International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 10; Issue 03 (A); March 2021; Page No.24019-24022
DOI: http://dx.doi.org/10.24327/ijcar.2021.24022.4759

Case Report

# RIDGE SPLIT TECHNIQUE WITH SIMULTANEOUS IMPLANT PLACEMENT IN HORIZONTALLY RESORBED MAXILLARY ALVEOLAR RIDGE: A CASE REPORT

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A R T I C L E I N F O

*Article History:*
Received 06th December, 2020
Received in revised form 14th January, 2021
Accepted 23rd February, 2021
Published online 28th March, 2021

*Key Words:*

Implant, piezosurgery, ridge‐split, atrophic ridge

A B S T R A C T

Narrow alveolar ridges remain a serious challenge for successful placement of endosseous implants. To overcome such clinical presentation in 1970s, ridge splitting or bone spreading procedure was introduced by Hilt Tatum. Ridge split procedures are commonly performed for horizontal augmentation of narrow ridges which would otherwise preclude implant placement. Maxillary bone has inherent quality of flexibility which can bemoulded to desire location by using series of instrument namely chisels and osteotome.
This article describes a case report with management of bucco-palatal ridge defect with ridge splitting using a piezosurgical unit and expansion osteotomy technique using chisel and mallet in maxillary esthetic zone.



## INTRODUCTION

While implant dentistry has become a desirable option for replacement of missing teeth, the available bone foundation determines the possibility of implantation. To facilitate osseointegration and avoid bone resorption, narrow, edentulous alveolar bony ridges less than 5-mm wide require bone augmentation prior to implant placement. By augmenting the defective area, the implant surgeon provides the necessary foundation for implant placement by establishing a bony wall thickness of at least 1 mm around implants.[1,2]

Narrow edentulous alveolar ridge of 3 mm or less requires horizontal augmentation. These procedures involve the use of bone grafting with different types ofgrafts (autografts, allografts, xenografts, or bone substitutes), guided bone regeneration (GBR) aloneor in combination with grafting procedures [3,4] as well as the use of ridge expansion techniques utilizing split ridge osteotomy[5] and horizontal distraction osteogenesis.[6] Onlay grafting with biodegradable membranes and autografts is the most frequently used technique; however, this technique involves a long ossification period, and the tendency of the graft material to resorb can easily decrease bone quality and quantity[7]. Time lost and donor-site morbidity are the main disadvantages of this reconstructive approach. Crestal ridge bone augmentation is an alternative bone expansion technique that can be used to augment the atrophic maxilla and mandible prior to implant placement.

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This method was first introduced by Dr Hilt Tatum in the 1970s[8] and was commonly referred to asridge splitting, bone spreading, or ridge expansiontechnique. This method aims at the generation of bone around the implant sites by bone osteotomies that enable buccal cortex repositioning after greenstick fracture of the buccal bony wall. Advantages such as the possibility of simultaneous implant placement, avoiding donor site, reducing morbidity, and shortening the treatment time have all been associated with this approach.

This clinical report describes a technique of ridge split bone expansion with simultaneous implant placement in maxillary esthetic zone.

### Case Report

A 20 years old male patient reported to the department of periodontology and implantology, SMBT dental college and hospital, Sangamner with a chief complaint of missing tooth in upper right front region of jaw (figure 1).History revealed that patient had met with an accident which led to avulsion of 11. Patient was systemically healthy.

Intraoral examination revealed missing upper right central incisor (Tooth no. 11) with atrophic alveolar ridge with 11 covered with thin, healthy, and un-inflamed mucosa. Various treatment options were discussed with the patient. As the patient was concerned about his appearance he wanted a fixed prosthesis replacing missing tooth.

Cone beam computed tomography with 11was performed to evaluate the bone quality and quantity. Routine blood investigations were advised to the patient. CT scan (figure 2) revealed inadequate labio-lingual dimension of bone at the

crest for implant placement. In the central incisor region width of bone was 3.69 mm (figure 2). There was adequate cortical and cancellous bone to allow ridge expansion. Hence the decision was made to place simultaneous implant, with maxillary single stage alveolar ridge split technique using the piezosurgery kit.

**Figure 1**

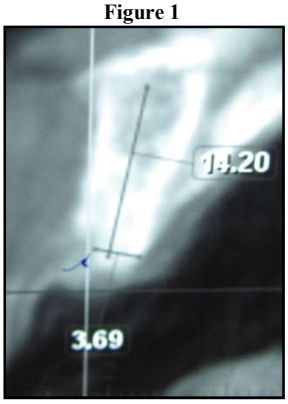


**Figure 2**

***Clinical Procedure***

Local anesthesia (2% lidocaine with1:100,000 epinephrine) Adrenaline was injected in the area of surgery. After administration of local anesthesia, incision was made along the ridge crest and extended at least one tooth adjacent on both the sides of the edentulous region. A full thickness muco-periosteal flap (figure 3) was elevated on the labial and palatal aspect of maxillary central incisor region. Adecision was made to place one simultaneous implant in the maxillary central incisor region (tooth no. 11). Horizontal splitting along the crestal bone was performed from distal to mesial direction 2 mm away from the adjacent teeth with piezo-electric. Bone expansion was carried out using sequential set of chisels (width 1.5, 2.5, 3, 3.5 mm) at full depth (length 8 mm) depending on the predetermined implant dimensions (figure 4).A significant increase was achieved in the bone dimension, which enabled the placement of endosseous dental implant successfully (figure 5). After preparation of the implant site Adin implant was placed in maxillary central incisor region (size 3.75 mm × 11.5mm) (figure 6). Interpositional bone graft (DMDBA) (figure 6) and PRF plug (figure 7) was placed for better healing and osseointegration. Tension free mucoperiosteal tissue closure was performed over the implant using 3-0 non- resorbable suture (figure 8).

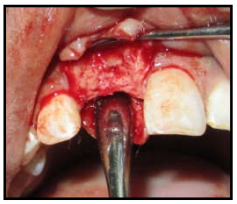

**Figure 3**

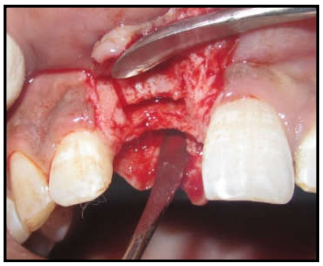

**Figure 4**

**Figure 5**

**Figure 6**

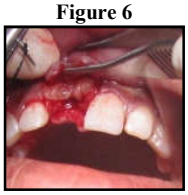

**Figure 7**

**Figure 8**

Nonsteroidal analgesics Tab. Dolostattwice daily for 3days and antibiotic Cap. Amoxicillin 500 mg thrice daily for 3 days and 0.2%chlorhexidine mouth rinse for 2weeks twice daily was the postoperative protocol administered to the patient. Patient was recalled after 10 days and suture removal was done as healing was uneventful.

After 4 months of healing period the implant was stable clinically (figure 9) and radiographically normal bony trabeculae were noted surrounding implant (figure10) suggestive of osseointegration. Hence, second stage surgery was planned for the implant. Full-thickness mucoperiosteal flap was reflected with 11region, the ridge width was increased to 6 mm and so healing abutment was placed(size: 3.5mm x 5mm) (figure 11) and flap sutured using interrupted sutures. Patient was recalled after 1 month. On removal of the healing abutment healthy gingival collar was seen hence using elastomer putty and light body impression material (figure 12), impression was made and sent to the laboratory for fabrication of prosthesis. Prosthesis (figure 13) was fabricated keeping the occlusal considerations in mind. Any excess cement around implant crown was removed meticulously. Post-operative CBCT at 10 months follow-up was taken with 11 region which revealed that ridge width was increased to 6.69mm (figure 14).

**Figure 9**

**Figure 10**

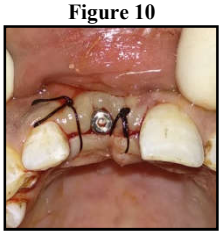

**Figure 11**

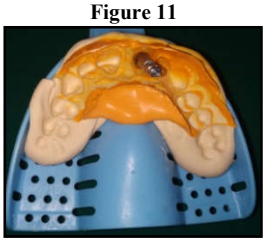

**Figure 12**

**Figure 13**

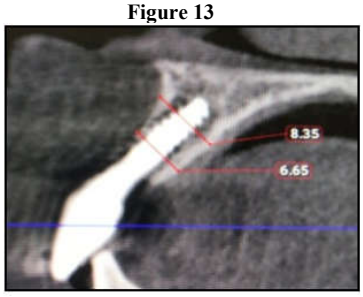


**Figure 14**

## DISCUSSION

Narrow alveolar ridges need to be augmented before implant placement for achieving a successful and predictable treatment outcome. Onlay bone grafts used for lateral augmentation require invasive surgical procedures to obtain the graft and implant placement is delayed 3–6 months as required for the integration of the graft. The rate of lateralonlay bone graft resorption has been reported from20–50% after 6 months.[9]For GBR procedures, the drawbacks include membrane collapse and membrane exposure leading to infection.[10,11] Distraction osteogenesis leaves patient uncomfortable and is cumbersome.[12]

The ideal indications of ridge splitting and bone expansion procedure are those sites that do not require vertical ridge augmentation and having cancellous bone present between labial and palatal cortical plate. It can be best done in a narrow ridge of minimum 3 mm with greater preference in maxillary bone over mandibular. In the present case vertical bone height was sufficient i.e approximately 14.2mm with insufficient bucco- palatal width of 3.69 mm for implant placement.

Although ridge splitting and bone expansion appears to be technique sensitive it has many advantages over different technique.[13,14]It takes advantage of inherent quality of flexibility of cancellous bone. Maxillary bone is pliable and can be slowly manipulated to improve quality (compaction) and expanded to desired width. When clinicians allow time for manipulation of bone, it can eventually mould to desired location. It never allows loss of patient bone which is usually unavoidable by mere drilling procedure.[15]

The technique present in this article works satisfactorily well in maxilla bone compared to mandible. Since maxillary bone is more porous, mainly D2, D3 and D4 type bone can be manipulated to desired location. However, mandibular bone presents mainly D1 and D2 quality, thus poses greater difficulty with bone manipulation.

Splitting of atrophic alveolar ridges essentially converts a one-wall defect to a four-wall defect. The benefit of additional defect walls was clearly demonstrated by Cortellini *et al*.[16] who found that bone defect fill improved proportionally to the number of residual defect walls.

Several authors advocated different ridge split technique,[17,18]in which crestal cut osteotomy is joined to adjacent vertical osteotomy cut on either or on both side followed by creation of greenstick fracture of buccal plate. Bone splitting does not affect the facial and palatal plates equally, the thicker palatal bone is more difficult tomanipulate therefore, the expansion process is primarily in the direction of the thinner facial plate. After the expansion of osteotomy to appropriate size, it is either grafted with bone graft (two step)[19] or implant is placed at same appointment (single step).[20]

The technique documented in this report used piezoelectric surgery unit to create corticotomies, whereas others used scalpel blades,[21] sharp chisels,[22]flexible diamond disks,[23] carbide burs,[24] or microsaws.[25]Studies comparing wound healing of piezoelectric bone cuts to those created with alternative methods have demonstrated reduced trauma and faster healing with the former and increased inflammation with the latter.[26,27] The piezoelectric surgical instrument offers three important advantages[28]forosseous surgery: First, the cut is precise because it is produced by micro vibrations of the cutting tip. Second, the cut is safe because the ultrasonic frequency used does not cut soft tissue.[29] Third, the cutting action is less invasive, producing less collateral tissue damage, which results in better healing. The patient discomfort is also minimal.

The DMDBA bone graft and PRF plug was placed in this case which had added advantages. The PRF plug acts as a healing material accelerates wound closure by acting as a fibrinbandage.[30]The leukocytes concentrated in the PRF scaffold holds anti‑infectious properties. The Platelet concentrates secrete the growth factors which are protected from proteolysis by the fibrin network, the growth factors

promote cell migration and matrix remodelling during healing period.[31]The demineralized bone matrix material has a potential osteoinductive property which influences the osteoblastic behaviour toward new bone formation.[32]

In a study conducted by Yoon *et al*., the implant survival rate after ridge‐split procedure during an average follow‐up period of 4.2 ± 2.1 years was 100% regardless of the implant system and complications.[33] Likewise, another study showed that the mean loss of the alveolar bone height was 0.542 mm.[34] Thusin the present case, the crestal ridge split technique provided a predictable outcome and allowed reduced treatment duration by cutting off the waiting time for the second surgery. However, the limitation of the technique used in the case was a discomfort to the patient because of malleting that could have been averted by the use of the rotary instruments with surgical bone cutting burs and piezosurgery instruments. Furthermore, there is a risk of buccolingual bone fracture when excessive force is delivered which makes the procedure technique sensitive.[34] Despite the risk, the present case showed no such complication and the patient was satisfied with the final outcome after a follow‐up period of 10 months.

## CONCLUSION

Ridge split technique is effective for horizontal expansion in atrophic alveolar ridge without the need for more complex treatment. It also decreases the rehabilitation time and improves bone support quality. The most important factors for successful ridge split cases are careful patient selection and bone evaluation. Although this surgical approach may be used in both the jaws. It is better suited for maxilla. Piezosurgery makes the procedure predictable and convenient to perform. There was sufficient trabecular bone with cortical bone on either side so this was an ideal case for ridge splitting with bone expansion.

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**How to cite this article:**

Anuja Muley *et al* (2021) 'Ridge Split Technique With Simultaneous Implant Placement In Horizontally Resorbed Maxillary Alveolar Ridge: A Case Report', *International Journal of Current Advanced Research,* 10(03), pp. 24019-24022.
DOI: http://dx.doi.org/10.24327/ijcar.2021.24022.4759


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