Ridge Augmentation by Guided Bone Regeneration Technique

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Abstract

Resorption of the edentulous or partially edentulous alveolar ridge or bone loss due to periodontitis or trauma frequently compromises fixed prosthesis placement. Therefore, augmentation of an insufficient bone volume is often indicated to attain predictable long-term functioning and an aesthetic treatment outcome. Guided bone regeneration (GBR) techniques have been used for vertical and horizontal ridge augmentations with acceptable results. The principle of guided bone regeneration can be applied for localized ridge augmentation in a staged approach. The technique is based on the principle of guided bone regeneration utilizing barrier membranes. In the present article, the GBR surgical procedure is presented. In addition, the different aspects of the surgical technique needed to achieve a predictable success are also discussed.

Keywords: Guided bone regeneration, Guided tissue regeneration, Ridge augmentation, Bone graft, Membrane.


Introduction

Resorption of alveolar bone following loss of teeth is an inevitable outcome. In cases with trauma or congenital defects, this resorption is further increased. The term ‘localized alveolar ridge defect’ refers to volumetric deficit of bone and soft tissue within the alveolar process. The most commonly used classification for ridge defects is the Seibert’s nomenclature. Another classification was given by Allen that classifies the defects from Type A to Type C (Table 1).1,2 Various techniques for ridge augmentation include distraction osteogenesis, guided bone regeneration and piezosurgery. The distraction osteogenesis and piezosurgical techniques are more invasive techniques compared to guided bone regeneration (GBR) procedure. Guided bone regeneration is based on principles of guided tissue regeneration (GTR). Guided tissue regeneration was first developed in the early 1980s by Nyman et al.3 Melcher described the concept of selective cell repopulation of defects to enhance healing.4 Exclusion of fast-growing epithelium and connective tissue from a periodontal wound for 6 to 8 weeks allows the slower growing tissues, including osteoblasts, cementoblasts and periodontal ligament cells occupy the space adjacent to the tooth.3,5 Guided bone regeneration concept employed the same principles of specific tissue exclusion but was not associated with teeth. Thus, the term applied to this technique was GBR. This case report presents GBR procedure for management of alveolar ridge defects and its outcome after 6 months.

Principles of Guided Bone Regeneration

To achieve better clinical outcomes, the GBR barrier should possess the following properties:

Cell Exclusion

In GBR, the barrier membrane is used to prevent gingival fibroblasts and/or epithelial cells from gaining access to the wound site and forming fibrous connective tissue.

Tenting

The membrane is carefully fitted and applied in such a manner that a space is created beneath the membrane, completely isolating the defect to be regenerated from the overlying soft tissue.

Scaffolding

This tented space initially becomes occupied by a fibrin clot, which serves as a scaffold for the ingrowth of progenitor cells. In GBR, the cells will come from adjacent bone or bone marrow.

Stabilization

The membrane must also protect the clot from being disturbed by movement of the overlying flap during healing. It is therefore often, but not always, fixed into position with sutures or mini bone screws.
Where necessary, as in nonspace maintaining defects, such as dehiscence or fenestration, the membrane must be supported to prevent collapse.

CASE REPORT

An 18-year-old boy reported to the department of periodontics with the chief complaint of replacement of upper left front tooth. The patient gave the history of trauma 6 months back following that the tooth got avulsed. The patient was systemically healthy. On intraoral examination, upper left central incisor was found missing and ridge deficiency was also seen in the same region (Fig. 1). Ridge defect was combined horizontal and vertical (Seibert’s Class III). The 2-dimensional periapical radiograph of the patient showed that there was association of osseous defect comprising of differential bone loss in the same region (Fig. 2).

Later, comprehensive treatment plan was done, after 4 weeks of completion of phase I therapy, the case was scheduled for surgical procedure in anticipation of ridge augmentation. Full thickness flap was raised by giving crestal incision in the region of the missing tooth 21 and continued by giving sulcular incision to the adjacent teeth for proper accessibility (Fig. 3). After complete debridement and isolation, defect was found to be of both horizontal and vertical pattern falling under Siebert’s Class III classification of volumetric deficit of bone and soft tissue within the alveolar process (Fig. 3). An AlloplastBioGraft bone graft was placed into defect and care was taken not to overfill the defect and over the grafted area, resorbable guided tissue regeneration membrane (Periocol GTR) was stabilized by giving periosteal suturing (Figs 4 and 5). Finally flap was closed by simple interrupted sutures and periodontal dressing Coe-Pak was given over the surgical site (Figs 6 and 7). Postoperative instructions were given and

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<tr>
<td>Horizontal or buccal tissue loss with normal ridge height</td>
<td>Class I</td>
<td>Type B</td>
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<tr>
<td>Vertical tissue loss with normal ridge height</td>
<td>Class II</td>
<td>Type A</td>
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<tr>
<td>Combined horizontal and vertical bone loss</td>
<td>Class III</td>
<td>Type C</td>
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Table 1: Seibert’s and Allen’s classification of ridge defects

Fig. 1: Preoperative image showing ridge defect in 21 region
Fig. 2: Preoperative IOPAR of 21 region
Fig. 3: Mucoperiosteal flap reflection showing ridge defect
Fig. 4: Placement of bone graft (BioGraft HA)
also advised Amoxicillin (500 mg), three times daily for 5 days, and Ibuprofen (400 mg) thrice daily was prescribed for 3 days along with 10 ml of chlorhexidine (0.2%) mouthwash twice daily for 14 days.

The patient was recalled after 1 week for suture removal. Healing was satisfactory with no postsurgical complications. He was recalled after 1 and 6 months for further evaluation and maintenance showing appreciable improvement in ridge both vertically as well as labiolingually (Figs 8 and 9). Postoperative radiograph (6 months) also showed appreciable improvement in bone regeneration (Fig. 10). Then finally fixed prosthesis was given to the patient (Fig. 11).
DISCUSSION

The most commonly seen localized alveolar ridge defects are the combined Class III defects (56% of cases) followed by horizontal Class I defects (40% of cases). Vertical defects were reported to be found in 4% of the patients. Large vertical and horizontal bone defects pose a prosthodontic challenge as it is difficult to restore esthetics and function along with the complete closure of the defect. Such clinical conditions are not successfully treated by conventional fixed or removable prosthesis alone. Guided bone regeneration can be successfully used in either a simultaneous approach or a staged approach. Four prerequisites need to be fulfilled for predictable success with GTR: The structure of the membrane should not allow the penetration of cells through the membrane, which is an important factor for its success as a physical barrier. The use of an appropriate barrier membrane: The structure of the membrane leads to its contamination with bacteria from the oral cavity and frequently to an infection in the membrane site. Close adaptation is necessary to achieve a sealing effect to prevent the ingrowth soft tissue cells derived from the gingival connective tissue, because these cells are able to compete with bone-forming cells in the created space underneath the membrane. In addition, stabilization of the membrane is useful for maintaining close adaptation of the membrane to the bone during wound closure. The use of an appropriate supporting device is useful in surgical sites without an intact buccal bone wall for natural space making.

Autogenous bone grafts stabilize the blood clot, are biocompatible and absolutely safe from the standpoint of disease transmission, and have a good space maintaining capacity.

Additional factors important for achieving complication-free primary soft tissue healing are meticulous and careful handling of the soft tissues, precise wound closure with mattress and interrupted sutures, and appropriate postoperative treatment and medication. Mineralized and demineralized freeze-dried bone allografts have been utilized as a membrane-supporting device in ridge augmentation procedures with encouraging clinical results. For achieving predictable results, a sufficiently long healing period is important. Sites of early membrane removal attain less gain in bone height.

CONCLUSION

The guided bone regeneration procedure is a surgical procedure of choice for localized hard tissue ridge augmentation. A predictable result can be achieved if the prescribed surgical protocol is followed. However, the surgical procedure is technically demanding and requires a precise and systematic surgical technique. Furthermore, the method is not completely developed yet. Therefore, the GBR technique should be used with extreme care for predictable results.

REFERENCES