Guided Bone Regeneration for Fenestration Defects in Dental Implants: Surgical Techniques and Case Presentation with Review

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ABSTRACT

Guided bone regeneration (GBR) has been applied in implant dentistry for increasing the width and height of the alveolar ridge in areas with insufficient bone. Various materials and techniques have been used for this purpose. It refers to a surgical procedure by which utilizing a mechanical barrier to create a secluded space around the defect to permit bone regeneration without the competition of other tissues. This report presents a case with buccal fenestration on maxillary implant sites observed during a surgical procedure. An allograft and a nonresorbable membrane were concomitantly used to increase the width of the alveolar ridge. Hard tissue regeneration was evident clinically. The implants were restored for functioning. Factors affecting outcomes are also discussed. Membrane stability and the space-making effect remain the keys to success. This case report and review describes the management of bony fenestration which was encountered during the implant placement procedure.

Keywords: Bone graft, Demineralized freeze-dried bone allograft, Guided bone regeneration, Nonresorbable membrane, Ridge augmentation.


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INTRODUCTION

Guided bone regeneration (GBR) has made the placement of implants possible in sites that were not a part of the original implant protocol. It has been successfully applied for increasing the width and height of the alveolar ridge before implant installation and in the treatment of peri-implant bone defects in experimental animals and in clinical cases. Recently, it has been further applied in preserving extraction sockets, in adjunct to immediate implant placement or in the treatment of fenestration or dehiscence of implants sites compromised by insufficient bone.

The GBR technique refers to a surgical procedure by which utilizing barrier membranes as a mechanical barrier to create a secluded space around the defects to permit bone regeneration without the competition of other tissue. Nonresorbable expanded polytetrafluoroethylene (e-PTFE) membranes, collagen membranes, or other bioabsorbable polymer barriers have been used for the purpose. These barriers can be used alone or supported by either autogenous bone grafts or various bone substitutes. The efficacy of these various procedures have been evaluated clinically and histologically.

CASE REPORT

A 25 years old female patient reported to the department of periodontics, Institute of Dental Sciences, Bareilly, complaint of missing teeth and looking for a new restoration on her left maxilla. Clinical and radiographical examinations revealed that the left maxillary lateral incisor and canine had residual roots. An apical radiolucency was also noted on the canine. Extraction of the residual roots was recommended. The gingiva was healthy on clinical examination. The masticatory mucosa was sufficient. Since, the patient rejected a removable prosthesis for psychological reasons, a radiographic (RVG) was taken to evaluate the osseous morphology for implant installation. It revealed sufficient bone height and bone width. An area of thick soft tissue, which gave the edentulous ridge a nice wide appearance, was noted on the buccal side. Considering the alignment and the angulations of the implant fixtures needed for restoring prosthesis of acceptable occlusion, a GBR procedure was kept as an option if in case of buccal dehiscence or fenestration created during the surgical procedure.

Patient was motivated for implant placement and after taking her consent dental implant was included in treatment plan. Under local anesthesia a full thickness mucoperiosteal flap was reflected. Osteotomy was carefully carried out keeping parallelism and inter incisal distance. A smooth-surface pure-titanium implant (Alpha-Bio) was carefully placed according to the standard protocol described by
Adell et al\textsuperscript{10} (Fig. 4). Standard 3.75 mm diameter implant with a length of 13 mm were used.

After flap reflection a fenestration area on buccal cortical plate with respect to 23 was seen, so GBR was done after implant placement. Demineralized freeze dried bone allograft (DFDBA) was humidified and grafted onto the fenestration areas (Figs 5 and 6). An e-PTFE membrane (GTAM, WL Gore, Flagstaff, AZ, USA) was stabilized
onto the grafted site (Fig. 7). The flaps were closed with a horizontal mattress and interrupted suture of nonresorbable material (WLGore) (Fig. 8). Postoperatively, 500 mg amoxicillin tid for 5 days and 400 mg ibuprofen tid were given for 3 days. 0.2% chlorhexidine mouth rinse was also prescribed. The sutures were removed after 10 days. The patient had no immediate denture throughout the healing period. She was recalled once a week for the first month. The wound healed uneventfully. After 2 months nonresorbable membrane was removed by second surgery.

DISCUSSION

One should never be too cautious about carrying out a very successful surgical procedure with a future treatment plan. When the expected conditions encounter clinical limitations, the clinician usually makes compromises with the treatment plan. In this case, for example, changing the alignment of the fixtures, using angulated abutments, or resulting a compromised occlusal scheme had to be considered. On the other hand, preparing a substitute procedure, such as a GBR technique, to solve the problems challenges the clinician’s knowledge and skill and is also limited by the development of biomaterials.

The clinical outcome of this case clearly demonstrated a positive effect of the barrier membrane on bone regeneration around the implant. Several factors could have influenced the quantity of bone formation in a GBR technique. The space-maintaining capability and its duration of the barrier membrane are the most important ones. Dahlin et al.13 demonstrated that the amount of bone regeneration is determined and limited by the available space. Although, some absorbable membranes, such as poly lactic acid and poly glycolic acid (PLA/PGA)11 or collagen12 have been applied in the GBR technique, their stiffness and duration have been questioned. Sandberg et al13 noted that some resorbable membranes used in their study showed a lack of stiffness, resulting in the collapse of the membrane into the defect area, causing the newly formed bone to take on an hourglass shape.

Absorbable membranes generally start to resorb after 4 to 6 weeks. With membrane resorption, the barrier effect could decrease too soon to achieve complete bone regeneration. In a comparative histologic human study, Simion et al.11 found that e-PTFE membranes were the most effective barrier material, in that denser and a greater amount of regenerated bone were found. Autogenous bone graft provides the most predictable osteogenic result. However, a second surgical site is needed to harvest the graft material, which discourages patients from the GBR procedure. Bone replacement grafts, such as DFDBA alone,9,14 a composite graft of DFDBA/freeze dried bone allograft (FDBA)15 or hydroxyapatite (HA)12 have been used with variable results reported. In the evidence of a histologic human study by Simion et al.11 viable bone was observed in the absence of inflammatory cell infiltrate in regenerated bone by using an e-PTFE membrane with DFDBA. Because of the limited availability of bone substitute, only DFDBA was used in this case.

Although, no histologic analysis was done, the clinical appearance seemed to be satisfactory and comparable to that of a previous study. Thicknesses of the soft tissue and primary closure of the flaps are also important aspects of the surgical procedure to maintain wound stability during healing. Early exposure of the membrane, with consequential bacterial contamination of the healing tissues, hinders bone regeneration, despite careful maintenance with chlorhexidine application.15

CONCLUSION

The result of this case suggests that a nonresorbable e-PTFE membrane with DFDBA can be used for treating fenestration defects around implants. The compilation of case report
information is on-going in order to determine whether predictable results can be maintained in term of long-term stability and clinical benefit. Unfortunately in the present case, we could not do further follow-up because of patient’s time constraint.

REFERENCES