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Case Report

Repair of Furcal Perforation Using Light-cured MTA: A Case Report

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Abstract

Furcal perforations pose a critical challenge in endodontics, often impacting the long-term success of the tooth if not addressed effectively. This report outlines the management of a furcal perforation in a 34-year-old female patient using Dentigrate LC, a light-cured mineral trioxide aggregate (MTA). During the endodontic procedure, a furcal perforation was identified and sealed with Dentigrate LC, which provides the benefit of a controlled setting time due to its light-curing properties. The outcome was evaluated clinically and radiographically over a 2-year period, revealing successful perforation sealing with no evidence of infection or periodontal issues. This case demonstrates the potential advantages of light-cured MTA in treating furcal perforations, suggesting it as a viable alternative to traditional materials.

Key words: Endodontic, Iatrogenic furcal perforation, Mineral trioxide aggregate, Root canal treatment

INTRODUCTION

The primary objectives of endodontic therapy are to remove infection, alleviate pain, and preserve the natural tooth by effectively treating the root canal system. As the initial step, the access cavity is crucial in determining the overall success of the root canal procedure.

Iatrogenic errors in the access cavity during endodontic treatment arise from the clinician's actions or techniques, potentially compromising the treatment's success. These mistakes can weaken the tooth's structure, reduce the efficacy of root canal therapy, and negatively impact the tooth's long-term prognosis.

Perforation is a critical iatrogenic error that may occur during access cavity preparation in endodontic procedures. It involves an unintentional breach between the root canal system and the tooth's external surface, creating an opening into the adjacent periodontal tissues.

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Furcal perforation, often an iatrogenic error, can result from a misaligned bur during access opening or while searching for canal orifices on the pulp chamber floor, internal or external root resorption, significant carious lesion, and iatrogenic damages. This causes an inflammatory response in the periodontium, which may lead to the irreversible loss of periodontal attachment in that area. Furcal perforation is one type of procedural error that can occur during endodontic treatments and effect how root canal therapy turns out. Perforations are the second most common cause of endodontic failure, accounting for 9.6% of all unsuccessful cases, according to Ingle's[1] research on endodontic failures.

According to the *AMERICAN ASSOCIATION OF ENDODONTISTS (AAE) GLOSSARY OF ENDODONTIC TERMS (TENTH EDITION)*, perforation is defined as the mechanical or pathologic communication between the root canal system and the external tooth surface.

Apical perforation – A perforation in the apical one-third of the root.

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Furcation perforation – A perforation in the furcal area of the tooth.

Strip perforation – A complete penetration of root canal walls due to excessive lateral tooth structure removal during canal preparation usually occurs in curved roots or roots with surface invaginations.[2]

The survival of perforated teeth is influenced by several factors, including

- The size of the perforation
- The timing of its repair
- The location and depth of the perforation
- The presence of periodontal disease and the vitality of the pulp before endodontic treatment.

The management of furcal perforations can be either surgical or non-surgical, depending on their specific characteristics. In general, the prognosis is very good if the perforation is accurately diagnosed and repaired with a material that ensures proper sealing and biocompatibility.[3] The prognosis is more dependent on the location and magnitude of the lesion's contamination. The goal of conservative treatment for furcal perforation is to promptly seal the defect.[4]

To repair furcation perforations, a variety of materials have been utilized over the years, including amalgam, tricalcium phosphate, hydroxyapatite, gutta-percha, calcium hydroxide, zinc oxide-eugenol-based cement (such as intermediate restorative material and super-ethoxy benzoic acid), glass ionomer cement (GIC), composite resins, resin-glass ionomer hybrids, demineralized freeze-dried bone, and mineral trioxide aggregate (MTA), and bio dentine.[5]

MTA is often considered ideal for perforation repair due to its:

- Effective sealing properties
- Biocompatibility
- Bactericidal activity
- Radiopacity
- Its ability to set in the presence of blood or tissue fluids.

These attributes make MTA highly suitable for treating root perforations, as it aids in regenerating periodontal attachment and promoting osteogenesis and cementogenesis.[3]

There are few reports on the repair of furcal perforation with MTA. Arens and Torabinejad[6] reported that two cases are described in which MTA was used to repair furcation perforation successfully. Pace *et al*.[7] had done clinical and radiographic follow-ups at 6 months, 1 year, 2 years, and 5 years and indicated a successful outcome of sealing perforations in nine out of ten teeth.

Through a long-term follow-up, the purpose of the present case is to present a successful treatment of iatrogenic furcal perforation of a permanent mandibular first molar using MTA.

CASE REPORT

A 34-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, Kalka Dental College, Meerut, with the chief complaint of pain in her lower right back tooth region for 3 months and swelling in the lower right back tooth region for 10 days.

The pain was dull and continuous in nature, and the pain became worse during mastication and applying pressure to the affected tooth, which relieves on medications.

On oral examination, there was temporary restoration present with relation to 46, tooth was tender on percussion and painful on palpation also there was localized swelling, periodontal pockets, and gum inflammation around the surrounding tooth.

Upon dental history, the patient revealed that she had undergone endodontic treatment 3 months back in a private clinic.

On radiographic examination, it was seen that there was radiolucency in the furcal region [Figure 1a] and the presence of periapical radiolucency with relation to 46 [Figure 1b] subjective of irreversible pulpitis associated with periapical periodontitis and periapical abscess with furcation perforation involvement with relation to 46.

The treatment advised was pulpectomy followed by non-surgical repair of perforation using MTA and permanent composite restoration.

The patient was informed about the condition, and associated risks, alternatives, and benefits were discussed.

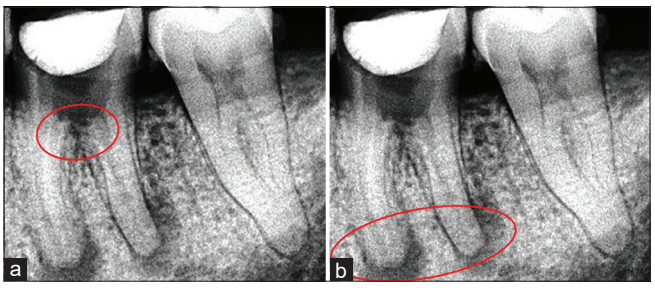

Figure 1: Pre-operative radiograph revealing (a) perforation (b) the presence of periapical radiolucency with relation to 36

The patient signed the written consent form, acknowledging their understanding of the procedures and agreeing to proceed with the treatment.

2% local anesthesia with adrenaline (1:80,000 (Lignox) was administered. The procedure was carried out after the rubber dam placement temporary restoration was removed, the perforation site was visibly noticeable, and bleeding was observed in the furcation area. Hemorrhage control was achieved by applying a cotton pellet soaked in 2.5% sodium hypochlorite for 30 s.

The canal was negotiated using 10 no K file, and working length was determined using 15 no K file measured by Root Zx II apex locator and confirmed by radiograph [Figure 2].

Root canal shaping and cleaning were done up to the F2 instrument (25/0.06) and irrigated with 2.5% sodium hypochlorite solution between each instrument. The final irrigation was carried out using 17% ethylenediaminetetraacetic acid for 3 min, followed by a rinse with 2.5% sodium hypochlorite and finally 0.9% saline. Afterward, the canals were aspirated and dried with absorbent paper points, and obturation was completed using F2 gutta-percha and an epoxy resin-based sealer.

MTA was chosen as the preferred material for repairing the perforation, that is, Dentigrate LC [Figure 3].

The MTA was placed at the perforation site and light-cured using the Unicorn DenMart O-light. The hardness of the MTA was gently tested with an operator explorer.

A GIC base was made over the MTA plug followed by composite restoration [Figure 4].

The patient was prescribed antibiotics and analgesics and reported that the pain subsided after the procedure, remaining asymptomatic the following day. A follow-up appointment was scheduled for 30 days later and was evaluated by radiograph [Figure 5].

After 1 month, with no signs of inflammation or pain, the crown preparation was completed and the crown was delivered with relation to 36.

Figure 3: Mineral trioxide aggregate

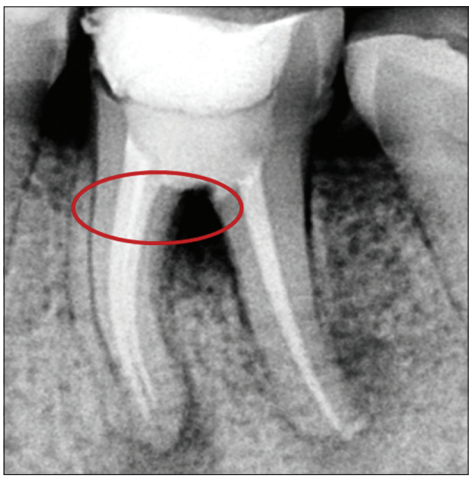

Figure 4: Mineral trioxide aggregate plug made followed by glass ionomer cement base and composite restoration

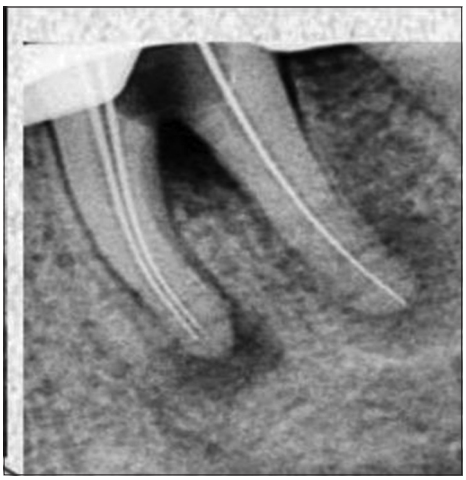

Figure 2: Working length determination

Figure 5: 1-month follow-up

The patient was scheduled for follow-up visits at intervals of 3 months, 6 months, 1 year, and 2 years.

After 3 months, periapical healing was seen [Figure 6]. Furcation healing became noticeable 6 months after the treatment [Figure 7]. Osseous repair in the furcal area was observed after 1-year follow-up [Figure 8]. Radiographic follow-up at 2 years [Figure 9] showed that the furcal and periapical radiolucency had disappeared.

DISCUSSION

Furcal perforations present a complex challenge in endodontics, often jeopardizing the tooth's long-term prognosis. In the past years, amalgam, composite resin, and GICs have been used for sealing furcal perforation. However, studies have shown that MTA is apparently superior to these materials with respect to marginal adaptation,[8-10] bacterial leakage,[8-11] and cytotoxicity.[12] Main *et al*.[13] concluded that MTA provides an effective seal of root perforations and can be considered a potential repair material enhancing the prognosis of perforated teeth that would otherwise be compromised.

MTA is composed of 75% Portland cement, 20% bismuth oxide, and 5% dehydrated calcium sulfate. The dominant compounds in both types of gray and white MTA are calcium oxide, silica, and bismuth. Although both the gray and the white versions of MTA perform similarly in terms of furcal sealing and antimicrobial effectiveness,[14] the gray version has a more favorable behavior *in vitro* in terms of the development of odontoblasts,[15] whereas the white version is associated with the development of cementoblasts and keratinocytes which is required in furcation repair.[16]

Pitt Ford *et al*. in 1995 stated that MTA has the capacity to produce hard tissue formation. They reported that there is the continuous formation of hard tissue around MTA when it is used as a perforation repair material. MTA has the greater release of calcium in the first 24 h of activation.[17]

Figure 6: 3-month follow-up

Figure 8: 1-year follow-up

Figure 7: 6-month follow-up

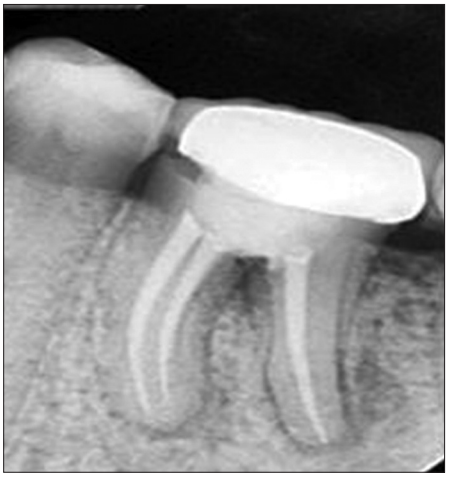

Figure 9: 2-year follow-up

In this case, we used Dentigrate LC, a light-cured MTA, for the repair of a furcal perforation. The clinical efficacy of light-cured MTA in managing furcal perforations is well documented. Nagmode *et al*.,[18] highlight the material's excellent sealing ability and biocompatibility, which are essential for the successful repair of perforations. These properties were evident in our case, where Dentigrate LC effectively sealed the perforation, as confirmed by follow-up clinical and radiographic evaluations.

Compared to traditional MTA, light-cured formulations provide significant benefits. These include improved physical properties such as greater compressive strength and a shorter setting time, both of which can lead to better clinical outcomes. This aligns with our observations, where the rapid setting and ease of handling of light-cured MTA contributed to a more efficient and effective repair process.

Long-term Outcomes and Future Directions

While the immediate results in our case were encouraging, ongoing research is essential to further confirm these benefits and refine best practices for managing endodontic perforations.

CONCLUSION

This case report demonstrates the effective management of irreversible pulpitis associated with apical periodontitis, apical abscess, and furcal perforation using light-cured Dentigrate LC MTA.

The use of Dentigrate LC provided several advantages, including

- Controlled setting time
- Ease of application
- Enhanced sealing properties.

The successful outcome, evidenced by the resolution of symptoms, absence of further infection, and evident healing in radiographic findings, underscores the material's efficacy in handling complex endodontic challenges.

Dentigrate LC's light-curing feature facilitated precise control over the setting process, which was critical in managing the perforation and ensuring a durable seal. The positive clinical and radiographic results observed in this case align with current literature supporting the use of light-cured MTA for such indications.

Overall, Dentigrate LC MTA proves to be a valuable tool in endodontic therapy, offering significant benefits in the management of furcal perforations and associated conditions.

Continued use and further studies will help to further validate its effectiveness and refine its application in clinical practice.

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