

Case Report

Platelet-Rich Fibrin to Induce Apical Closure in an Immature Multi-Rooted Permanent Tooth with Necrotic Pulp: A Case Report

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Abstract: Regenerative endodontic procedures are the emerging techniques for the restoration of functional pulp and dentine. The case report presented here describes the management of a symptomatic mandibular first molar with an immature apex and necrotic pulp in a 9 year old child. The tooth was tender on percussion and palpation and elicited a negative response to sensibility testing. A regenerative endodontic procedure was performed using triple antibiotic paste as intracanal medicament and platelet-rich fibrin (PRF) as scaffold. Recall visits after 4, 6 and 8 months showed complete resolution of periapical lesion with increased canal wall thickness. The regenerative procedure used induced root development by increasing root wall thickness and closure of apex with regaining of pulp vitality.

Keywords: Immature Tooth, Platelet-Rich Fibrin, Pulp Regeneration.

INTRODUCTION

Immature permanent tooth with necrotic pulp is often a diagnostic and treatment dilemma. In teeth with incomplete root formation, every attempt should be made to preserve vitality until maturation has occurred. Loss of pulp vitality before completion of root development leaves a weak root more prone to fractures, thin dentinal walls, poor crown root ratio, and open apex etc. Cvek *et. al* observed increased incidence of cervical root fractures in treated immature teeth compared to teeth with completed roots [1].

Management of such cases include conventional apexification procedures using calcium hydroxide or single visit techniques using materials such as mineral trioxide aggregate (MTA). According to the available literature procedures using calcium hydroxide have numerous disadvantages, such as multiple visits in a short period of time and thin dentinal walls. Recently various researchers used materials like MTA for establishment of a hard tissue barrier at the apex. But this procedure is also associated with similar disadvantages, such as thin dentinal walls and a failure to induce further root development [2]. Platelet-rich fibrin (PRF) was developed in France by Choukroun and Dohan. PRF is a matrix of autologous fibrin, which consists of a large quantity of platelet cytokines, leukocyte cytokines and growth factors that gets

embedded during centrifugation. PRF obtained from Choukroun's technique is a strong fibrin membrane enriched with platelet and growth factors [3, 4]. Hence this case report focused on the management of mandibular first molar with immature apex and periapical radiolucency using PRF membrane matrix and MTA to promote periapical healing.

CASE REPORT

A 9-year-old healthy male child reported to the department of Pediatric Dentistry, AB Shetty Dental College, Mangalore, India, with a complaint of pain in relation to lower left permanent first molar teeth. Patient's parents informed about a history of pain that aggravates during night time since two weeks. Pain was dull, aching and continuous. On intraoral examination, the tooth was tender on percussion and palpation. The tooth showed no response to sensibility testing. Probing depths were normal and the tooth showed normal physiological mobility. Radiographic examination of the tooth showed widening of lamina dura and an immature apex. A diagnosis of symptomatic apical periodontitis was made. Regenerative endodontic treatment was planned for the tooth.

After obtaining parental consent, the tooth was anaesthetized using 2% lignocaine with adrenaline (1:1, 00,000, LIGNOX* 2% A, INDOCO, Mumbai) followed

by rubber dam isolation. An access cavity was prepared. Proper access was made and the canal was irrigated with 20 mL of 1% sodium hypochlorite (Vensons, India) followed by normal saline. The working length was determined radiographically. After performing minimal filing, the canal was coated with 17% EDTA (GLYDE FILE PREP, Dentsply Mallifier) for 5 min and copiously irrigated with saline[fig:-1].

Equal proportions of ciprofloxacin, metronidazole, and minocycline were ground and mixed with propylene glycol to a thick paste consistency. This antibiotic paste was coated in the canal using spreader and packed with large endodontic pluggers. Triple antibiotic paste (Banchs and Trope) [5, 6] was given for a period of three weeks and the cavity was sealed with IRM. In the subsequent visit, symptoms were resolved. There was no tenderness to palpation or percussion. The intracanal dressing was removed by irrigation with normal saline and the canal was coated again with 17% EDTA for 10 min, flushed with saline and dried with paper points. PRF was prepared by drawing 10 mL of blood in a test tube without anticoagulant, and centrifuging immediately using a table top centrifuge (REMI Lab. Inst., India) for 8 min at 3000 rpm. The resultant product consisted of three layers, viz., acellular platelet poor plasma, PRF in the middle layer, and red blood corpuscles at the bottom. The acellular plasma was removed from the test tube and was discarded. The PRF was removed with the help of tweezers. It was placed on a gauze piece and fluid present in the fibrin clot was squeezed out. PRF was placed in the root canal up to middle third, followed by condensing using pluggers. MTA (ProRoot) (2 mm) was then placed on the top and the access cavity was sealed with a wet cotton pellet and IRM (DENTSPLY). On the next day, the cotton pellet was removed and GIC restoration was performed.

The patient was recalled after 4, 6[fig:2] and 8 after months for re-evaluation. Compared with adjacent teeth, tooth was asymptomatic and was not sensitive to percussion or palpation tests. During the initial two visits sensibility tests with cold and EPT elicited a negative response. During the latest visit; at 8 months the tooth showed minimal positive response to EPT and cold test when compared to the molar teeth of the contralateral and opposing arch. Radiographic examination showed resolution of the periapical lesion, further root development, and continued apical closure of the root apex (Fig. 3). The patient is scheduled for a 12-month re-examination.



Fig-1: after access opening and placement of triple antibiotic paste



Fig-: 2 follow up after 4 months of placing PRF



Fig-: 3 follow up after 8 months of placing PRF



Fig- 1: after access opening and placement of triple antibiotic paste



Fig:- 2 follow up after 4 months of placing PRF



Fig:- 3 follow up after 8 months of placing PRF

DISCUSSION

Regeneration of the pulp-dentin complex is gaining momentum recently. Regenerative endodontic procedures are essentially based on the triad of stem cells, growth factors, and scaffolds. According to the recent studies, PRF can be considered as an ideal scaffold as it increases proliferation and differentiation

of dental pulp stem cells. There is slow release of growth factors as it incorporates leukocytes, platelets and a wide range of key healing proteins in a dense fibrin matrix [2]. This case has some similarities and some differences with the previous case reports and series [2, 3, 7]. Tooth with an open apex, a necrotic pulp, and a periapical lesion was selected for regeneration.

Similar to many previous reports; 1% NaOCl was used as an intracanal irrigants and triple antibiotic paste as an intracanal medicament to disinfection of the root canal [2, 7]. MTA was placed over the blood clot to isolate the root canal from the external surface of the tooth and to utilize the ability to create a hard tissue barrier at the interface to the blood clot. This procedure has been reported in many studies [7].

Continued thickening of the dentinal walls, root lengthening, and apical closure in 8 months were observed with positive responses to cold and EPT.

A few cases have reported positive responses to cold and EPT after a regenerative endodontic procedure [7]. According to various authors vitality responses in these teeth depends on the coronal level of tissue regenerated in the root canal and the thickness of filling materials over this tissue(s). Hence it is assumed that if the filling materials are placed close to the cemento-enamel level, it is more likely to elicit a positive response to cold or EPT and vice versa. NaOCl concentrations have shown a negative effect on SCAP cell survival and dentin sialophosphoprotein (DSPP) expression. The use of 0.5% or 1.5% NaOCl, followed by 17% EDTA, counters these deleterious effects on stem cell viability. Hence irritants were used judiciously [8].

Choukroun's PRF is a matrix of autologous fibrin, which consists of large quantity of platelet and leukocyte cytokines that gets intrinsically incorporated during centrifugation. Hence the growth factors are progressively released over time (7-10 days) depending upon the rate of disintegration of fibrin mesh [3]. According to studies, the levels of released growth factors, such as TGF-B1 and PDGF, were progressively increased and reached the maximum amount on day 14, and then decreased mildly for PRF. In contrast, PRP demonstrated an uncontrolled release of TGF-B1 and PDGF, which reached the highest amount on day 1 and then decreased rapidly. In short, PRF provides a delayed and prolonged release of growth factors, as opposed to the single sharp burst of growth factors provided by PRP[9].

Simonpieri *et al.* reviewed advantages of the use of PRF as it acts as an apical barrier and offers mechanical sustenance. Accordingly PRF fragments

act as biological connectors which promotes chemotactic migration of cells which forms the basis of revascularisation. Slow release of the platelet cytokines (PDGF, TGF- α , and IGF-1) ensures continuous process of healing [3]. Keswani *et al.* reported that PRF is relatively an ideal scaffold for revascularisation. High concentration of inherent growth factors enhances cellular proliferation and differentiation. It acts as a matrix for tissue in growth, especially SCAP cells. SCAP cells are capable of odontoblast-like differentiation and formation of dentin *in vivo*. Their high proliferative potential makes them a likely source of odontoblasts for root dentin formation even during conditions of pulp necrosis [10].

In a case report, histologic nature of tissues formed in the canals of human revascularized/revitalized immature permanent tooth with apical periodontitis was evaluated. The study compared outcomes using either a mixture of a blood clot and PRP or a blood clot alone as a scaffold. The tissues formed in the canals were mineralized tissue along with fibrous connective tissue. No pulp-like tissue characterized by the presence of odontoblast-like cells was observed lining the dentin-like mineralized tissue [11].

However repair of the pulp by vital tissue is better than replacement of the pulp with inert materials; especially in immature permanent tooth. The long-term outcome between apexification and revascularization/revitalization needs to be investigated.

CONCLUSION

Revascularisation or regeneration processes are capable of significant increase in root length and dentinal wall thickness which is essential for long term prognosis of the endodontically treated teeth. However long term success of regeneration procedures should be evaluated.

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