Dual combination-PRF and hydroxyapatite in the treatment of periapical lesions.

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Abstract-PRF (Platelet rich fibrin) is referred to as second generation platelet concentrate, used in stimulation and acceleration of soft tissue and bone healing because of local and continuous delivery of growth factors and proteins, mimicking the needs of the physiological wound healing and reparative tissue processes. In this case report, a periapical endodontic surgery was performed on a 19 year old male patient with pus discharge in upper front teeth region and a large bony defect radiographically. Granulation tissue was enucleated and the periradicular bony defect was grafted using PRF and hydroxyapatite bone graft. Results of 8 months has been reported which showed satisfactory healing of the periapical pathosis. On the basis of the results obtained in our case report, we hypothesize that the use of PRF in combination with hydroxyapatite bone graft in the treatment of periapical inflammatory lesion fastens the healing process.

Keywords: PRF, Hydroxyapatite bone graft, Inflammatory periapical lesion, Regeneration

I. Introduction

Inflammatory periapical lesion is due to reaction of bone near the apex of tooth that develops after the pulpal necrosis or extensive periodontal disease. Most of the cases with periapical lesions heal adequately after nonsurgical endodontic intervention. Periapical surgery becomes the important therapy selection when the root canal treatment cannot be adequate enough for the elimination of apical lesion. Abramovitz et al have reported that treatment of 24.5% of the cases was impossible without surgical therapy.

The successful outcome of endodontic therapy depends on complete periapical repair and regeneration. Better result is achieved by using growth factors, extracellular matrix and bonemorphogenetic proteins instead of routinely used synthetic bone grafts, because synthetic bone grafts induce regeneration by osteoconduction, whereas, biological modulators induce regeneration by osteoinduction.

HA bone grafts show excellent bone conductive properties, which permits outgrowth of osteogenic cells from existing bone surfaces into the adjacent bone material. Platelet-rich fibrin (PRF) is second-generation platelet concentrate as described by Choukroun et al that allows oneto obtain fibrin membranes enriched with platelets and growth factors, after starting from an anticoagulant-free blood harvest. PRF being both the healing and interpositional biomaterial, accelerates wound closure and mucosal healing due to fibrin bandage and growth factor release.

This case report presents combination of prf with hydroxyapatite bone graft material in management of a periapical inflammatory lesion in anterior maxilla.

II. Case Report

A 19 year old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of irregular pus discharge since 4 months in the upper front teeth region. There was no previous history of pain or discomfort. The patient’s medical status was noncontributory and he mentioned that he had no history of trauma to the related area. Patient was undergoing orthodontic treatment since 1 year. On intra oral examination, presence of sinus opening with pus discharge located in between maxillary left central and lateral incisor was seen. (fig. 1) When Radiographic examination is done, it showed periapical radiolucency with a well-circumscribed sclerotic border around the right maxillary incisor, left maxillary central incisor, left maxillary lateral incisor and left maxillary canine. (fig. 2, 3) The vitality tests showed the negative response for the teeth 11, 21, 22 and tooth 23 showed delayed response.
The root canal treatment was planned for 11, 21, 22, 23. After isolation access opening was done, working length was determined radiographically (fig. 4). Cleaning and shaping was done using step back technique till an apical size of # 55 in relation to 11, 21, and 23. Tooth 22 was prepared till an apical size of #55. 3% sodium hypochlorite solution was used to irrigate the canals during the canal preparation. Calcium hydroxide was used as the intracanal medicament in between the visits. Pus discharge stopped completely after two weeks. Root canals were obturated using gutta percha (Dentsply maillefer Ballaigues) and zinc oxide eugenol sealer by the lateral condensation technique (fig. 5). One month postobturation patient reported with intermittent pus discharge through sinus.
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Hence, a periapical endodontic surgery was planned. Under local anesthesia (1:200000 adrenaline, DJ Lab, India), a full thickness mucoperiosteal flap was reflected with vertical releasing incision starting from the distal of the tooth 12 to distal of the tooth 23 (fig. 6). A large periapical defect was seen with complete loss of labial cortical plate (fig. 7). Tissue curettage was done at the defect site followed by thorough irrigation using sterile saline solution (fig. 8). Using #702 tapered fissure bur (SS White burs), root end resection was performed in teeth 21. A 10ml sample of whole blood was drawn from the patient’s right arm. The blood sample was transferred into a test tube without anticoagulant and centrifuged immediately at 3000rpm for 10 minutes to obtain the PRF (fig. 9). Commercially available HA bone graft crystals were placed and sprinkled over the PRF gel and together the mixture was placed into defect (fig. 10,11). Flap stabilization was done by suturing using 3-0 black silk suture material (Sutures India Pvt. Ltd, Karnataka, India) (fig. 12). Analgesics and antibiotics were prescribed and the patient was advised to use chlorhexidine mouthwash for a week. The sutures were removed after 7 days.

Clinical healing was uneventful. Patient was reviewed at 3 months, 6 months and 8 months. After 1 month, healing sinus was noticed (fig. 13). After 3 months patient was asymptomatic (fig. 14). 6 months and 8 months follow up radiograph shows complete bone formation (fig 15 and fig. 16).
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Fig 10 - mixing of PRF with bone graft
Fig 11 - placement of combination in the defect
Fig 12 - suture placement
Fig 13 - 1 month follow up
Fig 14 - 3 months follow up
Fig 15 - 6 months follow up
Fig 16 - 8 months follow up
III. Discussion

The success of an endodontic procedure depends upon complete healing of the lost periapical tissues. Most periradicular lesions heal uneventfully after conventional endodontic treatment. However, some cases might require surgical intervention to remove the pathological tissue and to eliminate the source of irritation that could not be removed by orthograde root canal treatment. This case report demonstrates that the combination of PRF and hydroxyapatite in management of periapical lesion which showed satisfactory healing of periapical pathosis.

The ultimate outcome of the nature of wound healing after endodontic surgery can be repair or regeneration depending on the nature of the wound; the availability of progenitor cells, signaling molecules, adhesion molecules, extracellular matrix and associated noncollagenous protein molecules. Since repair does not reconstitute the architecture and functions of the original tissue after wound healing, regenerative approach that aim to restore the lost tissues (periodontal ligament, bone, cementum, and connective tissue) have been introduced. Bone regeneration after surgical intervention takes place in a very slow manner. Hence, to enhance these processes a number of bone substitutes are being tried out.

Hydroxyapatite crystals when used, act as a scaffold upon which new bone is deposited, followed by a slow resorption of the graft. Synthetic bone grafts induce regeneration by osteoconduction, whereas, these biological modulators induce regeneration by osteoinduction. Bone grafts alone without a blood clot or angiogenic factors are not likely to be capable of promoting periapical wound healing.

PRF, in the form of a platelet gel, can be used in combination with bone grafts to offer several advantages which include promoting wound healing, bone growth and maturation, graft stabilization, wound sealing, haemostasis and improving the handling properties of graft materials. PRF prepared using Choukroun’s technique, is prepared naturally, without the addition of thrombin. PRF results from a natural and progressive polymerization occurring during centrifugation. The fibrin network thus formed presents a particularly homogeneous three-dimensional organization, highly coherent than natural fibrin clots.

PRF may play an important role in therevascularization of the graft by supporting angiogenesis. The PRF clot forms a strong natural fibrin matrix, which concentrates almost all the platelets and leucocytes of the blood harvest, and creates a complex architecture as a healing matrix, that can protect growth factors from proteolysis. PRF contains large number of growth factors like platelet derived growth factor (PDGF), transforming growth factor β1 (TGF β1), insulin like growth factor (IGF), etc., exhibiting varied potent local properties such as cell migration, cell attachment, cell proliferation and cell differentiation. These growth factors are involved in wound healing and are promoters of tissue regeneration.

The progressive polymerization mode of coagulation in PRF helps in the improved incorporation of the circulating cytokines into the fibrin meshes (intrinsic cytokines) which helps in wound healing by moderating the inflammation.

Sculean et al. concluded that the combination of barrier membrane and grafting materials results in histological evidence of periodontal regeneration, predominantly bone repair. Pradeep et al. in their study concluded that combination of hydroxyapatite and PRF increases the regenerative effects in the treatment of human three wall intrabony defects.

The advantages of PRF over PRP are its simplified method of preparation and lack of biochemical handling of the blood. Calcium chloride and bovine thrombin accelerators are used in preparation of PRP, which is discovered to be associated with the development of antibodies to the factors V, XI and thrombin, resulting in the risk of lifethreatening coagulopathies. When compared to PRP, PRF does not dissolve quickly during the following hours after application. PRF results to be slowly destroyed by remodeling due to the solid consistency of fibrin like natural blood clot. In addition, the embedment of numerous growth factors in this matrix appeared logical and natural.

It requires around 1 year duration for complete healing to occur after the periapical surgery while with the use of PRF, healing is rapid and requires approximately 6 months for complete regeneration of bone. In this case report PRF in conjunction with hydroxyapatite crystals induced the rapid rate of bone formation and showed satisfactory healing of the periapical pathosis.

IV. Conclusion

PRF is a rich source of growth factors and its application is an effective way to induce tissue repair and regeneration. In a clinical situation the use of bone substitutes like hydroxyapatite crystals in combination with PRF will definitely enhance periapical regeneration.

References


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