

## Revascularization procedure in an open apex tooth with external root resorption: A case report

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### Abstract

External inflammatory root resorption (EIR) represents a challenge in endodontic practice. EIR commonly occurs after dental trauma that results in periodontal ligament injury, pulp necrosis and subsequent infection. Treatment of EIR is based on disinfecting the root canal system through chemomechanical procedures and then filling it with calcium hydroxide or triple antibiotic paste. Dental trauma commonly occurs in young patients whose teeth are not fully formed and have thin dentinal walls and open apices. Revascularization therapy has proven to be suitable for treatment of root canals of teeth with pulp necrosis and open apices. This case report presents successful revascularization treatment of a permanent immature tooth with external root resorption and chronic apical periodontitis. The tooth was treated by the protocol suggested by the American Association of Endodontics (AAE), consisted of disinfecting the root canal system, filling it with blood clot and sealing the root canal with mineral trioxide aggregate followed by bonded resin restoration. The symptoms disappeared, the size of the periapical lesion reduced and the tooth was asymptomatic during the 12 month follow up period.

**Key words:** calcium hydroxide, external root resorption, mineral trioxide aggregate revascularization, trauma.

### Introduction

External inflammatory resorption (EIR) affects root surface and is a relatively frequent sequel of dental luxations and avulsion injuries. It is a progressive condition with a potentially precipitous onset, and is capable of advancing rapidly, such that an entire root surface may be resorbed within a few months if the tooth is left untreated (1). Treatment of EIR is based on disinfecting the root canal system by chemomechanical procedures and then filling it with calcium hydroxide for several months (2, 3). Treatment should be carried out as soon as the resorptive process has been diagnosed. The earlier EIR is diagnosed and treated, the better the prognosis will be. In 2004, Banchs and Trope published a case report describing a new treatment procedure for the management of open apex necrotic teeth called “revascularization” (4). The protocol differs from traditional apexification techniques in that disinfection of canal is performed with both sodium hypochlorite and chlorhexidine and as described, with a combination of three antibiotics (ciprofloxacin, metronidazole, and minocycline). At the subsequent appointment, the triple antibiotic paste (TAP) is removed and bleeding is induced into the canal. The canal is sealed with mineral trioxide aggregate (MTA) and after it has set, a bonded restoration is placed. Unlike traditional apexification or when apical barriers are used, revascularization procedures allow for increase in both the length of the root and root wall thickness(4).

Revascularization therapy has proven to be suitable for the treatment of open apex teeth with pulp necrosis (5, 6). It had been assumed that in the absence of bacteria and necrotic pulp and if scaffold with stem

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cells or growth factors are present, regeneration of dental pulp would be feasible (7).

The aim of this study was to evaluate the use of calcium hydroxide (Ca) as a medicament in revascularization of a tooth with EIR.

### Case report

A 24-year-old female suffered a recurrent abscess in maxillary left incisor region and was admitted to the endodontic department at dental clinic of Mashhad University of Medical Sciences, Iran. for the treatment of maxillary anterior swelling. On clinical examination, the tooth was slightly discolored and was tender to percussion and palpation. The sensivity tests (including cold, heat and electric pulp test) of the upper left central incisor was negative. Dental history revealed that the patient had suffered a trauma when he was 8 years old and did not receive any treatment at that time. A diagnostic x-ray showed external inflammatory root resorption and chronic apical periodontitis (Fig. 1). After an explanation regarding the procedures to be performed, the patient was asked to sign the informed consent.



Figure 1. Diagnostic X-ray

The treatment was accomplished according to the clinical protocol recommended by the American Association of Endodontics (AAE). At the first appointment, local anesthesia using 2% lidocaine with 1:100,000 epinephrine (Daro Pakhsh, Tehran, Iran) was performed and a rubber dam was applied. After accessing the pulp cavity, pus drainage was evident from canal. Working length was determined by means of a No.110 K- type file (Dentsply Maillefer, Switzerland) 1 mm shorter than the root apex and confirmed by a radiograph. The root canal was rinsed with 5.25 % sodium hypochlorite (NaOCl) for 5 minutes followed by irrigation with 10 ml saline and then drying with sterilized paper points (META

BIOMED CO. LTD, Iran). The canal was filled with Ca paste and the tooth was sealed with Cavit (ARIA DENT Coltozol, Iran) (Fig. 2).



Figure 2. The canal was filled with Ca paste

4% mepivacaine (Daro pakhsh, Tehran, Iran) was the local anaesthetic agent used for the second appointment, performed 3 weeks later. Rubber dam was applied and temporary restoration and Ca was removed. Pus drainage was stopped. The root canal was irrigated with 5.25% Naocl (4) and 10 ml saline solution. Bleeding from the apical region was evoked using a K- file beyond the root apex. After formation of the blood clot approximately 3 mm apical to the cemento enamel junction, MTA (ANGELUS, Brazil) was mixed with sterile water and applied over the clot, covered with a wet cotton pellet and temporary restoration (Fig. 3). After 1 week, the temporary restoration was removed and access cavity was restored with composite restoration (3M ESPE , USA ).

In the 3, 6 and 12 month follow up; the patient was completely asymptomatic (Fig. 4-6). The tooth was not tender to percussion and palpation. After 12 months, the patient was referred to the restorative department to repair the crown discoloration.



Figure 3. MTA was applied over the clot

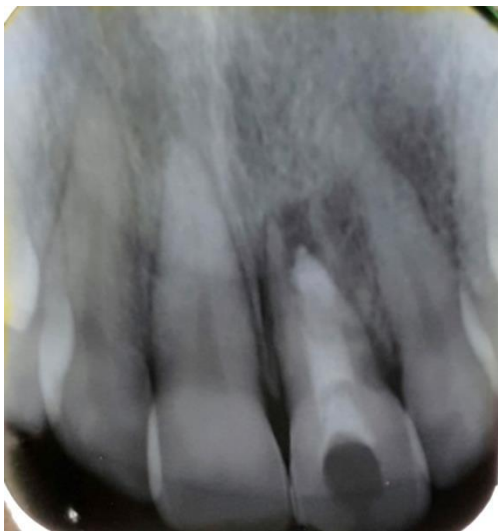
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## Discussion

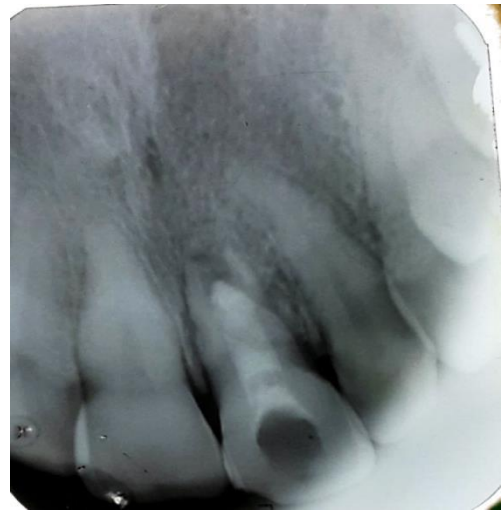
EIR is a common finding after luxation and avulsion injuries (8). The diagnosis of EIR in clinical settings is merely based on radiography (9). Pulp infection is one important additional stimulus to root resorption after trauma to teeth (3, 10). When appropriate disinfection of root canal is achieved, arrest of root resorption and repair of the resulted cavities with cement or bone and regeneration of periodontal ligament is expected(11). In the present clinical study, regenerative endodontic procedures to arrest external inflammatory root resorption was experimented. According to tissue engineering principles, there are 3 necessary elements for regeneration : stem cells, scaffolds and growth factors (7).

The main sources of stem cells are the preapical tissues and blood, whereas the growth factors and scaffolds could come from intracanal blood clot (12, 13).

In revascularization procedures, root canal disinfection is achieved by the use of TAP or Ca. Long-term dressing of root canal with Ca may be beneficial in the treatment of EIR; however, this protocol should be used judiciously because of the associated risk of root fracture (11). The proposed technique presented in this clinical study is the same as that used in revascularization therapy. In this clinical study, revascularization therapy was able to arrest resorption areas in our case of EIR within 12 months of the commencement of the procedure, with new tissue formation in the apical area and maintenance of physiological status of the tooth at follow-up periods beyond 12 months (Figs. 4-6).



**Figure 4.** 3-month follows up



**Figure 5.** 6-month follows up



**Figure 6.** 12 month follow up

In revascularization therapy, after disinfection of root canals, bleeding is evoked from periapical tissues (14) to form a clot that provides both stem cells and the scaffold in which new tissue can differentiate. In fact, the blood clot brings together growth factors and stem cells which are capable of differentiating into newly formed tissue that acts toward regeneration of pulp tissue, especially in the immature teeth with open apex after suitable disinfection of necrotic pulp (15).

There have been few researches on effectiveness of revascularization therapy in treating EIR(16). This case report also, showed that revascularization therapy may be effective in arresting EIR.

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