CASE REPORT

The use of a New Bone Graft Stabilizing Material for Ridge Augmentation

Khaled Ben Salah, Rohit Radhakrishnan

ABSTRACT

Patients often present for treatment with complete dentures or implants after alveolar ridge resorption has taken place. In such cases, clinicians are obligated to perform advanced augmentation procedures to reconstruct lost bone to aid in denture retention or to place implants in a prosthetically driven position. Procedures used to augment horizontal as well as vertical bone deficiencies include different types of bone grafts, usually in conjunction with a barrier membrane. The function of the barrier membrane is to stabilize the bone graft and to exclude epithelial and connective tissue cells from the healing area. In this report, we present the case of a male patient with an irregular alveolar ridge and a Seibert's class I ridge defect, who was treated successfully by alveoloplasty and localized ridge augmentation using a bovine bone graft mixed with a new stabilizing material, which did away with the stability problems of using bone grafts alone.

Keywords: Bone graft stabilizer, Ridge augmentation, Alveoloplasty.

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INTRODUCTION

Many patients who lose teeth to caries, periodontal disease or any other etiology fail to replace those teeth at the proper time. When they decide to seek replacement for their missing teeth, many of them present with ridge resorption. In such cases, clinicians are required to augment these resorbed areas to reconstruct lost bone. Ridge augmentation aids in denture retention or in placement of implants in prosthetically driven positions. Ridges showing horizontal, vertical and combined ridge deficiencies were classified by Seibert into class I, II and III respectively.[1] Over the years, different materials have been successfully used to augment both horizontal and vertical ridge deficiencies. These have included different types of bone grafts such as autogenous bone,[2-6] allografts[7-9] and alloplasts such as hydroxylapatite,[1,10-15] bioactive glass[16] and durapatite.[17] The use of combination bone grafts,[12,18,19] bone grafts with growth factors[8] and soft – tissue grafts[5,20,21] have also been reported. Of late, ridge augmentation using barrier membranes has become popular. Most studies have demonstrated successful ridge augmentation using barrier membranes in conjunction with bone grafts.[4,5,22-29] Barrier membranes alone[30] or in conjunction with tenting screws/pins[31,32] have also been used. Some authors have reported success using bone grafts with tenting screws/pins and barrier membranes.[33,35] A barrier membrane functions to stabilize any grafted material and provides more predictable bone fill of the defect by using the principle of guided bone regeneration.[36] Here, we present a case of preprosthetic ridge augmentation using a bovine bone graft stabilized by a calcium sulfate—containing material, in lieu of a barrier membrane.

CLINICAL REPORT

A male patient, 75 years of age, from Benghazi presented with a chief complaint of wanting to replace his missing teeth. Almost all of his teeth were extracted due to caries or periodontal disease over the years. He also explained that he had difficulty in chewing solid food, which was the main reason for his seeking treatment.

The maxillary arch was completely edentulous. In the mandibular arch, only teeth 31, 32 and 41 were present. On palpation, the anterior region of the maxillary arch was highly irregular, suggesting irregular topography of the underlying bone (Fig. 1). The mandibular arch was normal in this respect. A class I alveolar ridge defect[34] was present the maxillary right canine region (Fig. 1).

Maxillary and mandibular impressions were taken with alginate and study casts were fabricated in dental stone (Fig. 2). An OPG was taken to assess the feasibility of implant placement and to check for any other pathology. The

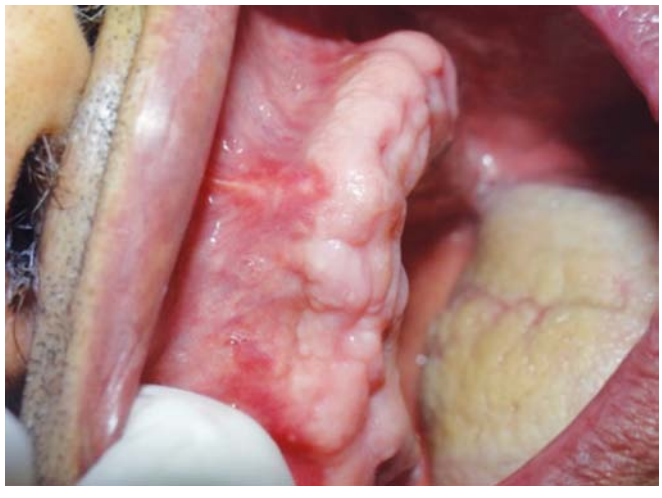

Fig. 1: Highly irregular maxillary residual ridge with class 1 ridge defect in the right canine region

proximity of the maxillary sinuses to the crest of the alveolar ridge ruled out implant placement. Remaining roots with tooth number 14 were seen. Routine blood investigations were also carried out; the reports of which were normal.

A comprehensive treatment plan was discussed with the patient, and approved by him. At the 1st visit, teeth 31, 32 and 41 were extracted under local anesthesia. At the 2nd visit, 2 weeks later, we decided to correct the bony irregularities and the Class I ridge defect in the maxillary right anterior region. After achieving adequate anesthesia by lidocaine (1:80,000), a crestal incision was made over the area using a No. 15 blade mounted on a BP handle. The incision was extended a little distal to premolar region in order to gain access to the remaining roots of tooth 14. A vertical releasing incision was given to facilitate access to the ridge defect. The tissue was elevated buccally and lingually with a periosteal elevator to expose the bone of the residual ridge and the site of the planned ridge augmentation. The topography of the bony ridge was highly irregular, with several incompletely filled extraction sockets (Fig. 3). Alveoloplasty was carried out with a bone file, smoothening out the bony irregularities as far as possible. Root pieces of tooth number 14 were located and extracted with root forceps. We had initially decided to correct the class I ridge defect using a bone graft and a GBR membrane, but we decided to use a bone graft and a new calcium sulfate - containing bone graft stabilizer (Calcigen) instead (Fig. 4), in order to evaluate its clinical efficacy. Small holes were drilled in the cortical bone of the defect site with a round steel bur mounted on a low speed handpiece to facilitate bleeding (Fig. 5). A bovine bone graft (Bioresorb) (Fig. 6) was mixed with the bone graft stabilizer powder and setting liquid (Calcigen) as per the manufacturer's instructions and placed onto the ridge defect, into the extraction socket of tooth 14 and into the other irregularities as deemed necessary (Fig. 7). After a few minutes, the material set like cement, and could not be easily displaced. There was no need for any additional stabilization in the form of a membrane. A periosteal

Fig. 2: Study cast of the maxillary arch showing class 1 ridge defect in the 13 region

Fig. 4: Calcigen bone graft stabilizer: powder and setting liquid

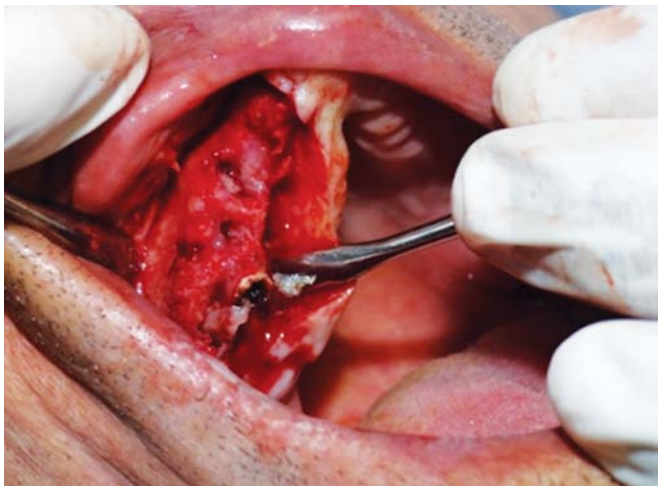

Fig. 3: Irregular topography of the residual ridge in the maxillary right anterior region. Note the presence of root pieces of 14

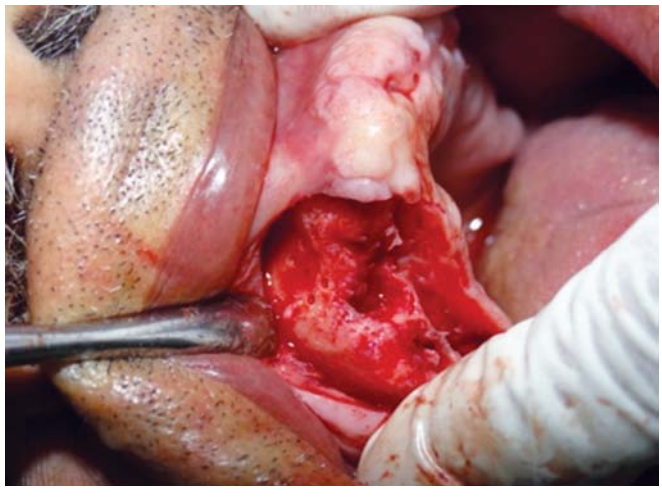

Fig. 5: Perforations made in the cortical bone of the defect site

releasing incision was given and the flaps were returned and sutured with anchor sutures in 3-0 black silk (Fig. 8). The patient was dismissed with instructions to take antibiotics and analgesics for 3 days and to rinse his mouth twice daily with a chlorhexidine mouthwash for 1 week. Ten days later, a similar surgical procedure was carried out to smoothen out the irregularities on the ridge in the maxillary left anterior region. No bone graft was used in this area.

Healing after the surgical procedures was uneventful. The sutures were removed 10 days after each surgical procedure. The class I ridge defect in the maxillary right canine region had been corrected, with gain in the buccolingual ridge width. No irregularities were found on palpation of the maxillary ridge and the grafted site felt stable and firm. After 6 weeks of completion of all the surgical procedures, impressions were made for complete dentures. After the necessary steps, the patient received his new complete dentures; the retention, stability and esthetics of which were satisfactory (Fig. 9).

DISCUSSION

Presently, ridge augmentation is usually carried out with the help of bone grafts covered by membranes to stabilize the bone graft and to achieve guided bone regeneration.[4,23,24,27,38] Tenting screws or pins are also used concurrently to prevent the membrane from collapsing into the defect.[31,33-35] Placement of a membrane and tenting screws or pins needs special training and may necessitate a second surgery to remove it, if a non – resorbable membrane is placed. Placing a bone graft over a class 1 ridge defect is relatively easy. Many authors have reported successful ridge augmentation using bone grafts alone.[1-3,7,10,12] Meijndert et al reported that that patients demonstrated improved function with their dentures after ridge augmentation using hydroxylapatite alone.[13] However, there is always a problem with possible displacement of the grafted material. Some authors suggested using acrylic stents[11,15] or red rubber urethral catheters[11] to stabilize the bone graft. Some authors solved the problem of graft displacement by using a fibrin

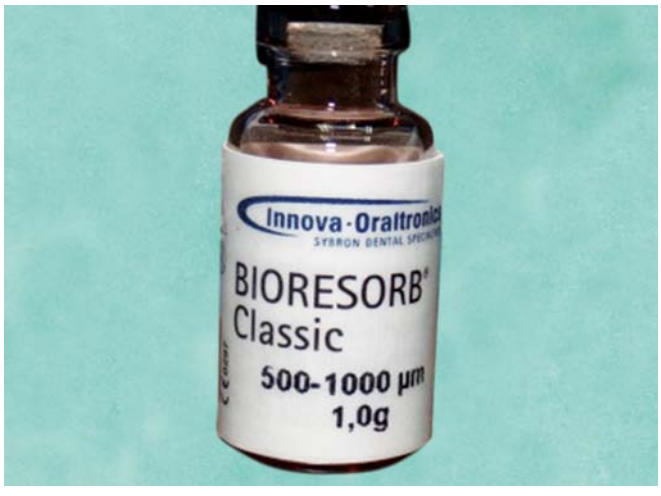

Fig. 6: Bovine bone graft material which was mixed with calcigen stabilizer

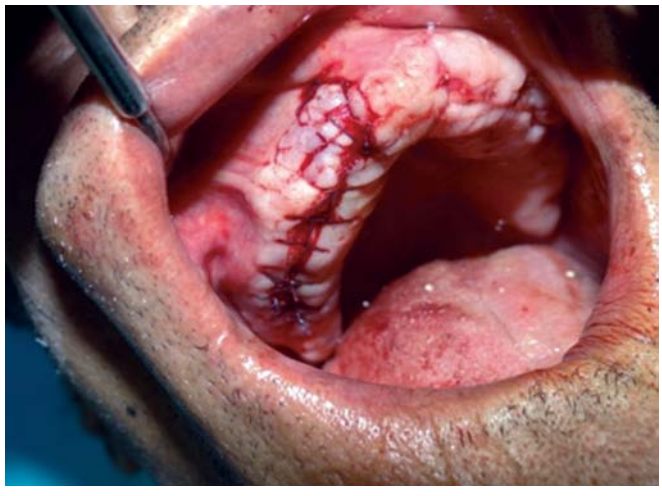

Fig. 8: Flaps sutured over the grafted material. Note the gain buccolingual ridge width in the defect area

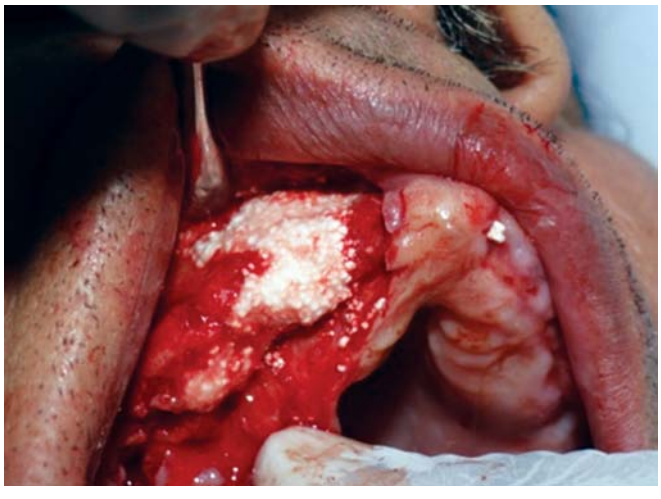

Fig. 7: Bone graft mixed with stabilizer placed onto the defect site

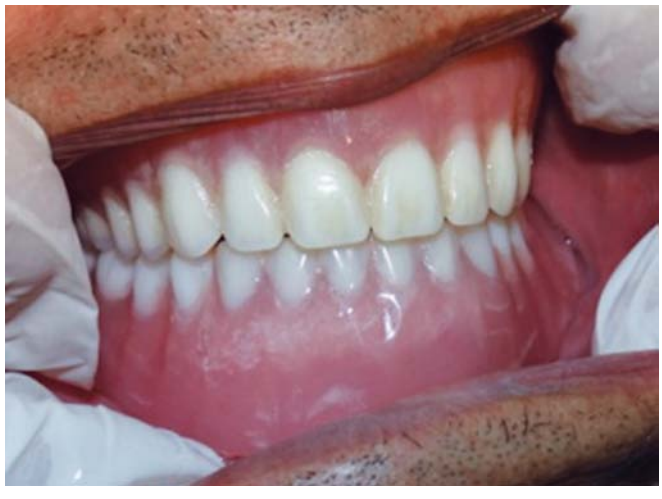

Fig. 9: Insertion of complete denture

adhesive mixed with the graft material.[37-39] Hotz observed that the use of a fibrin binder prevented the dislocation of graft granules during delivery and that the grafted material retained its shape until fibrous ingrowth was complete.[38] Another study reported that by mixing a fibrin adhesive with the bone graft material, the individual shape and situation of the graft was maintained, without any additional means of fixation. Even under functional load after 6 weeks, the shape of the grafted material remained unchanged. In our case, we successfully stabilized the bone graft (Bioresorb) by mixing it with a calcium sulfate stabilizer (Calcigen). Once the graft – stabilizer mix was placed into the defect, it set like cement within a few minutes and could not be displaced under digital pressure. Six weeks postoperatively, when impressions were taken for fabrication of complete dentures, the grafted site was stable and firm to palpation, with improvement in ridge contour and cosmetic appearance, indicating the clinical success of the procedure. We did not evaluate the success of the procedure from a radiographic or histologic point of view. Baker and Connole,[2] who used autogenous bone grafts alone for preprosthetic ridge augmentation, also emphasized evaluation of success by functional improvement, rather than radiographic evaluation. Barrier membranes prevent epithelium and connective tissue cells from migrating into the bone defect, thus allowing osteogenic cells to be established.[36] Murray and Roschlau pointed out that when a cavity with a source of osteoblasts (autogenous graft or osteoblasts from the prepared recipient site) and a blood supply was isolated from adjacent soft tissues, it could fill with bone, whereas if the space were not protected, it might fill with fibrous connective tissue.[40] By perforating the cortex prior to placement of the graft material, we provided a source of osteoblasts and blood cells for the grafted area. Thus, increasing the chances for bone fill. Mehlisch[18] used a combination of purified fibrillar collagen and hydroxylapatite for augmentation of deficient edentulous alveolar ridges. Twenty-four months later, ridge firmness was rated by prosthodontists as good to excellent. Histologically, the grafted material was surrounded by dense, fibrous connective tissue or trabeculae of woven or lamellar bone. In our case, the augmented area was stable, firm to palpation, with good contour and esthetics 12 months after the surgical procedure. This proves that clinically, the procedure was a success. It is our assumption, that histologically, the findings in our case would be more or less similar to those of Mehlisch[18] rather than to those of Doblin,[33] who reported the formation of dense, new, viable bone by using DFDBA with e-PTFE membranes and stainless steel bone pins. Reconstruction of deficient ridges with bone grafts alone has proved to be effective. However, resorption of up to 50% of the grafted volume over a 3 years period was reported by Ten Bruggenkate et al.[20] It is possible, that in our case, there may be some amount of reduction in the volume of the grafted area in a few years, but this remains to be seen.

SUMMARY

The ultimate goal of a ridge augmentation procedure is to form a bearing surface for the denture that will provide stability, retention and support. At the present time, 18 months after the procedure, the result of the ridge augmentation procedure is stable. This fact easily be verified on the most recent study cast of the patient's maxillary arch (Fig. 10). The patient's denture fits and functions well and is esthetically satisfactory. Clinical success with preprosthetic horizontal ridge augmentation is possible using this relatively simple and cost-effective technique of using a stabilizer mixed with a bone graft material, in lieu of a barrier membrane.

Fig. 10: Study cast made 1 year and 2 months postsurgically showing stable gain in ridge width

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