Treatment of inflammatory external root resorption resulting from dental avulsion and pulp necrosis: Clinical case report

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The aim of this case report was to present a treatment for severe inflammatory external root resorption. The condition developed due to the patient’s neglect to seek adequate treatment following replantation of an avulsed maxillary left central incisor. Following diagnosis, treatment consisted of conventional endodontic therapy with calcium hydroxide dressings and definitive filling of the root canal after the resorption was controlled radiographically. A 24-month follow-up showed that the resorption process had stabilized and the patient was free of symptoms. Successful tooth replantation requires following the indicated therapy effectively. Nevertheless, when an inflammatory external root resorption occurs, adequate endodontic treatment to remove the necrotic content and bacteria is required, as is the use of calcium hydroxide dressings.

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A tooth is avulsed when it is completely exarticulated from the alveolus. The maxillary central incisors are most commonly involved, and children between the ages of 11 and 16 are most affected. Several factors have been identified as determinants of success, whether they influence the vitality of the periodontal ligament (time interval between avulsion and replantation, treatment of the root surface, and storage medium) or they interfere in the repair process (immobilization and endodontic therapy). The delay in replanting the tooth often is related to the ignorance of the patient, who typically has no knowledge of proper immediate post-traumatic conduct.

One of the most common sequelae resulting from tooth avulsion is external root resorption, which can be inflammatory or substitutive (ankylosis). Alveolar ankylosis is defined as a progressive process in which fusion of the alveolar bone with the tooth results in a progressive resorption of the root and its substitution by bone (substitutive resorption). Inflammatory external root resorption is directly associated with endodontics because of the ensuing pulp necrosis and subsequent presence of microorganisms in the root canal system and dentinal tubules. Histologically, irregular areas of cementum and dentin are observed with inflammatory cells and adjacent periodontal tissue. Radiologically, the typical finding is a root resorption with radiolucence adjacent to the neighboring bone tissue. The process through which an inflammatory external root resorption occurs has not been explained completely; however, it is known that destruction of the pre cementum layer and necrosis of cementoblasts result in a denuded root surface that, together with a necrotic pulp and bacteria inside the dentinal tubules, is the essential factor leading to resorption. This denuded root surface allows irritants inside the root canal to come into contact with the periodontium, not only through the apical foramen or lateral canals, but also through dentinal tubules, particularly in young patients, whose dentinal tubules are wider.

An inflammatory external root resorption should be treated first by cleaning the root canal thoroughly and applying calcium hydroxide dressings. Calcium hydroxide paste has an alkaline pH (12.2), and the dissociation of calcium ions and hydroxyls promotes a considerable increase in pH over the entire external root surface, since inflamed areas have an acidic pH, the resulting increase in pH neutralizes the action of the clastic cells, thereby inhibiting the resorption process.

Case report
A healthy 11-year-old boy was referred to the endodontic team of the Sao Leopoldo Mandic Dental Research Center. He complained of a Class IV tooth fracture in the maxillary left central incisor. During anamnesis, it was reported that this tooth had been avulsed...
six months earlier and that it had been replanted hours later by an emergency service. During the time between avulsion and replantation, the tooth had been stored in a 0.9% physiological solution.

During the clinical examination, a provisional sealing on the palatinal aspect was noted, and a negative response to the cold pulp vitality test (Endo-Ice, Coltene/Whaledent, Inc.) was observed, suggesting pulp necrosis. The patient was asymptomatic and the tooth had normal mobility. When asked about the treatment performed immediately after avulsion, neither the patient nor his mother was able to give any further details. Radiographic examination revealed a severe external root resorption in the maxillary left central incisor (Fig. 1).

After the treatment and prognosis were explained to the patient and his mother, conventional endodontic therapy was initiated. The patient was anesthetized with 4% articaine with adrenalin 1:200,000 (DFL Industria e Comercio SA). The sealing was removed and the crown was opened with burs 1557 and 2082 (KG Sorensen), aided by a dental operating microscope (DFV).

Once the tooth was isolated, it was irrigated copiously with 2.5% sodium hypochlorite and debrided in the crown-apex direction with Kerr-type files (Dentsply Maillefer) up to file No. 80. The files were used to debride the canal walls gently because the walls were very thin. The working length had been determined with an apex locator (Root ZX, J. Morita USA, Inc.).

Once the canal was prepared, it was irrigated with 17% EDTA for three minutes, followed by irrigation with 2.5% sodium hypochlorite. The canal then was dried and filled with calcium hydroxide combined with propylene glycol as the intracanal medication, using lentulo spirals. The access cavity was sealed with resin composite. The calcium hydroxide dressing remained inside the canal for 30 days (Fig. 2), at which time it was changed and left in for another 30 days (Fig. 3). A passive ultrasonic irrigation (MiniEndo ultrasonic unit with a CT4 tip, SybronEndo) was used for one minute with 17% EDTA alternating with 2.5% sodium hypochlorite to guarantee effective removal of the calcium hydroxide paste during the change of medication.

Sixty days after treatment began, the root canal was filled with No. 80 gutta-percha cones (Dentsply Maillefer) and AH Plus cement (Dentsply Maillefer) using the lateral condensation technique (Fig. 4). The tooth was restored immediately with composite resin and, after 24 months, clinicoradiographical examination showed no signs or symptoms of any alteration. The resorption process had been...
arrested and a return of the normal lamina dura was observed on the radiograph, indicating that the therapy was successful (Fig. 5).

Discussion
The preservation of cementoblasts in avulsed teeth is one of the keys to a good prognosis. The medium in which the tooth was stored after avulsion, the length of time it remained out of the alveolus, and the manipulation of the root portion are the primary factors involved in preserving cementoblasts with a greater or lesser degree of viability.2 In the case presented here, lack of treatment by the patient resulted in pulp necrosis, which, combined with the destruction of the precrestum layer, led to an inflammatory external root resorption.

An inflammatory external root resorption requires endodontic treatment to remove the necrotic tissue, as opposed to a substitutive external root resorption, in which the dental tissues are gradually replaced by bone tissue, irrespective of the therapy used.5,14 The use of intracanal medication also appears to be essential. In this case, calcium hydroxide was combined with propylene glycol to promote a slower and more continuous release of calcium ions and hydroxyls.15 This combination also allows the medication to remain in contact with the dentin for a longer period.

A definitive recommendation for the amount of time during which the calcium hydroxide paste should remain in the canal has not yet been determined, and studies show variations.16-18 Trope et al believe that a longer period would guarantee periodontal ligament healing, but other studies have shown that teeth treated with calcium hydroxide dressings for long periods are more susceptible to fracture.19-21 For this reason, the calcium hydroxide paste must be thoroughly removed from the root canal during medication change and before final obturation of the canal.22 In this case, 17% EDTA was combined with ultrasound to optimize canal cleansing between changes and before definitive filling of the root canal.23,24 Lateral condensation is a safe obturation technique and, because the root canal walls were thin, was the authors’ treatment of choice. The tooth was definitively restored immediately afterward to minimize the risk of coronal microleakage and fracture. After two years of clinical and radiographic follow-up, it was noted that the root resorption had stabilized, which demonstrated the success of the treatment performed; this result is in keeping with previously reported cases.1,25

Summary
This case report outlines the treatment for severe inflammatory external root resorption. Although the prognosis for these cases is difficult to guarantee, the correct diagnosis and treatment plan is essential for a good prognosis. Calcium hydroxide combined with propylene glycol is the intracanal medication widely used for treatment, due to the dissociation of calcium ions and hydroxyls resulting in an increase in pH that neutralizes the action of the clastic cells, thereby inhibiting the resorption process.

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Manufacturers

Coltene/Whaledent, Inc., Cuyahoga Falls, OH 800.221.3046, www.coltene.com
Dentsply Maillefer, Tulsa, OK 800.924.7393, www.maillefer.com
DFV, Sao Paulo, SP, Brazil 55.11.3264.0155, www.dfv.com.br
J. Morita USA, Inc., Irvine, CA 888.566.7482, www.morita.com
KG Sorensen, Barueri, SP, Brazil 55.11.4197.1700, www.kgsorensen.com.br
SybronEndo, Orange, CA 800.346.3636, www.sybronendo.com

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