

Case report

Bone Graft Associated with Photobiomodulation in a Bariatric Surgery Patient: Case Report.

ABSTRACT

The indication of bariatric surgery in the obese population has been indicated to improve the individual's health. However, the difficulty of absorption of nutrients after this procedure can result in difficulty in bone remodeling. Post-extraction bone grafts are considered the preferred technique for multidimensional preservation of the alveolar ridge. In photobiomodulation, bone neoformation by stimulating cells such as osteoblasts is effective. In this case report, we present the simultaneous use of photobiomodulation with red and infrared lasers associated with bone grafting for bone preservation of the alveolar ridge after tooth extraction.

1. INTRODUCTION

Obesity is a chronic disease, that promotes increased morbidity, mortality, and reduced quality of life (Blüher et al.,2023, Tzenios,2023). The need for improvement or resolution of these events promoted a marked demand for the use of bariatric surgery (Stenberg et al., 2021). This procedure can promote inadequate levels of absorption of calcium, vitamin D, iron, folic acid, vitamin B12, zinc, copper, selenium, and vitamins A, E, and K, which are essential for bone homeostasis (Stenberg et al., 2021, Ha et al., 2021, Schafer, 2017) altering bone remodeling, decreasing bone mass and increasing the risk of fracture (Mele et al., 2017).

Studies in humans demonstrate that dimensional changes lead to a reduction in the width of the alveolar ridge of up to 50% during the first year after tooth loss in the premolar and molar locations, where two-thirds of the total changes occur in the first 3 months after extraction (Schropp et al., 2003, Araújo et al., 2005). The evaluation of the alveolar bone of patients undergoing bariatric surgery demonstrated greater bone loss and a sparser trabecular pattern when compared to the eutrophic group (Vargas et al.,2020).

To minimize post-extraction bone loss and maintain the contour of hard and soft tissues, alveolar preservation is indicated, which will maintain the bone framework of the socket for subsequent and adequate rehabilitation with implants (Sanz et al.,2015, Horváth et al., 2013). Several systematic reviews reveal that xenograft has potential as a promising bone substitute for alveolar preservation, demonstrating limited bone losses compared to other bone substitutes (Avila-Ortiz et al., 2014, Ten et al., 2011). Furthermore, the use of LED $\lambda = 850$ nm demonstrates better tissue organization and the presence of more mature bone tissue, resulting in less resorption (Dalapria et al., 2022). The use of Lasers has also shown effectiveness in bone repair when used in extraction sockets (Kulkarni et al., 2023).

To date, the question of what happens in the jaws pre- and post-surgery of patients undergoing bariatric surgery, as well as the results of using bone grafts associated with photobiomodulation in these patients, has not been much clarified.

2. CASE REPORT

Patient MML, 65 years old, female, white, height 1.55 meters, initial weight 104.6 kilograms, and pre-diabetic condition. Bariatric surgery was indicated, and performed in October 2013. In the post-surgical period, he presented frequent vomiting. In November 2016, she was admitted to the Intensive Care Unit for potassium replacement where she was diagnosed with Severe Malnutrition due to lack of protein. Currently, he notices that there has been dry skin, hair loss and osteoporosis, receiving medical monitoring with a gastroenterologist and nutritionist, weighing 45-47 kilograms.

In July 2020, during a dental examination, he showed residual roots of teeth 24, 25, and 26 (figure 1). A volumetric computed tomographic examination (Cone Beam) was performed at the ICC Radiologia Diagnostico Odontológico (Lapa Unit) in October 2020 (figure 2). The panoramic images showed the roots (figure 3).



Figure 1 Initial oral condition

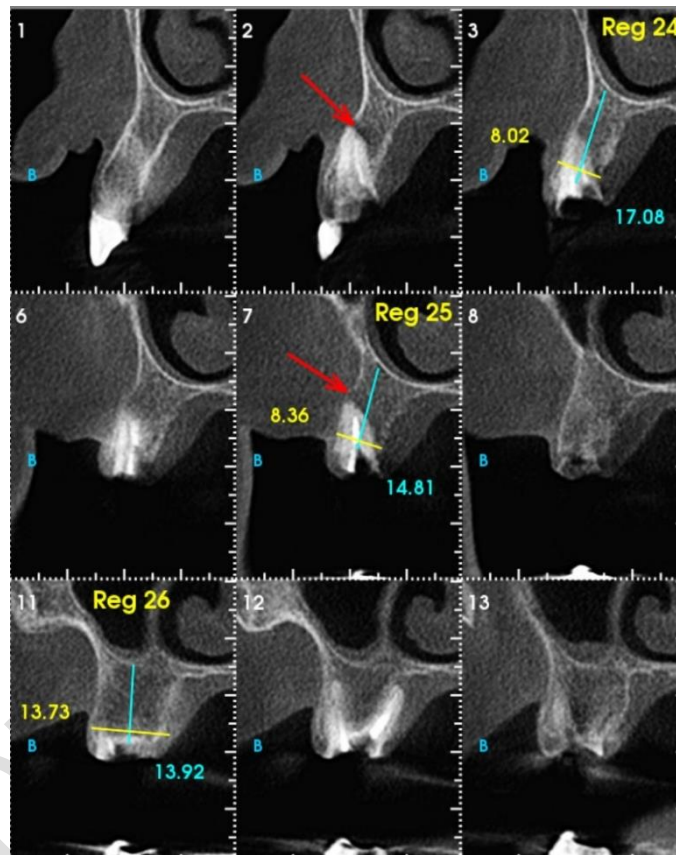


Figure 2 Tomography initial teeth 24, 25, and 26



Figura 3 Initial panoramic radiograph

he removal of the residual roots was carried out in November 2020, during the surgery, a bone graft of bovine origin Lumina-Bone® (Critéria), medium granulation (600 to 425 µm), batch LB 0104/20, expiration date 27/ 03/2022 and use of bovine collagen membrane Lumina-Coat®(Criteria) dimension 1 X 20 X 30 mm, lot LC 036/20, expiration date 04/02/2022. Immediately after the suture, was removed after 15 days, photobiomodulation was performed at the buccal, lingual points and over the occlusal region (figure 4). The semiconductor diode Laser Therapy EC® (DMC) device was used using red (InGaAlP) and infrared (AlGaAs) irradiation simultaneously. Phototherapy was performed weekly, totaling 26 sessions. Table 1 presents the photobiomodulation parameters.

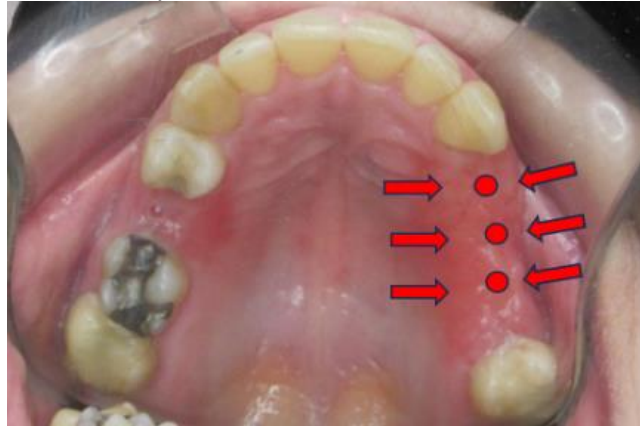


Figura 4 Irradiation points

Table 1 Parameters Photobiomodulation

Parameters	Red	Infrared
Central wavelength (nm)	660	808
Spectral Width- FWHM (nm)	20	20
Operation mode	Continuous	
Mean maximum power (mW)	100	100
Polarization	Random	
Beam Profile	Top hat	
Beam area (cm ²)	0,098	0,098
Irradiance at target (mW/cm ²)	1016	
Exposure time (s)	20 per point	20 per point
Radiant energy per point (J)	2	2
Radiant Exposure (J/cm ²)	20,41	
Number of points irradiated	9	
Total energy per session (J)	18	18
Application Technique	Contact	
Number of sessions and frequency	weekly during 6 month	

Total energy irradiated (J)	468	468
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A tomographic examination of the treated region was carried out in April 2021 to assess whether it was suitable for receiving dental implants (figure 5).

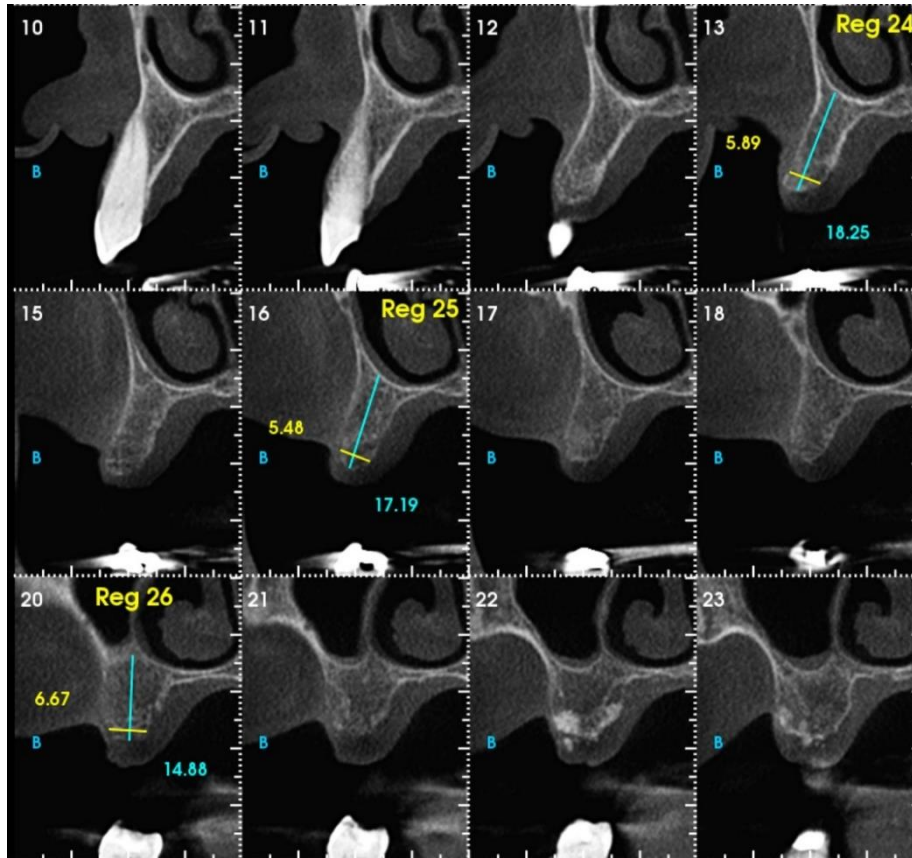


Figure 5 Tomograph of the alveolar bone in the region of the teeth 24, 25, and 26

The implants were installed in May 2021. In the region of teeth 24 and 25, conical implants were placed, measuring Ø3.8 X 11.5 mm, reference SWHI 3811N (SIN®), batch T080293945. In the region of tooth 26, a conical implant was placed, measuring Ø4.5 X 11.5 mm, reference SWHI4511N (SIN®), batch T080293847 (figure 6). Immediately after the procedure, photobiomodulation was performed according to the initial parameters, followed weekly during the first month, for a total of 4 sessions.



Figure 6 Radiography of the position of the implants

3. RESULTS

Table 2 shows the reduction in bone volume in thickness between 26.55% and 51.42% (2.16 and 7.25 mm) after 26 consecutive weeks of photobiomodulation. In contrast, there was a gain in height between 6.85% and 16.07% (0.96 and 2.38 mm).

Table 2 Measurement of the thickness and length of the alveolar ridge in milimeters and percentages

	10/23/2020		04/20/2021		Percent	
	Length	Thickness	Length	Thickness	Length	Thickness
Tooth 24	17.08	8,02	18.25	5,89	+6,85	-26,55
Tooth 25	14.81	8.36	17,19	5.48	+16,07	-34,80
Tooth26	13.92	13.73	14.88	6.67	+6,89	-51,42
	Initial		After 26 sessions		After 26 sessions	

4. DISCUSSION

According to reports in the literature, dimensional changes in the width of the alveolar ridge in the first year after tooth extraction can reach a 50% reduction, and two-thirds of this occurs in the first 3 months (Schropp et al., 2003, Araujo et al., 2005, Santos et al., 2021). In this case report, after 6 months of the surgical procedure and weekly sessions of photobiomodulation with 850 nm laser, the loss in thickness of the alveolar ridge for teeth 24 and 25 was 26.55% and 34.80%, respectively, and the region of tooth 26 followed the pattern proposed in the literature (51.42%).

Tomlin et al (2014) point out that the alveolar ridge's expected vertical bone loss after a tooth extraction is on average 0.5 - 0.9 mm in 12 months (Tomlin et al., 2023). In this case, where there was weekly photobiomodulation, there was an initial gain in tooth 24 of 1.17 mm, tooth 25 of 2.38 mm, and tooth 26 of 0.96 mm.

According to Vargas et al (2020), bariatric surgery patients present more pronounced bone loss and a sparser bone trabecular pattern (Vargas et al.,2020). In the patient in question, bone loss was not greater than the pattern reported in the literature related to eutrophic patients, in addition to no sparse bone trabecular pattern was observed. Thus, the need to associate bone grafting and photobiomodulation techniques to preserve the alveolar ridge becomes evident.

Photobiomodulation in bone tissue using low-power lasers has been investigated as an effective method in scientific studies. These studies demonstrate that the therapy accelerates and stimulates the neoformation of bone tissue, improving the entire repair process of the surgical site (Romão et al.,2015, AboElsaad et al., 2009). Given the reported case of severe malnutrition in the patient's medical history and the fact that she was undergoing bariatric surgery, a low-intensity laser was used to ensure successful healing and osseointegration of the bone graft. This was confirmed by the computed tomography scan performed before implant placement and by the primary stability of the implants during surgery and subsequent osseointegration, enabling rehabilitation without complications.

5. CONCLUSION

Given the limiting nutritional status presented by the patient due to bariatric surgery, alveolar bone preservation with exogenous bone graft associated with the use of low-power laser demonstrated efficacy and enabled alveolar dimensional maintenance, enabling the correct positioning of the implants and proper oral rehabilitation.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) to publish this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

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UNDER PEER REVIEW