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Case Report

The Use of Intentionally Exposed High Density Polytetrafluoroethylene Barrier in Guided Bone Regeneration: A Case Report

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Abstract

Introduction: Bone loss is one of the major difficulties faced in implantology and oral rehabilitation. Several bone graft techniques have been developed and optimized, including particulate or block, split-crest, distraction osteogenesis, among others. By the end of the 1990s, guided bone regeneration (GBR) is developed, aiming the rise of the bone reconstruction success ratio, making them more predictable. The technique consists of a barrier or membrana for bone and soft tissues separation, avoiding the fibroblasts migration into the bone matrix while it is still in the formation process. Additional techniques to enhance the graft stability were developed, such as sticky-bone. The high density PTFE (d-PTFE) barrier used in the present case report offers the possibility for oral exposure, differently from the traditional GBR, which full coverage of the membrane is required. The main advantage observed is the bigger amount of ceratinized tissue gain without compromising the healing process. The present study aims to report a case of the use of d-PTFE barrier in a bone reconstruction for alveolar preservation after tooth extraction procedure.

Case Report: female patient, 61 years old, reporting a failure during tooth extraction and resulting in the crown fracture of the element 24. Atraumatic tooth extraction was realized and the alveolar preservation with biomaterial graft associated to i-PRF and covered with d-PTFE barrier was realized. Intentionally exposed d-PTFE barrier for bone defects reconstruction in dental implant area is a promising option comparing to traditional GBR when looking for a major gain of ceratinized tissue, although new studies are encouraged in order to better define protocols and indications.

Keywords: PTFE Barrier; Guided Bone Regeneration; Bone Graft

Introduction

Alveolar bone resorption is a pathological condition that occurs in a responsive manner to dental loss, periodontal disease, dental or bone fractures and long-term usage of removable prosthesis. Functional stimulation absence promotes a predictive bone resorption according to its etiology. Graded bone volume reduction can cause a situation of insufficient amount of bone, making grafts an obligatory requirement to install dental implants [1,2].

Alternatives for bone defects reconstruction were developed among the years of study and practice in implantology, such as block grafts, split-crest, osteogenic distraction, orthodontic movements and particulate grafts. Although, failure in cases of vertical or horizontal deficiency was directly related to epithelial cells infiltration between the grafted bone and the receptor site. This phenomenon was associated with the turnover difference between soft and hard tissues [1-5].

Studies conducted in the 1980s by Nyman and Kerring about periodontal tissue regeneration showed that cells who first reach the wound will determine the main tissue type. The concept of Guided Tissue Regeneration (GTR) was developed and opened up new treatment modalities, such as Guided Bone Regeneration (GBR), first described in the 1990s by Nyman and serving as an alternative for bone reconstruction before dental implants treatment [3].

GBR is well described by a physical barrier applied between bone and periosteum, preventing epithelial cells, which rapidly differentiate themselves, from infiltrating the bone defect area, in order to avoid prejudice for the bone augmentation. The graft can be autologous, allogenous or xenogenic. For the non-resorbable barriers, polytetraflurorethylene (PTFE), titanium meshes and screens can be cited. Resorbable membranes such as collagenous are a common alternative [4-8].

Adequate blood supply and the absence of micro mobilization are requirements for a successful bone reconstruction. Beyond PTFE barriers, techniques like tended screws, membrane fixation with thumbthacks, customized titanium meshes or the *sticky bone* are alternatives to keep the graft dimensional stability [9,10].

The PTFE barrier can be divided into two categories: expanded (e-PTFE) and high density (d-PTFE). The former shows a porous polymer characteristic: stable, bioinert and resistant to enzymatic degradation within the oral cavity. A common clinical failure of this material is postoperative infection, which can be related to its porous nature. High density PTFE membranes have a less porous structure, hardening the bacterial infiltration process into the bone graft, consequently reducing postoperative infection rate compared to e-PTFE. The current evidence preconizes full wound closure and absence of the barrier exposure as requirements for a successful treatment, but intentional exposure has been conducted and showed promising results [7].

Intentional exposure of d-PTFE barriers is described as an alternative to conventional GBR, that demands full coverage of the material. Keratinized tissue thickness gain was the main advantage of intentionally exposed barriers [11,12].

Aiming the graft stability and rehabilitation longevity, PTFE barriers can be associated with the *sticky bone* technique. The present study reports a clinical case of an atraumatic tooth extraction, bone reconstruction using xenogenic graft mixed with i-PRF and the application of a d-PTFE barrier intentionally exposed [13-15].

Case Report

A female patient, 61 years old, came into the Implantology service inside FUNORTE school (Divinópolis cty, state of Minas Gerais, Brazil). Complained about a crown fracture of the tooth element number 24. During anamnesis, she denied any kind of comorbities, known allergies or daily use of medications. At the physical examination, an extended loss of dental structure (absence of the crown portion) could be observed on tooth 24 (Figure 1). A CBCT-Scan was taken and analyzed by the oral surgeons, who observed an absence of the buccal bone wall around tooth 24 (Figure 2). Because of financial matters, the patient opted to remove the dental remaining root and rehabilitate with a dental implant. A treatment was then purposed: Atraumatic removal of tooth 24, alveolar preservation and buccal bone wall reconstruction with xenogenic bone graft (Lumina Porous CRITERIA) associated with i-PRF (*sticky bone*) and a d-PTFE barrier to cover the graft (Lumina PTFE).

Figure 1: Remaining dental root after failed attempt of tooth extraction.

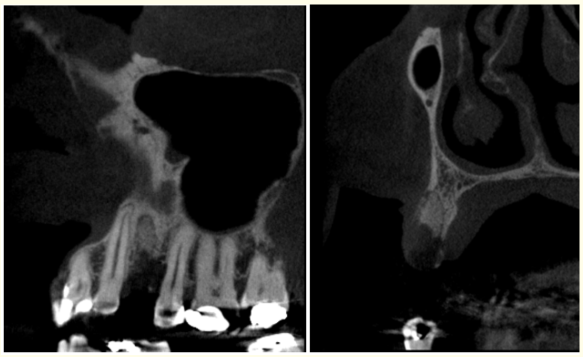

Figure 2: Tomographic images of the element 24, evidencing buccal plate defect and remaining dental root.

Surgical procedure

A blood sample was collected and stored in test tubes. The centrifugation process started, lasting for 10 minutes at 1920 rpm.

Biosafety protocols were followed for surgical preparations, and the procedure started with local anesthesia block (Lidocaine 2%+ Epinefrine 1:100.000), intrasulcular incision between buccal gingival portion of teeth 23 and 25, providing an adequate view of tooth 24 and adjacent alveolar bone (Figure 3). Atraumatic tooth extraction was conducted using a periotome, keeping the alveolar bone integrity. Three L-PRF membranes and the liquid from i-PRF were collected from the test tubes (Figure 4). After that, *sticky bone* was made from i-PRF mixed with the xenogenic graft and positioned over the alveolus, being slightly condensed until full coverage (Figure 5), then the L-PRF membranes were placed over on it (Figure 6). A d-PTFE barrier was cut and adapted over the surgical site (Figure 7). Sutures were performed and the barrier was left intentionally exposed, in order to maximize the keratinized tissue gain (Figure 8). It was removed with the sutures after 28 postoperative days (Figure 9).

Figure 3: Buccal plate defect after full exposure of alveolar process.

Figure 4: L-PRF membranes.

Figure 5: Sticky bone already adapted over the alveolar bone.

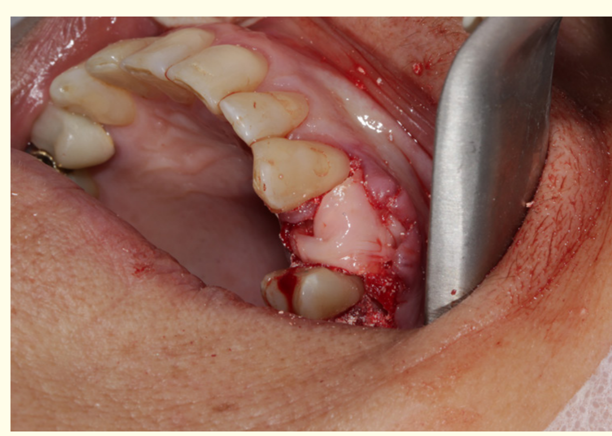

Figure 6: L-PRF membrane covering the graft.

Figure 7: d-PTFE barrier cut and adapted.

Figure 8: Sutures to keep the barrier well positioned.

Figure 9: Removal of barrier and sutures. Granulation tissue could be noticed and there was no graft exposure.

Postoperative period

After 90 postoperative days, a new clinical assessment was conducted and a satisfactory keratinized tissue thickness could be noticed (Figure 10). A new CBCT-scan was done and an adequate bone neoformation area, compatible with the intended bone augmentation, was observed. A standardized bone trabeculation and no suggestive figure of osteolysis were important signs (Figure 11).

Figure 10: 90 postoperative days clinical image, evidencing satisfactory soft tissue aspect.

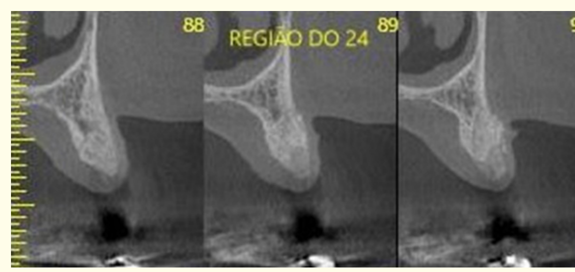

Figure 11: Tomographic images 90 days after bone reconstruction, a complete bone graft incorporation could be observed.

As for the new surgical procedure, the bone was again exposed and bone graft adequately incorporated (Figure 12). A standard drilling sequence was performed and the implant correctly installed. A healing screw was inserted and sutures done, following the horizontal mattress technique for adequate exposure of the healing screw (Figure 13).

Four months after implant surgery, the patient was evaluated again. A panoramic radiographic exam showed a satisfactory contact between bone and implant screw (Figure 14,15). During physical examination, the surgeon noticed no signs of mobility or infection, compatible with a well-succeeded osseointegration process.

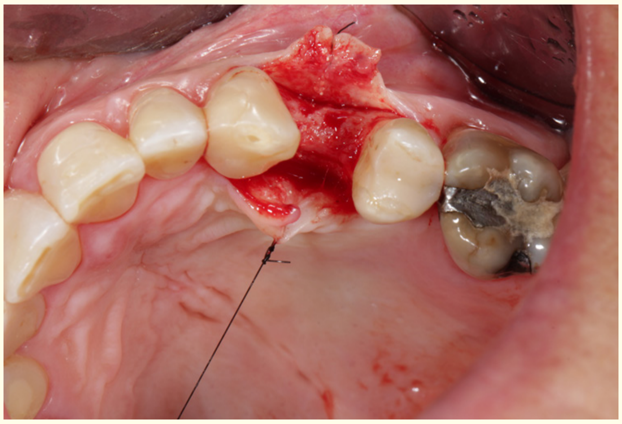

Figure 12: Alveolar bone exposure previously to implant installation.

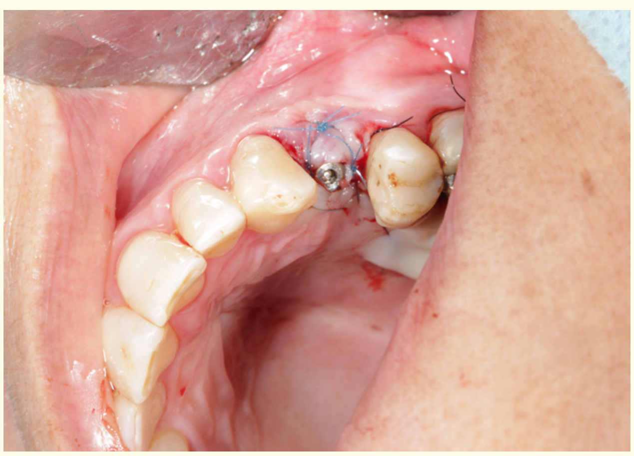

Figure 13: Healing abutment and sutures for a better adaptation of gingival tissues.

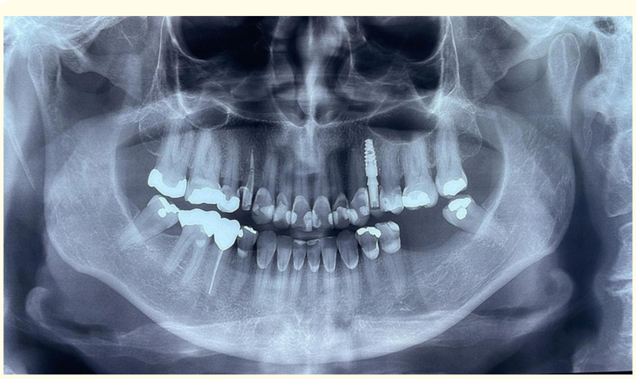

Figure 14: 4th postoperative month Panoramic Radiograph, showing adequate implant-bone contact.

Discussion

Due to the larger area of contact with healthy bone, particulate grafts enhances the incorporation process, although a stable blood clot and minimal graft micro movements are necessary for a successful treatment. High density PTFE barriers are indicated to maintain dimensional stability, which is also benefited by the use of i-PRF associated to allogen bone grafts (*sticky bone*). Valladão., *et al.* [15] conducted a retrospective study in which a guided bone generation was performed with i-PRF-associated autogenous and allogenous bone grafts. Resorbable collagen membranes were used for horizontal defects and titanium-enhanced d-PTFE barriers for the vertical ones. A postoperative control was made with CT-scans to measure bone augmentation, and the results for both kinds of defect were satisfactory.

Palkovics., *et al.* [13] conducted a case series to analyze the barrier exposure of d-PTFE used for their bone reconstructions in comparison to previously published e-PTFE studies. In conclusion, lesser negative impacts were noticed in favour of d-PTFE barriers. Luongo., *et al.* realized an histomorphometric analysis in post-reconstruction bones. High density PTFE barriers were left intentionally exposed in all 18 patients, and no bacterial growth has been found.

Barboza., *et al.* [11] performed a randomized clinical trial to evaluate keratinized tissue augmentation after tooth extraction and d-PTFE barrier application. Two groups containing 15 patients each were submitted to tooth extractions: the control group, that had only the teeth extracted and the test group, which had the extraction and d-PTFE barrier use. The keratinized tissue thickness was measured in both groups and a significant augmentation was observed in the test group compared to the control. Mandarino., *et al.* [12] conducted a similar study, although they associated the genetic expression and histological analysis to microscopically evaluate the formed tissue quality after 4 postoperative months and found similar results compared to Barboza., *et al.* [11], with an important keratinized tissue thickness gain, but no significant difference on the height. For the biomolecular analysis, no difference could be stated for both bone and gingival tissues in both groups. The two studies concluded that a bigger keratinized tissue thickness gain could be noticed after the use of d-PTFE barriers, although Mandarino et al.[12] did not observe changes in the tissue repair process.

Conclusion

Intentionally exposed high density PTFE barriers are promising treatment alternatives when compared to traditional bone guided regeneration in implant dentistry, specifically when a natural aspect of the tissue is prioritized, and keratinized tissue formation appears to be influenced by the use of d-PTFE barriers. The use of *sticky bone* may enhance the bone graft stability and boost the tissue repair. Even with the clinical success reported in this study, the use of intentionally exposed d-PTFE barriers needs to be further studied in order to standardize clinical protocols, clearly understand its clinical indications, advantages and complications.

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