CASE REPORT

Management of Immature Apices in a Taurodontic Mandibular Second Permanent Molar: A Case Report

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Abstract

Aim: The aim of this case report is to document the successful apexification of a taurodontic, non-vital permanent mandibular second molar in a 13-year-old patient, utilizing calcium hydroxide (CaOH) as intracanal medication.

Background: Immature taurodontic teeth with necrotic pulp present a significant challenge for conventional endodontic therapy. These cases require specialized treatment approaches to promote root development and closure of the apical foramen, essential for the long-term preservation of the affected tooth.

Case description: A 13-year-old patient presented with a taurodontic, necrotic permanent mandibular second molar associated with pain. Following access opening and thorough cleaning and shaping of the canals, CaOH was applied as an intracanal medicament to induce apical root closure in both mesial and distal canals. Over a period of 10 months, successful root closure was observed, and the tooth was subsequently obturated.

Conclusion: This case report highlights the successful apexification of a taurodontic, necrotic permanent molar using calcium hydroxide, with positive clinical and radiographic outcomes observed at a 1-year follow-up.

Keywords: Apexification, Calcium hydroxide, Case report, Immature root apices, Open apex, Root canal anatomy, Root canal therapy, Taurodontism.

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Introduction

The conventional endodontic treatment of immature necrotic teeth is challenged by interrupted root canal development and the absence of apical closure. Taurodontism complicates the disinfection of the root canal system, and the open apex increases the risk of irrigation and disinfectant materials being extruded into the apical region. Historically, teeth that lacked pulp and had open apices were treated using custom-made gutta percha often combined with apical surgery and retrograde filling techniques. The thin dentinal walls and poor crown-root ratio of immature teeth frequently led to short, fragile teeth with an uncertain prognosis.[1] In such scenarios, apexification became the standard treatment method. Initial evidence indicated that calcium hydroxide (CaOH) had osteoinductive properties, which paved the way for apexification in non-vital permanent incisors.[2,3] Apical root closure and bone healing were documented after placing CaOH inside the canal in 50 out of 55 maxillary incisors with immature roots.[4] Histological studies identified the calcified material forming over the apical foramen as either cementoid or osteoid.[5,6] Additionally, revascularization of necrotic immature permanent teeth can be achieved by inducing a blood clot from the periapical tissues into the canal space.[7] Some studies report success using a mixture of CaOH and saline paste for apexification procedures.[8–10] Apexification procedures are frequently carried out on necrotic immature permanent anterior teeth, but they are less commonly reported in posterior permanent teeth. Few case reports exist; however, this case was selected for its unique presentation of taurodontism with an open apex molar.

This article discusses a case where CaOH was effectively used to encourage root end growth and apical closure in a permanent molar tooth.

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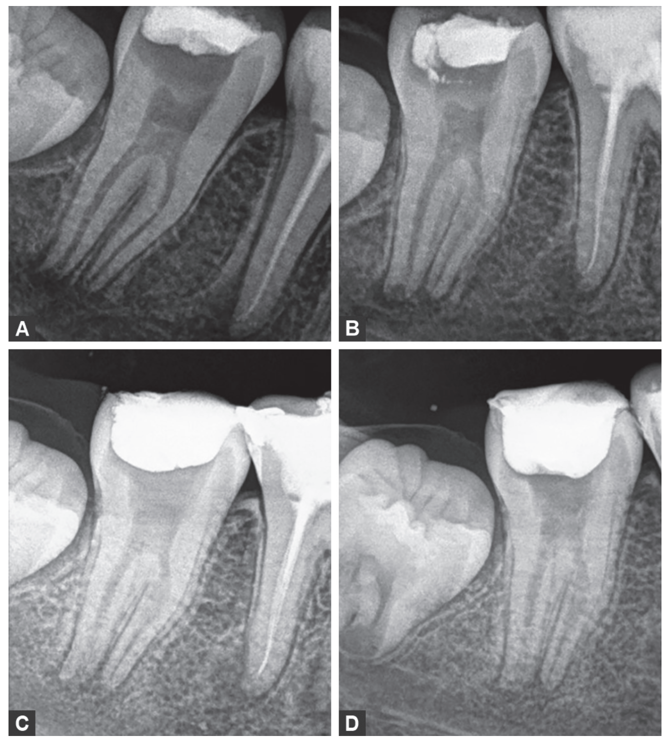
Case Description

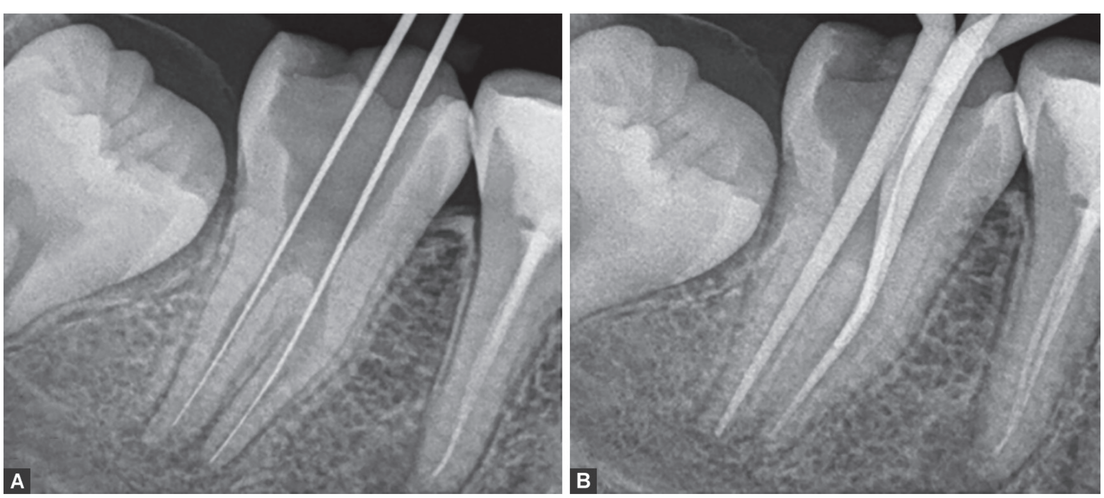
A 13-year-old female patient presented to the department with a chief concern of pain in the lower right back tooth area for the past 3 months. Upon clinical examination, a significant carious lesion was noted in the second permanent molar on the lower right side (tooth number 47), which elicited tenderness upon percussion. Radiographic analysis revealed a periapical radiolucency associated with incompletely formed root apices on both the mesial and distal sides of tooth #47, along with a persistent, dull, throbbing pain (Fig. 1). The pulp chamber in tooth #47 is enlarged compared with the adjacent tooth #46. According to Shifman and Chanannel's[11] study, the mandibular second molar is the most commonly affected tooth by taurodontism. They state that if the distance between the cementoenamel junction and the floor of the pulp chamber is ≥2.5 mm, and the ratio of the distance from the lowest point at the occlusal end of the pulp chamber to the highest point at the apical end of the chamber divided by the distance from the CEJ to the apex is 0.2 or greater, it indicates taurodontism. Following comprehensive clinical and radiographic assessments, a diagnosis of asymptomatic irreversible pulpitis with symptomatic apical periodontitis in relation to #47 was established. Consequently, an apexification procedure was recommended for tooth #47.

The tooth was anesthetized with 2% lidocaine containing 1:80,000 epinephrine, followed by isolation and access opening. Necrotic pulpal tissue was carefully extracted using a barbed broach. After determining the working length, meticulous biomechanical preparation was performed till K#80 file for circumferential filing. This was achieved with minimal instrumentation and without employing a rotary system. Canal disinfection was performed through extensive irrigation with saline and 3% sodium hypochlorite (NaOCl), with the process enhanced by a sonic activator (Dentsply Tulsa Dental Specialties, Tulsa, OK). The canal was dried with sterile paper points and filled with a CaOH paste mixed with saline. The occlusal surface was temporarily sealed with Cavit™ (3M ESPE, St. Paul, MN, USA). A postoperative radiograph was immediately taken to assess the distribution and extent of the materials in the root canals. The progress of apexification was monitored at intervals of 1, 3, 6, 9, and 10 months (Fig. 2). The reduction in the size of the apical foramen or formation of the apical barrier was confirmed using gutta percha cones and an apex locator. After 10 months, there was a noticeable increase in root length, prompting the initiation of conventional root canal treatment (Fig. 3). The canal was obturated with gutta percha and AH Plus root canal sealer (Dentsply Sirona) Subsequently, the tooth was restored using

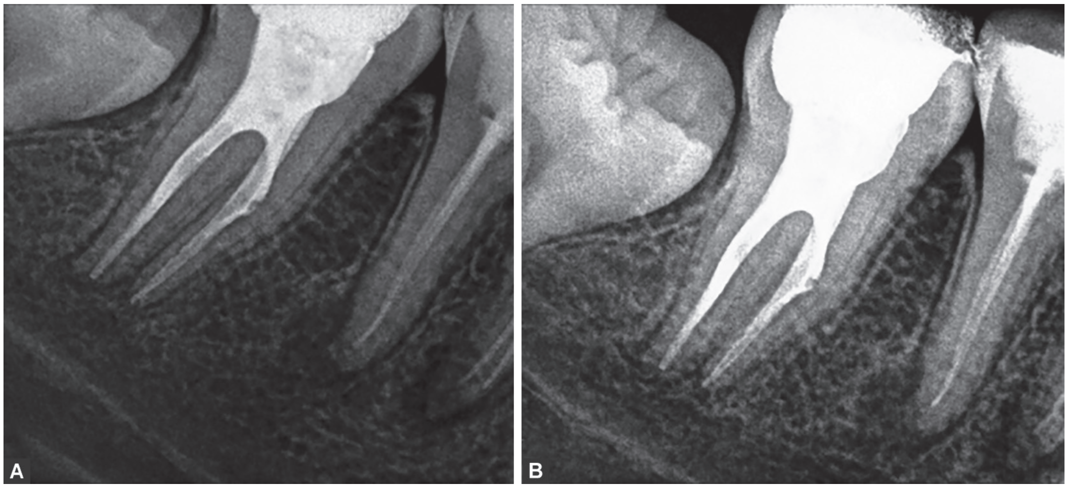
Fig. 1: Preoperative radiograph of #47



Figs 2A to D: Radiographs of #47 after placing CaOH at intervals of (A) 1 month; (B) 3 months; (C) 6 months; (D) 9 months



Figs 3A and B: Radiographs of #47 showing (A) Working length determination; (B) With master cone



Figs 4A and B: Radiographs of #47 (A) Immediately after obturation; (B) 18th month review

composite restorative material. We continued follow-up of the patient after obturation up to 18 months. We witnessed evidence of apical closure radiographically and the patient was clinically asymptomatic after the initial appointment throughout and after the completion of treatment. Crown placement was postponed due to the patient's young age, allowing time for her jaw growth to complete and for her to reach a stable physiologic occlusion.

Discussion

Apexification aims to stimulate the formation of a calcified barrier in the root of a tooth with an open apex, or to encourage further apical development in teeth with incomplete roots and necrotic pulp (American Association of Endodontics, 2003).[2] This barrier, usually made up of osteocementum or similar bone-like tissue, is created by thoroughly cleaning and shaping the root canal, removing all necrotic tissue, and sealing the tooth with appropriate materials to prevent bacterial contamination.[12] The primary goal of apexification is to create an apical stop for compacting obturating materials.[3] Apexification in a taurodontic tooth presents several challenges, including achieving thorough disinfection and effective canal irrigation. To address these issues, we used sonic irrigation with 3% sodium hypochlorite.[14]

Several materials can be used for apexification, such as CaOH, MTA, tricalcium phosphate, dentin chips, calcium phosphate ceramics, hydroxyapatite.[1] Kaiser[2] first introduced CaOH in apexification mixed with CMCP which was later popularized by Frank.[13] And CaOH is the most common agent for using apexification. In comparison to the MTA, CaOH has a dual action. that is, disinfection of the canal and continued apical closure or decrease in the size of foramen. MTA enables the formation of artificial apical stop/barrier that does not increase the root length or continued closure it might increase the susceptibility to root fracture.[15]

The apexification procedure typically takes between 6 and 24 months, with material refilling recommended every 3–6 months, although radiographic evidence suggests refilling only when paste resorption occurs.[16] Oktem et al.[17] and Cathro et al.[18] demonstrated the formation of a calcific barrier in teeth treated with apexification within as little as 6–7 months in their case reports. Conversely, Vidal et al.[19] observed barrier formation only after 18 months in their case report. Given the patient's young age and the need for long-term success, we chose apexification with calcium hydroxide, which has the potential to enhance dentin thickness through osteoinduction.

The apical barrier that forms may have a porous or "Swiss cheese" appearance and can take the shape of a cap, bridge, or ingrown wedge composed of cementum, dentin, bone, or osteodentin.[3,15,16] The formation of the matrix and subsequent calcification is influenced by any remaining healthy pulp tissue, the odontoblastic layer, and the reactivation of Hertwig's epithelial root sheath. Bogen and Ricucci[20] reported a 20-year follow-up case study utilizing MTA, indicating that the effectiveness of barrier formation is highly dependent on the technique employed and the extent of pulp necrosis present at the time of treatment.[9]

We evinced progressive closure of the apex from the third month of the treatment, and the creation of an apical barrier by 10th month. In our case, both clinical and radiographic evidence showed successful apexification within a relatively short period of 10 months (Fig. 4). Beyond just forming a barrier, there was also a significant increase in root length in the treated tooth, consistent with findings from other studies. Most documented cases of molar apexification have been completed within 12–13 months, making this case significant for achieving apical closure more quickly.

Limitations

Apexification often involves prolonged treatment time with multiple appointments, which can lead to extended patient discomfort and increase the risk of root fractures in immature teeth with thin dentinal walls.

Conclusion

This case report illustrates the positive clinical and radiographic outcomes associated with the utilization of CaOH in facilitating sustained root development and encouraging the closure of root ends in immature, necrotic permanent teeth of young patients. The satisfactory outcome of the case report on the taurodontic mandibular molar can be attributed to appropriate diagnosis, case selection, treatment planning, and apexification following the correct protocol.

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