ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 2, Issue – 3, May - June- 2019, Page No. : 266 - 273

Ridge Augmentation using Combination technique with Demineralized Freeze Dried Bone Allograft Block and Collagen Membrane with Delayed Implant Placement-A Case Report.

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Type of Publication: Case Report

Conflicts of Interest: Nil

Abstract

It is well established that tooth extraction is followed by a reduction of the buccolingual as well as apicocoronal dimension of the alveolar ridge at the edentulous site. Ridge augmentation facilitates the placement of implant in order to achieve optimum function and esthetics. A case of severe maxillary ridge deficiency successfully treated with horizontal ridge augmentation to facilitate implant placement is described. Ridge augmentation was achieved using a combination of Demineralized freeze dried bone allograft block(DFDBA) , particulate grafting, and Guided bone regeneration(GBR) . A significant increase in the width of the ridge was observed after 8 months which further facilitated the implant placement .

Keyword: Ridge augmentation, Demineralized freeze dried bone allograft, combination technique, guided bone regeneration.

Introduction

Augmentation procedures to increase the volume of deficient or atrophic alveolar bone have been extensively performed worldwide in an effort to safely place the implants where they can support an adequate functional and esthetic prosthesis. Ridge augmentation serves three primary objectives:

1. Function - to create an adequate volume of vital bone for ideal restorative and function position of implant
2. Esthetic -to support the associated soft tissues for an esthetic appearance.
3. Prognosis -for predictable long term prognosis of the implant.

Implant should always be planned keeping in mind the prosthesis , which is called as “backward planning” or “restoration driven” approach. It is the part of this rationale that a dentist , rather than accepting a restorative compromise , should consider reconstructing the bone to meet the restorative needs. Any tooth loss may be followed by extensive resorption of the alveolar ridge. Due to the resulting bone loss, the alveolar anatomy will undergo various degrees of alteration. Implants should be placed in correct prosthodontic position according to the treatment plan. Alveolar bone width should exceed the diameter of the proposed implant by 1-1.5mm both on buccal and on the lingual or palatal side[1]

According to Seibert , ridge defects in edentulous regions can be divided into three classes :

1. Class I: loss of tissue in the bucco-lingual direction with normal height in the apical-coronal direction.
2. Class II: loss of the tissue in the apical-coronal direction, with normal width in the bucco-lingual direction.
3. Class III: a combination of Class I and Class II (loss of both height and width).[2,3]

Bone is a dynamic structure with a continuous remodeling to ensure renewal of form and function. Although bone tissue exhibits a large regeneration potential and may restore its original structure and function completely, bony defects may often fail to heal with bone tissue. Various methods for ridge augmentation depending on the type of ridge defect [4] -

Horizontal ridge defect

1. Guided bone regeneration using resorbable or non-resorbable membrane

2. Onlay block bone graft

3. Ridge splitting and ridge expansion

4. Combination approach –by using resorbable or non resorbable membrane and bone block or particulate graft.

Vertical ridge defect

1. Onlay block grafting
2. Shell technique
3. Swinging interpositional graft
4. Staged interpositional graft
5. Distraction osteogenesis.

The biologic mechanisms forming the basis of bone augmentation include three basic processes: osteogenesis, osteoconduction, and osteoinduction

Various materials used for ridge augmentation are-

1. Autograft-this is the gold standard. Autologous bone functions as a scaffold for the new bone formation. They are also known to contribute osteogenic stem cells and growth and differentiation factors that chemically bind to proteins in the autologous bone matrix.
2. Allograft- Demineralized freeze-dried bone allografts (DFDBA) have been used extensively in periodontal therapy. DFDBA is used because it contains bone morphogenetic protein (BMP), which induces new bone formation during the healing process.
3. Xenograft-Deproteinized bovine bone matrix is a well documented bone substitute offering a low substitution rate for intra-oral grafting.
4. Alloplast- Various synthetic bone grafts are commercially available like- Hydroxyapatite, beta-tricalcium phosphate and bioactive glass.

We have described a case of horizontal ridge augmentation using a combination approach.

Case Report

A 35-year-old male patient with missing maxillary left first premolar due to trauma wanted a permanent replacement of his missing teeth. Clinical examination , diagnostic impressions, photographs, radiographs, and a thorough history were obtained from the patient. A moderate maxillary horizontal ridge deficiency was noticed[Fig 1,3] A CBCT scan of the edentulous area was used to accurately measure the available bone dimensions[Fig 2]. The scan revealed the following bone dimensions which were inadequate for implant placement

Bone height at Tooth #24 = 14.7 mm

Bone width at Tooth #24 = 5.3 mm

Finding that the available bone width was inadequate for the implant , we decided to horizontally augment the implant recipient site with a suitable substitute.Therefore, a ridge augmentation procedure using a combination of block graft (DFDBA ,Tata Memorial hospital), particulate DFDBA graft and GBR with collagen membrane was

planned in order to achieve adequate ridge width to facilitate the placement of implant.

Oral prophylaxis was performed , patient was explained about the entire surgical procedure and informed consent was taken.

Surgical Procedure

The recipient site was anesthetized using 2% Lidocaine with 1: 100,000 epinephrine. Horizontal incision was given on the recipient site slightly palatal to the mid-crestal region(paracrestal). Two vertical releasing incisions were placed mesial to lateral incisor and distal to first molar. Full thickness flap was reflected. Bleeding points were created using a small round bur[Fig 4a,b,c].

The DFDBA block graft was cut to appropriate size and anchored to fit the recipient site intimately[Fig 5,6]. Once properly positioned, the graft was fixated with one titanium positional screw of 1.5 mm diameter passing though the graft into the remaining native alveolar bone . Particulate graft was placed over the block graft and space between block graft and recipient area[Fig 7]. The entire area was covered with the help of a resorbable fish collagen membrane [Fig 8] . Following this, the flap was replaced and the area was sutured. The surgical area is covered with periodontal dressing.[Fig9,10] .

The patient was given post surgical instructions and oral hygiene instructions were reinforced. The patient was prescribed the antibiotic amoxicillin 500 mg three times daily for seven days to prevent nosocomial infection and anti-inflammatory agent ibuprofen 400 mg two times daily, for a period of five days. The use of 0.2% chlorhexidine mouth rinse two times a day was instituted for two weeks. Suture removal was done after 10 days. Post operative follow-up the next day, after 10 days, and three months showed uneventful healing at both the surgical sites. Significant improvement in the ridge width was noticed at eigth months[Fig 11,12,13] . All the initial examination procedures were repeated post operatively to aid in the final prosthetic plan. On re-examination, the available bone dimensions were as follows: Bone width at Tooth #24 = 10 mm .

Delayed Implant placement

An implant of 4.8 mm diameter was planned to be placed in the edentulous area.

On flap reflection, significant increase in the ridge width was observed.

At the time of implant placement, the positional titanium screw was removed[Fig14]. Implant site preparation was done , followed by placement of implant[Fig15,16].

After 3 months, transfer post was placed and final impression was taken[Fig 17,18,19]. The patient was delivered with a final prosthesis of full ceramic[Fig 20].

Patient was recalled every 3 months for re -evaluation .

Figure 1 : Pre-operative view-ridge defect with respect to 24

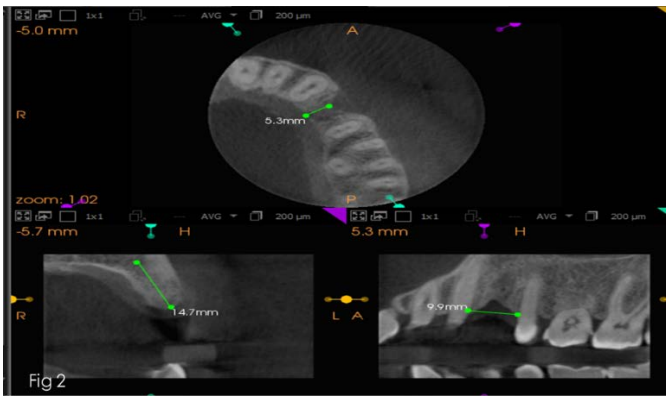


Figure 2 : Pre-operative view-CBCT

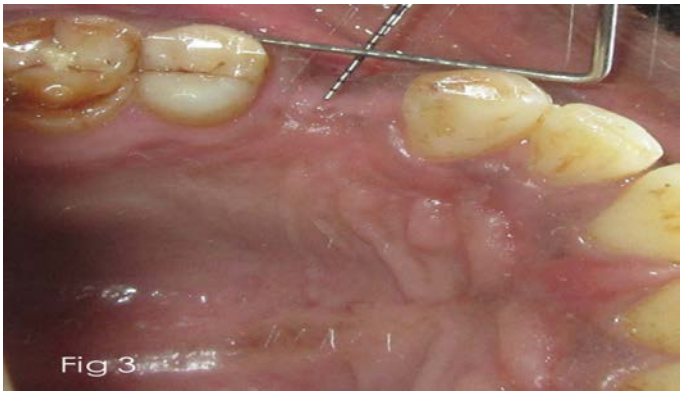


Figure 3 :Pre-operative view-horizontal ridge deficiency present.

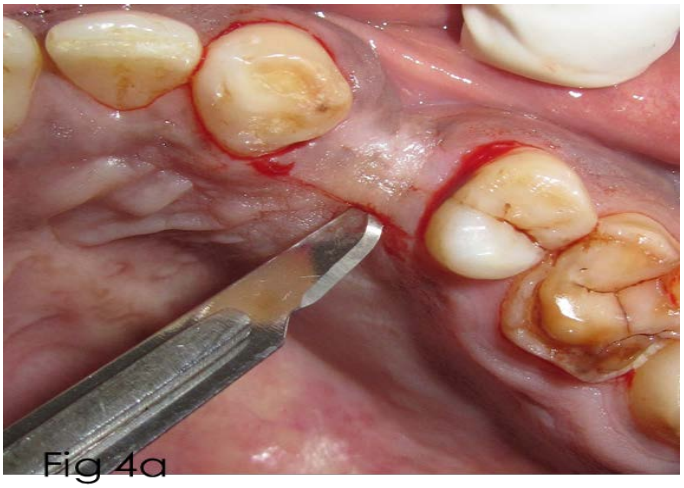
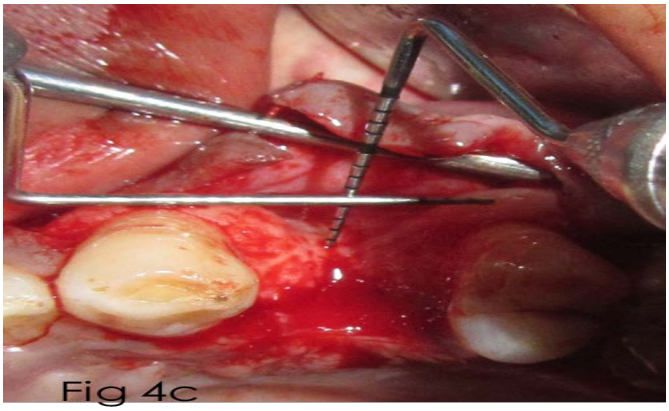


Figure 4 a: Paracrestal incision placed

Figure 4 b : Vertical releasing incisions placed



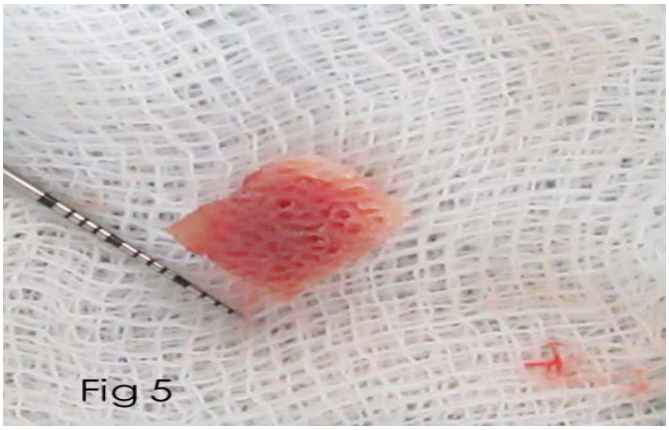


Figure 5 : Demineralized Freeze Dried Allograft Bone (DFDBA Block)

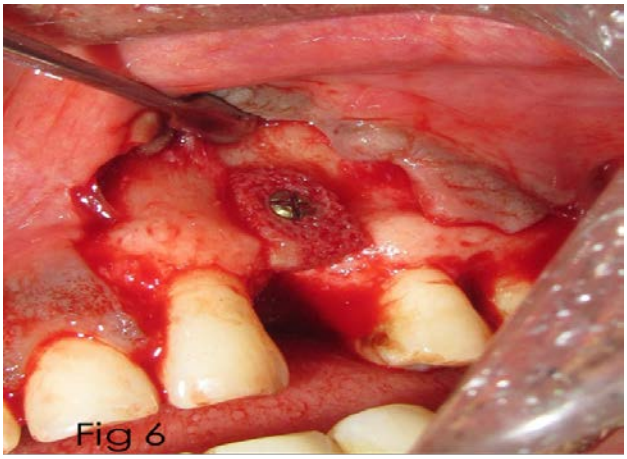


Figure 6 : DFDBA block placed into the ridge defect with the help of titanium positional screw

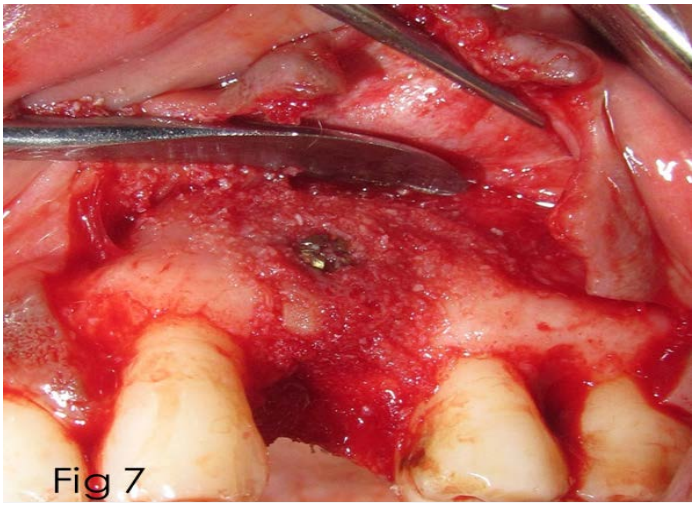


Figure 7 : Placement of DFDBA particulate graft

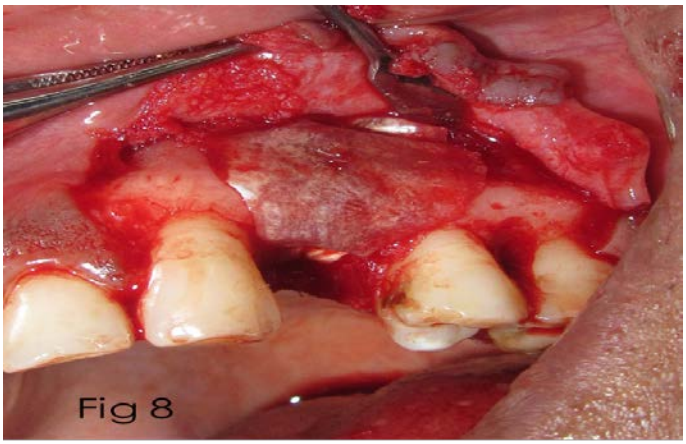


Figure 8 : Stabilization of collagen membrane

Figure 9 : Primary closure achieved with interrupted suture technique with 3-0 silk suture

Figure 10 : Periodontal dressing placed

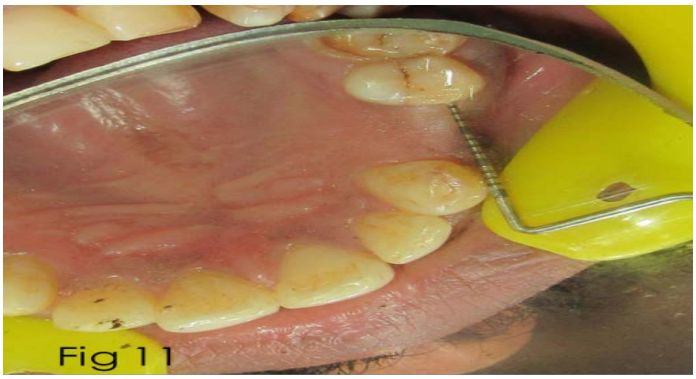


Figure 11: Postoperative view-after 8 months

Figure 12: Postoperative view-after 8 months CBCT

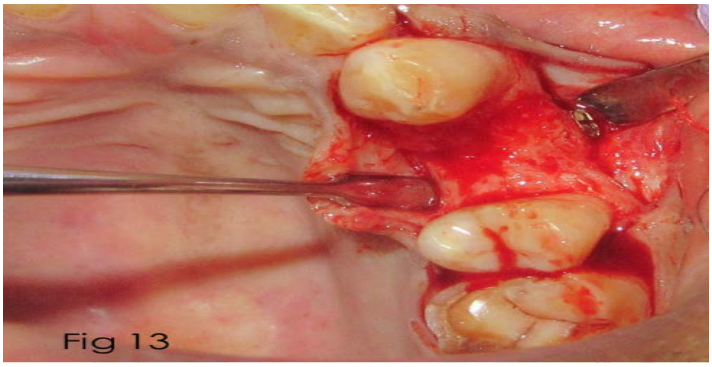


Figure 13 : Postoperative view-after 8 months

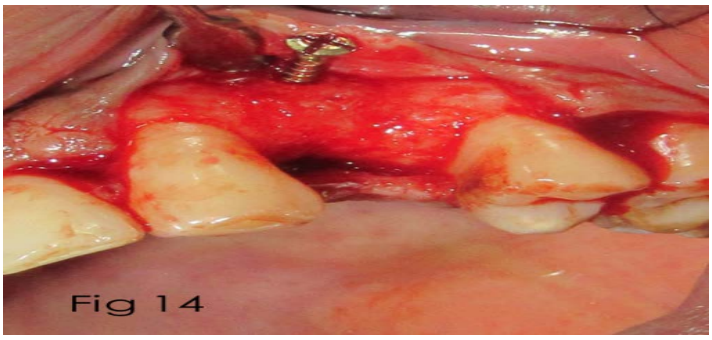


Figure 14 : Removal of titanium positional screw

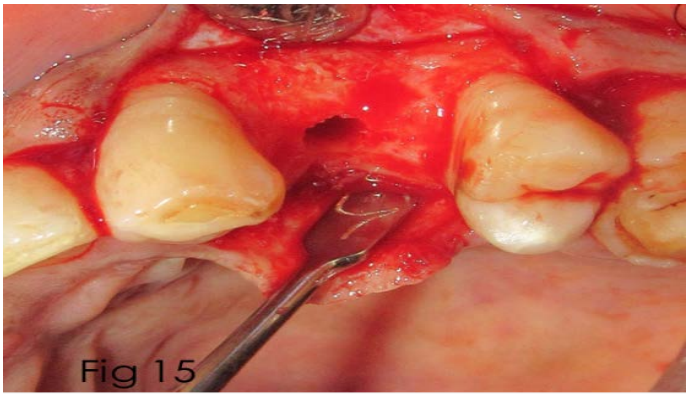


Figure 15 : Osteotomy preparation done

Figure 16 : Implant placement done

Figure 17 : Intra-oral Periapical Radiograph od the implant

Figure 18 : Healing cap removed

Figure 19 : Transfer post placed and final impression taken

Figure 20 : Final full ceramic prosthesis placed

Discussion

Guided bone regeneration (GBR) refers to the promotion of bone formation which is based on the principle of using barrier membranes for space maintenance . This promotes the ingrowth of osteogenic cells and prevents migration of undesired cells from the overlying soft tissues into the wound. A variety of nonresorbable and resorbable barrier membranes has been used in bone augmentation with the GBR concept.[4] We have used a resorbable collagen membrane in our case, in order to overcome the limitations of non resorbable membranes, such as the need for a second surgical procedure for their removal with the added risk of loss of some of the regenerated bone further to flap reflection. Also, an invitro study comparing resorbable and non resorbable membranes concluded that bioabsorbable membranes, particularly collagen and hyaluronic acid may promote bone regeneration through their activity on osteoblasts, thus suggesting that bioabsorbable membranes may be more suitable than non-resorbable membranes favoring bone regeneration and repair[5,6]

Because of the lack of rigidity, most bioabsorbable membranes must be used in combination with a graft material for space maintenance in bone augmentation applications. Therefore, a combination of particulate and block allograft was used along with the membrane.

Although autograft is considered as the gold standard, there are several drawbacks like second surgical site, increased morbidity , inadequate availability of graft and patient ‘s acceptance. [7] In our case, patient was unwilling for an autograft ,hence a allograft (DFDBA) bone block was selected to fill the defect. The current widespread use of DFDBA is based on the purported osteoinductive ability of demineralized bone graft preparations. Demineralization of the graft exposes the bone-inductive proteins located in the bone matrix, and, in fact, may activate them[8].. Recently, Shigeyama et al found that crude protein extracts of DFDBA contain immunoreactive bone morphogenetic protein (BMP), as well as other biologically active molecules. [9]

1.Despite the apparent presence of BMP in DFDBA, direct clinical comparison of treatment success using mineralized freeze-dried bone allografts and DFDBA yielded similar results,although the former is osteoconductive, whereas the latter is intended to be osteoinductive.

2. Becker et al questioned the use of DFDBA after examining its variable effectiveness during healing of extraction sockets. [10,11]

3. In contrast to the studies cited above, use of DFDBA to augment healing around implants has also been shown to offer no advantage over treatment without DFDBA.

Thus, the variability in clinical outcome could be a function of differences in either DFDBA processing techniques and/or donor characteristics.[13] This combination approach is useful in treating severe defects involving multiple missing teeth where individual approaches alone may not be sufficient to achieve the desired results. This is one of the few case reports using fish collagen membrane and DFDBA block and particulate graft.

Conclusion

Ridge augmentation of an edentulous area could be a challenging procedure, especially in the anterior area where both esthetics and function need to be restored. Since individual approaches may not provide the desired results and patient was not willing for a autograft, we used a combination of DFDBA block graft, particulate graft and GBR with fish collagen membrane in order to achieve sufficient ridge width, thus facilitating the placement of implant.

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