Case Report

IMPLANT INSERTION AND GUIDED BONE REGENERATION IN THE ANTERIOR UPPER JAW

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ABSTRACT

Anterior maxillary atrophy is characterized by the loss of bone in the front portion of the upper jaw, specifically the alveolar ridge bone. This atrophy can result from various factors, including tooth loss, periodontal disease, trauma, or developmental abnormalities. Dental implants may be challenging to place in the atrophic anterior maxillary due to insufficient bone volume and compromised anatomical conditions. Several treatment options are available to address anterior maxillary atrophy and restore both function and aesthetics. Bone augmentation procedures, such as bone grafting or guided bone regeneration, can be employed to rebuild the deficient bone volume. This paper describes a bone atrophy of the anterior upper jaw treated with implant insertion and guided bone regeneration.

KEYWORDS: *jaw maxilla, bone, regeneration, implant, membrane*

INTRODUCTION

Anterior maxillary atrophy is a condition characterized by the loss of bone in the front portion of the upper jaw, specifically the alveolar ridge bone (1-14). This atrophy can result from various factors, including tooth loss, periodontal disease, trauma, or developmental abnormalities. As the bone in the anterior maxillary region diminishes, it determines aesthetic and functional challenges, impacting a person's facial appearance, speech, and ability to wear dental prosthetics such as dentures or implants. One of the primary causes of anterior maxillary atrophy is the loss of teeth, which initiates a cascade of events leading to bone resorption.

This can result in a loss of vertical and horizontal bone dimensions in the anterior maxillary region, creating a concave or collapsed appearance. Periodontal disease is another significant contributor to anterior maxillary atrophy. The inflammation associated with periodontal disease can destroy the alveolar bone, which surrounds and supports the teeth. In severe cases, this bone loss can extend into the anterior maxillary region, exacerbating the atrophy. Trauma to the upper jaw, such as fractures or injuries sustained in accidents, can also contribute to anterior maxillary atrophy. Trauma can damage the bone structure, leading to compromised stability and eventual resorption. Additionally, developmental abnormalities or congenital conditions may result in inadequate bone formation in the anterior maxillary region, predisposing individuals to atrophy.

The consequences of anterior maxillary atrophy extend beyond mere aesthetic concerns. The loss of bone in this region can pose significant challenges for dental rehabilitation. Traditional removable dentures may not fit securely in a resorbed maxillary ridge, leading to issues with stability, retention, and discomfort for the patient. Dental implants may also be challenging to place in the atrophic anterior maxillary bone due to insufficient bone volume and compromised anatomical conditions.

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Several treatment options are available to address anterior maxillary atrophy and restore both function and aesthetics. Bone augmentation procedures, such as bone grafting or guided bone regeneration (GBR), can be employed to rebuild the deficient bone volume.

GBR is a dental surgical technique designed to augment the volume of bone in areas where it is deficient (15-17). The primary goal of GBR is to create a conducive environment for the regeneration of bone, enabling the placement of dental implants or improving the stability of existing teeth. The procedure involves using barrier membranes, typically made of biocompatible materials, to physically separate the bony defect from surrounding soft tissues, preventing the infiltration of non-osteogenic cells. This exclusion allows space for bone-forming cells, such as osteoblasts, to populate the area and initiate the regeneration process. The barrier membrane serves as a scaffold, guiding bone growth and preventing unwanted tissue ingrowth. Additionally, GBR may involve using bone grafts or substitutes to further support and enhance the regeneration process.

Autografts (bone harvested from the patient), allografts (donor bone from another individual), xenografts (bone from another species), or synthetic bone graft materials may be utilized, depending on the specific requirements of the case. GBR has become a valuable tool in implantology, and it addresses challenges associated with insufficient bone volume for successful implant placement. The technique has demonstrated effectiveness in promoting bone growth and enhancing the long-term stability of dental implants, ultimately contributing to improved patient outcomes and satisfaction (15-17). We reported a case of bone atrophy of the anterior upper jaw treated with implant insertion and GBR.

CASE REPORT

A male patient 36-year-old presented to our dental clinic complaining about his prosthetic rehabilitation. Teeth 11 and 21 appear very disproportionate to the smile line (Fig. 1). After removing the fixed prosthetics, tooth 11 and an implant in site 22 appeared (Fig. 2).

The patient presented moderate bone atrophy in the anterior maxilla. In agreement with the patient, it was decided to replace the fixed prostheses with implant-prosthetic rehabilitation. The patient underwent a cone-beam computed tomography scan and orthopantomography. Before surgery, the patient was informed about the operative risk and complications, and written consent was obtained from the patient for publication of this case report and accompanying images. Rehabilitative surgical treatment was planned and assessed with the use of heterologous bone, reinforced membrane, and insertion of the implants in the atrophic maxilla to achieve bone height and width.

Fig. 1. *Teeth 11 and 21 appear very disproportionate to the smile line.*

Fig. 2. *After removing fixed prosthetics, tooth 11 and an implant in site 22 appeared.*

After local anesthesia with articaine, the mucosa was incised and detached. Subsequently, 2 implants were positioned in sites 11 and 21 (Fig. 3). Heterologous bone (Geistlich Bio-Oss® Thiene VI, Italy) was then placed around the implants (Fig. 4). A resorbable membrane (Geistlich Bio-Guide® Thiene VI, Italy) covered bone graft and was fixed with mini-screws (Fig. 5). The resorbable membrane was then fixed palatially, after detaching the mucosa of the palate (Fig. 6). Thereafter a connective pedunculate flap was raised from the right side of the palate in the area of molar and premolar and rotate anteriorly (Fig. 7). It was stitched medially to cover the resorbable membrane (Fig. 8, 9)

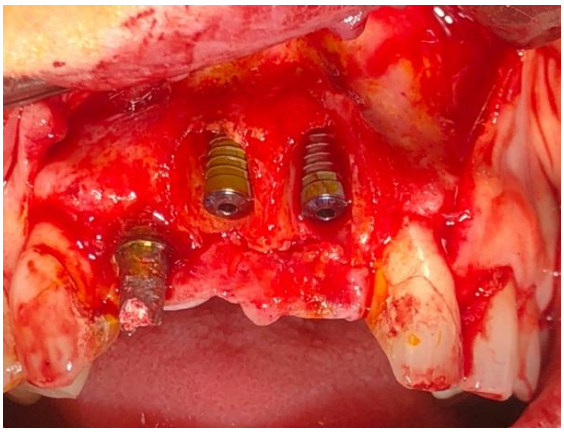


Fig. 3. *Implants positioned in sites 11 and 21.*

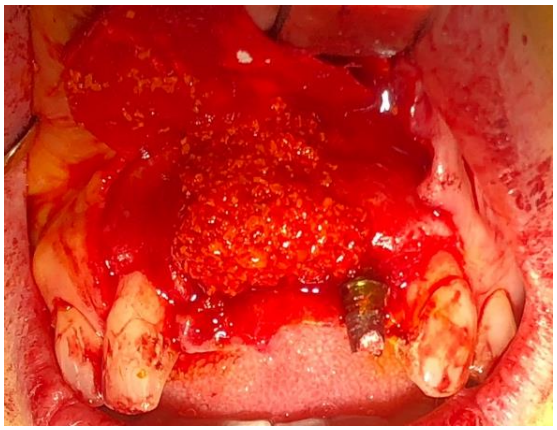


Fig. 4. *Heterologous bone placed around the implants.*

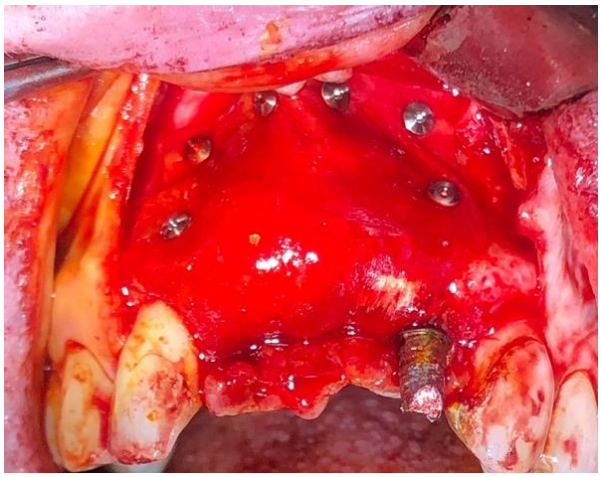


Fig. 5. *Resorbable membrane fixed on vestibulum.*

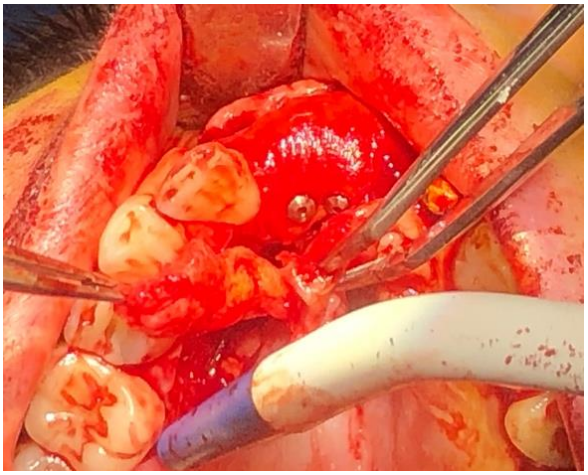
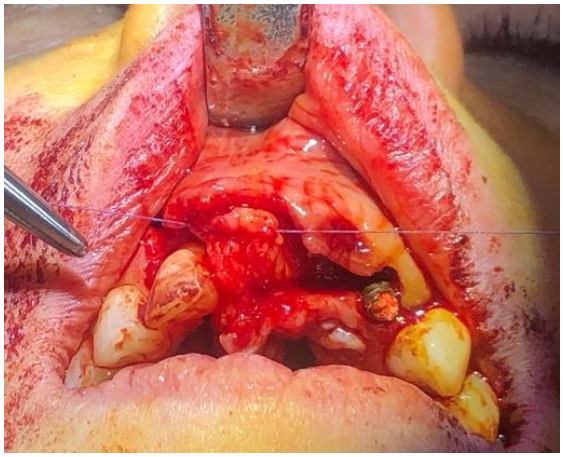


Fig. 6. *Resorbable membrane fixed on the palate with miniscrews.*

Fig. 7. *A connective tissue flap from the palate was rotated anteriorly.*



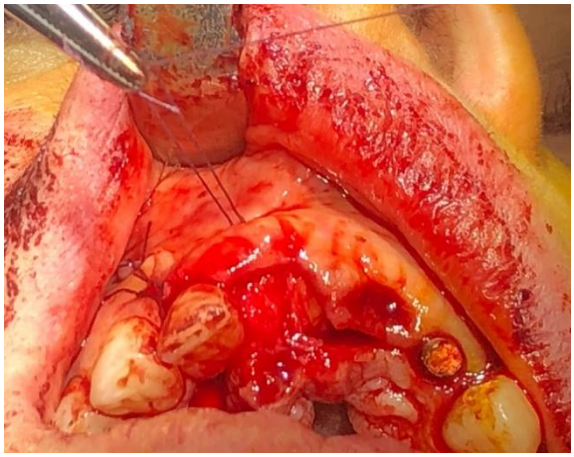


Fig. 8, 9. *A connective tissue flap was fixed to cover the resorbable membrane.*

Finally, the mucosa was completely sutured with absorbable transmucosal stitches (Fig. 10, 11).

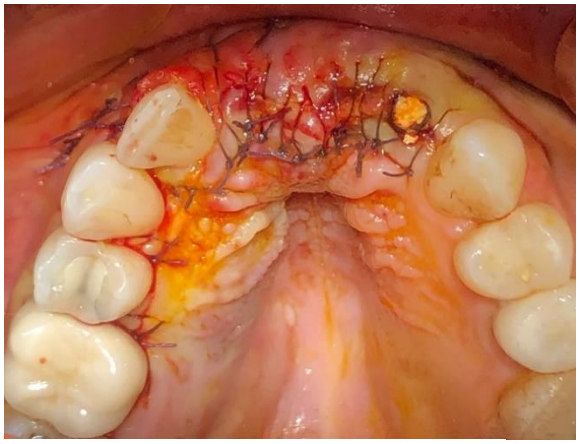


Fig. 10. *Occlusal view of the mucosa completely sutured with absorbable stitches.*

Fig. 11. *Frontal view of the sutured surgical field.*

A temporary fixed prosthesis was cemented while awaiting the healing of the soft and hard tissues (Fig. 12)

Fig. 12. *Frontal view of the temporary fixed prosthesis.*

DISCUSSION

Anterior maxillary atrophy is a condition characterized by the loss of bone in the front portion of the upper jaw, specifically the alveolar ridge bone (1-14). The loss of bone in this region can pose significant challenges for dental rehabilitation. Several treatment options are available to address anterior maxillary atrophy and restore both function and aesthetics.

First, several biomaterials were investigated. Kamadjaja et al. (1) evaluated the stability of tissue augmented with deproteinized bovine bone mineral (DBBM) particles associated with implant placement in the anterior maxilla. They verified that horizontal ridge augmentation using DBBM particles related to implant placement in the anterior maxilla produces good clinical stability. The stability appears higher in immediately inserted fixtures than those inserted in a second stage. Caramês et al. (2) focused on a composite PRF/particulate xenograft used for GBR. By using computer beam computer tomography scans obtained at pre-surgery, post-surgery, and the 12-month follow-up. Authors showed that PRF associated with a xenograft aid to promote an effective horizontal bone gain.

de Freitas et al. (3) compared the effect of recombinant human bone morphogenetic protein-2 (rhBMP-2) in an absorbable collagen sponge carrier (ACS) with autogenous bone graft for augmentation of the edentulous atrophic anterior maxilla. The alveolar ridge dimension was assessed using an analogue caliper and cone-beam computed tomography. The authors found a positive effect of rhBMP-2 for GBR. Moussa et al. (4) investigated the effect of platelet-rich fibrin (PRF) added to autologous graft on the augmentation results of autogenous palatal bone blocks. They found that autogenous palatal bone block surface resorption is significantly decreased using PRF coverage.

To cover alveolar ridge augmentation, specific flap or connective grafts were investigated. Yu et al. (5) introduced a novel method of split-thickness labial flap in maxillary anterior ridge horizontal augmentation. The authors found that the flap advancement technique facilitates clinically passive primary closure. This technique can be used successfully in both particulate and onlay horizontal graft procedures. Kirmani et al. (6) reported a single-staged ridge split approach using piezoelectric surgery with simultaneous implant placement followed by connective tissue grafting at second-stage surgery. The single-staged segmental ridge split technique reduces not only the total treatment duration but also the surgical morbidity of the patient. A subepithelial connective tissue graft is strongly advocated around implants as it is highly predictable while ensuring better esthetic results in terms of tissue color, texture, and long-term stability of the surrounding mucosa. Canullo et al. (7) presented a series of patients treated with tooth extraction and single-implant placement in the anterior maxilla. The horizontal bone deficiency was treated with beta-tricalcium phosphate and a bioresorbable polylactic acid membrane. Primary closure was obtained by a novel coronally advanced flap adapted from mucogingival techniques. Authors concluded that GBR using a bioresorbable polylactic acid membrane and resorbable beta-tricalcium phosphate bone graft in conjunction with a coronally advanced flap is a predictable procedure for horizontal bone augmentation with simultaneous implant placement in the esthetic area.

Some studies investigated implant survival/success rate and GBR bone stability. Kuchler et al. (8) did a systematic revision of clinical studies examining the survival and success rates of implants in horizontal ridge augmentation, either prior to or in conjunction with implant placement in the anterior maxilla. They found that staged and simultaneous augmentation procedures in the anterior maxilla are both associated with high implant success and survival rates. Jiang et al. (9) performed a clinical study to evaluate hard tissue volume stability during the healing stage of GBR with particulate bone graft and resorbable collagen membrane, showing that GBR partially undergoes horizontal volume reduction during the healing stage. Chen et al. (10) evaluated the buccal bone thickness of immediate implant placement with buccal bone augmentation in patients with a thin buccal plate in the esthetic zone. A clinical trial was done on eighteen consecutive patients requiring a single tooth replacement. Authors found that simultaneous buccal bone augmentation may maintain a predictable buccal bone thickness for immediate implant placement in the maxillary anterior sites with a thin buccal plate (<1 mm) at 1-year follow-up after final restoration. The tentpole procedure has also been positively applied for anterior maxillary regeneration. Guillen et al. (11) compared horizontal bone augmentation in the anterior maxilla associated with two types of tenting screws used in the screw tent-pole technique. Both kinds of screws produced positive results.

Titanium mesh alone or in combination with biomaterials was used to perform alveolar crest regeneration. Deshpande et al. (12) presented a successful case of vertical and horizontal ridge augmentation in the anterior maxilla using autograft, xenograft, and titanium mesh with simultaneous placement of implants. Alagl et al. (13) described a patient who presented with a localized, combined, horizontal, and vertical ridge defect in the anterior maxilla. The patient was treated using titanium mesh and alloplast material mixed with a nano-bone graft to treat the localized ridge deformity

for future implant installation. Ribeiro Filho et al. (14) studied the use of titanium mesh and recombinant human bone morphogenetic protein 2 (rhBMP-2) for the repair of major bone defects in the alveolar bone. They found that the combination of rhBMP-2 and titanium mesh provided effective augmentation of the atrophic anterior maxilla prior to implant placement.

In our case report, we used a GBR technique: heterologous bone associated with a resorbable membrane fixed with mini screws for bone augmentation. We used a resorbable membrane in this case report since it has several advantages. Resorbable membranes are typically made from materials like collagen or synthetic polymers, which are well-tolerated by the body. Since resorbable membranes break down over time, there's no need for a second surgery to remove them. Resorbable membranes minimize the risk of infection associated with long-term membrane exposure. They promote guided tissue regeneration by maintaining space for bone growth while gradually resorbing. Clinicians find them easier to manipulate during surgery due to their flexibility.

On the other hand, the disadvantages of resorbable membranes must be considered. The rate of resorption can vary among patients, affecting the duration of membrane function. Resorbable membranes may lack the structural integrity of non-resorbable ones, potentially leading to membrane collapse. If resorption occurs too quickly, it can expose the graft site prematurely. Resorbable membranes tend to be more expensive than non-resorbable alternatives. Some patients may experience mild inflammation during resorption.

CONCLUSIONS

GBR involves the use of barrier membranes to guide the growth of new bone at sites where bone volume is deficient. It is commonly applied in implant dentistry to enhance bone quality and quantity for successful implant placement. GBR aims to create a favorable environment for bone regeneration by preventing soft tissue infiltration into the defect site and allowing osteogenic cells to populate the area. GBR may be successful if some guidelines are followed: proper case selection, adequate primary stability of the membrane, good wound closure, and patient compliance during the healing phase. GBR is a valuable technique in implant dentistry, allowing predictable bone regeneration and successful implant outcomes.

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