AN UNUSUAL REPAIR OF PERFORATING INTERNAL INFLAMMATORY ROOT RESORPTION; A CASE REPORT OF ENDODONTIC TREATMENT

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ABSTRACT

Internal inflammatory root resorption (IIRR) can occur as a complication of dental trauma which leads to progressive loss of the root structure. An early diagnosis could influence the therapeutic approach. Nevertheless, endodontic treatment in these situations is challenging, with a doubtful prognosis. The present report described a perforating IIRR, resulting from a trauma suffered four years previous. A 15-year-old female patient was presented to the endodontic clinic, reporting pain in the maxillary incisor region. Intraoral radiography revealed a large radiolucent area compatible with IIRR, communicating with the periodontium in the middle third on the distal root face of the right central incisor. The root canal of the right central incisor was chemo-mechanically prepared. Calcium hydroxide (CH) paste was used and renewed periodically four times. Root canal filling was performed only in the cervical third, up to the level of the root resorption. During follow-ups, tooth was asymptomatic. Radiographically, there was evidence of periapical tissue repair and bone tissue formation. The tooth remained asymptomatic 3 years afterwards. The present case report supports the idea that a satisfactory intracanal decontamination allows a favorable environment for tissue repair.

KEYWORDS: Calcium hydroxide. Dental pulp necrosis. Root canal therapy. Root resorption.

INTRODUCTION

Internal inflammatory root resorption (IIRR) occurs when an inflammatory response within the pulp tissue leads to the activation of dentinoclastic cells.[1,2] The American Association of Endodontics (AAE) consensus, based on the revision of Levin et al. (2009), establishes that this type of resorption can be considered a result of the presence of microorganisms within the root canal, causing pulpitis and a resorption area.[1,2] When active, the IIRR results in a tooth with some necrotic and infected pulp tissue, as well as some pulp tissue with irreversible pulpitis.[1,2]

In the case of internal resorption, loss of mineral structure of the teeth will occur.[3,4] The available evidence suggests that dental injuries such as traumas are one of the main etiological factors related to this condition.[5] Clinically, cases of IIRR can be easily overlooked once it occurs asymptomatically, and internal resorptive destruction of the dentinal structure may be detected radiographically only at an advanced

stage.[6] Early treatment of this pathological condition is imperative to avoid root perforation and, consequently, tooth extraction. Thus, endodontic treatment is a highly recommended therapeutic approach.[3]

Currently, there are few reports on root perforation induced by internal root resorptions[7,8] and the clinical procedures that can be performed to resolve the case. This treatment considered the elimination of causal factors such as bacterial infection, interruption of the progressive resorption mechanism and stimulation of hard tissue repair in the resorption area through chemo-mechanical preparation and the use of calcium hydroxide (CH) pastes.[7] Additionally, mineral trioxide aggregate (MTA) has been used for root canal filling and filling of perforation defects.[9] The present study aims to report the management of a perforating IIRR in the middle third on the distal face of the root in an upper central incisor.

CASE PRESENTATION

Written informed consent was obtained from the patient for the publication of the case report.

A 15-year-old female patient was presented to the endodontic clinic reporting pain in the upper right lateral incisor. The patient reported a history of dental trauma, which had occurred four years ago, in the region of teeth #11 and #12. The patient reported that had never felt any pain after the trauma, henceforth, never sought dental care.

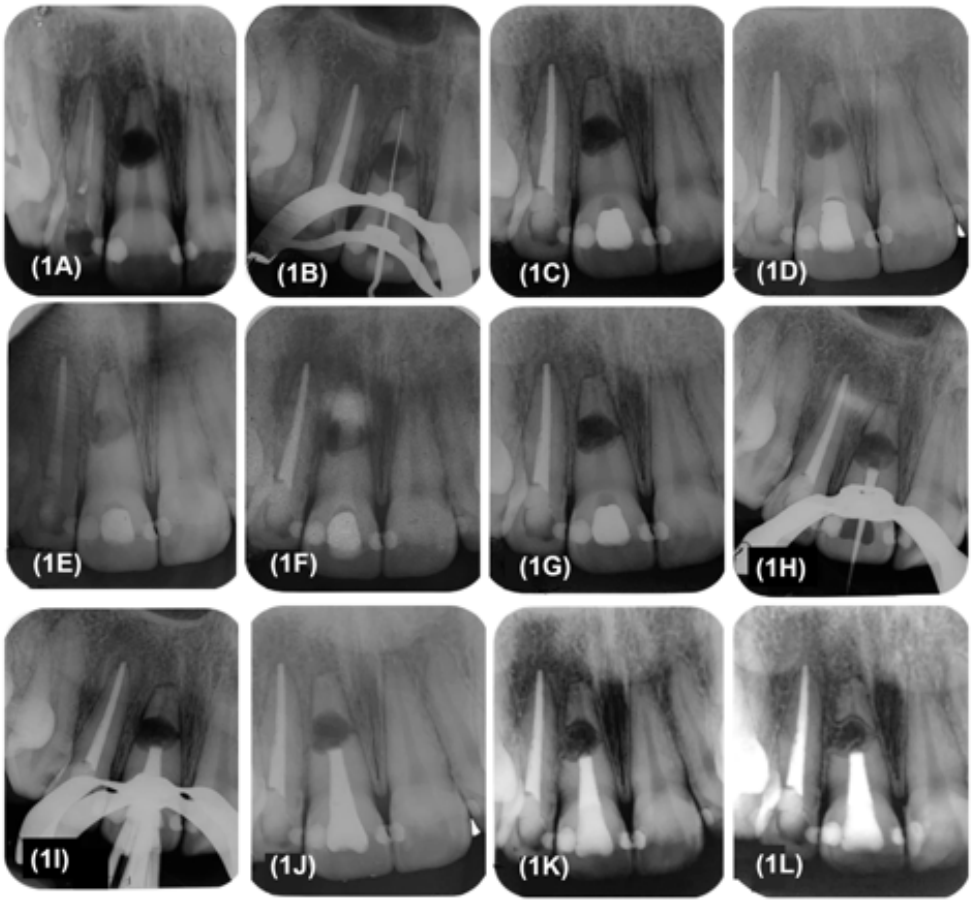
A general practitioner attended the patient and performed endodontic treatment of tooth #12. The clinician referred the patient to an endodontist for evaluation of tooth #11. Radiographically, it was verified a resorptive area on tooth #11. There was no chronicle of orthodontic treatment and the patient denied the presence of parafunctional activity. The patient's medical and family narrative was non-contributory.

Tooth #11 was asymptomatic. The crowns of teeth #11 and #12 were free of dental caries, however, a chromatic alteration was observed in the crown of tooth #11, which responded negatively to thermal pulp test, as well as to the vertical and horizontal percussion tests. The mucosa corresponding to the regions of teeth #11 and #12 presented a normal clinical appearance, without protuberances or fistulas. Periodontal probing depths and tooth mobility were considered normal.

Intraoral periapical radiography (Kavo Focus; Kavo Kerr, São Paulo, SP, Brazil) showed that tooth #12 had a poorly filled root canal (Figure 1A). An extensive radiolucent area was observed with great communication with the periodontium in the middle third on the distal face of the root of tooth #11, compatible with internal root resorption. Based on clinical and radiographic information, it was determined a diagnosis of active-stage IIRR, as the tooth responded negatively to pulp sensitivity tests, suggesting partial necrosis, but without radiographically visible apical periodontitis[1].

The differential diagnosis of an internal or external inflammatory root resorption was based on the accurate observation of the radiographic image, where the contours of the resorption area included the root canal. Given the advanced stage of resorption and the

Figure 1. (A) Preoperative periapical radiograph of teeth #11 and #12. **(B)** Radiograph showing the establishment of the working length of tooth #11. **(C)** Tooth #11 filled with calcium hydroxide paste. **(D-G)** Radiographic evaluation of tooth #11 after intracanal medication exchange. **(H)** Selection of gutta-percha cone. **(I)** Root canal obturation using the inverted gutta-percha technique. **(J)** Follow-up radiograph after 1 year, evidencing formation of bone tissue. **(K)** Follow-up radiography after 2 years. **(L)** Follow-up radiography after 3 years, showing tissue repair and bone formation.



reduced amount of tooth structure, the root was at high risk of fracture and tooth loss. Despite endodontic treatment showing a dubious prognosis, instead of extraction, endodontic treatment was performed with periodic changes of intracanal medications and radiographic follow-ups.

Root canal retreatment was performed on tooth #12. The procedures performed on tooth #11 were as follows: local anesthesia with 2% mepivacaine containing 1:100.000 epinephrine (2% Mepiadre; DFL, Rio de Janeiro, RJ, Brazil) was administered. Tooth #11 was isolated with a rubber dam. The pulp chamber was accessed with diamond burs mounted on a high-speed motor (Kavo, Joinville, SC, Brazil) under copious water irrigation. At this stage, the pulp chamber was empty and the pulp tissue was necrotic. However, profuse bleeding occurred in the pulp chamber when the root canal was explored with a #25 K-file (Dentsply, Maillefer, Baillaigues, Swizerland) at the level of the resorption area due to the presence of inflamed granulomatous tissue. Bleeding was contained by rinsing with saline solution at each visit using a 30-gauge Navitip needle (Ultradent Products Inc., South Jordan, USA) for a duration of 2–3 minutes inserted at the level of the resorption area, with a total volume of 20mL of saline solution.

The root canal was irrigated with 10mL of 1% sodium hypochlorite (NaOCl; Formula e Ação, São Paulo, SP, Brazil) and saline solution. The access to the apical third of the root canal was obtained using a #15 K-file, trespassing the resorption area. The working length was determined 1mm short from the radiographic apex (Figure 1B). Root canal preparation was performed at the working length up to a #80 K-file. The root canal was rinsed with 10mL of 1% NaOCl after the use of each instrument. At the end of instrumentation, the root canal was irrigated using 3mL of 17% ethylenediaminetetraacetic acid (EDTA; Formula e Ação, São Paulo, SP, Brazil).

The cervical and apical thirds of the root canal were dried with paper points (Dentsply, Maillefer, Baillaigues, Swizerland). Subsequently, CH powder (Maquira, São Paulo, SP, Brazil) was mixed with propylene glycol (Sigma Aldrich, São Paulo, SP, Brazil) until a viscous paste was obtained. The paste was introduced into the root canal by a #40 Lentulo spirals (Dentsply, Maillefer, Baillaigues, Swizerland) (Figure 1C) and the access cavity was temporarily sealed with glass ionomer cement (Vitro Fil LC; DFL, Rio de Janeiro, RJ, Brazil).

After 1 month, the patient returned to the clinic and was asymptomatic. CH paste was removed from the root canal by using 1% NaOCl, 17% EDTA, and saline solution with the aid of a size #45 K-file. A freshly mixed CH paste was inserted into the root canal in the same manner as previously mentioned and the access cavity was temporarily sealed with glass ionomer cement. Radiographic evaluations were performed, and the images suggested disruption of the apical root third and improvement in bone density (Figures 1D, 1E). These procedures were performed again after 2, 3, and 4 months, accomplishing four changes of the CH pastes (Figures 1D, 1E, 1F, and 1G). After that, the radiolucent resorption area suggested to have decreased in size.

Six months afterwards, periapical radiograph evidenced bone formation. Root canal was filled in the cervical third, up to the level of resorption, using the inverted gutta-percha technique with a zinc-oxide and eugenol sealer (Endofill, Dentsply, Rio de Janeiro, RJ, Brazil) (Figures 1H, 1I).

Follow-ups after 12, 24, and 36 months were performed. Tooth remained asymptomatic. Periapical radiographs were taken and evidenced hard tissue formation in the perforation area and remodeling of the root surface. The resorption area presented newly formed bone tissue, simulating a replacement resorption with maintenance of the periodontal ligament space (Figures 1J, 1K, and 1L). Oral hygiene instructions were also given at each follow-up.

DISCUSSION

Inflammatory root resorption can cause tooth loss. Patients usually seek dental care when there is noticeable change in the color of the tooth crown, or changes in the oral mucosa and/or pain.[10] Late clinical interventions can result in an unsatisfactory outcome. In addition, if the tooth structure is severely compromised and perforation has occurred, the prognosis is poor and tooth extraction should be considered. In the present case report, the initial radiograph showed an extensive root resorption with periodontal communication. In this situation, in addition to hindering the removal of the inflamed tissue, it contributes to tooth fragility and increases susceptibility to fracture. However, the literature states that even in unfavorable conditions, endodontic treatment remains a viable approach for tooth preservation.[8,9]

The literature often reports the difficulty in differentiating the diagnosis between internal and external root resorption.[3,6] Both conditions have the presence of inflamed tissue and, when located coronally, a typical pink clinical appearance known as 'pink spot', related to the presence of vascularized connective tissue containing osteoclasts, is often observed without the presence of other symptoms.[10] In this case report, clinical and radiographic parameters determined the diagnosis as internal root resorption. In this situation, some

characteristics can be observed, such as well-defined margins; uniform radiolucency; symmetrical distribution of the root; canal walls with a balloon-like shape and often filled with inflamed tissue when observed during chemo-mechanical preparation.[5,11]

It is imperative to differentiate the active and non-active IIRR. When the blood supply is lost, the apical portion of the pulp will necrose, and the dentinoclasts will die. Thus, resorption will no longer be active.[1,2] Subsequently, microorganisms will metabolize the necrotic pulp tissue, resulting in apical periodontitis.[1,2] The present case did not present apical periodontitis, suggesting an aggressive IIRR.

The mentioned tissue factors promote great difficulties in the endodontic treatment of IIRR, including excessive bleeding.[10] The use of NaOCl in low concentration for tissue dissolution, and the subsequent use of saline solution, avoiding periradicular tissue injuries and patient discomfort are essential.[8] In addition, the removal of pulp tissue interrupts the blood supply and the arrival of clastic cells, preventing the progression of resorption.[3,5,8,10] However, if resorption perforates the root, communicating the root space with the periodontium, the treatment process can be more challenging. In these situations, the use of CH pastes is recommended, in an attempt to stimulate the formation of mineralized tissue.[8]

In the present case reported, CH paste changes were performed four times, with a total of 30 days of intracanal paste permanence, aiming at a satisfactory ionic release, providing a favorable environment for tissue neoformation.[12] Superior intratubular penetration of CH pastes with a viscous vehicle rather than an aqueous vehicle have been previously observed[12], for this reason, CH powder was mixed to propylene glycol to obtain a viscous paste.

Previous studies have suggested that a high alkaline pH and greater ionic are related to the use of CH powder mixed with viscous vehicles.[13-15] Furthermore, it has been shown that the greater the intratubular penetration of the CH paste, the greater its ability to reach microorganisms, favoring a greater disinfection capacity. This is mainly due to the increase in pH (approximately 12) along the entire root length, favoring the elimination of bacteria such as *Enterococcus faecalis*, which can survive at pH 11.5.[16]

It is necessary to mention that when communication with the periodontium occurs, due to the extension of the IIRR, the destruction of adjacent periodontal tissues may occur. Thus, endodontic treatment can be performed by sealing the perforation using a biocompatible material.[4] In these cases, MTA has been the material of choice for the surgical or non-surgical treatment of the perforation.[9] However, in the present case, it was observed in the clinical and radiographic follow-ups that, after several changes of the CH pastes, there was formation of bone tissue in the resorption area.

The inverted gutta-percha technique was chosen for filling the cervical third of the root canal. Throughout the follow-ups, the presence of periodontal ligament was observed, without ankylosis formation. These clinical approaches ensure tooth maintenance, avoiding surgical procedures or tooth extraction.

The present case report is in agreement with Kaval et al.,[8] in which relates the healing mechanism to a three-step process: root canal disinfection, interruption of osteoclastic activity, and initiation of new tissue formation within the resorption area and root canal.[8] It should be noted that the absence of root canal filling of the apical third did not impair the repair process, since during the 36 months of follow-up endodontic retreatment was not necessary. Thus, it is possible to affirm that the chemo-mechanical procedures play a fundamental role in the reduction of bacteria to levels compatible with those to allow tissue healing, and that the use of CH pastes contributed to the elimination of remaining bacteria, and ionic release, creating an environment favorable to tissue neoformation.[12]

CONCLUSION

Conservative endodontic techniques can interrupt the IIRR process and induce the production of mineralized tissue even in the presence of perforation. CH with viscous vehicle showed great potential for bone tissue stimulation.

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CONFLICTS OF INTEREST

None.

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