

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
27 April 2006 (27.04.2006)

PCT

(10) International Publication Number
WO 2006/043748 A1

(51) International Patent Classification⁷: **A61C 8/00**

(21) International Application Number:
PCT/KR2005/002813

(22) International Filing Date: 25 August 2005 (25.08.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10-2004-0084452 21 October 2004 (21.10.2004) KR

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KM, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM,
PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM,
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YU, ZA, ZM, ZW.

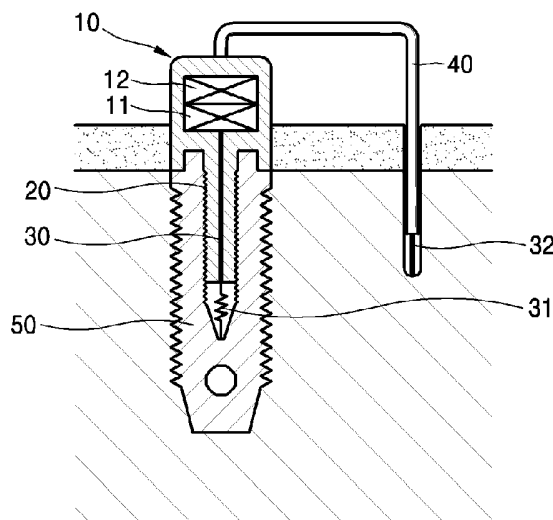
(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,
RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: APPARATUS FOR ACCELERATING OSSEOINTERGRATION



(57) Abstract: Provided is an apparatus for accelerating osseointegration. The apparatus provides a current to bones around a fixture inserted into an alveolar bone and includes: a constant current generator generating a constant current; a fixing unit fixed to the constant current generator and inserted into a fixture; a first current transferring unit passing through the fixing unit from an edge of the constant current generator and transferring the constant current into the fixture; and a second current transferring unit connected to another edge of the constant current generator and transferring the constant current into the bones around the fixture. The apparatus can be easily mounted in the mouth embedded with a battery since it has a small size and uses a minimum number of wires, thereby considerably reducing a healing period of a dental implant by increasing the rate of osseointegration.

Description

APPARATUS FOR ACCELERATING OSSEOINTERGRATION

Technical Field

- [1] The present invention relates to an apparatus for accelerating osseointegration, and more particularly, to an apparatus for accelerating osseointegration by flowing a current between an alveolar bone and a fixture.

Background Art

- [2] An apparatus for accelerating osseointegration considerably reduces time required for osseointegration.

Disclosure of Invention

Technical Problem

- [3] A conventional apparatus for accelerating osseointegration disclosed in U.S. Patent No. 5,738,521 relates to a constant current generator powered by a 9 volt battery in order to generate an alternating electric signal having a frequency in the range of from about 40 to 100 KHz at a constant effective current in the range of from 10 to 100 microamperes rms.
- [4] However, the constant current generator has an inappropriate size to be inserted into the mouth and is thus placed on a part of the body outside the mouth. Thus, a wire must be inserted into the mouth of a patient, thereby distressing the patient. Also, when a current supplier is placed on a part of the body outside the mouth, it is almost impossible to keep supplying an electrical current to an affected part of the patient by inserting the wire from the part of the body outside the mouth into the mouth for a clinical application. Further, the constant current generator cannot accelerate osseointegration to effectively reduce the time required to treat the affected part using the alternating current flow.
- [5] Another conventional apparatus for accelerating osseointegration provides a current using a galvanic battery in an implant. However, when an electrode of the apparatus is made of silver chloride AgCl and aluminum Al, the electromotive force of the galvanic battery is theoretically about 1.9 volts, whereas the actual electromotive force is below 1.9 volts. Thus, this conventional apparatus has a voltage too low to accelerate osseointegration. Also, silver Ag is reduced from the silver chloride AgCl electrode when the current flows therethrough, and an aluminum Al ion is melted in an electrolyte to be saturated, which reduces the current. Therefore, the conventional apparatus cannot keep supplying the current required to accelerate osseointegration.

Technical Solution

- [6] The present invention provides a small-sized apparatus for accelerating osseoin-

tegration.

Advantageous Effects

- [7] The apparatus for accelerating osseointegration according to the present invention can be easily mounted in the mouth since it has a small size and uses a minimum number of wires, thereby considerably reducing a healing period of a dental implant by increasing the rate of osseointegration.

Description of Drawings

- [8] The above and other features and advantages of the present invention will become more apparent by describing in detail embodiments thereof with reference to the attached drawings in which:
- [9] FIG. 1 is a diagram of an apparatus for accelerating osseointegration according to an embodiment of the present invention ;
- [10] FIG. 2 is a diagram of the detailed inner constitution of the apparatus for accelerating osseointegration according to an embodiment of the present invention;
- [11] FIG. 3 is a diagram of an apparatus for accelerating osseointegration according to another embodiment of the present invention ; and
- [12] FIG. 4 is a cross-sectional view of the apparatus for accelerating osseointegration of FIG. 3.

Best Mode

- [13] According to an aspect of the present invention, there is provided a n apparatus for accelerating osseointegration which provides a current to bones around a fixture inserted into an alveolar bone, the apparatus comprising: a constant current generator generating a constant current; a fixing unit fixed to the constant current generator and inserted into a fixture; a first current transferring unit passing through the fixing unit from an edge of the constant current generator and transferring the constant current into the fixture; and a second current transferring unit connected to another edge of the constant current generator and transferring the constant current into the bones around the fixture.
- [14] The constant current generator includes a power supply and an insulator surrounding the power supply.
- [15] The power supply provides a continuous current of 5 m A ~ 20 m A.
- [16] The constant current generator further includes a constant current circuit.
- [17] The height of the constant current generator is 6 mm and the diameter thereof is smaller than 6 mm .
- [18] The constant current generator has a shape of a healing abutment.
- [19] The constant current generator is mounted to a temporary or permanent tooth prosthesis.

- [20] An edge of the second current transferring unit is connected to both poles of a power supply and another edge of the second current transferring unit is inserted into a surrounding tissue other than the fixture, or exposed in the shape of a ring surrounding the healing abutment, and an edge of the first current transferring unit is connected to a negative pole of the power supply, and another edge of the first current transferring unit passes through the fixing unit 20 to be connected to the fixture.

Mode for Invention

- [21] The present invention will now be described more fully with reference to the accompanying drawings in which embodiments of the present invention are shown.
- [22] FIG. 1 is a diagram of an apparatus for accelerating osseointegration according to an embodiment of the present invention. Referring to FIG. 1, the apparatus for accelerating osseointegration is mounted in a fixture 50 inserted into an alveolar bone, and includes a constant current generator 10, a fixing unit 20, a first current transferring unit 30 (not shown), and a second current transferring unit 40.
- [23] The constant current generator 10 includes power supply (not shown) and generates a constant current. The constant current generator 10 will now be described in detail.
- [24] According to the present embodiment, the height of the constant current generator 10 may not be higher than 6 mm in consideration of an opposite tooth in order to prevent inconvenience caused by food ingestion and stomatitis caused therefrom. The height of the constant current generator 10 may be between 2 mm and 4 mm and the diameter thereof may not be higher than 6 mm in consideration of a space between neighboring teeth and an error caused by inserting the fixture 50.
- [25] The surface of the constant current generator 10 is formed of an insulator, which may be an engineering plastic material having good strength, elasticity, shock resistance, abrasion resistance, heat resistance, cold resistance, chemical resistance, electric insulation, etc., and the surface of the engineering plastic material may be coated to be biocompatible.
- [26] According to the present embodiment, the constant current generator 10 can have the shape of a healing abutment. However, the constant current generator 10 is not restricted thereto but can be formed in the shape of a tooth or a variety of other shapes according to a part to which the apparatus for accelerating osseointegration is applied.
- [27] The fixing unit 20 is inserted into the fixture 50 to fix the constant current generator 10 to the fixture 50. The fixing unit 20 has the shape of various fixtures and an upper structure. The fixing unit 20 has the shape of a screw since the apparatus for accelerating osseointegration of the present embodiment uses the fixture 50 and the upper structure in the shape of the healing abutment as illustrated in FIG. 1. According to the present embodiment, the fixing unit 20 is formed using substantially the same material as the surface insulating material of the constant current generator 10.

- [28] The first and second current transferring units 30 and 40 are formed using a coating wire capable of transferring a current. An edge of the second current transferring unit 40 is connected to both poles of a power supply and another edge of the second current transferring unit 40 is inserted into a surrounding tissue (skin, gingival mucosa, oral mucosa, periosteum, compact bone, cancellous bone, etc.) other than the fixture 50, or exposed in the shape of a ring surrounding the healing abutment. An edge of the first current transferring unit 30 is connected to a negative pole of the power supply, and another edge of the first current transferring unit 30 passes through the fixing unit 20 to be connected to the fixture 50. The output current of the constant current generator 10 flows in saliva or mucosa via the first and second current transferring units 30 and 40 or by means of the exposed ring.
- [29] FIG. 2 is a diagram of the detailed inner constitution of the apparatus for accelerating osseointegration according to the present embodiment. Referring to FIG. 2, the constant current generator 10 includes a power supply 11 and the surface thereof is formed of an insulating material as described with reference to FIG. 1.
- [30] According to the present embodiment, the rheobasic voltage of the power supply 11 supplies a variety of required current, i.e., current in the range of about 0.1 m A to about 100 m A, more desirable a current in the range of 5 m A to 20 m A for a rapid increase of the osseointegration rate when inserting the fixture 50, and most desirable a current in the range of 20 m A.
- [31] Tests performed with the apparatus for accelerating osseointegration of the present embodiment showed that the rate of osseointegration increased by 20 ~ 30 % when a continuous current of 5 m A was applied, and by 50 ~ 60 % when a continuous current of 20 m A was applied.
- [32] Also, test results regarding relationship between the current flow and rate of osseointegration showed that the rate of osseointegration did not increase when a current below 1 m A was applied, the rate of osseointegration increased when a current applied increased from 5 m A to 20 m A, the rate of osseointegration decreased when the current applied increased from 20 m A to 50 m A, and a bone density decreased when a current higher than 50 m A was applied. To be more specific, the continuous current having a constant strength flows in a predetermined range, thereby accelerating osseointegration around the fixture 50 and overcoming function load. Therefore, although a treatment period required for implanting the fixture 50 in an alveolar bone and connecting the healing abutment to the fixture 50 depends from patient to patient, the treatment period is generally reduced from 3 ~ 6 months to 6 ~ 16 weeks, which shows the relationship between the current and an osseointegration period.
- [33] According to the present embodiment, the diameter and height of the power supply 11 may be smaller than 6 mm in order to easily insert the constant current generator 10

into the mouth and minimize the apparatus for accelerating osseointegration. The power supply 11, but not restricted to, can use first and second miniaturized and integrated batteries except a battery (e.g., a lithium battery easily exploded against moisture) that may cause some risk in the mouth, and form the constant current generator 10 using various batteries such as a thin film type micro battery being developed as a next generated battery. However, a kind of a power supply cannot restrict the scope of the present invention.

[34] However, since various resistance is generated according to a bone density and amount of bones, the constant current generator 10 may further include a continuous current unit 12 that automatically prevents a current higher than 20 mA from flowing.

[35] The continuous current unit 12, but not restricted to, can be manufactured in a variety of shapes such as an exclusive chip using parts in the form of a package, die, or a wafer or using ASIC processing to be embedded in the constant current generator 10.

[36] According to the present embodiment, two mercury cells having below 5 mm in diameter, about 2 mm in height, and a rheobasic voltage of 1.55 V are in serial connected to each other and inserted into the constant current generator 10 along with a constant current circuit in order to flow a continuous current of 5 mA ~ 20 mA.

[37] Therefore, the apparatus for accelerating osseointegration according to the present embodiment can be easily mounted in the mouth since it has a small size and uses a reduced number of wires. Thus, by using the apparatus of the present invention, the rate of osseointegration is considerably increased, thereby reducing a healing period of a dental implant, and greatly increasing a success rate of the implant.

[38] FIG. 3 is a diagram of an apparatus for accelerating osseointegration according to another embodiment of the present invention. The apparatus for accelerating osseointegration according to the present embodiment is different from the apparatus for accelerating osseointegration illustrated in FIG. 1 in that a second current transferring unit 40 is not formed of wires, and a conductor surrounding the surface of the constant current generator 10 is a circular material or formed of a point (or points) 300.

[39] According to still another embodiment of the present invention, an opening is formed in the constant current generator 10 to flow a current in saliva or mucosa.

[40] While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

Claims

- [1] An apparatus for accelerating osseointegration which provides a current to bones around a fixture inserted into an alveolar bone, the apparatus comprising:
a constant current generator generating a constant current;
a fixing unit fixed to the constant current generator and inserted into a fixture;
a first current transferring unit passing through the fixing unit from an edge of the constant current generator and transferring the constant current into the fixture; and
a second current transferring unit connected to another edge of the constant current generator and transferring the constant current into the bones around the fixture.
- [2] The apparatus of claim 1,
wherein the constant current generator includes a power supply and an insulator surrounding the power supply.
- [3] The apparatus of claim 2,
wherein the power supply provides a continuous current of 5 m A ~ 20 m A.
- [4] The apparatus of claim 2,
wherein the constant current generator further includes a constant current circuit.
- [5] The apparatus of claim 1 or 2,
wherein the height of the constant current generator is 6 mm and the diameter thereof is smaller than 6 mm.
- [6] The apparatus of claim 1 or 2,
wherein the constant current generator has a shape of a healing abutment.
- [7] The apparatus of claim 1 or 2,
wherein the constant current generator is mounted to a temporary or permanent tooth prosthesis.
- [8] The apparatus of claim 2 , wherein the current transferring unit comprises:
a first current transferring unit passing through the fixing unit and electrically connecting an electrode of the power supply and the fixture; and
a second current transferring unit electrically connecting another electrode of the power supply and a tissue around the fixture.
- [9] The apparatus of claim 2 , wherein the current transferring unit comprises:
a first current transferring unit passing through the fixing unit and electrically connecting an electrode of the power supply and the fixture; and
a second current transferring unit connected to another electrode of the power supply, and a circular material or a point of a conductor surrounding the surface of the constant current generator.

FIG. 1

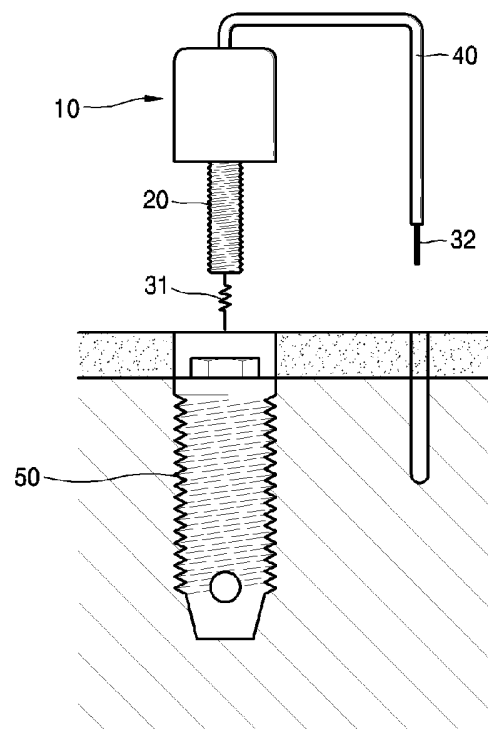


FIG. 2

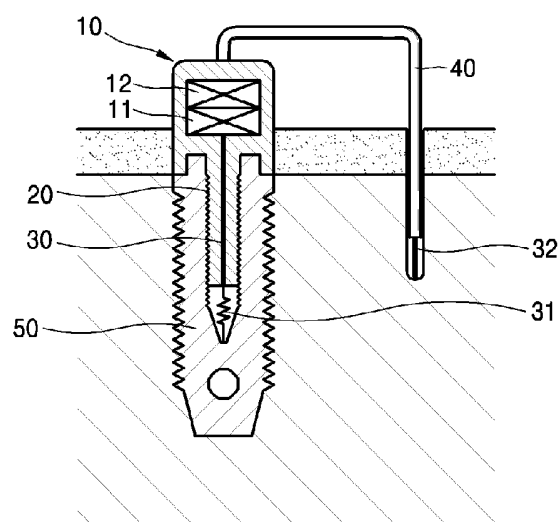


FIG. 3

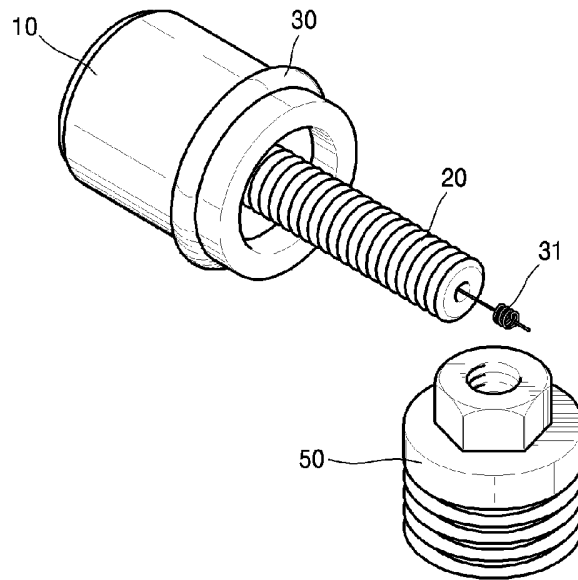
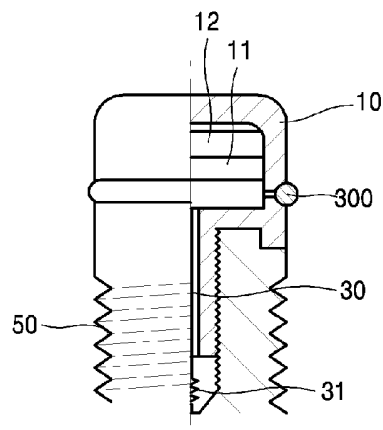


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2005/002813

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 A61C 8/00**

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)

IPC7 A61C, A61N1/*

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

Korean Patent and applications for inventions since 1975

Utility Models and applications for Utility Models since 1975

Japanese Utility Models and applications for Utility Models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5378521A (Bioletron, Inc.) 14 Apr. 1998 see the whole document	1
A	US 4153060A (University of Pennsylvania) 8 May 1979 see the whole document	1
A	KR 10-2004-0063442A (Taisan Solutions, Inc.) 14 Jul. 2004 see the whole document	1



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

28 NOVEMBER 2005 (28.11.2005)

Date of mailing of the international search report

29 NOVEMBER 2005 (29.11.2005)

Name and mailing address of the ISA/KR

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920 Dunsan-dong, Seo-gu, Daejeon 302-701,
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Telephone No. 82-42-481-5596



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2005/002813

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US5738521A	14.04.1998	None	
US4153060A	03.05.1979	None	
KR 10-2004-0063442A	14.07.2004	None	