International Journal of Research in Medical Sciences
Patil S et al. Int J Res Med Sci. 2017 Mar;5(3):1151-1155
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20170682

Case Report

Management of traumatised maxillary central incisor with immature open apex using mineral trioxide aggregate and tailor made gutta percha: a case report

Suvarna Patil, Upendra Hoshing, Sharanappa Kambale, Ruchika Gupta*

Department of Conservative dentistry and Endodontics, Vasantdada Patil Dental College and Hospital, Sangli, Maharashtra, India

Received: 07 January 2017
Revised: 10 January 2017
Accepted: 08 February 2017

***Correspondence:**
Dr. Ruchika Gupta,
E-mail: ruchikagupta13081989@gmail.com

ABSTRACT

Root development and apex closure after the eruption of teeth takes a minimum of 3-4 years. If trauma to the pulp occurs during this period, it becomes a challenge for the clinician to treat the pulpal injury. Apexification is the treatment of choice for necrotic teeth with immature apex. Apexification done with calcium hydroxide encounters certain difficulties like very long treatment time, possibility of tooth fracture and incomplete calcification of the bridge. Mineral trioxide aggregate (MTA) was introduced as an alternative material to traditional materials for the apexification of immature permanent teeth. This case report presents successful management of a case with open apex using MTA followed by Tailor made gutta-percha.

Keywords: Apexification, MTA, Open apex, Tailor made gutta-percha

INTRODUCTION

Dental trauma happens most frequently in young patients, who generally presents with immature teeth.[1] Root formation stops, when such teeth with open apex suffer from pulp pathology. Consequently, wide canals with thin and fragile walls and open or even ‘blunderbuss’ apex make chemo-mechanical debridement difficult and hamper apical closure.[2] Open apices can be of two configurations - non-blunderbuss and blunderbuss.[3]

Non-blunderbuss

The walls of the canal may be parallel to slightly convergent as the canal exits the root -the apex, therefore can be broad (cylinder shaped) or tapered (convergent).

Blunderbuss

The word ‘blunderbuss’ basically refers to an 18th century weapon with a short and wide barrel. It derives its origin from the Dutch word ‘DONDERBUS’ which means ‘thunder gun’.

The walls of the canal are divergent and flaring, more especially in the buccolingual direction - The apex is funnel shaped and typically wider than the coronal aspect of the canal. In these conditions, induction of root formation (apexogenesis) or root end closure (apexification) are the accepted treatment options.

Selection of teeth for apexogenesis or apexification depends on clinical and radiographic features.

If the patient reports within 24 hours of traumatic pulp exposure, apexogenesis is the treatment of choice. On the contrary, if the patient fails to report within 24 hours of pulp exposure or there are definite signs of pulp non-vitality, apexification is the only conservative treatment option left. American Association of Endodontists has defined Apexification is a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp.[4]

Apexification requires the chemo-mechanical debridement of the canal followed by placement of an intracanal medicament to assist or stimulate apical healing and formation of a horizontal apical barrier at the apical end of the root canal to facilitate the subsequent obturation of the canal without voids and excess material in the periapical tissue. The most common material used in apexification is calcium hydroxide.[5] However, the length of time required for this is variable, ranging from 3-18 months. This presents problems with patient compliance, re-infection due to loss of temporary restoration and also predisposes the tooth to fracture.[6]

A one step apexification procedure eliminates these problems. It implies the non-surgical compaction of a biocompatible material into the apical end of the root canal, thus, creating an apical stop and enabling immediate filling of the root canal.[7] MTA has been described as a good material for this procedure owing to its good canal sealing property, biocompatibility and ability to promote dental pulp and periradicular tissue regeneration.[8,9] It has been reported that MTA root fillings placed at the cemental canal limit showed better results than overfillings.[10] This case report demonstrates the use of MTA apical plug in immature open apex where, an apical matrix was inadvertently created by calcium hydroxide use.

CASE REPORT

A 19-year-old male presented to the department of conservative dentistry and endodontics, (VPDC, Sangli) with chief complaint of discolored tooth in upper front right region of the jaw. Patient gave no history of pain or discomfort associated with chief complaint tooth i.e. tooth number 11. Patient had noticed the discoloration for three years. He had history of trauma ten years before. Patient gave history of swelling and pus discharge from the same region 4 years before and had taken medication for same and subsequently swelling and pus discharge subsided. Patient's medical history was non - contributory. Clinical examination revealed a discolored central incisor having Ellis class IV fracture (Figure 1).

There was no current evidence of swelling or tooth mobility found. The tooth was not sensitive to percussion. The periodontal probing was within normal range (2-3mm). Thermal and electric pulp tests confirmed that tooth #11 was non-vital, whereas all adjacent teeth contained vital pulps. Radiographic examination revealed root canal of 11 was wide, root incompletely formed with wide open apex and periapically a radiolucent area was seen (Figure 1).

Figure 1: Preoperative clinical and radiograph view.

Based on subjective and objective findings, a diagnosis of Ellis Class IV fracture with immature open apex with periapical radiolucency was made. A one step apexification preceded by canal disinfection for two weeks with calcium hydroxide was planned for this tooth. The tooth was isolated with rubber-dam (Hygienic Dental Dam, Coltene Whaledent Germany) and the access cavity was prepared with high speed air turbine with careful attention to the direction of the Endo-Access bur. Operating microscope (Global Surgicals Corporation, St Louis, MO, US) was used throughout the procedure to facilitate visualization. Working length was determined with 80 k file which was 18 mm from the reference point that is incisal edge (Figure 2).

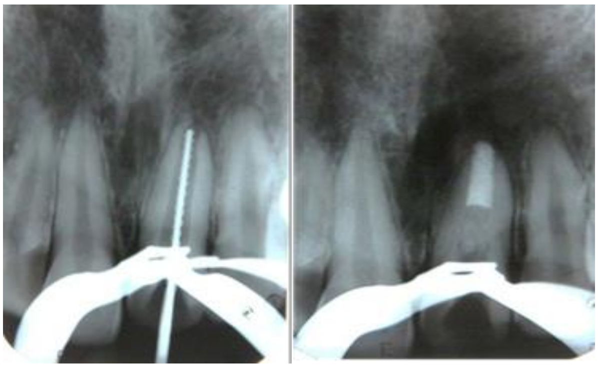

Figure 2: Radiograph showing working length determination and MTA plug given for apical stop.

At this stage, the number 80 file was found loose and easily passing beyond the apical limit of the canal. The canal was thoroughly cleaned using 80 size k file with circumferential filing and with alternative irrigation of 5.25% sodium hypochlorite using endovac and saline. To obtain canal disinfection prior to MTA placement, a calcium hydroxide dressing (RC CAL, Prime Dental Products, India) was placed in the canal. Then a small cotton pallet was placed and the access cavity was temporarily sealed with Cavit (3M ESPE, Saint Paul, MN). The patient was asked to return after two weeks. After 15-days interval, the root canal was re-entered, instrumented and irrigated with 5.25% sodium hypochlorite using endovac and 2% chlorhexidine and final irrigation was carried out with saline. Then canal was dried with absorbent paper points.

The white MTA (MTA Angelus, Londrina, Brazil) was mixed according to manufacturer's instructions to a paste consistency with sterile water and delivered to the canal using an nonsurgical MTA carrier (Micro Apical Placement System, Produits Dentaires, Vevey, Switzerland) in about 5mm thickness and condensed with the help of hand pluggers to get a homogenous well sealed apical plug (Figure 2).

Figure 3: Preparation of tailor - made gutta.

A sterile moist cotton pellet was sealed inside for setting of MTA and access cavity was sealed with Cavit (3M ESPE, Saint Paul, MN).

Figure 4: Trial radiograph of tailor made gutta percha cone and post obturation radiograph.

The patient was recalled after 24 hours, and hardness of the apical barrier was checked, subsequently root canal was obturated with tailor made gutta-percha. Custom made (tailor made) gutta-percha was fabricated by arranging the number of heated, coarse, gutta-percha butt to tip on a clean and sterilized glass slab. Points were rolled with spatula into rod – shaped mass. By repeating heating and rolling, the roll of gutta-percha was formed to approximate size of canal to be filled (Figure 3). Before trial point testing of tailor – made roll, gutta-percha was chilled with ethyl chloride spray. After preparation of tailor made gutta-percha trial radiograph was taken to check the fit of tailor-made gutta-percha (Figure 4).

Figure 5: Post opertive clinical and six month follow up radiographic view.

And then remainder of canal was obturated with this custom-made gutta-percha with AH-Plus sealer (Dentsply, Germany) and the access cavity was sealed with composite resin. The final radiograph was then taken to confirm the sealing of the pulp chamber and canal (Figure 4).

After 15 days' patient was recalled and crown preparation of tooth 11 was done, gingival retraction cord was applied and rubber base impressions were received after removing retraction cord. Then impressions were sent to laboratory for fabrication of crown and then zirconia crown was cemented (Figure 5). Six months follow up demonstrated a radiographic decrease in the periapical radiolucency (Figure 5). The tooth was asymptomatic and clinically functional and is still under active follow up.

DISCUSSION

The goal of apexification is to obtain an apical barrier to prevent the passage of toxins and bacteria into periapical tissues from root canal.[12] The traditional use of $Ca(OH)_2$ apical barriers has been associated with unpredictable apical closure, extended time taken for barrier formation, difficulties in patient compliance, and the risk of reinfection resulting from the difficulty in creating long-term seals with provisional restorations and susceptibility to root fractures arising from the presence of thin roots or prolonged exposure of the root dentine to calcium hydroxide.[6] The barrier produced by calcium hydroxide apexification has been reported to be incomplete having swiss cheese appearance, and can allow apical microleakage. Thus a permanent root canal filling is still mandatory. Pulp revascularization remains a good treatment option for such cases but the patient was not agreeable to the time constraints. So, one step apexification with MTA was decided for this case.

One-visit apexification has been defined as the non-surgical condensation of a biocompatible material into the apical end of a root canal. The rationale is to establish an apical stop that would enable the root canal to be filled immediately. Apexification with MTA requires significantly less time.[13] Thus, there is increasing popularity with one-visit apexification procedures that use mineral trioxide aggregate (MTA) as osteoconductive apical barriers.[8,13-15] MTA is relatively non-cytotoxic and stimulates cementogenesis.[16,17] MTA is biocompatible and facilitates the formation of dentinal bridges and cementum, and regeneration of the periodontal ligament. It can stimulate cytokine release from the bone cells, indicating that it actively promotes hard tissue formation.[18]

The Portland cement– based material generates a highly alkaline aqueous environment by leaching of calcium and hydroxyl ions, rendering it bioactive by forming hydroxyapatite in the presence of phosphate-containing fluids. Unlike the extended use of $Ca(OH)_2$ in immature roots, prolonged filling of these roots with MTA did not reduce their fracture resistance.[6,19] Torabinejad reported the ingredients in MTA as tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide with some other mineral oxides that were responsible for the chemical and physical properties of aggregate. The powder consists of fine hydrophilic particles that set in the presence of moisture. The hydration of the powder results in a colloidal gel with a pH of 12.5 that will set in approximately 3 hours.[8] MTA has a compressive strength equal to intermediate restorative material and Super EBA (Bosworth) but less than that of amalgam.

It is commercially available as ProRoot MTA (DENTSPLY), and has been advocated for use in the immediate obturation of an open root apex. MTA can induce cementum-like hard tissue when used adjacent to the periradicular tissue. MTA is a promising material because of its superior sealing property, its ability to set in the presence of blood and its biocompatibility. Moisture contamination at the apex of tooth before barrier formation is often a problem with other materials used in apexification. Because of its hydrophilic property, the presence of moisture does not affect its sealing ability.[8] MTA has demonstrated the ability to stimulate cells to differentiate into cells that form hard tissue and to produce a hard-tissue matrix.

MTA has been widely recommended for plugging open apices. Authors have reported that MTA root fillings placed at the cemental canal limit showed better results than overfillings.[10] Various materials have been used to prevent MTA extrusion into the periodontal tissues, including hyroxyapatite, collagen, calcium phosphate cement and calcium sulphate. In this case, the apical stop gained by calcium hydroxide, was used to obtain a dense MTA plug contained within the apical limit of the tooth. The six-month follow up showed clinical and radiographic signs of healing.

Not only the selection of material, but also the thickness of apical MTA barrier has played a key role in clinical success. A 5-mm thick apical MTA barrier has proven to be significantly stronger with lesser leakage than a 2 mm thick barrier. In the present case, a condensed 5 mm apical MTA plug was made.[19]

CONCLUSION

The use of MTA apical plug after gaining a matrix with calcium hydroxide therapy showed a positive clinical outcome for the immature tooth.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Patil S, Hoshing U, Kambale S, Gupta R. Management of traumatised maxillary central incisor with immature open apex using mineral trioxide aggregate and tailor made gutta percha: a case report. Int J Res Med Sci 2017;5: 1151-5.