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Revascularisation of non-vital immature teeth with platelet rich fibrin: A report of 2 cases

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Abstract
Platelet rich fibrin (PRF), an autologous leukocyte is ideal biomaterial for pulp-dentin complex regeneration. It contains various growth factors like platelet-derived growth factor, transforming growth factor-1 and vascular endothelial growth factors. Their sustain release over prolonged period in root canal increases the success of revascularisation in blunderbuss canal. This case report presents 2 cases of immature apices with necrotic pulp in maxillary anterior region of young and middle age patients. After thorough disinfection of root canal with sodium hypochlorite as irrigant and triple antibiotic paste as medicament, bleeding was induced from periapical area. PRF was placed in canal as scaffold. Narrowing of apical foramen was reported in both cases after 12 months.

Keywords: Revascularisation, non-vital immature teeth, platelet rich fibrin, 2 cases

1. Introduction
Management of necrotic pulps in immature teeth is a big challenge in endodontics [1]. Thin dentinal walls and open apex poses difficulty in canal instrumentation, irrigation and obturation. For conventional treatment, an apical stop is required against which obturating materials can be condensed. In past decades, apexification with Ca(OH)2 was the treatment option for such cases [2]. Long term calcium hydroxide placement in root canal leads to formation of porous barrier at apical end. This procedure alters the intrinsic properties of dentin and increases its brittleness [3]. Mineral trioxide aggregate (MTA) [4] and biodentine [5] are recently introduced biocompatible materials which act as artificial apical barrier for obturation. Increase in root length and thickening cannot be achieved by these apexification materials. Periapical surgery can be performed to achieve retrograde seal, but avoided as it affects the crown root ratio. With increase in interest towards regeneration, new procedure of revascularisation was introduced. Various case reports/series have been published in literature [6, 7]. Blood clot acts as a natural scaffold in which cell differentiation and proliferation can occur. Other scaffolds like platelet rich plasma (PRP) [7] and platelet rich fibrin (PRF) [8] recorded better success in root thickening and apical closure. The aim of this article is to present case reports of revascularisation of immature teeth with platelet rich fibrin.

Case 1
A 34 year old female referred to endodontic clinic from a private practitioner with complains of pain and swelling in upper front teeth. Patient gave a history of fall from stairs in childhood 25 years back. Clinical examination revealed maxillary central incisors tender on percussion with bony expansion in labial vestibule on palpation. Intraoral periapical radiograph (fig1a) showed thin lateral dentinal walls with wide open apex surrounded by periapical lesion. A diagnosis of symtomatic apical periodontitis was established. After explaining the procedure, its risks and outcome, revascularisation with PRF was planned. An informed consent was taken from patient. Revascularisation was performed as per the protocol. Clinical treatment protocol of revascularization is described in table 1.
PRF preparation and placement-About 8 ml of blood drawn by venipuncture of antecubital vein was collected in a 10-ml sterile glass tube without any anticoagulant and was immediately centrifuged at 3000 rpm for 12 minutes. The PRF was collected using forceps and pressed gently with sterile gauze. It was then introduced into the root canal with a sterile cotton plier and gently pushed to root canal.

Root canal was double sealed with MTA followed by composite restoration. Follow up was done at 6 and 12 months (fig1 b & c).

Case 2

A 12 years old boy presented with lingering pain in broken upper front tooth. Patient had a bicycle fall 3 years back. On clinical examination, Ellis class III fracture was found in left maxillary central incisor. Radiological examination revealed blunderbuss canal with periapical lesion (fig 2a). Electric pulp testing and cold test gave negative results. On the basis of clinical, radiographic and pulp vitality test records, a diagnosis of pulp necrosis with symptomatic apical periodontitis was made. After taking informed consent, management through revascularisation was planned. Patient was recalled after 6 and 12 months for follow up (fig 1b & c).

Table 1: Revascularisation treatment protocol

Visit	Treatment procedure
1st appointment	Local anaesthesia, rubber dam isolation, root canal access, working length determination, and irrigation with sodium hypochlorite and/or EDTA with minimal or no instrumentation. Triple antibiotic paste placement as intra-canal medicament.
2nd appointment	Irrigation and root canal dressing changed till canal disinfection achieved.
3rd appointment	Local anaesthesia, rubber dam isolation, irrigation to remove remaining intra-canal medication and laceration of periapical tissue with overinstrumentation to induce bleeding into the canal. Platelet rich fibrin (PRF) placement in canal. MTA placed at level of cementoenamel junction, followed by placement of a resin bonded restoration.

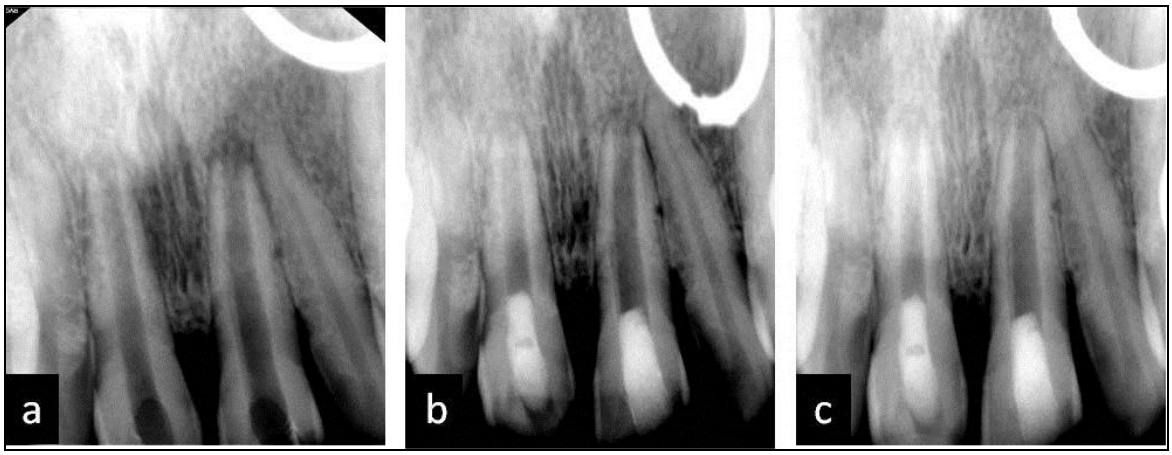

Fig 1: Intraoral periapical radiographs show a) lateral thin dentinal wall with blunderbuss canals in relation to tooth number 11 and 21, b) healing of periapical lesion at 6 months follow up, c) narrowing of apical foramen with periodontal architecture formation after 12 months.

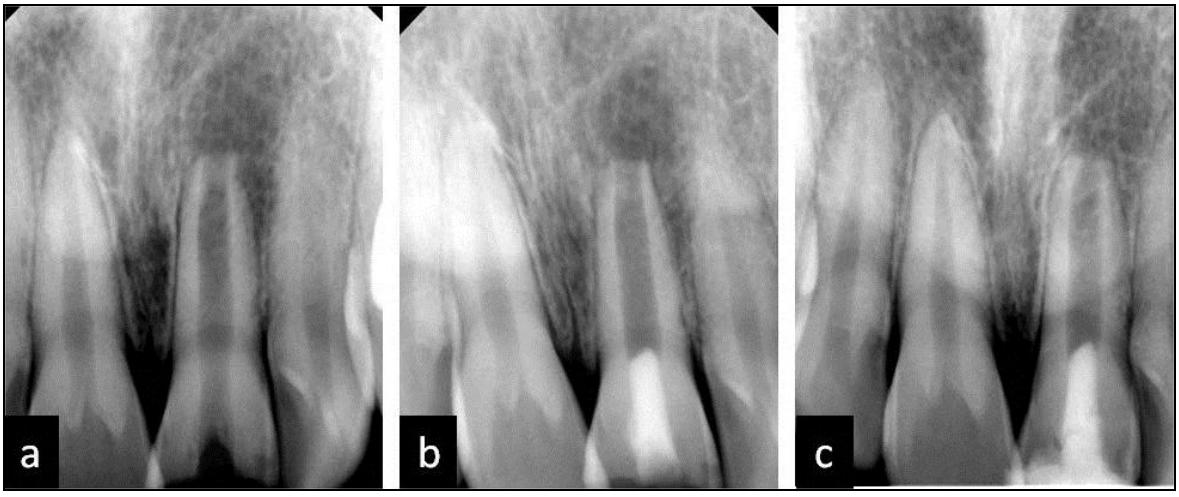

Fig 2: a) Preoperative radiograph revealing open apex with periapical lesion, b) 6 months follow up, c) healing of periapical lesion along with small extension of dentinal walls at apex leading to narrowing of apical foramen.

Discussion

A traumatic injury to young permanent tooth with wide apical foramen causes necrosis of pulp tissue which in turn leads to failure of root development and apical closure. Further consequences are periapical infection, granuloma or cyst. Management of this blunderbuss apical opening is an enigma to endodontist. Revascularisation is viable treatment option for immature necrotic teeth. This procedure involves thorough disinfection, induction of bleeding from periapical area with placement of scaffold and tight coronal seal. Mechanical instrumentation can lead to fracture of fragile lateral dentinal walls [9]. Disinfection protocol includes minimum or no mechanical preparation with chemical debridement. Different concentrations of sodium hypochlorite and EDTA are used for

irrigation. Chlorhexidine is avoided as it can hamper the vitality of pulp stem cells [10]. Calcium hydroxide is standard intracanal medicament but it decreases the bleeding induction as it causes coagulation necrosis. So, triple antibiotic paste (TAP) is proposed as intracanal medicament by Hoshino *et al* for revascularisation cases. Components of TAP includes metronidazole, ciprofloxacin and minocycline. Equal proportions of these were grounded and mixed with distilled water and a thick paste was made [11]. Disinfected root canals provide conducive environment for in-growth of tissue in canal. Wide open apex makes bleeding from periapical area feasible which is intentionally induced by over-instrumentation. Various scaffolds like blood clot [6], collagen [12], gelatin [13], PRP [7] and PRF [8] are used by researchers in literature. Blood clot acts as scaffold for growth of stem cells recruited from the apical pulp tissue remnants, periodontal ligaments, apical papilla or bone marrow. It provides a pathway for migration and various growth factors for stem cells. Blood clot has limited and unpredictable amount of growth factors. Collagen was placed as scaffold in root canal but no statistically significant difference was found as compared to blood clot in a dog study [12]. Platelet rich plasma, first generation, autologous platelet concentrate was introduced to overcome the shortcomings of blood clot. With placement of PRP along with blood clot, better clinical outcome was recorded in a pilot study [7]. Various growth factors such as platelet derived growth factor, transforming growth factors, insulin like growth factor, vascular endothelial growth factor, epidermal growth factor, epithelial cell growth factor were found in PRP. Thrombin or calcium containing products (calcium sulphate, calcium chlorite etc) are needed for the release of growth factors by degranulation of platelets. PRF is a second-generation platelet concentrate that have some advantages over PRP. It has a very significant slow sustained release of many key growth factors for at least 1 week [14] and up to 28 days [15] as compared to fast release of PRP. No anticoagulant or thrombin is necessary for its activation or action. Excellent healing and periapical architecture achieved with revascularisation and PRF within 12 months in both young and middle age patients.

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