Surgical procedure for guided bone regeneration using resorbable membrane barrier for ridge augmentation in successful implant placement

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ABSTRACT

Objectives: Guided bone regeneration (GBR) is a widely used technique to augment alveolar ridge defects to allow implant placement and improve the final aesthetic outcomes of implant-supported restorations. Since the introduction of GBR, which is based on the theory of guided tissue regeneration, scientific evidence has demonstrated its effectiveness in regenerating lost bone. A biologically based technique must be used for clinical success and to avoid the occurrence of complications. This article will discuss a step-by-step surgical procedure for GBR using absorbable membrane barrier for ridge augmentation in implants. Materials and Methods: A full-thickness midcrestal incision is made between the teeth preserving the interdental papilla. The required osteotomy is then prepared, the 4.1 × 10 SLA Straumann implant is placed, and good primary stability is achieved. Following implant placement, GBR procedures are performed. A resorbable collagen membrane is then cut to the same shape as the template and placed over the surgical site. Results: The GBR using absorbable membrane barrier for ridge augmentation produces a dense bone, resulting in minimal or no bone loss when implants are placed into this bone. Conclusions: This GBR using absorbable barrier membrane for ridge augmentation in implants had several advantages over other techniques. One advantage is preserving the interdental papilla and providing sufficient advancement of the flap, which are very important for the success of GBR and for the success of implants placed. The second advantage is avoiding of second surgery for the removal of membrane even though the complications using resorbable membrane barrier may have been multifactorial. Therefore, meticulous surgical and restorative procedures are necessary to reduce the prevalence of complications.

Key words: Absorbable membrane barrier, guided bone regeneration (GBR), implant placement

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INTRODUCTION

Guided bone regeneration (GBR) is a well-documented and versatile procedure for regenerating bone, thereby allowing successful implant placement.[1]

The surgical procedure consists of placing an occlusive physical barrier between the connective tissue and the bone defect to prevent the migration of the epithelial and connective tissue cells into the defect and to stabilize the blood clot and graft. This allows the slower migrating osteogenic cells to proliferate and form new bone, thereby selectively repopulating the wound with osteoblasts prior to the migration of connective tissue and epithelial cells.[2]

This article will discuss a step-by-step surgical procedure for GBR using absorbable membrane barrier for ridge augmentation in implants.

Procedure
Step 1: The flap is designed in accordance with the following five principles.

a. Access to the bone defect
b. Maintenance of the blood supply of the elevated flap and the neighboring tissues
c. Preserving the interdental papilla
d. Providing the sufficient advancement of the flap
e. Allowing for tension-free primary closure

A full-thickness midcrestal incision is made between the teeth preserving the interdental papilla. Two full-thickness vertical incisions are made down to the bone on either side, starting in the area of the base of the vestibule and continuing coronally in one continuous cut to meet the crestal incision [Figure 1]. The vertical incisions are made trapezoidal with the base, widening apically to ensure an adequate blood supply and an easy coronal repositioning of the flap after augmentation with the graft material[3] [Figure 2].

The required osteotomy is then prepared, the 4.1 × 10 SLA Straumann implant is placed and good primary stability is achieved [Figure 3]. Following implant placement, GBR procedures are performed when the facial bone shows a concave morphology or the presence of dehiscence as shown in Figure 4.

Step 2: Recipient site preparation

The bony defect is debrided of granulation tissue and tissue tags, using curettes and back-action chisels. Cortical perforations (decortications) are then made with a #1 or #2 round bur using high speed with copious irrigation to create bleeding at the surgical site. The decortications are designed to increase the blood supply and osteogenic progenitor cell migration from the bone marrow to the site of augmentation[4] [Figure 5].

Step 3: Releasing incisions

Periosteal releasing incisions are made with a sharp 15 C blade on the inner apical portion of the flap,
creating a 2-3 mm split-thickness dissection [Figures 6 and 7]. These releasing incisions allow for better flap release and subsequent advancement of flap closure. Making these periosteal incisions allow easy access to the apical periosteum for stabilizing sutures [Figure 8]. This exposed apical periosteum will be used as anchorage for the membrane-stabilizing sutures [Figure 9].

Step 4: Graft materials and membrane placement

An autoclaved tinfoil is used as a template, fitted and trimmed to the ideal shape [Figure 10]. A resorbable collagen membrane is then cut to the same shape as the template and

Figure 4: Buccal view after implant placement with a bony defect on the buccal surface of the implant

Figure 5: Decortications of the surgical site to create bleeding

Figure 6: Periosteal releasing incisions creating a 2-3 mm split-thickness dissection using a new surgical blade

Figure 7: Split-thickness periosteal dissection

Figure 8: Split-thickness periosteal dissection helps advance the flap coronally without tension

Figure 9: The exposed periosteum is used as an anchorage for the membrane stabilizing sutures
placed over the surgical site [Figure 11]. Once the membrane is in the correct position, it is then adjusted to extend 2-3 mm beyond the augmented area.

The demineralized allograft bone (porous bone graft) is placed and condensed to fill the bone defect, ensure proper space maintenance and bone contact, and support the membrane [Figure 12].

Step 5: Stabilization of graft material and barrier membrane

Stabilization of the membrane and the underlying graft material is achieved by using horizontal mattress sutures extending from the apical portion of the facial periosteum to the palatal aspect of the flap [Figure 11]. To minimize the risk of irritation and infection on the palatal aspect, the suture knot is positioned and stabilized inside the flap and only 2-3 mm of suture is exposed palatally. Chromic gut suture is the material of choice as it is strong enough to stabilize flap,[5] absorbs in 10-14 days, and its monofilament structure limits plaque accumulation [Figure 13].

Step 5: Suturing to advance the flap coronally

To coronally advance the flap, a horizontal mattress suture is used to connect the inner middle portion of the buccal flap to the inner aspect of the palatal flap. On the facial aspect, the suture is placed to the depth of the tissue while not completely perforating through the flap. The periosteum is then coronally advanced together with the flap, allowing passive tension-free closure of the flaps [Figure 14].

Step 6: Suturing to ensure primary closure

Final tissue adaptation is achieved by means of multiple interrupted 4-0 chromic gut sutures, regularly spaced to close the incisions [Figure 15].

A provisional prosthesis is used when necessary to provide aesthetics and function for the patient and to protect the augmented site during healing. The healing phase of hard tissue augmentation procedures requires that no transmucosal pressure be placed on the grafted and/or regenerated ridge tissues or the implants themselves. A
fixed provisional restoration is recommended. However, in some cases a clasp partial removable denture can be used if it is properly adjusted to ensure no contact with the augmented area. A vacuum-formed shell can also be used and the missing teeth filled with acrylic or resin composite. The patient should be shown how to insert, remove, and clean any removable prosthesis.

RESULTS

The case has been evaluated after the procedure at 3 months [Figure 16], 6 months, and 9 months. It was found that GBR using absorbable membrane barrier for ridge augmentation produces a dense bone, resulting in minimal or no bone loss when implants are placed into this bone.

CONCLUSION

Understanding and utilization of proper incision design and flap advancement, releasing incisions, bone decortications, stabilization of the graft and membrane, tension-free primary closure of the flap, and postoperative patient compliance are crucial factors in obtaining predictable outcomes. This GBR using absorbable barrier membrane for ridge augmentation in implants had several advantages over other techniques.

One advantage was preserving the interdental papilla and providing sufficient advancement of the flap, which are very important for the success of GBR and for the success of implants placed.

The second advantage was avoiding of second surgery for the removal of membrane. In addition, complications such as membrane exposure, infection, graft particle leakage, collapse of grafted site, and excessive bleeding complications were minimal in this surgical technique even though complications using resorbable membrane barrier may have been multifactorial. Therefore, meticulous surgical and restorative procedures are necessary to reduce the prevalence of complications.

The GBR using absorbable membrane barrier for ridge augmentation produces a dense bone, resulting in minimal or no bone loss when implants are placed into this bone. The graft materials used in this procedure provide osteogenicity, osteoinductivity, and osteoconductivity. This can be absorbed as new bone formation occurs.

One can perform this technique in most of the implant cases. The technique will likely evolve over time so that different sized cortical bone pins and cortical bone chips are available for different situations.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES


