Case Report

GUIDED BONE REGENERATION FOR TREATING POSTERIOR MANDIBULAR ATROPHY: A CASE REPORT OF EXCEEDING THIN CREST

L. Tomaselli

Private practice, Bologna, Italy

Correspondence to:
Luigi Tomaselli, DDS, MS
Private practice,
Via Azzurra 26,
40138 Bologna, Italy
e-mail: gigitomaselli@gmail.com

ABSTRACT

Oral rehabilitation of mandibular atrophy involves restoring function and aesthetics to patients who have experienced significant bone loss. This condition, often resulting from tooth loss, aging, or systemic diseases, presents challenges for dental practitioners. Effective rehabilitation requires a combination of surgical and prosthetics. In this case report, we offered a surgical solution with bone grafts, membrane use, and insertion of dental implants in one surgical step, improving patients' ability to chew, speak, and smile confidently.

KEYWORDS: *atrophic, mandible, posterior, ridge, augmentation, onlay, graft, implants*

INTRODUCTION

Oral rehabilitation of mandibular atrophy (ORMA) involves restoring function and aesthetics to patients who have experienced significant bone loss. This condition, often resulting from tooth loss, aging, or systemic diseases, presents challenges for dental practitioners. Effective rehabilitation requires a combination of surgical, prosthetic, and sometimes regenerative techniques to ensure successful outcomes (1-2).

Mandibular atrophy is the progressive resorption and loss of alveolar bone in the lower jaw. This condition can lead to several complications, such as reduced bone volume (a significant decrease in bone height and width, complicating the placement of dental implants) and changes in jaw shape and structure that can affect facial aesthetics and function. Finally, due to lack of support, mandibular atrophy can lead to functional impairment, such as difficulty in chewing, speaking, and maintaining oral prostheses (3).

The etiology of mandibular atrophy is mainly related to tooth loss. Other conditions could be systemic diseases and periodontitis. Tooth loss is the most common cause, where loss of mechanical stimulation from teeth accelerates bone resorption. Natural bone loss associated with aging processes can also provoke mandibular atrophy. Diseases such as osteoporosis can reduce bone density throughout the body, including the mandible. Chronic gum disease can lead to the destruction of supporting bone around teeth (4).

A comprehensive diagnostic assessment is essential for planning ORMA. Evaluating the patient's oral health, assessing soft tissue conditions, and identifying existing dental issues are crucial for planning oral rehabilitation. Panoramic radiographs and cone-beam computed tomography (CBCT) provide detailed views of bone structure, density, and the location of vital anatomical structures such as the mandibular nerve. Reviewing the patient's systemic health to identify any factors that might affect bone regeneration or surgical outcomes is mandatory.

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ORMA typically involves a multidisciplinary approach combining surgical and prosthetic interventions. Bone augmentation can be assessed using bone grafting, guided bone regeneration (GBR), and distraction osteogenesis (5). Bone grafts can be harvested in different ways: autogenous bone grafts (from the patient's own body), allografts (from a donor), xenografts (from another species), or synthetic materials. GBR is a method used for bone augmentation. GBR uses barrier membranes to direct the growth of new bone and prevent the invasion of soft tissues into the graft site (6). Instead, distraction osteogenesis is a process where the bone is gradually lengthened by surgically cutting the bone and then slowly separating the two segments, allowing new bone to form in the gap (7).

Dental implants are a cornerstone of ORMA, providing stable support for prosthetic teeth. Titanium or zirconia implants are surgically placed into the augmented bone. Accurate preoperative planning and imaging are crucial to avoid complications, especially with the mandibular nerve. Once osseointegration is achieved, various prosthetic options can be used, including single crowns, bridges, and full-arch prostheses (8). Prosthetic rehabilitation involves designing and fitting dental prostheses to restore function and aesthetics. Partial or complete dentures are often used when bone augmentation is not feasible or as an interim solution before implant placement. Implant-supported crowns and bridges permanently fixed in the mouth provide a more stable and natural-feeling solution than removable prostheses.

ORMA requires a patient-centered approach. ORMA must be tailored to the specific needs, anatomy, and health conditions of each patient, and the procedures, benefits, risks, and maintenance requirements of the prosthetic solutions must be understood. Regular monitoring and maintenance are needed to ensure the longevity and functionality of implants and prostheses. A case of exceeding atrophy of the posterior mandible is described here, treated in one surgical step using fixtures, heterologous mixed with autologous bone and covered with a non-resorbable-reinforced membrane.

CASE REPORT

A 58-year-old female presented to the dental office with complaints, including chewing difficulty and aesthetic dissatisfaction, owing to the absence of dental elements. The anamnesis revealed a frustrated rehabilitation attempt approximately 10 years previously with a partial prosthesis. As time went by, bone resorption occurred. The patient underwent a CBCT scan and orthopantomography. Clinical and radiographic examinations revealed severe mandibular atrophy (Fig. 1).

Fig. 1. *Endo-oral photos showing posterior partial edentulous mandible and an exceeding thin ridge.*

Rehabilitative surgical treatment was planned and assessed using 50% heterologous/autologous bone, reinforced membrane, and insertion of the implants in both the edentulous areas to achieve bone height and avoid mandibular fracture (Fig. 2-5).

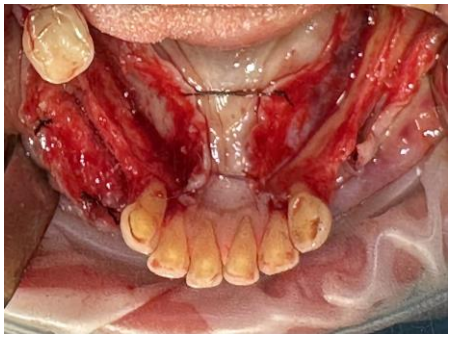

Fig. 2. *Mandibular posterior crest after detachment of mucosa and periosteum. The residual mandibular ridge appears very thin.*

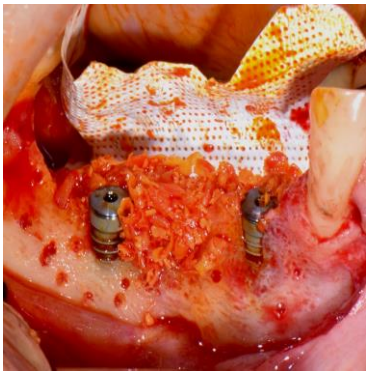

Fig. 3. *Insertion of dental implants covered with 50% heterologous/autologous bone and reinforced membrane.*

Fig. 4. *Lateral view of reinforced membrane stabilized with mini screws both in the lingual and vestibular side.*

Fig. 5. *Occlusal view of two reinforced membranes stabilized with mini screws.*

Finally, the soft tissues were removed by horizontal cutting in the periosteum to reach an elongation and a passive repositioning of flaps and then sutured (Fig. 6).

Fig. 6. *The mucous membrane is tight sutured at the end of surgery.*

The postoperative medication protocol consisted of antibiotics (amoxicillin 500 mg every 8 hours for 7 days), corticosteroids (dexamethasone 4mg every 12 hours for 3 days), anti-inflammatory and analgesic drug (ibuprofen 600 mg every 12 hours for 5 days), for treatment of pain or swelling. During the postoperative period, the patient reported mild-to-moderate pain for the first few days, with no progression of the condition. After 10 postoperative days, the sutures were removed (Fig. 7). Six months after surgery, the oral mucosa appeared healed (Fig. 8).

Fig. 7. *Removal of stitches 10 days after surgery. The mucosa appears perfectly healed.*

Fig. 8. *Clinical appearance of the mandibular mucosa 6 months after surgery. Note the reduced quantity of keratinized gingival on the top of aveolar ridge.*

Once the mucosa was healed, a fornix lengthening was performed by doing a sovra-periosteal flap and stretching the mobile gingiva in the lower part of the vestibule. Then, keratinized mucosa was collected from the palate and grafted bilaterally on the regenerated alveolar crest (Fig. 9-11).

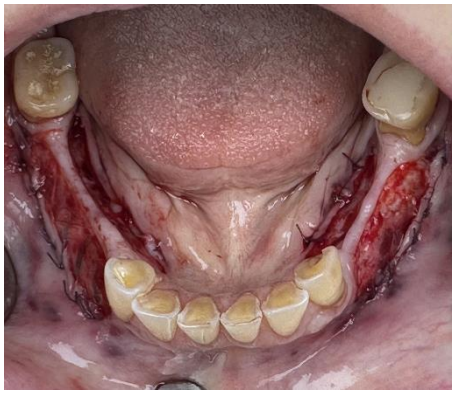

Fig. 9. *Deepening of the vestibular and lingual fornix by doing a sovra-periosteam flap sutured on lower part of vestibular and lingual ridge.*

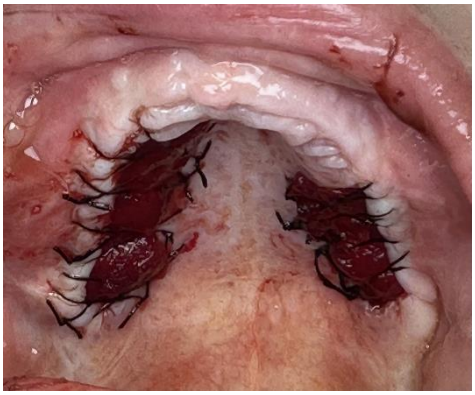

Fig. 10. *Palatal dome where keratinized mucosa was collected.*

Fig. 11. *Keratinized mucosa bilaterally sutured on alveolar ridge.*

Two months later, the implants showed a good amount of alveolar bone (Fig. 12). The good quality of mucosa obtained by the augmentation done two months before was sutured around healing pillars. The sequence of soft tissue augmentation is visible in Fig. 13.

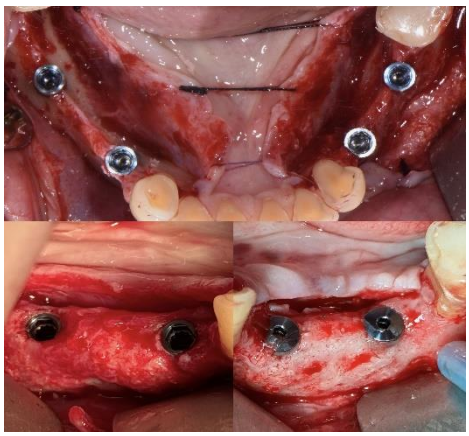

Fig. 12. *Comparison of bone dimension between pre- and 6 months post-regenerative procedure of posterior alveolar ridge.*

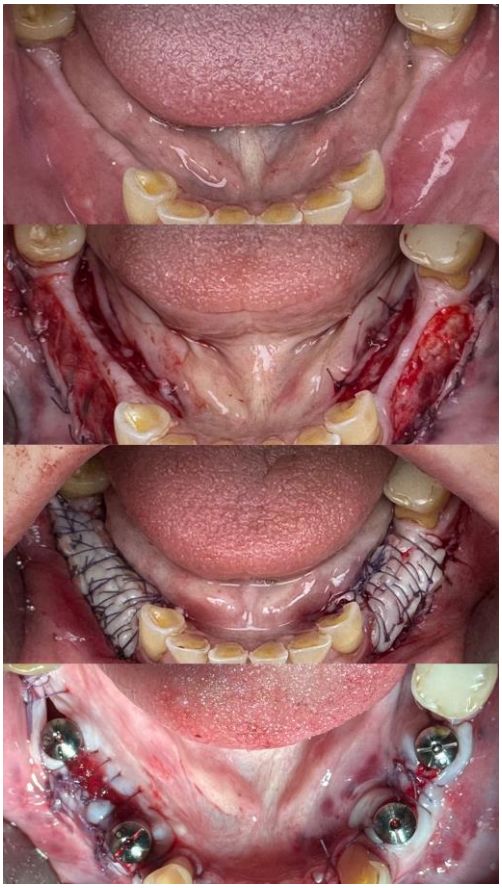

Fig. 13. *Comparison of soft tissue dimension between pre- and 2 months post-grafting procedure of posterior alveolar ridge (soft tissue).*

Then implants were prosthetically rehabilitated after one month of soft tissue healing around screws (Fig. 14). The follow up was uneventfully 3 years post-finalization of the case (Fig. 15, 16).

Fig. 14. *Peri-implant soft tissue healing at the time of digital impression.*

Fig. 15. Crown *#34-35-36.*

Fig. 16. *Crown #44-45-46.*

DISCUSSION

ORMA presents a significant challenge in modern dentistry. When severe atrophy makes the jaw unsuitable for dental implant placement, ORMA is necessary for replacing missing teeth.

Causes of mandibular atrophy could be tooth loss, trauma, denture wear, and periodontal disease. When teeth are extracted, the alveolar bone no longer receives the stimulation necessary to maintain its dimension, leading to gradual resorption of the bone over time. Fractures or injuries to the jaw can disrupt bone growth and healing, leading to localized atrophy. Ill-fitting dentures can put excessive pressure on the jawbone, accelerating resorption. Severe gum disease can damage the alveolar bone, contributing to atrophy. Certain medical conditions and medications can also contribute to bone loss in the jaw.

Consequences of mandibular atrophy are difficulty chewing, facial collapse, speech impediments, and social and psychological impact. Reduced jawbone volume can weaken the bite force, making it difficult to chew certain foods. Atrophy can alter facial contours, leading to a sunken appearance. Changes in jaw structure can affect speech patterns. The consequences can significantly impact a patient's quality of life and self-esteem.

Bone grafting offers a viable solution for restoring bone volume and enabling dental implant placement. The procedure involves transplanting bone tissue to the atrophied site, stimulating new bone growth, and creating a strong foundation for implants (9). However, bone block grafts require a second surgical field to be collected, which augments the operation time and surgical risks. Consequently, today GBR is the most used surgical technique.

From a general point of view, there are three main types of bone graft materials used: autogenous bone graft (from the patient’s own body), allograft (from a donor), and xenograft (from another species). Autogenous bone graft involves harvesting bone from another location in the patient's body, typically the chin, hip, or iliac crest. It offers the advantage of optimal biocompatibility and vascularization. Allograft bone utilizes bone tissue donated from a cadaver. Allografts are readily available and require minimal donor site morbidity but carry a small risk of disease transmission. Xenograft uses bone tissue derived from animals, most commonly cows. Xenografts are readily available and require no additional surgery for harvest (10). Here a 50% mixture of heterologous/autologous bone was used with optimal bone regeneration.

The choice of bone graft material and surgical technique depends on the severity of atrophy, the desired implant placement, and the patient's overall health. Mandibular bone grafting procedures are typically performed under local anesthesia on an outpatient basis. Healing time varies depending on the extent of the surgery but generally takes from 6 to 9 months. The reported case is an example that adds additional strength to this surgical technique. A rigid protocol is mandatory to reach successful results.

CONCLUSIONS

ORMA presents a significant challenge in implant dentistry. However, GBR offers a reliable and effective solution for restoring jawbone volume and enabling implant placement. By utilizing the appropriate graft material and

surgical approach, dentists can create a strong foundation for successful dental implants, improving patients' ability to chew, speak, and smile confidently.

ORMA is a complex but highly rewarding process that can significantly improve the quality of life for affected patients. Advances in surgical techniques, bone regeneration methods, and dental implant technology have greatly enhanced the success rates of these treatments. A multidisciplinary approach, meticulous planning, and patient-centered care are essential for optimal functional and aesthetic outcomes.

REFERENCES

1. Chiapasco M, Zaniboni M, Boisco M. Augmentation procedures for the rehabilitation of deficient edentulous ridges with oral implants. *Clin Oral Implants Res.* 2006;17(Suppl 2):136–59.
2. Clementini M, Morlupi A, Agrestini C, Ottria L. Success rate of dental implants inserted in autologous bone graft regenerated areas: a systematic review. *Oral Implantol (Rome).* 2011;4(3–4):3–10.
3. Dahlin C, Johansson A. Iliac crest ABG versus alloplastic graft and guided bone regeneration in the reconstruction of atrophic maxillae: a 5-year retrospective study on cost-effectiveness and clinical outcome. *Clin Implant Dent Relat Res.* 2011;13:305–10.
4. Misch CE, Perel ML, Wang HL, Sammartino G, Galindo-Moreno P, Trisi P. Implant success, survival, and failure: the International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference. *Implant Dent.* 2008;17(1):5–15.
5. Carinci F, Farina A, Zanetti U, Vinci R, Negrini S, Calura G, Laino G, Piattelli A. Alveolar ridge augmentation: a comparative longitudinal study between calvaria and iliac crest bone grafrs. *J Oral Implantol.* 2005;31(1):39–45.
6. Liu J, Kerns DG. Mechanisms of guided bone regeneration: a review. *Open Dent J.* 2014; 8:56–65.
7. Sakkas A, Wilde F, Heufelder M, Winter K, Schramm A. Autogenous bone grafts in oral implantology—is it still a “gold standard”? A consecutive review of 279 patients with 456 clinical procedures. *Int J Implant Dent.* 2017; 3:23.
8. Garg AK. Bone biology, harvesting, & grafting for dental implants: rationale and clinical applications. *IL: Quintessence Publishing*; 2004.
9. Vermeeren JI, Wismeijer D, van Waas MA. One-step reconstruction of the severely resorbed mandible with onlay bone grafts and endosteal implants. A 5-year follow-up. *Int J Oral Maxillofac Surg.* 1996;25(2):112–5.
10. Kang YH, Kim HM, Byun JH, Kim UK, Sung IY, Cho YC, Park BW. Stability of simultaneously placed dental implants with autologous bone grafts harvested from the iliac crest or intraoral jawbone. *BMC Oral Health.* 2015; 15:172.