Management of Open Apex Using Alternative Techniques: Series of 3 Case Reports

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Abstract

Traumatic injuries during early childhood interfere with root development leading to the formation of a tooth with an open apex. Apexification is considered as the best choice for the treatment of such cases. Use Mineral Trioxide Aggregate (MTA) as apical plug material optimizes the treatment outcome. Other than MTA different techniques are also used to restore the function and stability of the immature permanent tooth. In this case report 3 different techniques are used to treat the open apex. In the first case, MTA apical plug along with backfill was done. Complete canal obturation with MTA and custom cone technique were performed for the second and third cases respectively.

Keywords: *Apexification; Mineral Trioxide Aggregate; Complete canal obturation; Open acces management.*

Introduction

It is quite natural to achieve proper canal disinfection, adequate debridement and optimum apical sealing of the root canal in a completely formed and well-developed root, whereas achieving these parameters in a tooth with incompletely formed root is a challenge in the field of dentistry. Lack of apical stop in cases with open apex puts the clinician in an uncertain circumstance. In every step of root canal starting from chemo-mechanical preparation including irrigation till the apical sealing of the root canal clinician need to be very careful to avoid peri-apical extrusion of the materials, which may lead to post-operative symptoms like pain and swelling. Besides this an additional problem while treating this immature permanent tooth is the thickness of the radicular dentin, which may fracture during or after the root canal treatment.[1] These types of teeth are more commonly associated with periapical pathology.[2]

Early necrotized pulp and inflammatory apical root resorption are the most common etiological factors for the formation of immature teeth.[3,4] Apical barrier formation facilitates 3-dimensional cleaning and well adaptation of obturating materials leading to a successful endodontic treatment. Materials used for such cases should have properties like, antimicrobial, should be bioactive, should create a fluid-tight seal, should have high strength and should reinforce root dentin.[5] Earlier calcium hydroxide was used for the process of apexification, but it takes 5 to 20 months to form a calcific barrier.[6] This lengthy course of treatment offers a challenge like – difficulty in patient follow up management, increases the risk of tooth fracture with intracanal calcium hydroxide dressing for an extended period and also there is a delay in the completion of treatment.[7] Various authors have also confirmed that long term use of calcium hydroxide as intracanal dressing increases the risk of fracture in the future.[4,7,8]

Recently interest has focused on the use of MTA (mineral trioxide aggregate) for apexification. Its powder consists of hydrophilic compounds, which can set in the presence of moisture. Good biocompatibility, excellent sealing ability, high compressive strength, tissue

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regeneration capacity are also added to its properties.[9] Importantly MTA reduces the appointment time, even allows single visit apexification. MTA offers a good apical barrier that allows vertical condensation of warm gutta-percha.

Technique 1: A 21-year male patient named Satyanarayan Sabat reported to the Department of Conservative Dentistry and Endodontics, Institute of Dental Sciences, SOA University, Bhubaneswar with the chief complaint of the discoloured tooth in the upper front tooth region. The patient gave the history of trauma 12 years back. Clinical examination revealed discolored tooth with open access and tender on percussion to the tooth 21. An intraoral periapical radiograph revealed an incompletely formed root apex with irregular periapical radiolucency (Figure 1a). Hence, the final diagnosis was pulpal necrosis with symptomatic apical periodontitis in tooth 21. After rubber dam isolation (Hygienic Dental Dam, Coltene Whaledent Inc., Germany), chemomechanical preparation of root canal was done upto F5 (Dentsply Maillefer, Switzerland) along with circumferential filing using # 80 K-file (Mani Inc., Japan). Chemomechanical preparation performed in conjunction with a copious amount of 3% Sodium hypochlorite (Prime Dental, India) and saline solutions. 5 ml of 17 % Ethylenediaminetetraacetic acid (Prevest Denpro, India) was used for smear layer removal. On completion of preparation calcium hydroxide dressing (Avue Cal, Dental Avenue, India)was given for 1 week.

After a 1-week tooth was again re-accessed under rubber dam isolation. 5 ml of 17 % EDTA and Copious amount of saline solution was used to remove the calcium hydroxide dressing from the canal. Canal was aspirated and dried thoroughly with absorbent paper points. MTA (Angelus, Londrina, PR, Brazil) was mixed according to the manufacturer's instructions and 4 mm of the apical plug was created using hand pluggers. A gutta-percha point was introduced into the canal to confirm the apical barrier (Figure 1b). a moist cotton pellet was placed over the MTA and the canal was sealed with a temporary restoration. Next day, the remaining portion of the root canal was coated with silicate-based sealers (MTA Filapex; Angelus, Londrina, SP, BR) and obturation was done by back-filling of gutta-percha using system B (Sybrondental, Orange, CA, USA) setting 200°C upto the level of CEJ (Figure 1c). Glass ionomer cement (3M ESPE, USA) was used for access cavity restoration (Figure 1d).

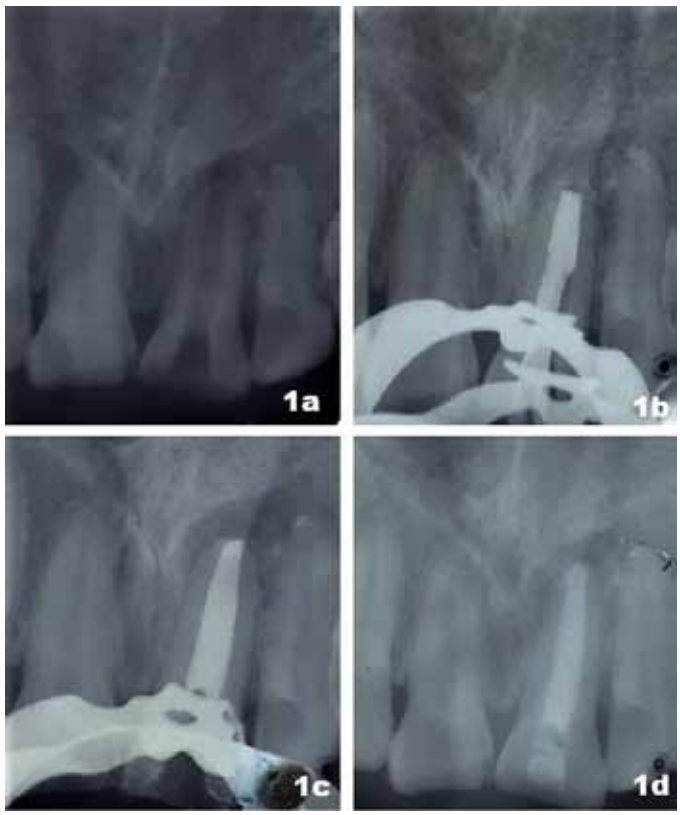

Figure 1: 4mm apical plug of MTA followed by backfilling of gutta percha

Technique 2: Another male patient aged 18 came to the Department of Conservative Dentistry & Endodontics, Institute of Dental Sciences, Bhubaneswar, with the chief complaint of unpleasant smile and gave the history of trauma 10 years back. On clinical examination discolored tooth was noticed in 21. Intraoral periapical radiographic examination revealed a wide-open apex with a thin radicular dentinal wallalong with periapical radiolucency in tooth 21 (Figure 2a). Under rubber dam isolation chemo-mechanical preparation for the tooth was performed similarly as described in technique 1. Calcium hydroxide dressing (Avue Cal, Dental Avenue, India)was given for 1 week followed by temporary restoration. After 1 week of intracanal dressing tooth was irrigated with 17% EDTA (Prevest Denpro, India) and copious amount of saline solution to remove calcium hydroxide from the canal. Canal was aspirated and dried thoroughly with absorbent paper points. MTA (Angelus, Londrina, PR, Brazil) was mixed according to the manufacturer's instructions and the entire radicular portion of the canal was packed with MTA (Figure 2c). moist cotton pellet was placed over MTA and temporary restoration was used to maintain the coronal seal for the particular tooth. After 24 hours cotton pellet was removed and coronal restoration was done using glass ionomer cement.(3M ESPE, USA) (Figure 2d).

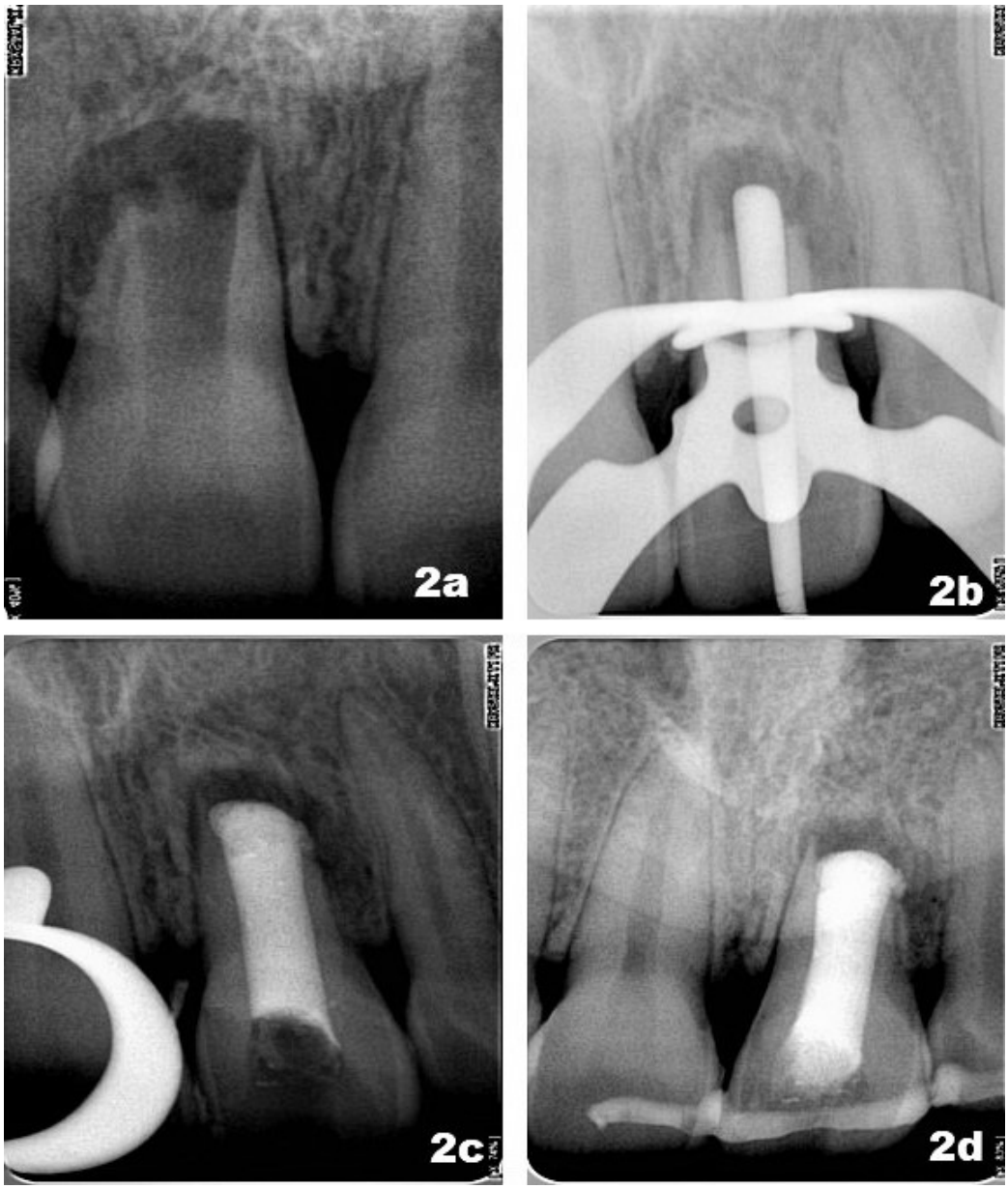

Figure 2. Entire canal was filled with MTA

Technique 3: A 14-year-old male patient requested dental treatment in the upper right central incisor following trauma before 5 years due to fall from the bike. Radiographic examination revealed incompletely formed root with no periapical changes (Figure 3a). Clinical examination revealed a discolored tooth in 11. All the necessary protocols were maintained under rubber dam isolation. Chemomechanical preparation of the canal including calcium hydroxide dressing was carried out the same way as described in the technique 1. After the removal of calcium hydroxide from the canal,it was obturated by the custom cone technique or roll cone technique using a resin-based sealer, AH Plus (Dentsply Maillefer, Switzerland). Gutta-percha points were softened by heat and rolled together between glass slabs. Tip of gutta-percha points were elasticized by using a heated instrument and then introduced into the canal to record the internal morphology of the apical portion of the canal (Figure 3b). This process was repeated till proper tug back was achieved. Canalwas sealed upto the level of CEJ and the access cavity was filled with glass ionomer cement restoration (3M ESPE, USA) (Figure 3c).

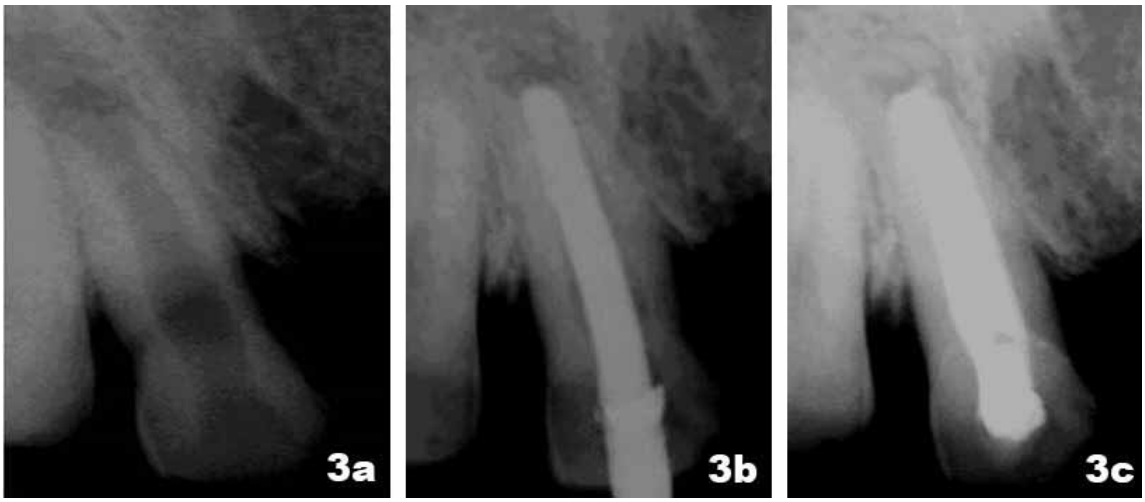

Figure 3. Custom cone/Roll cone technique

Discussion

Successful treatment of permanent immature teeth mainly depends on the proper cleaning of the root canal system as mechanical instrumentation can not be used appropriately. So, the disinfection of the entire root canal relies on the chemical action of sodium hypochlorite and on calcium hydroxide which is used as an intracanal medicament.[10] At high concentration Sodium hypochlorite is known to be toxic especially when it extrudes apically. Therefore, the use of a low concentration of sodium hypochlorite is advisable for disinfection in cases of immature teeth.[11] 17 % EDTA solution was used to rinse the canal before placement of calcium hydroxide as it removes the smear layer and opens up the dentinal tubule for penetration of calcium hydroxide through the dentin.[12] Along with this use of EDTA ensures better removal of calcium hydroxide from the canal before obturation.[12] Initially calcium hydroxide was used to form the apical barrier in non-vital immature teeth. One study has investigated thatfor apexification, apical barrier formed by calcium hydroxide is porous and even contains some amount of soft tissue.[13]

MTA has excellent biological properties and has the potential to create a good apical seal, therefore it has been strongly recommended to use as an artificial barrier in the teeth with open apices, thus reducing the treatment appointment to 1-3 visits. High pH of MTA allows it to destroy surrounding microorganisms and its bioactive nature encourages blastic cells to promote the process of healing.[5,15] Along with this, it also facilitates the deposition of cementum on it because of the presence of calcium and phosphorous ions (15). In a prospective study apexification using MTA has shownan increased prevalence of healing and apical closure.[16] Thus, an apical seal with MTA favours regeneration. Taking all the advantages of MTA into consideration, it was used

for the apexification process in the first two cases of this case report.

In the first technique-the apical plug of MTA was given and obturation was performed by backfilling of soften gutta-percha. 4-5 mm of MTA apical barrier has proven to be significantly stronger and showed less leakage than a 2 mm apical plug. In this case,a 4 mm apical barrier of MTA was given. MTA apical plug facilitated obturation by condensation without any over extrusion of gutta-percha. In technique 2,the tooth was very immature and the thickness of radicular dentin is less, thus making the tooth more vulnerable to fracture. In such cases adaptation of gutta-percha master cone to the dentinal wall would be difficult. Additionally, it has been confirmed the use of MTA strengthens root dentin.[17,18] Considering the above-mentioned factors root canal was completely obturated using MTA. As an experiment, a conventional method of obturation (tailor-made gutta-percha obturation) was attempted in technique 3. Rootend closure was achievedby customized gutta-percha cone. Considerably successful treatment along with complete resolution of symptoms was observed when the tooth was obturated with a custom cone technique.[19] The choice of treatment for teeth with open apex depends on the selection of case, operator's experience as well as on the handling of various materials.

Conclusion

There are various ways to manage a tooth with an open apex. MTA has numerous applications in the field of endodontics starting from pulp capping including pulpotomy to apexification. Due to its excellent biocompatibility and strength it is used for apical barrier formation in immature young permanent teeth. Apart from all the advantages of apexification materials, proper canal disinfection, achieving a fluid-tight seal, limiting the apical barrier and obturation within the canal, play an important role in a successful endodontic treatment.

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