

# Revascularization of Teeth with Necrotic Pulp and Open Apex in immature permanent teeth by Using Concentrated Platelet-rich Plasma: A Case Report

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## ABSTRACT

**Introduction-** Tissue engineering is a growing field and one of the advanced successful endodontic procedures in an immature permanent teeth with open apex and partially necrotic pulp. Pulp revascularization is reliant on the ability of residual pulp, periodontal, periapical stem cells and to differentiate and regenerate. These cells have the potential to generate a highly vascularized and a conjunctive rich living connective tissue which colonizes the available pulpal space. Up to now, apexification procedures were applied for these teeth, using calcium dihydroxide or MTA to produce an artificial apical barrier. However, the pulp revascularization allows the stimulation of the apical development and subsequently root maturation of immature teeth. In this case report, cPRP was used as a scaffold delivery system to induce the apical barrier formation. **Method-** A 9-year-old female patient who had a history of trauma 2-3 months back, developed pulpal necrosis and apical periodontitis. After preparing an access cavity, its necrotic pulp was removed, copious irrigation was done with normal saline and LSTR was performed. After 3 weeks triple antibiotic mixture was removed, the PRP was injected into the canal space up to the cemento-enamel junction level. Three millimeters of white mineral trioxide aggregate was placed directly over the PRP clot. Three days later, the teeth was then double-sealed with permanent filling materials. **Results-** On Clinical examination 8 months later revealed no sensitivity to percussion or palpation tests. Radiographic examination of this tooth showed resolution of the periapical lesion, further root development, and continued apical closure. **Conclusion-** The short-term results of the present case, it appears that regeneration of vital tissues in a tooth with necrotic pulp and a periapical lesion is possible; PRP is potentially an ideal scaffold for this procedure.

**Keywords:-** open apex, regenerative endodontics, dental pulp stem cells, immature apex, pulp regeneration, revascularization, concentrated platelet-rich plasma

## INTRODUCTION-

An open apex is defined as absence of sufficient root development to provide a conical taper to the canal. Normally, without any pulp or periapical pathology, open apex is found in a developing immature tooth root. Typical physiologic root closure of permanent teeth may take **2-3 yrs** after eruption. Any trauma or lesion prior to completion of root development, might cease dentin formation, and thereby arrest the root growth [1]. Treatment should be based considering pulpal status and the degree of root development. In cases of reversible pulpitis, regardless of the stage of root development, vital pulp therapy is the treatment of choice. Whereas for pulpal necrosis or irreversible pulpitis, apical closure will dictate the line of treatment i.e. conventional root

canal therapy can be performed for a well closed apex tooth [2,3]. However, in cases with open apex, further treatment options must be contemplated.

Traditionally, apexification procedure was performed with calcium hydroxide [4]. But numerous, long term applications, unpredictability of apical closure makes it undesirable [5], henceforth, mineral trioxide aggregate (MTA) was proposed [6].

Regenerative endodontics is known to be the biologically based treatment plan that is targeted to replace damaged cells and structures in the dentine-pulp complex with live viable tissue, which restore normal physiologic functions. These procedures not only produces apical barrier but also allow throughout root development and strengthens dentine walls [7-9] This can be done through inducing blood clotting or via stem-cell therapy like scaffold implantation, injectable scaffold delivery, pulp implantation, gene delivery, post-natal stem-cell therapy and three-dimensional cell printing[7,9]

In this case report, pulp revascularization was performed via injectable scaffold delivery using concentrated Platelet Rich Plasma (cPRP)

## CASE REPORT-

A 9 year old female patient was referred to our department of pedodontics and preventive dentistry for evaluation and treatment of fractured upper central incisors. Patient's parent gave a history of trauma 2-3 months back when she fell in the school van, fracturing her teeth and recently experienced sensitivity to cold. She had bleeding from that teeth region for 10-15 minutes, and was conscious and aware. She dint visit any physician neither she took any medications. Recurrent cough & fever episodes were her contributory medical history. There was no extraoral or intraoral swelling present. Clinically the teeth showed slight yellowish discoloration without any mobility and fracture line involving pulpal chamber (**Fig-1**). Radiographically, there was periapical radiolucency with 21, immature root, open apex, widening of PDL space and disruption of lamina dura subjecting both 11, 21 (**Fig-2**). Based on clinical and radiographic final diagnosis was made to be apical periodontitis with necrotic pulp.

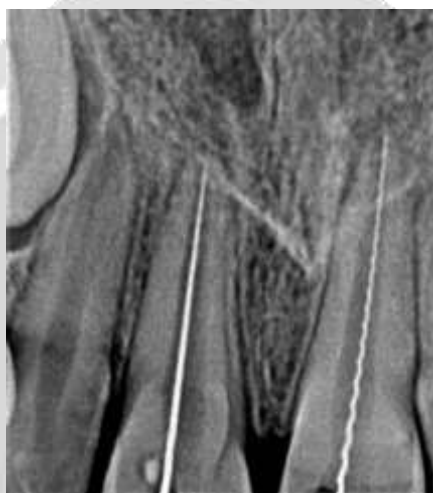


**Fig- 1:** Pre-operative clinical observation



**Fig- 2:** Pre-operative radiograph showing periapical radiolucency with 21, immature root, open apex, widening of PDL space and disruption of lamina dura subjecting both 11, 21

After considering various treatment options for the case, the decision was made to perform regenerative endodontic protocol using cPRP. Proper informed written consent was taken from the patient's father. Local anesthesia was injected (2% lidocaine with 1:80000 adrenaline), the pulp chamber was accessed with a No. 4 round bur. A size 10 K-file was introduced into the canal space and the patient presented with mild discomfort, potentially indicating the presence of remaining vital pulp tissue. The clinical diagnosis was then revised from total pulpal necrosis to partial necrosis. The necrotic pulp was removed with the aid of barbed broach. Working length was estimated with a No. 15 k file (**Fig-3**). Although no instrumentation was done but irrigation was done with normal saline considering the fact that NaOCl might be irritant to periapical tissues, followed by drying with sterile paper points. LSTR was performed by making a combination of metronidazole (200gm), ciprofloxacin (250gm), minocycline (50gm) grinding in a mortar pestle after removing the top coat, then mixing with distilled water into a thick creamy paste (**Fig-4**). It was carried with a finger lenturo spiral and inserted into the canal till Cemento-Enamel Junction. Using cotton pellets and RC sealer, the canal was sealed temporarily.



**Fig -3:** Working Length Estimation wrt 11,21



**Fig -4:** Triple Antibiotic paste

3 weeks later, the patient revisited our department for further treatment and was asymptomatic. Radiographic evaluation showed no periapical radiolucency with 21. The temporary restoration, cotton pellet was removed, the triple antibiotic paste flushed off with 20ml saline irrigation.

Preparation of cPRP was performed according to Dohan et al [10]. Venous blood (20 mL) was carried to tubes containing anticoagulant to prevent activation and degranulation of platelet, and the tubes were centrifuged at 1000 g (soft spin) for 10 min. Initial centrifugation produced 3 distinct layers- RBC at the bottom, an intermediate layer of 'buffy coat', which contains extensive platelets concentrations and a layer of 'platelet-poor plasma' (PPP) at the top. The majority of the Platelet poor plasma was discarded with the aid of sterile syringe, and the residual contents (PPP, buffy coat and some red blood corpuscles) were transferred to an empty tube and

centrifuged for 15 min at 2200 g (hard spin). This procedure again produced 3 well defined layers and cPRP was obtained ( **Fig-5,6**). This cPRP was then injected into the canal space up to the level of the CEJ and allowed to clot for 10 min. The canal space was sealed with GIC and composite build-up was done for the esthetic concerns [10].



**Fig-5:** Concentrated Platelet Rich Plasma ( cPRP), **Fig-6:** Transfer of cPRP into a sterile injectable syringe

The patient was recalled every 2 months for clinical and radiographic evaluation (**Fig-7,8**). After a 8 months follow up, there was no periapical radiolucency, apical closure was almost complete with concomitant thickening of dentinal walls, pulp space was reduced and no widening of PDL space was observed (**Fig-9**).



**Fig-7:** Radiograph at 3 months follow up visit**Fig -8:** Radiograph at 6 month follow up visit

**Fig -9:** Radiograph at 8 months follow up visit showing no periapical radiolucency, apical closure was almost complete with concomitant thickening of dentinal walls, pulp space was reduced and no widening of PDL space was observed

## DISCUSSION-

Regenerative endodontics to stimulate apexogenesis instead of performing replacement therapy using artificial substitutes is one of the recently advanced treatment modalities for immature teeth with necrotic pulps.

In this case report, good healing was achieved at 6 months, which is attributed to the high platelet concentration, that contains various growth factors and cytokines like interleukins 1,4 and 6. It induces collagen production, enrolls vital cells to the traumatic site, generates anti-inflammatory agents, initiates angiogenesis, prompt cellular differentiation, and encourages hard and soft tissue wound healing [11,12].

Our present study results are in conjunction with the study by Torabinejad & Turman (2011) [13] . Jadhav et al. (2012) also presented with similar results [14].

In this case study, no instrumentation was done since instrumentation could make the dentinal walls vulnerable to fracture. It might be traumatic to the vital stem cells, odontoblasts, epithelial cells of Hertwig's root sheath, growth factors which are present in abundance, periapically and are required during dentinogenesis. These cells further differentiate into secondary odontoblasts which generates dentin on root canal walls [15-17].

The success of pulp revascularization case also depends on the disinfection of the canal. In this case, the LSTR procedure was done using a mixture of metronidazole, minocycline and ciprofloxacin [18]. Case reports of tooth discolorations were seen following using minocycline [19-22]. Thibodeau & Trope (2007) followed by Dabbagh et al. (2012) reported successful regenerative treatment when they substituted minocycline with cefaclor [23,24]. To avoid discoloration, the use of dentin bonding agents to seal the dentinal chamber have also been recommended [25, 26]. Similar results were seen in the case undertaken by us.

## CONCLUSION-

Taken together, cPRP as a scaffold delivery system is highly beneficial in treating immature teeth with necrotic pulp and periapical pathology. This case report documents favourable outcomes for the teeth both clinically and radiographically in as early as 8 months time period. However, long term prospective studies comparative with other treatment modalities would give a clearer pictures are advised.

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