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## **Case Report**

# Efficacy Of Blood Clot Scaffold In The Regenerative Endodontic Treatment Of A Traumatized Immature Necrotic Central Incisor With Complicated Crown Fracture: A Case Report With A 9-month Follow-up

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## Abstract

**Introduction:** Regenerative Endodontic Procedure (REP) is an innovative approach comprising principle of tissue engineering to restore damaged tissues of pulp-dentin complex. Being a promising approach; its application in an immature necrotic permanent incisor subjected to complicated crown fracture might be worthy.

**Body:** A 9-year-old Egyptian boy came to clinic suffering from severe pain and swelling after fracture of maxillary right central incisor during playing. The tooth had positive response upon percussion and palpation with no mobility Radiographic examination showed fracture of almost two-thirds of the clinical crown with immature root Cvek's classification stage II (almost 1/2 root length) with ill-defined periapical lesion and disrupted lamina dura. Based on clinical and radiographic findings, the tooth was diagnosed as non-vital pulp with immature root and asymptomatic apical periodontitis. Endodontic regeneration using blood clot scaffold was done in two visits. After minimal instrumentation using Hfile #50 in scraping motion on root canal walls, 20ml 1,5% NaOCl irrigation, a double antibiotic paste (ciprofloxacin and metronidazole) paste was used as intracanal medication. At the 2nd visit, 17% EDTA irrigation was followed by intentional over-instrumentation into periapical area using K-file #20 to induce intracanal bleeding and Blood clot scaffold formation. A 3 mm layer of Neo putty MTA was used as coronal plug just below cementoenamel junction followed by glass ionomer restoration and final composite restoration. A 3 month follow up showed absence of any clinical sign and symptoms. After 9 months, healing of periapical lesion and increase in tooth length was observed radiographically. Conclusion: Regenerative Endodontic Procedure should be preferred in cases where the root development is severely deficient to allow continuation of root development and strengthening of the weakened dentinal tissues to prevent suspected root fracture.

**Keywords:** Regenerative endodontics, revascularization, regenerative endodontic procedure, blood clot revascularization, blood column revascularization

## Introduction:

Regenerative Endodontic Procedure (REP) is an innovative approach comprising principle of tissue engineering to restore damaged tissues of pulp-dentin complex. It aims to enhance healing of periapical lesion and achieve root maturation and strengthen dentin structures to avoid suspected fracture of the root. (Wei et al, 2022)

Traumatic dental injuries are representing 5% of whole injuries which occur usually in children and adolescents. School children showed 25% of dental trauma and 33% of adults are subjected to trauma of permanent teeth. Luxative dental injuries are most common in primary teeth, while coronal fractures are more commonly in permanent dentition. (Levin et al, 2020)

Clinical outcome of regeneration and apexification in young immature necrotic teeth have similar survival rates. Regenerative endodontic procedure is preferred in cases of severely deficient root development. Moreover, the blood clot maturegenesis approach has comparable clinical and radiographic outcomes to platelet-concentrates approaches. However, after a proper systematic search, there is no case report concerned with efficacy of blood clot scaffold in the regenerative endodontic treatment of a traumatized necrotic immature central incisor with complicated crown fracture. (Panda et al, 2022).

#### Case report

Case report was written following reporting items of case reports in endodontics (PRICE) 2020 guidelines. A 9-year-old Egyptian boy was referred to the clinic of post graduate in the department of endodontics, Cairo university in August 2023. Chief complaint was severe pain and swelling related to a fractured maxillary right central incisor which occurred during playing in aqua park two days ago. The patient was reassured. Medical history, was non-contributory ASA (class I). Extraoral examination showed normal findings. Intraoral examination revealed gingival swelling related to fractured right central

incisor. Figure 1 (a) The tooth had positive response upon percussion and palpation with no mobility. Cold pulp sensibility testing using chloride spray ethyl (The Egyptian Pharmaceutical Trading Company, Egypt) was non conclusive and it was decided to repeat it visit. the following Radiographic on examination showed fractured crown including almost two third of clinical crown, immature root Cvek's classification stage II (almost <sup>1</sup>/<sub>2</sub> root length) with ill-defined periapical lesion and disrupted lamina dura. Figure 1 (b) (Cvek M,1992)

The tooth was diagnosed as non-vital pulp with immature root and asymptomatic apical periodontitis after assessment of clinical and radiographic findings. The recommended approach was regenerative endodontic treatment of offending tooth. Informed consent was signed after the treatment was described to the parents.

The patient was prescribed Analgesic (NSAID) Brufen (Ibuprofen) 100mg/ 5ml syrup twice daily for one week, antibiotic (amoxicillin+ clavulanic acid) Augmentin 312 mg/5ml powder for oral suspension 80ml and chlorohexidine mouth wash twice daily for one week. The patient was instructed to avoid any hard food and stick to soft diet and recall after 2 weeks. After this emergency visit, a definitive treatment was scheduled to be a two-visit protocol.

At the first intervention visit: Clinical examination revealed no swelling and no pain on palpation. electric pulp tester and (ethyl chloride) sensibility tests were negative which confirmed that the tooth was necrotic. Local anesthesia 1.8 ml 2% mepivacaine with 1:100,000 epinephrine (Alexandria, Co. for Pharmaceuticals, Egypt) was administered. Rubber dam isolation was done, then a straightline access cavity was prepared using round bur #4 and endo-z bur under illumination and magnification lopes (3.5 x) (Univet, Italy). Working length was determined by estimation using preoperative radiograph. Minimal instrumentation was done using H-file #50 in scraping motion on root canal walls. Irrigation was performed with 20ml 1.5% NaOCl (Chlorox, Egypt) for 5min using side vent needle to decrease possibility of irritants extrusion to periapical tissues. This was followed by 3ml saline then 20 ml 17% EDTA (PREVEST Den Pro, India) for 5 min. Irrigation needle was set at 1 mm shorter than working length; this minimizes extrusion and harmful effect on stem cells in the periapical area. The canal was dried using paper points (Paper Points, META BIO MED, Korea). Double antibiotic paste (DAP) was prepared by grinding one tablet of Metronidazole (250mg) (Flagyl, Sanofi, Paris, France) and one tablet of ciprofloxacin (250mg) (CIPROCIN, European Egyptian Pharm. Ind, 10th of Ramadan, Egypt) mixed 1:1(0.1-1.0mg/mL) with saline to be in a creamy consistency. The mix was be inserted inside root canal just below the cervical line or cemento-enamel junction. The access cavity was closed using glass ionomer restoration.

At the second intervention visit; after 2 weeks, there were no signs/symptoms. Plain 3% local anesthesia of mepivacaine (Alexandria, Co. Pharmaceuticals, Egypt) was administered. After rubber dam isolation, 20ml of 17% EDTA irrigation was done, followed by dryness of the canal using paper points. Blood clot formation was initiated by intentional over-instrumentation into periapical area using K-file #20 (MANI INC, Kiyohara, Japan) 2 mm beyond the apex. Blood clot was formed after 5-10 min of filling the canal entirely with blood to level of cemento-enamel junction. 3-mm layer thickness of Neoputty MTA (NeoPUTTY®, Avalon Biomed, USA), as capping material, was placed above the formed blood clot. The application was done using composite applicator and bonding brush with no pressure to avoid excessive entrance into the canal. The access cavity was sealed using glass-ionomer restoration (ChangShu ShanaChi Dental Materials Co., Ltd, China) followed by resin composite restoration (Tetric N-Ceram, Ivoclar Vivadent In, Liechtenstein, Switzerland). Post operative periapical

radiograph and Postoperative photograph were taken. Figures 1 (c,d). The patient was recalled for follow up after 5 months. Clinical and radiographic examination showed that patient was asymptomatic and root increased in length and restoration was retained in function. Figure 1 (e). At 9 months follow up, more increase in root length and approximating edges of root walls apically dentin was showed radiographically. Increase in root length was measured radiographically as a straight line from the level of the tooth's CEJ to the level of the tooth's root apex. Figure 1 (f)



Figure (1) A panel of clinical photographs and radiographs of the regeneration case.

a) **Preoperative photograph** showing crown fracture of the maxillary right central, b) **Preoperative radiograph** showing maxillary right central with immature root , c) **Postoperative radiograph** (second regenerative visit), d) **Postoperative**  **photograph** after restoration (second visit), e) **Recall radiograph** after five months, f) **Recall radiograph** after nine months. (Yellow arrows indicate root length of maxillary right central with immature root Black arrows indicate root length of maxillary left central with mature root).

## **Discussion:**

Regenerative endodontic procedure was selected in the current case as it is a promising paradigm shift in management of immature necrotic teeth which enhance root development continuation and apical closure. (Huang GT, 2008).

In addition, traditional use of Ca (OH)2 apexification and mineral trioxide aggregate (MTA) apical barrier approach in immature necrotic teeth management showed no enhanced root lengthening and dentin walls remained thin. These fragile roots are liable for fracture and eventual tooth loss. (**Diogenes et al, 2016**)

Blood clot was selected as a biological scaffold as it utilizes stem cells which introduced inside the root canal via apical bleeding and considered endogenous source of stem cells. Blood clot acts as most commonly used biological scaffold in regeneration endodontic procedure without any added cost or complicated approach. (Torabi nejad et al, 2011)

The case presented was diagnosed with complicated crown fracture which was the cause of pulp necrosis and cessation of root development. A systematic review and metaanalysis concluded that regenerative endodontic treatment can be successfully administrated to necrotic immature teeth, regardless of etiology of pulp necrosis. (Koç and Del Fabbro, 2020) A correlation was found between causes of pulp necrosis as caries, trauma or dental anomaly and success rate of regeneration procedure

Regenerative endodontic procedure was selected based on good prognosis and

healing rates of this approach. The reported high survival (97.3%) and healing rates (93.0%) with good root development (77.3% root lengthening and 80.6% root thickening are very encouraging to utilize this approach. (**Ong et al**, **2020**)

A double antibiotic pastes, which consisted of ciprofloxacin and metronidazole, was used in the present case as an intra canal medication. It was preferable to triple antibiotic paste which is not used any more as an intra canal dressing since minocycline leads to severe discoloration. Furthermore, Ca (OH)2 was not selected based on the results of a systematic review and meta-analysis by (Almutairi et al., 2020) which showed that there was a strong association between canal calcification and the type of the intra canal medication used. Moreover, a complete calcification was reported in 46.5% of cases using Ca (OH)2. On the other hand, in the antibiotic intra canal medication group only 10% of cases showed complete canal calcification and 15.7% showed partial calcification. (Almutairi et al., 2020).

NeoPutty MTA was selected as coronal plug in the current case. Noteworthy, both NeoPutty MTA and conventional White MTA showed a high level of clinical and radiographic success when used as a coronal plug in regenerative endodontic procedure of necrotic immature permanent teeth. However, NeoPutty MTA showed less discoloration potential compared with conventional White MTA making it a promising coronal plug material especially in the esthetic zone. (Tawfeek et al, 2023)

### **Conclusions:**

- Regenerative endodontic procedure should be preferable in cases of severely deficient root development to allow root development continuation and strengthening of dentinal structures to avoid suspected root fracture.
- Follow up is very crucial in the process of management of traumatic dental

injuries particularly in young developing teeth to track treatment outcome.

#### **Conflict of interests**

There is no suspected conflict of interest related to this study.

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