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Case Report

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A 2-Year Follow-Up of Trauma-Induced Open Apex Mandibular Central Teeth: A Case Report

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ABSTRACT

This case report presents the clinical and radiographic follow-up of a 10-year-old male patient diagnosed with post-traumatic necrotic pulp and open apex-associated apical periodontitis. The patient presented to our clinic complaining of pain and swelling following dental trauma approximately 3 months ago. Clinical and radiographic evaluation revealed open apices, periapical radiolucent lesions, and loss of pulpal vitality in permanent incisors no 31 and 41.

As part of the treatment protocol, both teeth underwent apexification using a non-surgical apical barrier technique using mineral trioxide aggregate (MTA). Initial disinfection was achieved with calcium hydroxide medicament, followed by the creation of a 4-mm-thick apical barrier with MTA. One week later, after confirming the hardening of the MTA, the remaining canal space was filled using the lateral condensation method, and the restoration was completed.

No symptoms were observed at the patient's 3, 6, 12, and 24-month follow-ups. Radiographs showed; the apical lesions were observed to have regressed and periapical healing was achieved. This case demonstrates the long-term success of the apical barrier technique using MTA in necrotic permanent teeth with open apices.

Keywords: Open apices, dental trauma, MTA, apical barrier, periapical healing

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INTRODUCTION

Traumatic dental injuries are common, particularly in childhood and adolescence, and can affect the pulp and periapical tissues of the tooth. Such trauma can lead to complications such as pulp necrosis and open apices, especially in permanent teeth with incomplete root development [1]. Treatment of teeth with open apices is a more complex and demanding process compared to conventional endodontic methods [2].

Periapical lesions resulting from trauma occur when infection spreads to the periradicular tissues and, if left untreated, can lead to arrested root development, chronic infections, and tooth loss. Recent advances in biocompatible materials and regenerative endodontic approaches have increased treatment success in such cases [3]. In particular, the use of materials such as Mineral Trioxide Aggregate (MTA) facilitates the creation of an apical barrier in teeth with open apices and positively affects the prognosis [4]. In this case report, the 2-year clinical and radiographic follow-up of two mandibular central teeth with open apices that developed periapical lesions as a result of trauma and incomplete root development is presented; the applied treatment protocol and long-term results are evaluated.

CASE REPORT

A 10-year-old male patient presented to our clinic with complaints of pain and swelling in the lower anterior region approximately 3 months after experiencing dental trauma. From the medical history, it was learned that the patient had not received any medical intervention following the trauma. The patient had no known systemic diseases.

Clinical examination revealed percussion and palpation sensitivity in teeth numbered 31 and 41. Both teeth retained their physiological color and exhibited grade 2 mobility. No response was obtained from thermal and electric pulp tests. (**Figure 1**)

Figure 1. *Condition before the start of treatment*

Radiographic examination revealed that root development of teeth 31 and 41 was incomplete, with open apices and radiolucent areas observed around the apices of both teeth. These findings were consistent with necrotic pulp and chronic apical periodontitis.

A non-surgical apical barrier technique using Mineral Trioxide Aggregate (MTA) was planned for both teeth. In the first session, a semi-rigid splint (0.4 mm hollow round stainless steel wire) was applied to stabilize the traumatized teeth, and it was retained for two weeks. Following stabilization, a passive irrigation protocol was performed. Each canal was irrigated with 10 mL of 2.5% sodium hypochlorite (NaOCl) for 5 minutes, followed by 5 mL of sterile saline solution. Final irrigation was performed using 5 mL of 17% EDTA for 1 minute to remove the smear layer. The working length was determined using an apex locator and confirmed radiographically. Root canal instrumentation was performed with a hybrid technique using stainless steel hand K-files up to size #60, avoiding excessive mechanical preparation due to the thin dentinal walls. After drying the canals with sterile paper points, calcium hydroxide paste was placed as an interappointment intracanal medicament and sealed with a temporary restorative material. The medicament was left in place for 2 weeks before the placement of the MTA apical barrier.

Figure 2. *Following the splint application, the first session of root canal treatment was performed.*

After two weeks, it was observed that the symptoms had subsided and the swelling had resolved. The canals were irrigated and dried using 2.5% NaOCl. A 4 mm-thick layer of MTA (Angelus Soluções Odontológicas, Londrina, Brazil) was placed in the apical region, a moist cotton pellet was placed over it, and the cavity was sealed with a temporary filling material (Cavitimi, Procal, Germany).

After one week, hardening of the MTA was confirmed, and the remaining canal space was filled using the lateral condensation technique with AH Plus root canal sealer

(Dentsply De Trey, Konstanz, Germany) and gutta-percha (Gapadent, Allerhausen, Germany). The coronal portion was restored with flowable composite resin (3M™ Filtek™ Z250 Universal, USA). (Figures 3–4)

Figure 3. *6-month follow-up after MTA application*

Figure 4. *2-year follow-up after treatment*

Follow-up appointments were scheduled at the 3rd, 6th, 12th, and 24th months. During clinical follow-ups, no pain, swelling, or sensitivity was observed. Radiographic evaluation showed significant regression of the apical lesions and healing of the periapical tissues. The teeth remain functional and asymptomatic.

DISCUSSION

The treatment of necrotic permanent teeth with open apices poses a significant endodontic challenge [5]. Traditional apexification methods using long-term calcium hydroxide can weaken the dentin structure, increasing the risk of root fractures [6]. In this case, the use of mineral trioxide aggregate (MTA) for apical barrier formation resulted in faster apical closure and successful clinical and radiographic outcomes.

MTA is one of the preferred materials in the treatment of teeth with open apices due to its biocompatibility, excellent sealing ability, and capacity to promote hard tissue formation [7]. In our case, MTA effectively formed an apical barrier, supported tissue healing, and led to the complete resolution of the lesions.

Several studies in the literature report high success rates for one-step or short-term apexification procedures using MTA [8]. Especially in necrotic immature permanent teeth due to trauma, minimally invasive approaches have been shown to yield favorable outcomes [9]. In this case report, the patient's asymptomatic status, healing of apical lesions, and continued function after a two-year follow-up demonstrate the effectiveness of the treatment method. However, achieving proper technique and adequate isolation during MTA placement is crucial for treatment success.

This case report presents a successful outcome following the management of traumatic injuries in two mandibular central incisors with open apices; however, it is subject to several limitations. As a single case report, the findings cannot be generalized to a wider population. Additionally, the absence of histological analysis limits the evaluation of true tissue regeneration. The treatment success was evaluated only through clinical and radiographic follow-up, which may not fully reflect the biological healing process. Longer follow-up periods and additional cases are needed to support the reproducibility and reliability of the treatment approach described.

CONCLUSION

In cases of necrotic pulp and open apex resulting from trauma, it is possible to maintain the tooth functionally and asymptomatically in the oral cavity with a successful treatment protocol. In this case, the non-surgical apical barrier technique using MTA demonstrated long-term regression of apical lesions and healing of periapical tissues. Due to its biocompatibility, sealing ability, and moisture tolerance during setting, MTA is an effective material for the treatment of teeth with open apices. With proper case selection, adequate disinfection, and controlled application, this method provides a reliable treatment option for managing pulp necrosis and apical pathologies in pediatric patients.

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper and that they have approved the final version.

Conflicts of Interest

There is no conflict of interest for the publication of this article.

Disclosure

The authors have reported no conflicts of interest in preparing and publishing this article.

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