Clinical case

Vertical guided bone regeneration with d-PTFE membrane

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ABSTRACT

The purpose of this article is to describe, step by step, the technique of Guided Bone Regeneration (GBR) for vertical ridge augmentation in extremely atrophic maxillary crests. In order to achieve this in a patient with significant bone deficit in the fourth quadrant, vertical bone augmentation was carried out using titanium-reinforced dense polytetrafluoroethylene (d-PTFE) membranes, as well as autogenous bone in combination with inorganic bovine bone in a 1:1 proportion. After nine months, significant vertical bone gain was formed. Measurements were taken both before and after surgery, which allowed for quantifying the results with an increase of 10 mm horizontally and 4 mm vertically. Three implants were placed on the ridge with newly formed bone and after one year of load, the new bone remained stable. This clinical case corroborates the effectiveness of the Guided Bone Regeneration technique. Two years after surgery, the high success rate of the implants placed after this surgical procedure allows us to affirm the efficacy of this technique for the rehabilitation of atrophic alveolar crests without showing relevant complications.

KEYWORDS

Guided Bone Regeneration; GBR; Vertical augmentation; Non-resorbable.

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INTRODUCTION

Increasing maxillary bone has become a predictable treatment in recent decades. There are several methods to carry it out such as bone distraction, onlay grafts or guided bone regeneration (GBR) with membrane. GBR, in the hope of being confirmed by new studies, appears to be a viable option for bone augmentation.

GBR is a therapeutic alternative that arises from traumatic or physiological reabsorption of the maxillary and mandibular bone tissues, giving rise to atrophic alveolar crests. In many instances these atrophies make implant treatment impossible, so techniques of this type can be of interest for restoring adequate bone support and allowing for rehabilitation by means of implants. Under ideal conditions, Guided Bone Regeneration combines the management of soft tissues and bone tissue, as well as aesthetics and functionality.

The high level of knowledge and surgical management that these surgeries require is more evident when dealing with vertical regenerations, since they are more compromised in terms of adjacent tissues that provide good support in order to provide stability for the graft as a source of bone-forming cells. This increase can be vertical or horizontal. In vertical GBR, it is preferable to use dense polytetrafluoroethylene (d-PTFE) membranes. However, when the increase is only horizontal, reabsorbable collagen membranes can be used.[1,2]

The application of techniques such as GBR for horizontal increase is well documented, with high rates of implant success and low complication rates.[2-4] The surgical application of these techniques for supracrestal regeneration was first described in 1994[5,6], when the first histological advances of vertical regeneration in humans and animals occurred. Some authors provide success rates of 94.7%, stating that bone increased vertically by GBR responds to the placement of osseointegrated implants in a manner very similar to native bone. There are few studies that describe long-term vertical GBR, but they do present positive results and with low complication rates.[5]

In this article, the objective is to evaluate the satisfactory result of vertical GBR in a clinical case, by means of autologous bone graft in combination with xenograft, to determine clinical and radiographic success, possible complications and success of the placed implants after prosthetic load. This shows the competitive role that this technique represents when faced with implant treatment in atrophic alveolar ridges.

CLINICAL CASE

The patient is a 62-year-old woman with no relevant medical pathology. The upper arch was rehabilitated by means of a fixed metal-ceramic tooth-supported prosthesis and the lower arch was previously restored by means of a skeletal.

After recent evaluation by cone-beam computed tomography (CBCT) at the level of the fourth quadrant, it was decided that the patient was not a candidate for implant treatment because of insufficient bone height and width. That is why it was decided to opt for a Guided Bone Regeneration treatment. The proposal for this technique arises due to figures of less than 8 mm in both width and height.

The clinical history was completed considering smoking as an excluding factor. In addition, considerations such as treating patients without periodontal disease or active endodontic lesions, having a sufficient amount of soft tissue and space for the bone implant were taken into account, as well as ensuring that the periodontium of the adjacent teeth is healthy. These must have moderate or scant bone loss since the bone peaks that hold these pieces are the ones that will help predict the regeneration that may be obtained in that area. The patient underwent previous antibiotic treatment that consisted of taking 2g of Amoxicillin two hours before surgery (Figures 1 and 2).

We proceeded to obtain plasma-rich fibrin (PRF). Penicillin was added to prevent possible infections. After this process the first incision was carried out,

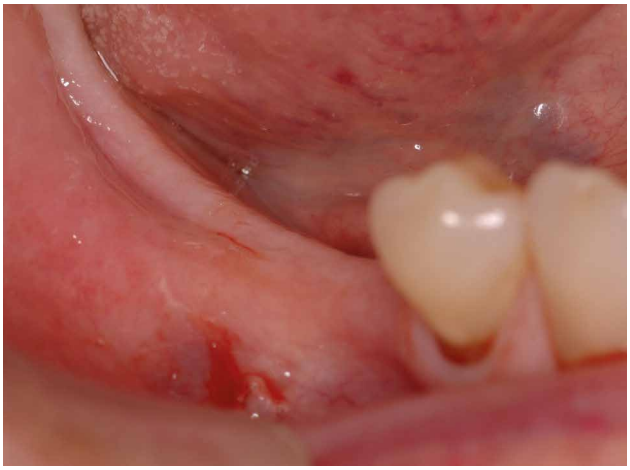


Figure 1. Vestibular view prior to surgery.

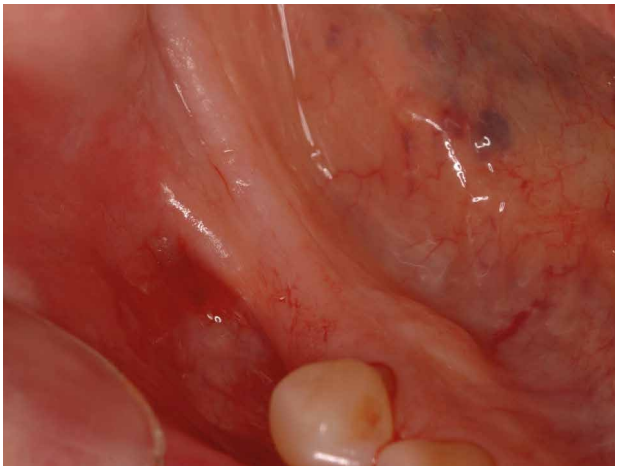
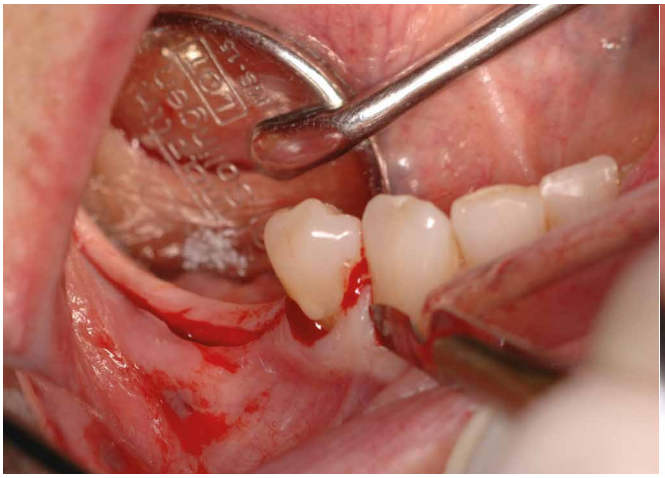
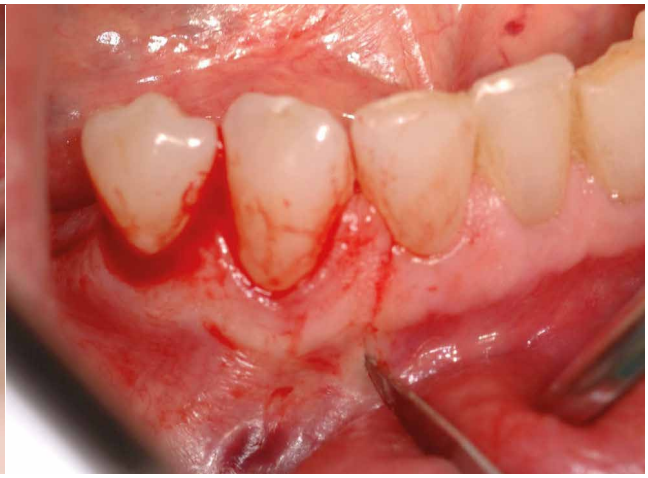


Figure 2. Occlusal view prior to surgery.





Figures 3 and 4. Initial incision.

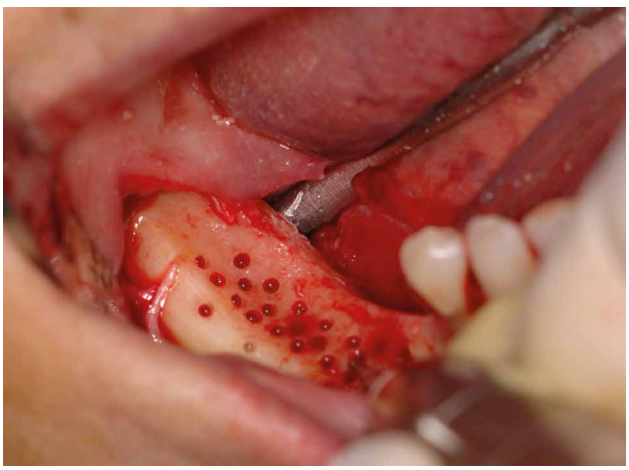


Figure 5. Perforation of the cortical bone.

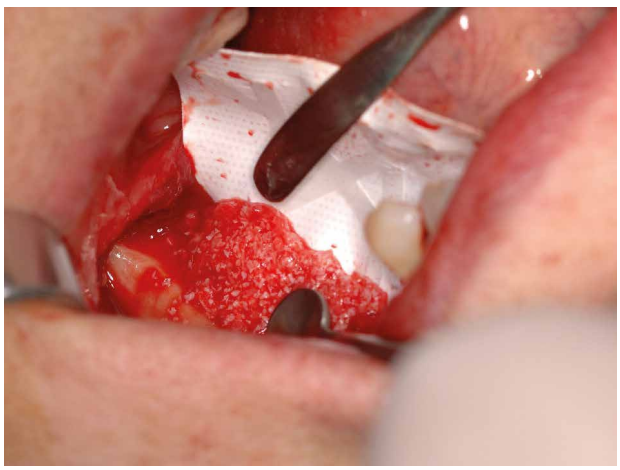


Figure 6. Placement of the regeneration material.

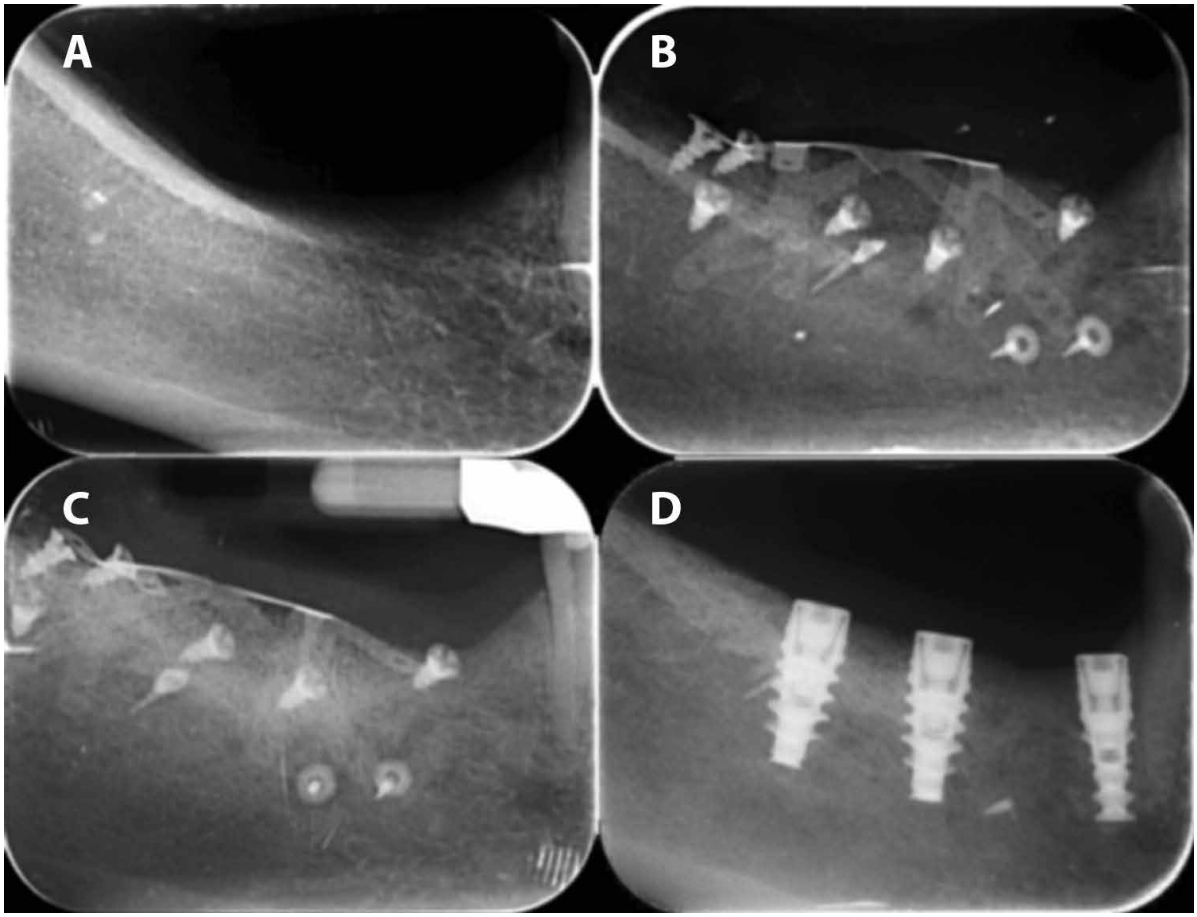


Figure 7. A) Prior to surgery. B) At the time of surgery. C) Follow-up at 5 months. D) Placement of the implants at one year.

for which a number 15c scalpel was required. This was a full-thickness supracrestal incision on the keratinized gingiva and two incisions perpendicular to it, two teeth mesial from the defect and two distal to it (Figures 3 and 4). Care was taken to not damage both the papilla and the periodontium of the adjacent tooth, as well as the palatal artery if it was the maxilla or the mental nerve in the case of the mandible. The incision was made diagonally on the ascending branch of the jaw. The objective is to obtain a safety flap with sufficient extension so that it is possible to make a primary closure both vertically and horizontally, well vascularized, wide and with vitality, in order to facilitate adequate surgical access. A total thickness gingival detachment was performed up to at least 5 mm below the bone defect, paying attention to the mental nerve outlet.

With the help of a disposable curved Safescraper scraper (Geistlich, Princeton, United States), autologous bone was obtained using the branch branch of the mandible as a donor area. A sufficient quantity of bone was obtained to occupy the bone defect using a mixture of bone and particulate bone mineral, Bio-Oss (Geistlich, Princeton, United States) in a 1:1 ratio, reducing the amount of bone to be obtained, using the least invasive technique and reducing postoperative discomfort.

Using the handpiece and a small round burr, the mandibular cortex was prepared by performing numerous cortical perforations whose purpose was to facilitate a greater flow of blood cells (Figure 5). A non-resorbable d-PTFE membrane was used, reinforced with a Cytoplast Ti-250 titanium mesh (Osteogenics, Lubbock, United States). The objective is to establish

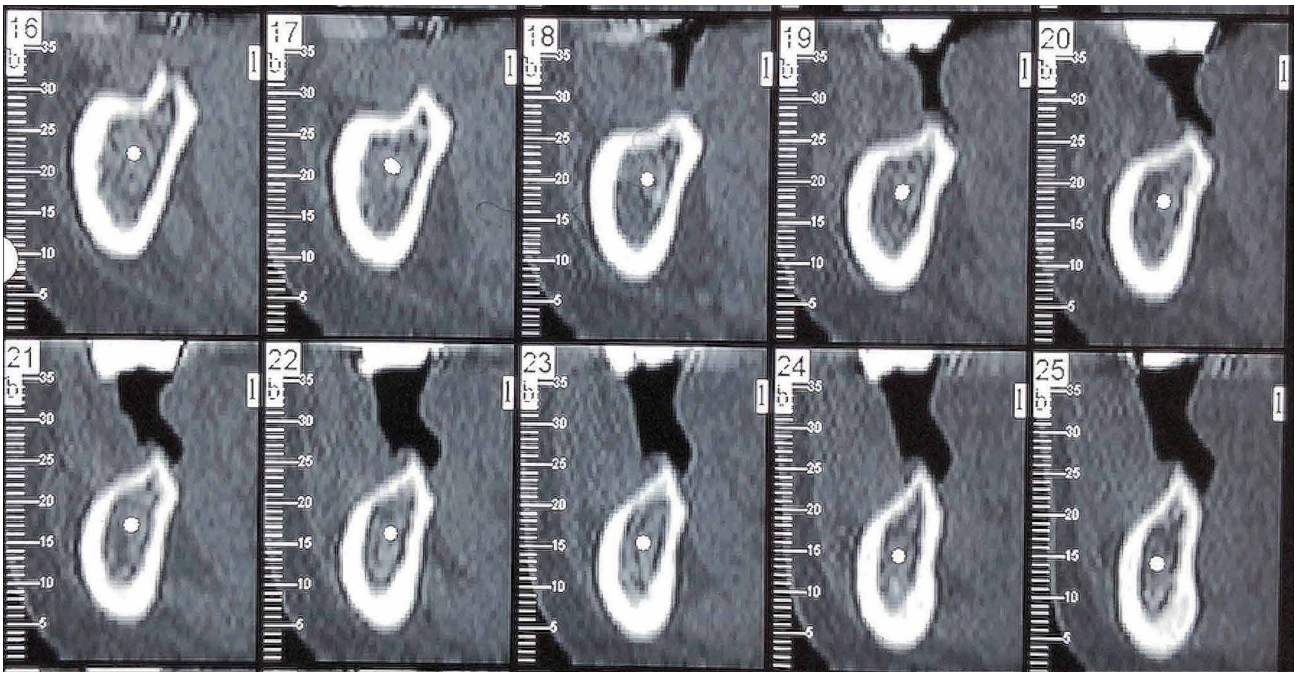


Figure 8. CBCT prior to surgery.

a physical barrier between the immature bone tissue and the soft tissues. Fixation of this material is done by micro-screws or thumbtacks, always starting by fixing the lingual or palatal part. A preparation based on Fibrin-Rich Plasma obtained by plasmapheresis and a combination of autologous bone and Bio-Oss bone mineral (Geistlich, Princeton, United States) in a 1:1 proportion was placed inside the membrane (Figure 6). Penicillin was also added. In this case, a resorbable Derma collagen membrane was placed (OsteoBiol, Torino, Italy). Finally, the flap was closed. In order to release the flap, firm and horizontal cuts were made in the periosteum, thus achieving greater elasticity of the flap. A 3-0 monofilament d-PTFE suture from Cytoplast® was used to suture. First, mattress sutures were placed 4 mm from the incision line. Single and interrupted sutures were also placed in the same material to close the edges of the flap and leave at least one 4 mm thick layer of connective tissue between the membrane and the oral epithelium.[7] The close contact formed between both connective tissue provides

a barrier to avoid exposure of the membrane, since increasing contact facilitates healing. The vertical incisions were stitched with simple stitches. During the first week after surgery, antibiotic, analgesic and anti-inflammatory treatment was prescribed; Amoxicillin 750 mg every 8 hours, Ibuprofen 600 mg every 8 hours and Metamizole 1 capsule every 6 hours, in case of pain. At three weeks, with the tissue sufficiently mature, the stitches were removed. Nine months later, a second procedure was performed to remove the membrane. One year after the surgery, the implants were placed (Figure 7).

DISCUSSION

Vertical bone augmentation has proven to be a satisfactory treatment when using d-PTFE membranes with titanium reinforcement, PRF and a combination of autologous bone with particulate bone mineral an a 1:1 ratio.

Many authors such as Jovanovic et al.[6] and Urban et al.[8] do not perform this technique in smoking patients, as the vasoconstrictor effects of tobacco strongly compromise post-surgical healing.

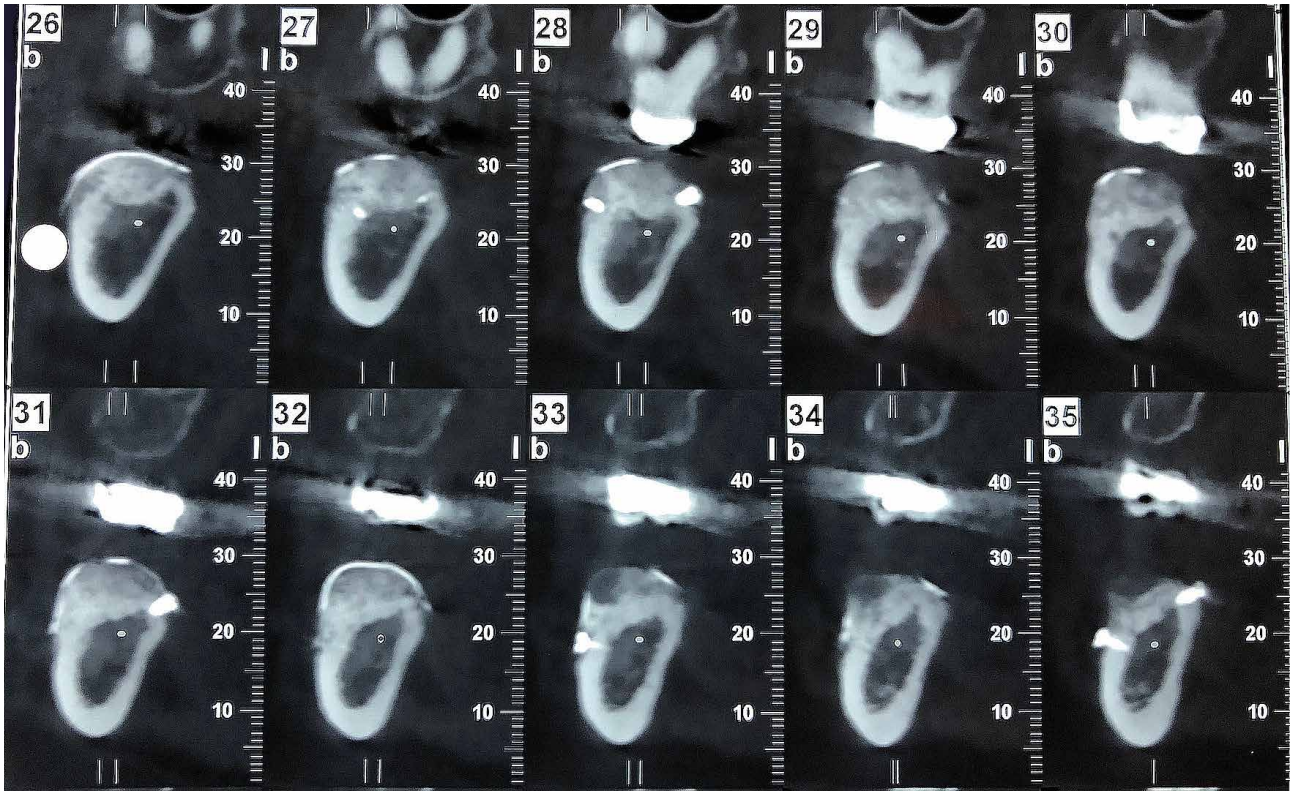


Figure 9. CBCT 5 months after surgery.

Autologous bone represents an ideal matrix to support the newly formed bone, providing an immunologically compatible source of viable bone cells, good osteoconductive scaffolding, in addition to the precursor growth molecules necessary for bone formation.

It is essential that the membrane provides high stability to the graft.[7] In the event that the edges of the membrane are not well adapted, a second membrane would be placed. Authors such as Jovanovic et al.[6] and Urban et al.[8] recommend the use of native collagen membranes, but their reabsorption is quite fast, from 4 to 6 weeks. Closure of the flap is of vital importance because the fact that a primary closure is achieved without any tension and thus does not press our graft at all is what will determine the surgical success or failure.[1] From a personal point of view, the authors of this article have preferred the use of non-resorbable sutures. Resorbable sutures usually do not support much tension. In addition, there is always some inflammation in the surrounding tissue due to the metabolic process of inflammation. However, if a resorbable suture would appear on the market that would allow tension without loosening the knot and degradation would be via simple hydrolysis, it could also be suitable for this surgery.

Complications such as membrane exposure and/or subsequent infection was documented in 2.7% of cases, reflecting an improvement over previous articles that present figures between 12.5% and 17%.[5] Despite this, the long-term results where implant placement was performed, show vertical bone regeneration of up to 12 millimeters, with the use of autologous bone chips being indispensable.[5,7] In this clinical case, no relevant complication occurred. One way to minimize the risk of membrane exposure would be to release the closure flap widely so that there is no tension. In addition, the application of penicillin in the graft is recommended to prevent possible infections. The bone gain achieved in this case was 10 mm horizontally and 4 mm vertically,

in accordance with the expectations provided by other authors. The success of the three implants placed was 100% 14 months after placement, which coincides with the results presented by Urban et al. in other studies.[8]

Future long-term studies are needed to be able to determine the technique's predictability. On the other hand, studies included do not have a significant sample size; it would be interesting for subsequent studies to contribute a greater number of cases and a greater long-term follow-up.

CONCLUSIONS

A vertical increase of 4 mm was achieved as well as a horizontal increase of 10 mm (Figures 8 and 9).

After two years, the regenerated bone achieved adopted a density very similar to that of native bone. In numerous articles, it was concluded that histologically, the bone obtained possessed characteristics very similar to those of the original bone.

The guided bone regeneration carried out in this patient made it possible to rehabilitate the posterior sector using implants, which showed 100% survival after 14 months of placement.

Guided bone regeneration seems to be a predictable technique according to the protocols; however, more studies are required to be able to adapt this technique to daily clinical practice.

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