Horizontal Ridge Augmentation in Class III Alveolus Defect According to the Elian and Tarnow Classification

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ABSTRACT

Guided bone regeneration (ROG) is the process of reconstructing bone defects. The size of the alveolar ridge can be affected by loss of alveolar bone due to trauma or periodontal disease. In this case report, horizontal ridge augmentation with a xenograft and resorbable collagen membrane was used to restore anterior bone loss in a 69-year-old patient with stage IV generalized periodontitis, stage B periodontitis and stage III alveolar defects according to Elian and Tarnow. Treatment consisted of the extraction of the affected teeth. The results obtained over six months showed an increase in the horizontal ridge of 4.8 mm, demonstrating the efficacy of ROG in alveolar defects. Finally, the results of this case highlight the potential of ROG for horizontal flanges.

Keywords: Alveolar defect, bone crest augmentation, collagen membrane, guided bone regeneration.

1. Introduction

Periodontal regeneration is a tissue regeneration process using biomaterials such as polytetrafluoroethylene, polyglactin, polylactic acid, calcium sulfate, and collagen to increase bone mass [1]. Loss of alveolar bone after tooth extraction caused by dental injury, bone damage, periapical pathology, or periodontal disease. After tooth extraction, the dimensions of the alveolar ridge are changed due to absorption of the bone of the crest [2], [3]. The presence or absence of hard and soft oral tissues [4], [5] affects the quality of the alveolar bone. This has been a challenge in the selection of treatment options. The Elian and Tarnow classification is a guideline for making decisions about the type of treatment and biomaterial selection, focusing on the condition of the alveolus after extraction. There are three types.

Type I alveoli maintain a normal bone table and vestibular soft tissues. Type II is characterized by the loss of the bone table in the oral cavity. In type III, the facial soft tissues and the vestibular table are significantly reduced [4]. Changes in the structure of the vestibular skeleton bone surface affect aesthetics and are the cause of dental implant complications [6]. To treat this type of alveolar defect, it is recommended to follow the Tolstunov decision table, which describes the basic algorithm of the type of treatment to be performed, recommending the use of absorptive barriers and bone allografts for horizontal defects [7], [8].

The application of ROGs in horizontal defects is determined by the specific shape of the defect. Angiogenesis and adequate blood supply play a key role in the effective promotion of bone regeneration [4], [9]. Combinations of barrier membranes and bone graft substitutes have become the most common clinical procedures. The membranes, which are created from soft tissue, are supplemented with bone graft substitutes that prevent membrane collapse and act as a three-dimensional scaffold. The scaffold provides support for osteogenic cells, promotes bone formation during the healing process, and improves the results of guided ROG [9]. The biocompatibility and the ability to promote wound healing of collagen membranes are notable. They have the advantage of being a one-step surgical procedure, reducing the risk of new tissue formation and effective tissue integration [8], [10]. However, the disadvantage of collagen membranes is that they are mechanically capable of causing bone defect collapse. Therefore, it is recommended to use them in combination with bone grafts to...
optimize results [10]. This clinical case aims to restore bone loss in the anterior sector with collagen membranes soluble in xenografts and type III alveolar defects.

2. CASE PRESENTATION

2.1. Patient Information

A 69-year-old female presented to the Department of Periodontics and Implantology of the National Autonomous University of Mexico. On intraoral examination, multiple dental restorations, partial edentulism, collapse of the teeth, and collapse of the bite were observed. Periodontal exudate and gingival resorption were observed. Radiographic studies with periodontal defects and with vertical and horizontal bone resorption were performed (Figs. 1a and 1b). Periodontal evaluation was performed by observing bleeding, scaling, and loss of clinical attachment to the periodontal pockets. Grade 3 tooth mobility was detected on teeth 13, 12, and 21. The periodontal diagnosis was stage IV, general, grade B. The patient used fixed anterior supporting teeth 12, 13, and 21. According to McGuire’s classification, the prognosis for these teeth is not “hopeful”.

Initial periodontal treatment included controlling plaque, scaling, and root planning. A comprehensive plan was developed for endodontics, oral implants, and orthodontic treatment. Teeth 13, 12, and 21 were extracted during the surgical procedure. The crest incision was made with a vertical release to elevate the full thickness flap to improve visibility. Inflamed tissue was removed. After removing the granular tissue, the absence of vestibular tables was confirmed, and the extracted socket was classified as type III according to Elian and Tarnow. Matrix Oxide® (1 cc, 0.25–1 mm particles) is used to coat the absorbable collagen membrane (Biotek® 25 × 25 mm) to treat a type III alveolar defect. A simple horizontal mattress (PGA 4–0 and Silk 3–0) was used to fix the flap in position. The patient received postoperative instructions, antibiotics (amoxicillin 500 mg every 8 hours for 8 days), analgesics (lysine clonixinate 500 mg every 8 hours for 4 days), and 0.12% cyclohexadiene gluconate rinses twice daily for 14 days. (Figs. 2a–2d).

The clinical and tomographic follow-up after 6 months of surgery shows the increase of the horizontal ridge in different sites and a gain of 4.8mm was achieved. (Figs. 3a–3d).

3. DISCUSSION

Autogenous bone, although considered the gold standard for grafts due to its properties of osteoinduction, osteogenesis, and osteoconduction, presents clinical disadvantages, such as the need for a second donor site, high morbidity, difficulty of adaptation, and risk of post-regeneration resorption, which can vary between 23.5% and 60.0% of the original volume. Faced with these
drawbacks, various alternatives to bone biomaterials have emerged, such as xenogeneic and allogeneic bone grafts and completely synthetic substitutes [11], [12]. Xenogeneic bone grafts are characterized by their gradual resorption, offering long-term stability and a reduction in complications. A systematic review study concluded that these grafts achieve an increase in average thickness of 4.4 mm, findings that coincide with our results, where a gain of 6.38 mm was obtained at the site of tooth 21 [11].

Regarding membranes, the scientific literature indicates that non-cross-linked membranes have better results in terms of biocompatibility, tissue integration, and reduction of postoperative complications compared to cross-linked collagen membranes [10]. In guided bone regeneration techniques, resorbable collagen membranes achieve volumetric bone gains without significant differences between cross-linked and non-cross-linked membranes [13]. Adequate preservation of soft tissue volume without exposure was achieved with the non-cross-linked collagen membrane used in this clinical case. Furthermore, the selection of biomaterials and the choice of ROG treatment were guided by the classification of alveolar defects proposed by Elian and Tarnow.

4. Conclusion

In this case report, a type III alveolar defect was diagnosed according to the Elian and Tarnow classification. For accurate selection of biomaterials and predictable positive results, the use of this classification was important. ROG treatment showed an increase in the horizontal crest at 6 months. This indicates that soft tissue can be preserved without complications and that successful regeneration can be achieved.

Conflict of Interest

Authors declare that they do not have any conflict of interest.