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Case Report

Delayed miniature pulpotomy in a symptomatic mature molar

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ABSTRACT

This case report describes miniature pulpotomy (MP) with calcium-enriched mixture (CEM) cement, 1 week after carious pulpal exposure of a symptomatic mature molar. A 24-year-old woman was referred with complaining of severe lingering pain on the second upper left molar; a dental history revealed that the tooth had been prepared 1 week ago, but on pulp exposure, her dentist just dressed the cavity. After anesthesia/isolation in the same session, the temporary restoration was removed, the previously pulpal exposure was observed, and MP was carried out. Hemorrhage was effectively controlled using 5.25% NaOCl, the clot free pulpal wound was completely covered employing CEM cement, and the cavity was permanently restored by resin composite. The patient's pain gradually relieved within 24 h. The tooth was functional and able to respond to vitality tests in regular clinical follow-ups. At 15-month follow-up, a dentinal bridge was observed under the capping biomaterial, radiographically; moreover, no calcification or apical pathosis was detected. MP with CEM cement might be a treatment option for the management of exposed dental pulp with a clinical diagnosis of irreversible pulpitis, although further trials with larger sample size and longer follow-ups are recommended.

Key Words: Calcium-enriched mixture cement, dental pulp diseases, endodontics, pulpotomy

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INTRODUCTION

The dental pulp is a unique connective tissue due to being enclosed with healing capacity like other connective tissues mainly due to rich vascular network/stem cells which can actively contribute to the regeneration process following inflammatory events.[1,2] It is sensitive to external factors such as the microorganisms' ingression through dental caries, crack or dentinal tubules, etching and/or bonding materials for adhesion, mechanical irritations during restorative preparation, trauma from occlusion and orthodontic movement. Such factors may initiate the inflammatory events, leading to pain, and root resorption through neurogenic inflammation and hard tissue remodeling. Therefore, a comprehensive understanding of the inflammation processes within the pulp is necessary for the development of proper dental procedures and immunotherapeutic agents.[3]

Vital pulp therapy (VPT) is devised to preserve and to maintain the vitality of teeth pulpally involved.[4,5] Notable progress has been made in this field due to a better understanding of pulp pathophysiology, improved clinical protocols, and advanced bioceramic materials. With proper case selection, conservative VPT can provide suitable treatment modalities for

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permanent teeth diagnosed with normal pulps or reversible/irreversible pulpitis.[6,7]

Pulpotomy among VPT techniques for the treatment of exposed immature/mature permanent teeth falls into three sub-categories including miniature pulpotomy (MP), partial or shallow pulpotomy (Cvek), and coronal/cervical/full pulpotomy. Partial pulpotomy is originally indicated for the treatment of mechanically-exposed immature permanent incisor using calcium hydroxide ($Ca[OH]_2$) for pulp capping and zinc oxide-eugenol for cavity filling/sealing and permanent restoration at the next session. Although at the present time, other endodontic materials such as bioceramics are also used for one/two-session(s) treatment of immature/mature mechanically/carious exposed teeth.[8] The exposure size in this technique before covering is small (<2 mm).[9]

MP procedure (MPP) removes the superficial inflamed layers (~1 mm) using minimal enlargement of the exposure site without removing the surrounding dentine.[10] This procedure results in maintenance of the healthy coronal pulp in the pulp chamber and decreased hyperemia and hence simpler bleeding cessation. Differentiation capacity of undifferentiated mesenchymal/stem cells (placed at the deeper layers of the pulp) into odontoblast-like cells make the basis for repair of the pulp–dentin complex. MPP allows to contacting between the biomaterial and the underlying cells directly leading to further progression of the healing processes.[11] The seal obtained from pulp capping material in MP seems to be adequate due to a sufficiently-deep cavity surrounded by unremoved parallel dentinal walls.

The materials used for the above-mentioned approaches are $Ca(OH)_2$, mineral trioxide aggregate (MTA), calcium-enriched mixture (CEM) cement, adhesives, resin-modified glass ionomers (RMGIs), and much recently bioactive dentin molecules.[7,12] This report shows an MP done using CEM cement for a symptomatic mature permanent molar diagnosed with irreversible pulpitis 1 week after pulp exposure intended to remove caries and restoration but left untreated.

CASE REPORT

A 24-year-old woman referred to our clinic complaining of severe lingering pain provoked by exposure to cold water on the second upper left molar. One week before, her tooth had been opened to remove the carious lesion and restore but left untreated when pulpal bleeding due to carious exposure had been encountered. It had been restored using cotton pellet and temporal restorative material [Figure 1a]. The patient had been recommended to use analgesics if needed and visit an endodontist for root canal therapy.

Vitality tests showed the severe lingering positive response for cold (>15 s), and negative response for palpation and percussion. Clinical examination showed nothing special except temporal restoration. The periapical radiography revealed an upper second molar with no pathosis in pulp space and periapical tissues. The diagnosis of irreversible pulpitis with normal PA was confirmed after the removal of temporal restoration and cotton pellet when an active bleeding was seen from pulpal exposure. Three treatment modalities were considered as follows; (1) complete pulpectomy based on carious exposure and mature apex, (2) pulpotomy based on the small size of exposure, bleeding from pulp and no periapical pathosis, and (3) extraction with or without replacement. The patient was thoroughly informed of all procedures and each benefit and left free to choose. She chose the second. The signed informed consent was obtained, and treatment was commenced. No medical and dental contributory factor was traced. She was first requested to rinse her mouth with 0.2% chlorhexidine gluconate. Infiltration with 2% lidocaine and 1:80000 epinephrine (Darupakhsh, Tehran, Iran) was the anesthesia of choice. After rubber dam isolation, the caries remnants were completely excavated.

The cavity and exposed surface of pulp were rinsed with 5.25% NaOCl for disinfection and lightly brushed using a sterile medium-sized round diamond bur (Komet, Lemgo Switzerland) in a high-speed handpiece under copious water irrigation. Carefully no more than 1 mm of uppermost pulp tissue was removed under × 2 magnification (Orascoptic, Kerr Co., WI, USA). Hemorrhage cessation was achieved through 5-minute gently applying a cotton pellet soaked in full-strength sodium hypochlorite solution on the exposed area of pulp. CEM cement powder and liquid (BioniqueDent, Tehran, Iran) were mixed in accordance with manufacturer's instructions. The biomaterial was gently condensed into the pulpal cavity using dry sterile cotton pellets. After 5 min,[13] the prepared cavity was carefully restored with composite resin (z100; 3M ESPE, MN, USA) and an immediate postoperative radiograph taken [Figure 1b]. Thereafter, the patient was suggested to use analgesic if needed and was monitored by phone through the first 24 h for pain

Figure 1: The steps of treatment. (a) Initial radiography showing temporized upper left second molar exposing the pulp. (b) Immediately, after miniature pulpotomy with calcium-enriched mixture cement. (c) Fifteen month follow-up showing dentinal bridge formed under capping material and no pathosis, pulpally, and periapically.

assessment before clinical follow-up. The tooth was not sensitive to cold and heat subjectively and had a normal function the day after. At 15 months, clinical findings showed positive pulpal response to the cold test, normal probing depth, and healthy soft tissues around the tooth. Intraoral PA radiography revealed dentinal bridge formed just beneath the bioactive capping material and normal PDL as indicators of pulpal and periapical normality.

DISCUSSION

Among pulpotomy techniques, MP is very conservative. The present case which was a symptomatic mature permanent molar with signs and symptoms indicative of irreversible pulpitis was subjected to 1-week delayed MP through using CEM cement.

Complete caries removal in vital, asymptomatic permanent teeth with deep carious lesions may probably ends in the unavoidable exposure of the pulp. As a result, the complexity and cost of treatment are increased, and many patients are faced with extraction as a mere viable option. Increasing evidence supports noninvasive concepts such as selective/incomplete or stepwise instead of invasive such as nonselective/complete to remove deep caries in vital teeth, mainly since pulpal risks are significantly decreased.[14,15]

Although studies advocate the notion that the time elapsed between coronal fracture and treatment with Cvek pulpotomy in permanent teeth plays an important role in minimizing the discomfort and pain possibility, microbial pulp invasion, and ensuring pulp and periodontal healing, others consider that neither time between the accident and treatment nor size of exposure is crucial if the uppermost inflamed pulpal tissue is amputated to the level of a healthy pulp.[8,16] On the ground of carious exposure in permanent mature teeth, there is no evidence regarding the impact of time elapsed between exposure and VPT on the treatment outcomes. In the present case, regardless of one-week delay, it was decided to choose MP with CEM cement based on bleeding cessation and small size of pulpal exposure. Ethically, the pain relief was the main goal to be addressed which was achieved. Moreover, it was shown that the pulp vitality had been maintained over a 15-month period.

On the contrary to the $Ca(OH)_2$ which can irritate the underlying pulp to shift toward complications such as necrosis due to tunnel defect made, CEM cement stimulate the pulp to form a uniform bridge, and separate the pulp from irritants, and hence, there should not be concern subsequent to the pulpotomies such as MP done with CEM cement. CEM cement has the capacities such as sealing ability, alkalinity, and biocompatibility to be implemented in such cases for dentin bridge formation.[17] Continuous dentinal bridge formed adjacent to CEM cement can acts as a trustable indicator of long-term success, because noncontinuous bridge can easily introduce pathways for recontamination of the pulp and treatment failure consequently.[18] In addition, it has been shown that CEM cement provides a source of calcium and phosphate ions endogenously for accelerating hydroxyapatite crystal formation which acts as second-seal on the surface.[19] Considering the importance of coronal seal after VPT which is well-supported for the achievement of long-term success, composite restoration was made to protect all the underlying materials from reinfection in this case. The quality of bridge formed underneath MTA and CEM cement is similar although a layer of odontoblast-like cells is more likely to be formed under the CEM cement.[12]

The present case seems to be different from the previously published paper for delayed pulpotomy in a midroot and complicated crown-root-fractured permanent incisor with hyperplastic pulpitis,[20] because the tooth is mature with irreversible pulpitis resulted from caries exposure diagnosed 1-week later.

Totally, conservative and economical treatment modalities like vital pulpotomies with regenerative approaches can be better choices over conventional root canal procedures if the elementary steps done properly. According to the health technology assessment, pulpotomy using CEM cement not only is acceptable like root canal therapy for treating permanent molars with irreversible pulpitis but also is more successful, accessible, affordable, available, and safer.[21] Pulpotomy in mature teeth with carious pulp exposure seems being focused recently.[4,5] In a case-series study carried out to compare different VPT techniques for symptomatic permanent teeth, no difference achieved. The capping biomaterial used for these therapeutic interventions was CEM cement.[22]

In conclusion, MP with CEM cement might be a good option for mature teeth with a diagnosis of irreversible pulpitis.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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