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Surgical Management Of Periapical Lesion Using Platelet-Rich Fibrin And Formation Of Apical Barrier With MTA In Immature Permanent Anterior Teeth In Pediatric Patient: Case Report

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Abstract:
Background: *Untreated endodontic infections of longer duration leads to periapical lesions in teeth. Periapical surgery includes the curettage of all periapical soft tissues. However, the use regenerative material or growth factors helps in the new bone formation. Platelet concentrates such as platelet-rich fibrin(PRF), which is rich in growth factors and its efficiency in inducing tissue repair and regeneration is well known.*
Materials and Methods: *This paper describes a case of chronic periapical lesion in a 14 year old male pediatric patient treated with periapical surgery using platelet-rich fibrin(PRF) in the surgical defect and formation of apical barrier with MTA(mineral trioxide aggregate) in immature maxillary anterior teeth having open apex in maxillary left central incisor. Initially, conventional endodontic treatment was started but it was not successful, then apical surgery was performed.*
Results: *Clinical and radiographic evidence of bone regeneration and healing without any clinical symptoms was seen at follow-up examinations.*
Conclusion: *PRF gave predictable clinical and radiographic evidence of bone formation. Moreover, good quality apical seal by using root-end filling materials like MTA also contributes to the success of the treatment. The success rate can be modified and increased by using grafts, and various host modulating agents.*
Keywords: *endodontic surgery, platelet-rich fibrin, mineral trioxide aggregate, immature permanent teeth*

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I. Introduction

Periapical lesions can be caused by endodontic infection or necrosis caused by trauma. In young patient traumatic injuries are very common to anterior teeth.[1] Traumatic injury to young permanent teeth results in cessation of root completion and necrosis of the pulpal tissue. As a result of necrosis, inflammation and release of toxins at the apex of the root occurs.[2] Surgical interventions to periapical lesion is the last resort, which is considered after unsuccessful conventional endodontic treatment.[3] Conventional periapical surgery not only provides direct visualization of the lesion but also helps in eliminating unhealthy necrosed tissues. However, it results in connective tissue repair which is an undesirable outcome.[4] With the introduction of regenerative therapies in endodontics, particularly growth factors with platelet concentrates, true regeneration of the periapical tissues has been made possible.[5,6]

Platelet-rich fibrin (PRF) is a second generation platelet concentrate, which was first developed by Choukroun et al in 2001.[7] PRF releases cytokines such as platelet derived growth factor (PDGF), transforming growth factor beta-1 (TGFβ1) and vascular endothelial growth factor (VEGF), trapped between the fibrin meshwork. The release of cytokines is slow and continuous over a period of 14 days.[8] Although periapical surgeries using PRF as a grafting material was extensively reported in adult patients but we did not find any study concerning pediatric patients. The purpose of the present case report is to assess the healing after periapical surgery using PRF in immature anterior teeth of a pediatric patient.

II. CASE REPORT

A 14-year-old male patient reported with the chief complaint of pain in upper front tooth region since 5 days. Patient's past dental history revealed trauma in the maxillary anterior region around 3 years back leading to the fracture of both central incisors. Behaviour of the patient was definitely positive. Extraorally, there was no relevant finding present. Intraorally, fractured 11 and 21 can be seen and discoloration w.r.t 21 (Fig. 1a). On carrying out electric pulp test, there is no response w.r.t tooth 21 and 22 but normal response w.r.t tooth 11. Periapical radiograph reveals huge radiolucency around the root apex of teeth 21 and 22 with open apex w.r.t 21 (Fig. 1b). Conventional root canal treatment was started in teeth 21 and 22. Since it was not successful then periapical surgery was planned with sealing of the open apex w.r.t 21 using MTA as apical barrier and placement of PRF in curetted periapical defect followed by conservative restoration of fractured teeth 11 and 21. Informed consent was taken prior to the treatment after explaining the entire procedure.

Fig. 1 (a) Intraoral pre-operative photograph, (b) pre-operative radiograph

On the first appointment, access opening was done w.r.t teeth 21 and 22. The canal was debrided and irrigated with 1.5% sodium hypochlorite followed by normal saline. Working length was established and biomechanical preparation was done up to no. 80 K-file and no. 40 K-file in teeth 21 and 22 respectively. Calcium hydroxide intracanal medicament was placed in teeth 21 and 22. At subsequent visits, weeping canals were evident and the tooth was symptomatic. The necessity of the surgery was explained to the patient. After the administration of 2% lignocaine, crevicular incision along with two vertical releasing incisions were given and flap was raised. The periapical cavity was curetted and irrigated with normal saline (Fig. 2). Obturation was completed in tooth 22 and MTA plug was placed in tooth 21 intraoperatively (Fig. 3 a,b). Meanwhile, an 8ml sample of venous blood was drawn from patient's forearm and centrifuged at 3000rpm for 10 minutes. The freshly formed PRF was placed inside the periapical cavity and the flap was re-positioned and sutures were placed (Fig. 4). The patient was recalled after 48 hours and obturation was completed in tooth 21 with gutta percha using lateral compaction technique. Fig. 5 (a) and (b) shows radiographic healing after 1 month and 1 year respectively.

Fig. 2 shows intra-operative clinical photograph.

Fig. 3 (a) shows intra-operative radiograph, obturation w.r.t 22 was done and MTA plug was placed w.r.t 21, (b) obturation i.r.t 21 completed after 48 hours.

Fig. 4 freshly formed PRF was placed in the cavity and sutures were placed.

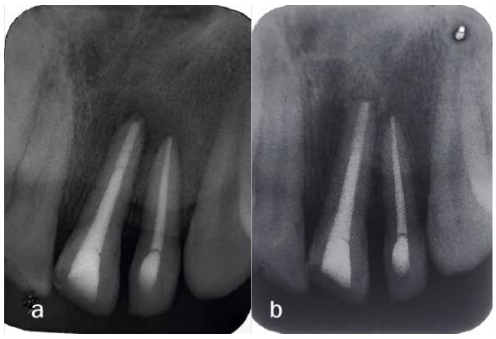

Fig. 5 (a) shows healing after 1 month and (b) shows healing after 1 year.

III. DISCUSSION:

Application of growth factors and host modulating agents locally at the surgical site, tremendously promotes periapical tissue regeneration and healing. Tissue growth factor (TGF-β) and platelet-derived growth factor (PDGF) stimulates collagen production which promotes soft tissue healing and new bone formation.[9] These growth factors are secreted by α-granules, which are secretory granules of platelets. These growth factors gets released whenever platelets get activated by a stimulus or aggregated by some activators. The highest amount of growth factor present are TGF-β and PDGF which promotes the healing of soft tissue and bone by increasing the stimulation of collagen production thus improving wound strength and initiation of callus formation.[10] Studies have shown that the presence of growth factors helps in attracting stem cells present in apical papilla.[11]

In the present case PRF was placed at the periapical defect. The rational for using PRF over PRP(platelet-rich plasma) is that PRF is produced in a naturally, without using any anticoagulant, bovine thrombin, or calcium chloride for platelet activation and fibrin polymerization. Thus it is purely autologous and thus does not cause any allergic reaction to the patient. Also, the process of formation of PRF is simple and of low cost.[10]

In the present case, the open apex was sealed intra-operatively using white MTA. This offers ease of placement of MTA and provides better visualization and control over the material. A 3- to 5-mm-thick MTA apical plug is recommended by the manufacturer for one-visit apexification produces a reasonable seal that improves over time. MTA also gave excellent sealing when compared to EndoSequence Bioceramic Root Repair Material. Studies have shown that MTA cement gave better sealing ability, it is an ideal retrograde filling material, because of its biocompatibility and has a good marginal adaptation when compared with portland cement and IRM.[12-14] Keeping these properties of MTA in mind, resection of the root of about 2-3mm is avoided in the present case since most of the accessory canals are present in the apical 2-3mm of the root. This prevent shortening of the root structure in apicoectomy procedures.

The only limitation of using PRF is the low quantities were produced because it is obtained from an autologous blood sample. This fact limits the use of PRF for surgeries having larger defects. PRF tissue banks are unfeasible. The fibrin matrix is comprised of all the circulating immune cells and all the antigenic plasmatic molecules, thus, it is totally specific to the donor and cannot constitute an allogenic graft tissue.

IV. CONCLUSION:

From the present case report, we conclude that periapical surgery can be performed easily and effectively using platelet-rich fibrin. PRF being totally allogenic, gave predictable clinical and radiographic evidence of bone formation. Moreover, a good quality apical seal by using root-end filling materials like MTA also contributes to the success of the treatment. The success rate can be modified and increased by using grafts, and various host modulating agents.

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