J Oral Res
oral and craniofacial sciences

Case

Management of merged external/internal root resorption using CEM cement: a case report.

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Receipt: 07/15/2018 Revised: 09/12/2018
Acceptance: 09/28/2018 Online: 11/12/2018

Abstract: Chronic pulpal inflammation and infection are the main predisposing factors for internal and external root resorption (IRR & ERR); however, merging of IRR and ERR is a rare lesion which rigorously alters the anatomy of root canals. This study reports a case of merged IRR and ERR in an asymptomatic maxillary left central incisor in a 33-year old Caucasian woman that was managed by one-visit root canal therapy (RCT) using calcium-enriched mixture (CEM) cement. Radiographic examination showed a short root with under-filled root canal obturation associated with ERR/IRR and an apical lesion. After thorough chemo-mechanical preparation, the root canal was obturated with CEM cement; one week later, the access cavity was permanently restored. Clinical/radiographic examinations at 1-year follow-up revealed uneventful healing, reestablishment of lamina dura and stabilization of the resorptive defects. The treatment outcome demonstrates that one-visit RCT using CEM cement may be a viable treatment option in cases with merged external/internal root resorption. Further clinical trials with a larger number of cases are suggested to document a higher level of evidence.

Keywords: Calcium-enriched mixture cement; dental cements; endodontics; root canal therapy; root resorption.

INTRODUCTION.

Establishing an accurate clinical diagnosis and identifying the etiological factors in root resorption are the keys to success in an effective treatment and case management.[1] Several types of resorption are recognized and researchers have presented classifications of tooth/root resorptions.[1-3] Tooth resorption has been categorized into three groups: trauma-induced, infection-induced and hyperplastic invasive tooth resorptions.[4] Pulp infections are a common cause for inflammatory resorption;[5] root canal therapy (RCT) is the recommended treatment for pulp infection-induced inflammatory resorption.[3]

Traditional treatment for teeth diagnosed with resorption would be the use of long-term therapy with calcium hydroxide (CH). Cvek 1973 reported a high success rate for long-term CH therapy.[6-8] However, it is a time consuming treatment, and may cause weakening of the root structure. There is also the risk that the patient may fail to follow through with the required visits. Moreover the necrotizing effect of CH could be harmful for the periodontal ligament (PDL). In addition, it is reported that in some of the cases the affected tooth will be lost during the treatment or after the treatment due to a non-restorable fracture

Conflict of interests: The authors declare no conflict of interests.

Ethics approval: informed written consent.

Funding: None.

Authors' contributions: All authors contributed to the execution of the study.

Acknowledgements: None.

Cite as: Mirmohammadi H & Asgary S. Management of merged external/internal root resor-ption using CEM cement; Case report. J Oral Res 2018;7(8):382-386.
doi:10.17126/joralres.2018.080

ISSN Online 0719-2479 - www.joralres.com © 2018

or vertical root fracture.[6,9] It is also reported that CH will be effective only when it is in close contact with infection and due to the large size of its particles, it will be ineffective for eliminating bacteria inside the dentinal tubules.[10]

Decreasing the number chair-side appointments has some advantages: treatment is faster, better tolerated by patients, avoids recontamination of root canals between appointments, and it prevents some extra-costs. However, despite existing evidences to support the one-visit RCT, there is still a lot opposition to one-visit endodontic treatment for necrotic pulps.[11,12] MTA (mineral trioxide aggregate), a Portland cement-based formulation was developed more than 20 years ago as a root-end filling material but its potential for new clinical applications later became evident thanks to its innovative hydraulic properties and sealing ability. Many similar materials have been developed, such as the recent hydraulic calcium silicate cements (HCSC), and have gained the trust of many operators who proposed its clinical use for apexogenesis, pulp capping and other procedures.[13]

The use of MTA to restore external root resorption (ERR) has been investigated. A well-documented case report from Olivieri *et al.,*[14] with cone-beam CT and histological evaluation after extraction, demonstrated the healing of inflammatory ERR after treatment with MTA by the presence of cementum-like tissue interposed within the dentin defect. Calcium enriched mixture (CEM) cement is a novel calcium silicate based cement, which differs from MTA specifically because of its internal phosphate reservoir and its bioactivity has been shown to be superior to MTA.[15] Previous studies showed successful outcomes when CEM cement was used as a perforation repair material,[16] as root-end filling material,[17] in the management of ERR,[18] in surgical repair of class 3 invasive cervical root resorption (ICRR),[19] and in the non-surgical management of class 4 ICRR.[20]

This case report shows the unique radiographic appearance of the presence of both internal and external root resorptions. The purpose of this case report is to describe the importance of clinical findings, proper diagnoses, and the successful management of this case using non-surgical one-visit RCT with a novel endodontic biomaterial (CEM cement).

CASE REPORT.

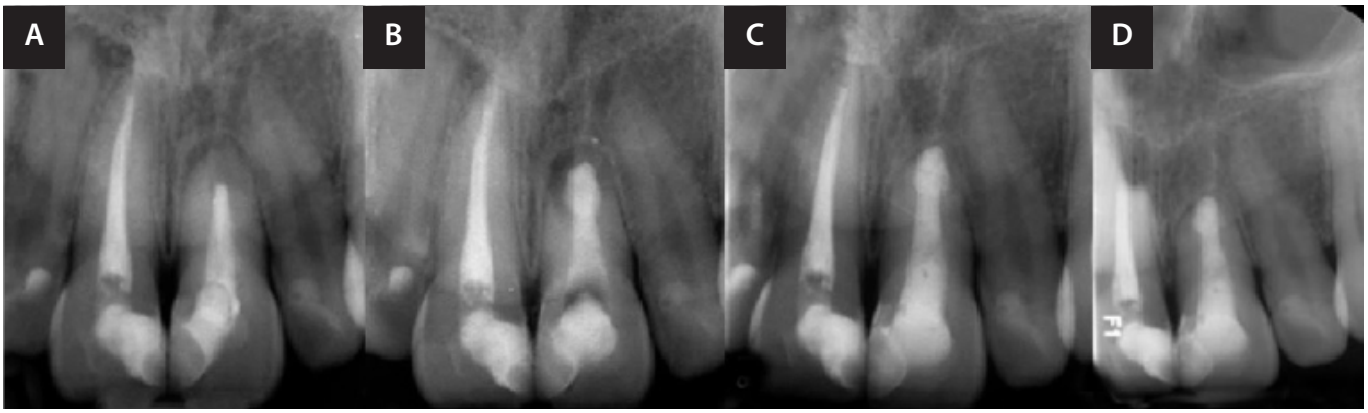
A 33-year old Caucasian woman was referred to a private endodontic clinic with a chief complaint of occasional pain and discomfort associated with her maxillary left central incisor. The patient's medical history was reviewed; she was considered a healthy person with no known systemic disease or use of medication. There were no known previous traumatic injuries and the patient had no contraindication to dental treatment.

Intraoral examination revealed good oral hygiene and normal periodontal probing depths (≤3mm); however, the involved tooth was slightly tender to percussion and palpation. She reported that the tooth had been endodontically treated many years ago. The periapical radiograph showed a severely ERR (a significant shorter root than adjacent incisors), an IRR, a previous RCT with incomplete obturation and an apical lesion (Figure 1-A).

Based on the clinical and radiographic findings, the pulpal and periapical diagnoses were inadequate previous RCT and symptomatic apical periodontitis, respectively. The recommended treatment was chemo-mechanical root canal debridement, and the definitive treatment was one-visit non-surgical RCT of the involved tooth. The risks and benefits of the procedure were reviewed; informed consent was signed and obtained.

The patient was asked to rinse with 0.2% chlorhexidine mouthwash before local injection. The teeth were anesthetized with 2% Lidocaine with 1:80,000 epinephrine (DarouPakhsh, Tehran, Iran). Following isolation, access cavity was prepared, the entire root-canal fillings were removed using Hedstrom files and the working length was determined. Using the step-back technique, the canal was instrumented; copious irrigation using 5.25% NaOCl solution was carried out. The CEM cement (BioniqueDent, Tehran, Iran) was prepared according to the manufacturer's instructions and applied to the canal using a calibrated measured plugger. When appropriate obturation of the canal with the biomaterial was radiographically confirmed, a moistened sterile cotton pellet was placed over the CEM and the access cavity was temporarily sealed (AsiaChemiTeb Co., Tehran, Iran) (Figure 1-B). The patient was recalled after 7 days; in the absence of signs/symptoms, the access cavity was permanently restored with adhesive resin-composite (Z100; 3M ESPE, MN, USA).

Figure 1. The periapical radiograph.



A. Preoperative periapical radiograph of left upper first central incisor indicating severe external/internal root resorption, a previous RCT with incomplete obturation and an apical lesion. **B.** Immediate postoperative radiograph showing complete root canal obturation with CEM cement. **C.** Four-year follow-up radiograph showing complete periradicular tissue regeneration. **D.** At six-year follow-up.

The healing was uneventful at 4-year follow-up. Clinically, the probing depths were within normal limits (≤3mm) and no tooth mobility could be detected; the tooth was asymptomatic and functional. The 4-year follow-up radiograph demonstrated reestablishment of lamina dura, complete bone healing and no further root resorption (Figure 1-C). The treatment was deemed successful. Additionally the patient also showed up after six years, with no pain to percussion or palpation and pocket depth and mobility remained within normal limits (Figure 1-D).

DISCUSSION.

This case, which includes IRR, ERR and a endodontic-periodontic lesion, is possibly unique. The presence of the root resorption is most likely indirectly related to the endodontic-periodontic condition presented. The tooth was already endodontically treated probably with a diagnosis of irreversible pulpitis; however it was treated very short of appropriate length. Remaining pulp tissue had been contaminated or had become contaminated during the first treatment and pulp may then undergo a dynamic change from pulpitis to necrosis. The IRR could be caused by pulp inflammation at the early stage, with the pulp then becoming necrotic which resulted in the endodontic-periodontic lesion and ERR.

Internal resorption is associated with inflammation of the dental pulp, which is conventionally treated by performing RCT.[21]

The worst-case scenario is the conjunction between internal and external root resorption, which was the case for the patient in this report. This constellation of issues presents difficulties for the clinical management of open apex cases.

There are still dilemmas regarding the etiology and treatment of ERR, and a Cochrane systematic review revealed that there is no reliable evidence regarding the most suitable protocol of treating ERR, and treatment is based on clinicians' experiences and patient related factors in most cases.[22] As of now the mostly used treatment protocol for ERR consists of a short-term dressing of a creamy paste of CH (for one month), followed by a long-term dressing of densely packed CH in order to kill the bacteria inside the dentinal tubules and neutralize endotoxins. The main mechanism of action of CH is thought to be to provide an alkaline pH via its disassociation into Ca+ and -OH ions which can diffuse through dentinal tubules.[23] Recently developed calcium silicate endodontic biomaterials (*i.e.* CEM Cement & MTA) have the ability of releasing Ca+ and -OH ions, and providing a long-lasting seal, which could be used as a definitive obturation material. In other words, while CH cannot be used as a proper material for a single-visit treatment, recently developed biomaterials can solved this problem.

MTA was the first calcium silicate bioceramic developed for dental use. It has been used for root-end filling, pulp capping, pulpotomy, apexogenesis, apical barrier formation in teeth with open apexes, repair of root perforations, treatment of resorptive lesions, revascularization, and as a root canal filling material.[16,24-26]

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Despite a high success rate of tooth-colored MTA, it has some disadvantages such as discoloration of the tooth, prolonged setting time, high cost and difficult handling.[27] Recently, other silicate base bioceramics were introduced to overcome the disadvantages of MTA. From these biomaterials, CEM cement seems to be the most supported cement by current evidence,[28-31] and it has an easier handling with no reported discoloration. Also the treated tooth in this case report did not show any discoloration after one-year follow-up.

Complete healing of the periapical bony defect could be due to the proper disinfection during the treatment, but also due to the biochemical properties of CEM cement. MTA and CEM have similar effects on hard-tissue formation. Moreover, when applied to bone defects, it resulted in osteogenesis.[32] They can also induce cementogenesis, and have the potential for periodontal regeneration;[17,33] they have been successfully used for the management of different resorptive lesions[18-20,34] and postoperative evaluations of the present case also did not show any progression of the resorption.

The bioactivity of the hydraulic calcium silicate cements has been recently questioned, as it seems that formation of a hard tissue in contact with simulated body fluids could be considered as a chemical reaction between the materials and such a solution; however, universal standards are lacking for unbiased appraisal of the relative *in vivo* bioactivity of hydraulic calcium silicate cements.[35] In contrast, there are a few histological studies that support their bioactivity, as a bioactive cement creates a suitable environment for osteogenesis and specifically cementogenesis in endodontics by developing a natural bonding interface between body tissues and biocements.[17,33] However, the long-term effect of these cements on the periapical environment, and effect of this environment on their setting is yet to be studied.

In summary, this report presents a case of failure of previous RCT with combined IRR/ERR and an apical lesion; proper root canal disinfection and choice of adequate biomaterial could stop the resorption process. The correct diagnosis of the stimulating factor for tooth resorption is critical for clinical management and success. Root canal disinfection and providing a proper seal with the help of a bioactive material such as CEM cement could be the treatment of choice for such cases. Further clinical trials with a larger number of cases are suggested to document a higher level of evidence.

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