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Case Report

Super natural power of MTA!! Successful management of badly mutilated young molars, report of two cases with 3 years follow up

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ABSTRACT

Apexification in one visit with Mineral Trioxide Aggregate (MTA) is beneficial in effectively sealing the open apices of young mutilated teeth. Although, placement of MTA through canals is difficult and many times leads to over extrusion due to wide apex. This case report presents the outcome of extruded MTA during apexification in mandibular young permanent molars in children. On long term follow-up, complete healing of the periapical radiolucency was evident around MTA without any symptoms. MTA apexification in incisors have been found in literature, but very few cases are reported with long term follow up regards to young molars.

1. Introduction

Three-dimensional obturation with apical seal of a root canal is the basic requirement for a successful outcome in Root canal treatment of permanent teeth. But the challenge is faced when nonvital tooth is immature with open apex. In such cases, Apexification procedure or Regenerative Endodontics is employed. 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] Material of choice for apexification was calcium hydroxide in past era, but in recent times MTA has been universally accepted for apexification.

MTA is made up of dicalcium silicate, tricalcium silicate, bismuth oxide, and calcium sulphate. The MTA powder hydrates to a fine crystalline gel-like consistency. This solidifies into a structure in less than three hours.[2] Due to MTA's hydrophilic nature, the existence of moisture, particularly blood, has no effect on its capacity to seal.[3]

When compared with calcium hydroxide–induced apical closure, MTA has multiple advantages like less treatment time required, the tooth is less likely to fracture and requiring less visits to the clinic.[4]

The major drawback of MTA among others[5] is its manipulation to achieve its placement in the wide apical area. In most of the open apex cases, MTA requires an orthograde condensation which can lead to extrusion of material in to peri- radicular tissues.

The use of MTA as an apexification agent in incisors and premolars is documented in a sizable number of case studies, but the present case report highlights unique nonsurgical endodontic management of open apex of immature mandibular permanent molars with MTA along with its long-term outcome when extruded unintentionally.

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2. Case Reports

2.1. Case 1

A 10-year-old girl visited to the Paediatric Dentistry department with pain in the left mandibular first molar from past 2 months. Intraoral examination (Figure 1A) revealed the presence of deep dentinal caries and destructed tooth structure with open pulp chamber in mandibular left first permanent molar. Her medical history was non-contributory. The tooth was unresponsive to electric and thermal testing. A blunderbuss canal was present in the distal root and a deep carious lesion was observed during the radiographic evaluation (Figure 1B). There was also evidence of periapical infection around the root apex. As the distal root apex was open hence, apexification with MTA followed by Root Canal Treatment was planned. After explaining pros and cons of the treatment, informed consent was taken from the parents.

Pre-endodontic composite buildup and rubber dam isolation was done (Figure 1C). Following the preparation of the access cavity, the canal was prepared till the F1 of the Pro-taper Gold file, and instrumentation was carried out by hand files followed by irrigation with 3% NaOCl and normal saline. As an intracanal medicament, calcium hydroxide was pushed into the canals (Figure 1D) and patient was recalled after 3 weeks. On subsequent next visit the tooth was reassessed and canals were dried with paper points and MTA apexification was carried out in distal root. Before removing the rubber dam, a radiograph was taken to evaluate the quality of MTA filling (Figure 1E) and it was observed that a significant portion of the MTA had been extruded into the periapical lesion.

The material's extrusion process, along with any possible consequences were explained to the parents. A hand plugger was used to check hardened MTA by gently tapping on in after 24 hours. The canals were obturated with gutta-percha using backfill technique followed by stainless steel crown (Figure 1F).

Patient was recalled after every six months for follow-up. On one year follow-up, extruded MTA was detached and remain embedded in bone (Figure 1G). After a three-year period of observation, constant width of the periodontal ligament space and continuity in the lamina dura indicate that the lesion was healed and there were no any notable signs seen on radiographs with extruded MTA (Figure 1H).

2.2. Case 2

An 11-year-old girl visited to department with pain in the lower left first permanent molar since last 3-4 weeks. Clinical examination revealed temporary restoration with a deep occlusal pit with respect to the left mandibular permanent first molar (Figure 2A). Radiograph showed temporary restoration with periapical radiolucency and the existence of an open apex on mesial and distal root (Figure 2B). The decision was made to treat the tooth with MTA apical plug. After explaining the possible risks and benefits of the procedure, an informed consent form signed by the parent was obtained.

Biomechanical preparation was done after working length determination followed by calcium hydroxide as intracanal medicament. Given the large apical foramen, there was a chance that the CH paste would extrude. Consequently, a radiographic evaluation of the CH dressing extension was conducted and it revealed calcium hydroxide extrusion into the mandibular canal (Figure 2C). The patient reported neither pain nor any other complaints.

Following three weeks, 5.25% NaOCl, 17% EDTA, and saline were alternately irrigated to flush out the calcium hydroxide. Then, both root canals were dried with paper points and an apical plug with MTA mixture (Figure 2D) was prepared. Small amount of MTA was extruded from mesial and distal canals into radiolucency of periapical area. The parents were informed about the iatrogenic error of extruded MTA. The remaining part of the root canal was filled with gutta-percha (Figure 2E) using backfill technique and a stainless steel crown was placed. (Figure 2F).

Radiographic examination after a year follow-up (Figure 2G) revealed resorption and healing of calcium hydroxide in periapical area, the position of the extruded MTA seemed to have changed; also mandibular canal was observed free of calcium hydroxide. Complete resorption of material from mandibular canal was confirmed and the shifted extruded MTA from the mesial canal appeared to be resorbed on 3-year follow-up radiograph (Figure 2H).

3. Discussion

Mandibular first permanent molars are on high risk for dental caries as it erupts first in the oral cavity.[6] If not intervened on time, permanent molars may become extensively decayed and ultimately indicated for extraction. After extraction of first permanent molar one of the treatment approaches include spontaneous space closure by second permanent molar. But the space closure is age specific and less predictable in the lower arch than the upper arch.[7] To avoid these unpredictable consequences and psychological trauma to the child, nonsurgical management of the mutilated young mandibular first permanent molar by MTA apexification holds promising results.

Due to its various Biomimetic properties, MTA showed clinical and radiographic success as a root end closure material and established as a suitable material for apexification than calcium hydroxide.[8] MTA is mainly made up of tricalcium and dicalcium silicate, which when hydrated, forms calcium silicate hydrate gel (C-S-H) and CH.[9] Bismuth oxide (Bi2O3), the radio-opacifier in MTA powder is found in C-S-H both as part of its structure and as unreacted filler particles. It can encourage cell differentiation into cells which forms hard

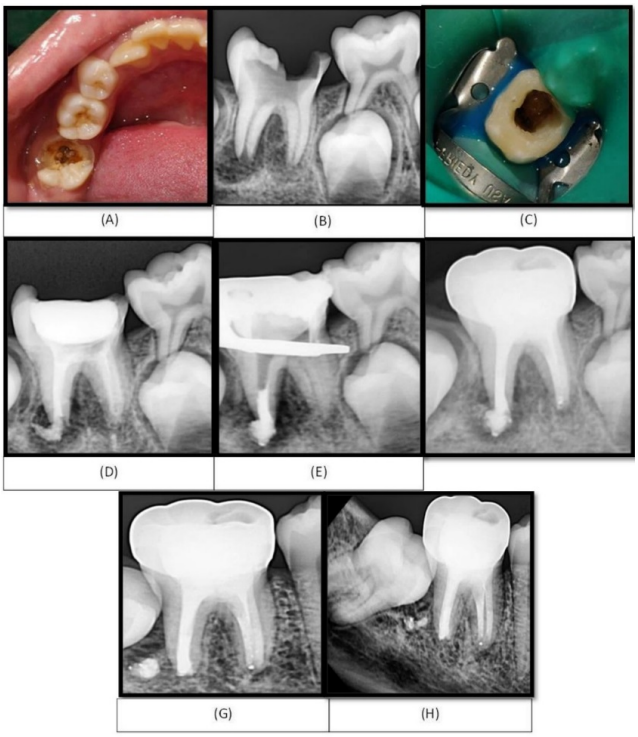

Figure 1: A: Preoperative clinical photograph; **B:** Preoperative radiograph with periapical lesion in distal root of 36; **C:** Composite build up with rubber dam isolation; **D:** Placement of calcium hydroxide as intracanal medicament; **E:** Extruded MTA during Apexification; **F:** Post Obturation with stainless steel crown. **G:** 1 year follow up **H:** 3 years follow up

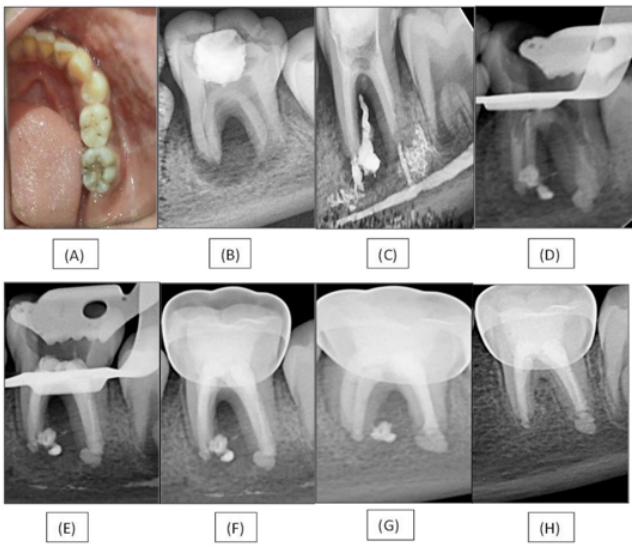

Figure 2: A: Preoperative clinical photograph; **B:** Preoperative radiograph; **C:** Radiopaque calcium hydroxide extruded into mandibular canal; **D:** MTA placement; **E:** Postoperative radiograph revealed extrusion of MTA in Distal Canal; **F:** 6 months Follow Up; **G:** 1 Year Follow Up; **H:** 3 years Follow Up.

tissue and create hard tissue matrix, when applied as an apical barrier.[10] However, MTA apical barrier technique has disadvantage of extrusion in the apical area due to open apex.

Several factors which will intensify the risk of filling material extrusion beyond tooth apex are: the complex anatomy of the root canals, an undeveloped root apex, an excessive compaction force, over-instrumentation, etc.[11] Extrusion of irrigation solution, dressing and obturating materials and sealers have been reported to persuade nerve injury along with irritation and pain when extruded.[9,12,13]

In the above cases, unfortunately MTA was extruded into the periradicular region during root end closure. It appeared that the periapically extruded MTA has been relocated from its original location and on follow ups, reduction in size of the extruded material was evident on radiograph. It is believed that the calcium silicate over time gets absorbed into the surrounding tissue and only the radio-opacifier bismuth oxide remains and was visible on radiograph. Irrespective of the position of dislodged MTA, healing of the lesion around it was evident. Expecting the poor prognosis with overfilling root canal filling materials, these healing responses were exceptionally favorable.[14,15] Extrusion of MTA during apexification in an open apex is not a common accident and if it extrudes does not impair the healing of its surroundings, but can sometimes cause discomfort, along with irritation and pain.[9] It has been recommended to use a resorbable matrix to easily control length and avoid overfilling. The use of resorbable barriers such as calcium hydroxide, collagen, calcium phosphate, tricalcium sulphate or calcium sulfate hemihydrate in combination with collagen has been used as an internal matrix to avoid unintentional extrusion of MTA.[10,16]

Kumar V. et al have documented MTA apexification successfully in young posterior teeth.[17] Likewise in the second case MTA apexification was done in all the root canals. Here, some amount of MTA was extruded in both canals, but lesion around it was healed upon follow up. Demiriz L. et al also concluded that extrusion of MTA in the apical area can lead to healing of periapical region due to its properties like bone deposition without any inflammatory reaction, regeneration of periapical tissues to a normal condition and an excellent biocompatibility.[18]

According to Grotz KA. et al. severe acute pain during or just after endodontic intervention and neural alterations such as hyperesthesia, anaesthesia, paraesthesia, and hypoesthesia are the initial symptoms with material extrusion into the mandibular canal.[19] Contrast to this, second case demonstrated overextension of calcium hydroxide into mandibular canal due to open apex or high compaction force without neural alterations. Here, the patient did not show any pain or symptom of nerve injury. Over a period of time, sealer may completely be cleared from the periapical area by macrophages, which

then sooner or later heal up.[20] The patient was followed-up for 3 years which showed elimination of calcium hydroxide from mandibular canal without any reported symptoms.

Lentulo spiral applies less intracanal pressure than a syringe when applying filling pastes.[21] Hence, to prevent material extrusion, its use has been suggested which eventually decreases the risk of nerve damage in children.

4. Conclusion

Nonsurgical management of mutilated young permanent molars can be successfully carried out by MTA apexification procedure. While the posterior teeth are less visible, less accessible because of their narrow canals, and have a smaller mouth opening than the anterior teeth, MTA apexification with precise technique gives favourable outcome. MTA promotes periapical healing and apexification even in cases where a significant portion of the material was unintentionally extruded.

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6. Conflict of Interest

None.

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