Case Report

Single visit apexification technique by root end barrier formation with MTA

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ABSTRACT

Aim: To seal with Mineral trioxide aggragate(MTA) and make a sizeable communication between the root canal system and the periradicular tissue and provide a barrier because of lack of apical constriction.

Summary: A 9 year old girl who had met with trauma about six years ago, before she visited department of Paediatric Dentistry , Update Dental College,Dhaka,Bangladesh for the treatment of mandibular right lateral incisor. The case was diagnosed as necrosis of pulp with open apex. After proper isolation access opening and biomechanical preparation was performed with 1mm short of the radiographic apex and calcium hydroxideused as intra canal medicament. After 15 days MTA was placed in the canal till a barrier of 4mm was achieved. Later obturation was done using lateral condensation technique.Size of the periapical lesion was almost decreased after one year of follow up. Follow-up was done after 1 month, 6 months and 1 year later.

Introduction:

The primary objective in endodontic therapy is the complete obturation of the root canal space to prevent re-infection. In teeth with incomplete root development caused by trauma, caries and other pulpal pathosis, the absence of the natural constriction at the end of the root canal presents a challenge and makes control of filling materials difficult. The aim is to seal a sizeable communication between the root canal system and the periradicular tissue and provide a barrier against which obturation material can be compacted.Because of the lack of an apical constriction, an alternative to standard root canal treatment, apexification or root end closure has been advocated.[1,2]Three techniques have been suggested to obturate an immature tooth, which involved the use of a root filling material without the induction of apical closure.[3]

1) Placement of a large gutta-percha filling or customized gutta-percha cone with sealer at the apex. 2) Placement of gutta-percha with sealer short of the apex. 3) Periapical surgery.

These techniques did not gain popularity since there was no physical apical barrier to facilitate obturation. However, two other techniques were reported which aimed to provide an apical barrier.[3]

1) Placement of calcium hydroxide to induce a mineralized apical barrier. 2) Placement of a biocompatible material such as dentinal chips against which a root filling could be placed.

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Apexification can be defined as a 'method to induce a calcific barrier in a root. The American Association Endodontist's Glossary of endodontic terms refers to apexification 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."[4]

Mineral Trioxide Aggregate is a powder consisting of fine hydrophilic particles of tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide. It also contains small amounts of other mineral oxides, which modify its chemical and physical properties. Hydration of the powder results in formation of colloidal gel that solidifies to form a strong impermeable hard solid barrier in approximately three to four hours. Electron probe microanalysis of MTA powder showed that calcium and phosphorus are the main ions present.[5]Bismuth oxide powder has been added to make the aggregate radio-opaque. Mineral trioxide aggregate has a pH of 12.5 after setting, similar to calcium hydroxide. This may impart some antimicrobial properties.[6]The material has a low solubility and a radio-opacity slightly greater than that of dentin. As because it has low compressive strength[5], it should not be placed in functional areas.[4]But in single visit apexification technique by MTA is currently being appreciated.According to Tomson et al .,the bioactive properties of MTA that stimulate reparative bridge formation can be attributable to the material providing a biocompitablenoncytotoxic antibacterial environment.[27]MTA also provides a favorable surface morphology for cell attachment and has the ability to form hydroxyapatite on its surface in the presence of tissue fluid.They hypothesized that soluble components of MTA during and after setting on the dentin interface may cause the release of growth factors and other bioactive molecules,such as transforming growth factor beta(TGF-β_1) and adronomedullin.The increased presence of these dentine extra cellular proteins as the result of MTA culminates in dentin bridge formation after stimulating reparative dentinogenicmechanisms.MTA may also act to entomb residual microorganisms at the dentin interface. The slow release of calcium ions also allows the material to stimulate growth factors from the dental pulp and promote signalling molecules (TGF-β ,interleukin(IL) 1 α, IL-β ,macrophage, colony- stimulating factor(MCSF),that encourage hard tissue formation.[28]MTA has been used to create a hard tissue barrier quickly after the disinfection of the canal. Calcium sulphate can be pushed through the apex to provide a resorbableextraradicular barrier against which to pack the MTA.

Case report and results

A 9 year old girl who had met with trauma about six years ago, before she visited the Department of Paediatric Dentistry , Update Dental College,Dhaka,Bangladesh for the treatment of mandibular right lateral incisor. Patient had met with trauma and no treatment had been performed until the moment. She had chief complaint of pain which was mild, intermittent and had started few days back. Clinical examination revealed the crown size was reduced and discoloured and mobility of the teeth was within normal limits. Radiolucency with context to 26 and open apex with periapical radiolucency was evident, on radiographic evaluation. On the basis of clinical and radiographical examination, the case was diagnosed as necrosis of pulp with open apex.

On the first appointment, after proper isolation access opening to root canal instrumentation was established by standardized technique.i Working length was established 1mm short of the radiographic apex. Copious irrigation was done using 3% sodium hypochlorite and 2% chlorhexidine throughout the biomechanical preparation. The canal was dressed with intra canal medicament , calcium hydroxide and the access cavity was sealed with fast setting zinc oxide eugenol cement(IRM) . Patient was then recalled after 15 days.

Clinical photograph

Access cavity preparation

Dressing with Ca(OH)2

After sinus healing

MTA Placement

After 1 month follow up

After 6 month

After 1 Year

On second appointment, calcium hydroxide was removed using H- files along with normal saline irrigation and MTA powder (Dental Tulsa Dentsply, De Tray, Germany) and distilled water were mixed in 3:1 ratio and placed in the canal by cement lifter.MTA was condensed with the help of castom made pluggers made with no.60 Guttaparcha which snugly fitted to the desired length. After placement of MTA, radiograph was taken and moist cotton was placed in the canal .Finally sealed with IRM.

Two days later patient was recalled and temporary filling was removed to check the hardness of MTA. Obturation was done using lateral condensation technique and permanent restoration was done. Size of the periapical lesion decreased significantly and tooth was clinically alright after one year of follow up.

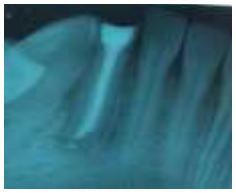
Preoperative radiograph

Working Length Determination

MTA Radiograph

Post Obturation Radiograph

After 1 Month



After 6 Month

After 1 Years

Discussion

It is essential to choose a treatment plan that is best for patient and dentist in complicated cases. Apexification is a method by which artificial barrier in the root apex is formed in such a way that obturating material can be filled in the canal space[16]. Calcium hydroxide has been extensively used to accomplish apical closure due to its ability to induce hard tissue formation, but it is more time consuming,which may between 3 and 21 months[17,18,25,26].MTA was used in immature premolars of dogs and was concluded that it induced apical plug more often with less inflammation.[19] MTA has shown good sealing abilities and biocompatibility to the periradicular tissue.[20,21,22]MTA has been successfully used as an apical barrier.[23,24] In this case maintaining sterilization of root canal, intracanal medicament, good apical seal using MTA and a three dimensional obturation has contributed to the success of the cases.

Although a variety of materials have been proposed for induction of apical barrier formation, calcium hydroxide has gained the widest acceptance. The use of calcium hydroxide was 1st introduced by Kaiser [9] in 1964 who proposed that this material mixed with camphorated parachlorophenol (CMCP) would induce the formation of a calcified barrier across the apex. Calcium hydroxide can be mixed with a number of different substances (Camphorated mono chlorophenol, distilled water, saline, anesthetic solutions, chlorhexidene, cresatin) to induce apical closure .[10.11]. The calcium required for apical bridge formation comes through the systemic route as demonstrated by Pisanty and Sciacky .[12]Siqueira and Lopes[11] discussed the mechanism of its antimicrobial activity in detail and Frank in 1966 published three case histories of apical closure induced by calcium hydroxide related to Hertwig's epithelial root sheath.

The traditional use of calcium hydroxide apical barriers has been associated with unpredictable apical closure, time taken for barrier formation, patient compliance, risks of re-infection 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 dentin to $Ca(OH)_2$,[13,]Torneck[14] and others have indicated that when apical closure takes place clinically with $Ca(OH)_2$, there is not complete bridging of the apex histologically. Thus there is increasing popularity with one visit apexification techniques using Mineral Trioxide Aggregate (MTA) as osteoconductive apical barrier.[8] MTA has a compressive strength equal to intermediate restorative material and Super – EBA but less than that of amalgam. It is commercially available as ProRoot MTA (Dentsply Tulsa Dental, Tulsa). MTA has the ability to induce cementum like hard tissue when used adjacent to the periradicular tissues. MTA has its superior sealing property, can set in the presence of blood and It is biocompatible. Shabahang[15]et al examined hard tissue formation and inflammation histomorphologically after treating open apices in canine teeth with osteogenic protein-1, MTA and calcium hydroxide. MTA induced hard tissue formation with the most consistency, but the amount of hard tissue formation and inflammation was not statistically different among the three materials.

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