Root canal obturation of an open apex root with calcium enriched mixture

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ABSTRACT

Introduction: Inflammatory external root resorption in the permanent dentition is a dental complication, usually associated with inflammation of bacterial/endoontal origin. This case report describes nonsurgical root canal retreatment of a mandibular molar with inflammatory external root resorption (IERR) and open apex with calcium enriched mixture (CEM) cement. Case Report: Radiographically, the distal root of a lower right first molar had IERR and an open apex associated with a mixed periapical lesion. One-visit cleaning/shaping and obturation was performed with CEM and gutta-percha/sealer in distal and mesial roots, respectively. The tooth crown was permanently restored one week post operatively. Three years subsequent to treatment, the tooth remained asymptomatic with clinical and radiographic evidence of complete healing. Conclusion: The biological properties of CEM cement may make it a suitable endodontic biomaterial and treatment option for teeth suffering from inflammatory external root resorption and the associated open apex.

Keywords: Calcium enriched mixture, Canal obturation, CEM cement, Root resorption, One-visit, Open apex.

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INTRODUCTION

The process of root resorption in the permanent dentition is usually pathological and subdivided into two forms — internal and external. External root resorption (ERR) can be categorized into surface, inflammatory (IERR), replacement (i.e. ankylosis), pressure, invasive (cervical) and idiopathic external root resorption as well as those related to systemic conditions. The most causative factors for IERR are infection and trauma [1]. A radiographic defect which affects both external root surface of the dentin and adjacent bone is indicative of IERR [2].

IERR is initiated by damage to the cementum caused by trauma/inflammation/infection of the dental pulp/periodontium. Also, bacteria and their by-products, as well as tissue breakdown products from inside the root canal system are able to stimulate inflammation in the nearby periodontal fiber (PDL) which leads to aggressive/progressive IERR. Apical IERR is the most frequently observed type of ERR. It affects majority of teeth with evidence of apical periodontitis. The biological apical boundary of the root canal disappears when the apical part of the root is resorbed and thus a tight seal with the root filling technique is impossible due to the inadequacy of apical stop.
Calcium enriched mixture (CEM) cement is a new tooth-colored water-based endodontic biomaterial mainly composed of calcium oxide, sulfur trioxide, phosphate and silica. It has alkaline pH (pH >10.5) and releases calcium hydroxide during and after setting [3]. Antibacterial properties of CEM cement are comparable with calcium hydroxide (CH) [4]. Sealing ability, cytotoxicity and biocompatibility of CEM cement are comparable to mineral trioxide aggregate (MTA) [5–7]. Scanning electron microscope (SEM) surface characteristics of set CEM cement are comparable to human dentin; it has the ability to promote hydroxyapatite formation even in normal saline solution [8–9].

The following case report discusses successful management with CEM cement obturation of a root with IERR and subsequent open apex.

CASE REPORT

A 29-year-old female patient was referred to the private clinic. She had difficulty in chewing food on the mandibular right side. Medical and family history was non-contributory.

The extraoral examination was unremarkable. Intraoral examination revealed that the right mandibular first molar was sensitive to percussion and palpation. Periodontal probing did not reveal any loss of attachment and the tooth displayed no mobility. The patient could not recall any relevant traumatic episode. Radiographic examination showed that distal root had an extensive area of external root resorption that resulted in a reduced root length and an open apex associated with a mixed periapical lesion (radiolucent center with radiopaque periphery). The image demonstrated the presence of overextended gutta-percha in the distal root (Figure 1A). A diagnosis of IERR associated with chronic apical periodontitis was made. Several possible treatment options were explained to the patient and informed consent was signed by patient. The treatment plan recommended and chosen consisted of root canal treatment (RCT) that obtained good shaping, chemomechanical cleansing and disinfection of the root canal system, followed by gutta-percha and sealer canal obturation in mesial canals. Because of the extent of the IERR and the lack of an apical stop, CEM cement (BioniqueDent, Tehran, Iran) was considered for the root canal obturation biomaterial in the distal root.

A 0.2% chlorhexidine gluconate rinse was carried out to reduce oral bacteria. Under local anesthesia (2% lidocaine containing 1:80,000 adrenaline; Darou Paksh, Tehran, Iran) and rubber dam isolation, the right mandibular first molar was retreated. Working length was determined radiographically. The root canals were shaped/cleaned using step-back technique, with gates glidden burs and K-files (Mani, Japan). Copious irrigation with 5.25% sodium hypochlorite solution was carried out. The canals were dried using paper points (Aria Dent, Tehran, Iran); the mesial canals were obturated with gutta-percha cones (Aria Dent, Tehran, Iran) and Roth 801 endodontic sealer (Roth Int., Chicago, USA) using lateral condensation technique.

CEM powder and liquid was mixed according to manufacturer’s instructions. The cement was inserted into the distal canal incrementally with an amalgam carrier; condensation was completed by pluggers of appropriate length up to the apical limit. A radiograph was taken to ensure proper adaptation of the CEM cement with the canal walls (Figure 1B). CEM cement was covered with a wet cotton pellet and the access was sealed with Cavit (ESPE, Norristown, PA). In the absence of symptoms at the one week follow-up, the tooth was permanently restored with amalgam (Cinalux, Shahid Faghihi Co., Tehran, Iran) (Figure 1C).

Three years postoperatively, the patient was symptom-free and no clinical signs/symptoms of infection or inflammation were observed. The gingival attachment was healthy and tooth mobility was normal. Radiographic examination revealed complete healing of the mixed periapical lesion accompanied by arrest of the IERR process (Figure 1D).

**DISCUSSION**

This clinical case reports a tooth affected with severe IERR caused by pulp infection. The IERR had caused a reduction in root length and apical root shape to the point that an open apex was produced. IERR is considered healed if the adjacent periodontium is re-established and the resorption process terminates. In the case reported here, the arrest of IERR accompanied by complete healing of periodontium was successfully achieved with CEM cement canal obturation.

High-quality RCT and restorative procedures play an important role in obtaining the high level of endodontic success and saving the natural tooth. Research has shown a direct association between pulp infection and
periapical lesions [10]. Mild inflammation may cause the formation of condensing apical periodontitis. In order to arrest inflammation and permit regeneration of the periodontium, the primary goal of IERR management should be based on the decrease of bacterial numbers and their by-products from the root canal system during RCT.

Research has revealed that accurate cleaning/shaping of root canal, along with copious irrigation, is able to significantly reduce the number of bacteria [11]. Many studies have recommended the additional use of calcium hydroxide inter-medicament to achieve an improved disinfection of the root canal system; however, CH dressing has a number of disadvantages including necrotizing effects, increasing dentin brittleness and unpredictable antibacterial efficacy. Sodium hypochlorite solution, however, has recognized bactericidal properties. This bactericidal irrigant bleaches, deodorizes and dissolves the tissue and disinfects the root canal system [12]. We used full strength NaOCl solution to obtain the irrigants maximal effects.

Interestingly, we observed complete healing of the mixed periapical lesion with reformation of bone structures and bony infill creating normal radiographic appearance adjacent the involved tooth. The main factor in success of RCT is bacterial tight seal. CEM cement is a tooth-colored water-based endodontic biomaterial with good sealing ability as well as bactericidal effects against endodontic pathogens similar to calcium hydroxide [4]. Fresh mixed CEM cement has alkaline pH [3]. The alkaline environment helps the inhibition of the odontoclasts and the reproduction and differentiation of pluripotent cells, which are able to initiate hard tissue formation. Moreover, animal studies have demonstrated that CEM and MTA induce comparable cementogenesis when used as perforation repair or root-end filling materials [6]. It seems that sealing ability [5], antibacterial effect [4], and alkaline pH [3] as well as biocompatibility of CEM cement [6–7] might partially explain the favorable treatment outcome in this case.

CONCLUSION

CEM cement may be an appropriate endodontic material in management of external root resorption. However, further clinical studies with larger samples are recommended.

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Author Contributions

Saeed Asgary – Substantial contributions to conception and design, Drafting the article, revising it critically for important intellectual content, Final approval of the version to be published

Mohammad Jafar Eghbal – Substantial contributions to conception and design, Drafting the article, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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REFERENCES