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APEXIFICATION USING MODIFIED INTERNAL MATRIX CONCEPT: A CASE REPORT.

Case Report

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ABSTRACT:
Immature roots with necrotic pulps in young permanent teeth are characterized by wide root canals with open apex and thin walls. Treatment of such teeth pose a great challenge. Traditionally such teeth were treated by apexification using calcium hydroxide and more recently by apical barrier technique using MTA apical plug. It is advised to use a resorbable and biocompatible apical matrix in cases involving MTA for careful condensation of the material in the apical region. This case report presents successful outcome of apexification with combined use of Mineral Trioxide Aggregate as an apical barrier and collagen membrane as an internal matrix.

Key words:
Apexification, Collagen Matrix, MTA, Immature permanent tooth.

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Conflict of interest: None

INTRODUCTION : An immature permanent tooth is a young/newly erupted permanent tooth with incomplete root apex formation. After a permanent tooth emerges in the mouth, the completion of root development and closure of the apex occurs up to 3 years.[1] Hertwig's epithelial root sheath (HERS) is responsible for determining the shape of the root/s. Any disruption in the blood supply to HERS as a result of pulp necrosis can disrupt cell proliferation and differentiation causing cessation of root development.[2] Immature roots with necrotic pulps in young permanent teeth are therefore characterized by wide root canals with open apex and thin walls. Traumatic dental injuries play a significant role in causing the pulp necrosis and subsequent infection of the root canal system in immature permanent teeth.[3]

Treatment of such teeth is aimed to provide a root end closure. In the past, various techniques used for managing the open apex were: custom fitting of the filling materials [4], paste fills [5] and periapical surgery [6]. The contemporary approach involves apexification, which 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.[7]

Mineral trioxide aggregate (MTA) was developed for use as a root-end filling material and for repair of root perforation. Later, for apical filling of teeth with open apices and apexification therapy. The use of MTA in the apexification procedure has shown to provide an excellent treatment option in the management of teeth that present with incomplete root and apex formation. It has several advantages such as it neither gets resorbed, nor weakens the root canal dentin, and also sets in the wet environment. [8]

It is advised to use an apical matrix of some resorbable and biocompatible material against which the sealing material, MTA can be packed and its extrusion in the periapical space can be controlled. To achieve this an absorbable collagen wound dressing (eg, Colla-Cote®), placed at the root end allows MTA to be packed within the confines of the canal space.[9]

Therefore, present case report highlights the nonsurgical management of a symptomatic tooth with blunderbuss canal and large periapical radiolucency using bio-resorbable collagen matrix and MTA.

CASE REPORT: An 11-year-old boy reported to the Department of Pediatric and Preventive Dentistry with the chief complaint of a broken upper right front tooth with persistent pus discharge since 3 months. Patient revealed

history of trauma from a hand pump 3 years ago in right maxillary anterior region of jaw. On clinical evaluation the tooth 11 was discoloured with a sinus opening and the cold vitality test was negative indicative of pulp necrosis. (Figure 1)

Figure 1. Pre-operative intra-oral clinical picture

Pre-operative Intra Oral Periapical Radiograph (IOPAR) in relation to 11 revealed ill-defined radiolucency at the apex of the tooth 11 along with an open apex.

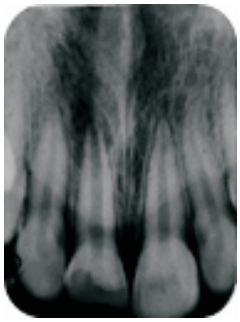

Figure 2. Pre-operative radiograph

A final diagnosis of chronic apical abscess i.r.t tooth 11 with an open apex was made.

Considering the age of the patient, oral hygiene status, future prognosis of the tooth and patient's wish to undergo non-surgical management, Apexification was chosen as the most definite treatment of choice. The treatment consisted of two phases namely: healing of periapical lesion using intracanal medicament Metapex (Meta Biomed Co. Ltd, Cheongju, Korea) followed by root end closure using collagen matrix and Pro-Root MTA (Maillefer, Dentsply, Switzerland) apical plug. After obtaining the informed consent, access cavity was prepared under rubber dam isolation in relation to 11 and minimal biomechanical preparation along with copious irrigation with NaOCl and saline was done. Canal was dried and an intracanal dressing of Metapex (Meta-Biomed) was placed. Patient was recalled after 1 month but reported back after 3 months again with the complaint of pus discharge from the sinus opening in the tooth 11. On clinical evaluation the coronal seal was broken and on retrieving the intracanal medicament multiple tiny wooden sticks present in the canal. (Figure 3.)

Figure 3. Retrieval of foreign object at 3 months follow-up

On eliciting the history, it was found that in order to deal with the itching sensation patient used to dig his tooth's canal from the day since the treatment had started. The broken coronal seal and foreign objects were found to be the likely cause of recurrent infection and pus discharge. The canal was again thoroughly cleaned and irrigated followed by metapex dressing which was changed every month and follow up was done both clinically and radiographically. The patient was strictly instructed to comply with the post-operative instructions given for a successful treatment outcome and patient as well as parent counselling was done. Radiograph at 4 months showed complete healing of the periapical lesion i.r.t. 11 but no constriction of the root apex was seen. (Figure 4.)

Figure 4. Healed periapical lesion at 4 months follow-up.

Following this apexification i.r.t 11 was planned using a MTA plug with the modified internal matrix concept.(8) The canal space was dried using sterile paper points followed by placement of a small absorbable collagen plug (Cologenesis Colo Gide GTR Membrane) using endodontic finger pluggers (Dentsply Maillefer) beyond the apex in order to create a periapical barrier to avoid extrusion of MTA in periapical area. (Figure 5)

Figure 5. Placement of collagen matrix

MTA plug was condensed against the collagen matrix in a thickness of approximately 4mm using MTA carrier (GDC) and number 3 endodontic plugger (Dentsply Maillefer) that fitted best in relation to the apical diameter of the root apex. (Figure 6.)

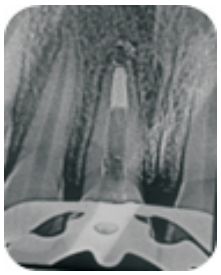

Figure 6. Apical barrier of MTA

A sterile moistened cotton pellet was placed over the MTA and sealed with temporary restoration. The MTA was allowed to set and the remaining canal was obturated by Gutta Percha using cold lateral condensation technique on the next day. This was followed by post and core build-up. (Figure 7.)

Figure 7. Post- operative picture

Radiographic follow-up of the case at 9 months showed presence of a thin dentin bridge at root apex. (Figure 8.)

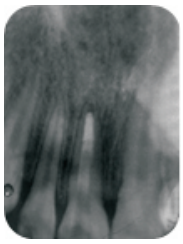

Figure 8. Follow up radiograph showing presence of thin calcific bridge at the root apex.

The patient is under regular follow-up.

DISCUSSION: Currently popularized concept of pulp revascularization could have been another treatment option, but due to unpredictable outcome of the procedure and longer treatment duration[10] a more definite treatment, apexification was chosen.

The treatment plan in our case aimed to harness the best of both, Calcium Hydroxide and MTA's properties. The combination of these two procedures was used to reduce the overall treatment duration. Calcium Hydroxide was used to ensure canal disinfection and periapical healing in order to achieve a firm/hard barrier for collagen matrix and MTA condensation.

Apexification using Calcium Hydroxide alone is uncertain and of long duration of approximately 5-20 months,[11] due to which there is a high chance of marginal leakage from the coronal seal and/or restoration failure resulting in re-infection, which was evident in our case.

The temporary seal failed which resulted in re-infection and prolongation of the treatment. The endodontic failure due to coronal leakage is well established in literature.[12-14] More recently, the use of apical barrier techniques with mineral trioxide aggregate (MTA) being placed at the open apex has shortened the treatment times and resulted in favorable healing outcomes. [15]

It is interesting to report 2 cohort studies[16,17] in which trauma led to pulp necrosis and bacterial colonization. Both studies concluded that apexification with placement of an apical barrier of MTA showed superior outcomes than Regenerative Endodontic Procedures.

The modified internal matrix concept, recommended the use of collagen as a completely resorbable barrier material and MTA as a perforation repair material.[8] The same concept has been utilized for the placement of MTA apical barrier in our case.

Absorbable collagen membranes are mechanically malleable, adaptable, and easy to manipulate, which may be beneficial in clinical application. Other advantageous properties of collagen include hemostatic function, semi-permeability, allowing nutrient passage, natural enzymatic degradation, and chemotactic ability to attract fibroblasts. [18]

A plug of resorbable collagen membrane was used in our case for effective condensation of MTA to avoid it's periapical extrusion. If extruded into the peri-radicular tissues, osseous healing and resorption of MTA might occur, or it may remain unset and affect the healing process. More histological studies on tissue reactions to unset MTA, the effects of unset MTA on the healing process and the effects of set MTA on soft peri-radicular tissues are recommended.[19]

Presence of a calcific bridge at follow up of 9 months might be due to the osteo-inductive property of the MTA[8]) and the guided tissue regeneration capacity[18] of the collagen matrix that was placed at the root apex.

CONCLUSION : Using an internal matrix of collagen before placement of MTA has demonstrated to give good results in apexification. The placement of MTA has become predictable with controlled condensation, reduced frequency of appointments and a foreseeable future.

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