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Case Report

Horizontal Bone Augmentation in the Mandible by Subperiosteal Tunneling Technique: Case Report

Vilton Zimmermann de Souza *[1], Emilly Schoenberger [2], Roberto Francisco Wesoloski [3], Gislaine Garcia [4], Leonardo Rosalen da Silva [5], Rafael Manfro [6]

[1]Mestre em Implantodontia, Doutorando em Implantodontia - São Leopoldo Mandic.
[2]Cirurgião Dentista - UNOESC; Graduanda em Dentistica - ZENITH.
[3]Especialista em Radiologia Odontológica - ABO.
[4]Especialista e Mestre em Implantodontia - São Leopoldo Mandic.
[5]Cirurgião Dentista - UNOESC; Graduando em Implantodontia - CEOI.
[6]Mestre e Doutor em Implantodontia - São Leopoldo Mandic.

*Corresponding author: Vilton Zimmermann de Souza; *viltonsouza@yahoo.com*

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Abstract

Bone augmentations for installation of dental implants are often necessary and often decreases patient acceptance of treatment due to increased morbidity. In this clinical case, we report the procedure of subperiosteal tunneling (tunnel technique) combining in situ xenogeneic graft, of slow absorption bovine origin, for horizontal augmentation in the mandible. Bone grafts, horizontal and vertical, are extremely important procedures for oral rehabilitation in implant dentistry, thus enabling the re-establishment of an adequate framework for the installation of implants with correct positioning, restoring function and aesthetics to our patients. The most commonly used therapy consists of raising a more invasive flap to expose the bone tissue and performing associated grafting techniques. However, in well-indicated cases, we have this tool at our disposal, where we can treat our patients with minimally invasive techniques, such as subperiosteal tunneling, with very favorable clinical results. The main advantage of this approach, in addition to the minimally invasive technique, is the preservation of the periosteum and blood supply to the flap, which may contribute to increased favorable wound healing and a reduced risk of flap dehiscence and membrane exposure. This tunnel approach to guided bone regeneration in horizontal bone gains, specifically adapted and filled with xenogeneic bone, resulted in a significant gain in bone volume in thickness, which allowed implant placement (average increase of 5.0mm observed on tomography). As for morbidity, the patient reported a better postoperative period in the reconstruction surgery compared to the implant installation surgery, measured by the visual analogue scale (VAS).

Keywords: ***Case report. Alveolar. Tunneling. Xenogen Graft.***

1. Introduction

Bone augmentations are frequent to allow the installation of dental implants in the correct position, allowing the recovery of function and aesthetics, mainly the maintenance of long-term rehabilitation [1-2].

The treatment of deficiencies in thickness normally presents a good prognosis in all the techniques described in the literature [3-6]. The current quest is to reduce the morbidity of these techniques by increasing patient comfort and acceptance. The use of bone substitutes with absorbable membranes in open field allows an average increase of 3 to 4 mm in the thickness of the atrophic ridges [3,4,7].

Reconstructions using tunnel accesses have reduced morbidity, presenting similar results in the bone augmentation obtained [6,8-11-12].

A series of cases were reported in one study, with 21 patients, using a minimally invasive subperiosteal ridge augmentation technique, with a follow-up period ranging from 4 to 30 months. The technique included using a laparoscopic approach to deliver a growth factor/xenograft combination into a subperiosteal pocket. No flap elevation, cell-occlusive membranes, space-maintenance devices, or decortication procedures were used. The results demonstrated predictable and consistent bone regeneration. The mean gain in ridge width for all treatment categories was 5.11 mm (SD 0.76 mm). Morbidity and complication rates were also consistently reduced. Human histology results show xenograft particles surrounded by newly formed bone [12].

The aim of the authors in this article was to use the periosteum tunneling technique with a small incision and detachment of the flap performed in a tunnel, maintaining the integrity of the periosteum in the grafted region, through a clinical case demonstrating with tomographic measurements the bone increase obtained and an assessment of the symptoms of the inflammatory process using a visual analogue scale (VAS).

2. Case Report

Patient 52 years old, caucasian, female, attended the dental office seeking rehabilitation of the posterior region of the mandible on the left side, through dental implants, after orthodontic treatment.

During the anamnesis, no systemic problems that contraindicated or compromised the success of the treatment were reported. The patient also reported that she felt a lot of fear and anxiety about dental treatments.

In the clinical and imaging evaluation, a deficiency in thickness was observed for installing dental implants in the edentulous region of elements 35, 36 and 37 (**Pictures 1 and 12 A**). Dental element 34 had a periapical lesion and the patient reported that the element had already been endodontically re-treated, which ended up not having the desired effect because the lesion did not show regression, in addition to presenting extensive restorations with infiltrations and invasion of biological space.

After the evaluations, the patient was presented with a treatment plan that first involved bone reconstruction to increase thickness, and in a second surgical procedure, the extraction of tooth 34 with immediate implantation, in addition to the installation of two implants over the grafted area, supporting a 3-element fixed prosthesis.

The preoperative medication used was 1g of amoxicillin 1 hour before the procedure. A 2% lidocaine anesthetic solution with 1:100,000 adrenaline (DFL, Rio de Janeiro/RJ, Brazil) was used for vestibular and lingual infiltrative technical anesthesia.

A single vertical incision of approximately 7mm was made on the buccal surface of the ridge, close to tooth 34, respecting the anatomical condition of the mental nerve (**Picture 2**). With appropriate instruments, subperiosteal detachment was performed in a tunnel along the entire length of the vestibular defect, creating space for bone reconstruction. Then, with the aid of spherical drills, bone decorticalization was performed through the space obtained by the tunnel created. Through the vertical incision, a collagen membrane (Geistlich Bio-gide) was installed next to the periosteum (**Picture 3**). The bovine inorganic bone substitute (Geistlich Bio-Oss) was inserted and accommodated, filling the entire tunnel created by the detachment (**Picture 4**). The graft was pressed for approximately 1 minute to remove the hydration serum from the material and give the desired shape for the reconstruction. And then the wound was closed with simple 4-0 Vicryl stitches (**Picture 5**).

The patient was instructed not to use prostheses in the region during the entire period of ossification. The antibiotic medication was maintained for 7 days using 500mg 8/8hs. To control pain and the inflammatory process, Ketoprofen 100mg and Paracetamol 750mg were used for two days, associating local ice packs in the first 48 hours.

Postoperatively, pain and swelling were analyzed. The patient, after instruction, indicated the intensity of the painful sensation using the Visual Analogue Scale (VAS) evaluating her pain between mild (0-2), moderate (3-7) and severe (8-10) (**Picture 13**). After the tunnel-type procedure, the patient reported mild postoperative pain (number 0.5 on the scale), as for discomfort during the procedure, also mild pain (number 0.5 on the scale). For the measurement of swelling/edema, the patient evaluated it within the same scale and reported it to be mild (number 0).

There were no complications during the healing period, and the area was clinically healthy. Six months after grafting, a new imaging exam was performed in the same radiological clinic, allowing a comparison between pre and postoperative exams. To measure the bone gain obtained, tomographic thickness measurements were performed using 4mm as a reference, from the bone crest of the ridge towards the mandibular base, represented by the green line (**Pictures 12 A and 12 B**). This vertical measurement in the region of the sites where the implants would later be installed was performed with the aim of standardizing the obtainment of horizontal measurements before and after the tunneling procedure. Acquisition software and equipment were used (1. tomograph - I-Cat manufacturer Imaging Sciences International - Hatfield PA - USA. Acquisition protocol: area of 6cm, acquisition time 40 sec, voxel size 0.2mm, kVp 120 m.As 36; 2. Software e-VolDX version 5.0.1.15 developed by CDT Software). In table 1, the horizontal bone gain can be analyzed, measured at 4 mm from the bone crest.

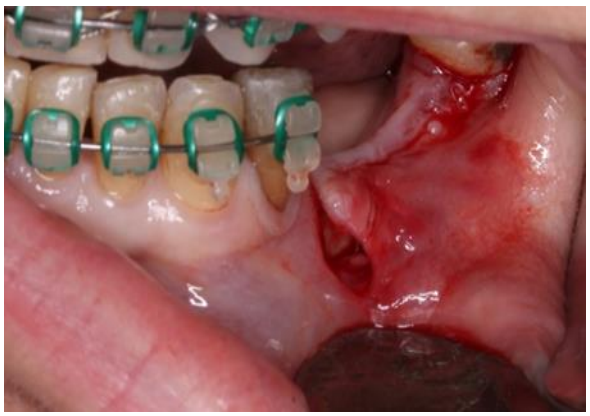
The surgery to install the implants was performed 6 months after the reconstruction, following the same pre and postoperative medication protocol. An incision over the crest of the ridge with mesial relaxant and subperiosteal detachment was performed to access the reconstructed ridge and to extract element 34, which had an alveolus with no buccal plate (**Picture 6**).

Next, the installation of the three previously planned implants was performed (**Picture 7**). A tissue reconstruction was initiated in the buccal region of the implant in the area of dental element 34 and extended posteriorly, using bovine inorganic bone and collagen membrane (**Pictures 8 and 9**). The area was sutured again, coapting the incised edges, using simple 4-0 Vicryl sutures.

In the postoperative period, the patient used the same medication used in the first surgical procedure, and answered the same questions regarding pain and edema using the VAS scale. In the intervention for the installation of the implants, the patient indicated moderate postoperative pain (number 3), in relation to mild discomfort during the procedure (Number 1), and moderate swelling (Number 6). The comparison between the two surgical moments can be analyzed in Table 2.

The patient had no postoperative complications until the implants were reopened (**Picture 10**). After 3 months, the metal-ceramic prostheses were installed (**Picture 11**).

Picture 1

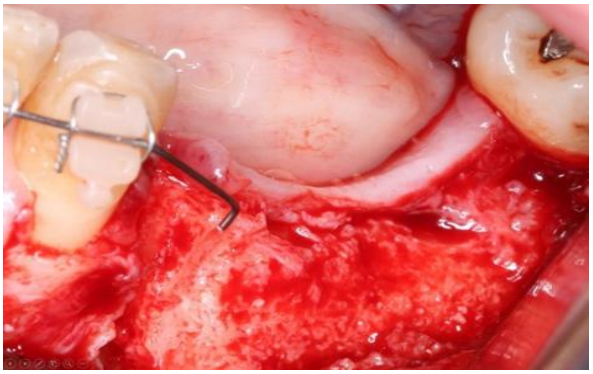


Picture 2

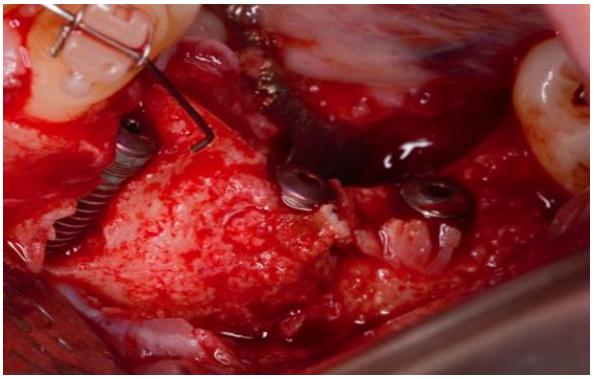
Picture 3

Picture 4

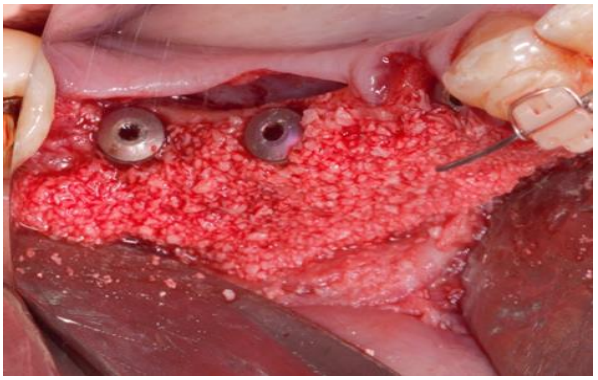
Picture 5



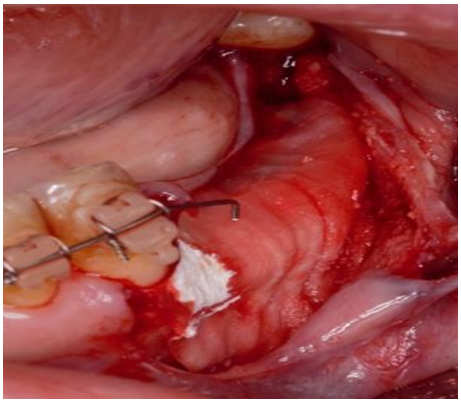
Picture 6



Picture 7



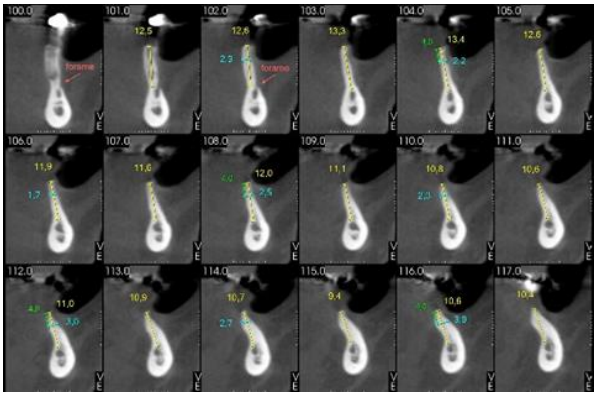
Picture 8



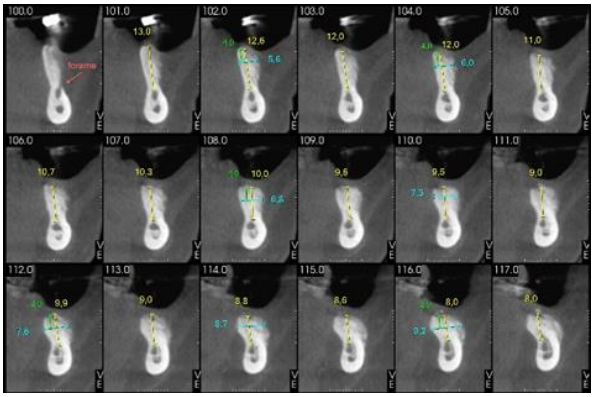
Picture 9

Picture 10

Picture 11



Picture 12A



Picture 12B

Picture 13: Visual Analogue Scale (VAS)

MILD MODERATE SEVERE

Table 1: Horizontal bone gain at 4 mm from the bone crest.

	Preoperative	6 Months Postoperative	Thickness of Bone Gain
Cut 104	1,4 mm	5,7 mm	4,3 mm
Cut 108	2,1 mm	7,4 mm	5,3 mm
Cut 112	2,4 mm	7,2 mm	4,8 mm
Cut 116	3,0 mm	8,7 mm	5,7 mm

Table 2: Results of discomfort during the procedure, swelling and pain after the subperiosteal tunneling procedure:

Patients - Related results	Mild (0-2)	Moderate (3-7)	Severe (8-10)
Discomfort during procedure	0,5		
Edema	0		
Postoperative pain	0,5		

3. Discussion

Tissue augmentations are required in most dental implant treatments. The need for these procedures can often reduce patient acceptance of treatments due to the morbidity inherent in the techniques. The use of bone substitutes and more conservative techniques allow reducing morbidity, obtaining the same results [1,4,8,9,12]. Even using bone substitutes, most techniques require large flaps to allow tension-free primary closure. Even guaranteeing the success of the technique, more invasive flaps result in a greater inflammatory process, in more edema, requiring medication to control pain for a longer period [1,6].

Tunnel flaps allow bone augmentation through guided tissue regeneration with a much smaller detachment than conventional flaps, allowing bone augmentation equivalent to conventional techniques [8-12]. In this way, the main objective of this study is to evaluate the feasibility of the tunnel technique through pre and postoperative computed tomography, observing the increase obtained and the possibility of installing the implants as planned, in addition to the morbidity of the treatment through the use of an EVA scale for evaluate the level of pain and the amount of postoperative analgesic medication compared to traditional techniques.

In this reported case, the bone increase evaluated 6 months after the surgery was sufficient to install the implants without the need for additional techniques. The patient's perception of pain and discomfort was lower in the reconstruction surgery than in the procedure for installing the implants where a conventional flap was performed.

In view of the relevant results presented in the literature, the technique reported and discussed should be considered as a good alternative for grafts aimed at horizontal augmentation, minimizing surgical morbidity for our patients and postoperative complications. One should also consider the importance of periosteum integrity through this execution, which is very important for the success of cases considering predictability and success in the medium and long term.

4. Conclusion

In the treated case, it was possible to observe that the guided tissue regeneration technique performed by tunnel flaps is feasible for horizontal augmentations in the posterior region of the mandible. When considered in relation to discomfort during the procedure, edema and postoperative pain, the tunneling technique for bone reconstruction presented lower morbidity than the moment of implant installation.

Declarations

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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