Case Report

Regenerative Endodontic Management of a Periapical Lesion using Platelet Rich Fibrin: A Case Report

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ABSTRACT

Periapical inflammatory lesions occur in response to the ingress of microbes from the root canal. The treatment rendered in endodontic procedures includes root canal cleaning and shaping followed by obturation. In an event when the pathology cannot be cleaned due to obturation, surgical intervention has to be delivered. The rationale of surgical endodontics is to eliminate the pathological tissue in an infected necrotic tooth present at the apex of a root canal and throughout the apex and retrofill the space inside the root canal with biologically inert material so as to achieve a tight seal. Herein we are documenting a case report of 26-year-old male patient with a chief complaint of swelling and pain in the upper front teeth region and a large bony defect radiologically in which a periapical endodontic surgery was performed. The surgical defect was filled with platelet-rich fibrin (PRF). Clinical examination revealed uneventful wound healing. Radiologically, the defect has been almost entirely replaced by new bone at the end of 8 months. On the evidence of the outcomes obtained in our case report, we hypothesize that healing process was enhanced by an autologous PRF and can be used as a regenerative material of choice in such type of endodontic procedures.

Key words: Apicectomy, mineral trioxide aggregate, platelet rich fibrin, periapical lesion, regenerative dentistry

INTRODUCTION

Rehabilitation of an infected tooth or with periapical lesion depends on early treatment and removal of the necrotic tissue or pathology along with causative microorganisms.[1] In cases where conventional root canal treatment fails to eliminate the lesion, it gives a sign of surgical endo-perio intervention.[2-4] Surgical endo-perio intervention can involve the regenerative endodontic procedure as the last alternative which includes the elimination of infected soft tissue and sometimes application of graft material to enhance new bone formation at the defective site. Enhancement of the regenerative process of the human body by utilizing the patient's blood is a unique concept in dentistry.

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Platelet-rich fibrin (PRF) also known as second generation platelet concentrate initially reported by Choukroun *et al.*[4] (without the addition of thrombin) is a staggering cost-effective autologous tissue engineering product and has gained much popularity due to its promising results in wound healing. Various treatment modalities for infected root canal have been proposed earlier as the treatment modalities for endo-perio involvement including open flap debridement, root resection, and retrograde filling, where healing is by scar formation.[3] PRF is an immune and platelet concentrate with a particular composition, three-dimensional architecture, and associated biology that collects all the constituents of a blood sample to favor wound healing and immunity.[2,5] PRF contains the multitude of growth factors, such as platelet-derived growth factor (PDGF), transforming growth factor β1 (TGF-β1), and insulin-like growth factor (IGF), exhibiting varied potent local properties such as cell migration, cell attachment, cell proliferation, and

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cell differentiation.[6] As the interposition material, it avoids the initial invagination of undesired cells thereby behaves as a competitive barrier between desired and undesired cells.[5,7] This case report describes the healing of a defect which was treated using PRF alone.

CASE REPORT

A 26-year-old male patient came to the Department of Conservative Dentistry and Endodontics, KMCT Dental College, Calicut, Kerala, India, with the chief complaint of pain and swelling in the upper front teeth region. The patient had no medical contraindication to dental treatment. Dental history revealed an incident of trauma to the upper two central incisor teeth 3 years ago. Clinical examination revealed Ellis Class II fracture on tooth #8 (upper right central incisor) and discolored tooth #9 (upper left central incisor) which were sensitive to percussion test. On radiographic examination, a diffuse periapical radiolucency in relation to tooth #8 and a large well defined periapical radiolucency in relation to tooth #9 was observed [Figure 1].

The root canal treatment for #8 and #9 was performed in three visits, and calcium hydroxide (RC CAL; Prime Dental products) was used as the intracanal medicament. The root canals were obturated using gutta percha (Dentsply DeTrey GmbH, Philadelphia, USA) by the lateral condensation technique. Access cavity was filled up with composite. Review and follow-up was done at intervals of 1 week, 1 month, 2 months, 4 months, and 6 months. After a period of 6-month, expected healing did not occur [Figure 2]. Hence, a periapical endodontic surgery was planned. Before planning for the surgical procedure, patient's platelet count (3.5 lac/mm^3), hemoglobin (12.5 g/dl), bleeding time (2.5 min), and clotting time (4.5 min) was assessed and found to be within normal limits.

PRF Preparation

The PRF was prepared in accordance with the protocol developed by Choukroun *et al.*[7] During the surgery, 10 mL of blood was drawn from the patient's antecubital vein and collected in a sterile tube without anticoagulant and immediately centrifuged in centrifugation machine (REMI centrifuge machine Model R-8c with 12 mL × 15 mL swing out head) at 3000 revolutions per minute for 10 min. Blood centrifugation immediately after collection allows the composition of a structured fibrin clot in the middle of the tube, just between the red corpuscles at the bottom and an a cellular plasma (platelet-poor plasma) at the top. PRF results from a natural and progressive polymerization which occurs during centrifugation. PRF was easily separated from red corpuscles base using a sterile tweezers and scissors just after removal from the tube and then transferred onto a sterile test tube [Figure 3].

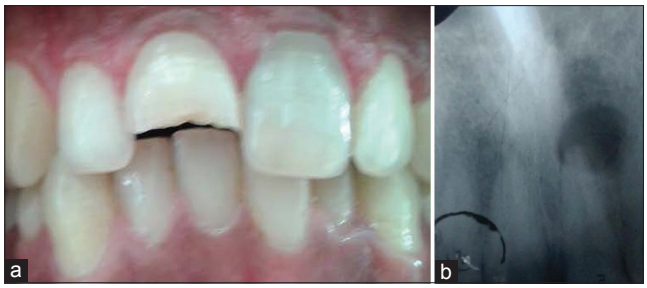

Figure 1: (a and b) Pre-operative clinical presentation and radiograph showing periapical radiolucency in relation to #8 and #9

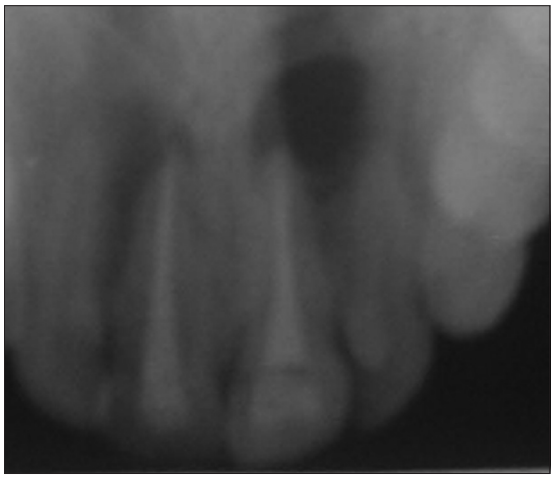

Figure 2: 6 months post-root canal treatment radiograph showing non-healed periapical lesion

Figure 3: The prepared platelet rich fibrin

Surgical Procedure

Under local anesthesia (1:80,000 adrenaline, Xylocaine, DJ Lab, India), a full thickness mucoperiosteal flap was reflected by a sulcular incision starting from the distal of tooth #7 to distal of tooth #10. A large periapical defect in relation to tooth #9 and a separate small defect in relation to tooth #8 were seen with complete loss of labial cortical plate. The lesions measured 6 mm × 7 mm × 13 mm for tooth #8 and

12 mm × 15 mm × 15 mm for tooth #9 corresponding to the length, width, and depth of the lesion [Figure 4]. Tissue curettage was done at the defect site followed by thorough irrigation using sterile saline solution. The cystic lining was enucleated and sent for biopsy [Figure 5]. Using #702 tapered fissure bur (SS White burs), root end resection was performed in teeth #8 and #9 and gray mineral trioxide aggregate (MTA) (ProRoot MTA); Dentsply, Tulsa, OK, USA) was used as the root filling material. The PRF prepared during the surgery was filled into the intrabony defect to cover the defect [Figure 6]. Flap stabilization was done followed by suturing using 3-0 black silk suture material [Figure 7].

Post-operative Care

The patient was kept under the antibiotic (amoxicillin) coverage along with anti-inflammatory drugs (diclofenac sodium + paracetamol) and 0.2% chlorhexidine gluconate solution as mouth rinse for a period of 5 days. Suture removal was done 1 week later and the healing was uneventful and esthetic composite buildup of the fractured tooth was done [Figure 8]. The patient was re-instructed for proper oral hygiene measures postoperatively and examined weekly up to 1 month after surgery and then 2, 4, and 8 months [Figure 9]. During the review visits, there were no symptoms of pain, inflammation, or discomfort. These follow-up visits included routine intraoral examinations and professional plaque control. Radiographically, the defect was almost completely replaced with new bone formation at the end of 8 months. The patient was completely satisfied with the results of the treatment.

DISCUSSION

This case report evaluated the clinical efficacy of PRF in the treatment of an intrabony defect due to a non-healed periapical lesion. PRF is a matrix of autologous fibrin, in which a large quantity of platelet and leukocyte cytokines is embedded during centrifugation. 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] The main component of PRF is a high concentration of growth factor present in the platelets which are required for wound healing.[9] The PRF acts much like a fibrin bandage, serving as a matrix to accelerate the healing of wound.[10] Even though various combinations of PRF and graft materials are widely used, nowadays, use of PRF alone which is cheaper compared to the combinations is found to be equally efficient or superior as within 8 months good deal of healing had occurred in our case. The effect of

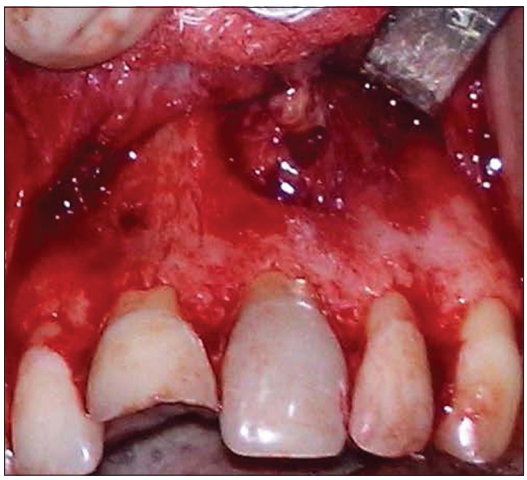

Figure 4: Intraoperative view of the lesions

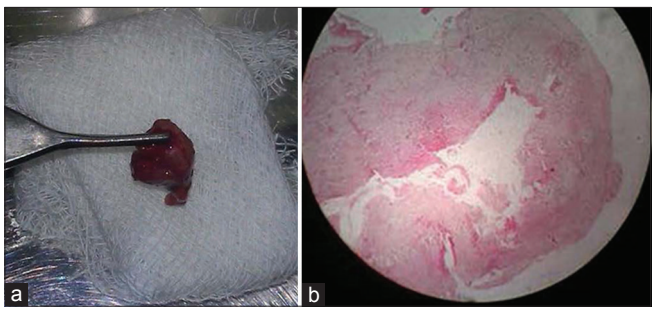

Figure 5: (a and b) The cystic linings enucleated and histopathological view

Figure 6: Root end resected and filled with mineral trioxide aggregate, and platelet rich fibrin filled into the intrabony defect

Figure 7: Flap stabilization done

Figure 8: Post-operative clinical view with esthetic composite buildup of the fractured tooth

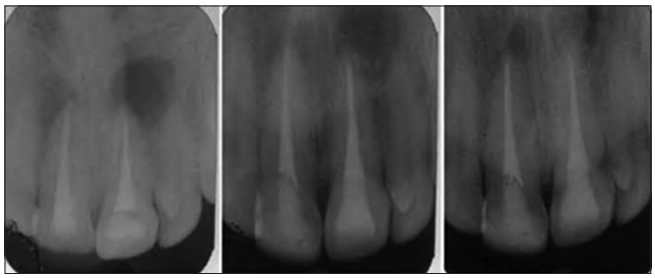

Figure 9: Post-operative radiographic views at 2, 4, and 8 months

combinations of bone graft materials on the healing potential of PRF has still to be found out.

Among the various growth factors that PRF contains PDGF, TGF β-1 and β-2, IGF, epidermal growth factor (EGF), vascular endothelial factor, and fibroblast growth factors are believed to play a major role in bone metabolism and potential regulation of cell proliferation. PDGF is an activator of collagenase which promotes the strength of healed tissue. TGF-β activates fibroblasts to form procollagen which deposits collagen within the wound. PRF facilitates healing by controlling the local inflammatory response. *In vivo* application of PDGF increased bone regeneration in calvarial defects when a bio-absorbable membrane was used as a carrier.[11,12] TGF-stimulates biosynthesis of type I collagen and induces deposition of bone matrix *in vitro*. When TGF-was applied with a biodegradable osteogenic material, bone growth around calvarial defects increased significantly.[13] IGF-I stimulates bone formation by proliferation and differentiation, and it is synthesized and secreted by osteoblasts. An increase in the proliferation of human osteoblasts has been demonstrated with a combination of PDGF, IGF-I, TGF, and EGF.[14,15]

According to Simonpieri *et al.*,[8] the use of this platelet and immune concentrate during bone grafting offers the following 4 advantages: First, the fibrin clot plays an important mechanical role, with the PRF membrane maintaining and protecting the grafted biomaterials and PRF fragments serving as biological connectors between bone particles. Second, the integration of this fibrin network into the regenerative site facilitates cellular migration, particularly for endothelial cells necessary for the neo-angiogenesis, vascularization, and survival of the graft. Third, the platelet cytokines (PDGF, TGF- α, IGF-1) are gradually released as the fibrin matrix is resorbed, thus creating a perpetual process of healing. Finally, the presence of leukocytes and cytokines in the fibrin network can play a significant role in the self-regulation of inflammatory and infectious phenomena within the grafted material.

The preparation of PRF is quite easy and fast and simplified processing minus artificial biochemical modification than PRP, which takes more time. PRF is a by-product of the patient's own blood; therefore, chance of infectious disease transmission is rare. Since PRF harvesting is done with only 8-10 ml of blood, the patient need not bear the expense of the harvesting procedure in a hospital or at the blood bank.

CONCLUSION

From the presented case, it can be concluded that PRF is efficacious clinically and radiographically in the treatment of intrabony defect. PRF is an autologous preparation and found to be clinically effective and economical than any other available regenerative materials. PRF with its beneficial outcomes will definitely revolutionize the surgical dentistry in the near future.

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