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CASE REPORT

RIDGE EXPANSION IN DEFICIENT ALVEOLAR RIDGE WITH IMMEDIATE IMPLANT PLACEMENT: A CASE REPORT

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ABSTRACT

With advancement in clinical dentistry, implant therapy is one of the most upcoming treatment option for fixed prosthesis with a predictable outcome. However, sometimes insufficient bone due to long standing edentulism may pose a challenge for implant placement. To overcome such a clinical presentation in 1970s, ridge splitting or bone spreading procedure was introduced by *Hilt Tatum.* This technique has been used for esthetic rehabilitation and implant site preparation in cases of deficient alveolar ridges to satisfy the basic ideal need of hard tissue augmentation. In this case report, we describe a case of horizontal ridge augmentation using ridge expansion technique which was performed using ridge expansion kit and simultaneous implant placement in esthetic mandibular anterior zone. Bone expansion resulted in correction of atrophic alveolar ridge (Labiolingual width > 3.5mm) without significant surgical risk and multiple surgeries. The degree of bone expansion obtained had remodelled the alveolar bone providing adequate bone support for prosthesis. A significant increase was achieved in the bone dimension, which enabled the placement of endosseous dental implants successfully. After 4-5 months of healing period both the implants were stable clinically and radiographically and hence were restored.

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INTRODUCTION

Rehabilitation of missing teeth using dental implants is considered one of the most efficient treatment methods for edentulous patient. Patients often desire a "fixed" treatment rather than removable dentures, to feel normal and to overcome the psychological trauma they have been through. Insufficient bone thickness of an atrophic mandible ridge is a common problem for placement of dental implants. Narrow edentulous alveolar ridge of 4 mm or less requires horizontal augmentation. Various surgical techniques have been mentioned in the literature: Guided bone regeneration (Buser *et al*., 1990), onlay block bone grafting (Pikos, 2000), ridge split technique or ridge expansion (Scipioni *et al*., 1994; Sethi and Kaus, 2000) and distraction osteogenesis (Laster *et al*., 2005). 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 (Ignatius *et al*., 2001).

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Time lost and donor-site morbidity are the main disadvantages of this reconstructive approach. The split-crest technique should be delineated as a bone expansion procedure, which potentially eliminates the overall disadvantages of Onlay grafting for esthetic and functional demands. This clinical report describes the ridge expansion technique using ridge expansion kit (ESSET kit) for expansion of atophic anterior mandibular ridge with immediate implant placement.

Case report

A 48 years female patient reported to the Department of Periodontics and Oral Implantology, D.Y. Patil University School of Dentistry, Navi Mumbai with a chief complaint of missing teeth in lower front region of the jaw (Figure 1). She underwent extraction of mandibular incisors one year back as they were mobile. Extraction was done under Local anesthesia with no complications. Patient was systemically healthy. Intraoral examination revealed missing mandibular incisors (Teeth no. 32, 31, 41, 42) with atrophic alveolar ridge covered with thin, healthy, and un-inflamed mucosa. Various treatment options were discussed with the patient. As the patient was concerned about her appearance she wanted a fixed prosthesis replacing missing teeth.

Figure 1. Intraoral pre-operative view

Figure 2. Cone Beam Computed Tomography of mandibular anterior region

Cone beam computed tomography was performed to evaluate the bone quality and quantity. CT scan (Figure 2) revealed inadequate labio-lingual dimension of bone at the crest for implant placement. In the lateral incisor region width of bone was more than 3.5 mm (Figure 3). There was adequate cortical and cancellous bone to allow ridge expansion. Hence the decision was made to place immediate implants, with ridge expansion technique using the ESSET Kit.

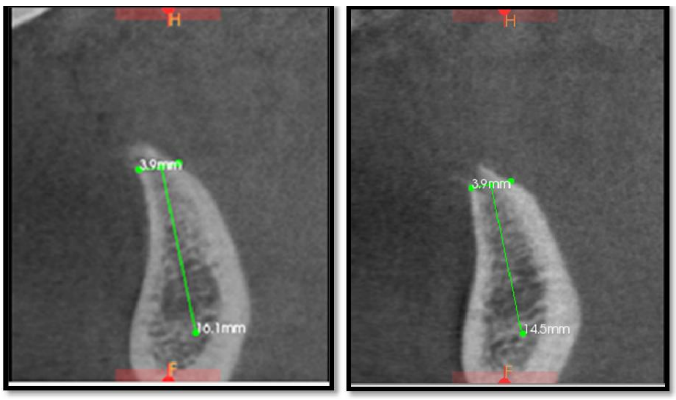
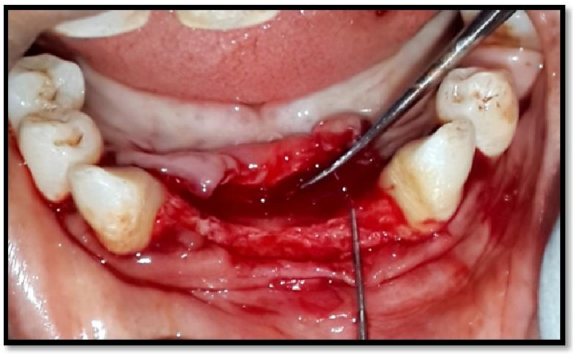


Figure 3: CBCT showing width 3.9mm and height 15mm

Clinical Procedure

Prophylactic antibiotic was given to the patient an hour before the procedure. Local anesthesia lignocaine 2% containing 1:80,000 Adrenaline was injected in the area of surgery as an infiltration. After administration of local anesthesia, incision was made along the ridge crest (Figure 4) and extended atleast one tooth adjacent on both the sides of the edentulous region. A full thickness muco-periosteal flap (Figure 5) was elevated on the labial and lingual aspect of mandibular alveolar ridge. A decision was made to place two immediate implants in the lateral incisors region (teeth no. 32, 42). For ridge expansion procedure Easy Safe Stable Expanding & Tapping (ESSET) kit was used (Figure 6). Narrow irregular bone (width>3.5 mm) was modified using Crest remover (Ø7.0) with a speed of 1,200-1,500 rpm (Figure 7). Twist drill (Ø1.8 mm) was used to locate the placement of implant. After this full depth vertical cut was given using the saw (Ø 7mm, Ø 10mm, Ø 13 mm in this sequence) with a speed of 1,200-1,500 rpm.

Figure 4. Crestal incision given



(a)

(b)

Figure 5 (a, b). Full thickness mucoperiosteal flap raised showing ridge width between 3-4mm

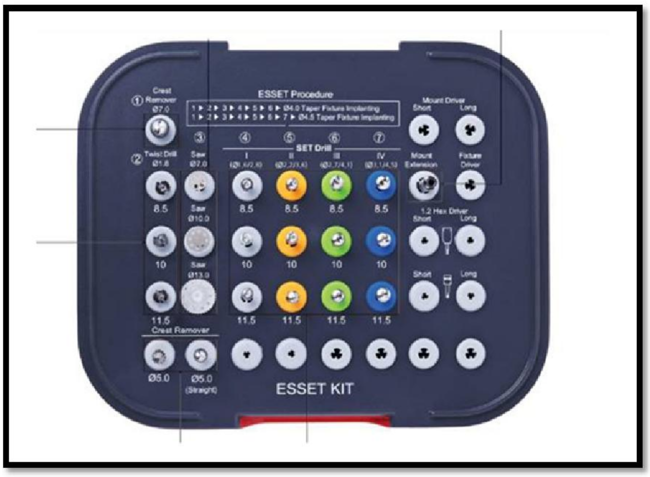
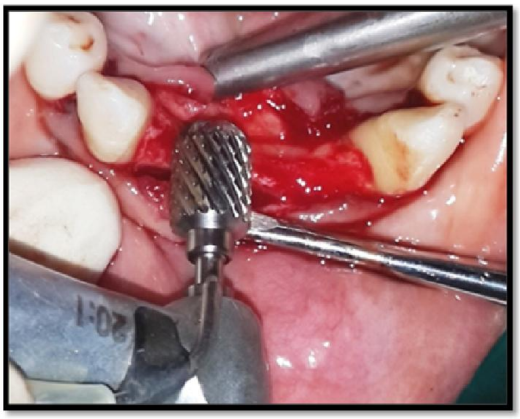
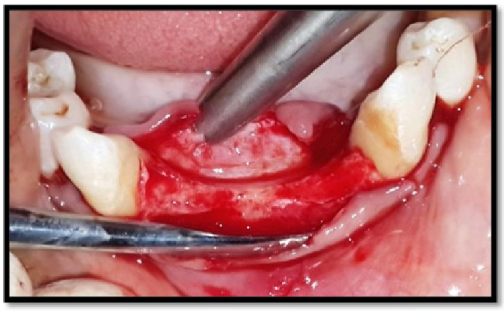


Figure 6. Ridge expansion kit (ESSET Kit)



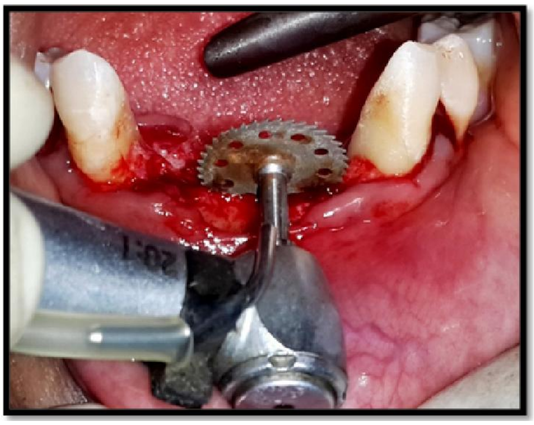
(a)



(b)

Figure 7(a, b). Crestotomy done using crest removal

Horizontal splitting along the crestal bone was performed from distal to mesial direction 2 mm away from the adjecent teeth. Bone expansion was carried out using sequential set of drills (Ø1.6, Ø 2.2, Ø 2.7) at full depth (length 11.5mm) (Figure 8) simultaneously on both the implant sites with 25-35 rpm speed. A significant increase was achieved in the bone dimension, which enabled the placement of endosseous dental implants successfully. After preparation of the implant sites, implants were placed in both the lateral incisors region (size 3.5mm × 11.5mm) (Figure 9). Tension free mucoperiosteal tissue closure was performed over the implants using 3-0 nonresorbable suture (Figure 10).



(a)

(b)

Figure 8 (a, b). Ridge expansion done

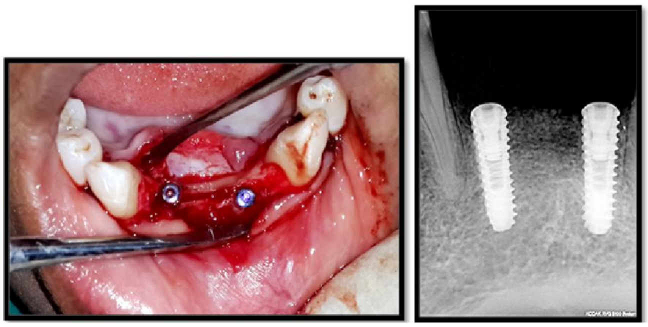


Figure 9. Implant placed after ridge expansion

Figure 10. Interrupted sutures placed

(a)

(b)

Figure 11(a, b). Post-operative view after 3-4 months

(a)

(b)

Figure 12(a, b). Healing abutments placed

Figure 13. Impression made (using Rubber based impression material)

Figure 14. Final prosthesis

Nonsteroidal analgesics Tablet Enzoflam thrice daily for 7 days and Antibiotics combination of Amoxicillin 500 mg and Clavulanate potassium 125mg thrice daily for 7 days and 0.2% chlorhexidine mouth rinse for 2weeks twice daily was the postoperative protocol administered to the patient. Patient was recalled after 14 days and Suture removal was done as healing was uneventful. This report demonstrated the successful use of expanding the anterior mandibular alveolar ridge. It also showed that this technique allows for immediate implant placement. After 3-4 months of healing period both the implants were stable clinically and radiographically (Figure 11) and well osseointegrated. Hence, second stage surgery was planned for both the implants.

Full-thickness mucoperiosteal flap was reflected from 32-42 region, healing abutments were placed (size: 4mm x 5mm) (Figure 12) and flap sutured using interrupted sutures. The patient was recalled after 14 days. On removal of the healing abutments healthy gingival collar was seen hence using elastomer putty and light body impression material (Figure 13), impression was made and sent to the laboratory for fabrication of prosthesis. Due to longer crown height and space below the restoration margins, a FP3 type of prosthesis with pink colored porcelain to replace a portion of the soft tissue was given (Figure 14).

DISCUSSION

The technique of ridge split or ridge expansion was introduced in early *1970s* by *Hilt Tatum* for horizontal ridge augmentation while maintaining the periosteal attachment by carefully expanding the cortical plates to improve atrophic alveolar ridge for implant placement. This technique has an added advantage of augmentation and implant placement in a single sitting. Ridge splitting techniques are useful for managing narrow edentulous ridge (>3.5 mm) for implant placement with a predictable outcome (Summers, 1995). Tantum inserted >5000 maxillary anterior implants using ridge splitting before 1985 wherein, he expanded atrophic ridges >3 mm for simultaneous implant placement and augmentation keeping the periosteum intact. Later, Summers and Scipioni *et al*. in 1994 revived and published articles on edentulous ridge expansion with 98.8% implant survival rate for over 5 years (Scipioni *et al*., 1997).

The ridge deficiencies can be horizontal, vertical or combination of both as described by Siberts classes A, B and C, respectively. Dental implant devices are placed into edentulous ridges where an appropriate bone width is available to support removable or fixed type dental restorations. A minimum of 1.0 – 1.5 mm of bone width/thickness on the facial and lingual aspects of the implants is necessary making an average of 6 mm buccal/lingual ridge thickness necessary for a commonly desired 4 mm diameter implant. This creates a major challenge in implant dentistry since alveolar atrophy always occurs subsequent to tooth extraction which limits the use of endosseous implants to restore oral function. With the emergence of implant dentistry and introduction of microsaws, piezosaws, and specific ridge split osteotomes this technique has become an integral part of implant dentistry, wherein primarily bone expansion techniques were indicated in regions of division B bone volume and density of D3 or D4. Bone due to its dynamic viscoelastic nature, thinner ridges (<3.5 mm) can be expanded with better controlled instrumentation with less risk of fracture, trauma and bone perforations. The softer the trabacular bone quality, the lower the elastic modulus and greater the viscoelastic nature of the ridge. Therefore, less dense the bone, the easier and more predictable is the bone expansion (Misch, 1999).

The ESSET Kit was developed over the course of 10 years. Initially developed in 2002 by Dr. B.H. Suh, Dr. Suh tried to resolve the issue of insufficient horizontal bone volume without using bone grafts by focusing on the visco-elastic properities of bone tissue and the elasticity coefficient of the alveolar bone. Using the ESSET (Easy Safe Stable Expanding & Tapping) Kit for narrow ridge cases can shorten the healing time by not using bone grafts but utilizing natural stem cells from the expanded bone. Dental implants are placed with high degree of stability. Ridge expansion technique using ESSET kit was simple, predictable, and safe. Using a mallet and chisel to split the ridge may cause patient discomfort and is associated with high risk of buccal plate fracture The procedure is unpredictable and implant initial stability is unknown. In GBR cases, bone cells are supplied from a limited direction. Bone generation requires significant time to go through the multiple stages of healing; incorporation replacement, modeling and RAP. In ridge split cases, the dental implant was enveloped by the patient's natural bone. Sufficient blood supply surrounding the implant allows for bone regeneration to occur quicker. This shortens the bone healing process and integration of the implant. *Demetriades et al.* (2011) in this study ridge split technique, splits and expands the buccal-lingual bone to create space that allows for new bone to form. In other words, blood supply through the periosteum of the buccal cortical bone is maintained to form the osseous tissue and the lamellar bone. The treatment period is relatively shorter compared to GBR procedures (4 to 6 months) (Neophytos Demetriades, 2011).

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. This procedure can be implemented in patient with good bone quality and narrow ridge with thick cortex and some cancellous bone in mandible. Owing to the various advantages of ESSET kit over other conventional procedures it is one of the most predictable and easy to use technique implant placement in narrow ridges.

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