Case Report

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Hard and Soft Peri-Implant Tissue Augmentation using Ridge Split with Guided Bone Regeneration and Free Gingival Autograft

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Abstract

Horizontal ridge deficiency, particularly in the mandibular arch, poses a challenge for implant supported rehabilitation. Ridge split, along with expansion, allows simultaneous implant placements in such defects, and avoids the delay which usually follows hard tissue augmentation procedures. A 53 year old female with missing mandibular anterior teeth and a bucco-lingual ridge deficiency was treated using the ridge split technique and simultaneous implant placement. Demineralized freeze dried bone allograft (DFDBA) along with anorganic bovine bone (ABB) was packed in the expanded crypt and covered by a collagen membrane. Following successful implant osseointegration, soft tissue augmentation by a vestibular deepening procedure with a strip of autogenous free gingival graft was performed. Prosthetic rehabilitation was done using cement retained prosthesis after the healing phase. The case was then followed up for 3 years where stable results were noted. Condensed treatment time and a predictable outcome were achieved by using this technique.

Keywords: Bone graft, Dental implants, Gingival graft, Narrow ridge, Ridge split

Abbreviations: DFDBA: Demineralized Freeze Dried Bone Allograft; ABB: Anorganic Bovine Bone

Introduction

The alveolar ridge undergoes resorption, following tooth extraction, resulting in a bucco-lingual and/or apico-coronal bone deficiency [1]. Extensive bone and keratinized tissue loss (upto 50% of the original dimension) is seen through the first year after tooth removal, particularly during the first 3 months [2].

It is well established that implant placement is prosthetically driven rather than bone driven [3]. The alveolar ridge split procedure, introduced by Tatum, may be used to augment atrophic ridges prior to implant placement which allow ideal three dimensional implant placement [4]. Osteotomes used in synergy with this technique, expand the implant site and decrease the removal of the already limited quantity of native bone, as is done during standard

drilling procedures. Also, along with the surrounding bone, an adequate amount of keratinized tissue around the implant ensures sufficient implant maintenance and its long term success [5].

This article describes a case of narrow alveolar ridge along with mucosal deficiency managed with ridge splitting and simultaneous implant placements followed by soft tissue augmentation after implant osseointegration. The case was followed up for 3 years after the procedure where stable results were noted.

Case Report

A 53 year old female reported with a complaint of missing lower front teeth. She had had her mandibular incisors extracted 12 years back and was currently wearing

a removable partial denture. Clinical examination revealed a Seibert's class I ridge defect, that is, bucco-lingual loss of tissue contour (Figure 1a). A cone beam computed tomography showed a ridge width of 3-4 mm (Figure 1b).

Figure 1a: Pre-operative occlusal view, missing teeth #32, 31, 41, 42, Bucco-lingual ridge deficiency present.

Figure 1b: Cone beam computed tomography showing 3-4 mm of ridge width.

A full thickness muco-periosteal flap was reflected. A mid crestal bone cut along with anterior releasing bony cut was performed using a piezoelectric surgical unit. Chisel and osteotomes were used in increasing sizes to gradually expand the divided ridge (Figure 2a). Implants of 3.8x11 mm were placed at tooth #32 and #42 region. A mixture of demineralized freeze dried bone allograft (DFDBA) (Rocky Mountain Tissue Bank, Aurora, CO, USA) of particle size 500 μ and anorganic bovine bone (ABB) (Bio-Oss, Geistlich AG, Wolhusen, Switzerland) of particle size 250-800 μ in a 1:1 proportion was packed in the expanded crypt (Figure 2b). The reconstructed site was covered with a biphasic cross linked collagen membrane (Bio-Gide, Geistlich AG, Wolhusen, Switzerland) in two layers (Figure 2c).

Following the implant placement, the tissues were allowed to heal for a period of 5 months. After confirming successful osseointegration, a vestibular deepening procedure was performed. A no. 15 surgical blade was held perpendicular to the gingival surface and a superficial horizontal incision was made just coronal to the mucogingival junction while retracting the lips firmly (Figure 2d). The periosteal recipient beds were then prepared by sharp dissection in an apical direction with the blade held nearly parallel to the alveolar process.

Muscle and loose connective tissue fibers were thoroughly scraped to prevent subsequent graft mobility. A strip of palatal autograft from the left posterior hard palate was harvested 3 mm apical to the gingival margin of adjacent teeth. After shaping the donor tissue, it was fixed on the recipient site with periosteal sutures (4-0 vicryl, Johnson & Johnson, Ethicon, USA) (Figure 2e). The tissues were then allowed to heal for 8 weeks (Figure 2f).

Figure 2a: Ridge split and expansion performed.

Figure 2b: Implants in position. A mixture of demineralized freeze dried bone allograft (DFDBA) and anorganic bovine bone (ABB) in a 1:1 proportion.

Figure 2c: Biphasic cross linked collagen membrane.

Figure 2d: Vestibular deepening procedure.

Figure 2e: Strip of free gingival autograft sutured.

Figure 2f: 8 weeks after soft tissue augmentation.

Subsequently, an implant supported cement retained porcelain fused to metal fixed partial prosthesis was fabricated and cemented (Figure 3a). The patient was then followed up every 6 months for a professional cleaning for 3 years. At the 3 year follow up visit, stable results of the hard and soft tissue augmentation are noted (Figure 3b, Figure 3c).

Figure 3a: Porcelain fused to metal cement retained prosthesis. **Figure 3b:** 3 years follow-up.

Figure 3c: Post-operative radiographs.

Discussion

Narrow alveolar ridges need to be augmented prior to implant placement for achieving successful results. There is a general consensus in implant dentistry, that a minimum of 6-7 mm of bone width is necessary for placing a standard diameter implant of 3.5-4 mm [6]. This ensures the presence of 1-1.5 mm of native bone on the buccal and lingual/palatal surfaces of the implant [4]. Only bone grafting, guided bone regeneration using resorbable or non-resorbable membranes and distraction osteogenesis which are used for lateral augmentation, are invasive surgical procedures and also delay the implant placement by 3-6 months [7]. These procedures also significantly increase the treatment cost and patient morbidity besides having risks of their own, such as tissue dehiscence, infection etc [8].

Alveolar ridge split technique is used for bone expansion in the treatment of horizontal deficits and atrophic ridges. Due to higher cancellous bone content, ridge expansion is possible in the maxillary bone. However, in case of the mandible, there is a need for splitting the ridge using horizontal and vertical osteotomy due to the presence of thick cortical plates. Traditionally, manual or motor-driven instruments were used for splitting the ridge. However, they are difficult to control and generate significant heat when used in a cortical bone. The piezoelectric surgical instrument provides an advantage of precision along with producing less collateral tissue damage and being less invasive. This results in few post-operative complications and reduces the patient discomfort as well [9].

A minimum of 3 mm of bone width, with at least 1 mm of cancellous bone, is required to perform ridge split procedure [10]. A recent systematic review by Bassetti et al. [11] revealed that the implants placed in conjunction with alveolar ridge split have a similar survival rate (91.7-100%) to the implants placed in pristine bone. This shows the efficacy and benefit of this technique, when indicated, over complex bone regenerative techniques. A mixture of DFDBA and ABB packed in the expanded crypt combined the osseointegrative and osseointegrative properties of DFDBA with the slow resorption rate of ABB. This resulted in the stimulation of adjacent osteoblast to form new bone.

An association between the width of peri-implant keratinized mucosa and implant survival has been noted in a recent systematic review by Thoma et al. [12]. A lower mean alveolar bone loss is seen in implants surrounded by more than 2 mm of keratinized tissue [13]. Thus, a free gingival autograft harvested from the hard palate was used to augment the soft tissue deficit in the implant site.

Although technically more demanding, the strip technique increased the keratinized mucosa around the implants along with concomitant reduction in patient discomfort. The augmented keratinized tissue also facilitated maintenance and prevented occurrence of peri-implantitis.

Conclusion

When judiciously used ridge splitting is a helpful technique in managing narrow and resorbed ridges. The procedure provides a favorable and predictable outcome along with reducing the overall treatment time. The clinical success in this case can be attributed to the hard and soft peri-implant tissue augmentation that led to its long term stability.

Declarations

Consent to participate: Obtained

Consent for publication: Obtained

Competing interests: Nil

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