Apexification with Mineral Trioxide Aggregate and Restoration using Fabricated Post : A Case Report

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Abstract

Trauma to non-vital immature permanent teeth with exposed apex is common and involves approximately 30% of the pediatric population. Mineral trioxide aggregate (MTA) is the best choice for apexification for apical barrier formation and healing in immature teeth.

To report the success of apical closure using MTA on a non-vital permanent incisor with an apical open due to trauma.

An 18-year-old female patient with complained of broken and discolored upper right front teeth. Trauma incident since 6 years ago due to falling from a bicycle. On clinical examination, non vital central incisors maxillary teeth Class IV Ellis fracture with an open apex and discoloration due to trauma. Periapical radiographs showed apical remain open with a large root canal and periapical radiolucency.

Central incisors maxillary teeth had pulp necrosis with exposed apex were treated with apexification using MTA, then restoration with Fiber posts and all porcelain crowns.

The treatment results showed that apexification with MTA could shortened the visit time by forming an apical barrier that stimulate healing and could be directly followed by the final restoration.

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Introduction

Trauma to immature anterior teeth can cause pulp necrosis of the tooth so apical maturation and normal tooth thickness cannot be obtained. An open apex can be treated by apexification treatment.[1-2] Apexification is a method of inducing apical development of non-vital immature teeth, with the formation of osteocementum or other bone-like tissue aimed at inducing closure of the apical third of the root canal or the formation of an "apical calcific barrier" at the apex so that obturation can be performed normally.[1-3] Calcific barrier aims to prevent the extrusion of cement and gutta percha to the periapical direction during obturation. A major problem in apexification treatment is the difficulty of achieving good apical closure.[4] The purpose of apexification is to achieve apex closure through the formation of a calcified barrier at the tip of the apex so that obturation of the root canal can be performed properly and to ensure successful apexification, the root canal must be free of infection. Because of its ability to stimulate the hard tissue around the apex, as an apical calcific barrier.[2-3]

Weaknesses in the apexification process using Calcium Hydroxide that it takes several visits to form the apical calcific barrier, sometimes reaching 5 to 54 months and a lot of radiation exposure from periapical radiolucency. Replacement of calcium hydroxide paste can be done every 3 months. In addition, there can be susceptibility to root and crown fracture during treatment due to the brittle structure of the hard tooth tissue with thin root canal walls.[1,6]

So as the progress of science and technology in dentistry makes mineral trioxide aggregate (MTA) the right alternative material besides calcium hydroxide. With the advantages of its properties, which is as an apical plug to fill the apical end without waiting for the formation of the apical calcific barrier.[5,7] MTA powder consisting of hydrophilic fine particles which main components are tricalcium silicate, tricalcium aluminate, tricalcium oxide, silicate oxide and are

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strong bases with an initial pH of 10.2 and will become 12.5 which hardens in 3-4 hours after mixing.

The power of MTA to pressure will increase for up to 21 days in a humid environment. MTA can create an anti-bacterial, anti-fungal atmosphere in a humid environment and has the ability to form hydroxyapatite on the surface and create a biologic seal. The use of MTA for apexification results is more certain and shortens the treatment time with more satisfactory results.[1,2,4] The purpose of this case report is to describe cases of apexification using MTA in central upper incisors.

Case Report

A 16-year-old female patient came to the Department Conservative Dentistry of the Nala Husada Dental Hospital, Faculty of Dentistry, Hang Tuah University, Surabaya, on her own volition with the complaint that her right upper anterior tooth was broken due to a fall. The upper left front tooth was broken due to a fall five years ago, it was never treated. There were no complaints of pain, the patient wanted her teeth to be treated.

Objective examination revealed that the left central incisor was fractured in the half crown and the gingiva around the tooth appeared normal (Figure 1A). The vitality tests performed were EPT test, thermal test, cavity test, K-File needle test did not react and vitality was negative. The radiographic examination showed an open apical foramen and a diffusely circumscribed periapical radiolucency (Figure 1B). The clinical diagnosis was pulp necrosis and chronic periapical abscess. The treatment plan included apexification with MTA material with a Thermoplastic filling technique (backfill) then post crown restoration with All Porcelain restoration material. The prognosis in this case was good.

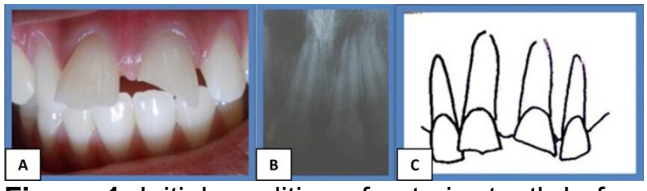

Figure 1. Initial condition of anterior teeth before treatment. Initial clinical photo shows fracture anterior crown (A), radiographic examination showed radiolucent at the periapical (B)

On the first day of visit a diagnosis was made and informed consent was filled out. During the treatment, the working area was isolated and the cavity entrance was performed using an endo access bur, after which the average working length was determined, which was 21 mm and confirmed by radiography. Then debridement and irrigation with sodium hypochlorite 2.5% and sterile distilled water were carried out and then dried using paper points. After that, sterilized with calcium hydroxide, cotton and temporary filling.

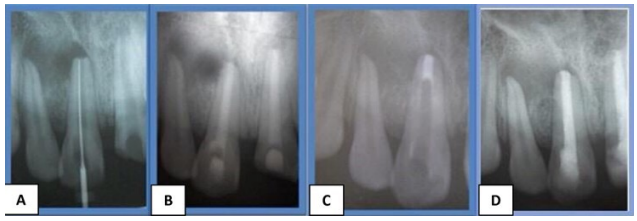

Figure 2. Diagnostic wire photo (A), sterilization with calcium hydroxide (B), MTA material application (C), obturation (D)

Control on the second visit. At this visit the patient had no complaints, no extra oral abnormalities, negative percussion and normal gingiva. Then the root canal was irrigated with sodium hypochlorite 2.5% and sterile distilled water, then dried with a sterile paper point, then applied the MTA material that had been stirred according to the manufacturer's instructions on the apical third covered with moist cotton and temporarily filled (Figure 2C).

A week later on the third visit. The patient felt no complaints, no extra oral abnormalities, negative percussion and normal gingiva. The X-ray showed the MTA plug in the form of a radiopaque appearance at the apex. Then thermoplastic filling (backfill) with a resin-based paste was then covered with cotton pellets and temporarily filled, after which an X-ray of the filling was taken.

One week later, at the fourth visit a control was carried out, the patient felt no complaints, no extra-oral abnormalities, negative percussion and normal gingiva. After that, the gutta point was taken using a penetration drill and calibration drill, then crown decapitation, then tooth impression was taken using double impression elastomer material, and antagonistic impression with irreversible hydrocolloid material, and then inserted the temporary crown with temporary cement.

On the fifth visit, a cast post was inserted using luting cement. Gingival management was then performed on the maxillary preparation and impression with double impression elastomer and then mandibular impression using irreversible hydrocolloid impression material. After that, bite registration was made. Selection of shade guide (A3) shade guide vitalumin and then insertion of temporary crown with temporary cement.

Figure 3. Fabricated post preparation (A), clinical appearance of custom post (B), radiographic appearance of custom post (C), temporary crown insertion (D)

Then on the sixth visit, all porcelain crowns were tried on and a porcelain crown fixed with resin-based cement (Figure 4B). On seventh visit, a control was performed with the all porcelain crown in good condition, no complaints percussion, normal gingiva.

Figure 4. Before treatment (A), all porcelaine crowns insertion (B)

Discussion

Trauma when the tooth still immature will cause the tooth get pulp inflammation. This condition will cause root formation to stop. A necrotic pulpal tooth with an open apex has a thin root canal wall that breaks easily, making it difficult to clean and fill the root canal.[3] In this case, apexification was performed first to obtain closure at the apex through the formation of a calcific barrier at the tip of the apex. Factors in the formation of the barrier were good debridement of the root canal system and creating a good crown seal. Conventional apexification with calcium hydroxide has encountered many problems, so various alternative materials have been proposed. the use of MTA as an apical plug that induces the formation of the apical calcific barrier and the healing process so that the root canal filling process can be carried out more quickly, and prevents fracture.[5,8]

MTA is a material in the form of an aggregate powder containing mineral oxides. Apexification using MTA can be done in two visits until the final restoration is made so as to prevent fracture. The use of MTA for apexification has several advantages, including shortening the time period of treatment visits, biocompatible, can induce hard tissue formation, and form a good apical plug.[1,9] In this case, the patient experienced trauma to the upper front teeth with radiographic examination showing that the apical open with a large root canal and a thin root canal wall so that it could be difficult to do endodontic treatment, especially in filling so as not to overdo it.

Apexification using MTA material can stimulate the formation of a calcific barrier and apical healing so that the formation of apical density and allows the placement of restorations in the root canal to be carried out immediately with a minimum of 24-hour MTA application to prevent tooth fracture and restoration can be completed immediately. This can reduce the risk of root and crown fracture between visits with thin root canals. In this case, the placement of a fabricated post into the root canal strengthened the root canal wall without reducing the thin root canal wall. Then proceed with the manufacture of the core and all porcelain crown restorations. So that the final restoration was done immediately to prevent fracture.[3.10]

In this patient, central incisors maxillary teeth used a fabricated post and core since fabricated post and core can be made as a single unit according to the form of root canal preparation. Fabricated post and cores insertion was done one by one in the same time to get same normal size and form and also good alignment (normal overjet and overbite) for each

tooth thus aesthetic aspect can be achieved (Figure 3).[11]

Afterwards, inserted posts and cores were further adjusted to obtain favorable axial parallelism that allows easy placement of the all porcelain crowns. The crown were adjusted to ensure optimal aesthetic and function of the restoration could be achieved in the stomatognathic system and making a final restoration to prevent fracture.[11,12]

Conclusions

Apexification is a procedure used for traumatized immature permanent teeth with non-vital and apical tooth conditions. The purpose of apexification is to achieve apex closure through the formation of a calcified barrier at the tip of the apex so that root canal obturation can be performed properly. MTA is an alternative for the apexification process as an apical plug and healing without waiting for the formation of the apical calcific barrier so as to shorten the patient's visit time by directly obturating and making a final restoration to prevent fracture.

Declaration of Interest

The authors report no conflict of interest.

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