

Case Report
Pediatric and Preventive Dentistry

Regenerative Endodontic Treatment Using an Induced Blood Clot and Platelet-Rich Fibrin in Two Immature Permanent Premolars: A Case Series

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Abstract

Background: Regenerative endodontic treatment uses a scaffold within a disinfected canal to support healing in immature permanent teeth. This case series describes the use of two scaffold approaches in mandibular premolars. **Case Presentations:** A 12-year-old girl received treatment of tooth 34 using an induced intracanal blood clot. A 12-year-old boy received treatment of tooth 45 using platelet-rich fibrin (PRF). At the first visit, both canals were irrigated with sodium hypochlorite and medicated with antibiotic paste. At the second visit, the medicaments were removed and the canals were irrigated with EDTA. Bleeding was induced beyond the apex of tooth 34 and allowed to clot; PRF was placed in tooth 45. Mineral trioxide aggregate was placed over each scaffold, followed by coronal restoration. Immediate postoperative, two-week, and three-month follow-up radiographs documented the treated teeth. **Conclusion:** These cases illustrate the use of an induced blood clot and PRF as scaffolds in regenerative endodontic treatment. Radiographic follow-up was available up to three months. Longer clinical and radiographic follow-up is needed to assess sustained healing and continued root development, and these two cases cannot establish comparative scaffold effectiveness.

Keywords: Blood Clot, Immature Permanent Tooth, Mandibular Premolar, Platelet-Rich Fibrin, Regenerative Endodontic Treatment.

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INTRODUCTION

Pulp necrosis in an immature permanent tooth can stop root development, leaving an open apex and thin dentinal walls. These features make treatment difficult: the open apex complicates root canal filling, and the incompletely formed root may be more vulnerable to fracture. Although apexification can provide an apical barrier, it does not aim to promote further physiological root development [1].

Regenerative endodontic treatment seeks to control infection and create conditions that may support healing and continued root maturation. Its clinical goals include the resolution of symptoms and periapical

disease; any increase in root length, thickening of the dentinal walls, or apical closure must be assessed during follow-up [2]. A scaffold placed within the disinfected canal provides a framework for tissue ingrowth. The usual approach is to induce bleeding through the open apex and allow a blood clot to form, although obtaining sufficient bleeding can be difficult in some cases [3].

Platelet-rich fibrin (PRF) is another scaffold prepared from the patient's own blood. Its fibrin network contains platelets and growth factors that may support cell migration and tissue healing. PRF has been used both on its own and alongside an induced blood clot in regenerative endodontic procedures [4]. In a small retrospective study, clinical and radiographic outcomes

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at one year were similar in teeth treated with PRF and those treated with an induced blood clot [5]. Further evidence is needed to understand how scaffold choice affects long-term outcomes.

This case series describes regenerative endodontic treatment of two immature permanent mandibular premolars, using an induced blood clot in one tooth and PRF in the other. It presents the treatment steps and available follow-up findings for each case.

CASE PRESENTATION

Case 1: Induced Blood-Clot Scaffold

A 12-year-old girl underwent regenerative endodontic treatment of tooth 34, the mandibular left first premolar. A preoperative periapical radiograph was obtained. At the first appointment, the access cavity was prepared and the working length was determined. The canal was irrigated with sodium hypochlorite (NaOCl) and dried with paper points. Double antibiotic paste was placed in the canal, and the access cavity was sealed with glass ionomer cement (GIC).

The patient returned after three weeks with no signs of infection. Local anaesthesia without a vasoconstrictor was administered. The medicament was removed, and the canal was irrigated with ethylenediaminetetraacetic acid (EDTA) and dried with paper points. A K-file was passed beyond the apex to induce bleeding into the canal up to the cemento-enamel

junction. After the blood clot formed, mineral trioxide aggregate (MTA) was placed, followed by GIC and a composite restoration. An immediate postoperative periapical radiograph was obtained, followed by radiographs at two weeks and three months (Figure 1).

Case 2: Platelet-Rich Fibrin Scaffold

A 12-year-old boy underwent regenerative endodontic treatment of tooth 45, the mandibular right second premolar. A preoperative periapical radiograph was obtained. At the first appointment, the access cavity was prepared and the working length was determined. The canal was irrigated with NaOCl and dried with paper points. Triple antibiotic paste was placed in the canal, and the access cavity was sealed with GIC.

The patient returned after four weeks with no signs of infection. Local anaesthesia without a vasoconstrictor was administered. The medicament was removed, and the canal was irrigated with EDTA and dried with paper points. Platelet-rich fibrin (PRF) was placed into the canal toward the apex. MTA and an interim restoration were then placed. After 24 hours, the tooth was restored with composite resin. An immediate postoperative periapical radiograph was obtained, followed by radiographs at two weeks and three months (Figure 2). The postoperative radiograph showed radiopaque material extending into the canal below the intended coronal MTA barrier level, suggesting possible apical displacement of MTA into the PRF scaffold.

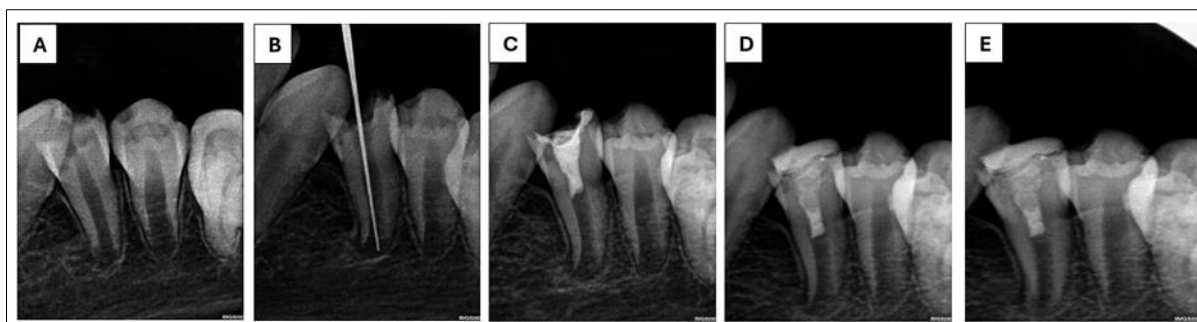


Figure 1: Serial periapical radiographs of tooth 34: (A) preoperative radiograph; (B) working-length determination; (C) immediate postoperative radiograph following induction of an intracanal blood clot and placement of mineral trioxide aggregate (MTA); (D) two-week postoperative radiograph; and (E) three-month follow-up radiograph

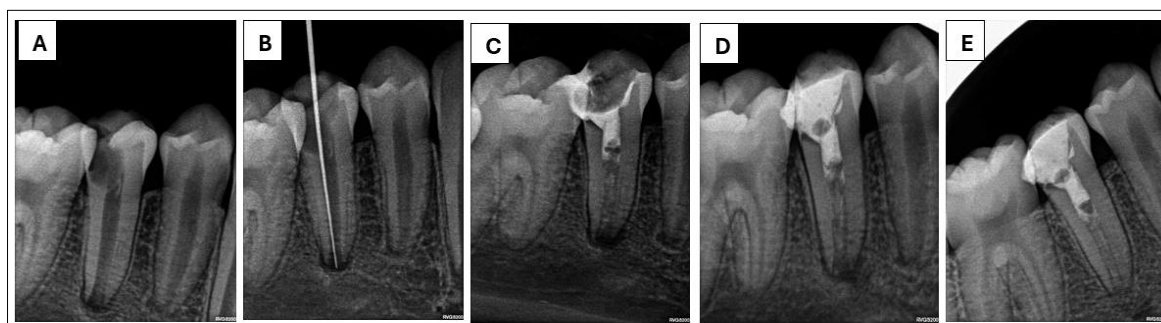


Figure 2: Serial periapical radiographs of tooth 45: (A) preoperative radiograph; (B) working-length determination; (C) immediate postoperative radiograph following placement of platelet-rich fibrin (PRF) and mineral trioxide aggregate (MTA); (D) two-week postoperative radiograph; and (E) three-month follow-up radiograph

DISCUSSION

The two cases in this series used different scaffolds during regenerative endodontic treatment of mandibular premolars in 12-year-old patients. In tooth 34, bleeding was induced through the apex and an intracanal clot was allowed to form. In tooth 45, platelet-rich fibrin (PRF) was placed in the canal. Both teeth underwent irrigation and intracanal medication before scaffold placement, followed by an MTA barrier and coronal restoration. The cases therefore provide a clinical account of two approaches to creating a scaffold within the canal.

Disinfection is essential to regenerative treatment, but the canal environment must also support cells that may enter through the open apex. Both cases were initially irrigated with sodium hypochlorite and received antibiotic paste. At the second visit, the medicament was removed and the canals were irrigated with EDTA before scaffold placement. In a laboratory study using human root segments, irrigation with 17% EDTA supported greater survival of stem cells from the apical papilla than the other protocols tested [6]. This offers a biological rationale for the EDTA rinse used here. However, their experiment used cells within a platelet-rich plasma scaffold, and its survival measurements cannot be applied directly to either patient.

The choice of intracanal medicament also differed between the cases. Double antibiotic paste was used in tooth 34 with the intention of reducing the risk of staining, whereas tooth 45 received triple antibiotic paste. Avoiding minocycline removes one possible source of discoloration, but it does not eliminate the risk. Ragab *et al.*, (2019) observed discoloration despite using an antibiotic mixture without minocycline and discussed MTA as another possible contributor. Crown colour should therefore be assessed during follow-up alongside the clinical and radiographic findings [7].

An induced blood clot provides a scaffold within the canal and is the established approach used in tooth 34. PRF, used in tooth 45, provides a fibrin matrix containing platelets and growth factors. It can be prepared separately when obtaining sufficient intracanal bleeding is difficult. These features explain the interest in PRF, although its biological properties alone do not establish better clinical outcomes. In a retrospective study that closely resembles the scaffold choice in the present series, Lv *et al.*, (2018) compared five teeth treated with PRF without induced bleeding and five treated with an induced blood clot. At 12 months, symptoms and periapical radiolucencies had resolved in both groups. Root elongation, wall thickening and apical closure were each observed in four of five teeth per group, with no significant difference between groups. The small sample limits the strength of that comparison [5].

Other clinical studies show why scaffold findings need careful interpretation. Shivashankar *et al.*, (2017) compared PRF, induced bleeding and platelet-rich plasma (PRP) in immature teeth. Root lengthening and wall thickening were comparable across groups at 12 months; the greater periapical healing reported for PRP should not be interpreted as a PRF effect [8]. Narang *et al.*, (2015) reported more favourable root lengthening in their PRF group, but each treatment group contained only five teeth [9]. Ragab *et al.*, (2019) found no significant difference in root lengthening or reduction of periapical radiolucency between a blood-clot group and a group receiving blood clot plus PRF [7]. Because PRF supplemented induced bleeding in that trial, its protocol differs from the PRF placement described for tooth 45.

The broader evidence remains cautious. In a systematic review and meta-analysis of 16 human studies, Tang *et al.*, (2022) found no statistically significant advantage of platelet concentrates over blood clots for root lengthening, dentinal wall thickening or apical closure. The included studies used different platelet preparations and treatment protocols, so a pooled finding cannot establish that PRF and a blood clot perform identically. Clinical improvement also needs to be distinguished from root maturation [10]. In a three-case series using induced bleeding with PRF, Kandemir Demirci *et al.*, (2020) reported periapical improvement after 36 months, but no clear increase in root length or wall thickness and no response to pulp sensibility testing [4].

A technical concern in Case 2 was the apparent apical displacement of MTA into the PRF scaffold. The absence of an intervening collagen matrix may have provided inadequate support during MTA placement, although this explanation cannot be confirmed from the radiographs alone. The intracanal radiopacity should therefore not be interpreted as newly formed mineralized tissue. This observation highlights the importance of scaffold stability and controlled placement of the coronal barrier. Both cases were documented using immediate postoperative, two-week, and three-month follow-up radiographs; however, longer follow-up is needed to assess sustained periapical healing and continued root maturation. Radiographs alone cannot establish the return of pulp sensibility or regeneration of a functional pulp–dentin complex. Interpretation is further limited by the inclusion of only two teeth and differences in intracanal medicaments, intervals between appointments, and scaffold choice.

CONCLUSION

This case series describes regenerative endodontic treatment of two immature permanent mandibular premolars using an induced blood clot in one tooth and platelet-rich fibrin in the other. Both procedures involved canal disinfection, scaffold placement, an MTA barrier, and coronal restoration, with radiographic follow-up up to three months. Longer

clinical and radiographic follow-up is required to assess sustained healing and continued root development. These two cases cannot determine whether either scaffold offers an advantage.

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