Management of an Immature Tooth Using MTA and Composite Canal Reinforcement

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Abstract: Complete debridement, thorough disinfection and optimal sealing of the root canal system are the major challenges associated with endodontic treatment of teeth with open apices. In such teeth, thin radicular dentinal walls are susceptible to fracture. To ensure a better prognosis in such fractured prone thin dentinal walls, internal radicular reinforcement with various adhesive materials like glass ionomer cement, composites is recommended. A 15-year boy reported to the department with tooth #21 showing large periapical radiolucency in association with an immature tooth having flared wide root canal. Here presenting a management of this case using MTA as an apical plug and composite as canal reinforcement material. This case report highlights the use of apical stop and canal reinforcement technique for management of immature teeth with thin radicular walls.

Keywords: Open apex, Mineral trioxide aggregate (MTA), Apexification, Canal reinforcement, Apical plug.

1. INTRODUCTION

In children and adolescents, young permanent teeth are often prone to injuries due to orofacial traumas leading to pulpal inflammation or necrosis with cessation of root development and compromised apical closure [1, 2]. Endodontic and restorative management of such cases is difficult because of incomplete closure of the apex and thin dentinal walls. Apexification method utilizes long-term calcium hydroxide treatment to induce calcific bridge formation at the apex of the nonvital, immature root. Studies showed that successful hard tissue barrier will be formed in 79 to 96% of cases with duration more than 18 months [3].

The unpredictable and often lengthy course of this treatment modality presents challenges such as the vulnerability of the temporary coronal restoration to re-infection, need of high level of patient conformity, further weakening of immature roots due to hygroscopic properties of calcium hydroxide etc. Andreasen et al. [4] suggested in a study that the long-term calcium hydroxide therapy may weaken immature roots [4]. Hence artificial apical barriers with a variety of materials have been recommended as a substitute to conventional calcium hydroxide apexification. The popularity of mineral trioxide aggregate (MTA) apical barrier is due to factors like biocompatibility [5], superior sealing properties [6] etc. To ensure a better prognosis in such fractured prone thin dentinal walls, internal radicular reinforcement with various adhesive materials like glass ionomer cement, composites is recommended [7]. Aim of this case report is to highlight the use of MTA as a apical plug and composite as canal reinforcement material in an immature tooth.

2. CASE REPORT

A 15-year old male reported to the department with the chief complaint of a fractured discoloured upper front tooth. Patient gave a history of road traffic accident 7 years back. On clinical examination tooth #21 was found to be discoloured and fractured (Figure 1A). An intraoral periapical radiographic examination of tooth #21 showed large periapical radiolucency in association with flared wide root canal (Figure 1C). On vitality testing (with electric pulp tester) tooth #21 was found to be non-vital and tooth #22 was found to be vital. Patient was explained regarding wide thin radicular walls with open apex and all treatment options available. Informed written consent was taken. Tooth #21 was isolated with a rubber dam. A conventional access cavity was prepared in the palatal surface of the central incisor. The cavity was widened with start-x ultrasonic tips (Dentsply Tulsa, Tulsa, OK, USA) to enhance the visibility of the root canal. The working length was measured radiographically with a bent K-file (Dentsply Maillefer, Tulsa, OK) and recorded for reference (Figure 1D,E,F). The canal was then gently prepared with minimal instrumentation and irrigation was performed with 2.5% NaOCl (NaOCL, Cmident, New Delhi, India). The canal was dried with sterile paper point and calcium hydroxide paste (Prime Dental Products Pvt Ltd, Mumbai, India) was placed. The

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access cavity was sealed with cavit (3M ESPE AG, Seefeld, Germany). After 1 week, calcium hydroxide was removed by rinsing with alternating solutions of 2.5% NaOCl and 17% EDTA (Largal Ultra, Septodont, Saint Maur des Fosses, France). A final rinse with sterile water was performed. Once the canal was dry at the working length, with no exudates, the MTA (Dentsply Tulsa) apical plug was placed. A sterile cotton pellet moistened with sterile water was placed over the MTA for 48 hours to achieve optimum setting of MTA by double hydration mechanism (Figure 2A). The access cavity was sealed temporarily.

Patient was recalled after 48 hours and cotton placed in canal was removed. Internal aspect of the root canal was etched with phosphoric acid. To remove all traces of etchant, thorough rinsing using saline was performed within the canal and complete intra-canal dryness was achieved with ISO size #80 paper point (Dentsply Maillefer, Tulsa, OK). Using a microbrush, dentine bonding agent (Clearfil Liner bond 2, kuraray) was applied and cure. Restorative composite resin material (Z100; 3M Dental Products) was dispensed and packed into the root canal. The Luminex light-transmitting post (Dentatus, Weissman Technology) was lightly coated in Vaseline and inserted centrally into the root canal to its full depth. Excess material was removed from the access cavity and a light-curing tip was placed at the end of the plastic post. The light was transmitted along the entire length of the post for polymerisation of the surrounding composite (Figure 2A). The post was then removed with a rotating and pulling motion. In the space left after post removal, quartz fibre post was luted with the dual cured resin cement (RelyX™, 3M ESPE) (Figure 2B). Post obturation restoration was given and tooth was restored with porcelain fused to metal crown (Figure 2C).

3. DISCUSSION

Complete debridement, thorough disinfection and optimal sealing of the root canal system are the major challenges associated with endodontic treatment of teeth with open apices. [8] The major consideration given in restoring immature, non-vital teeth is to assess the stage of root development and remaining root wall thickness. The traditional apexification technique utilizes long-term intracanal calcium hydroxide to promote the formation of a calcified barrier. But when restoring immature teeth, immediate apexification using an MTA barrier offers several advantages over conventional apexification. These include fewer appointments for the patient, development of an immediate
apical seal, and less potential to weaken tooth structure with long-term calcium hydroxide [9].

As the dentin wall thickness decreases, the resistance to fracture becomes more dependent upon the reinforcing capability of the materials used for intracanal reinforcement. Anterior teeth having wide flared canals are at high risk of fracture, because the strength of any tooth is directly related to the bulk of the remaining dentin [10, 11]. Thus, for a flared canal, it is important that lost tooth structure must be replaced with a strong substitute and that the residual structure must be protected from the functional stress. Endodontically treated teeth can be directly restored with several elements (stainless steel posts, composite resin), but the potential for these materials to perform differentially than dentin under dynamic load or thermal expansion may affect the resultant modulus of the elasticity, compressive strength and tensile strength of the remaining tooth structure. Composite being having similar modulus of elasticity is of choice for use as a reinforcing material [12].

The prospective problem of using composite resin within the root canal may be polymerisation shrinkage of the composite resin away from the dentinal walls towards the post leaving space at the composite dentine interface. This can be eluded if all steps in bonding procedure are carefully followed [13]. Even though the greater numbers of clinical stages are associated with a three-stage system; its bonding strength is higher than single/ double stage dentin bonding agent [14]. Light-transmitting post permitted polymerisation of the composite resin along the entire length [12]. Thus luminex post system was used to transmit light towards composite.

4. CONCLUSION

Management of blunderbuss, short root with thin radicular walls is a treatment challenge [15]. In such cases apical stop can be created using MTA apical plug and thin radicular walls can be reinforced using various materials like composite.

REFERENCES


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