Clinical and Radiographic Evaluation of Porous Titanium Granules on Osseointegration of Immediate Dental Implants

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- Ca^{+2}…….Calcium ion.
- CCD system……Charged coupled device system.
- CEJ……Cementoenamel junction.
- DBM…..demineralized bone matrix.
- DFDBA…..demineralised freeze-dried bone allograft.
- D-PTFE…..high density polytetrafluroethylene.
- e-PTFE….Expanded polytetrafluroethylene.
- GTR…….Guided tissue regeneration.
- HF….hydrofluoric acid.
- HIV…..Human immunodeficiency's virus
- HNO_3 ……Nitric acid.
- H_3PO_4 …..Phosphoric acid.
- H_2SO_4 …….sulfuric acid.
- PD…….probing depth.
- PO_4^{-2}……phosphate ion.
- PTG…..Porous titanium granules.
- SD…….Standard deviation.
- TCP……Tri calcium phosphate.

INTRODUCTION

The loss of tooth can induce emotional trauma, digestive problem, and also physical deformity due to bone resorption by the time. The degree of bone loss varies between different individual subjects according to the anatomic area. Within the first 6 months after extraction more than 50% of alveolar bone height and 60% of alveolar bone width may be lost.

Immediate implant solves this problem, as it preserve the width and height of alveolar bone and enhance esthetics.

The level of bone support around the implant supported single-tooth restoration is a key factor in the survival and esthetic outcome of immediate implant. So a bony wall deficiency around it may compromise its osseointegration.

Guided bone regeneration is used in implant treatment to promote the function and esthetic in an inadequate bone volume and area where it can increase the width and height of alveolar bone. Attempts to regenerate bone around an implant involve the usage of natural or synthetic graft materials.

One of these synthetic graft materials is porous titanium granules. It acts as an effective scaffold that has an osteoconductive property. It allows good bone integration due to the structure of the granules. Titanium granules was used as a bone substitute material for sinus floor augmentation, contour enhancement of the alveolar process around delayed dental implant, treatment of a large cystic cavity, and in treatment of peri-implantitis. On the other hand, it was not used with immediate implant.

Hence the purpose of this study was to use titanium granules with immediate dental implant as an osteoconductive material to compensate any vertical bone defect and voids between implant and bone walls and to evaluate its effect on osseointegration of immediate dental implant.

REVIEW OF LITERATURE

Dental implant

Many definitions had been proposed to describe dental implant. The best was: A permanent device that is biocompatible, biofunctional, placed on or within the bone associated with oral cavity to provide retention and support for a fixed or removable prosthesis.[1]

Branamark[2] was the first surgeon who studied different aspects of implant design, including biological, mechanical, physiological and functional phenomena relative to the success of endosteal implant.

Classification of dental implant:

Dental implant can be classified in different ways. This classification is based upon their anchorage component as it is related to the alveolar bone that provide support and stability of the prosthetic appliance. **Branamark et al**.[2] classified dental implants into 5 categories.

Transosseous implant:-

It is composed of a metal plate and transosteal pins. The metal plate is held with retentive pins to the inferior border of the mandible. The pin penetrates through the full thickness of the mandible.[3] One advantage of using transosteal implant is predictable longevity, but on the other hand it needs 6mm vertical bone height and 5mm bone width at least to gain proper primary stability.[1]

Subperiosteal implant:-

It is quite reliable, as it can be used in atrophied jaw. It needs at least 5mm of bone height. It is custom made fabricated by direct or indirect impression techniques.(1)

Intra mucosal implant:-

It differs in form, concept, and function from other types of implants. They are mushroom –shaped titanium projections that are attached to the tissue surface of a partial or total removable denture in the maxilla. It plugs into prepared soft tissue receptors sites in the gingiva to provide additional retention and stability. Pain was experienced during healing, and that explains why it was no longer used.(1)

Endodontic stabilizers:-

They are highly successful, tooth root lengthening implants. One reason for their success is that they have no site of premucosal penetration because they are placed into bone through the apex of natural tooth. It offers one stage treatment for teeth that suffer from inadequate crown root ratio.(1)

Endosseous implants:-

It is an alloplastic material inserted surgically into residual bony ridge, primarily to serve as prosthodontic foundation. There are two main subcategories of endosteal implant; plate and root form implants. (4)

The plate form implant usually uses the horizontal dimension of the bone, flat and narrow in facio-lingual dimension. It is also called blade vent implant.

Furthermore, the second major category of endosseous implant is root form implant. It is 3-5mm in diameter and 7-20mm long.[4] It can be classified according to different aspects:-

1- Surgical or non surgical technique.
2- Technique of loading.
3- Type of implant-bone interface.
4- Time of insertion.

1-According to surgical or non surgical technique:-

Implant placement can be done by surgical or non surgical techniques.

A)Surgical techniques are classified into:-

Two stages surgical technique: in which implant should be inserted, covered and allowed to integrate for period of 3-6 months.[5] Contemporary research states that two stage surgery technique is unnecessary, but patient-specific factor may direct the clinician's judgment and points him towards two-stage surgery such as cigarette use, alcohol consumption or periodontal status.[6] Two- stages surgical technique had several theoretical advantage such as bone healing to implant surface that occurs in an environment free of bacteria, prevention of epithelization at the implant bone interface. On the other hand, its major drawback is the need for second surgical procedure to expose the implant and attach a transmucosal abutment.[7]

One stage surgical technique: allows the implant to project through bone and soft tissue into the oral cavity. It eliminates the need for second stage surgery and allows easy soft tissue maturation before fabrication of the final prosthesis. [5]

B) Non-surgical technique:

It uses either a soft tissue punch device to gain access to the alveolar ridge for implant placement or drilling procedure that is performed directly through the mucosa.[8] The flapless implant technique reduces the amount of crestal bone loss than the conventional flap technique, and results in a significantly stable soft tissue profile, reduce edema, pain and discomfort.[9] Despite the advantages of flapless implant placement, it has several drawbacks including the removal of keratinized tissue and the surgeon's inability to submerge implants.

Mini incision surgery is a new technique in which the extending vertical relieving incisions to vestibular tissues should be avoided. It aims to capitalize the advantage of flapless technique in order to preserve the keratinized mucosa, allows minimal soft tissue reflection, and overcomes inability to submerge implant fixture. [10]

2- According to technique of loading:-

Implant can be classified according to technique of loading into conventional delayed, early, immediate, or progressive loading.

- *Conventional delayed loading:* in which the prosthesis is attached to implant in the second stage procedure after 3-6 months. [7]
- *Early loading:* starts within 6 weeks from implant insertion.[7]
- *Immediate loading:* in which a restoration is attached and placed in occlusion with the opposing dentition at the same time of implant insertion, but the force applied is decreased to