ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2019; 5(2): 230-232

www.oraljournal.com
Received: 21-02-2019
Accepted: 22-03-2019

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Platelet rich fibrin (PRF) in the surgical management of periapical lesions: A research article

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Abstract
Periapical inflammatory lesion is the local response of bone around the apex of tooth that develops after the necrosis of the pulp tissue or extensive periodontal disease. PRF is an excellent material for enhancing bone healing, owing to its stimulatory effect on angiogenesis and epithelialization because of local and continuous delivery of growth factors and proteins and thus can be used as graft material in bone defects.
Objective: To describe the use of PRF as a graft material for the treatment of periapical lesion.
Materials and Methods: Fifteen cases are presented in which conventional endodontic therapy failed to resolve the problem and periapical root-end surgery was required.
Results: At the end of six months, all patients showed significant bone regeneration.
Conclusion: It can be concluded that the use of platelet rich fibrin yields an ideal scaffold for use in tissue repair.

Keywords: Periapical lesions, platelet rich fibrin, tissue repair

1. Introduction
Successful treatment for periapical lesion depends on removal of lesion along with causative microorganism. In cases where conventional root canal therapy fails to eliminate, the lesion surgery is the last alternative. Periapical surgery includes removal of diseased soft tissue and sometimes application of different graft material to enhance new bone formation at the defective site [1]. Using platelet-rich fibrin, or PRF, is a way to accelerate and enhance the body's natural wound-healing mechanisms. Platelet rich fibrin (PRF) is a wonderful tissue engineering product and has gained much popularity due its promising results in wound healing. The features of this product are an attribute of platelet cells, which, after cellular interactions, release growth factors. Growth factors are the biologically active substances that are involved in tissue-repair mechanism such as chemotaxis, cell proliferation, angiogenesis, extracellular matrix deposition, and remodelling [2]. PRF contains and releases (through degranulation) at least seven different growth factors (cytokines) that stimulate bone and soft tissue healing. An easy, cost-effective way to obtain high concentrations of growth factors for tissue healing and regeneration is autologous platelet storage via PRF.

2. Materials and Methods
Fifteen patients, aged between 18 to 28 years, were selected for the study. The patients had been diagnosed with periradicular lesions of orthodontic origin (deep bite) based on clinical signs and symptoms, intraoral and radiographic findings. The selected cases included those in which conventional endodontic therapy failed to resolve the problem and periapical root-end surgery was required. Patients who agreed to take part in the study were asked to sign an informed consent form before undergoing the treatment.
Phases of Treatment
1. Phase I - SRP, Orthodonthic consultation for deep bite correction of patients and endodontic consultation.
2. Phase II - Surgical phase
3. Phase IV - Maintanence phase.

The first step of the treatment plan was to carry scaling and root planing, complete the root canal therapy in cases where dry canals existed and in others obturation was done on the day of surgery and orthodontic consultation for bite plane to correct deep bite.

2.1 Surgical Protocol

The surgical protocol included a routine medical history followed by blood investigations. The surgical procedure included reflection of a full thickness mucoperiosteal flap by sulcular incision and two relieving vertical incisions. Debridement of tissues at the defect site was followed by irrigation with sterile saline solution.

2.3 Armamentarium and Technique for PRF Preparation

PRF preparation requires an adequate table centrifuge and collection kit including: A 18 gauge needle and 10 ml blood collection tubes.

2.4 Protocol for PRF preparation

10 ml of venous blood was drawn from the patient. Whole blood was drawn into the tubes without anticoagulant and immediately centrifuged at 3,000 rpm for 10 minutes.

Within a few minutes, the absence of anticoagulant allows activation of the majority of platelets contained in the sample to trigger a coagulation cascade. The result is a fibrin clot containing the platelets located in the middle of the tube, just between the red blood cell layer at the bottom and acellular plasma at the top. This clot was removed from the tube and the attached red blood cells scraped off and discarded.

PRF gel was carefully placed into the cavity till the entire cavity was filled. Wound closure was performed with a 3-0 black silk suture. Analgesics (ibuprofen 3 days), Antibiotics (Amoxicillin + Clavulanic acid [Co-amoxyclav-625 mg] tid-5 days) were prescribed post-operatively.

The sutures were removed after seven days. The patients were reviewed after one week and one, two and six months. Standard IOPA radiography was done using the paralleling cone technique.

3. Results

The patients did not complain of any unusual or severe pain. There were no signs of infection, untoward reaction, wound dehiscence or extrusion of material in any of the patients. Radiographically all patients showed complete bone regeneration at the end of six months.

4. Discussion

PRF represents a new step in the platelet gel therapeutic concept with simplified processing minus artificial biochemical modification. Unlike other platelet concentrates, this technique requires neither anticoagulants nor bovine thrombin (nor any other gelifying agent), making it no more than centrifuged natural blood without additives. PRF consists of a fibrin matrix polymerized in a tetra molecular structure, with incorporation of Cytokines, platelet, leucocytes and circulating stem cells [3].

Developed in France by Choukroun *et al*. in 2001, the PRF production protocol attempts to accumulate platelets and released cytokines in a fibrin clot. Though platelets and leukocyte cytokines play an important part in the biology of this biomaterial, the fibrin matrix supporting them certainly constitutes the determining element responsible for the real therapeutic potential of PRF [4].

Following the debates about the contents and the role of the various components of these preparations, a first classification was proposed in 2009 [5] and is now widely cited as a milestone in the process of clarification of the terminology. This classification is actually very simple, and separated the products following at least 2 key parameters: the presence of a cell content (mostly leukocytes) and the fibrin architecture. This separation allowed to define 4 main families to regroup the products.

1. Pure Platelet-Rich Plasma (P-PRP) – or Leukocyte-Poor Platelet-Rich Plasma – products are preparations without leukocytes and with a low-density fibrin network after activation. Per definition, all the products of this family can be used as liquid solutions or in an activated gel form. It can therefore be injected (for example in sports medicine) or placed during gelling on a skin wound or suture (similar to the use of fibrin glues).
2. Leukocyte-and Platelet-Rich Plasma (L-PRP) products are preparations with leukocytes and with a low-density fibrin network after activation. Per definition, like the P-PRP, all the products of this family-can be used as liquid solutions or in an activated gel form.[6] It can therefore be injected (for example in sports medicine) or placed during gelling on a skin wound or suture (similar to the use of fibrin glues).
3. Pure Platelet-Rich Fibrin (P-PRF) – or Leukocyte-Poor Platelet-Rich Fibrin – are preparations without leukocytes and with a high-density fibrin network. Per definition, these products only exist in a strongly activated gel form, and cannot be injected or used like traditional fibrin glues. However, because of their strong fibrin matrix, they can be handled like a real solid material for other applications. The main inconvenient of this technique remains its cost and relative complexity in comparison to the other forms of PRF available, the L-PRF (Leukocyte- and Platelet-Rich Fibrin) [5].
4. Leukocyte- and Platelet-Rich Fibrin (L-PRF) products are preparations with leukocytes and with a high-density fibrin network [7]. Per definition, these products only exist in a strongly activated gel form, and cannot be injected or used like traditional fibrin glues. However, because of their strong fibrin matrix, they can be handled like a real solid material for other applications.

PRF results from a natural and progressive polymerization occurring during centrifugation which signifies increased incorporation of the circulating cytokines in the fibrin meshes (intrinsic cytokines). The intrinsic incorporation of cytokines within the fibrin mesh allows for their progressive release over time (7-11 days), as the network of fibrin disintegrates [8] Such a configuration implies an increased lifespan for these cytokines, because they will be released and used only at the time of initial cicatricial matrix remodelling (long term effect). The cytokines are thus maintained available *in situ* for a convenient period, when the cells start cicatricial matrix remodelling, i.e., when they have to be stimulated to launch injured site reconstruction. Slow polymerization with physiologic thrombin concentrations implies very elastic matricial architecture (equilateral junctions between fibrin fibrillae particularly favourable to cell migration and soluble molecule retention). The easily applied PRF membrane acts much like a fibrin bandage, serving as a matrix to accelerate the healing of wound edges.

5. Conclusion

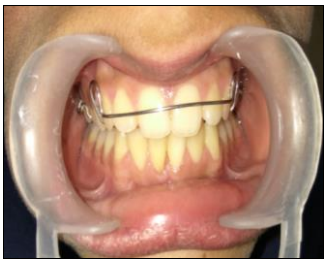
PRF is a healing biomaterial as it contains all the factors required for optimal wound healing. Previous research and

clinical experience indicate that PRF improves early wound closure, maturation of bone, and the final aesthetic result of the periodontal soft tissues. Long-term follow-up of the present case and long-term controlled clinical trials will be required to evaluate the final treatment outcome.

6. Financial Support and Sponsorship
Nil

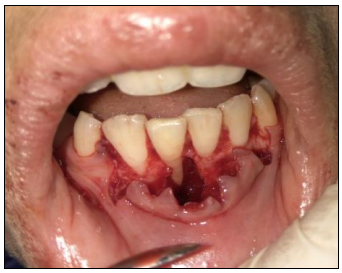
7. Conflicts of Interest
There are no conflicts of interest.

8. Pictoral presentation

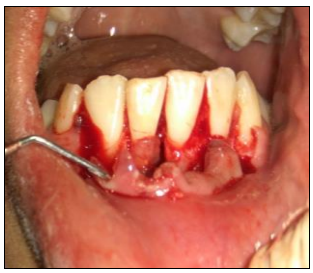


Frontal view

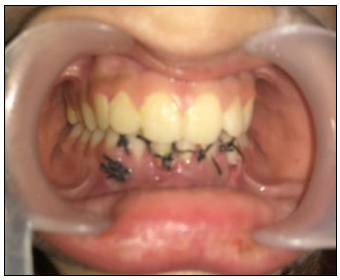
Sulcular incision



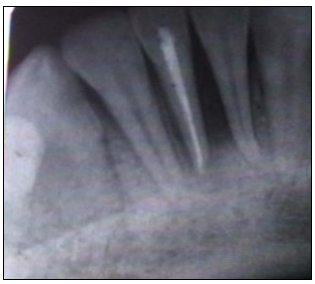
Defect exposed



PRF placed



Sutures placed



X ray after 6 months

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