

Case Report

Apexification treatment on tooth with a history of trauma: A case reportDevi Eka Juniarti,¹ Tiara Anandita², Cindy Grace Tania², Eric Priyo Prasetyo¹, Tamara Yuanita¹¹Department of Conservative Dentistry, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia²Undergraduate Student, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia**ABSTRACT**

Background: Traumatic dental injuries to the teeth may result in pulpal and periapical disease. Most dental traumas occur in the 7-10-year-old age group with incomplete apical root development. Apexification is the procedure to close the apex using bioactive material to create an apical plug. MTA can be used as a material of choice to treat open apex. **Purpose:** To perform an apexification of open apex with MTA apical plug. **Case:** A 30-year-old female patient with a chief complaint to fix her missing anterior filling and blackened tooth. The tooth had a history of trauma when the patient was 7 years old. One year ago, the tooth had intermittent pain so the tooth was treated and filled by another dentist. **Case Management:** Access opening is performed and apical gauging is determined. Then, working length was established. Debridement was done with H-file #80. Irrigation sequence with NaOCl 1,5% - Aquadest – EDTA 17% - aquadest. Ca(OH)₂ dressing was given and temporary restoration was placed. On the second visit, temporary restoration was removed, followed by a root canal filled with MTA 3 mm from the apex using MAP carrier then confirmed with a radiograph. **Conclusion:** Trauma that occurs during tooth formation may cause an open apex that is treatable using an MTA plug.

Keywords: Apexification, Mineral Trioxide Aggregate, apical plug, open apex

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INTRODUCTION

Root canal treatment is a procedure designed to eliminate all infected or dead pulp tissue from within the root canal of a tooth, aiming to prevent further infections.¹ Dental traumatic injuries are most common in youngsters aged 7 to 12 years. These injuries may cause pulpal necrosis, which stops root growth and results in an immature root apex.² In teeth with inadequate root growth caused by trauma, caries, or other pulpal pathosis, the lack of natural constriction at the end of the root canal complicates filling material control.³

Dental trauma is a leading cause of anterior tooth fracture and pulp vitality loss in children.⁴ Treatment of fractured teeth is determined by various aspects, including the level of tooth structural loss, pulp viability, the presence of an immature apex, and the patient's aesthetic concerns.⁴ Trauma to teeth before root completion in young children causes irreparable pulp injury, which leads to pulpal necrosis and inadequate root growth.⁴

Apexification is a nonsurgical approach for forming a calcific barrier at the open root apex of nonvital teeth.⁵ The primary goal of doing an apexification operation is to create an apical barrier against which the obturation material can be condensed without overextending into the periradicular tissue.⁶ The apexification surgery permits patients to retain

traumatic teeth that would otherwise be extracted. It allows the tooth to be retained in the arch for an extended period of time.⁶

CASE

A 30-year-old female came into Universitas Airlangga Dental Hospital with the main complaint being her front maxillary tooth had lost its cavity filling and had darkened. The patient has the desire to restore said tooth. It is found that the patient has no systemic disease or allergy. However, the patient has a history of falling accidents at the age of seven resulting in a broken tooth that has been repaired. A year ago, the patient suffered from swelling at the corresponding region with pain that disappears and arises.

Intra-orally, there is a composite filling on tooth 11 that is visible through radiographic imaging (Figure 1). The percussion test, bite test, vitality test, thermal test, and cavity test upon that tooth have all resulted in negative. The needle test also showed a negative result, reaching 20 mm insertion. The pulp is diagnosed to have undergone previously initiated therapy alongside an open apex. The apical of the tooth is diagnosed to have apical periodontitis surrounding tooth 11. Extra-orally, the darkened tooth 11

is visible, with the overjet and overbite of the patient still considered normal.

CASE MANAGEMENT

The patient have a good prognosis, with dental tissues enough for restoration to be done. A suitable treatment plan for this case consists of an endodontic treatment for tooth 11 with a root canal and MTA as its apical plug. It is also befitting to have fiber posts and crown as its permanent restoration. The restoration material is planned to be made with lithium disilicate. Upon the endodontic management of this case, the treatment is comprised of 4 main visits.

The first visit started with dental health education and patient communication, information, and education. Informed consent was done beforehand. All of the visits started with a 1% povidone-iodine gargle for 30 seconds. A rubber dam was placed, and an access opening was done (Figure 2A). For apical gouging, K files were done up to #80 (Figure 2B). The working length was then measured using K-file Ni-Ti number #80 using an apex locator that was later confirmed using radiographic imaging to show a 10mm

working length (Figure 3A). Debridement was done using H-file #80 with a circumferential filing motion technique. Sequence irrigation was done using 1.5% NaOCL-aquadest and 17% EDTA-aquadest using 1 side-vent 30G needle (Figure 2C). The root canal is dried using endo suction and a sterile paper point. Lastly, root canal dressing was done using Ca(OH)₂ and the cavity was closed using a temporary filler.

The second visit first started with an evaluation of the cavity following the last treatment. It is reported that there were no extra-oral anomalies. Intra-oral examination showed negative results for percussion and bite test, the temporary filling is still attached, and the gingiva is perceived to be normal. Rubber dam placement is followed with the removal of temporary filling. The remaining Ca(OH)₂ paste is dried and rinsed, followed by sequence irrigation using 1.5% NaOCL-aquadest and 17% EDTA-aquadest using 1 side-vent 30G needle. After that, the root canal is dried using endo suction and a sterile paper point. The MTA powder & liquid were prepared according to the factory instruction, then filled 3 mm away from the apical using a MAP carrier and condensed using a plugger (Figure 3B). The MTA filling is then confirmed using



Figure 1. Pre-operative photograph (A), pre-operative radiographic imaging.



Figure 2. Creating an access opening (A), apical gauging (B), sequence irrigation (C).



Figure 3. Measurement of working length (A), Insertion of MTA filling (B), MTA filling through radiographic imaging (C).

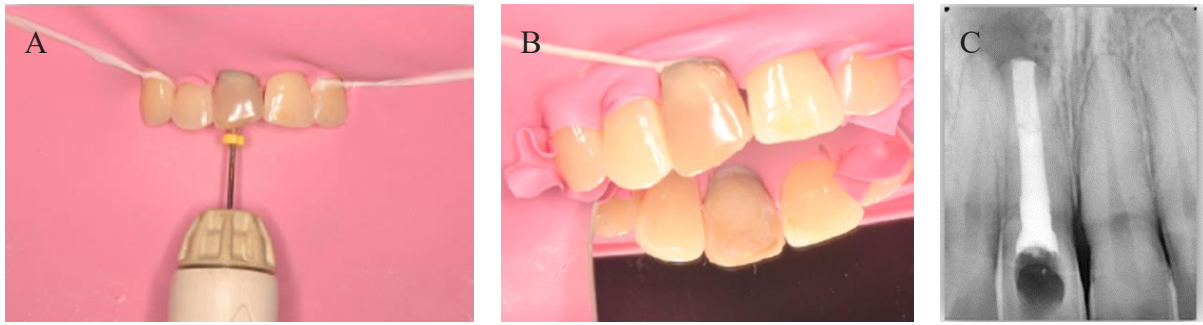


Figure 4. Tooth preparation (A), Tooth 11 after temporary filling (B), Tooth 11 post-operative radiographic imaging (C).

radiographic imaging (Figure 3C). The cavity is filled with damp cotton and closed with a temporary filling. By the third visit, the cavity was evaluated; the bite test and percussion test were negative. Then, the rest of the root canal was filled with backfilled gutta percha. Radiography imaging was taken periapically to confirm the obturation.

By the fourth visit, the patient no longer holds any complaint, with no abnormality extra-orally and negative bite and percussion test results. The temporary filling is found intact with normal surrounding gingiva. The temporary filling is disassembled, followed by filling the root canal with resin-based paste using a backfilled technique. The root canal filling is confirmed through radiographic imaging while the cavity is closed using temporary filling (Figure 4).

DISCUSSION

Hertwig's epithelial root sheet (HERS), holds responsibility for the teeth's radicular development.⁷ This dual-layer apical sheath is positioned between the dental papilla and follicle.⁷ Some of the HERS functions include inducing and regulating root formation, such as the root's shape, size, and number.⁸ The HERS works on the direction of the apex causing differentiation within the dentinogenesis and odontoblasts.⁷ Damage during the HERS work would also mean damage to the process of dentinogenesis.

In this case, the patient had experienced dental trauma on tooth 11 over 20 years ago, when the patient was 7. The radiographic imaging shows tooth 11 having an open apical foramen. Trauma causes the HERS mechanism to be disturbed causing the end of dentinogenesis. This means some of the tooth anatomy is left unfinished, which is the root apical in this case, showing an open apex.⁷ An open apex refers to the periapical pathologic condition where the apex of the canal is wider than the apical, calling for an apexification on a non-vital pulp.³

The indication of apexification is teeth that hold signs of irreversible pulpitis, necrosis within the pulp, or the presence of pulpal periapical pathology.³ Apexification should never be done on vital pulp, or one with very short root and compromised periodontium.³ Upon the treatment of the patient's open apex, Mineral Trioxide Aggregate (MTA) was chosen for apexification due to its compatibility

with treating an incomplete root canal with necrotic pulp while taking as minimal time as possible.^{9,10} The MTA holds amazing biocompatibility when filling any voids in the form of apatite-like formation.⁹ On top of MTA, the more traditional Ca(OH)₂ paste is also used to promote the formation of a calcification layer within the root apex.¹¹

Swelling on a previously treated tooth is not uncommon. A previously treated tooth might have swelling flare-up in the form of pain or swelling.¹² This was possible due to the infiltration of microbe within the cavity, either due to damage on restoration, a fracture within the tooth, or an open dressing.¹² This condition could also be treated using Ca(OH)₂ paste that works by dissociating into ions of hydroxide and calcium, disbanding the endotoxins of bacteria through its chemical bond, and turning them into harmless fragments.¹²

When the inflicted trauma is found to be irreversible, the periodontal ligament that is located on the apex is damaged. This includes the HERS and neurovascular supply, causing the necrosis of the pulp and tissue.⁹ On trauma-caused pulpal necrosis, vascularization on the tooth could be disabled, thus, causing discoloration.¹³ On tooth 11, the necrosis of the pulp is represented with a darkened color.

In conclusion, trauma done during tooth development may cause damage to the HERS, the process of dentinogenesis and cementogenesis causing a tooth with an open apex. When doing an apexification on a tooth with an open apex, an MTA with excellent biocompatibility and apatite-like formation, and Ca(OH)₂ paste that is known for their calcification and antibacterial behavior suitable on treating open apex on a traumatized tooth with a previous flare-up.

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