Ridge Augmentation for Improved Implant Placement

CE 1

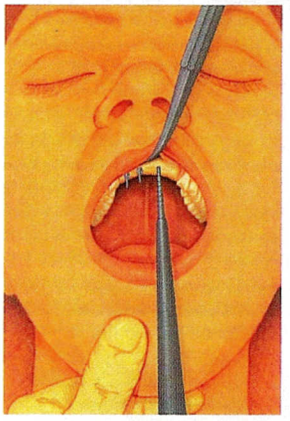
Abstract: *The placement of endosseous dental implants is often hampered by unfavorable anatomy of the alveolar bone. Guided bone regeneration and bone grafts have been used to reconstruct deficient alveolar ridges in preparation for dental implants. A case report is presented to illustrate two approaches to successful management of different alveolar defects.*

Edgard El Chaar, DDS
Clinical Fellow
Department of Periodontics
Advanced Education Program in Periodontics
College of Dentistry
New York University
New York, New York

Learning Objectives:

After reading this article, the reader should be able to:

- define the rationale of guided bone regeneration.
- describe ridge augmentation using the splitting technique.
- describe the grafting materials used for ridge augmentation.
- discuss the advantages and limitations of ridge augmentation procedures.



A sufficient quantity of bone for implant placement is an essential prerequisite for long-term success in oral implant therapy.[1] The quantity of alveolar bone decreases after periodontal disease or extraction, causing bone loss in both vertical and horizontal directions. Lack of horizontal bone volume often results in an exposed implant surface and, consequently, decreased bone-implant interface and potential implant failure. Also, if the alveolar ridge has a knife-edge morphology,[1] conventional implant placement would lead to entire loss of the ridge.

Several experimental and clinical studies[2-11] have demonstrated that guided bone regeneration (GBR) can be successfully employed to reconstruct bone around dental implants and also augment the height and the width of atrophic alveolar ridges before implant placement. The expanded polytetrafluoroethylene membrane is used as a mechanical barrier separating the soft tissue from the grafted zone to allow the slow-migrating osteogenic cells to repopulate the created space without competing with other cells from the surrounding tissues.

The use of either autogenous or alloplastic grafts is controversial.[12] These materials have regenerative potentials that differ in overall mechanisms, and in the quality and quantity of regenerated tissue.

Case Report

A 47-year-old woman with unremarkable medical and social histories presented with a history of generalized moderate-to-advanced adult periodontitis. Surgical treatment was carried out 4 years earlier with favorable results. Eight maxillary and mandibular incisors were extracted and replaced with transitional removable prostheses. The patient was unhappy with removable appliances and insisted on fixed restorations. She was advised that if the implant option was selected, it might require multiple surgical treatments, including augmentation of the unfavorable ridges.

Maxillary Evaluation and Surgical Treatment

The panoramic radiograph of the computed tomography scan of the maxilla revealed a limited height of bone despite the fact that the width appears to be adequate on the sagittal view (Figure 1). Inadequate midlevel width from images 22 to 24 can be seen (Figure 2). The crest has a width ranging between

Dr. El Chaar presented this topic at the Tri-Schools Meeting in Postdoctoral Periodontics at Boston University, Spring 1997.

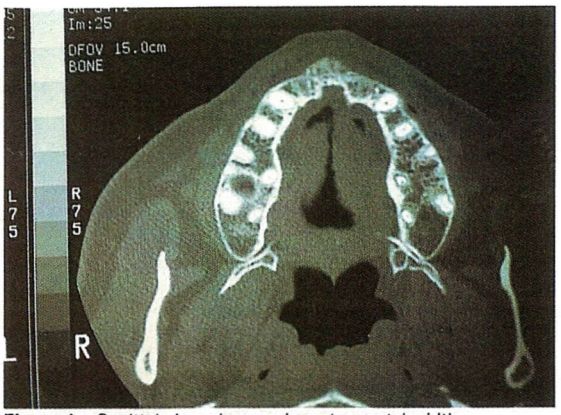


Figure 1—Sagittal view shows adequate crestal width.

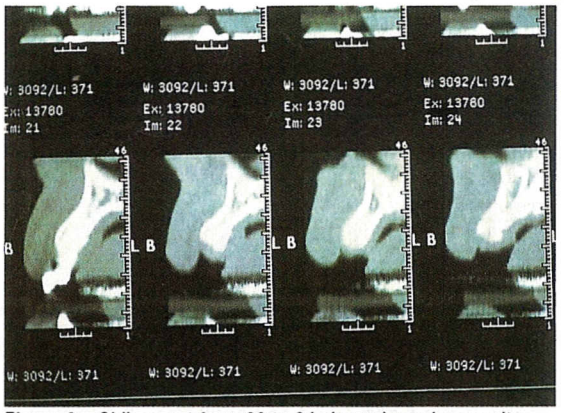


Figure 2—Oblique cut from 22 to 24 shows buccal concavity.

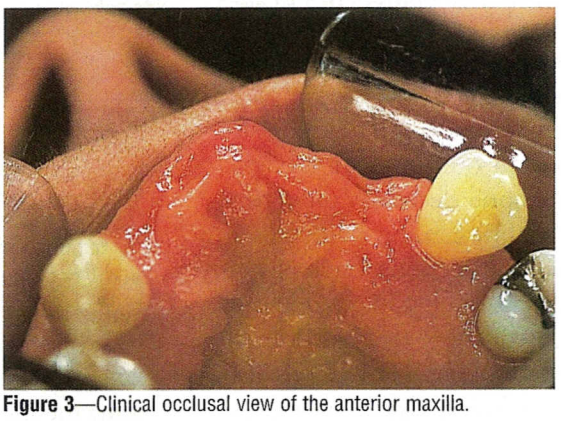


Figure 3—Clinical occlusal view of the anterior maxilla.

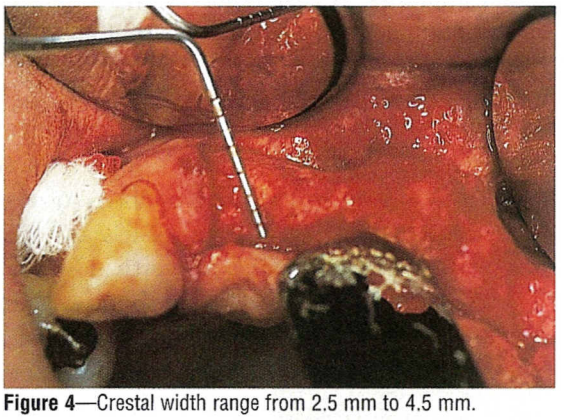


Figure 4—Crestal width range from 2.5 mm to 4.5 mm.

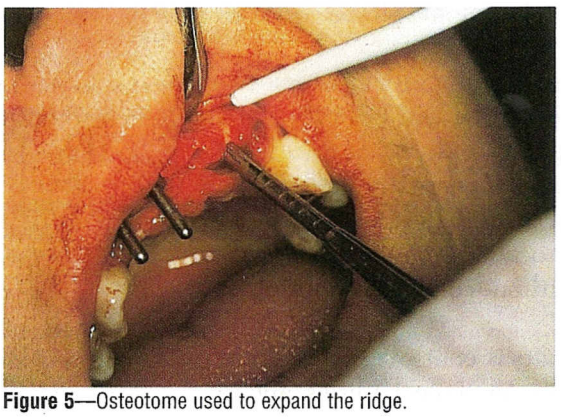


Figure 5—Osteotome used to expand the ridge.

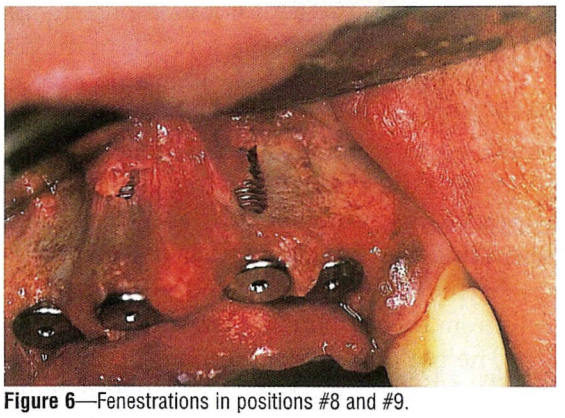


Figure 6—Fenestrations in positions #8 and #9.

2.5 mm and 4.5 mm (Figures 3 and 4).

In view of the buccal concavity, osteotomes were used after preparing with a 2 mm twist drill to expand the ridge and minimize the risk of dehiscences (Figure 5). Four 3.75 mm × 13 mm fixtures were placed. Two fenestrations occurred in positions #8 and #9 (Figure 6). These fenestrations were covered with a mixture of OsteoGraf®/N-300[a] and autogenous bone that was collected while drilling with the 2 mm twist drill. The graft was covered by Oval 6 GORE-TEX® Augmentation Material[b] (Figure 7). The barrier membrane was removed after 9 months, and the fill over the fenestration can be observed in Figure 8.

A biopsy was collected from the site of the bone graft. The slides were stained with hematoxylin and eosin. The microscopic view shows a large sample of the microporous OsteoGraf® surrounded by fibrous connective tissues as well as fragments of bone. Microporosities within the particles of OsteoGraf® show evidence of ingrowth of osseous-type tissues (Figure 9).

Mandibular Evaluation and Surgical Treatment

The mandibular panoramic radiograph reveals adequate height of bone with a good symphysis area as a future donor site (Figure

[a] CeraMed Dental, Lakewood, CO 80228

[b] Manufactured by W.L. Gore and Associates, distributed by 3*i* Implant Innovations® Inc, Palm Beach Gardens, FL 33410

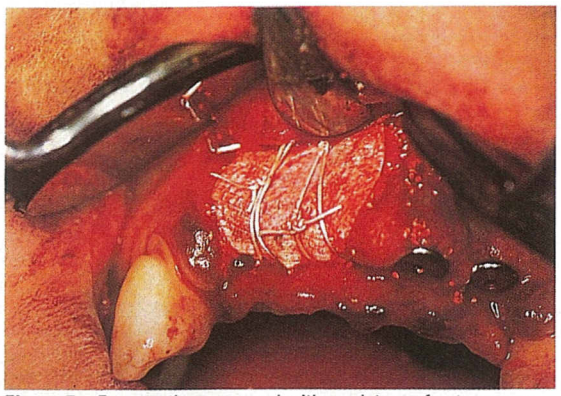


Figure 7—Fenestrations covered with a mixture of autogenous bone and OsteoGraf®/N-300 and barrier membrane.

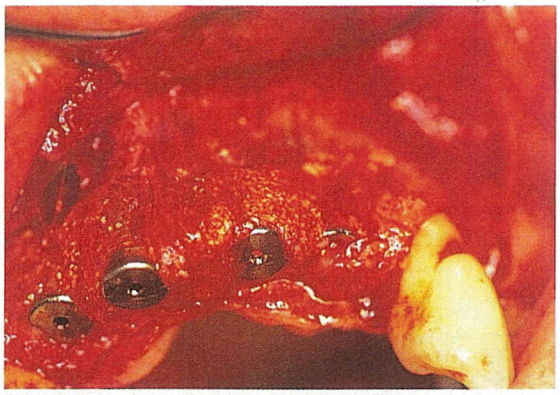


Figure 8—Barrier removed 9 months later. Fill over the fenestrations can be observed.

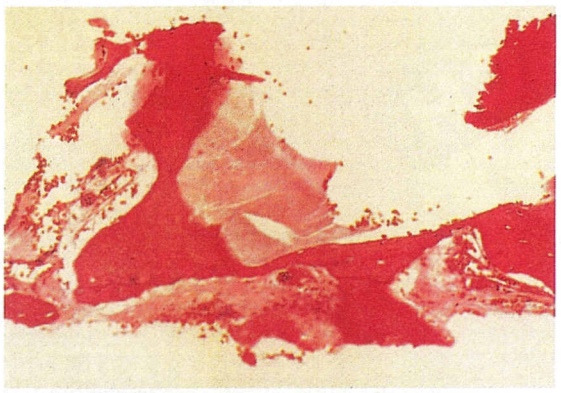


Figure 9—Histological slides shows particles of microporous OsteoGraf® surrounded by connective tissue and fragments of bone. Microporosities within the fragments show ingrowth of osseous-type tissue (hematoxylin and eosin stain).

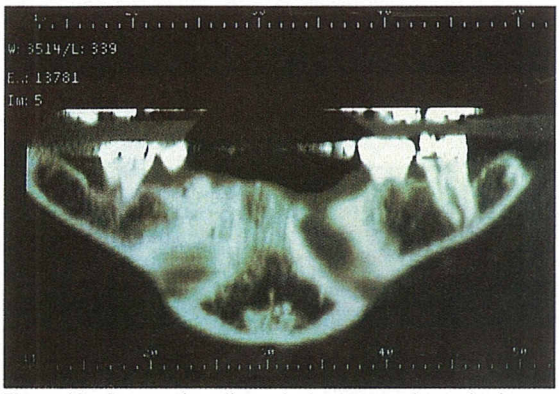


Figure 10—Panoramic radiograph shows a good symphysis area and a narrow crest up to 1 mm.

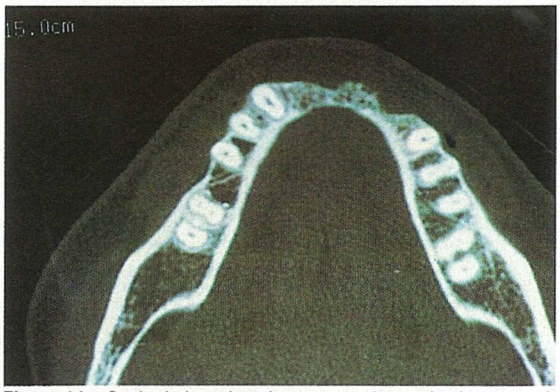


Figure 11—Sagittal view also shows a good symphysis area and a narrow crest up to 1 mm.

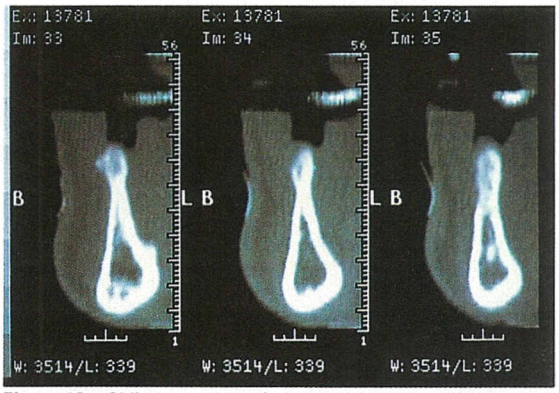


Figure 12—Oblique cuts corroborate with the sagittal view.

10). The sagittal view shows variations in ridge width from 1 mm in position 33 up to 4 mm in positions 34 and 35 (Figure 11). This made the ridge inadequate even for the narrowest diameter implant available. The oblique cuts corroborate the sagittal views (Figure 12). Surgical exposure of the area reveals a narrow crestal ridge with a significant buccal concavity (Figure 13). A channel was drilled and a split technique was performed to widen the place between the two cortices (Figure 14). Decortication was performed buccally, and two blocks from the symphysis area were obtained and stabilized by two stainless steel screws (Figure 15). Demineralized freeze-dried bone allograft (DFDBA) was placed over, around, and inside the channel created between the two cortices of the ridge (Figure 16). A barrier membrane placed over the area was stabilized with titanium screws (Figure 17).

Ten months later, the site was uncovered and the membrane was removed. One month after that, four Osseotite™ micromini implants[c] were placed (Figure 18). A biopsy was collected from the site where the DFDBA was placed;

[c] 3i Implant Innovations® Inc, Palm Beach Gardens, FL 33410

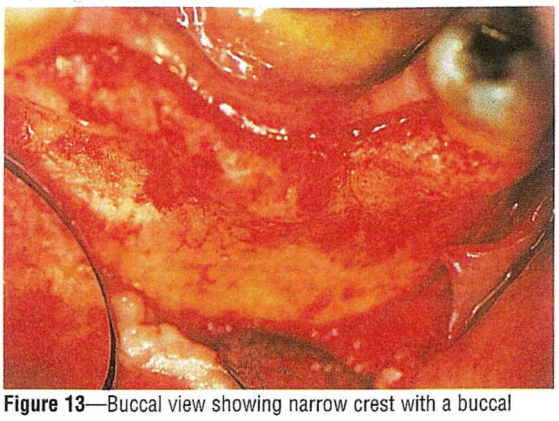


Figure 13—Buccal view showing narrow crest with a buccal concavity.

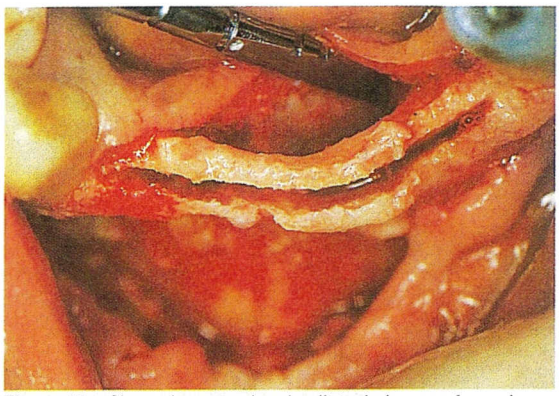


Figure 14—Channel prepared and split technique performed.

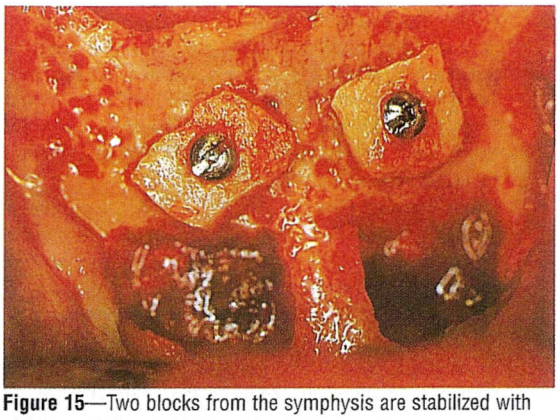


Figure 15—Two blocks from the symphysis are stabilized with stainless steel screws.

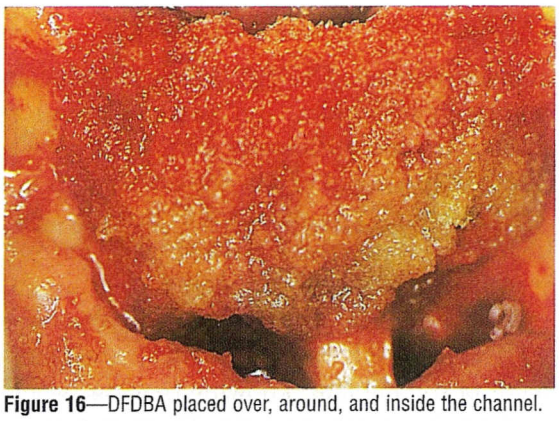


Figure 16—DFDBA placed over, around, and inside the channel.

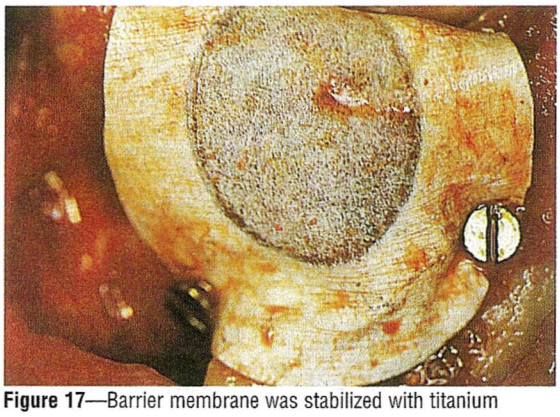


Figure 17—Barrier membrane was stabilized with titanium screws.

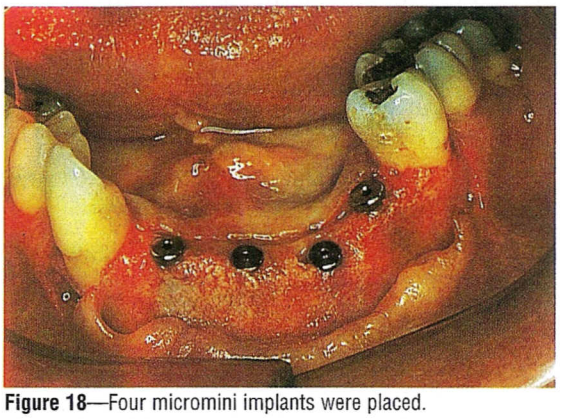


Figure 18—Four micromini implants were placed.

it revealed no unresorbed graft material (Figure 19).

A punch technique was performed at the second stage and a bone profiler was used with a manual drive[c], except for position #24, where a slight apical positioning of the tissue was necessary. On completion of prosthetic treatment, the patient will undergo a rigorously enforced program of periodontal supportive maintenance therapy.

Discussion

In position #8, the result was not as good as anticipated, possibly because the barrier was not extended far enough to include this area. The resulting augmentation is thin and transparent with threads visible through the transparency. It is possible that this area may become dehisced with time. In a 5-year retrospective report of exposed coronal threads, Lekholm et al[13] did not notice mucosal or implant failure when good oral hygiene was practiced.

Animal studies by Siebert and Nyman[14] and human studies by Buser et al[15] show that the potential for augmentation of ridges is good. Buser et al[15] recommended creation and maintenance of a space with a barrier and an

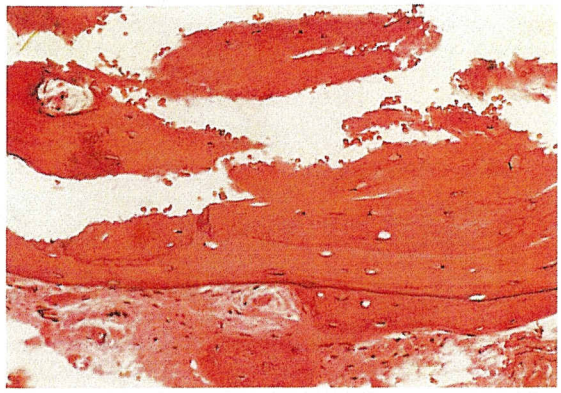


Figure 19—Histological slides from DFDBA-grafted site revealed no unresorbed graft material.

autogenous graft. DFDBA with some autogenous graft material as well as stabilization of the barrier and sufficiently long healing periods were needed to obtain the desired result.

Bruschi and Scipioni[16] and Simion et al[8] combined a greenstick fracture with implant placement covered by a membrane in widening narrow ridges. We chose to widen the ridge with a greenstick fracture and delay the placement of the implant, knowing that this would prolong the treatment time. There appears to be some disagreement on the efficacy of DFDBA as a grafting material. Although Becker et al[12] showed the presence of nonvital DFDBA particles, other studies[17] have shown that after a longer healing period these particles are eventually converted to bone. Reynolds and Bowers[18] stated that inflammation and containment of the graft appear to be important factors influencing the fate of DFDBA and the regenerative response.

Conclusion

Bone augmentation around implants and for the improvement of ridges is a predictable technique if certain criteria are met. First, membrane stabilization is necessary to maintain a space for the clot to form; it also stabilizes the graft and eliminates any micromovement that could impinge on the healing process. A long healing period is needed, and the membrane should be completely covered to eliminate any risk of infection. Finally, autogenous bone alone or in combination with allografts or xenografts should be used.

Acknowledgments

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