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CASE REPORT

Interdisciplinary Management of Periapical Lesion: A Novel Regenerative approach

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ABSTRACT

This paper describes two case reports of bone regeneration with a combination of platelet-rich fibrin (PRF) and bone graft for the treatment of chronic periapical lesion. The cases were followed for 8 months. The 1st case that presented with nonvital open apex was treated by bone regeneration using PRF in combination with bone graft through apical surgery. The 2nd case presented with chronic periapical lesion in the maxillary central incisor with a history of trauma 3 years back. Radiographically, a periapical radiolucency was seen. The nonsurgical approach by orthograde root filling using mineral trioxide aggregate (MTA), triple antibiotic paste, and tissue engineering concept was used as the treatment modality. Regular follow-ups at 3, 6, and 8 months were done. Healing was uneventful with progressive, predictable clinical and radiographic bone regeneration without any clinical symptoms. Combined use of PRF and bone graft for the treatment of periapical defects is a potential treatment alternative for faster healing than using these biomaterials alone.

Keywords: Mineral trioxide aggregate, Open apex, Periapical lesion, Platelet-rich fibrin.

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INTRODUCTION

The primary goal of dental treatment is the maintenance of the natural dentition health with optimum comfort, function, and esthetic.[1] The treatment of open apex is always a challenge for a clinician. Endodontic management of teeth with open apex includes intracanal disinfection using copious irrigation, placement of antibiotic pastes, and formation of a sterile blood clot inside the pulp cavity followed by periapical surgery and retrograde sealing of mineral trioxide aggregate (MTA) as coronal plug. Studies show there are pleuripotent stem cells at the apex of a young tooth, which can proliferate under sterile conditions to help in regeneration.[2] It uses the concept of tissue engineering to restore the root canal into a vital state allowing the continued development of tooth into the surrounding tissue. Platelets isolated from the peripheral blood acts as an autologous source of growth factors. The platelet-rich fibrin (PRF) represents a new revolutionary step in the platelet gel therapeutic concept and is being used in dentistry with high success.

The 1st case report highlights a periapical surgery for elimination of the pathology and aims to achieve complete wound healing by use of hydroxyapatite (HA) crystals in conjunction with PRF. Clinical examination exhibited uneventful wound healing. Based on our cases outcome, we conclude that the use of PRF in combination with HA crystals might have accelerated the bone regeneration. The 2nd case report highlights nonsurgical management of symptomatic teeth with immature apices and large periapical radiolucencies using PRF membrane with Biograft HA as periapical sealers to accelerate the healing of wound edges and MTA to promote periapical healing from within the root canal.[3]

Both the case reports showed that PRF and bone graft as a matrix with MTA has been demonstrated to be a good option for creating artificial root-end barriers. The placement of MTA is predictable over these matrices and the outcomes are very encouraging.

CASE REPORTS

Case 1

A 45-year-old male patient came to the Department of Periodontology, Kannur Dental College, Anjarakandy, with the chief complaint of grade I mobility and discoloration in the upper front teeth #7 (Fig. 1). His dental history revealed an incident of trauma to the upper front teeth region 8 years ago. The patient was medically fit to undergo dental treatment.

Clinical examination revealed discolored tooth #7, which was sensitive to percussion test. Vitality test gave a negative response in relation to #7. Periapical radiograph (IOPA) in relation to #7 revealed large well-defined periapical radiolucency and an open apex involving the right lateral incisor (Fig. 2). Based on clinical, radiological, and cytological examination, a

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Fig. 1: Preoperative clinical photograph of #7

Fig. 2: Preoperative radiograph showing open apex and periapical pathology

Fig. 3: Open flap for cystic lining and cyst enucleation done

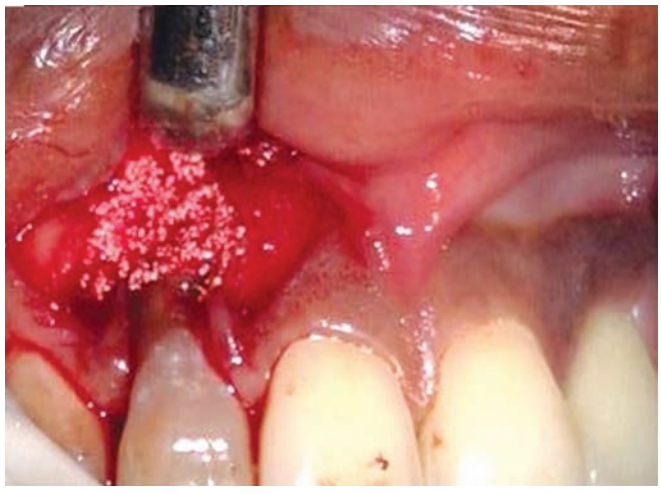


Fig. 4: Defect filled with hydroxyapatite particles

provisional diagnosis of radicular cyst or infected periapical cyst was made.

Endodontic access preparation under rubber dam isolation was done; there was drainage of white straw-colored fluid from tooth #7. The root canal space of tooth #7 was negotiated and the working length was measured. The apical foramen was gauged using hand K files, and the apical width was found to be equivalent to a size 40 K file. The apical zone was prepared to a size 80 K file. In this case, due to the presence of open apex, the constriction was not widened and an apical stop was prepared. Copious irrigation with 20 mL of 2.5% sodium hypochlorite was performed and the canal was dried. After disinfection of the canal, calcium hydroxide was given as intracanal medicament and recalled after 7 days. Inter-appointment medication of triple antibiotic paste was applied. Doxycycline, Metronidazole, and Ciprofloxacin were grounded and mixed with distilled water to make a paste thick in consistency.[4] This antibiotic mixture was placed in the canal using an amalgam carrier and packed with large endodontic pluggers. A combination of antibiotics also decreases the likelihood of the development of resistant bacterial strains and provides sterile environment. The access cavity was sealed with an intermediate restorative material. After 4 weeks, tooth #7 was asymptomatic and showed no sensitivity to percussion and palpation.

A full-thickness mucoperiosteal flap was reflected under local anesthesia by a sulcular incision from the distal of #6 to the distal of #8 (Fig. 3). A large periapical defect was seen with complete loss of labial cortical plate in relation to the left central and lateral incisor. The lesion measured 8 × 13 × 10 mm (Fig. 3). Cyst enucleation was done at the defect site followed by irrigation using sterile saline solution. Biograft HA (100% synthetic HA granules) were sprinkled and packed into the intrabony defect (Fig. 4). The mucoperiosteal flaps were repositioned in place by giving simple interrupted suture using 3–0 non-absorbable black silk surgical suture. Periodontal pack was placed over the suture site.

The PRF membrane was prepared by withdrawing 10 mL of intravenous blood from the antecubital fossa into a sterile tube via venipuncture, which was immediately centrifuged at 3000 rpm for 10 minutes. It yielded a fibrin clot wedged in between the top layer of the acellular plasma and the bottom layer of erythrocytes. The fibrin clot was subsequently separated using sterile tweezers and scissors and compressed with a glass slab to form a flat membrane.

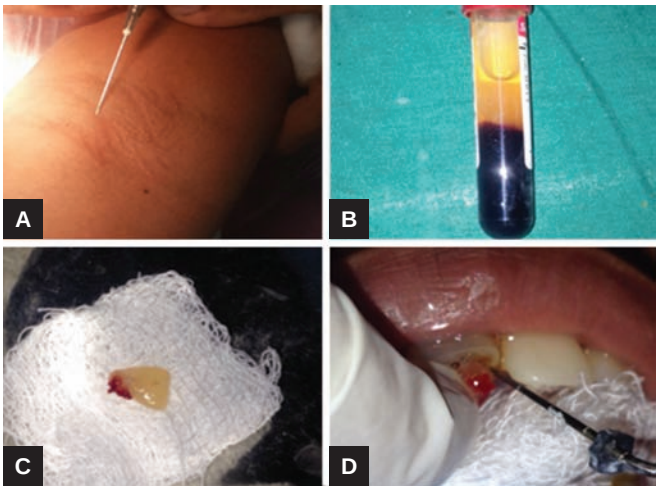
The triple antibiotic mixture was washed out with saline. After drying the canal with paper points, the fibrin membrane was pushed with hand plugger size # 2, 1 mm beyond the confines of working length (Figs 5A to D) and coronally to the level of the cementoenamel junction. Three millimetres of MTA coronal plug was placed. After 72 hours, permanent restoration was done with composite.

The patient was kept under the antibiotic and antiinflammatory coverage and 0.2% chlorhexidine gluconate solution as mouth rinse for a period of 7 days. Suture removal was done 1 week later and the healing was uneventful. The patient was reviewed at 1, 3, 6, and 8 months period during which there were no symptoms of pain, inflammation, or discomfort (Fig. 6). Radiographically, HA particles started resorbing and were replaced with new bone with progressive formation of root-end barrier (Fig. 7).

Case 2

A 15-year-old female patient reported to the Department of Periodontology, Kannur Dental college, Anjarakandy, with the complaint of mild pain in the right maxillary central incisor since 3 weeks (Fig. 8). Radiographic examination revealed the presence of a blunderbuss canal and large periapical radiolucency with respect to #8 (Fig. 9).

Nonsurgical treatment was opted considering the age and amount of trauma that was expected during surgical treatment and in the absence of a clearly defined sclerotic cystic border. Local anesthesia was not required as the tooth was nonvital. Access was prepared under rubber dam isolation. Pus exuded through the canal immediately after access preparation. Canal was irrigated using



Figs 5A to D: Platelet-rich fibrin placed in defect through canal

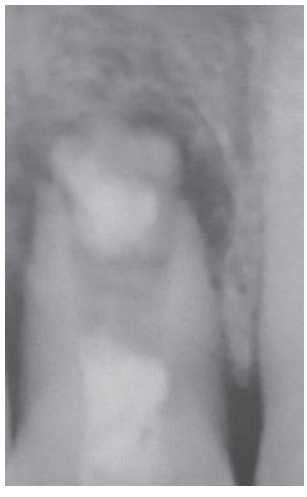


Fig. 6: Postoperative

Fig. 7: Postoperative radiograph after 8 months

Fig. 8: Preoperative clinical photograph #8

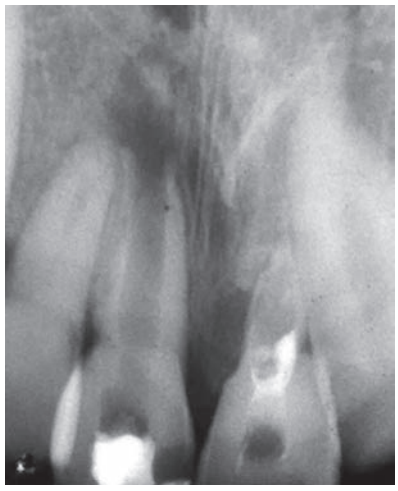


Fig. 9: Preoperative radiograph

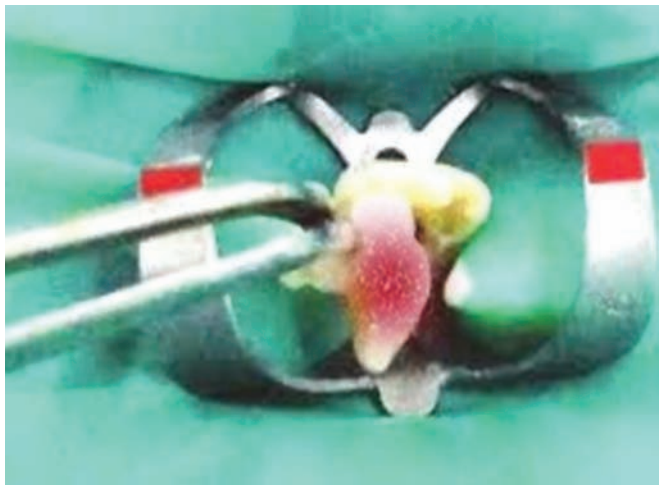


Fig. 10: Bone graft and PRF combination placed in the defect

Fig. 11: Postoperative (1 week)

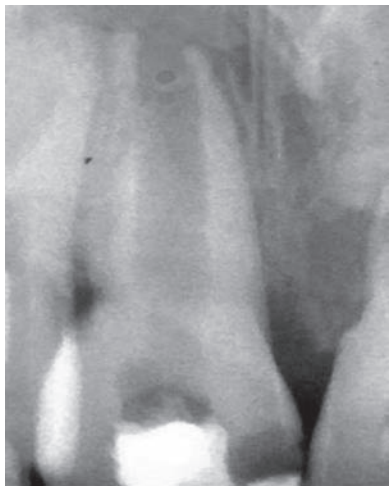


Fig. 12: Postoperative (8 months)

lukewarm normal saline to assist in exudation. Access preparation was left open until the exudate stopped coming out. This followed thorough biomechanical preparation, involving circumferential filling with a size 80 K file to remove any debris or necrotic dentin and root canal irrigation with 1.25% sodium hypochlorite solution. Thereafter, calcium hydroxide and iodoform combination was placed in the canal and the patient was recalled after 7 days. Recall appointment showed the patient was asymptomatic. Inter-appointment medication of triple antibiotic paste was applied.

Doxycycline, Metronidazole, and Ciprofloxacin were mixed with distilled water to form a paste thick in consistency. This antibiotic mixture was placed in the canal using an amalgam carrier and packed with large endodontic pluggers. The access cavity was sealed with an intermediate restorative material. After 4 weeks, the tooth was asymptomatic and interim restoration was removed and the dryness of canal was confirmed; the apical matrix/barrier was created via pushing HA crystals through the canal using finger pluggers and packing it in periapical area (Fig. 10). The PRF clot obtained was gently pressed into a membrane with a sterile dry gauge. The membrane was packed against the bone and was pushed beyond the apex into the bony space formed due to the periapical lesion to form a matrix for the placement of MTA.

This was followed by a placement of 5 mm apical plug of white mineral trioxide aggregate using a finger plugger. Keeping moist cotton over the canal orifice achieved complete setting of MTA, which was followed by the closure of access preparation using an interim restorative material. The patient was asymptomatic at 1-week recall visit (Fig. 11). The 8-month follow-up radiograph of the patient showed reduction in the size of the periapical lesion and progressive closure of root-end barrier (Fig. 12).

DISCUSSION

Regeneration of tissue after periapical surgery requires (a) recruitment of progenitor/stem cells to differentiate into committed cells, (b) growth factors as necessary signals for attachment, migration, proliferation, and differentiation of cells, and (c) local microenvironmental cues like

adhesion molecules, extracellular matrix, and associated non-collagenous protein molecules. Lack of any of these elements would result in repair rather than regeneration.[5]

In the 1st case report, orthograde root canal therapy was opted as the treatment option showing periapical cyst with sclerotic border as it has 85% success rate. Bone regeneration after surgical intervention takes place in a very slow manner. The objective of using a bone graft for defect fill is to achieve successful, faster, and complete healing of the bone. A variety of materials are available for bone regeneration, which are highly osteoconductive or osteoinductive.[6] These HA crystals act as a scaffold upon which new bone is deposited, which is then followed by a slow resorption of the graft. The use of PRF helps in better healing and faster regeneration, because of the biological modulators, and helps in osteoconduction by undifferentiating tissue to differentiate into new bone cells. The cytokines entrapped in the fibrin matrix of PRF help in the process of angiogenesis. The main platelet cytokines play a fundamental role in initial healing mechanisms owing to their capacity to stimulate cell migration and proliferation (particularly by PDGFs) and induce fibrin matrix remodeling as well as secretion of a collagen matrix.[7]

Shivashankar et al have reported a case of revitalization with PRF as a scaffold. It concluded that the PRF causes proliferation of human dental pulp cells and increases the protein expression of osteoprotegerin (OPG) and alkaline phosphatase (ALP) activity. Platelet-rich fibrin stimulates osteoblasts, gingival fibroblasts, and periodontal ligament cells proliferation as a mitogen.[8]

Hydroxyapatite has shown successful periodontal regeneration in periapical defects. The combination of HA with PRF resulted in greater pocket depth reduction, defect fill, and gain in clinical symptoms than PRF used alone and also maintains the space for tissue regeneration, which enhances the effects of PRF. Hydroxyapatite is an osteoconductive material and exerts its effects in defect areas, thus inducing bone regeneration. Nevertheless, without a blood clot or angiogenic factors, bone grafts alone are unlikely to be capable of promoting periapical wound healing. As the host's own biologic product, the blood clot is indispensable in tissue wound healing and acts as better space filler than all bone grafting materials.[9]

Mineral trioxide aggregate was developed at Loma Linda University for use as a root-end filling material. It has superior biocompatibility and sealing ability, which promote the formation of an apical barrier, and is less cytotoxic than other materials currently used in pulpal therapy. Apexification using MTA has advantages as it neither gets resorbed nor weakens the root canal dentin and has excellent biocompatibility with periradicular tissues.[10]

Periapical surgery has many limitations; it is an invasive procedure, has psychological impact on the patient, and requires skilled and experienced operator.

In the 2nd case report of a pediatric child, a combination of PRF membrane and HA crystals was used as a matrix from within the canal and MTA was demonstrated to be an effective alternative for creating artificial root-end barriers and inducing faster periapical healing of the cases with large periapical lesions.

CONCLUSION

The combination of PRF membrane and bone graft as a matrix with MTA has been demonstrated to be an effective alternative for creating artificial root-end barriers and inducing faster periapical healing. However, like other clinical studies, this study also has few limitations like short follow-up period of 8 months and a need for histological evaluation to confirm regeneration.

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