The Effect Of Single Versus Double Screws In Tenting Screw Technique For Horizontal Ridge Augmentation Before Dental Implant Placement (Randomized Clinical Trial)

1/8/2022

Introduction and Review

With increasing demands of the patient regarding aesthetics and function, the need for implant supported reconstructions has substantially increased. Extensive research is being done to improve the success of implant therapy. Numerous changes in the alveolus that follow tooth loss, frequently compromises dental implant placement in a prosthetically ideal position. The natural remodelling processes of alveolar socket begin immediately after extraction and may result in up to 50 % resorption of the alveolar ridge within 3 months **(Deepika-Penmetsa, S. L et al., 2017)**.

Dental implant has become an important treatment option for the treatment of partial and complete edentulism. High failure rates have been associated with implants placed in resorbed ridges with insufficient alveolar bone structure. Placement of implants in non-ideal positions as a result of bone deficiency may lead to the application of off-angle forces to the implant during function which significantly increases the force magnitude applied to the bone around the implant (***Aeh, A.*** **et al., 2017)**.

Several classification systems of alveolar ridge deformities have been proposed. Seibert introduced his widely used classification of ridge defects in 1983. In this classification, Class I defects represent buccolingual loss of tissue and normal apicocoronal ridge dimensions, Class II defects are those with apicocoronal loss of tissue and normal buccolingual ridge dimensions, while Class III defects represent a combination of both width and height deficiencies. In 1988, Cawood and Howell suggested an anatomic classification of the edentulous jaws for the preprosthetic surgery. It proposed six classes and detailed the changes that the edentulous alveolar process in anterior and posterior maxilla and mandible undergo after teeth extraction (the pattern of resorption). In 1989, Jensen proposed an implant-driven site classification by bone quality and quantity and proximity to vital structures. In 2002, Wang and Al-Shammari described a practical (therapeutically oriented) classification of alveolar ridge defects, that is, horizontal, vertical, and combination defects, proposing the edentulous ridge expansion approach (ridge-split) for the horizontal and combination defects of the alveolar Ridgel. **(Cawood, J. I. et al., 1988) (Jensen O. 1989) (Wang, H. L. et al., 2002)**

Bone regeneration and reconstruction **in** patients with severely atrophic ridges have been always controversial. Although several techniques can be used, it can be difficult to find an appropriate technique that provides bone with properties similar to those of the recipient site **(Pourdanesh, F. et al., 2017)**.

Various alveolar ridge augmentation procedures are available to gain enough bone volume and apply the ideal treatment plan afterwards. Guided bone regeneration, ridge splitting, distraction osteogenesis and autogenous block bone grafting are main techniques which have successful outcomes in reconstruction of bone defects. It's difficult to demonstrate that one augmentation procedure offers better outcomes than another. Studies documenting augmentation techniques seem to be comparable and state favorable results for each procedure. **(Aytekin, M. et al., 2020)**

A number of grafting materials are available. The use of autogenous bone grafts for ridge repair has been considered as the gold standard for obvious biological reasons because of its inherent osteogenic, osteoinductive, and osteoconductive properties. However, the surgical morbidity associated with graft procurement procedures has triggered countless attempts to avoid a second surgical site for graft procurement by using allografts, xenografts, or synthetic material to replace the lost alveolar bone **(Troeltzsch, M. et al., 2016) (Patel, A. et al., 2019) .**

Allografts are transferred from an individual to another within the same species. Since there is no need for a secondary surgical site to obtain allografts, reduced morbidity is one of the advantages brought by use of this graft. Unlimited source is another advantage over autografts. Although allografts have no osteogenic properties, they stimulate bone growth via osteoconduction and incorporation of osteoinductive growth factors. There are strict sterilization and decontamination protocols regarding these materials due to the risk of disease transmission and host immune response. Donors are carefully evaluated and graft materials are gradually processed to avoid any risks. Some studies reported that certain allografts are less osteoinductive than others because of the sterilization protocols and the variability of their content **(Aytekin, M. et al., 2020)**.

One of the most popular techniques is guided bone regeneration (GBR), which entails placing a membrane over the defect to create a secluded space into which osteogenic cells can migrate and remain undisturbed over the exposed part of the implant. Guided bone regeneration (GBR) is frequently used in combination with the installment of titanium implants. The application of a membrane to debar non-osteogenic tissues from interfering with bone regeneration is a key principle of GBR **(Elgali I et al., 2017) (Vijayalakshmi R et al., 2012)**.

The tenting technique, which originated from the principles of guided bone regeneration, involves raising the periosteum like a tent to allow osteoblasts to migrate into the gap to start osteogenesis. The gap that is made is then filled with osteoconductive or osteoinductive materials, and in some cases, both. The migration of epithelial cells can be prevented by the application of a barrier-like collagen membrane or other component. The technique is divided into three categories that depend on the method that is used to keep the periosteum up. the first of which was the tent-pole technique. The two other modifications, cortical autogenous tenting, and screw tenting, are usually used for smaller oral defects. Studies have shown that they can all be used to augment bone effectively **(Khojasteh, A. et al., 2012) (Takata, T. et al., 2001) (Marx, R. E etl al., 2002)**.

To avoid shrinkage resulting from pressure after flap closure, several space maintenance modalities were used to facilitate reconstruct ridge formation such as tenting screws, titanium (Ti) meshes, and Ti-reinforced polytetrafluoroethylene (PTFE) membranes. Nonresorbable membranes have a high risk of exposure, necessitating removal in the re-entry stage. Resorbable membranes have shown better biocompatibility and support of underneath bone growth. However, their lack of stiffness can lead to decreased bone volume gain. Therefore, the tent-pole technique, which combines resorbable collagen membrane and tenting screws, represents an effective approach, offering easy manipulation and low complication rates **(Doan, Tu et al., 2020)**.

Aim of the study

-First aim: Evaluate the effectiveness of screw tent technique in horizontal ridge augmentation

-**Second aim:** Compare the effect of using single screw versus double screws on obtaining maximum bone gain.

Patients and Methods

Patient selection

this study will be conducted on 16 patients indicated for horizontal ridge augmentation in premolar and molar area. After approval from the ethical committee, the entire patients will be recruited from the outpatients' clinic of the Oral Medicine, Oral Diagnosis, and Periodontology Department Faculty of Dentistry, Minia University.

Inclusion criteria:

1. Selected patients of both genders are 20-55 years old.

2. Patients are systemically healthy based on questionnaire dental modification of Cornell index **(Bolender, C. L. et al., 1969).**

3. Gingival health according to the new classification system **(Caton, J. G. et al., 2018).**

4. The recipient site of the augmentation is free from any pathological conditions.

5. At least 1 tooth area with a ridge defect and planned to receive a dental implant. The site must be bordered by at least 1 tooth.

6. Class I ridge defect according to Seibert's classification.

7. Adequate interocclusal space to accommodate the available restorative components.

Exclusion criteria:

1. Pregnant female.
2. Parafunctional habits such as bruxism and clenching.
3. Smokers.

Ethical regulation and Informed consents

All patients will undergo a delayed implant placement and the complete treatment plan will be explained to all patients including detailed steps, risks, and expected results. Verbal and written informed consent will be obtained from all patients before the commencement of the study. All steps will be examined and approved by the appropriate ethics committee and have therefore been performed following the ethical standards laid down in the Declaration of Helsinki and the research ethics committee of the Faculty of Dentistry, Minia University.

Pre-surgical phase

- At the initial visit, each patient will receive a diagnostic work-up that included a full periodontal examination, standardized periapical radiographs and diagnostic study casts.

- Horizontal ridge width will be measured with a bone caliper to the nearest millimeter at the midridge crestal level and then 5 mm apically. Stent will be used for the standardization of the measurements.

- A preoperative cone-beam computed tomography (CBCT) will be performed for each patient who met the inclusion criteria before the surgery to determine bone height and width and to evaluate the underlying bone condition.

- These clinical and radiographic measurements will be repeated at reentry after 6 months of healing.

Randomization

All cases will be randomly allocated according to flip coin test into 2 groups each group will include 8 patients.

Group A:

: 8 patients indicated for lateral ridge augmentation in premolar-molar area (class I Seibert's classification) will be candidates to screw tent technique using single screw at crest position

Group B:

8 patients indicated for lateral ridge augmentation in premolar-molar area (class I Seibert's classification) will be candidates to screw tent technique using double screws, one at a crestal position and the other one 5 mm apical to the first one.

Surgical Phase

- All patients will receive prophylactic antibiotic (1 gm. Amoxicillin-clavulanate, Augmentin ®, GlaxoSmithKline, UK) one hour preoperatively and then every twelve hours for four days and will be instructed to rinse with 0.12% Chlorhexidine (Orovex ®, MACRO, Egypt) for one minute prior to surgery and twice daily for 2 weeks postoperatively.

- All procedures will be performed under local anesthesia utilizing articaine hydrocholoride 4% with 1:100000 epinephrine (Septanest®, Septodont, USA).

- Sulcular incisions around teeth with mesial and distal vertical releasing incisions. A full thickness flap will be reflected on the buccal, and a full thickness flap will be reflected on the lingual/palatal to expose the residual alveolar ridge.

- Multiple cortical perforations will be performed with a 1/2 round bur to increase angiogenesis and supply of growth factors in all defect areas.

- In group A: single titanium bone screw will be placed in a crestal position to aid in graft stability. In group B: double titanium bone screws will be placed, one at a crestal position and the other one will be places 5mm apical to the first one.

- In both groups the defect will be filled with allograft, the graft will be extended at least 10 to 12 mm in the apicocoronal direction.

- The grafted site will be covered with Bovine pericardium membrane

- Tension-free primary flap closure will be achieved and sutured using a 5-0

Polypropylene suture.

- 6 months later at the reentry, the bone screws will be removed and dental implant will be placed at the augmented site.

Postoperative instructions

1. Routine verbal and written postoperative instructions for periodontal surgery will be given to all patients including ice compression on the surgical site during the first 4 h, a liquid and/or soft food diet for 3 days.

2. As with all surgical procedures, patients will be informed to contact our clinic if any problems will be developed during the postoperative period.

3. 1 gm. Amoxicillin-clavulanate (Augmentin ®, GlaxoSmithKline, UK) to be taken regularly every 12 hours for 4 days. Diclofenac Sodium 75 mg intramuscular injection (Voltaren, Novartis, Switzerland) was given every 12 hours for the first 48 hours and then was replaced with 50 mg enteric coated tablets taken only when needed. Patients were instructed to rinse with 0.12% Chlorohexidine 2 times per day for two weeks

4. The sutures will be removed after 2 weeks.

5. Patients were followed up for signs and symptoms of pain, inflammation, infection, wound dehiscence or membrane exposure 24 hours postoperatively, then day after day for the first week, and then monthly for 6 months.

Clinical assessment:

At reentry 6 months later,

Keratinized mucosa will be measured using periodontal probe to the nearest millimeter

horizontal ridge width will be measured with a bone caliper to the nearest millimeter m at the midridge crestal level and then 5 mm apically. Same stent will be used for the standardization of the measurements

Radiographic evaluation

After 6 months CBCT imaging will be used to measure ridge width and bone density.

Statistical analysis:

-All data will be tabulated and analyzed by statistical method.

References

Aeh, A., Ka, A.G., Ha, A., & Es, A. (2017). Xenogenic Flexible Bone Lamina Graft: A Successful Alternative to the Autogenous Onlay Bone Block Graft in Alveolar Ridge Augmentation: A Clinical, Radiographic and Histological Evaluation.

Aytekin, M., & Arisan, V. (2020). Alveolar Ridge Augmentation Techniques in Implant Dentistry. In (Ed.), Oral and Maxillofacial Surgery. IntechOpen. https://doi.org/10.5772/intechopen.94285

Bolender, C. L., Swoope, C. C., & Smith, D. E. (1969). The Cornell Medical Index as a prognostic aid for complete denture patients. The Journal of prosthetic dentistry, 22(1), 20–29. https://doi.org/10.1016/0022-3913(69)90268-6

Caton, J. G., Armitage, G., Berglundh, T., Chapple, I., Jepsen, S., Kornman, K. S., Mealey, B. L., Papapanou, P. N., Sanz, M., & Tonetti, M. S. (2018). A new classification scheme for periodontal and peri-implant diseases and conditions - Introduction and key changes from the 1999 classification. Journal of clinical periodontology, 45 Suppl 20, S1–S8. https://doi.org/10.1111/jcpe.12935

Cawood, J. I., & Howell, R. A. (1988). A classification of the edentulous jaws. International journal of oral and maxillofacial surgery, 17(4), 232–236. https://doi.org/10.1016/s0901-5027(88)80047-x

Deepika-Penmetsa, S. L., Thomas, R., Baron, T. K., Shah, R., & Mehta, D. S. (2017). Cortical lamina technique: A therapeutic approach for lateral ridge augmentation using guided bone regeneration. Journal of clinical and experimental dentistry, 9(1), e21–e26. https://doi.org/10.4317/jced.53008

Doan, Tu & Le, Lanh. (2020). Efficacy of the Tent-Pole Technique in Horizontal Ridge Augmentation. Pesquisa Brasileira em Odontopediatria e Clínica Integrada. 20. 10.1590/pboci.2020.109.

Elgali, I., Omar, O., Dahlin, C., & Thomsen, P. (2017). Guided bone regeneration: materials and biological mechanisms revisited. European journal of oral sciences, 125(5), 315–337. https://doi.org/10.1111/eos.12364

Jensen O. (1989). Site classification for the osseointegrated implant. The Journal of prosthetic dentistry, 61(2), 228–234. https://doi.org/10.1016/0022-3913(89)90380-

Khojasteh, A., Behnia, H., Shayesteh, Y. S., Morad, G., & Alikhasi, M. (2012). Localized bone augmentation with cortical bone blocks tented over different particulate bone substitutes: a retrospective study. The International journal of oral & maxillofacial implants, 27(6), 1481–1493.

Marx, R. E., Shellenberger, T., Wimsatt, J., & Correa, P. (2002). Severely resorbed mandible: predictable reconstruction with soft tissue matrix expansion (tent pole) grafts. Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons, 60(8), 878–889. https://doi.org/10.1053/joms.2002.33856

Patel, A., Greenwell, H., Hill, M., Shumway, B., & Radmall, A. (2019). Ridge Augmentation Comparing an Allograft Plus Autogenous Bone Chips to an Osteoinductive Demineralized Bone Matrix: A Clinical and Histologic Study in Humans. Implant dentistry, 28(6), 613–620. https://doi.org/10.1097/ID.0000000000000925

Pourdanesh, F., Esmaeelinejad, M., & Aghdashi, F. (2017). Clinical outcomes of dental implants after use of tenting for bony augmentation: a systematic review. The British journal of oral & maxillofacial surgery, 55(10), 999–1007. https://doi.org/10.1016/j.bjoms.2017.10.015

Takata, T., Wang, H. L., & Miyauchi, M. (2001). Migration of osteoblastic cells on various guided bone regeneration membranes. Clinical oral implants research, 12(4), 332–338. https://doi.org/10.1034/j.1600-0501.2001.012004332.x

Troeltzsch, M., Troeltzsch, M., Kauffmann, P., Gruber, R., Brockmeyer, P., Moser, N., Rau, A., & Schliephake, H. (2016). Clinical efficacy of grafting materials in alveolar ridge augmentation: A systematic review. Journal of cranio-maxillo-facial surgery : official publication of the European Association for Cranio-Maxillo-Facial Surgery, 44(10), 1618–1629. https://doi.org/10.1016/j.jcms.2016.07.028

Vijayalakshmi, R., Rajmohan, C. S., Deepalakshmi, D., & Sivakami, G. (2012). Use of platelet rich fibrin in a fenestration defect around an implant. Journal of Indian Society of Periodontology, 16(1), 108–112. https://doi.org/10.4103/0972-124X.94616

Wang, H. L., & Al-Shammari, K. (2002). HVC ridge deficiency classification: a therapeutically oriented classification. The International journal of periodontics & restorative dentistry, 22(4), 335–343.