Regenerative endodontic procedure using leukocyte- and platelet-rich fibrin associated with apical surgery: case report

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ABSTRACT

Introduction: Parendodontic surgery is an alternative to conventional endodontic treatment, especially in cases involving periradicular lesions associated with osteolytic processes, in which conventional endodontic therapy or retreatment was not successful. New therapeutic methods for the treatment of these cases have ground in clinical dentistry . For example, leukocyte- and platelet-rich fibrin which has a higher concentration and more prolonged release of growth factors, modulates the repair process. This process is based on the optimization of tissue regeneration through the insertion of fibrin membrane. **Objective:** The objective of this study is to report a case in which leukocyte- and platelet-rich fibrin associated with parendodontic surgery was used for bone repair. **Results:** Clinical and tomographic follow-up was performed after 72 days, which revealed absence of any symptoms, complete repair of the lesion, buccal cortical bone regeneration, and absence of detectable lesion on tomography. **Conclusion:** There was complete tissue regeneration at the lesion site.

Keywords: Microsurgery. Endodontics. Platelet-rich Fibrin.

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» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

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Introduction

Parendodontic surgery is indicated when conventional endodontic treatment or retreatment has not been successful. It is also indicated in iatrogenic cases in which irritant materials reach the apical region or when conventional treatment[1] fails to eradicate an extraradicular infection.

Thus, apicectomy associated with retrofilling consists of apical preparation of the root canal. The primary objective is the removal of factors that cause irritation in periradicular tissues[2,3] and later retrograde instrumentation and retrofilling.

Periradicular bone destruction has been a challenge for the dental professional. The treatment plan in these cases should take into account factors such as clinical and radiographic aspects of periradicular lesions, possibilities of treatment, and patient preference.[4]

The healing of lesions that lead to bone destruction is the central goal of regenerative surgeries. These surgeries, which combine hemolytic techniques and regenerative methods, have a high cure rate. The healing process occurs as a result of an extensive and complex interaction of epithelial cells, osteoblasts, fibroblasts, and signals that are released from platelets, such as cytokines and growth factors.[5]

Along these lines, the current literature has proposed new types of treatment, including regeneration promoted by leukocyte- and platelet-rich fibrin (L- PRF). The therapy consists of the release of biologically active molecules and growth factors at the lesion site, reducing the size of the lesions until they disappear altogether.[6]

In parendodontic surgeries, the regenerative procedure is a new alternative for the treatment of extensive apical lesions. In this case, the bone healing process is stimulated by osteogenesis and by growth factors released by L- PRF.[7]

Platelet-rich fibrin contains growth factors that are released slowly during the healing process. This mechanism prevents the proliferation of microorganisms from the oral epithelium and gingival connective tissue to the lesion site.[8]

L-PRF has been used in medicine because it is a natural autologous material that significantly reduces the risk of infections or the emergence of autoimmune processes, and also because it is easily handled and relatively affordable. In dentistry, its use is primarily targeted at accelerating the formation of new bone and of gingival tissue, in combination with parendodontic surgery.[9,10]

Thus, the present study aims to present a case report on the use of L-PRF in parendodontic surgery, highlighting its characteristics and advantages.

Clinical case

The research protocol was submitted to and approved by the Research Ethics Committee (CAAE: 86584618.0.0000.5578, opinion no. 2,653,031).

A 27-year-old patient presented with painful symptoms in the right upper lateral incisor region. Clinical examination showed elevation of the alveolar ridge, absence of periodontal pocket or mobility, and presence of pain during the vertical percussion test. Radiographic examination and cone-beam computed tomography (CBCT) were requested, which demonstrated technically poor endodontic treatment with leakage of material into the periapical area, as well as an extensive periapical lesion at the height, width, and depth of 7.8 mm, 8.5 mm, and 5.0 mm, respectively (Fig 1).

Conventional endodontic retreatment was performed with three calcium hydroxide dressing changes (Ultracal - Ultradent; Indaiatuba - SP, Brazil) at 10-day intervals with later obturation (Fig 2). As the leaked material could not be removed through the root canal, direct access via the periapical region was suggested, allowing the operator to directly visualize the leaked material.

L-PRF

Blood from the median cubital vein (right arm) was collected in four 10-mL tubes, without any additive (anticoagulant), and the samples were immediately centrifuged (Mont Serrat - Fibrin FUGE 25; Brazil). The tubes were arranged in pairs in opposite directions following the L-PRF protocol recommended by Choukroun[10] (RCF of 400 xg and time of 12 minutes). After that, three strata were collected: acellular plasma or platelet-poor plasma fraction at the top; red blood cells at the bottom; and the fibrin clot (L-PRF) in the middle. The resulting fibrin clots were then placed in the fibrin box (Mont Serrat, São Paulo - SP, Brazil) (Fig 3).

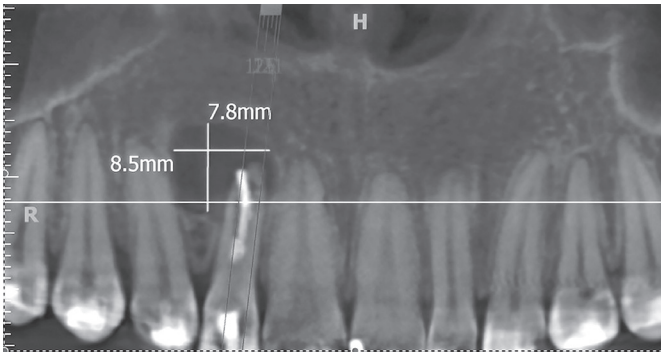

Figure 1. CBCT showing lesion size at baseline.

Figure 2. Periapical radiograph immediately after endodontic retreatment.

Apical surgery

Local anesthesia was administered and consisted of 2% lidocaine with epinephrine 1:100.000 (DFL, Rio de Janeiro, RJ, Brazil). An incision was made from the distal surface of the upper right central incisor to the mesial surface of the second upper premolar, with a relaxing incision and tissue detachment for direct access to the lesion site.

Buccal bone fenestration was observed under the microscope (Alliance, São Carlos - SP, Brazil) at 25x magnification. The margins were enlarged with a bone curette (Hu-Friedy, Rio de Janeiro, RJ, Brazil) for visualization of the lesion, and the whole injured tissue was excised, exposing the bone defect cavity.

A 4-mm apicectomy was performed with a Zecrya bur (FG Maillefer – Dentsply, Catanduva - SP, Brazil) perpendicularly to the long axis of the tooth, removing the extravasated gutta-percha. Retrograde root canal preparation was performed with PM 1 surgical insert (Helse, Santa Rosa do Viterbo, Brazil) and obturation with mineral trioxide aggregate - MTA (Angelus; Londrina - PR, Brazil).

In a sterile tray, three units of L-PRF membrane were cut and agglutinated with 0.3 grams of bone graft (Lumina Bone Porous Medium – Criteria, São Carlos - SP, Brazil). This combination was then inserted into the bone cavity to fill the entire space. The bone cavity was covered with an L-PRF membrane (Fig 4) and the flap was repositioned and sutured.

Results

Clinical and tomographic follow-up was performed after 6 months, revealing absence of symptoms, complete repair of the lesion, buccal cortical bone regeneration, and absence of detectable lesion on tomography (Fig 5).

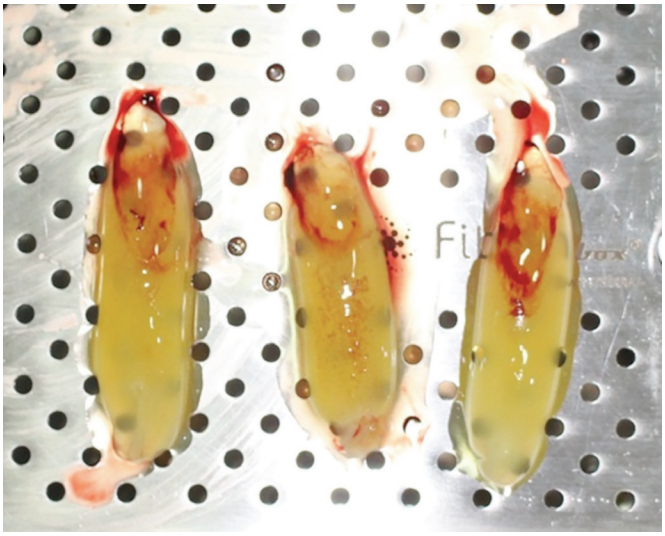

Figure 3. Fibrin clots.

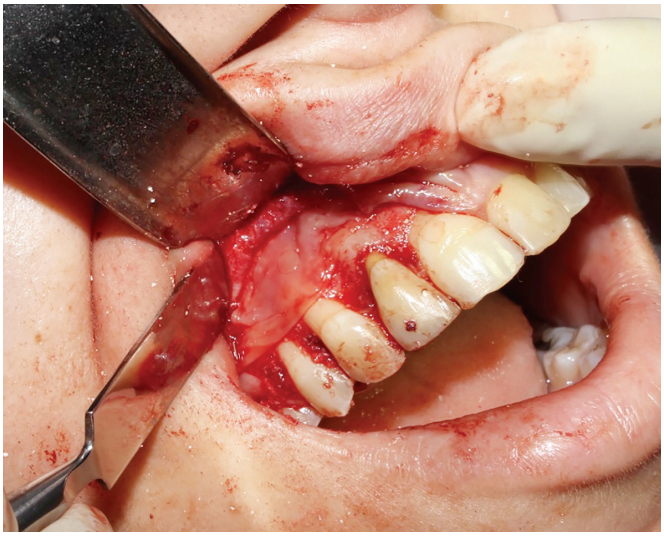

Figure 4. L-PRF membrane covering the bone window.

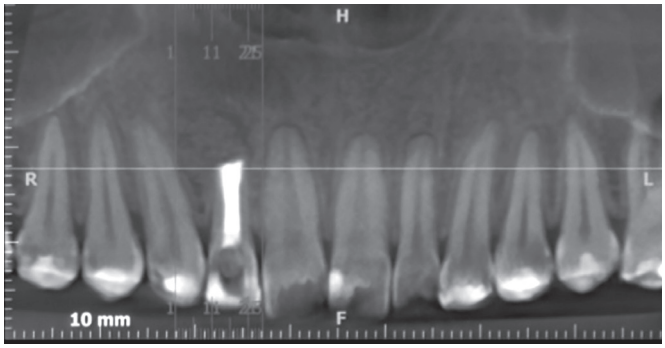

Figura 5. CBCT at 190 days after the surgery.

Discussion

Regenerative biotechnology has been on the rise in the medical and dental fields, associating diverse aspects such as cellular and molecular biology, materials science, and bioengineering. These innovations allow greater optimization in the processes of regeneration, repair, or tissue replacement.[9]

L-PRF is a biomaterial that is rich in glycoproteins and in some growth factors, favoring the repair of lesions efficiently and reducing the risks of rejection of the material.[11] This therapeutic modality emerged as the first technique derived from human blood samples and contains a platelet concentrate free of any anticoagulant or other artificial biochemical modifications. It was initially used in medicine, specifically in surgery, for tissue repair, and later in dentistry, primarily for the formation of new bone and gingival tissues.[12-17]

In the field of dental surgery, L-PRF aids in the reconstitution of the oral cavity architecture and function. Although there are other procedures in this field, there is no gold standard, and L-PRF is then considered an innovative element to fill this gap.[18-20]

Choukroun[10] initially described this technique in 2000 and thereafter proposed a standard protocol in which about 10 mL of the patient's blood is collected in plastic or coated glass tubes without using any additives. Centrifugation is then performed at 2700 rpm for 12 minutes and three phases are obtained in a tube, where L-PRF is the intermediate fraction between red blood cells and platelet-poor plasma.[21-22]

In a study[23] with a follow-up period of 7 to 20 months, complete healing and absence of symptoms were observed in 14 out of 15 patients with osteonecrosis of the jaw. L-PRF membranes are therefore assumed to contribute to satisfactory outcomes.

The technique described by Choukroun is a success in the process of bone regeneration when it comes to endodontic pathologies. In a case report[7] of a patient diagnosed with asymptomatic apical periodontitis, the innovative L- PRF approach was used in association with apical surgery. After follow-up, it could be inferred that the technique used was efficient and sufficient to provide an innovative alternative for complex clinical cases.

In the clinical case reported herein, the protocol proposed by Choukroun was also used. The CBCT images showed a lesion measuring 8.5 mm in width,

5,5mm in depth, and 8.0 mm in height, for which bone grafts with a size proportional to 3 g would be indicated. However, the hybrid L-PRF technique associated with only 0.3 g of bone graft was used as an adjunct. Despite the smaller amount of bone tissue, lesion size was successfully reduced, corroborating the regenerative potential of L-PRF.

Researchers described two clinical cases[6] in which L-PRF was used to evaluate the potential benefits of combining bone graft with this concentrate. In both cases, the individuals had radicular cysts and were treated through a regenerative process similar to the one described. Patients were evaluated for discomfort in the immediate postoperative period and after one week, followed up with periapical radiographic examinations every month up to six months after the procedure. There was reduction of lesion size in both cases and L-PRF helped with the healing process and reduction of postoperative discomfort.

The successful use of L-PRF was also demonstrated in the case of an extensive endodontic lesion in a left upper lateral incisor, evaluated by periapical radiographs and CBCT taken every six months, which showed absence of symptoms and total lesion regression.[7]

However, there is no information available to date demonstrating how factors such as PDGF-AA, PDGF-BB, TGFB1, VEGF, and PDGF-AB are released by the concentrate over time. The advantage of using L-PRF compared to other concentrates is that it releases these factors for a longer time.[8]

A correct treatment plan and a precise surgical technique are essential for clinical success. In this sense, the combination of lyophilized bone with L-PRF seems to present positive and reliable results for bone remineralization.[24,25]

Although L-PRF is not considered a membrane, it has shown the ability to reduce bone resorption in some cases because proliferation of periosteum-derived cells and osteoblasts prevents defective cells from entering the healing site. The fibrin clot ends up playing an essential mechanical role, protecting the grafted biomaterials and L-PRF fragments, serving as connectors between the bone particles.[26]

The use of a bioabsorbable collagen membrane in a case of endo-periodontal lesion presented a satisfactory healing process and tissue regeneration[27]. In another study that used the Choukroun protocol, the antimicrobial activity of the L-PRF clot from blood samples collected from 10 subjects was tested. There was evidence of antimicrobial activity against pathogens that interfere with the healing process, and it was concluded that the use of L-PRF reduces the risk of infection during the healing process.[22]

Thus, L-PRF has been shown to aid in the regeneration/healing process of endodontic lesions, favoring rapid tissue recovery and positively interfering in the effects of possible infections, associated with its full potential, as discussed previously.[22-28]

Conclusion

The results obtained in this clinical case report evidenced that L-PRF is a biocompatible material with significant advantages in dentistry. Such advantages include relative ease of preparation, no need for biochemical blood testing, high potential for regeneration because of the growth factors present in this material, and low cost.

After 190 days, no lesion was detected on tomography and there was complete tissue regeneration at the lesion site.

References

1. Hiremath H, Motiwala T, Jain P, et al. Use of second-generation platelet concentrate (platelet-rich fibrin) and hydroxyapatite in the management of large periapical inflammatory lesion: A computed tomography scan analysis. Indian J Dent Res. July-Aug 2014;25(4):517-20.
2. Kui AI, Labunet AJ, Popescu C, Popa D, Lascu L. Dentists' perspectives on the choice of treatment of teeth with apical periodontitis. Clujul Med. 2018;91(1):98-103.
3. Naik RR, Prashant DM. Techniques of root end preparation for the successful peri-radicular surgery: A literature review. Int J Appl Dent Sci. 2016;2(2):6-10.
4. Shah R, Triveni MG, Thomas R, Mehta DS. An update on the protocols and biologic actions of platelet rich fibrin in dentistry. Eur J Prosthodont Restor Dent. 2017;25(2):64-72.
5. Giannini RR, Cielo A, Boananome L, Rastelli C, Derla C, Corpaci F, et al. Comparison between PRP, PRGF and PRF: lights and shadows in three similar but different protocols. Eur Rev Med Pharmacol Sci. 2015;19(6):927-30.
6. Uppada UK, Kalakonda B, Koppolu P, Varma N, Palakurthy K, Manchikanti V, et al. Combination of hydroxyapatite, platelet rich fibrin and amnion membrane as a novel therapeutic option in regenerative periapical endodontic surgery: case series. Int J Surg Case Rep. 2017;37:139-44.
7. Pinto N, Harnish A, Cabrera C, Andrade C, Druttman T, Brizuela C. An innovative regenerative endodontic procedure using leukocyte and platelet-rich fibrin associated with apical surgery: a case report. J Endod. 2017;43(11):1828-34.
8. Kobaiyashi E, Fluckiger L, Fujika-Kobayashi M, Sawada K, Sculean A, Schaller B, et al. Comparative release of growth factors from PRP, PRF, and advanced-PRF. Clin Oral Invest. 2016;20(9):2353-60.
9. Talluto M, Marelli M, Paduano F. The Regenerative Medicine in oral and maxillofacial surgery: the most important innovations in the clinical application of mesenchymal stem cells. Int J Med Sci. 2015;12(1):72-7.
10. Choukroun J, Adda F, Schoeffler C, Vervelle A. Une opportunité en paro-implantologie: Le PRF. Implantodontie. 2000;42:55-62.
11. Shon DS, Kim HG. Simplified Ridge and Extraction Socket Augmentation using Sohn's Poncho Technique. J Implant Adv Clin Dent. 2018;10(2):16-35.
12. Castilho GFG, Miranda MEP, Bojorque JAS, Nuñez Barragán KI, Sibaña García DV. Gingival and bone tissue healing in lower third molar surgeries. Comparative study between use of platelet rich fibrin versus physiological healing. Rev Odont Mex. 2017;21(2):112-8.
13. Shahram G, Booms P, Kubesch A, Kubesch A, Lorenz J, Rutkowski J. Advanced Platelet-Rich Fibrin: A new concept for cell - based tissue engineering by means of inflammatory cells. J Oral Implantol. 2014;40(6):679-89.
14. Arbildo H, Gamarra L, Rojas S, Infantes E, Lamas C, Vásquez H. Clinical effect of platelet rich fibrin in the treatment of periodontal intrabony defects. Systematic review and meta-analysis. J Oral Res. 2017;6(5):127-35.
15. Porcellini A. Regenerative medicine: a review. Rev Bras Hematol Hemoter. 2009;31 Supl 2:63-6.
16. Dorso MD, Mazor Z, Rutkowski JL, Ehrenfest DMD. The Use of leukocyte- and platelet-rich fibrin during immediate postextractive implantation and loading for the esthetic replacement of a fractured maxillary central incisor. J Oral Implantol. 2012;38(2):181-7.
17. Hotwani K, Sharma K. Platelet rich fibrin - a novel acumen into regenerative endodontic therapy. Restor Dent Endod. 2014;39(1):1-6.
18. Venezuela MH, Oliva PM. Regeneration efficacy of platelet-rich fibrin in patients undergoing periodontal surgery: a systematic review and meta-analysis. Int J Odontostomat. 2014;8(1):21-8.
19. Demarco GT, Kirschinick LB, Watson LB, Conde MCM, Demarco FF, Chisini LA. What is the clinical applicability of regenerative therapies in dentistry? Rev Gaúcha Odontol. 2017;65(4):359-67.
20. Jonhs DA, Shivashankar VY, Shobba K, Johns M. An innovative approach in the management of palatogingival groove using Biodentine T and platelet-rich fibrin membrane. J Conserv Dent. 2014;17(1):75-9.
21. Gassling V, Douglas T, Warnke PH, Açil Y, Wiltfang J, Becker ST. Platelet-rich fibrin membranes as scaffolds for periosteal tissue engineering. Clin Oral Implants Res. 2010;21(5):543-9.
22. Babade PS, Mahale SA, Panjwani AA, Vaidya PD, Warang AS. Antimicrobial effect of platelet-rich plasma and platelet-rich fibrin. Indian J Dent Res. 2016;27(3):300-4.
23. Norholt SE, Hartlev J. Surgical treatment of osteonecrosis of the jaw with the use of platelet-rich fibrin: a prospective study of 15 patients. Int J Oral Maxilofac Surg. 2016;45(10):1256-60.
24. Molina OM. Bone augmentation with platelet rich fibrin, particulate bone and cortical plates. The J Implant Adv Clin Dent. 2018;10(2):6-15.
25. Simonpieri A, Choukroun J, Corso MD, Sammartino G, Ehrenfest DMD. Simultaneous sinus-lift and implantation using microthreaded implants and leukocyte- and platelet-rich fibrin as sole grafting material: a six-year experience. Implant Dent. 2011;20(1):2-12.
26. Raja VS, Naidu EM. Platelet-rich fibrin: Evolution of a second-generation platelet concentrate. India J Dent Res. 2008;19(1):42-6.
27. Bernabé PFE, Azuma MM, Ferreira LL, Dezan E Jr, Gomes Filho JE, Cintra LTA. Root reconstructed with mineral trioxide aggregate and guided tissue regeneration in apical surgery: a 5-year follow-up. Braz Dent J. 2013;24(4):428-32.
28. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJJ, Mouhyi J, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part II: platelet-related biologic features. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006;101(3):e45-50.