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Dental Implant Placement Using PRF To Rehabilitate An Area With Bone Compromise After Implant Removal: Case Report

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Abstract
The placement of dental implants aims to rehabilitate an edentulous region or a future edentulous area. The assessment of the quantity and quality of the connective and bone tissue in the region, as well as the patient's biological conditions, are determining factors for defining the feasibility and indication for the surgical procedure. In 1960, Branemark defined the concept of osseointegration as the ability of vital bone formation to integrate with the implant in the region where it was installed, bringing functional and aesthetic benefits. An implant typically takes between 3 to 6 months for the bone to form around its platform. However, some cases do not progress with a favorable prognosis for various reasons, such as failure in bone formation or bone resorption, which may require the removal of the implant. This work aims to descriptively present a clinical case of implant placement in a region where the implant did not osseointegrate. The procedure was associated with the Stick Bone graft technique to correct the bone defects and induce osteogenesis, along with the use of a PRF membrane to assist in the repair of the soft tissue in the region. After 8 months of follow-up, it was concluded that the prognosis was favorable, as the placement of a new implant in the region, associated with PRF, achieved osseointegration despite the reduced bone quality caused by the removal of the first implant.
Keywords: *Dental Implants, Platelet Rich Fibrin, Osseointegration, Bone Regeneration.*

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I. Introduction

Despite the high success rates in oral rehabilitations with dental implants, current trends show that failure rates are also common, prolonging rehabilitation time and generating potential expenses and dissatisfaction for both the professional and the patient (Brånemark *et al.*, 1969).

For El Askary *et al.* (1999), the factors determining the success or failure of dental implants are the patient's physiological conditions, their habits, care, and the execution of the surgical technique. All types of bones can present difficulties for implant installation, whether it is type I bone, frequently found in the mandible, or type IV bone, generally found in the maxila (Friberg; Jemt; Lekholm, 1991). In 2010, Nóia *et al.*

(2010) reported complications in 13.75% of dental implants, with a 9.72% rate of postoperative complications.

To avoid treatment failures, a meticulous planning process must occur before the surgical stage, starting with collecting information on the patient's medical history, the health status of adjacent teeth and the entire oral cavity, and the patient's habits. Additionally, the predictability of complications and possible failures in rehabilitation should be analyzed through examinations and clinical evaluations to prevent these problems from occurring. Some complications pointed out by the authors include iatrogenic factors, improper implant choice, incorrect angulation during installation, nerve injury, maxillary sinus perforation, fractures, lack of bone stability, proximity of implants to other teeth, and lack of postoperative care by the patient, among other factors (Misch, 2000).

Studies conclude that the success rate of implants installed in anterior regions is higher than in posterior regions (Kim, 2015). In case of implant failure or lack of osseointegration, it is recommended that removal be performed immediately, and the soft and hard tissues of the region should be carefully examined, curetted, and treated according to indications to ensure they remain healthy (Covani *et al.*, 2009). The use of minimally traumatic techniques for explanting an implant is necessary to avoid additional damage to the bone region and soft tissues. If installing a new implant in the region is appropriate, it should ideally occur immediately (Stajčić *et al.*, 2016).

When there is a deficiency in bone volume and quality for the installation of a new implant, techniques such as bone grafting with autogenous grafts or hydroxyapatite can be employed to provide the necessary support. Autogenous grafts are considered excellent due to their osteoinductive, osteoconductive, and osteogenic activity, but despite their significant advantages, they carry risks of infections, incompatibility, and morbidity in the donor region. As the primary inorganic component present in teeth and bones, hydroxyapatite has been widely used as a graft material due to its safety, biocompatibility, low resorption rates, and osteoconductive properties (Araújo *et al.*, 2020). To enhance the efficiency of autogenous or xenogenous grafts, blood concentrates can be introduced into the technique to achieve better compatibility and biological connection, such as Platelet-Rich Fibrin (PRF) (Ivanova *et al.*, 2017).

The Sticky Bone technique was introduced in 2017, consisting of combining bone with platelet aggregates. Various methods can be used, but for this technique, I-PRF (injectable Platelet-Rich Fibrin) has been an excellent option for combining the graft with concentrates (Sohn *et al.*, 2015; Agrawal, 2017). In addition to releasing growth factors in the region, it acts as a protective barrier for the graft and promotes better tissue regeneration (Agrawal, 2017; Choukroun *et al.*, 2006).

Therefore, the objective of this article is to present the solution and techniques used in a region where a dental implant had previously been removed due to lack of success and osseointegration, and which presented bone resorption. Six months after its removal, a new implant with a bone graft, combined with leukocyte-rich platelet-rich fibrin, was installed to achieve a promising result.

II. Case Report

Male patient, 58 years old, Caucasian, non-smoker, with healthy physiological conditions, attended the specialization clinic in Oral and Maxillofacial Surgery and Implantology. On intraoral and radiographic clinical examination of the region of tooth 14, it was noted that six months after the removal of the non-osseointegrated implant, the region already showed bone conditions for rehabilitation and installation of a new implant. Thus, a new treatment plan was discussed and developed to rehabilitate the region safely and with good results, associating the implant installation with bone grafting, using the Sticky Bone technique and a PRF membrane to improve healing and aesthetic conditions of the connective and bone tissues.

Figure 1- Preoperative panoramic radiograph

Preparation Of Prf For The Sticky Bone Technique And Obtaining The Membrane (L-Prf)

After venipuncture, six 9ml test tubes from the VAGUETTE brand were collected and used, with four red-capped tubes for obtaining the membrane (L-PRF) and two white-capped tubes intended for Sticky Bone. No biochemical additives or anticoagulants were added. To obtain the membrane, the L-PRF was removed from the tubes in its solid phase, and its dehydration occurred in a metal tray with a press specifically used for membranes. To obtain Sticky Bone, Bio-Oss graft with granulation 0.25mm - 1mm was placed in a metal tray, where the I-PRF was added and carefully manipulated so the materials could agglutinate.

Figure 2- Centrifuge used to obtain PRF.

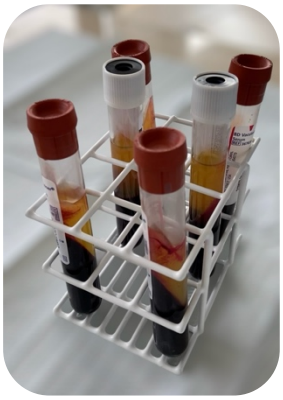

Figure 3- Blood concentrates obtained through centrifugation.

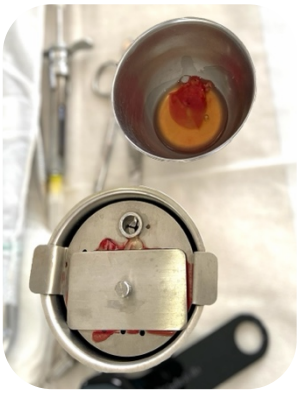

Figure 4- L-PRF membrane and Sticky Bone

Surgical Procedure

The procedure began with local infiltrative anesthesia in the Middle Superior Alveolar Nerve and Greater Palatine Nerve, followed by a Novak incision with two relieving incisions, one on the mesial of tooth 13 and one on the mesial of tooth 15. Mucoperiosteal detachment was performed with Molt elevators to expose the entire vestibular bone region. The surgery proceeded to implant installation, using drills from the Maximus Expander Kit for better bone preservation, following the sequence from the pilot drill to the 3.8mm drill in the kit, with copious irrigation with ozonated water. An HE-type implant, measuring 4.0x11mm from TitaniumFix, was installed with a torque of 50 newtons. The bone graft obtained with the Sticky Bone method was used throughout the vestibular bone region, followed by the positioning of the L-PRF membrane in the same region to improve aesthetics and induce more efficient osseointegration. The flaps were repositioned, and the surgery was completed with suturing of the entire incised region, totaling seven simple stitches with 4-0 Nylon thread and irrigation with ozonated water throughout the region. The patient was verbally and in writing instructed about postoperative care and prescribed antibiotic coverage with Amoxicillin + Clavulanate (875+125mg), Toragesic (10mg), and Dexamethasone (4mg). Suture removal was performed after seven days, without signs of infection or inflammation.

Figure 5- Site for implant installation

Figure 6- Operative view after incision and detachment

Figure 7- Installation of HE 4.0 x 11mm implant

Figure 8- Installed implant with cover

Figure 9- Positioning of Sticky Bone and L-PRF membrane in the vestibular region

Figure 10- Repositioned and sutured flap

Postoperative Evaluation

A new panoramic radiograph was requested for evaluation after three months. The implant was osseointegrated, the gingival region had more favorable aesthetics and volume and was healed. The patient was referred for prosthetic rehabilitation the following month.

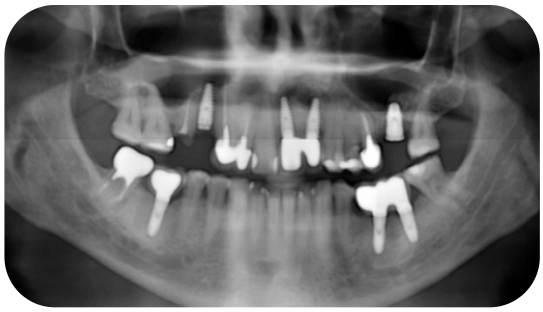

Figure 11- Panoramic radiograph three months postoperative

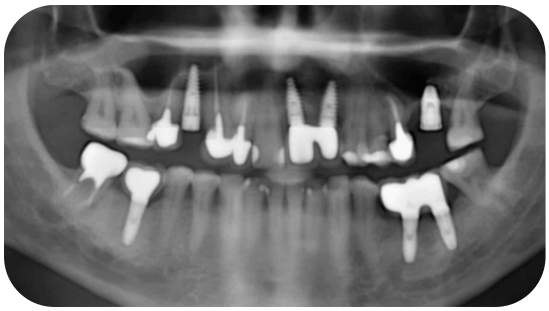

Figure 12- Panoramic radiograph eight months postoperative.

Figure 13- Region with nine months of healing, with a healing abutment installed

Figure 14- Crown trial over the implant.

III. Discussion

This study reports the case of a patient who had already lost an implant and was awaiting bone regeneration for another attempt at dental implant rehabilitation in the region of tooth 14, which became possible with current and promising techniques to induce healing and osseointegration. This was achieved using PRF associated with bone grafting, consisting of a fibrin matrix containing components that induce angiogenesis, osteogenesis, tissue remodeling, and osseointegration, thus promoting ideal healing (Choukroun et al., 2006).

Autogenous grafts are considered outstanding for osteoconduction, osteoinduction, and osteogenesis; however, they have the disadvantage of a high chance of morbidity in the region, as well as incompatibility and

infection (Deshpande et al., 2014). Xenografts are commercially available in various forms, are biocompatible, osteoconductive, and do not trigger inflammation (Araujo et al., 2009). Given these factors, bovine graft was chosen for the Sticky Bone technique.

Xenografts require a biological enhancer to induce osteoinduction, promoting new bone formation in the region (Browaeys; Bouvry; Bruyn, 2007; Castro et al., 2017); as seen in the Sticky Bone technique, which combines the bone graft with Platelet-Rich Fibrin (L-PRF) in its liquid form, known as i-PRF, obtained autologously and prepared via centrifugation without the addition of anticoagulants. The association with i-PRF allows for graft agglutination, angiogenesis, tissue repair, protection barrier to the xenogeneic material, vascularization, constant release of growth factors, thus enabling tissue regeneration (Agrawal, 2017; Shah et al., 2019; Mourão et al., 2015; Wang; Boyapati, 2006; Dohan et al., 2006).

PRF membranes are biocompatible and can act as a protective and stabilizing barrier for bone grafts, promote a gradual release of growth factors, increase tissue thickness in the implant region, favor aesthetics, and prosthetic rehabilitation; they stimulate the maturation of keratinized gingiva, can be used to cover implants, control the inflammatory process, prevent significant edema, accelerate the healing process, and reduce infection chances through their chemotactic and neovascularization activities (Dohan et al., 2006; Toffler, 2014; Simonpieri et al., 2004; Oliveira et al., 2015).

In the dental field, autogenous biomaterials obtained through Platelet-Rich Fibrin and leukocytes offer advantages when inserted in regions with resorption and bone defects, sinus lifts, periapical lesions, periodontitis, and as adjuncts in dental implant treatments, providing high success rates in osseointegration and overall treatment (Wang et al., 2021; Mu et al., 2020). Other advantages of using PRF in surgeries include the simple process of obtaining and handling, as they are autogenous; low cost, no addition of anticoagulants or biochemical materials in the process, eliminating disease transmission and immune reactions (Nóia, 2010; Shah; Thomas; Mehta, 2017; Raja; Naidu, 2008).

On the other hand, some studies report disadvantages in obtaining PRF, such as the need for a centrifuge, rapid centrifugation and material collection, the material obtained can only be used on the same patient and at the same surgical time, and the small amount that can be used, since it comes from the patient's blood (Choukroun et al., 2006; Costa; Santos; Santos, 2021; Silva et al., 2023). However, in implantology, the amount obtained through collection and centrifugation is sufficient.

IV. Conclusion

Dental implant surgeries depend on several factors, such as thorough evaluation, accurate diagnosis, meticulous surgical planning, and surgical skill. This case report demonstrates that in situations with deficient bone and gingival conditions, promising techniques like the use of PRF and bone grafts can be significant differentials for the success of dental implant osseointegration. These techniques accelerate the healing process, promote bone tissue neogenesis, and offer biomechanical properties that enhance treatment outcomes.

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