

## Case Report

### Treatment of strip perforation using cold ceramic

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#### ABSTRACT

Root perforation may occur at any stage of endodontic treatment and is mostly due to iatrogenic injury and may compromise the outcome of endodontic treatment. Repairing a perforation is difficult and the prognosis depends on various factors such as time, site and size of perforation, and the patient's overall health status. Hence, choosing the most appropriate material can be critical for the dentist. In this case report of a strip-perforation repair, an mineral trioxide aggregate-like material (cold ceramic) that has been shown in previous studies to have favorable properties, was successfully used.

**Key Words:** Canal therapies, retreatments, root, root canal filling material

#### INTRODUCTION

Tooth roots may become perforated during different stages of endodontic treatment, especially cleaning and shaping<sup>[1]</sup> and this leads to communication between the root canal and the outer surface of the tooth.<sup>[2]</sup> Perforation can occur at the apical, middle, or cervical root sites, and depending on the site of the perforation, treatment approach and prognosis can vary.<sup>[1]</sup> Prognosis may also be affected by the time between the incident and treatment, as well as the size of perforation. When minimal time has passed, and there is minor destruction, the perforation has a better prognosis,<sup>[3]</sup> although this is based on literature predating calcium-silicate-based materials.

Strip perforation is a type of root perforation occurring in the coronal third of the root canal near the furcation area due to misadventure in access preparation and inappropriate use of instruments such as Gates-Glidden burs.<sup>[1,4]</sup> This perforation occurs

on curved roots such as mesial roots of mandibular molars.<sup>[5]</sup> A major challenge in endodontics is repairing a strip perforation because it is usually inaccessible and may have a poor prognosis due to having an oval shape, thin margins, and proximity to the gingival sulcus.<sup>[1,5]</sup>

Perforations must be sealed with an appropriate repair material.<sup>[2]</sup> This material must have specific properties including good sealing ability, biocompatibility, radiopacity, nontoxicity, noncarcinogenicity, and moisture tolerance.<sup>[6]</sup> It should also be easy to place, as well as have the ability to promote osteogenesis and cementogenesis.<sup>[6]</sup> Historically, different materials have been used to repair perforations, for example, amalgam,<sup>[7,8]</sup> glass ionomer cements,<sup>[8]</sup> and cavite.<sup>[7]</sup> More recently, calcium silicate-based materials have been used such as mineral trioxide aggregate (MTA),<sup>[9]</sup> Biodentine,<sup>[10]</sup> and Bioaggregate.<sup>[11]</sup>

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Cold ceramic (Monsefteb, Yazd, Iran) is another MTA-like bio-ceramic material that has been introduced into endodontics as a root-end filling material.<sup>[12]</sup> Its main components include calcium oxide (48.12%), barium oxide (18.61%), silicon dioxide (16.19%), sulfur trioxide (10.15%), as well as trace amounts magnesium oxide, manganese (II) oxide, iron (III) oxide, sodium oxide, potassium oxide, and titanium dioxide. In the presence of moisture, cold ceramic sets initially within 15 min and reaches complete set within 24 h.<sup>[12]</sup> The sealing ability of this material has been reported to be better than a glass ionomer cement (Master-dent, Dentonics Inc., USA) and amalgam<sup>[13,14]</sup> cold ceramic is also biocompatible and nontoxic,<sup>[15,16]</sup> and has appropriate radiopacity.<sup>[17]</sup> This case report describes a mandibular molar with iatrogenic strip-perforation that was successfully managed using cold ceramic.

## CASE REPORT

A 39-year-old male was referred from his general dentist in December 2015 with a strip-perforation of the mesiolingual canal of the lower left first molar. The original root canal treatment had been completed some 2 years earlier by another dentist, and his current dentist had attempted retreatment but was unable to because of the strip-perforation. After patient examination, patient consent form was obtained. The patient's medical history was nonsignificant, and extra-oral evaluation revealed normal soft tissues. On oral examination, the tooth exhibited no mobility or probing defects. The tooth was exquisitely tender to percussion, had no caries, and had been temporarily restored with Cavit. Radiographic evaluation of the referrer's preoperative radiograph, which was provided by the patient revealed a periapical lesion and bone loss mostly around the distal root and in the furcation area, and also slight periodontal ligament widening around the mesial root as well as a likely strip-perforation [Figure 1]. Treatment options such as perforation repair and extraction/prosthetic replacement or extraction/implant were discussed with the patient, and he chose the perforation repair to retain the tooth.

Following the administration of local anesthesia, the tooth was isolated using a split-dam technique, the temporary restoration was removed, and straight-line access was achieved using a fissure bur. All canal orifices were located, and the exact



**Figure 1:** Referrer's preoperative radiograph (December 2015).

site of the perforation was confirmed using an operating microscope (Zeiss-Extaro300, Germany) and apex locator (Morita-Dentaport zx, Japan). After dental dam single-tooth isolation, working length determination was established with apex locator, and cleaning and shaping were completed using rotary ProTaper instruments (Diadent-Dia-Pt, South Korea) to an F3 instrument using a crown-down approach. Sodium hypochlorite solution (0.5% NaOCl; Golrang, Iran) was used for irrigation. The canals were dried with paper points. The Cold Ceramic (Monsefteb, Yazd, Iran) was then prepared according to the manufacturer's instructions and carried into the canals and also the perforation site with a MAP One carrier (Maillefer, Dentsply, Switzerland). A size 20 finger plugger (Mani, Japan) was used to compact the cold ceramic; enough space for postplacement in the distal canal was allowed [Figure 2]. A hand plugger, number 20 (Maillefer, Dentsply, Switzerland), was used to compact the material into the perforation site. The postoperative radiograph showed a satisfactory root canal filling and complete perforation obturation with cold ceramic, although a small amount of material was extruded through the perforation site [Figure 2].

The patient was prescribed analgesic medication (Ibuprofen 400 mg) in case of postoperative symptoms. He was reviewed 2 weeks after the treatment; after confirming a lack of clinical signs and symptoms, the patient was referred back to his general dentist for the final restoration. At the 19-month follow-up appointment, there were no clinical signs or symptoms, and the radiograph displayed excellent periradicular healing and bone regeneration [Figure 3].



**Figure 2:** Postoperative radiograph (December 2015).



**Figure 3:** Follow-up radiograph (July 2017).

## DISCUSSION

Strip-perforation is an endodontic incident that may happen unexpectedly, and influence the prognosis of the tooth. Strip-perforations are created mostly in curved roots, especially in mandibular mesial roots due to over-instrumentation and excessively tapering preparations.<sup>[18]</sup> This procedural complication will usually lead to a lesion and bone resorption at the perforation site as a result of microbial leakage or incompatible repair material extrusion.<sup>[18]</sup> Over time, the lesion may enlarge, with time and perforation size acting as determinative factors for the dentist in predicting treatment outcomes for the patient.<sup>[3]</sup> In this case, some 2 years had elapsed from the creation of the strip perforation, and so the prognosis was unfavorable as based on the literature. However, the properties of cold ceramic include excellent sealing ability, biocompatibility, nontoxicity, noncarcinogenicity, radiopacity, easy handling, and minimal adverse impact on hard tissue.<sup>[13-17,19]</sup> Hence, as an MTA-like material, cold ceramic was used as both the root filling material and the perforation repair material in this case. Many materials have been used for this purpose but have failed due to a lack of sealing ability or questionable biocompatibility. Therefore, new materials have been suggested for perforation repairs such as MTA, Biodentine and other bio-ceramic materials, because of their better properties and acceptable clinical results.<sup>[6]</sup> Good sealing ability can be achieved by using MTA, but a potential problem is its long setting time that may allow microbial leakage. The initial setting time of 15 min for cold ceramic may therefore improve the prognosis during the first 24 h.<sup>[20]</sup> Furthermore, the

handling of MTA can be challenging and takes time and practice, whereas cold ceramic is easily controlled in such sites.<sup>[20]</sup>

The goal of a perforation repair is to mechanically and biologically seal the communication between the periradicular tissues and the access cavity space, using a biocompatible material that promotes a favorable tissue healing response.<sup>[21]</sup> In the present case, the postoperative radiograph showed that this had been achieved, although there was some extrusion of the material into the tissues. However, cold ceramic has been shown to have minimum adverse effects on hard tissue<sup>[19]</sup> and this was confirmed in this case. Nevertheless, further studies are recommended in this area.

In conclusion, successful perforation repair requires a good coronal seal, bone regeneration, and resolution of signs and symptoms of infection, all of which were attained in this case.

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Nil.

### Conflicts of interest

Dr modaresi is the owner of cold ceramic material. Other researchers have also done studies on this material.

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