

*Research Article*

## Clinical Evaluation of Platelet Rich Fibrin in Revitalization of Necrotic Young Permanent Incisors

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### Abstract

**Background:** This in vivo study aims to evaluate the clinical success of Platelet Rich Fibrin (PRF) in the revitalization and healing of periapical lesions related to necrotic young permanent incisors in a randomized controlled study. **Methods:** This study was conducted on 31 teeth of 29 children in the age group of 8–11 years old who were selected with no sex predilection by predetermined inclusion criteria. All teeth were examined clinically to determine the clinical success over 6 months. Then all data were statistically analyzed using the Statistical Program for Social Sciences for Windows (SPSS), version 22 (IBM© Corporation, NY, USA). The Chi-square test was used to summarize the categorical data, including the frequencies of the participant's gender, tooth type, and baseline clinical criteria ... **Result:** The results demonstrated the clinical success of all cases after 12 months of treatment, with significant healing and the absence of the pre-apical sinus. **Conclusion:** Platelet-rich fibrin is an ideal scaffold that can be used with necrotic, immature teeth with pre-apical lesions.

**Key words:** revascularization- endodontic treatment- necrotic teeth - growing incisors

### Introduction

Regenerative endodontic procedures (RET) have gained more acceptance from endodontic and paediatric dentistry organisations as a successful therapeutic approach for growing permanent teeth with necrotic pulps over the past ten decades <sup>(1)</sup>.

Evidence-based guidelines have been developed by the American Association of Endodontics and the European Society of Endodontology to lessen the variance in RET operations concerning the use of intracanal treatments, scaffold systems, cleaning strategies, and restorative materials. These suggestions decreased some of the diversity in the RET treatments, However, differences in the intracanal medication, sealing material, and assessment techniques still exist due to a lack of high-quality data <sup>(2)</sup>.

The lack of appropriate stem cells, scaffold systems, injury to the Hertwig epithelial root sheath (HERS) from dental trauma, or persistent periapical infection are the main problems that often impact the success rate of regeneration procedures<sup>(3)</sup>. A scaffold that is appropriate for the recruitment or development of connective tissue, blood vessels, and neuronal structures through the apical foramen is necessary in order to regenerate dental pulp tissue <sup>(4)</sup>. Utilizing the blood clots as a scaffold in regeneration usually associated with low success rate due to limitations in creating an appropriate blood clot or cleaning the pulp canal, difficulties in producing apical bleeding, plus uncontrolled stem cells inside the canal region.<sup>(5)</sup>.

Recently the pulp regeneration technique has depended on the patient's blood to form

a three-dimensional scaffold that serves as a cytokine reservoir for tissue regeneration<sup>(6)</sup>. Platelet-rich fibrin is an autologous platelet concentrate that has higher platelet concentrations in its granules than a blood clot accomplishes. These platelets include platelet-derived growth factor (PDGF), transforming growth factor- $\beta$  (TGF- $\beta$ ), insulin-like growth factors (IGFs), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), and epithelial cell growth factor (ECGF)<sup>(7)</sup>.

### Materials and methods

The minia university's ethics committee reviewed and approved this current trial. Clear and thorough information was provided to all patients and their cares on the treatment protocols, anticipated results, potential side effects, and the availability of an alternate strategy in the event of a complication.

Twenty-nine children over the age of seven who met the following eligibility requirements, without regard to gender, participated in this experiment in the outpatient clinic of Minia University's paediatric dentistry department: healthy patients with immature permanent incisors with the presence of clinical signs and symptoms of necrosis or chronic apical periodontitis (little discomfort with intermittent episodes of pus discharge through the sinus tract) and an acceptable level of cooperation. Those with abnormal tooth mobility, a positive history of allergic reactions, systemic diseases, severe emotional or behavioral problems, or unrestorable teeth were excluded.

All procedures were performed by the same operator, as follows: A thorough assessment of the child who fulfills all the above criteria through clinical examination and preoperative radiograph.

**At the first visit:** 4% articaine LA with vasoconstrictor was delivered then after rubber dam application, the access cavity was prepared using a high-speed diamond round bur (PRIMA CLASSIC 801-014 X C). Copious irrigation to the root canals by

20 mL of 1.25% sodium hypochlorite solution using 0.3 mm gauge single-sided vented needles adjusted 3 mm short of the apex then appropriate dryness by large, sterile absorbent tips was done for delivering CaoH intra canal medication inside the root canals for 3 weeks followed by glassionomer restoration.

**The second visit:** After examination of the teeth for sensitivity to percussion and palpation LA and rubber dam application was done then teeth were reopened and thoroughly irrigated by 20 mL of sterile saline and 10 mL of 17% EDTA solution. PRF clot was prepared as 10 ml of the venous blood was collected through venipuncture of the antecubital vein using a sterile hypodermic syringe of the Luer-Slip type then divided into two specialized single-use 5 ml centrifuge tubes of the plain type. The centrifugation process is performed in a Benchtop Low-Speed Centrifuge ET-12M device at 3000 revolutions per minute for 10 minutes<sup>(8)</sup>. After centrifugation, the blood sample was separated into plasma-poor, plasma-rich, and red blood cell component. The clots (a gelatinous yellow-white substance) were carefully retrieved and dragged across a sterile 4 x 4 gauze pad to remove excess red blood cells. Then it was placed into the canal space to a level 3 mm below the CEJ (Cement-enamel junction) using a small hand plugger. A thin layer of biodentin was placed directly and condensed by a gold-plated instrument followed by a layer of reinforced glass ionomer and resin composite.

**All patients were recalled at 6 months for assessment of success criteria clinically.**

### Clinical criteria assessment

The assessment of pain, tooth color tenderness to percussion, Presence of swellings or sinus tracts, tooth mobility, and sensitivity test by thermal and Electric Pulp Tester to examine the vitality of dental pulp using electrical stimulation to stimulate the interdental nerves

### Statistical analysis

Data was analyzed using the Statistical Program for Social Sciences for Windows

(SPSS), version 22 (IBM© Corporation, NY, USA). The Chi-square test was used to summarize the categorical data, including the frequencies of the participant's gender, tooth type, and baseline clinical criteria, while the means of the baseline participant's age were compared using the independent sample t-test.

## Results

About 51.7% of participants were boys, while the girls contributed about 48.2% of the study, with the main age being ( $9 \pm 0.8$ ). The maxillary right central incisor is the most commonly treated tooth, while the maxillary left lateral incisor is the least common.

**Table (1):** Demographic characteristics of studied populations

Variables	PRF N(%)
<b>Gender</b>	
Male	15(51.7)
Female	14(48.2)
<b>Total</b>	29
<b>Age (years)</b>	
Mean $\pm$ SD	$9 \pm 0.8$
<b>Tooth type</b>	
Maxillary right central incisor	16(51.6)
Maxillary left central incisor	10(32.3)
Maxillary right lateral incisor	2(6.4)
Maxillary left lateral incisor	1(3.2)
<b>Total</b>	31

## Clinical evaluation

Only 25 patients with 29 teeth completed the follow-up period and about 4 patients could not be reached after the first visit due to changing their contact details. 88% success rate was recommended after 6m of follow-up period and 12% of treated teeth

exposed to recent trauma showed reinfection and need retreatment. Positive responses to pulp tests were detected in 51.7% (15/29) of teeth. Normal tooth mobility and no tenderness to percussion were recorded at 12m for all cases.

**Table (2):** clinical characteristics of treated teeth

Variables	Baseline N (%)	At 6m N (%)
<b>Presence of tenderness to percussion</b>	15(51.7)	0(0.0%)
<b>Presence of sinus or swelling</b>	17(58.5)	3(10.3%)
<b>Presence of tooth mobility</b>	13(44)	0(0.0%)
<b>Crown discoloration</b>	9(31%)	2(6.8%)

## Discussion

Recent advances in the regeneration procedure for necrotic immature vital teeth depend on using three-dimensional

scaffolds from the patient's blood by using platelet concentrates, as the drawbacks associated with the traditional blood clot make its use controversial (Cehreli et al., 2011).

Platelet-rich fibrin, which has a flexible fibrin architecture that promotes cytokine binding and cellular migration, is the perfect scaffold for the regeneration process since it releases important growth factors like TGF  $\beta$  and PDGF slowly and continuously for at least one week and up to 28 days. (Keswani et al., 2013)

A lower concentration of NaOCl (1.5%) irrigation was used to decrease its cytotoxicity to SCAP (AAE, 2016). Additionally, there are numerous benefits to using 17% EDTA, such as increased TGF- $\beta$ 1 release from the canal walls and assistance in removing the smear layer with expression of the odontoblast-like cell marker dentin sialophosphoprotein (DSPP), which improves dentin's wetting capacity and dental pulp stem cells' adherence. (Huang et al., 2012)

Since calcium hydroxide can release transforming growth factor $\beta$ 1 (TGF- $\beta$ 1) from dentin and increase concentrations of apical stem cell survival, the European Society of Endodontology suggested using it as an intracanal medicine. Additionally, it prevents the discoloration that may result from using the triple antibiotic paste (Tavares et al., 2021). Biodentin is used in this study to prevent discoloration associated with MTA, and it is more biocompatible, has a quicker setting time, and increases cellular adherence. (Glynis et al., 2021).

The second generation of platelet concentrates, known as platelet-rich fibrin, releases a large amount of different cytokines, such as transforming growth factor- $\beta$ , which is essential for signalling

molecules that support odontoblastic differentiation during tooth development and promotes more root completion as the fibrin matrix is resorbed. (Ammar et al., 2024). Also, PDGF and VEGF in the PRF matrix stimulate new capillary formation. The previous causes describe the result of our study and the clinical success of PRF, so we motivated the use of PRF as a scaffold in regeneration procedures.

## Conclusion

Platelet rich fibrin is an ideal scaffold in treatment of necrotic young permanent teeth

## Author contributions

All authors contributed to the study conception and design Conceptualization. Methodology, formal analysis done by Ahmad Abdel Hamid Elheeny (Assistant professor at pediatric and community dentistry department, faculty of dentistry, Mina University)

Practical work, data collection and analysis were done by Ghada Eslaman Tony (assistant lecture at the pediatric and community dentistry department, faculty of dentistry, Mina University)

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