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RESEARCH ARTICLE

COMPUTER AIDED DESIGN COMPUTER AIDED MANUFACTURING MILLED TITANIUM RESTORATION AS A GRAFT FOR THE LOST DENTAL BONE

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ABSTRACT

Titanium used in dentistry as a material shaped in a shape of dental root and put in a jaw bone as a dental root replacement due to its properties of oseointegration and compatablity with bone and gingiva. Bone loss happened due to infection in dental pocket and after extraction of a tooth . Now we can use this properties of oseointegration and compatability with gingiva and bones to use the titanium as a material for restoration of lost dental bone by mixing the data taken from intraoral scanner and CBCT for making the titanium graft restoration which CAD/CAM in the machines according the special software restor the lost bone function and form. Digital impression with intraoral scanner which record the state of bone loss. The software relate this scanning data with cone beam x ray data then make an imagination for the lost part of the bone and add the mechanical mean of retention by making a hole or more in bone before scaninning to add a mean of mechanical retention to the graft and to make a graft with a guide and enhance healing and then give order to the milling machine to mill it . After graft the soft tissue will be managed according to the case from normal flap to the level of adding gingival tissue in cases with a big amount of titanium graft.

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INTRODUCTION

The invention relates to the field of periodontics and oral surgery , in particular restoration of resorbed bone or lost bone from the maxilla and the mandible. Developments in digital dentistry have resulted in an increased and improved application of three-dimensional (3D) technologies in patient assessment and treatment. For the past three decades, CAD/computer-aided manufacturing (CAM), or intraoral scanning devices, have been used in dentistry. Intraoral cameras and 3D scanners can enhance the oral health care experience. Scanners have a variety of uses, including designing precision full-ceramic crowns, veneers, inlays, and occlusal guards, as well as assisting with implants. Intraoral scanners capture images of the hard and soft tissues, as well as restorations. Intraoral images are captured by the scanner and processed by software, which, in turn, generates point clouds. The point clouds are a large collection of points that generate a representation of the existing structures. Dental Cone Beam Computed Tomography systems provide three-dimensional (3-D) information, rather than the two-dimensional (2-D) information provided by a conventional X-ray image. This may help with the diagnosis, treatment planning and evaluation of certain conditions. .Also, cone beam x ray is more reliable to detect the quality of the bone and give us accurate measurements of all dental hard tissues and exact site of vital structure to avoid it in the procedure . Dependence on the cone beam x ray and intraoral scanner to put accurate data about the state of bone of the patient on a software for making a model.

This software can make the imagination of future sites of dental implant in second step after bone grafting with titanium and make their places ready to receive them later in the stage of their placement

Disclosure of Invention Dependence of restoration of the lost dental bone on CAD/CAM titanium restoration as a graft which restor the shape ,form and function of resorbed bone .This CAD/CAM titanium restoration as a bone graft has two means of retention , mechanical means of retention by adding holes in the bones and its positive replica added in the restoration with the concept of male female interlock to held the restoration in place till oseointegration between bone and titanium complete successfully and chemical means of retention by oseointegration of titanium with bone also the new oseointegration concept between the cementum of the tooth and titanium in cases of restoring resorbed bone between the teeth and need contact between titanium restoration and tooth cementum .this new oseointegration between the cementum and the tooth will solve a lot of dental problems and open a new techniques in dental implant field.

Prepartion stage of the case: by opening a surgical flap to expose the area of lost bone for making mechanical means of retention and intra oral scanning. Some cases need previous CBCT to detect the exact sites of holes with a surgical guide based on previous CBCT x ray. The expected cases is Case of resorbed bone in dental bone pocket restoration with titanium graft (restor all cases of pockets even cases of hopeless teeth and after then this teeth endodontically treated): In this case we have resorbed bone (described in figure 1 as number 5)

After anaesthia and surgical opening and and reflection of the flap we use a sharp dental tool to excavate the infected superficial layer of bone then we use a dental carbide bur in high speed contra with coolant to make one hole or more in the area of resorbed bone to be the receiving area of mechanical mean of retention of titanium graft restoration . Then, the area to be restored is ready to be scanned with intraoral scanner and making cone beam x ray.

Case of bone restoration of resorbed area of alveolar bone after multiple extraction (need bone and teeth restoration):

In this case after multiple extraction the alveolar bone resorbed and the basal bone remain (described in fig 3 as number 8). After anaesthia and surgical opening and and reflection of the flap the problem here will be restoration of alveolar bone and taking the retention from basal bone with chemical and mechanical means of retention of titanium graft restoration . The mechanical means of retention with male female interlock concept. In this case we start with cone beam x ray to detect the areas which can we drill with carbide dental bur through it to make the mechanical means of retention of the restoration without interference with any nerve or maxillary sinus or border of mandible. It will need a surgical guide to be accurate in drilling CAD/CAM made based on CBCT and CAD/CAM machine. Then we do the holes in the bones with carbide bur in high speed dental contra with coolant to make the areas of mechanical retention without any interference with important structure. Now we have a case prepared for intra oral scanning with intraoral scanner.

After making the intraoral scanning with intraoral scanner ,all data of the case will be transferred on the computer software then this data analyzed with data taken from cone beam x ray to make a software model of the case .This software has all data of the case from accurate measurement and density of the bone and relation with surrounding structure represent exact replica of a case with holes made to receive the titanium graft .Then the software imagine the lost part of the bone based in previous data from similar cases or with human planning to be customized in some cases to restor the shape ,form and function of the lost bone .This software imagination also add its positive mechanical means of retention to the titanium graft restoration .Then the software give the order to the CAD/ CAM milling machine to mill the titanium graft restoration with its positive means of retention (described in figure 5 as number 12 and described in figure 2 as number 7). This machines is faithful to basic metal milling, and have 5 axis machine available both for WET and DRY type milling. It has high degree of precision and fast milling time so customers not only can use for long, but the efficiency of working can be maximized. This machines are available in the market for zirconia and titanium milling. High productivity is ensured by cutting conditions which deliver excellent performance with hard materials. It has a high level of rigidity offered by the machine. These optimum operating conditions for the cutting tools reduce premature wear and, in turn, operating costs.

In the case of restoring the alveolar bone we notice in the design of titanium graft the site of future dental implant to be free from titanium and has the predicted shape of root part of the dental implant for immediate loading in the later stage without any preparation that will be inserted in this titanium graft restoration (described in fig 5 as number 11).

Stage of delivery of titanium graft restoration to the previously prepared case:

We ensure cleaning and irrigation with sterilized water before insertion of titanium graft restoration. Then we insert the restoration and ensure complete seal and lock with the bone to ensure complete entrance of titanium projection of titanium graft restoration in the prepared holes in the bone (described in figure 2 also described in figure 4). After insertion we reflect the flap and suture the reflected gingiva. In cases with big size of restoration that make the falp reflection difficult or short we add a gingival tisue graft from other oral sites to make the gingival covering the restoration relaxed after suturing to help in healing process.

Finally, it should be noted that the above components are only used to describe the technical solutions of the present invention and are not intended to limit the technical methods.

The present invention may be extended to other modifications, changes, applications, and embodiments, and thus all such Modifications, variations, applications, and embodiments are within the spirit and scope of the invention only under the authority of the inventor .

Brief description of drawings:

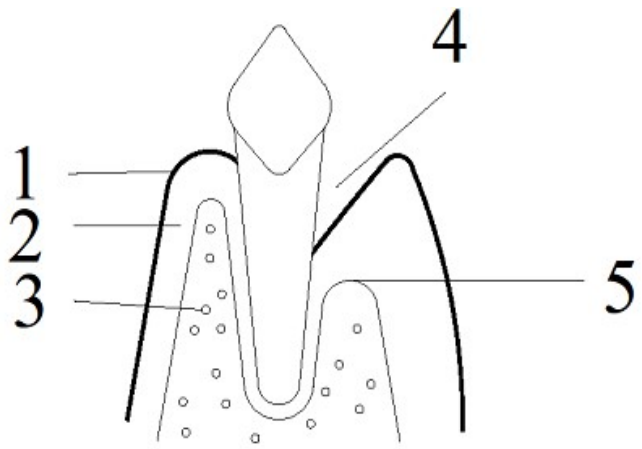

Fig.1 Schematic view showing the Case of dental bone pocket need titanium graft restoration

- oral epithelium
- connective tissue
- alveolar bone
- periodontal pocket
- resorbed bone

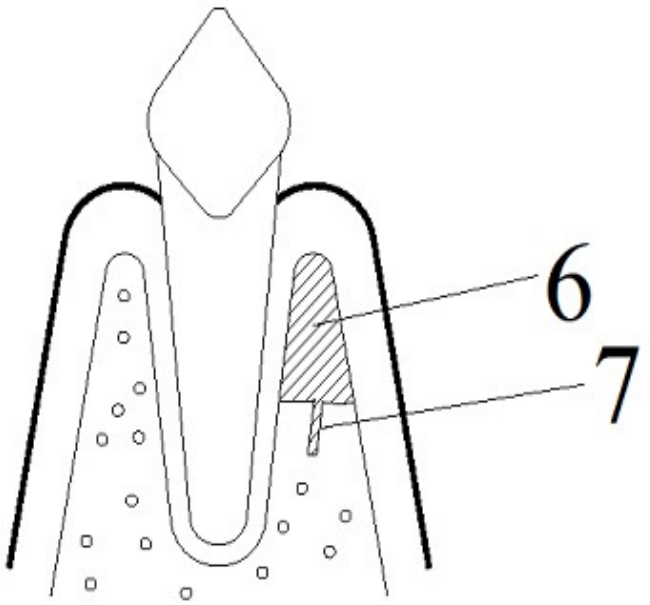

Fig. 2. Schematic view show the Case of dental bone pocket restored with titanium restoration:

- Titanium graft restoration
- Titanium projection as a mechanical mean of retention

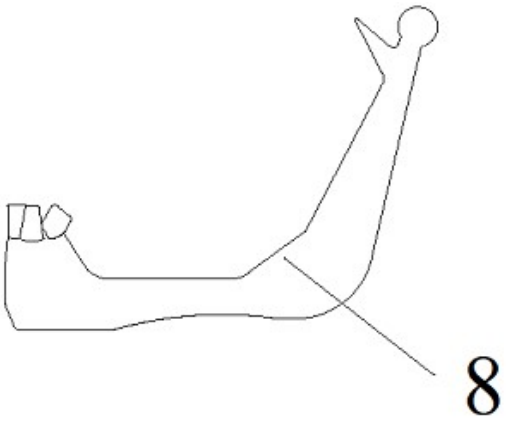

Fig. 3. Schematic view show Case of resorbed area of alveolar bone after multiple extraction need titanium graft restoration:

Resorbed basal bone

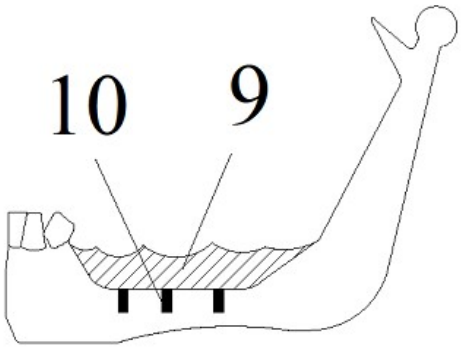

Fig. 4. Schematic view show Case of resorbed area of alveolar bone after multiple extraction restored with titanium graft restoration

Titanium graft restoration restor alveolar bone titanium projection of the restoration for mechanical means of retention with basal bone.

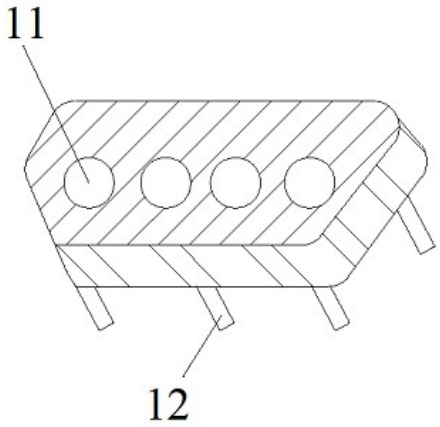

Fig. 5. Schematic view show the shape of titanium restoration for restoration of alveolar bone from the lateral side

The space of future dental implant. The titanium projection of the titanium graft restoration

Claims

- Any restoration of dental bone with CAD/CAM titanium to restor the shape ,form and function of dental bone.
- Any restoration of dental bones based on mixing the data from intra oral scanner and cone beam x ray to give a primary model software of the bone of the case and any software can imagine the lost part of the bone and mill it
- The idea of dental bone restoration with mechanical means of retention of male female interlock to enhance the oseaintegration of bone and titanium.
- The idea of prepared sites of dental implant as a space prepared in bone titanium restoration for future placement of the root of dental implant.
- The idea of restoring alveolar bone on basal bone with chemical mechanical means of retention taking into account the future site of dental implant and without interferenace with any nerve or sinus or risk of fracture to restor function and form of the alveolar bone .
- The idea and concept of restoring the bone under gingiva to have the normal shape, form and function as a separate treatment stage then restoring the teeth as a separate stage . This will give better result for the patient and the sensation of restoring the previous sense of natural teeth.
- The concept of oseointegration between the tooth cementum and titanium graft restoration to make a new type of oseointegration.
- The idea of normal contact of titanium restoration with the tooth cementum and the normal hygienic bond between them in cases with resorbed bone in dental pockets and need titanium bone restoration which will make contact with the tooth structure.

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