Apexification with MTA using Internal Matrix: Report of 2 Cases

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Calcium hydroxide (CH) has been reported to have several drawbacks when used for apexification. Mineral Trioxide Aggregate (MTA) has generated considerable interest as an alternative. Two different cases are reported using MTA for apexification. In the first case an incomplete CH barrier was used as a matrix against which MTA could be condensed. In the second case internal matrix was formed using absorbable collagen sponge and a comparable result could be achieved. Further studies are needed to develop it into a standardized method, akin to that of matrices used in class II restoration.

***Keywords**: Apexification, MTA, Internal matrix.*
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INTRODUCTION

Traumatic injuries sustained before closure of the apex often results in immature pulpless teeth. In such situations, the absence of a natural constriction at the end of the root canal makes control of filling materials difficult.[1] Root canal rehabilitation is a significant challenge, because of the size of the canal, the thin and fragile dentin walls and the large open apex. Apexification is defined as 'a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp.[2] Apart from allowing compaction of the root filling material, the goal of this treatment also includes obtaining an apical barrier to prevent the passage of toxins and bacteria into the periapical tissues from the root canal.

Calcium hydroxide (CH) has been the material of choice for apexification.[3] Calcific barrier formation is induced with repeated changes of material over the course of 5–20 months[4] averaging 12.9 months.[5] Some disadvantages of this technique have been reported. The lack of coronoradicular restoration and thus of an appropriate coronal seal makes the tooth susceptible to reinfection.[6] Prolonged contact with calcium hydroxide induces a significant decrease in the intrinsic properties of exposed dentin.[7] Repeated use of root canal irrigants like sodium hypochlorite, an organic solvent and chelating agent such as EDTA during treatment or to remove the calcium hydroxide after formation of apical barrier, result in further weakening of the dentin and render the tooth more prone to fractures These fractures occur frequently within 3 years of commencing treatment, with as many as 77% fractures in cases with least root development.[8]

Mineral trioxide aggregate (MTA) is a FDA approved, commercially available material that has evoked considerable interest as a root end filling material. The granular consistency of the mix with sterile water makes the orthograde placement of the material in the apical region of canal technique sensitive. Lemon[9] developed the internal matrix concept in which an intermediate layer of material is placed to form a barrier prior to placement of the repair material. A matrix of sterile absorbable collagen sponge has been advocated to reconstruct the outer shape of root and facilitate the adaptation of MTA. This material absorbs moisture and expands besides acting as a haemostatic.[10]

Hydroxyapatite,[9] decalcified freeze-dried bone[11] and calcium hydroxide have also yielded good results.

CASE REPORT

Two girls aged 9 years, reported to the dental department with history of traumatic injuries to maxillary central incisors that occurred approximately 18 months back. The teeth were diagnosed to be non vital with a combination of clinical signs and symptoms, vitality tests and radiographs. The teeth were isolated with rubber dam after achieving local anesthesia. Access cavity was prepared in the palatal surface of the incisors. The cavities were widened with GG drills to enhance the visibility of the root canal. The canal was then gently cleaned with manual instruments 1mm short

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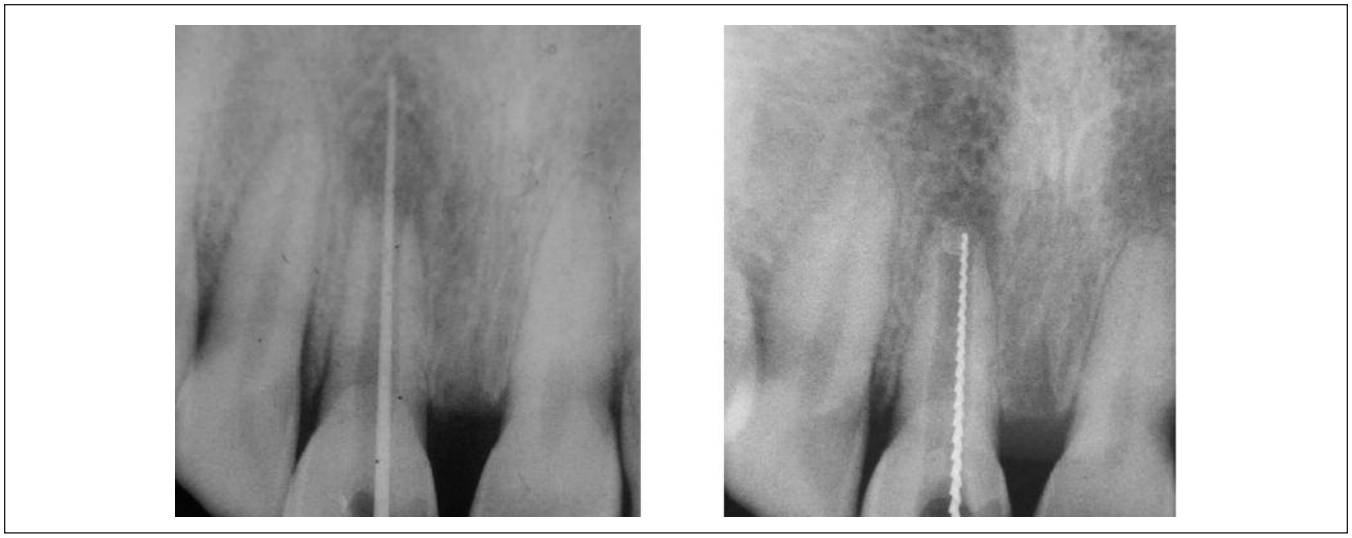

Figure1A. Periapical lesion with open, divergent apex in 11. 1 A: Incomplete barrier after 16 months induced by CH

of the root apex with 5% sodium hypochlorite irrigation followed by saline. The working length was measured radiographically and recorded for reference. The canals were dried with sterile paper points and filled with calcium hydroxide and the access cavity was sealed with Cavit (3M ESPE AG, Seefeld, Germany).

In the first case, a periapical lesion was evident with divergent root apex in tooth number 11 (Figure 1A) CH barrier was induced at the apex after 16 months of repeated dressings, with a reduction in the size of periapical region. However, this barrier was incomplete, fragile and could be easily pierced with a #50 file (Figure 1B). Grey MTA-Angelus (Angelus, Londriana, PR, Brazil) plug was placed in the canal with a carrier and pluggers, sized according to the apical diameter were used to condense the material against the barrier, to form apical plug with a thickness of approximately 4 mm. Correct placement of MTA was confirmed radiographically (Figure 1C). A sterile sponge pellet moistened with sterile water was placed over the canal orifice and the access cavity was sealed temporarily. The material was allowed to set for 48 hours after which the canal space was reentered. The set material was confirmed by gentle probing with a file. The remainder of the canal was then obturated using cold lateral compaction technique (Figure 1D). The complete resolution of periapical lesion in 11 is seen 6 months after MTA placement. (Figure 2)

The second case presented with an acute periapical abscess in 21 along with an open apex (Figure No. 3A, B), After 2 weeks of CH therapy, the material was removed by rinsing with alternating solutions of sodium hypochlorite 5% and EDTA 17%. The working length was confirmed with a wet line evident on the paper points. Small pieces of absorbable collagen sponge (Figure 3C) were then condensed beyond the canal apex using endodontic pluggers, until the periapical space was full in order to create a periapical barrier for the MTA. This procedure was adapted from the method described previously by Bargholz.[10] The subsequent procedure of MTA placement (Figure 3D) and root canal obturation (Figure 4) was performed as described in case number 1.

Figure 1C. MTA plug condensed against the incomplete barrier. **1D**. Obturation with cold lateral compaction technique

Figure 2. Healing 6 months following obturation

DISCUSSION

The calcific barrier observed with CH has been found to be variable and unpredictable. Available evidence is insufficient to provide clear guidelines for practice.[12] MTA has been reported to have several desirable properties such as biocompatibility, fibroblast stimulation, antimicrobial activity and sealing capacity with an ability to set in a moist environment.[13] Application of MTA results in predictable apical closure and reduction of the treatment time, number of appointments and radiographs, particularly in young patients.[14] Orthograde obturation with mineral trioxide aggregate as an apexification material also represents an attempt to strengthen immature tooth roots.[15] Though MTA is not bonded to dentin, interaction of the released calcium and hydroxyl ions of MTA with a phosphate-containing synthetic body fluid results in the formation of apatite-like interfacial deposits.[16] These deposits fill any gaps induced during the material shrinkage phase and improve the frictional resistance of MTA to the root canal walls probably accounting for the seal of MTA in orthograde obturation.[17] However, its low viscosity makes introduction in small or tortuous areas difficult. The control over the material is also relatively poor, particularly in open and divergent apices, where the material can extrude into the periapical region. Poor adaptation of MTA Angelus, in particular, has been suggested to be due to the reduction in setting time (10min compared to 2 hours of Pro-Root MTA), preventing better wetting and adaptation to cavity walls.[18]

In the case reported, barrier formed by calcium hydroxide was suitable for the MTA plug to be condensed against. A similar result could be achieved with the use of absorbable collagen sponge matrix, avoiding the complications of long term calcium hydroxide use, concomitantly preventing over filling with MTA. Absorbable collagen sponge is widely used as a carrier for bone morphogenetic protein, a possible future application in large periapical lesions. This assumption, however, does not preclude the use of calcium hydroxide as a canal disinfectant, which is essential for apexification with MTA. The setting properties and the strength of the material get affected in the presence of an acidic environment which can be countered by the alkalinity of CH.[19] Besides, the physical properties of dentin are not altered for up to 4 weeks after CH placement,[7] wherein generally advocated period of canal disinfection is from 1-2 weeks.

CONCLUSION

CH has been reported to have several disadvantages, notably the long duration of treatment. The use of MTA represents a

Figure 3A. Acute periapical abscess in 21. **3B.** Open apex

Figure 3C. Small pieces of absorbable collagen spoge. **3D.** MTA plug formed.

Figure 4. Obturation with cold lateral compaction technique

contemporary version of apexification, with the associated benefits of the material. In its current commercial form, MTA has poor handling characteristics. A technique using internal matrix of absorbable collagen sponge gives good control in condensing the MTA against it. Further studies are needed to develop it into a standardized method, akin to that of matrices used in class II restoration.

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