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(54) **Title**: SURFACE TREATMENT METHOD

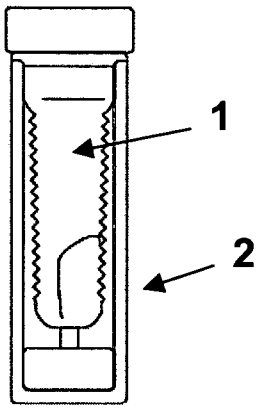

Fig. 1a

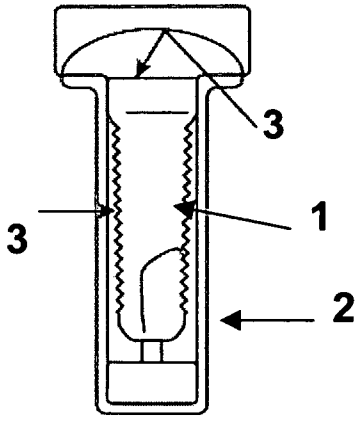

Fig. 1b

(57) **Abstract**: The present invention relates to a method of treating at least one dental implant component and/or dental prosthesis (1), the at least one dental implant component and/or dental prosthesis (1) comprising a metal compound and/or a ceramic material, wherein the at least one dental implant component and/or dental prosthesis (1) is still being placed in its unbroken sealed package (2), said unbroken sealed package (2) comprising a light transmitting package material (4) adapted to allow the passage of radiation with wavelengths at least below 400 nm, said method comprising the step(s) of: irradiating, through said light transmitting package material (4), a surface of said dental implant component and/or dental prosthesis (1) with radiation (3) having a peak wavelength below 390 nm, wherein the radiation irradiating the surface is generated by at least one artificial radiation source. The present invention also relates to an arrangement comprising at least at least one dental implant component and/or dental prosthesis (1) and a package (2).

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SURFACE TREATMENT METHOD

Field of the Invention

The present invention relates to a method of treating at least one dental implant component and/or dental prosthesis. The present invention also relates to an arrangement comprising at least one dental implant component and/or dental prosthesis and a package.

Background of the Invention

Rapid and sustainable stability and functionality of bone-anchored implants, such as dental implants, as well as optimal soft tissue healing may be achieved by improved surface structures of the implant. The surface of, e.g., dental implants has developed from a machined surface to a structured/rougher surface with better healing properties. One example of the latter is the TiUnite® surface provided by Nobel Biocare on dental implants, which is a more porous surface than a machined surface and that facilitates the integration of the implant compared to an implant with a machined surface by reducing bone resorption. To further guide and optimize the healing process, the implant surface can be coated with active substances. Such coatings can reduce inflammatory reactions leading to bone resorption, stimulate bone formation for faster osseointegration, or treat infections locally.

In addition it has been an object in the field of dentistry to provide products with excellent wetting properties. One way of increasing the wetting property or hydrophilic property of a surface immediately after manufacturing and before packaging an implant is disclosed in WO03030957. In WO03030957 an osteophilic implant with a roughened hydroxilated and hydrophilic surface, made from titanium or a titanium alloy and suitable for implantation in bones, whereby the implant is characterized in that said implant is treated in the hydroxilated state with high-energy ultra-violet radiation.

However, carbon molecules from the surrounding environment may in some situations affect the healing properties of the implant/implant component/dental prosthesis. It is believed that the surface becomes less hydrophilic the higher carbon content. In other words the longer an object has been stored in a polymer containing package the higher the content of carbon on the objects surface. It has been an object to alleviate the sometimes perceived problem of reduced hydrophilic properties. To this date no solution of how to improve the hydrophilic properties in a way that still enables the supplier to control the quality and characteristics of the dental component or implant just before it will be inserted into a patient has been proposed.

It is an object of the present invention to present a solution to this perceived problem. It is a further object to present a solution not affecting other properties of the dental component or implant component. Moreover it is an object to further improve the characteristics of the dental component or implant component before insertion according to a controlled process or method.

Summary of the Invention

Accordingly, embodiments of the present invention preferably seek to mitigate, alleviate or eliminate one or more deficiencies, disadvantages or issues in the art, such as the above identified, singly or in any combination by providing methods and arrangements according to the appended patent claims.

According to a first aspect, a method is provided for treating at least one dental implant component and/or dental prosthesis, the at least one dental implant component and/or dental prosthesis comprising a metal compound and/or a ceramic material, wherein the at least one dental implant component and/or dental prosthesis is still being placed in its unbroken sealed package, said unbroken sealed package comprising a light transmitting package material adapted to allow the passage of radiation with wavelengths at least below 400 nm, said method comprising the step(s) of: irradiating, through said light transmitting package material, a surface of said dental implant component and/or dental prosthesis with radiation having a peak wavelength below 390 nm, wherein the radiation irradiating the surface is generated by at least one artificial radiation source. Hence, a method of improving the hydrophilic properties of an implant component or dental prosthesis taking controllable and known data into account in a controlled process has been achieved. Also, antimicrobial, biocompatibility, and/or anti-inflammatory properties may be improved. The treated product is not released from its sealed package until it has been treated according a protocol ensuring accurate properties in a controlled manner.

The method may further comprise: discontinuing said irradiation step when a threshold value for one or more photoactive properties of the irradiated surface of said dental implant component and/or dental prosthesis is reached. Said threshold value may for instance be related to a contact angle of less than 30 degrees, preferably less than 5 degrees, and more preferably less than 1 degree. The contact angle can be measured/detected by means of techniques known per se. Also, threshold values other than the contact angle could be used.

Furthermore, said irradiation step may be controlled in accordance with one or more parameters presented with said package. Preferably, said one or more parameters are selected from the group of: package life, type and geometry of content in said package, predetermined irradiation time period, irradiation energy level, and irradiation wavelength. This may make it easier for a person who shall perform the irradiation through the unbroken sealed package to know for instance how long the irradiation should last.

Advantageously, said dental implant component and/or dental prosthesis comprises a titanium oxide surface, preferably a thin titanium dioxide or titanium oxide coating.

Further, said dental implant component and/or dental prosthesis may comprise any one of the materials selected from the group of aluminum, chromium, cobalt, gold, iron, lithium, nickel,

niobium, palladium, platinum, tantalum, zirconium, an alloy thereof, e.g. stainless steel, an oxide thereof, a silicate thereof or combinations thereof.

The photoactive generated properties, e.g. increased hydrophilic properties and the thus increased wetting characteristics of the surface, may enhance the bioactive properties of the surface leading to a possibly improved bone in growth capability. The irradiating can be made with a UVC (ultraviolet C) radiation, preferably with a peak wavelength within the range of 150-300 nm, more preferably within the range of 200-260 nm and most preferably around 250 nm, thereby enhancing the possible bioactivity of the treated (irradiated) surface. Also, an antibacterial surface of said dental implant component and/or dental prosthesis may be activated by irradiating with the UVC radiation.

Further, the irradiating can be made with a UVA (ultraviolet A) radiation, preferably with a peak wavelength within the range of 300-390 nm, more preferably within the range of 340-380 nm and most preferably around 360-370 nm, thereby activating an antibacterial surface (i.e. the irradiated surface) of said dental implant component and/or dental prosthesis. Hence, it is accomplished a method for activating said surface and improve its antibacterial properties. UV treatment is assumed to alter the molecular structure of surfaces by creating surface oxygen vacancies at bridging sites, resulting in a conversion of relevant sites with the loss of one electron. This is favorable for dissociative water adsorption. UV light energy greater than 3.2eV is needed after transmission through said light transmission package material in order to excite an electron from the valence band to the conduction band during treatment. Decontamination of hydrocarbon from a surface happens at wavelength in the UVA range. Meanwhile the direct decomposition of hydrocarbon by UVC light seems to happen in a lower range around 250 nm which is within the UVC range.

According to a preferred embodiment or embodiments of the method the irradiating is made with UVA and UVC in the treatment steps of the surface accomplishing all the above advantages in one treatment and before the seal of the package is broken. Since the object is treated in its original unbroken sealed package the whole process before insertion of the object (e.g. manufacturing, placing object in package, transporting package, etc.) may be certified if proper procedures and equipment is used leading to improved patient security.

Advantageously, said irradiating is generated by at least one LED (light emitting diode). In order to shorten the time necessary for activation of said object, the irradiating may be performed in a pulsed manner.

According to a preferred embodiment the light transmitting material of said package comprises a polymer of polyolefin, such as cyclic olefin copolymer. According to a second preferred embodiment the light transmitting material of said package comprises a polymer of fluoropolymer, such as Teflon FEP™. According to a third preferred embodiment the light transmitting material of said package comprises an ethylene vinyl acetate (EVA) polymer.

According to a forth preferred embodiment the light transmitting material of said package comprises polyethylene terephtalate glycol (PETG). The light transmitting behavior of said material is beneficial and also suitable for protecting an implant component and/or dental prosthesis.

According to another embodiment the package may comprise quarts glass as light transmitting material.

Said package may beneficially comprise a reflective material formed to distribute the incoming radiation within the package saving the energy and time needed to optimally prepare the object in the unbroken sealed original package. The package is positioned in or in front of the irradiating device or arrangement, or it is moved according to a controlled path before an irradiating device or arrangement, until a threshold value is reached based on stipulated criteria.

In order to uniformly activate an implant or dental implant component it is preferably held at its bottom end by a detachable pin in said package during treatment.

Further, the irradiating may be preceded by the steps of: manufacturing the at least one dental implant component and/or dental prosthesis; placing the manufactured at least one dental implant component and/or dental prosthesis in the package and sealing said package; and optionally transporting the at least one dental implant component and/or dental prosthesis placed in the sealed package to a treatment location.

Further, the irradiating may be followed by: breaking the sealed package and removing the at least one dental implant component and/or dental prosthesis from the broken package.

According to a second aspect of the present invention, there is provided an arrangement, comprising: at least one dental implant component and/or dental prosthesis, which includes a metal compound and/or a ceramic material; and a sealed package in which the at least one dental implant component and/or dental prosthesis is placed, the sealed package including at a light transmitting package material for wavelengths at least below 400 nm. The package may comprise a reflective material formed to distribute incoming high-energy radiation (e.g. UVA and/or UVC) within the package. Further, said at least one dental implant component and/or dental prosthesis may be held at its bottom end by a detachable pin in said package. This aspect may exhibit the same or similar features and technical effects as the first aspect of the invention, and vice versa.

Brief Description of the Drawings

These and other aspects, features and advantages of which embodiments of the invention are capable of will be apparent and elucidated from the following description of embodiments of the present invention, reference being made to the accompanying drawings, on which;

Figs. 1a and 1b are schematic cross-sectional side views to illustrate various steps in the treatment process of an embodiment,

Fig. 2 is a side view of a schematic second embodiment of an implant having been treated by the method,

Figs. 3a and 3b are schematic cross-sectional side views to illustrate how an activated implant according to one embodiment may be detached from its package after treatment according to an aspect of the method,

Fig. 4 is a perspective view of an alternative embodiment of a package comprising the implant suitable for being treated by the method,

Fig. 5 is a top plan view of the alternative embodiment in Fig. 4, and

Fig. 6 is an alternative embodiment of a package, as seen from the side, being subject to treatment as indicated schematically.

Fig. 7 is a flow chart of a method of providing at least one dental implant component and/or dental prosthesis.

Detailed Description of Embodiments

Specific embodiments of the invention will now be described with reference to the accompanying drawings. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. The terminology used in the detailed description of the embodiments illustrated in the accompanying drawings is not intended to be limiting of the invention. In the drawings, like numbers refer to like elements.

The meaning of object as used herein is at least one dental implant component and/or dental prosthesis 1. It is realized that a dental prosthesis 1 may encompass abutments, cover screws, temporary abutments, copings, etc.

The contact angle as used in the present application is the angle at which a liquid/vapor interface meets a solid surface. The contact angle is specific for any given equilibrium system and the Young relation determines the shape of a liquid/vapor droplet. If a liquid is very strongly attracted to the solid surface the droplet will completely spread out on the solid surface an the contact angle will be close to 0 degrees. This is the case for e.g. water on a strongly hydrophilic surface. Less strongly hydrophilic solid surfaces will have a contact angle up to 90 degrees.

Fig. 1a illustrates an embodiment of an implant 1 held in a package 2. It is the original package 2, which is still sealed and ready for being treated with UV radiation 3. The UV radiation 3 is schematically disclosed in fig. 1b in which some package sides are reflective and others are more or less completely translucent for wavelengths in the UVA and UVC range.

In the present method of treating at least one dental implant component and/or dental prosthesis, such as implant 1, the at least one dental implant component and/or dental prosthesis 1 comprises a metal compound and/or a ceramic material, and it is still placed in its unbroken sealed package 2. The unbroken sealed package 2 comprises a light transmitting package material 4 adapted to allow the passage of radiation with wavelengths at least below 400 nm. The method comprises the step of: irradiating, through said light transmitting package material 4, a surface of said dental implant component and/or dental prosthesis 1 with radiation 3 having a peak wavelength below 390 nm, wherein the radiation irradiating the surface is generated by at least one artificial radiation source.

'Peak wavelength' may be construed as the wave length at which the radiant intensity is maximum. Further, the package 2 should be sealed such that the contents (i.e. at least one dental implant component and/or dental prosthesis) is kept sterile, at least until the package is broken. The sealed package 2 may for instance be air-tight (hermetically sealed), or at least substantially air-tight. The sealed package may be formed like a blister pack, but it could also be an ampoule or a container sealed with a lid, for example. Further, more than one surface of the at least one dental implant component and/or dental prosthesis can be irradiated before it is removed from the package.

The irradiation step may be discontinued when a threshold value for one or more photoactive properties of the irradiated surface of said dental implant component and/or dental prosthesis 1 surface is reached. 'Photoactive properties' (or photoactive generated properties) may here be construed as properties generated by irradiating the surface which is photoactive. The properties may include hydrophilic, antimicrobial, biocompatibility, and/or anti-inflammatory properties.

The irradiation may be controlled based on parameters associated to each individual package 2. The irradiation may for instance be controlled by turning the at least one artificial light source on/off, or by exposing the package to/removing the package from the at least one artificial light source which is constantly turned on for a longer duration. The individual parameters may include package life, type and geometry of content in said package, predetermined irradiation time period, irradiation energy level, and irradiation wavelength. Hence, the amount of radiation treatment may vary depending on the desired threshold and the parameter value at the time of treatment.

In an exemplary embodiment, a predetermined irradiation time period may be printed on the package, which instructs the user of how long the at least one dental implant component and/or dental prosthesis should be irradiated to achieve a desired effect. However, the irradiation time period may be influenced by the other parameters, thus yielding a different actual/final irradiation time period. For instance, a higher irradiation energy level may shorten the predetermined irradiation time period, while a lower irradiation energy level may prolong the

predetermined irradiation time period. The predetermined irradiation time period, and any influence from the other parameters, may for instance be determined in advance by the provider of the dental implant component/dental prosthesis and/or the package.

Now, with reference to fig. 2 an implant or an implant component may have a coating, which is especially suitable for being activated. According to one embodiment an implant or fixture has been previously immersed in diethylene glycol solvent containing nanoparticles of titanium dioxide and agitated. The fixture or implant was then placed in an oven in order to promote solvent evaporation. In this step the titanium dioxide nanoparticles deposit onto the surface of the screw. Then a heat treatment cycle follows in accordance with e.g. WO 2007/088199. The resulting dental implant component and/or dental prosthesis 1 comprise a titanium oxide surface 10.

Alternatively although not disclosed in the drawings, the implant component and/or dental prosthesis 1 may comprise any one of the materials selected from the group of aluminum, chromium, cobalt, gold, iron, lithium, nickel, niobium, palladium, platinum, tantalum, zirconium, an alloy thereof, e.g. stainless steel, an oxide thereof, a silicate thereof or combinations thereof.

As described before the enhancement of hydrophilic properties is important for a sound osseointegration. The desirable state is a super hydrophilic surface where the contact angle is close to zero degrees. Preferably, the contact angle is below 5 degrees, which represents hydrophilic conditions. The surface advantageously comprises a titanium oxide.

The irradiating can be made with a UVC radiation, preferably with a wavelength peak value within the range of 150-300 nm, more preferably within the range of 200-260 nm and most preferably around 250 nm, thereby enhancing the possible bioactivity of the treated surface. Further, the irradiating can be made with a UVA radiation, preferably with a wavelength peak value within the range of 300-390nm, more preferably within the range of 340-380nm and most preferably around 360nm thereby activating an antibacterial surface of said dental implant component and/or dental prosthesis.

By controlling the light emitters irradiating is made with both UVA and UVC. Thus, an antibacterial and hydrophilic surface is obtained in a controlled manner, before insertion of the treated implant component or dental prosthesis in the maxillofacial region. The irradiating may be generated by at least one LED, which forms said at least one artificial radiation source. If the irradiating is performed in a pulsed manner, the energy emitted in one pulse can be double as if the same LED is held with a fixed light.

In figs. 3a and 3b it is disclosed how a dental implant component and/or dental prosthesis 1 is held at its bottom end 6 by a detachable pin 7. The detachable pin is fixed to the package 2 (not shown here). The bottom most part of the implant is spared for the treatment for enhanced surface properties although still acceptable for that part of an implant. After UV-treatment the implant component 1 is detached from the pin.

Now referring to figs. 4 and 5, a package in the form of a blister is disclosed. The light transmitting material 4 of said package 2 comprises a polymer selected from the group of polyolefin (such as cyclic olefin copolymer), fluoropolymer (such as Teflon FEP™), ethylene vinyl acetate (EVA), and polyethylene terephtalate glycol (PETG). These materials are highly translucent to UV light and formed in a curved manner. The reflective material 5 is a metallic foil or a metallic alloy coated bed or some kind of highly UV-reflective surface. As illustrated in fig. 4, the reflective material 5 may be provided on a substantially plane surface to which the dome-shaped light transmitting material 4 is attached.

According to a preferred alternative the transmitting material 4 of said package 2 (not shown), comprises quarts glass.

In fig. 6 an embodiment with the opposite characteristics to that of the embodiment in fig. 4 is disclosed. In addition it is schematically indicated how the UV light 3 is reflected against the curved reflective material 5 and passes the UV transmission material 4. The implant component or dental prosthesis component 1 is held in place during the whole treatment period such that the UV is uniformly and controllably distributed at a given distance (a few mm from the package cover). The generated energy is high in the closed compartment/package.

Fig. 7 is a flow chart of a method of providing at least one dental implant component and/or dental prosthesis, wherein the at least one dental implant component and/or dental prosthesis, for instance the implant 1, is manufactured in step S1.

Then, in step S2, the manufactured at least one dental implant component and/or dental prosthesis is placed in a package, e.g. package 2, and the package is thereafter sealed. The at least one dental implant component and/or dental prosthesis may also be sterilized, typically after the packaging, and before the forthcoming irradiation step.

The sealed package with the at least one dental implant component and/or dental prosthesis may then be transported (step S3) from the facility where steps S1 and S2 took place, to another location where the at least one dental implant component and/or dental prosthesis is to be treated by irradiation. This location may for instance be a dentist's clinic.

Thereafter, irradiation (step S4) of the at least one dental implant component and/or dental prosthesis still in the unbroken sealed package is performed, as described above. This step is typically performed by a dental technician or the dentist, and it can be executed just before the at least one dental implant component and/or dental prosthesis is to be applied to a patient.

After the irradiation, the sealed package is broken or opened, and the treated at least one dental implant component and/or dental prosthesis may now be removed from the package (step S5). Following this, the at least one dental implant component and/or dental prosthesis may be ready for application to the patient.

The present invention has been described above with reference to specific embodiments. However, other embodiments than the above described are equally possible within

the scope of the invention. Different method steps than those described above may be provided within the scope of the invention. The different features and steps of the invention may be combined in other combinations than those described. The scope of the invention is only limited by the appended patent claims.

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CLAIMS

1. A method of treating at least one dental implant component and/or dental prosthesis (1), the at least one dental implant component and/or dental prosthesis (1) comprising a metal compound and/or a ceramic material, wherein the at least one dental implant component and/or dental prosthesis (1) is still being placed in its unbroken sealed package (2), said unbroken sealed package (2) comprising a light transmitting package material (4) adapted to allow the passage of radiation with wavelengths at least below 400 nm, said method comprising the step(s) of:

irradiating, through said light transmitting package material (4), a surface of said dental implant component and/or dental prosthesis (1) with radiation (3) having a peak wavelength below 390 nm, wherein the radiation irradiating the surface is generated by at least one artificial radiation source.

2. The method according to claim 1, further comprising:

discontinuing said irradiation step when a threshold value for one or more photoactive properties of the irradiated surface of said dental implant component and/or dental prosthesis (1) is reached.

3. The method according to claim 2, in which said threshold value is related to a contact angle of less than 30 degrees, preferably less than 5 degrees.

4. The method according to any one of the previous claims, in which said irradiation step is controlled in accordance with one or more parameters presented with said package (2).

5. The method according to claim 4, in which said one or more parameters are selected from the group of: package life, type and geometry of content in said package, predetermined irradiation time period, irradiation energy level, and irradiation wavelength.

6. The method according to any one of the previous claims, in which said dental implant component and/or dental prosthesis (1) comprises a titanium oxide surface (10).

7. The method according to any one of the previous claims, in which said dental implant component and/or dental prosthesis (1) comprises any one of the materials selected from the group of aluminum, chromium, cobalt, gold, iron, lithium, nickel, niobium, palladium, platinum, tantalum, zirconium, an alloy thereof, e.g. stainless steel, an oxide thereof, a silicate thereof or combinations thereof.

8. The method according to any one of the previous claims, in which irradiating is made with a UVC radiation, preferably with a peak wavelength within the range of 150-300 nm, more preferably within the range of 200-260 nm and most preferably around 250 nm, thereby enhancing the possible bioactivity of the treated surface.

9. The method according to any one of the previous claims, in which irradiating is made with a UVA radiation, preferably with a peak wavelength within the range of 300-390 nm, more preferably within the range of 340-380 nm and most preferably around 360 nm, thereby activating an antibacterial surface of said dental implant component and/or dental prosthesis.

10. The method according to any one of the previous claims, in which irradiating is made with UVA and UVC.

11. The method according to any one of the previous claims, in which said irradiating is generated by at least one LED.

12. The method according to any one of the previous claims, in which the irradiating is performed in a pulsed manner.

13. The method according to any one of the previous claims, in which the light transmitting material (4) of said package (2) comprises a polymer selected from the group of polyolefin, such as cyclic olefin copolymer, fluoropolymer, such as Teflon FEP™, ethylene vinyl acetate (EVA), and polyethylene terephtalate glycol (PETG).

14. The method according to any one of the previous claims, in which the light transmitting material (4) of said package (2) comprises quarts glass.

15. The method according to any one of the previous claims, in which said package (2) comprises a reflective material (5) formed to distribute the incoming radiation within the package (2).

16. The method according to any one of the previous claims, in which said dental implant component and/or dental prosthesis (1) is held at its bottom end (6) by a detachable pin (7) in said package (2) during treatment.

17. The method according to any one of the previous claims, wherein the irradiating is preceded by the steps of:

manufacturing the at least one dental implant component and/or dental prosthesis;

placing the manufactured at least one dental implant component and/or dental prosthesis in the package and sealing said package; and

optionally transporting the at least one dental implant component and/or dental prosthesis placed in the sealed package to a treatment location.

18. The method according to any one of the previous claims, further comprising after the irradiating:

breaking the sealed package and removing the at least one dental implant component and/or dental prosthesis from the broken package.

19. An arrangement, comprising:

at least one dental implant component and/or dental prosthesis (1), which includes a metal compound and/or a ceramic material; and

a sealed package (2) in which the at least one dental implant component and/or dental prosthesis (1) is placed, the sealed package including at a light transmitting package material (4) for wavelengths at least below 400 nm.

20. An arrangement according to claim 19, wherein said package (2) comprises a reflective material (5) formed to distribute incoming high-energy radiation within the package (2).

21. An arrangement according to claim 19 or 20, wherein said at least one dental implant component and/or dental prosthesis (1) is held at its bottom end (6) by a detachable pin (7) in said package (2).

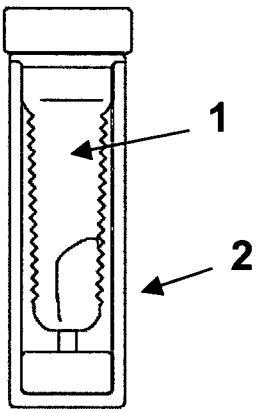

Fig. 1a

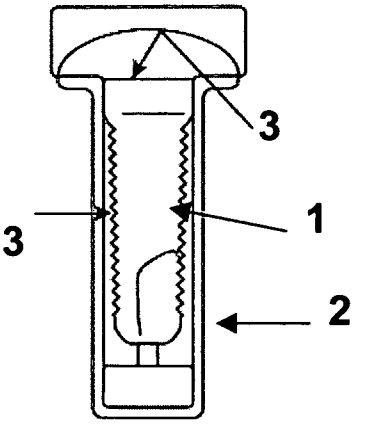

Fig. 1b

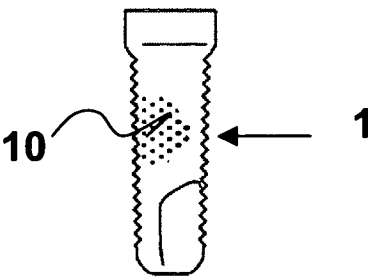

Fig. 2

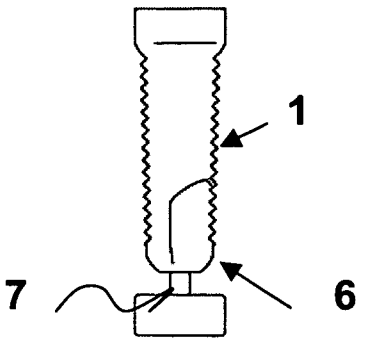

Fig. 3a

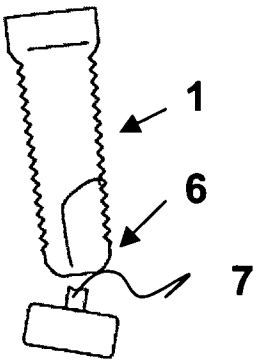

Fig. 3b

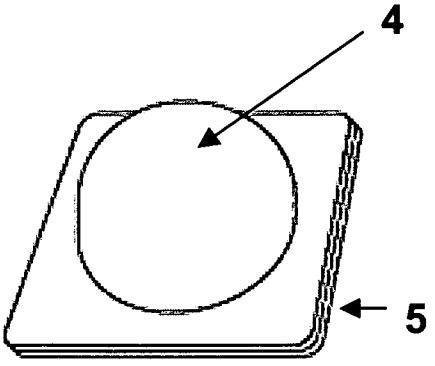

Fig. 4

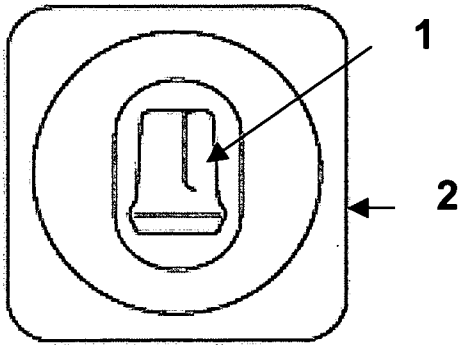

Fig. 5

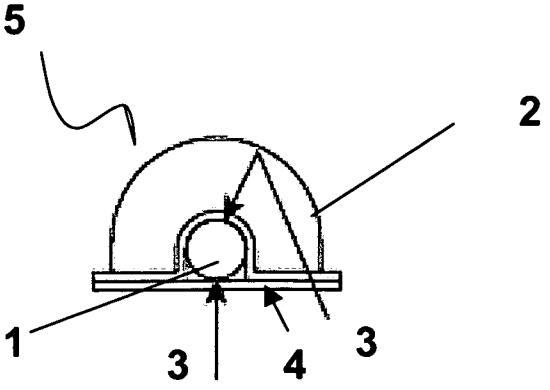

Fig. 6

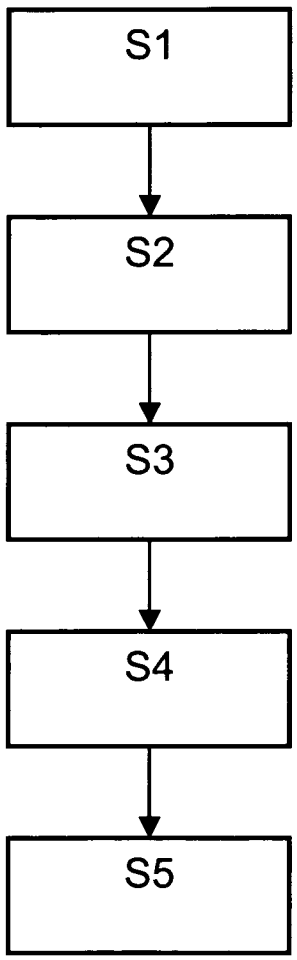

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/001249

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C8/00 A61K6/04
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)
A61K A61L B65B 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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2005/287045 A1 (LEVISMAN RICARDO [AR]) 29 December 2005 (2005-12-29) page 1, paragraph [0022]; figure 1 -----	1-5,14, 16-19,21 1-21
Y	US 2004/210309 A1 (DENZER ALAIN J [CH] ET AL) 21 October 2004 (2004-10-21) the whole document -----	1-21

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

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
24 June 2011	04/07/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pelli Wablat, B

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X,P	WO 2010/058254 A1 (BALDI GIOVANNI [IT]; CARNEVALE STEFANO [IT]) 27 May 2010 (2010-05-27) the whole document	1-7, 11-13, 15-17, 19-21

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