



(51) International Patent Classification:
A61C 8/00 (2006.01)

(21) International Application Number:
PCT/TR2017/050533

(22) International Filing Date:
31 October 2017 (31.10.2017)

(25) Filing Language: English

(26) Publication Language: English

(72) Inventor; and

(71) Applicant: **BENLIOGLU, Musfik** [TR/TR]; Ahmet Adnan Saygun Caddesi No:73/G Ulus Poyraz Sitesi, Kuruceme, 34340 Besiktas/Istanbul (TR).

(74) Agent: **ANKARA PATENT BUREAU**; Bestekar Sokak No:10, Kavaklidere, 06680 Ankara (TR).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,

SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: DENTAL IMPLANT HEALING CAP WITH INTEGRATED LED LIGHT SOURCE FOR PHOTODYNAMIC THERAPY

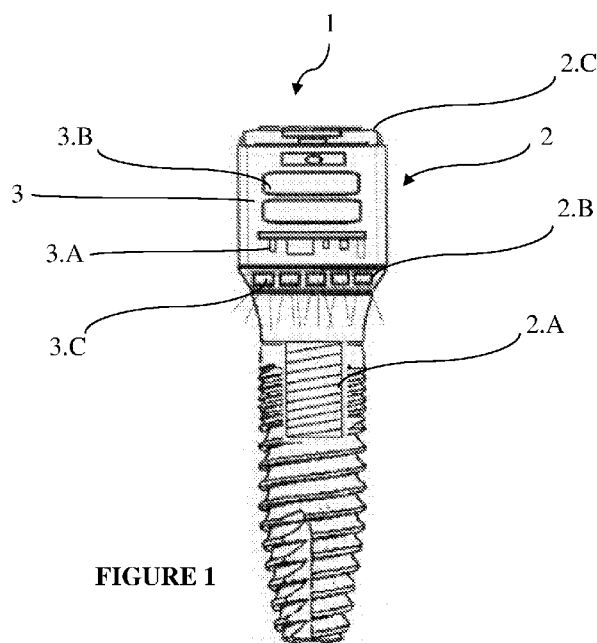


FIGURE 1

(57) Abstract: In the present invention, the gingival infections like gingivitis, periodontitis and bone support lost around a dental implant to be treated by photodynamic therapy and photo osteoblastic therapy can be performed by a dental implant healing cap with an integrated LED light source (1) that can be able to produce in a present lite paradigm at different wavelength lights to activate the already placed photosensitive materials around the implants to treat the infections at soft tissue cells and at the surrounding bone cells and also activate the bone cell regeneration by applying the specific wavelength of light.



DENTAL IMPLANT HEALING CAP WITH INTEGRATED LED LIGHT SOURCE FOR PHOTODYNAMIC THERAPY

5

Field of the invention

The present invention relates to dental implant healing cap with integrated LED source to promote the osteoblastic development of bone tissue, prevent the infections at soft tissue around the implant and provide the patient easy-handling for usage without need any medical personnel and extra equipment.

Background of the invention

Photodynamic therapy (PDT) is a medical treatment that utilizes a photosensitizing molecule (frequently a drug that becomes activated by light exposure) and a light source to activate the administered drug. The procedure is easily performed in a physician's office or outpatient setting. PDT is also referred to as blue light therapy. PDT is currently used in number of medical fields, including oncology (cancer), dermatology (skin), cosmetic surgery, ophthalmology, and oral medicine.

Although first used in the early 1900s, PDT in the modern sense is a new, evolving science. Current PDT involves a variety of incubation times for different the light-sensitizing drugs and a variety of light sources depending on the target tissue. The basic premise of PDT is selective tissue destruction.

The generation of singlet oxygen species by type II photochemical reactions is believed to be the predominant reaction in PDT. At low levels of PDT, biological systems may be positively stimulated by low enhancement of ROS levels.

30

PDT light sources include laser light, intense pulsed light, light-emitting diodes (LEDs), blue light, red light, and many other visible lights (including natural

sunlight). Photosensitizer drugs may become activated by one or several types of light. The optimal light source depends on the ideal wavelength for the particular drug used and target tissue.

- 5 PDT essentially has three steps. First, a light-sensitizing liquid, cream, or intravenous drug (photosensitizer) is applied or administered. Occasionally, a photosensitizing molecule that is already part of the body can be activated. Second, there is an incubation period of minutes to days. Finally, the target tissue is then exposed to a specific wavelength of light that then activates the photosensitizing medication. The
10 mechanism by which tissue is destroyed seems to depend on the presence of activated oxygen molecules.

One of the usage are is about dental therapies. PDT may also be used for local infections as well as in the treatment of dental bacterial disease, such as gum
15 abscesses, gum disease, gingivitis, and removal, deactivation or killing of plaque biofilms, implant infections.

The Korean patent document numbered KR20110132688 discloses a movable light therapy device for periodontal disease according to the present invention comprises: a
20 mouthpiece member comprises a light source array for irradiating light to teeth and the gums inside, and is inserted into the mouth of a patient to irradiate light to the teeth and the gums; and a controller supplied with power from the outside for controlling the operation of the light source array, wherein the controller is operated so as to control the wavelength and frequency of the light irradiated from the light
25 source array, thereby enabling treatment of periodontal disease. According to the movable light therapy device for periodontal disease of the present invention, it is possible to control with a wide range, the wavelength and frequency of light, thereby whitening teeth and showing various treatment effects such as periodontal disease treatment, dental implant treatment and the like. In addition, it is possible to
30 conveniently move the device according to the location of a patient by separating and storing a separate mouthpiece-type of equipment, and it is possible to conveniently sterilize the mouthpiece-type equipment by forming sterilization equipment.

In the state of the art, photodynamic treatment requires an experienced medical team, high costs and lots of time and being disturbing to patient.

5 To overcome these problems and able to apply photodynamic therapy, patients need a simple yet efficient and cheaper method of treatment applied by a Dental professional but can be performed outside of dental clinic throughout the treatment period.

Objectives of the invention

10 The present invention helps to promote the osteoblastic development of bone cells and to treat to infections such as gingivitis, periodontitis at the surrounding soft tissue and the implant surface.

15 This invention provides to remove the requirement of medical personnel, expensive medical equipment and allows the patient for self-administration after the first implementation until final removal.

20 Photodynamic therapy can be applied with a light source that can be integrated with the implant without the need for a light source designed for clinical use.

The present invention may be used in the treatment of oral infections caused by microbes and fungi, that cause all kinds of inflammation, gram positive and negative bacteria to the surrounding tissue of the implant by introducing a novel light source technology.

25

Detailed description of the invention

A realisation to fulfil the objective of the present invention is illustrated in the accompanying figures, in which:

30

Figure 1. shows a perspective view of the dental implant healing cap with integrated LED light source which is the subject matter of the invention.

The parts illustrated in the figure are individually numbered where the numbers refer to the following:

1. Dental implant healing cap with integrated LED light source
- 5 2. Body
 - 2.A. Screw part
 - 2.B. Main case
 - 2.C. Top cover
3. Light module
- 10 3.A. Control unit
 - 3.B. Battery cell
 - 3.C. Integrated LED source

The dental implant healing cap with integrated LED light source (1) comprises,

- 15 - at least one body (2) produced from steel or titanium in different sizes,
- at least one screw part (2.A) allows screwing into the female screw part within the implant,
- at least one main case (2.B) which has holes,
- at least one top cover (2.C) which is screwed onto the body (2), has a cavity
- 20 in the center to allows the operator to open or close the cover with a multi-sided key,
- at least one light module (3) for light emission,
- at least one control unit (3.A) designed to control short circuit, high temperature protection fuse, on/off switch, radiation pattern, radiation
- 25 wavelength, radiation power and duration,
- at least one battery cell (3.B) which is Li-Ion, Alkaline or Cadmium batteries,
- at least one integrated LED source on a flexible printed circuit. (3.C), angulated to the joining of gingival and implant surface.

- 30 The dental implant healing cap with integrated LED light source (1) has body (2) produced from steel or titanium in different sizes, have empty space for the light module (3) and protects the light module (3) and prevent being crushed against the

chewing forces. Body has three parts; screw part (2.A), main case (2.B) and a top cover (2.C).

5 The screw part (2.A) allows screwing into the female screw part within the implant to fix the dental implant healing cap with integrated LED light source (1). The main case (2.B) has holes to provide the LEDs to emit the light outside of the dental implant healing cap (1).

10 The top cover (2.C) is screwed into the body (2). There is a cavity in the middle of it which allows the operator to turn the cover (2.C) with a multi-sided key. At the deepest point of top cover (2.C), there is also another cavity to enable to perform the on / off function of device (1).

15 The light module (3) for light emission is disposable and has three parts; control unit (3.A), battery cell (3.B) and integrated LED source (3.C). The light module (3) is covered with a transparent module shell sealed with medical adhesives or ultrasonic welding, which does not allow penetration of liquid and other substances in the mouth. This case may be fulfilled with an elastomeric material to prevent any kind of short circuit or electrical failure due to air, acid, body liquids or any other penetration
20 as a second protection layer to make a perfectly sealed unit against outer gases or liquids of any kind.

The control unit (3.A) comprises means for current and voltage regulation of the LEDs (3.C.) and short circuit protection.

25

The control unit (3.A) may also comprise means for temperature sensing. As the device (1) is used, the circuit means and the LED source (3.C) may be overheated during the operations. When the temperature sensing means detects overheat or overcurrent situation caused from any other reasons, the control unit (3.A) can
30 deactivate the LED source (3.C) for example by a fuse.

The dental implant healing cap with integrated LED light source (1) can be used

manually and automatically. In automatic operation, the user has the possibility to change the working hours and working patterns of the device (1) with simple commands by using the control unit (3.A). If desired, dental implant healing cap with integrated LED source (1) can be reprogrammed or can be restore the factory settings.

5

The battery cell (3.B) supplies electricity to the LEDs. This type of battery can be a Li-Ion, Alkaline or Cadmium batteries.

10 The dental implant healing cap with integrated LED light source (1) contains at least one LED as light source. These integrated LED sources (3.C) are placed on the lateral sides of the implant facing toward the gingival and angled to the joint part of gingival and implant to emit the light with different wavelengths on a flexible printed circuit.

15 As a general working principle, integrated LED sources (3.C) selected due to the wavelength to which the photosensitizer materials in the body of a living organism are susceptible (between 350 nm, ultraviolet and 800 nm, infrared). Radiation pattern, as a pulse or a continuous glow, is adjusted with a determined algorithm during the production of the dental implant healing cap with integrated LED light source (1).

20 The LED sources (3.C), battery cell (3.B), control unit (3.A) and light module (3) are housed in a transparent module shell. Since the light module (3) is disposable, it can be changed by opening the top cover (2.C), if it is necessary to continue the treatment when the battery lifetime is over.

25 The dental implant healing cap with integrated LED light source (1) will be ready to use by screwing it into the implant body. To operate dental implant healing cap with integrated LED light source (1), the mechanical or magnetic key should be applied onto implant and the battery cycle is achieved. Required energy is provided for photodynamic therapy with emitted light with required wavelength.

30

The dental implant healing cap with integrated LED light source (1) will automatically start and stop during the previously programmed time. Radiation

algorithm and time is pre-determined according to the therapy applied.

During the dental implant healing cap with integrated LED light source (1) is mounted on the implant, it can be programmed in automatic mode. The operation
5 time of the dental implant healing cap with integrated LED light source (1) is adjusted according to the photosensitive material application and patient's sleeping time by using the key in the light module (3). First the patient needs to apply the supplied photosensitive material around the implant to be treated. After an upload of photosensitive material to the cells. It starts emitting the light with required
10 wavelength for photodynamic therapy at the specified time. After light emitting with an interval pattern as specified before, an infra-red radiation starts and continues at certain intervals to improve the osteoblastic activity for a specified time.

In a preferred embodiment of the invention, the dental implant healing cap with
15 integrated LED light source (1) can be used manually. In manual operation, the magnetic or mechanical key is applied into the screw part (2.A) on the implant to allow operation of the system. In both case (either automatic or manual), before the procedure is started, the gel or liquid photosensitizing agent is applied to the periphery of the implant and wait for the photosensitizer material loaded into the
20 cells.

The present invention may be used in the treatment of oral diseases in the tissue surrounding the implant which is caused by all kinds of inflammation, infections caused by gram positive and negative bacteria, and fungi without the need for a light
25 source designed for clinical use.

CLAIMS

1. The dental implant healing cap with integrated LED light source (1) comprising,
 - 5 - at least one body (2) produced from steel or titanium in different sizes, have empty spaces,
 - at least one screw part (2.A) allows screwing into the female screw part within the implant,
 - at least one main case (2.B) which has holes,
 - 10 - at least one top cover (2.C) which is screwed onto the body (2), has a recess in the middle of the it to allows the operator to turn the cover with a multi-sided key,
 - at least one light module (3) for light emission,
 - at least one control unit (3.A) adapted to control short circuit, high
15 temperature circuit break, on/off switch, radiation pattern, radiation wavelength, radiation power and duration,
 - at least one battery cell (3.B) which is Li-Ion, Alkaline or Cadmium batteries and
 - at least one integrated LED source (3.C), which is placed on the lateral
20 sides of the implant facing toward the gingival and angled to the joining of gingival and implant surface.
2. The dental implant healing cap with integrated LED light source (1) according to claim 1, wherein the cap is programmed to operate in automatic mode.
25
3. The dental implant healing cap with integrated LED light source (1) according to claim 1, wherein the cap is programmed to operate in manual mode.
4. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising a magnetic key to apply into the screw part (2.A) on
30 the implant to operate the system.

5. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising a mechanical key to apply into the screw part (2.A) on the implant to operate the system.
- 5 6. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising a battery cell (3.B) which is Li-Ion, Alkaline or Cadmium batteries.
7. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising a top cover (2.C), which has a cavity at the deepest point to enable to fulfill the on / off function.
- 10 8. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising a light module (3) which is covered with a transparent module shell, seaLED with medical adhesives.
- 15 9. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising a light module (3) which is covered with a transparent module shell, seaLED by ultrasonic welding.
- 20 10. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising the control unit (3.A) comprises means for current and voltage regulation of the LED sources (3.C.).
- 25 11. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising the control unit (3.A) which may work manually or automatically.
- 30 12. The dental implant healing cap with integrated LED light source (1) according to claim 1, comprising the integrated LED sources (3.C) to emits the light with different wavelengths on a flexible printed circuit.

13. Integrated LED light sources (3.C), according to claim 12, emitting the light in the wavelength which is between 350 nm, ultraviolet and 800 nm, infrared.

5 14. Integrated LED light sources (3.C), according to claim 12, selected due to the wavelength to which the photosensitizer materials are susceptible.

15. Integrated LED light sources (3.C), according to claim 12, comprising a radiation pattern, as a pulse or a continuous glow, which is adjusted with a determined algorithm.

10

15

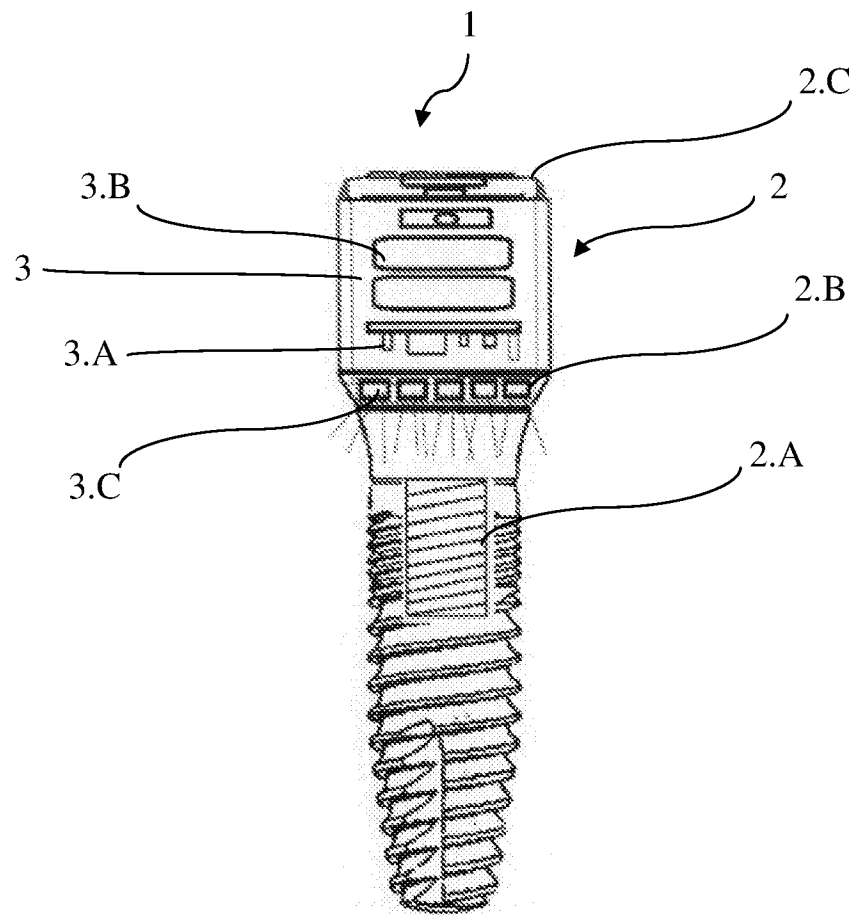
20

25

30

1/1

FIGURE 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/TR2017/050533

A. CLASSIFICATION OF SUBJECT MATTER

A61C 8/00 (2006.01)i

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 8/00

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 865260 B1 (STRAUMANN INST AG [CH]) 08 April 1999 (1999-04-08) Abstract, page 1-3; figure 1-2	1-15
Y	US 2013266909 A1 (DELFOSE DANIEL [CH] ET.AL) 10 October 2013 (2013-10-10) Abstract, par. 0002, 0026-0034; figure 1-4	1-15
A	WO 2011152585 A1 (MEDILUX CO LTD [KR]) 08 December 2011 (2011-12-08) Abstract, page 4-6; figure 1-2	1-15

☐ Further documents are listed in the continuation of Box C.
☐ See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search

18 April 2019

Date of mailing of the international search report

18 April 2019

Name and mailing address of the ISA/TR

Turkish Patent and Trademark Office (Turkpatent)
Hipodrom Caddesi No. 115
06560 Yenimahalle
Ankara
Turkey

Telephone No. (90-312) 303 11 82

Facsimile No. +903123031220

Authorized officer

Ali Riza Köker

Telephone No. +903123031198