ACTA SCIENTIFIC DENTAL SCIENCES (ISSN: 2581-4893)

Volume 3 Issue 5 May 2019

Case Report

Management of Traumatized Maxillary Central Incisor with Short Roots Using Unconventional Obturation Technique

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Received: March 25, 2019; **Published:** April 24, 2019

Abstract

Traumatic injuries to the Oro-facial region often results in maxillary anterior teeth fracture in children and young adults. The challenge in performing root canal treatment in teeth with necrotic pulps and wide-open apices is to obtain an optimal apical seal1. Apexification is the method of inducing the formation of a calcific barrier across an open apex in a case involving pulp necrosis with or without periapical lesion.

Calcium hydroxide Apexification has some drawbacks, such as weakening of roots after long term use, incomplete formation of apical bridge and re-infection because of temporary seal led to use of Mineral Trioxide Aggregate (MTA) as an alternative material due to its superior biocompatibility, good sealing properties, and regenerative abilities. Mineral Trioxide Aggregate has been proved to be the best available material for apexification since its introduction in 1993.

This is a case report of MTA Apexification followed by a Fiber Post Placement without Conventional Obturation in a non-vital maxillary left central incisor 21 with short roots. As Fiber Posts have a matching modulus of elasticity to dentin, forces are efficiently delivered along the root, thereby decreasing the risk of root fracture and also results in reinforcement of the remaining root structure.

Keywords: Apexification; Fiber Post; Mineral Trioxide Aggregate; Open Apex; Non Vital Tooth; Short Roots

Introduction

Treatment of traumatized teeth with necrotic pulps and open apices has some limitations such as overfilling and achieving an acceptable seal in the apical area. The use of the apical plug method seems to be more practical in the treatment of teeth with necrotic pulps with open apices. Apexification is defined as "A method of inducing a calcified barrier in a root with an open apex or the continued apical development of an incompletely formed root in teeth with necrotic pulp" [1].

Gerstein., *et al*. used Calcium hydroxide apical plug in teeth with open apices and reported that calcium hydroxide apexification required a long time to form the apical barrier, possibility of re-infection in between appointments and low fracture resistance of the tooth [2].

Mineral Trioxide Aggregate (MTA) was developed for use as a dental root repair material by Mahmoud Torabinejad. MTA is composed of dicalcium and tricalcium silicate, bismuth oxide, and calcium sulphate. Hydration of the powder results in a fine crystalline gel. This solidifies to a hard structure in approximately 3-4 hours. MTA was originally developed for root-end filling. Over the years, further research has resulted in MTA being applied in various clinical situations in addition to its use as a suitable root-end filling material [4]. MTA has been proposed as a material suitable for one visit apexification, as it combines biocompatibility and a bacteriostatic action with favourable sealing ability when used to repair root/pulp chamber perforations or as a root-end filling material [5]. MTA offers a barrier at the end of the root canal apical plug in teeth with necrotic pulps and open apices that permits

vertical condensation of warm Gutta-percha in the remainder of the canal [6].

Immature teeth that have lost a substantial amount of crown structure and have wide root canals with weak root dentinal walls and thin radicular dentin are difficult to restore both aesthetically and functionally. Prefabricated posts are often used due to their ease of placement and short clinical application time and its modulus of elasticity nearer to the dentin [7].

Case Report

50-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, C.K.S Theja Institute of Dental Sciences, Tirupati with the complaint of pain in the upper left anterior region, Patient had history of trauma nine years back which had been previously treated. Clinical examination revealed discolored maxillary left central incisor (Figure 1). Intra Oral Periapical Radiograph revealed incompletely formed apex with short roots as well as thin dentinal walls in the apical region in relation to the central incisor (Figure 2). Tooth elicited a negative response on thermal as well as Electric Pulp Testing, hence diagnosed as Ellis class IV fracture (Non-vital, without crown fracture). Root canal treatment and Apexification using MTA as an apical matrix followed by Fiber Post placement were planned in maxillary central incisor.

Figure 1: Pre-operative view.

Figure 2: Pre-operative Radiograph.

Procedure

After the rubber dam application, endodontic access was prepared in relation to 21 working length was determined and confirmed by radiograph (Figure 3). The canal was thoroughly cleaned using #80 K-file in a circumferential manner and irrigated with 2.5% sodium hypochlorite throughout the cleaning and shaping procedure. The canal was dried with Paper points and Triple Antibiotic Paste (500 mg Metronidazole, 500mg Ciprofloxacin, and 500 mg amoxicillin) was placed to obtain canal disinfection and the access was sealed with provisional restorative material IRM (Dentsply).

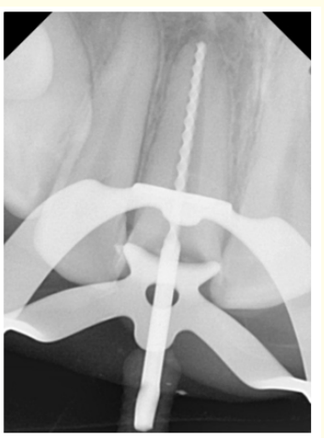

Figure 3: Working Length determination.

The patient was recalled a week later. After rubber dam isolation, the tooth was re-accessed and the canal was gently instrumented with K files and irrigated with saline. The canal was then dried with paper points and White Pro-Root MTA (Dentsply Tulsa, Switzerland) powder was then mixed with distilled water according to manufactures instructions and subsequently placed up to the apex with fined tipped MTA carrier and packed with endodontic pluggers. This procedure was repeated until the thickness of MTA reached almost 3mm and plug position is confirmed radiographically. After placement of MTA plug a moist cotton pellet was placed to ensure setting and a proper coronal seal was established with IRM. The patient was recalled the following day and the canal was dried with paper points.

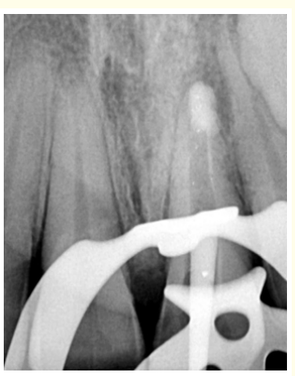

Figure 4: MTA plug of 3mm.

An appropriate translucent Fiber Post was selected (Maillefer France) and was sandblasted to facilitate bonding. The Fiber Post was cemented with dual-cure resin cement (Rely –X ARC, 3M ESPE, St. paul, USA) and was light activated through cervical portion for 40 seconds (Bluephase G4, Ivoclar Vivadent) (Figure 5). Core build-up was done with composite and temporization was performed and the final PFM crown was cemented after 1 week (Figure 6). After 6 months and 12 months follow up period periapical radiograph demonstrated complete healing of periapical lesion (Figure 7,8).

Figure 5: Cemented fiber post.

Figure 6: Cementation of PFM crown.

Figure 7: Radiograph after 6 months.

Figure 8: Radiograph after 12 months.

Discussion

The success of root canal treatment is dependent on obtaining a perfect hermetic apical seal. The traumatized teeth that become nonvital with or without loss of crown structure with open apex lacks natural apical constriction at the end of root canal which makes root canal filling difficult. Seltzer advocated apexification or root-end closure as an alternative to standard root canal treatment.

Apexification is the induction of calcific barrier at the root end. Traditional use of calcium hydroxide for apexification procedure has unpredictable apical closure having a Swiss cheese appearance resulting in apical microleakage and risk of re-infection, susceptibility to root fracture, multiple visits, and patient compliance. One visit MTA was introduced to overcome the limitations of calcium hydroxide as the apical sealing material [10].

MTA forms a seal between the material and the tooth. There is the formation of an apatite-like interface during maturation of MTA which fills in the gap. This apatite-like interface is formed during the shrinkage phase and improves the resistance of root canal walls to fracture. MTA exhibits excellent biocompatibility and non-cytotoxic with good sealing properties reducing microleakage11. For these reasons in the present case MTA was chosen for apexification procedure.

After 6 month and 12 month follow up period periapical radiographs demonstrated complete healing of periapical lesion this may be attributed due to the favorable environment provided by MTA for the cementum deposition because of the presence of calcium and phosphorus ion and production of interleukins and cytokines release which induces osteoblastic or cementoblastic activity [12,13].

The advantage of this unconventional obturation technique over conventional is both the post unit and the luting cement forms the single unit in delivering the forces efficiently to the root mimicking the monoblock concept of Obturation. Teixeira., *et al.* reported that even AH plus sealer does not bind to gutta-percha, moreover on setting the sealer tend to pull away from the gutta percha [14] Aptekar., *et al*. stated that gutta-percha does not reinforce endodontically treated teeth due to lack of seal along the dentinal walls. As gutta percha does not bond to the dentin wall it does not resist stress generated in the root canal. The forces that are transferred from post to root. are reduced because of lower modulus of elasticity preventing root fracture. According to several authors, fiber post reinforce mutilated teeth with thin root dentin as modulus of elasticity of fiber post (30-40GPa) almost near to dentin (15-25GPa) resulting in uniform stress distribution inside the root canal [15]. The fiber post was luted after MTA placement without obturation as a fulcrum point of a short post is closer to the occlusal table and often lead to root fracture because of their failure to be completely surrounded by periradicular bone.

Conclusion

MTA can be a favorable material for Apexification. It results in a good periapical seal, Fiber post can be directly placed on the MTA apical plug to reinforce the short roots as an alternative to commonly used roll cone and thermo plasticized obturation techniques for better prognosis.

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