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Removable partial denture type micro electric load device

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ABSTRACT

It is a denture type micro electric field loading device design. The device is a removable partial denture, and there are a power supply and the electrode plate in the denture. The electrode plate embedded in the denture base, electrode embedded in the buccal and lingual base, between the base and the artificial teeth is the power supply, the power supply and both sides electrodes connected by conductor, so the device can realize fast healing of dental implant, and the device has the advantages of small volume, convenient disassembly or use, easy cleaning, we can also use it as a temporary denture at the same time.

KEYWORDS

Micro dental device; Implant healing; Physical therapy.

INTRODUCTION

Clinical dental implant healing generally requires about 3~4 months[1], so in such a long period time of the healing process, patients often suffer pain and inconvenience when they received a implant in their jaws[2]. Therefore, we need to seek a method which can accelerate implant healing more rapidly.

Bone has been confirmed earlier as a natural electret material[3,4], it can be maintained polarization intensity for a long time after the polarization and the spatial and polarization charge can be stored in body is the root of skeletal electret effect[5]. Therefore, bio-electric phenomenon plays an important role in shaping and remodeling of bone.

Biological electric field generate within the wound is due to the human body itself, our body is also a complex piezoelectric, namely if we squeeze or tension the wound at its both sides, it will produce different charges, so it reveals the important significance of shift charges on growth of bone[6]. In addition, the research related to skin stem cells also showed that, epidermal stem cells moved toward the cathode in the micro electric field.

Direct current stimulation method has been widely used in promoting fracture healing, trauma treatment and nerve growth; it also has some part of the application in promoting healing of dental implant. Such as Micro dental Implant and Micro electric Field Stimulation Healing Device[7], the metal positive and negative pole of the healing device are exposed on the surface, which always come to contact with the gingival mucosa, extremely easy to cause the healing delay, and it easily coated by food residue, hardly to keep the mouth cleanly; Another device such as Dental Implant Micro electrical Stimulation of Healing Instrument, this healing instrument has a external power supply for its power driver, it needs to be alternated the high voltage into low-voltage DC through the transformation module, adjusted the current size by DC converter, stabilized the constant voltage or constant current through the controller. So the design of this equipment is complex, fussy operation, have to connect the civil power as a power supply, can't be used independently. On the one hand we think that the instrument has some safety problems, on the other hand, because of large volume, inconvenient carrying, so the treatment time is limited, not full day equipment, so the wound healing time is quite long.

In order to solve the problems above, we found that we could effectively promote the healing of implants, shorten the healing time through intervening the dental implant around by micro constant electric field. Therefore, the electrode plates are respectively embedded in the buccal and lingual sides of complete denture base, the power is embedded between denture base and artificial teeth, the power supply is connected with both sides of the electrode plate through a conductor, so this device can achieve a rapid healing, the device is small in volume, installation or disassembly, use are all convenient at the same time, and easy cleaning in the dental implants.

MECHANISM

We design a denture type micro electric field loading device, the device is a removable partial denture, and there are a power supply and the electrode plate in the denture. The electrode plate embedded in the denture base, electrode embedded in the buccal and lingual base, between the base and the artificialteeth is the power supply, the power supply and both sides electrodes connected by conductor, so the device can realize fast healing of dental implant, and the device has the advantages of small volume, convenient disassembly or use, easy cleaning, we can also use it as a temporary denture at the same time.

DESIGN AND IMPLEMENTATION

The apparatus was comprised of:

Power supply (1), as a miniature DC battery, set inside of the denture base (3), providing a voltage for the denture micro electric field loading device;

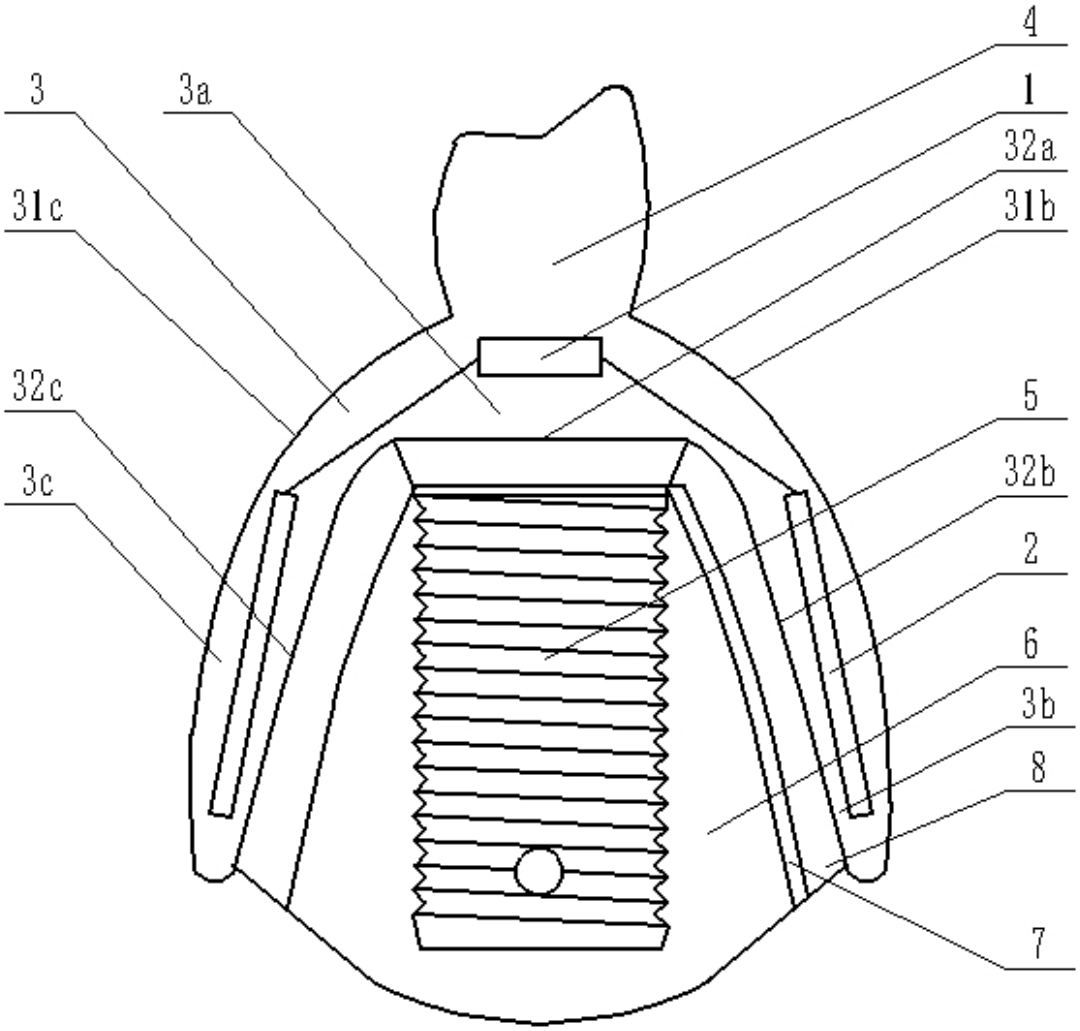
The two electrode plates (2), which are respectively set inside of the buccal (3b) and lingual(3c) side of denture base, connecting to the power supply(1) through a conductor.

Denture base (3), including the top of the denture base (3a), buccal denture base (3b) and lingual denture base (3c), the buccal side of the denture base (3b) and lingual denture base (3c) respectively connected with the top denture base (3a), the denture base (3) is located in the upper of the dental implant (5), wrapping the healing bits gums. Among them ,the buccal denture base (3b) set in the buccal surface of gums, the lingual denture base (3c) set in the lingual surface of gums, the outer surface of the buccal denture base(3b) is a polished surface (31b)which contact with the mouth, the outer surface of the lingual denture base (3c)is a polished surface (31c)which contact with the mouth, the inner surface of the buccal denture base (3b) is buccal tissue surface (32b), which matches the outer surface of the buccal healing bits gums , the inner surface of the lingual denture base (3c) is lingual tissue surface (32c), which matches the outer surface of the lingual healing bits gums , the inner surface of the top of the denture soft tissue (32a)matches the upper surface of implant (5),and does not produce obvious gaps between the denture base and gums, which can prevent the difficult healing between dental implant and the surrounding tissue caused by foreign invasion. In the upper of the denture base (3)are artificial teeth (4), produced by dental removable partial denture production requirements. Denture relative to the denture base (3) in the tilt direction and tilt angle is the same to adjacent natural teeth relative to gums respectively, which matches the corresponding position of occlusal height. To make the denture wearing comfortable, it use the same methods of conventional removable partial denture and does not improved on denture design, neither resulting in gaps among other matched upper and lower teeth, nor causing obvious gap between

denture and the opposite teeth. Denture base is insulated and waterproof which is made by resin, plastic or other polymer insulating materials.

Power supply (1) voltage of 0.5 ~ 10V, sustainable power supply 14 days to 3 months or more. Batteries are micro LC oscillator batteries, mini or micro-miniature storage batteries.

The length and width of the two electrode plates can be adjusted according to the size of the implant, covers an area of (1 ~ 5) x (1 ~ 5) cm^2. The average electric field intensity between the two electrode platess is 200 ~ 400mv/mm, it's a well stimulation to the healing bits and can promote wound healing, and does not cause discomfort to the patients. The thickness of the buccal denture base （3b） and lingual denture base（3c）are more than 4 mm, which does not increase the foreign body sensation to patients with oral cavity. Since the micro electric field between the two electrode plates is formed by the potential difference between them, without the need to form a loop, therefore, the two electrode plates can be encapsulated independently inside of the waterproof and insulation denture base, for one thing it can extend the battery usage time, for another it can prevent the loss due to corrosion caused by the saliva and avoid discomfort caused by the direct contact between the metal electrode plates and the gums or avoid oral tissue damage due to metal sharp boundaries.



1-Power supply; 2- electrode plates; 3- denture base;3a- the top of the denture base; 3b- buccal denture base; 3c- lingual denture base; 31b- the polished surface of buccal denture base; 31c - the polished surface of lingual denture base; 32a- the top surface of denture soft tissue; 32b- buccal tissue surface of the denture base; 32c- lingual tissue surface of the denture base; 4- dentures; 5- implants; 6- cancellous bone; 7- cortical bone; 8- gingival mucosa

Figure 1 : A schematic diagram of the denture micro electric field loading device.

CONCLUSIONS

The denture micro electric field loading device has the following advantages: small size, installate and disassemble conveniently on a dental implant; small size, the overall smooth, tight fit with gums, clean easily; the device without external equipments that can achieve its function and can realize all day long stimulation to dental implant; the production method is

simple and efficient, well industrial practicability; appearance and function is as with conventional temporary denture; micro electric field generated by the device may promote the implant tissue wound healing and the migration, proliferation, and differentiation of the local organizations stem cell; micro electric field can promote the combination between gingival mucosa and dental implant; it have effect on the improvement of periapical inflammation and periodontal diseases.

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