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Ridge Augmentation Procedure: Review and Case Report

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ABSTRACT

Ridge Augmentation procedures involve techniques utilized to increase the dimensions of the alveolar ridge, correcting deficiency in width, height or combination of both beyond the confines of the skeletal envelope of the ridge. The goal of this article is to review classification systems for alveolar ridge deficiencies as well as present on a Case report of effective clinical management for patient with combined horizontal and vertical alveolar ridge deficiency using a titanium mesh membrane.

Keywords

Ridge augmentation, Alveolar ridge deficiency, Guided bone regeneration, Titanium mesh membrane for GBR.

Introduction

Success of dental implants is dependent on having adequate bone quantity and quality in the alveolar ridge. Following tooth extraction significant reduction occurs in the alveolar ridge in both the horizontal and vertical dimensions [1]. Schropp and colleagues used subtraction radiography to assess changes in alveolar ridge from baseline to 12 months following tooth extraction and noted that alveolar ridge changes in the buccal aspect is significantly higher than the lingual or palatal aspect [1]. They also found that there was a reduction in ridge width of about 50%, with over two -thirds of that reduction occurring during the first three months following tooth extraction [1].

Placement of immediate implants has been advocated by multiple studies as a means of preventing loss of bone and soft loss in the edentulous ridge following tooth extraction [2,3]. Other ways to preserve tissue at the extraction site include the use of alveolar ridge preservation techniques at time of tooth extraction to reduce loss of tissue volume that can occur in alveolar ridge height and width post extraction [4]. For extractions sites that do not have ridge preservation, or when despite ridge preservation procedures being completed, there is deficiency in bone width and height, ridge augmentation procedures become necessary.

Deficiencies that exist in alveolar ridges following tooth extraction remain a major concern to tooth replacement especially when dental implants are planned for the edentulous site. This article reviews Classification systems that exist for deficiencies in the alveolar ridge dimensions, and present a case report in which Guided bone regeneration using titanium mesh was effective in correcting alveolar ridge deficiencies allowing for successful implant placement and restoration.

In 1983, Seibert classified alveolar ridge deficiencies in pontic sites into bucco-lingual, apico-coronal and combination of both [5]. According to his classification system:

Class I: Bucco-lingual (Horizontal) tissue volume loss

Class II: Apico-coronal (Vertical) tissue volume loss

Class III: Combined Bucco-lingual and apico-coronal tissue volume loss.

He utilized full thickness onlay connective tissue grafts to reconstruct deficient alveolar ridges prior to placement of fixed restorations [5]. In 1996, he also reviewed types of soft tissue and osseous tissue ridge augmentation techniques that can be used to correct deficiencies in tissue volume [6].

In 1985, Allen further modified Seibert's classification for tissue contour loss and utilized categories of Type A (Apico-coronal tissue loss), Type B (Bucco-lingual) tissue loss and Type C (combined apico-coronal and bucco-lingual tissue loss) and sub

categories based on defect extent into Mild, Moderate and Severe based on depth of ridge defect relative to adjacent alveolar ridge [7].

Mild defects: Less than 3mm
Medium defects: 3-6mm
Severe defects: more than 6mm

Based on the subcategories, the defects were assigned to receive ridge augmentation therapy with 14 sites treated with fibrous gingival tissue only, and 12 sites treated with hydroxyapatite [7]. Only sites with moderate to severe deficiency received hydroxyapatite or fibrous connective tissue, and mild sites received only fibrous connective tissue [7]. While all sites regardless of severity treated with fibrous connective tissue had shrinkage of tissue, only 2 sites treated with Hydroxyapatite displayed tissue shrinkage [7].

Misch and Colleagues categorized alveolar ridge defects in edentulous and partially edentulous arches into Division A (Abundant) Division B (Barely sufficient), C (Compromised) and D (Deficient) based on the height of the alveolar ridge, width, diameter, Crown height space and angulation of occlusal load [8]. For Division A (Abundant bone), with alveolar width of more than 7mm, the recommendation made is placement of an implant of 4mm or more in diameter. For Division B (Barely sufficient) bone, the recommendation is that for B+ division involving 4-7mm of bone indicated therapy is osteoplasty and implant placement. For Division B- bone, involving 2.5mm to 4mm of bone, they recommend Ridge augmentation using guided bone regeneration (GBR) principles. For Misch Compromised Division C bone, they recommend block and particulate bone grafting with soft tissue grafts. They also recommend osteoplasty as alternative therapy for Division C bone. For Misch Division D bone, they recommend autogenous Iliac crest bone grafts or multiple block bone grafts and soft tissue grafts before dental implant placement [8].

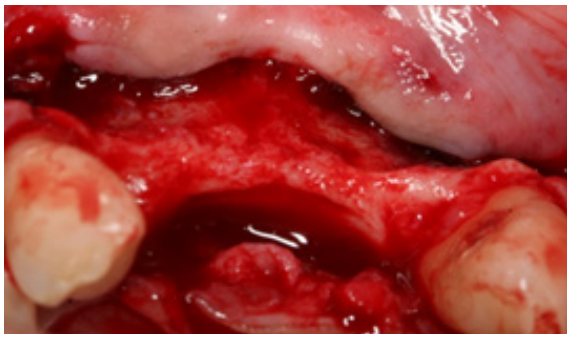
Ridge augmentation procedures involve techniques for augmenting deficient alveolar ridge beyond the confines of its skeletal envelope. Ridge augmentation can be utilized to augment bone in a horizontal, vertical or combined horizontal and vertical dimension depending on type of deficiency. Horizontal deficiencies can be corrected with Onlay block bone grafts, guided bone regeneration (GBR) using block grafts, particulate bone grafts and bone substitutes, and Split crest technique [9]. Vertical ridge augmentation involves Onlay bone grafts, Inlay bone grafts, guided bone regeneration (GBR) and Distraction osteogenesis to regain bone height [10].

During the guided bone regeneration process, bone can grow in the augmented ridge by osteogenesis, osteo-induction and osteo-conduction. Osteogenesis involves osteoprogenitor cells in bone grafts differentiating into osteoblasts and then osteocytes to make new bone [9]. Osteo-induction involves undifferentiated mesenchymal cells in native bone around the deficient alveolar ridge, which induce osteoblasts and chondrocytes to make new bone [9]. Osteo-conduction involves bone materials serving as a scaffold for already existing bone cells to deposit bone. In comparing autogenous bone to other types of bone, Chavda and Colleagues did not find any difference between autogenous bone and other types of bone grafts with regard to implant survival and success following ridge augmentation [11].

Case Report

A 54 year old female presented with the complaint that she was not happy wearing her lower partial dentures. (Figure 1) Her lower anterior alveolar ridge clinically was atrophic with concave area around #23 and #26. Recommendation based on CT scan x-rays involved guided bone regeneration (GBR) using particulate bone grafts and titanium mesh membrane to increase diameter and bone height prior to dental implant placement. Following administration of anesthesia using inferior alveolar blocks, guided bone regeneration therapy, utilizing DFDBA combined with Titanium mesh membrane was performed, the flap was closed used PTFE sutures. (Figures 2a, 2b, 3, 4 and 5) The guided bone regeneration procedure added 4mm to existing bone at the site and resulted in 6mm bone width for dental implant placement. Following surgical therapy, utilizing DFDBA combined with titanium mesh membrane, amount of bone gained was 4mm. After six months, two (3mm diameter Biohorizon implants) were placed. (Figures 6a, 6b, 7a, and 7b) After integration, the implants were restored by an implant supported fixed partial denture from #23-#26 and pictures show implants functioning well. (Figures 8 and 9) The patient was very happy with the esthetic result and function of the fixed implant restoration.

Figure 1: Initial Patient presentation.

Figures 2a and 2b: Edentulous ridge and Flap of surgical site.

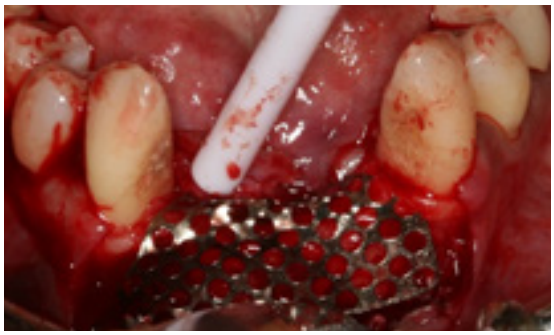


Figure 3: Placement of titanium mesh membrane.

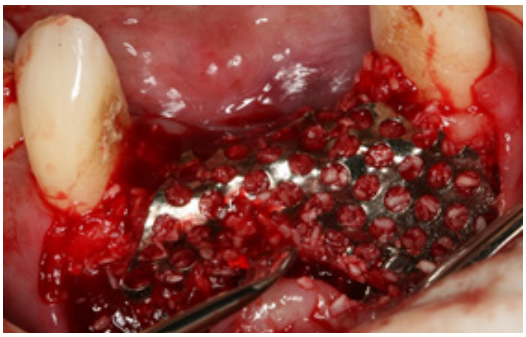
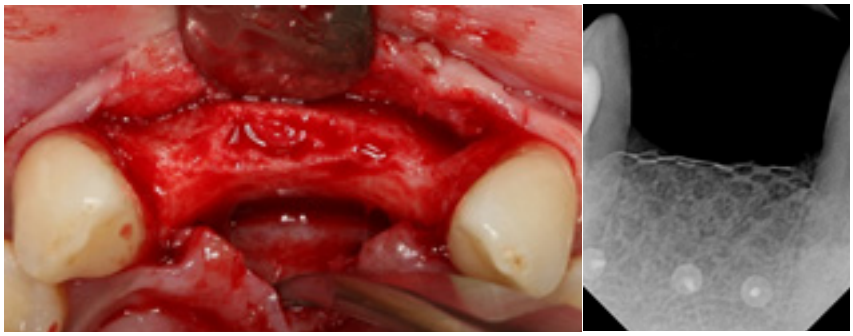
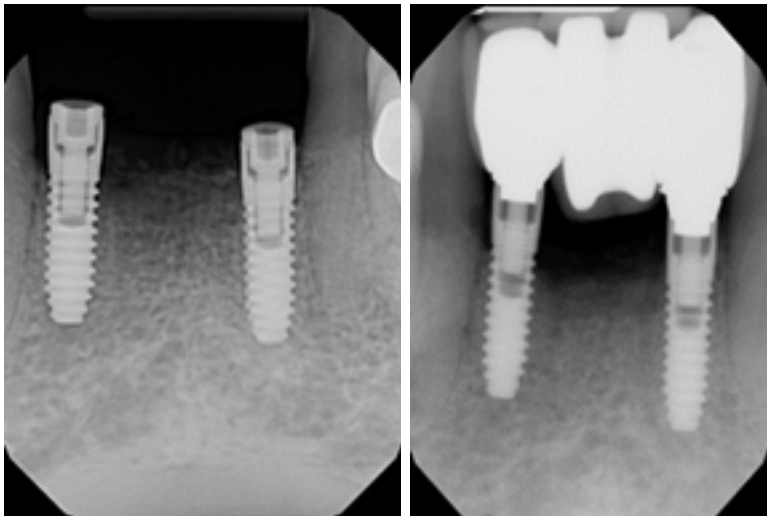


Figure 4: Bone graft and membrane in place.

Figure 5: Closure of flap.



Figures 6a and 6b: X-ray and Clinical results showing bone gain after the procedure.



Figures 7a and 7b: Dental Implant placement and restoration x-rays.


Figures 8 and 9: Implant Restoration.

Discussion

Correcting alveolar bone deficiencies is important to successful implant placement and restoration. Inadequate bone or defects in bone can be detrimental for implant placement adversely affecting implant placement and stability and resulting in angulation problems that can result in off axis forces on the implant restoration. The current recommended protocol for implant placement is prosthesis driven, with goal of ensuring that there is adequate bone and soft tissue support for placement of implants in locations in the alveolar ridge that are optimal for implant restoration. When deficiencies exist the goal is to correct them. One of the major ways to correct bone deficiencies and defects in bone is utilizing guided bone regeneration (GBR) for regenerating bone in alveolar ridges. When combination of horizontal and vertical augmentation is needed such as for ridges with Seibert classification III, Allen Type C or Misch Division C defects, the goal is to utilize either block grafts or particulate grafts combined with non- resorbable membranes such as the titanium mesh membrane to allow adequate time for maximum bone growth prior to membrane removal, improving chances of improved augmentation compared to resorbable membranes that might absorb too rapidly. A number of studies that compared autogenous bone grafts to allogenic and xenogenic grafts have noted no major difference in ridge augmentation with comparable results. An article by Avila-Ortiz and colleagues found that for alveolar ridge preservation use of DFDBA and inorganic bovine bone derivatives tended to have better outcomes than alloplastic materials. Studies are being conducted on the effect of Biologic agents and how they impact ridge augmentation with the goal of continuing to improve success with ridge augmentation procedures.

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