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Case Report

Platelet Rich Fibrin (PRF) with Biodentine - A Novel Approach for Bone Augmentation in Infected Periapical Cyst: Case Reports

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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. Radio graphically, the classical description of the lesion is round or oval, well circumscribed radiolucent image involving the apex of the tooth. The final 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; signalling molecules; and micro-environmental cues such as adhesion molecules, extracellular matrix, and associated non-collagenous protein molecules. We present here two case reports with and without PRF to check the healing potential of the periapical lesion with 6 months of observation and radiographic evaluation.

Key words: Periapical inflammatory lesion, Platelet rich fibrin, Platelet rich plasma, Regeneration.

INTRODUCTION

Periapical lesions of endodontic origin are mostly produced by an inflammatory response at the root apices of teeth with nonvital pulps. It is caused due to an imbalance between microbial factors and host defences at the interface between infected radicular pulp and periodontal ligament which will cause local inflammation, resorption of hard tissues, destruction of other periapical tissues. [1] Periapical lesions cannot be differentiated into cystic and noncystic lesions based on the radiographic features. [2] Most of the studies have showed an 85% of success rate after endodontic treatment of teeth with periapical lesions. [3,4] But failure after conventional root canal treatment will definitely leads to surgical intervention. [5]

Periapical Surgery has so many disadvantages that it is an invasive procedure, has a psychological effect on the patient, and requires an experienced and skilled professional. [6,7] But periapical surgery is the last resort when root canal treatment alone is not possible. Traditional surgical approaches to treat periapical defects include debridement of apical lesions along with reshaping of the surrounding bone, resection, and retro filling of root apex, where condition of healing is almost by repair. [8]

Enhancement of the regeneration of human body by utilizing the patient's own blood is a unique and recent concept in dentistry. Platelet rich plasma (PRP),

first generation of autologous platelet concentrate, has been used for the purpose of tissue regeneration. As its use has good clinical success but its complex preparation protocol and moderate benefits had limited its usage in regenerative surgeries. [9] PRF which means platelet rich fibrin has been introduced in the year 2001 by Choukroun et al, which is a second-generation platelet concentrate, enriched with platelets and growth factors which accelerate and enhance the body natural defense mechanism and promote periapical tissue regeneration and healing. As not like PRP, it is obtained from an anticoagulant and thrombin free blood harvest making it free from the risk of disease transmission. [10]

The purpose of these case reports is to compare the healing efficiency of large periapical lesions treated surgically with PRF and without PRF followed over a period of 6 months. Post-operative healing was checked by clinical & radiographical parameter.

CASE REPORT 1

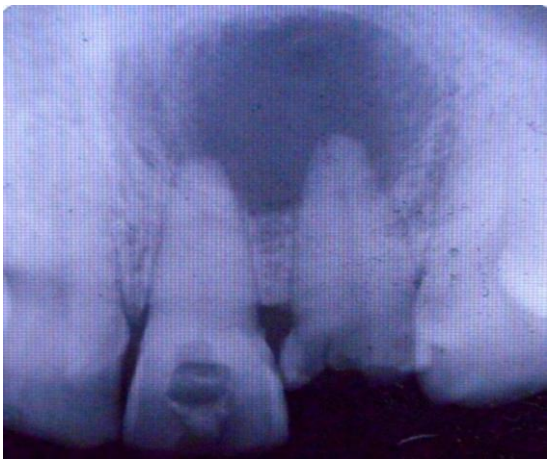

Figure 1: pre operative IOPA showing a large Periapical radiolucency i.r.t 21, 22.

A 28-year-old male reported to the department of conservative dentistry and endodontics with pain and broken tooth in the upper front teeth region. On clinical examination, tooth 21 was discoloured and 22 have the fracture involving pulp and they were tender on percussion. On radiographic examination, a large periapical lesion of size 2 x 2 cm was observed in relation to 21 and 22 (Figure.1)

The patient gave a history of trauma 2 years prior and had undergone root canal treatment with tooth 21, 22, in a private dental clinic 1 year back. After analyzing the case history, radiographs and clinical examination, decision was taken for periapical surgery. The patient was explained in detail about surgical treatment planning and the regenerative modality to be used. The root canal treatment was performed by working length determination and enlarged the canal till an apical size of # 55 and #60 in relation to teeth 21 and 22 using step back technique with 5.25% sodium hypochlorite solution (Novo Dental Product Pvt Ltd, Mumbai, India) as an irrigant to irrigate the canals during the canal preparation. The root canal treatment was performed in three visits and calcium hydroxide was used as the intracanal medicament. The root canals were obturated using gutta percha (Dentsply) and with seal apex as a sealer (Dentsply) by the lateral condensation technique (figure 2).

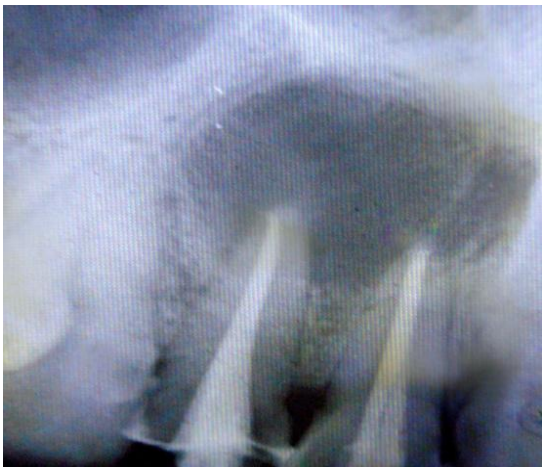

Figure 2: Post obturation IOPA -21, 22

Before the surgical procedure, patient's platelet count (4.5 lac/mm3), Haemoglobin (12.5 gm/dl), Bleeding time (2.5 min) and Clotting time (4.5 min) were assessed and found to be within normal limits. Under local anesthesia (1:200000

adrenaline) a full thickness mucoperiosteal flap was reflected by a sulcular incision starting from the distal of the tooth 23 to mesial of the tooth 21. A large periapical defect was seen. Tissue curettage was done at the defect site followed by thorough irrigation using sterile saline and betadine solution. Using #702 tapered fissure bur (SS White burs), root end resection was performed in teeth 21 and 22 and Biodentine (septodont) was used as the root end filling material (figure.3)

Figure 3: Reflection of mucoperiosteal flap, Cyst removal and Biodentine placement- 21, 22

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. 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. PRF was easily separated from red corpuscles base (preserving a small RBC layer) using sterile tweezers and scissors just after removal of PPP (platelet-poor plasma) and then transferred into a sterile dappen dish and then PRF gel was carefully placed into the cavity with sterile tweezers till the entire cavity was filled (figure.4).

Wound closure was performed with a 3-0 black silk suture. Analgesics (divon plus -3 days), Antibiotics (novamox 500 mg tid-5 days) were prescribed post-operatively and 0.2% chlorhexidine gluconate solution as mouth rinse for a period of 5 days and Suture removal was done 1 week later and the healing was uneventful.

Figure 4: PRF placement in bony cavity- 21, 22

CASE REPORT 2

A 23-year-old Indian female complaining of occasional pain in the upper right anterior region reported to the Department of Conservative Dentistry and Endodontics. On intraoral examination, canine was slight discoloured but there was no mobility, no swelling and no pus exudation was noticed. There was history of dental trauma which occurred in her childhood but no orthodontic treatment, and no injurious habit was reported by the patient.

A periapical radiograph was taken using the standardized techniques, which revealed presence of large periapical lesion of size 2 x 1.8 cm with tooth 12, 13 and14 (figure.5).

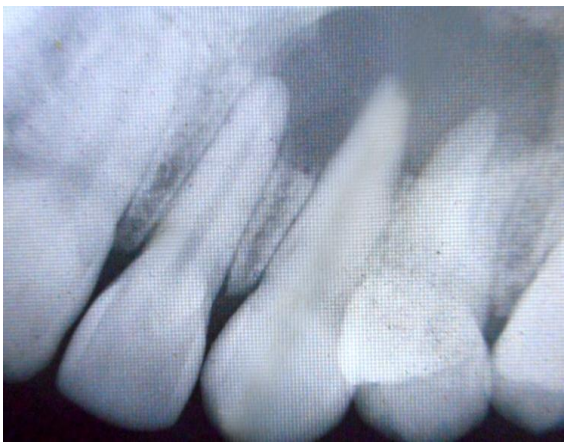

Figure 5: Preoperative IOPA showing a Large periapical radiolucency -12, 13, 14.

The patient was healthy and no other medical complication was there. So it was decided to do root canal treatment in 12, 13 and 14 and remove the lesion surgically. Before the surgical procedure, patient's platelet count (2.5 lac/mm3), Haemoglobin (10.5 gm/dl), bleeding time (2.5 min) and Clotting time (4.5 min) were assessed and found to be within normal limits. Root canal therapy of 12, 13 and 14 was done in conventional way using k files with working length determination and using step back method in 12, 13 and crown down technique in 14 was performed till an apical size of # 60 and #60 in relation to teeth 12, 13 and 25(6%) in both buccal and palatal canals in relation to 14 and 5.25% sodium hypochlorite solution (Novo Dental Product Pvt Ltd, Mumbai, India) was used to irrigate the canals during the canal preparation. The root canal treatment was performed in four visits and calcium hydroxide was used as the intracanal medicament. The root canals were obturated using guttapercha (Dentsply) and with seal apex as a sealer (Dentsply) by lateral condensation technique (figure.6).

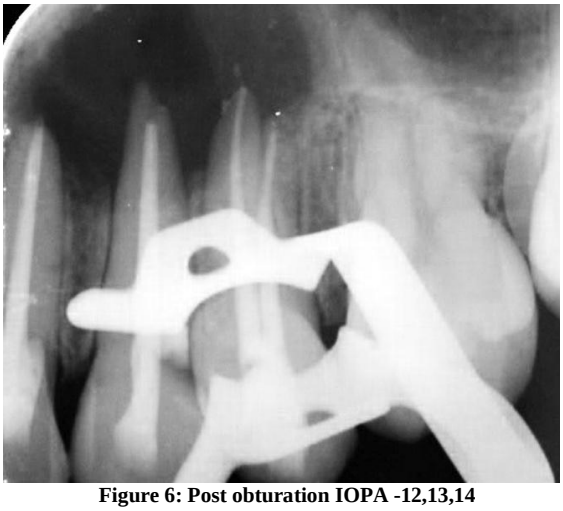

Figure 6: Post obturation IOPA -12,13,14

Under local anesthesia (1:200000 adrenaline) a full thickness mucoperiosteal flap was reflected by a sulcular incision starting from the mesial of the tooth 12 to the distal of tooth 14. A large periapical defect was seen. Tissue curettage was done at the defect site followed by thorough irrigation using sterile saline and betadine solution. Using #702 tapered fissure bur (SS White burs), root end resection was performed in teeth13 and Biodentine (septodont) was used as the root end filling material in relation to tooth 13 (figure.7)

Figure 7: Reflection of mucoperiosteal flap, Cyst removal and Biodentine placement-13.

Wound closure was performed with a 3-0 black silk suture. Analgesics (divon plus bd-3 days), Antibiotics (novamox 500 mg tid-5 days) were prescribed post-operatively and 0.2% chlorhexidine gluconate solution as mouth rinse for a period of 5 days and Suture removal was done 1 week later and the healing was uneventful.

Enucleated cystic lining was sent for histopathological examination for both the cases which revealed 6-7 cells layered thick, non keratinized stratified squamous epithelium. Connective tissue capsule showed the presence of cholesterol crystals along with acute & chronic inflammatory cells which confirmed the diagnosis of an infected periapical cyst in both the cases (figure.8 and 9).

Recall examinations after 3 and 6-months interval were done during which there were no symptoms of pain, inflammation, or discomfort clinically and at 6 month interval, an intra Oral Periapical Radiograph in relation to 21, 22

at where PRF was placed as a graft material showed a marked decrease in the size of radiolucency than the other lesion in relation to 12, 13 and 14 without PRF (figure. 10 and 11).

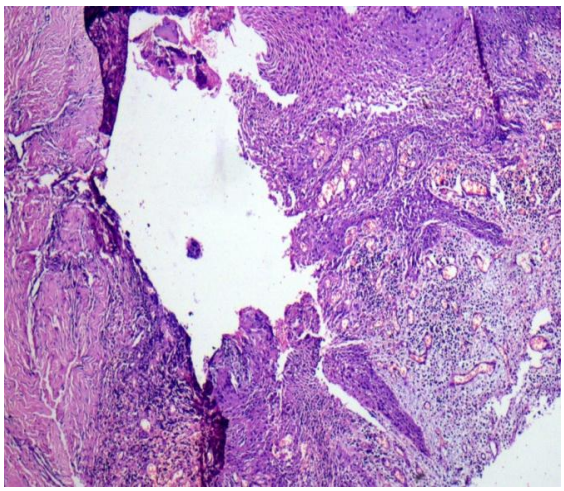

Figure 8: Histopathological image showing Diagnosis of periapical cyst-12,13,14.

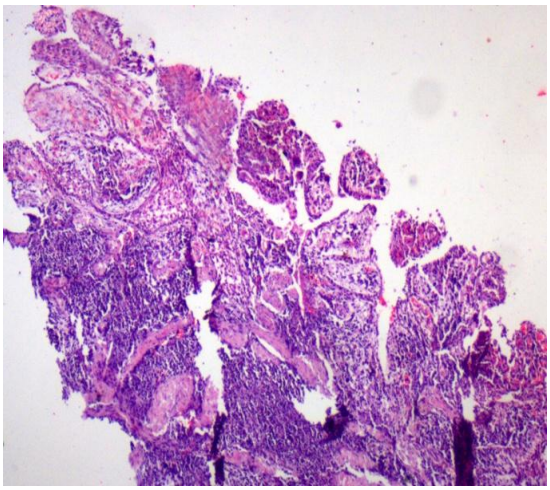

Figure 9: Histopathological image showing Diagnosis of periapical cyst- 21,22

Figure 10: Follow up IOPA after 6 months i.r.t 21, 22

Figure 11: Follow up IOPA after 6 months i.r.t 12, 13, 14

DISCUSSION

The exact mechanism of periapical lesion formation is not understood clearly. But it seems to be that products, released by microorganisms and dead pulp may initiate the process invoking, at the same time, an inflammatory reaction. [11,12] The periapical cyst is the most commonly occurring odontogenic cyst (52.3-70.7 percent) which is followed by the dentigerous cyst(16.6-21.3 percent) and then odontogenic keratocyst (5.4 - 17.4 percent). [13]

The choice of treatment may be determined by factors such as the extension of the lesion, relation with noble structures, evolution, and origin, clinical characteristic of the lesion, systemic condition and cooperation of the patient. [14] Periapical granulomas respond well to non surgical endodontic treatment, while periapical cysts are generally considered to require surgery as typed by Grossmans statement that "root canal treatment alone is contraindicated for tooth with a cyst, since the cyst will continue to develop unless the epithelial lining is completely removed by surgical means". [15]

Recent studies on bone healing are mostly aimed to accelerate bone

regeneration to maximize the predictability and the volume of regenerated bone. Regeneration of tissue after periapical surgery requires (a) recruitment of progenitor or stem cells to differentiate into committed cells, (b) growth/differentiation factors necessary as signals for attachment, migration, proliferation and differentiation of cells, and (c) local-microenvironmental cues like adhesion molecules, extra cellular matrix, associated non-collagenous protein molecules, and if lack of any of these elements results in repair rather than regeneration. [16] It is difficult to state whether Bone morphogenetic protein-2 (BMP-2), recombinant platelet derived growth factor-BB (rhPDGF-BB), platelet rich plasma (PRP), plasma rich in growth factors (PRGF), or a combination of all the four factors are responsible for bone regeneration. [17]

In this article first case report evaluated the clinical efficacy of PRF when compared to other case report in the treatment of periapical cyst. PRF is a matrix of autologous fibrin, where a large quantity of platelets, leukocyte and cytokines are 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. [18] The main component of PRF is high concentration of growth factor present in the platelets which are required for wound healing. The PRF acts as a fibrin bandage, and serves as a matrix to accelerate the wound healing. Amongst the various growth factors that PRF contains, platelet derived growth factor (PDGF), Transforming growth factor b (TGF b-1 & b-2), and insulin like growth factor (IGF), epidermal growth factor, vascular endothelial factor, and fibroblast growth factors which plays 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-B activates fibroblasts to form procollagen which deposits collagen within the wound and PRF facilitates healing by controlling the local inflammatory response. [19, 20]

According to Simonpieri *et al*, 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, of 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 neoangiogenesis, vascularization and survival of the graft. [21] 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. [22] Lastly, the presence of leukocytes and cytokines in the fibrin network can plays a main role in the self regulation of inflammatory and infectious phenomena within the grafted material. However, the high success rate may be due to modern surgical techniques, and improved root end filling materials. [23]

For root end filling materials various cements has been used recently but the choice of a root end filling material depends on biocompatibility, handling properties, apical seal, and long-term clinical success. Since the introduction of MTA it has been used as a root end filling material because of its good physical, biological properties and also being hydrophilic in nature but its use has always remained as a challenge because of its prolonged setting time, technique sensitivity, and high cost. [24] Biodentine™ is similar in its basic composition to MTA as the powder contains tricalcium silicate, dicalcium silicate and calcium carbonate as the principal components with Zirconium oxide as the radiopacifier and the liquid consists of calcium chloride in aqueous

solution with an admixture of polycarboxylate. Due to the addition of setting accelerators, which is calcium chloride, it results not only in fast setting of 9-12 minutes but also improves the handling properties and strength. [25] Kokate and Pawar conducted a study where they compared the microleakage of glass ionomer cement, MTA, and Biodentine™ when used as a retrograde filling material they concluded that Biodentine™ exhibited the least microleakage when compared to other materials used. [26]

Studies showed that the high pH and calcium ion released are necessary for a material to stimulate mineralization in the process of hard tissue healing. In a study carried out by Sulthan to evaluate the pH and calcium ion release of MTA and Biodentine™ as used as root end fillings he stated that Biodentine™ showed alkaline pH and ability to release calcium ions similar to that of MTA. [27] Han and Okiji carried out a study in which they compared the uptake of calcium and silicon ions released from MTA and Biodentine™ as endodontic materials into root canal dentine they showed that the elemental uptake of Biodentine is more prominent than MTA. [28]

In the present case, it was observed that at 6 months follow up after the surgical treatment of large chronic periapical lesion which was treated using PRF as a graft material resulted in significant, progressive, and predictable clinical and radiographic bone regeneration compared to other case which was treated without PRF. It can be postulated that PRF with Bio dentin could have accelerated the healing. However, like other clinical studies this study also has few limitations like short follow-up period of 6 months and a need for histological evaluation to confirm regeneration.

CONCLUSION

The clinical cases reported was managed successfully by endodontic therapy with emphasis on thorough debridement and disinfection of the root canal system which was followed by surgery and PRF membrane which was used as a graft material has induced the rapid rate of bone formation clinically and radiographically in the treatment of large periapical cyst. However, histological studies are required to examine the nature of newly formed tissue in the defect and long-term, follow up is needed over bone regeneration.

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