Case Report

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MINERAL TRIOXIDE AGGREGATE AS AN ORTHOGRADE APICAL PLUG IN INFECTED AND OPEN ROOT END APICES: A CASE SERIES

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ABSTRACT:

Young permanent teeth often show premature interruption of root development as a consequence of pulp necrosis due to trauma. Absence of natural apical constriction in these teeth cannot provide an apical stop against which one can place root canal filling material, which leads to its over-extrusion. The role of materials such as calcium hydroxide and MTA becomes indispensable in such cases to form apical plug in order to limit bacterial infection and establish a suitable environment for the induction of calcified tissue in the apical area. This article describes successful treatment of five cases that had open apices and periapical lesions using orthograde technique for placement of MTA to form a apical plug after root canal had been debrided and cleaned with 2% chlorhexidine . The apical plug of (3-4 mm) was formed in the root canal using MTA and than obturated. Post treatment follow-up revealed resolved peri-apical pathology.

Key words: Apexification, Mineral Trioxide Aggregate, blunderbuss, microleakage, immature.

INTRODUCTION:

Trauma to the tooth, most commonly found among young children, accounts for one third of all traumatic injuries in young boys and one fourth of all injuries in young girls.[1] Anterior teeth bear the brunt of many impact injuries because of their position. Cessation of root development is often seen after such injuries. Because the root development takes place for almost two years after the tooth has erupted in the oral cavity, an incompletely formed apex is one of the most common features seen in the traumatized teeth. The patient commonly reports after many years when necrosis of pulp has caused apical periodontitis or

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discoloration, causing either pain or compromised esthetics. Inadvertently radiographs reveal an open apex or blunderbuss apex.[2]

Treatment of the immature non vital tooth with apical pathology presents several treatment challenges. The mechanical cleaning and shaping of a tooth with blunderbuss canal are difficult. The thin, fragile lateral dentinal walls can fracture during mechanical filing, and the large volume of necrotic debris contained in the wide root canal is difficult to completely disinfect.[2] On conventional obturation of wide canal system, there is danger of splitting of the root during lateral condensation because of the forces applied during the process, hence it requires precise fabrication of a customized gutta-percha cone or highly technique sensitive obturating procedures like continuous wave method of sealing the canal using equipments like calamus or touch and heat. Endodontic management of such teeth includes surgery and retrograde sealing, calcium hydroxide induced apical closure (apexification), and, more recently, orthograde placement of apical plug of mineral trioxide aggregate(MTA) followed by guttapercha obturation.

On this regard, calcium hydroxide has historically been used to establish apical closure by inducing apexification. This technique, first introduced by Kaiser and later spread by Frank [3], allows hard tissue deposition at the end of the root. It restricts bacterial infection and establishes a suitable environment for peri-apical repair. Although calcium hydroxide apexification has a success rates in the mid-90% range [4], important disadvantages have also been associated with its utilization. The need of multiple appointments, the long period of time for treatment completion (from 3 to 21 months) [5], susceptibility to fracture [6] and coronal micro-leakage during treatment [7] are some of the disadvantages which could be mentioned. Also, the formed barrier, although apparently calcified, is in fact porous and sometimes contains small amounts of soft tissue [8].

With the ortho grade placement of MTA apical plug technique as used in the discussed cases, a one-step obturation after canal disinfection has been performed. The MTA plug acts as an artificial stop to the filling material and In agreement with other studies, MTA furthermore appeared to show good sealing ability, good marginal adaptation, a high degree of biocompatibility and a reasonable setting time (about 4 h). From a practical point of view, MTA can be used in the presence of moisture in the root canal. This property is important in teeth with necrotic pulps and inflamed periapical lesions because one of the problems found in these cases is the presence of exudate at the apex of the root [9]. However the application of MTA should be preceded by a temporary calcium hydroxide dressing in order to limit bacterial infection in the tooth.

CASE DETAIL:

Case 1: A 18 year old male patient, reported with a chief compliant of discoloured right maxillary central incisor with the history of trauma at the age of 9. The concerned tooth did not respond to both electric and heat test. Detailed radiographic examination revealed a large blunderbuss canal with associated periapical lesion in relation to maxillary right central incisor (Figure 1).There are two treatment options either surgical removal of periapical lesion and retrograde filling or non surgical root canal treatment followed apexification using apical plug of MTA. Considering the amount of surgical trauma and the age of the patient nonsurgical treatment was opted. Access opening was prepared under rubber dam isolation and working length was determined (Figure 2). Pus was extruded from the root canal immediately after access preparation. Biomechanical preparation was done using no 80 K-file using circumferential filing motion. Root canal debridement was done using alternate irrigation with 2% chlorohexidine and saline. Calcium hydroxide dressing was placed in the root canal and patient was recalled after one week. At subsequent appointment after removal of dressing, root canal was found completely dry and canal was debrided with 2% chlorohexidine. The canal was dried with paper points and orthograde placement of Mineral trioxide aggregate was done with MAP system in the apical portion of the canal, subsequent increments were condensed with hand pluggers till thickness of 2-5mm (Figure 3).A wet cotton pellet was placed, access cavity sealed with cavit G. In subsequent appointment root canal was back filled with Calamus obturation system, access cavity was sealed with composite material.

Case 2: A 13-year-old boy suffered trauma to his upper left central incisor 2 years before the first visit. Clinical examination revealed discoloration of maxillary left central incisor accompanied with pain at night and tenderness at percussion. The radiographic examination (Fig.5) revealed an immature tooth with a wide open apex and a radiolucent area in proximity of the apex of the tooth. The protocol for the creation of an orthograde apical plug with MTA mixture was implemented as in case I(Figure 6).

Case 3: A 14 year old male patient complained of discoloration and pain in maxillary left central and lateral incisor. Patient reported a history of trauma while playing football 2 years back. Radiographic examination revealed incompletely formed apex with blunderbuss canal (Figure 7). The protocol for the creation of an orthograde apical plug with MTA mixture was implemented as in case I.(Figure 8)

Case 4: A 16 year old male patient had a history of fall 2 months back. Clinical examination revealed fractured incisal edge of left maxillary central incisor with associated discoloration. Radiographic examination revealed incompletely formed apex with blunderbuss canal

(Figure 9). The same protocol as in case 1 was followed to create an orthograde MTA apical plug and obturation of canal was done with calamus system (Figure 10).

Case 5: A 22 year old male patient complained of pain in right mandibular first molar. Patient presented a history of previous dental treatment 2 years back where he underwent root canal treatment and root end resection . Radiographic examination revealed resected distal root end accompanied with a distinct periapical lesion and extruding gutta percha point with no endodontic filling of mesial roots (Figure 13). Retreatment was initiated with removal of gutta percha from distal root and working length determination of the tooth (Figure 14). The mesial roots were prepared and filled as they were without any clinical and radiographic pathology. The distal root with the resected root end and incomplete seal was sealed with orthograde MTA apical plug (Figure 15) and on cessation of symptoms, distal root was obturated(Figure 16).

DISCUSSION:

The cases reported here in demonstrated the applicability of MTA as a material used for apical plug in infected immature teeth. Although calcium hydroxide demonstrates satisfactory results on periapical repair and on obtaining an apical mineralized barrier, the use of MTA presents some advantages, such as the possibility of its placement in as little as one visit [10] or after 1 or 2 applications of root canal dressings [11], thus eliminating the waiting time required for calcium hydroxide apexification. This advantage is especially relevant because it has been proved that the placement of a permanent restoration after a short treatment time serves to increase fracture resistance of the immature teeth [4,6]. Also, calcium hydroxide long term treatment may increase the risk of root fracture [12].

In the present case reports, it was chosen to use calcium hydroxide dressing associated to CHX before MTA placement. The use of this association has been recently suggested, being supported by the advantages of keeping important properties of calcium hydroxide i.e: its tissue solving effect [13] and its capacity of acting as a physical barrier preventing inter appointment reinfection as well as increasing its antimicrobial effect .CHX has been shown to be more effective than calcium hydroxide in eliminating E .faecalis infection inside dentinal tubules [14]. For this reason it seems to be reasonable to associate its excellent antimicrobial capacity to calcium hydroxide.

The improvement of chemical capacity of disinfection seems to be especially relevant in cases of non-vital immature teeth, which present several challenges for promoting mechanical cleaning and shaping. Characteristics such as the presence of thin and fragile lateral walls and the large volume of necrotic debris contained in wide root canals make the achievement of sufficient disinfection difficult.

The treatment results obtained in the presented cases might be related to the fact that MTA is capable of maintaining the biological properties presented by calcium hydroxide. MTA forms calcium oxide when in contact with water, which when placed in contact with fluids of tissues forms calcium hydroxide, and triggers the same repair process in tissues [15,16]. In addition, MTA physical characteristics of expansion during the attachment assist to the achievement of the apical sealing. A 4-5mm apical plug is appropriate to resist displacement from the apex and to prevent infiltration of fluids in the canal [17]. MTA is a material which has less leakage , better antibacterial properties, high marginal adaptation, short setting time(4 hours), a pH of 12.5 and is more biocompatible [18].

Scaffolding is provided for the hard tissue barrier by MTA. A bioactive material MTA stimulates the production of interleukins and cytokine release. So it is capable of promoting the hard tissue repair.

CONCLUSION:

Within the limitations of the presented clinical cases, it could be concluded that use of MTA as an orthograde apical plug is an effective treatment of infected and immature root end apexes as it exhibits better sealing ability, antibacterial properties, hard tissue formation ability and biocompatibility for treatment of such cases. Hence, it may also be considered for the use with predictable clinical results.

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FIGURES:

CASE 1

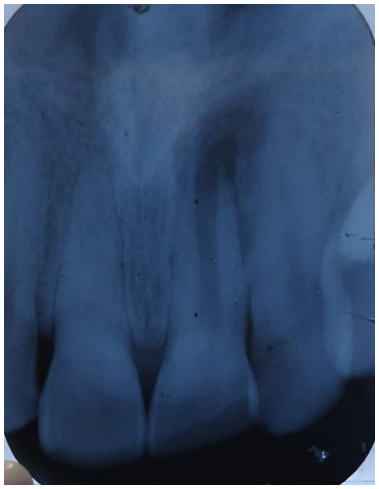

Figure 1: Preoperative radiograph showing blunderbuss apex and perapical radiolucency

Figure 2: MTA Apical plug created

Figure 3: Post operative radiograph showing healing at the peri-apical region

CASE 2

Figure 4: Preoperative radiograph showing incompletely formed apex of maxillary central incisor

Figure 5: MTA apical plug created

Figure 6: Post operative radiograph

CASE 3

Figure 7: Preoperative radiograph

Figure 8: MTA Apical plug formed

Figure 9: Post operative radiograph

CASE 4

Figure 10: Preoperative radiograph

Figure 11: MTA Apical plug created

Figure 12: Post operative radiograph

Case 5

Figure 13: Preoperative radiograph

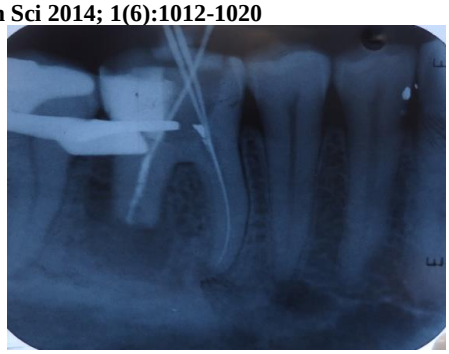

Figure 14: Removal of Guttapercha and working length determination

Figure 15: placement of apical plug at distal root of the molar and obturation of the mesial roots

Figure 16: Post operative radiograph showing obturation of distal canal