous sections 120 and 122 to allow for secondary bone apposition.

The configuration of the implant 100 can also help improve mechanical and biological function of the implant 100. The implant 100 can be configured to provide an improved method for improving primary and secondary implant fixation, such as by increasing surgical control during placement, and such as by minimizing the sensitivity of prior implants to variations in bone density.

In an example, the first porous section 120 can have a greater diameter than the second porous section 122. Each of the first porous section 120 and the second porous section 122 include an apical edge (e.g., a scraping edge) 138 and 140, respectively. The greater diameter of the first porous section 120 can allow its leading apical edge 138 to engage the osteotomy wall. The leading apical edges 138 and 140 can generate bone particulate as the implant is screwed into the osteotomy. The bone particulate can become entangled with or embedded within the porous material of porous sections 120 and 122. These entangled or embedded bone fragments can function similarly to a bone grafting material, and can help enhance secondary tissue ingrowth. However, if a single porous section were used for implant 100, the bone fragments may not reach the coronal aspect of the implant because they may have been exhausted and fully embedded at the apical end of the

single porous section. The present implant 100, with two separate porous sections 120, 122 that can have different diameters, can allow the apical edge 138 of the first porous section 120 to develop bone fragments for the porous section 120, which can thus help promote resulting in faster secondary bone ingrowth.

5 Moreover, by having the first porous section 120 with a greater diameter than the second porous section 122, the primary implant stability can be increased, because the offset diameters of the first and section porous section 120, 122 can allow for increased tissue compression of the implant within the osteotomy.

10 In an example, the implant 100 can be formed as a layered structure. In such an example, a first section of the core 102 that is above (e.g., more proximal than) the intermediate threaded section 110 can be provided. The porous section 120 can be slipped over the stem and secured to the core 102 in a suitable manner, such as via cement or by sintering the porous section 120 to the core 102, for example. The intermediate threaded section 110, with its stem, can then be attached to the upper
15 portion of the implant, such as by welding, for example. The second porous section 122 can then be slipped over the stem and attached to the core 102, such as discussed above. Then, the lower threaded section can be attached to the bottom of the stem to complete the implant 100.

20 In an example, the porous section 120, 122 can be attached to the core 102 in a manner wherein, after osseointegration of porous sections 120, 122 into the surrounding bone, the core 102 can be slightly movable relative to the porous sections 120, 122, such as to dissipate mastication or other forces imposed upon the implant 100. For example, the porous sections 120, 122 can be secured to the core 102, such as via an adhesive material that is slightly compressible, such that when
25 mastication or other forces are imposed upon the head portion of the implant 100 via the prosthesis and abutment, the head portion and/or stem portion of the core 102 of the implant 100 can move slightly relative to the porous sections 120, 122.

30 FIG. 3 shows a side view of an example of a dental implant 300. The dental implant 300 can be similar to the dental implant 100 described above, but in this case, the dental implant 300 can include an additional porous section.

The dental implant 300 can generally include a core 302 that can have a head portion 304, such as can include an abutment interface 330, and a stem portion 305, such as extending from the head portion 304. The stem portion 305 can include a first, coronal threaded section 308, a first intermediate threaded section 310, a second intermediate threaded section 312, and an apical threaded section 314. The core 302 can be made of a suitable biocompatible material, such as titanium. The threaded sections 308, 310, 312, and 314 can have a tapered structure, e.g., such that the apical threaded section 314 can have a smaller diameter than the threaded sections 308, 310, and 312, and the second intermediate threaded section 312 can have a smaller diameter than the coronal threaded section 308 and the first intermediate threaded section 310, and the first intermediate threaded section 310 can have a smaller diameter than coronal threaded section 308. The threaded sections 308, 310, 312, and 314 can be non-porous. The implant 300 can further include an internal hex and an internally threaded bore, such as for attaching a dental abutment, such as discussed above for implant 100.

The dental implant 300 can include a first porous section 320, a second porous section 322, and a third porous section 324 located along the stem portion 305. The first intermediate threaded section 310 of the stem portion 305 separates the first porous section 320 from the second porous section 322, and the second intermediate threaded section 312 separates the second porous section 322 from the third porous section 324. Thus, the first porous section 320 can be located toward the coronal end of the dental implant 300, the second porous section can be located at an intermediate area of the implant 300, and the third porous section 324 can be located toward the apical end of the dental implant 300.

In an example, the first porous section 320 can have a greater diameter than the second porous section 322, and the second porous section 322 can have a greater diameter than third porous section 324. Each of the first porous section 320, the second porous section 322, and the third porous section 324 can include an apical edge 380, 382, and 384, respectively. As discussed above, the relatively greater sizes of each porous section 320, 322, and 324, proceeding from the apical toward the coronal end of the implant 300, can allow each of the leading apical edges 384,

382, and 380 to engage the osteotomy wall. As discussed, this can help improve retention of bone particulate along the entire length of the implant 300. Further, the primary implant stability can be increased since the offset diameters of the first, section, and third porous sections 320, 322, and 324 allow for successively
5 increased tissue compression of the implant within the osteotomy.

In other embodiments, four or more porous sections can be provided for an implant, such as discussed herein.

FIGs 4 and 5 show an example of the implant 100 being implanted, with FIG. 4 showing a side view of the dental implant 100 during implantation and FIG.
10 5 showing the dental implant 100 after being implanted.

Here, a mouth can include a gingiva 410, a bone 400 and an osteotomy 402 bored into the bone 400 to receive the implant 100. A dental clinician can insert the dental implant 100 into the osteotomy such that the first threaded apical section 112 contacts an osteotomy wall 403. As the dental implant 100 is further implanted, the
15 apical porous section 122 contacts the osteotomy wall, then the intermediate threaded section 110 contacts the osteotomy wall, and then the coronal porous section 120 contacts the osteotomy wall. As discussed, the porous section 120 can have a larger diameter than the porous section 122, such that each leading apical edge of each of the porous sections 120, 122 can produce bone particulate during
20 the implantation, which can then become entangled with or embedded in the porous material, such as to enhance the grafting process.

Thereafter, a cap can be fitted onto the implant 100, such as to close the abutment coupling structure of the implant 100, and the gingiva can be sutured over the implant. In a second stage of the procedure, following osseointegration, the
25 dental clinician can reopen the gingiva at the implant site, and can secure an abutment and, optionally, a temporary prosthesis or temporary healing member, to the implant 100. Then, a suitable permanent prosthesis or crown can be fashioned, such as from one or more impressions taken of the abutment and the surrounding gingival tissue and dentition. Then, the temporary prosthesis or healing member can
30 be removed and replaced with the permanent prosthesis, which can be attached to the abutment, such as with cement or with a fastener, for example.

In some examples, the stratified structure of the described implant can be incorporated into other implants such as spinal implants.

Additional Notes

5 The above detailed description includes references to the accompanying drawings, which form a part of the detailed description. The drawings show, by way of illustration, specific embodiments in which the invention can be practiced. These embodiments are also referred to herein as “examples.” Such examples can include elements in addition to those shown or described. However, the present
10 inventors also contemplate examples in which only those elements shown or described are provided. Moreover, the present inventors also contemplate examples using any combination or permutation of those elements shown or described (or one or more aspects thereof), either with respect to a particular example (or one or more aspects thereof), or with respect to other examples (or one or more aspects thereof)
15 shown or described herein.

 All publications, patents, and patent documents referred to in this document are incorporated by reference herein in their entirety, as though individually incorporated by reference. In the event of inconsistent usages between this document and those documents so incorporated by reference, the usage in the
20 incorporated reference(s) should be considered supplementary to that of this document; for irreconcilable inconsistencies, the usage in this document controls.

 In this document, the terms “a” or “an” are used, as is common in patent documents, to include one or more than one, independent of any other instances or usages of “at least one” or “one or more.” In this document, the term “or” is used to
25 refer to a nonexclusive or, such that “A or B” includes “A but not B,” “B but not A,” and “A and B,” unless otherwise indicated. In the appended claims, the terms “including” and “in which” are used as the plain-English equivalents of the respective terms “comprising” and “wherein.” Also, in the following claims, the terms “including” and “comprising” are open-ended, that is, a system, device,
30 article, or process that includes elements in addition to those listed after such a term in a claim are still deemed to fall within the scope of that claim. Moreover, in the

following claims, the terms “first,” “second,” and “third,” etc. are used merely as labels, and are not intended to impose numerical requirements on their objects.

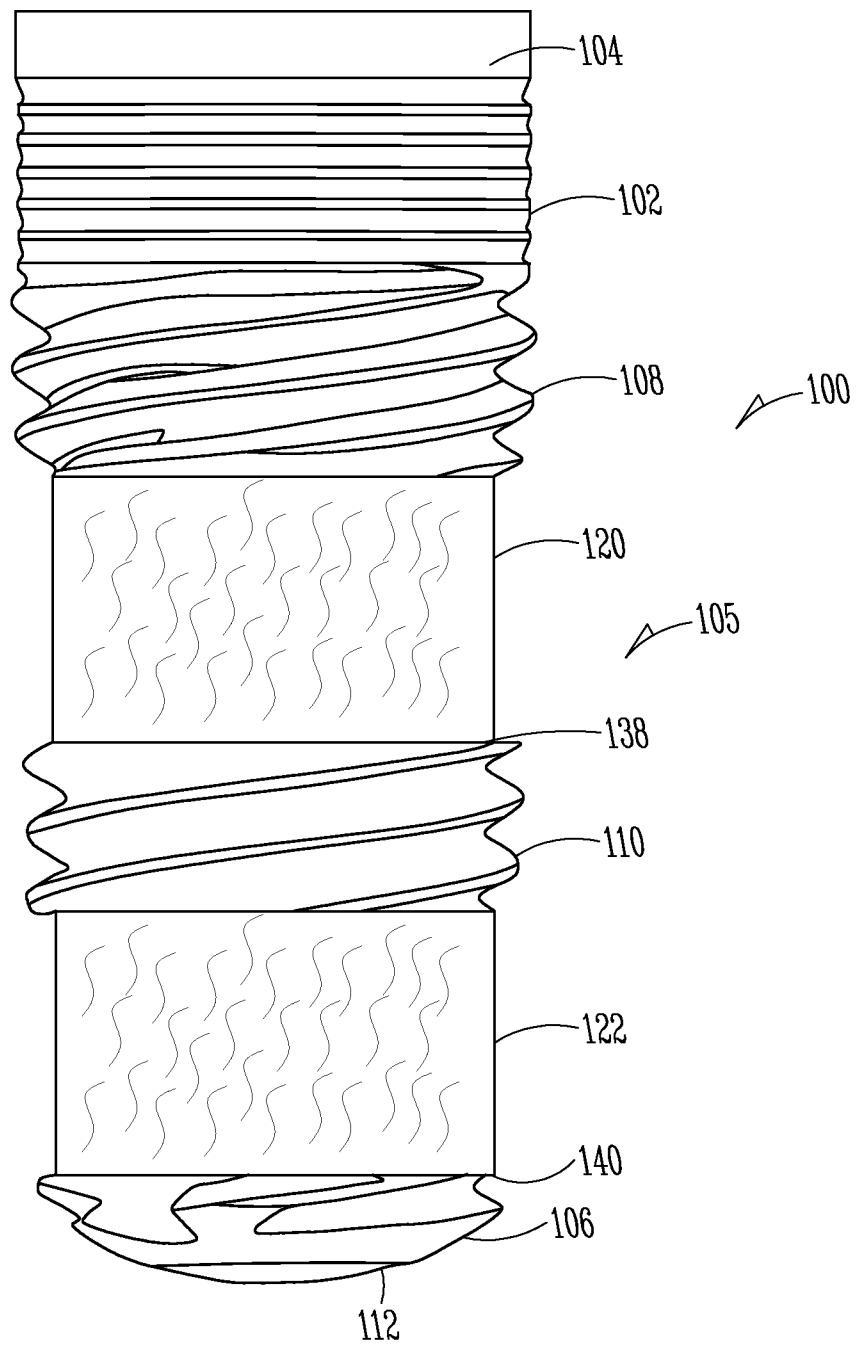
THE CLAIMED INVENTION IS:

1. An implant comprising:
 - 5 a core, having a head portion and a stem portion extending from the head portion, the stem portion including an intermediate threaded section;
a first porous section located along the stem portion; and
a second porous section located along the stem portion, wherein the intermediate threaded section of the stem separates the first porous section from the
10 second porous section.
2. The implant of claim 1, wherein the first porous section and the second porous section respectively include first and second porous sleeves disposed around the stem portion.
15
3. The implant of any one of claims 1 or 2, wherein the first porous section has a greater diameter than the second porous section.
4. The implant of any one of claims 1 through 3, wherein the first porous
20 section is located toward a coronal end of the implant and the second porous section is located toward an apical end of the implant.
5. The implant of any one of claims 1 through 4, including a third porous section located along the stem portion.
25
6. The implant of claim 5, wherein the stem includes a second, intermediate threaded section separate from the intermediate threaded section and the second intermediate threaded section separates the third porous section from the second porous section.
30

7. The implant of any one of claims 1 through 6, wherein the intermediate threaded section is non-porous.
8. The implant of any one of claims 1 through 7, wherein the first porous section includes a porous tantalum sleeve disposed around the stem portion and the second porous section includes a porous tantalum sleeve disposed around the stem portion.
9. The implant of any one of claims 1 through 8, wherein the stem portion includes a first, coronal threaded section, the intermediate threaded section, and a third apical threaded section.
10. The implant of any one of claims 1 through 9, wherein the first porous section and the second porous section respectively include first and second porous metallic sleeves disposed around the stem portion.
11. The implant of claim 10, wherein the first and second porous metallic sleeves include porous tantalum, porous titanium, or porous niobium sleeves.
12. An implant comprising:
a core, having a head portion, including an abutment interface, and a stem portion, extending from the head portion, the stem portion including a first, coronal threaded section, an intermediate threaded section, and a third, apical threaded section;
a first porous metallic sleeve disposed around the stem portion;
a second porous metallic sleeve disposed around the stem portion, wherein the intermediate threaded section of the stem portion separates the first porous metallic sleeve from the second porous metallic sleeve; and
wherein the first porous metallic sleeve is located toward a coronal end of the implant and the second porous metallic sleeve is located toward an apical end of the implant.

13. The implant of claim 12, wherein the first porous metallic sleeve has a greater diameter than the second porous metallic sleeve.
- 5 14. The implant of any one of claims 12 or 13, including a third porous metallic sleeve disposed around the stem portion.
15. The implant of claim 14, wherein the stem portion includes a second, intermediate threaded section separate from the intermediate threaded section, and
10 wherein the second intermediate threaded section separates the third porous metallic sleeve from the second porous metallic sleeve.
16. The implant of any one of claims 12 through 15, wherein the first, coronal threaded section, the intermediate threaded section, and the third, apical threaded
15 section are non-porous.
17. The implant of any one of claims 12 through 16, wherein the first porous metallic sleeve includes a porous tantalum sleeve and the second porous metallic sleeve includes a porous tantalum sleeve.
20
18. The implant of any one of claims 12 through 17, wherein the first, coronal threaded section has a greater diameter than the intermediate threaded section, and the intermediate threaded section has a greater diameter than the third, apical threaded section.
25
19. The implant of any one of claims 12 through 18, wherein the first and second porous metallic sleeves include porous tantalum, porous titanium, or porous niobium sleeves.
30

20. A method comprising:
inserting a dental implant into a mouth such that a first threaded apical
section contacts an osteotomy wall;
further inserting the dental implant such that an apical porous section
5 contacts the osteotomy wall;
further inserting the implant such that an intermediate threaded section
contacts the osteotomy wall; and
further inserting the implant such that a coronal porous section contacts the
osteotomy wall.
10
21. The method of claim 20, wherein the apical porous section has a smaller
diameter than the coronal porous section.

**FIG. 1**

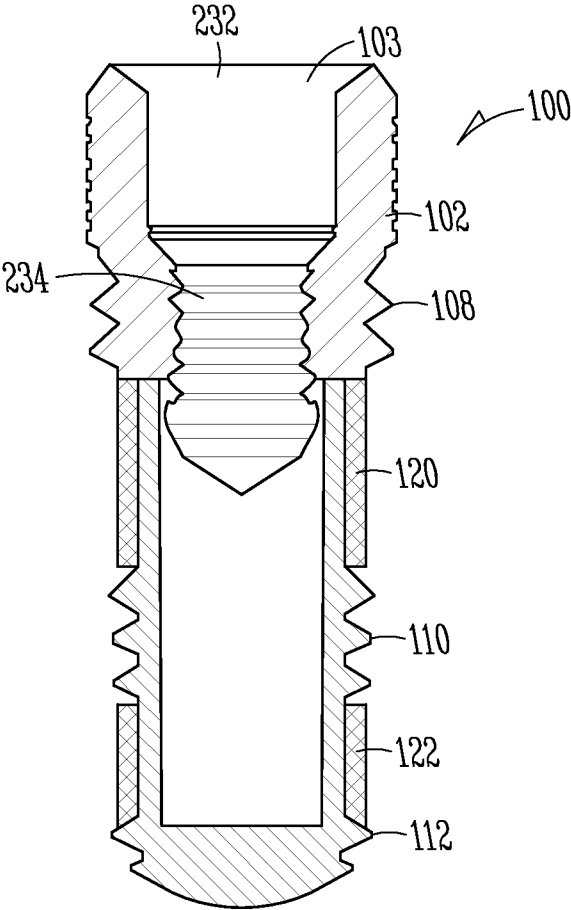


FIG. 2

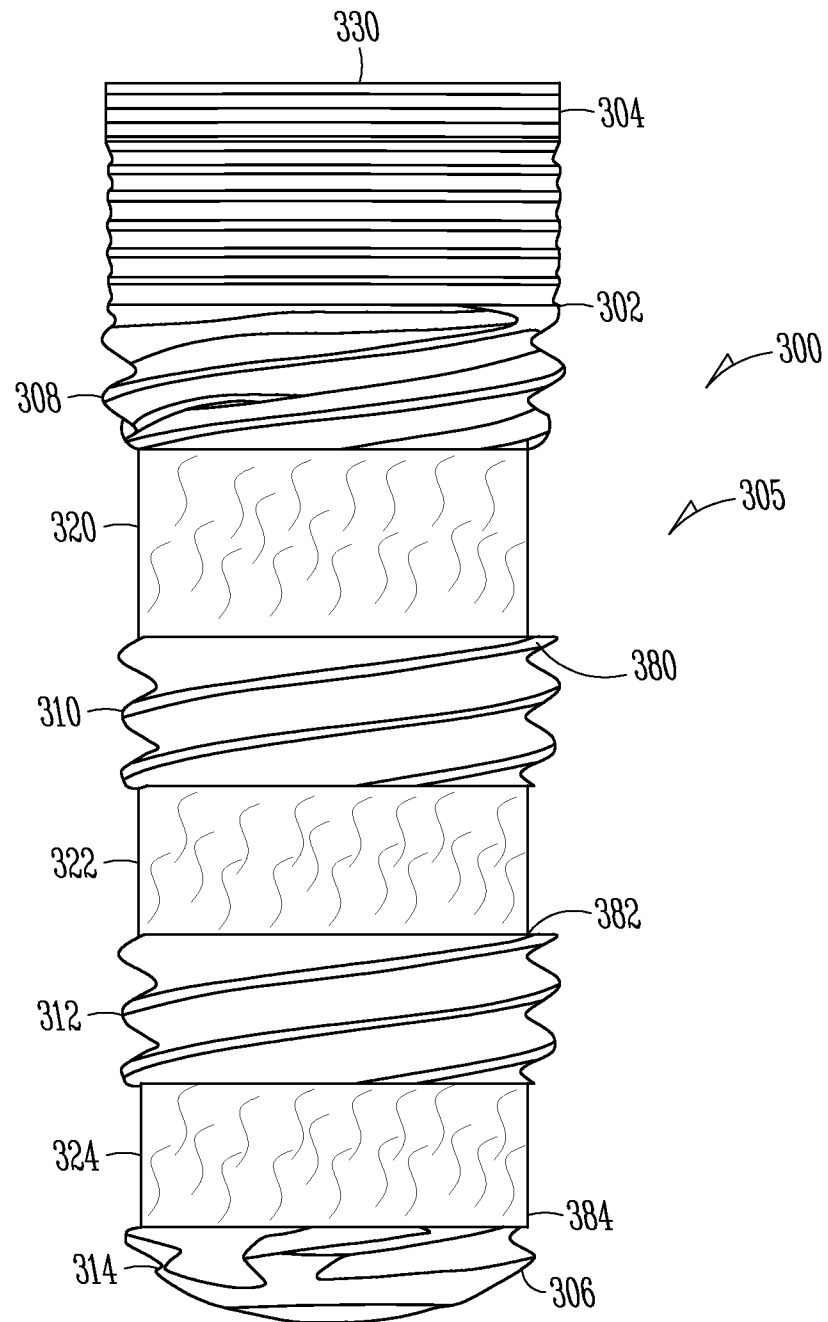


FIG. 3

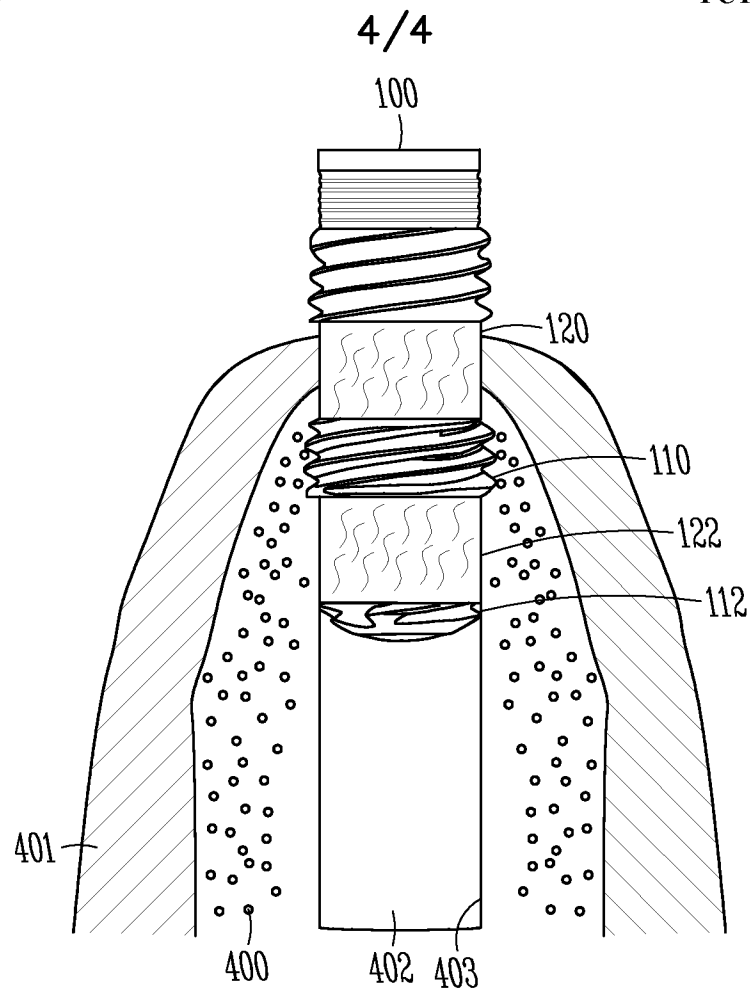


FIG. 4

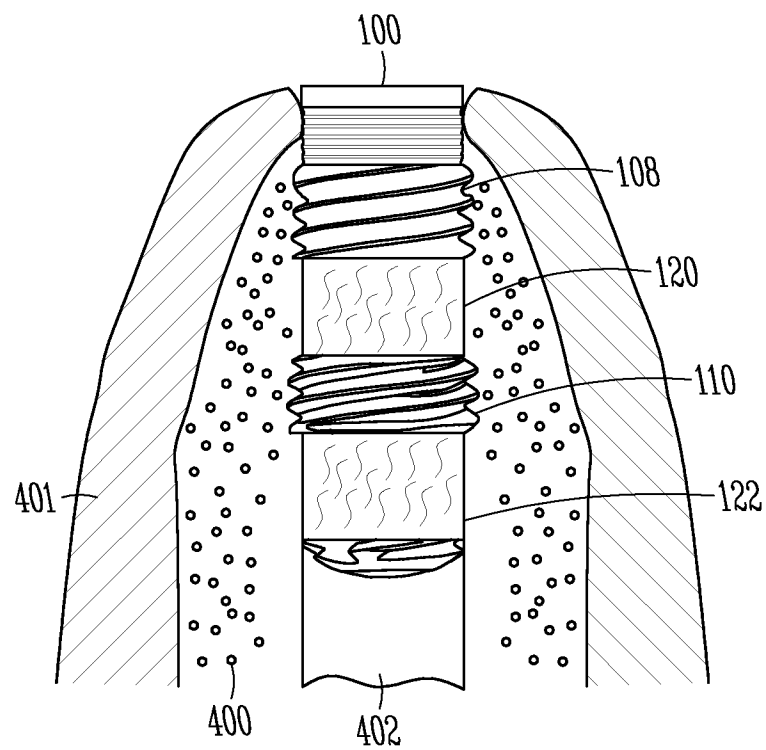


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/044729

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C8/00 A61B17/86
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 A61B A61F A61L C22C C22F

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, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/156646 A1 (PELOTE STEVEN [US]) 21 June 2012 (2012-06-21)	1,5-7,9
Y	paragraphs [0031] - [0034]	2,8,10,
A	figure 2	11
	-----	3,4,
		12-19
X	FR 2 929 102 A1 (FROMENTAL ROBERT [FR]) 2 October 2009 (2009-10-02)	1,3-5
A	pages 7-17	2,6-19
	figures 1-20	

X	US 5 360 448 A (THRAMANN JEFFREY J [US]) 1 November 1994 (1994-11-01)	1,3,4,7
Y	columns 4-10	2,8,10,
A	figures 1-6B	11
	-----	5,6,9,
		12-19
	-/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

7 August 2013

Date of mailing of the international search report

20/08/2013

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Pisseloup, Arnaud

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2013/044729

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/003638 A1 (COLLINS MICHAEL [US] ET AL) 7 January 2010 (2010-01-07)	1-4, 7-13, 16-19
A	paragraphs [0017] - [0073] figures 1-9	5,6,14, 15
A	----- US 2010/003640 A1 (DAMSTRA ROBERT [US] ET AL) 7 January 2010 (2010-01-07) paragraphs [0015] - [0046] figures 1-7	1-19
A	----- US 2007/172796 A1 (HYUN YOUNG KEUN [KR] ET AL) 26 July 2007 (2007-07-26) paragraphs [0027] - [0036] figures 1-3 -----	1-19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/044729

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 20, 21
because they relate to subject matter not required to be searched by this Authority, namely:
Independent claim 20 and its dependent claim 21 disclose a method for treatment of the human body by surgery by a dentist comprising multiple steps (Article 17(2)(a)(i) and Rule 39.1(iv) PCT).
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/044729

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