CASE REPORT

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Apexification and Radicular Rehabilitation in Maxillary Fractured Anterior tooth with Open Apex

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ABSTRACT:

Complete debridement, thorough disinfection and optimal sealing of the root canal system are the major difficulties associated with endodontic treatment of teeth with open apices. In such teeth, thin radicular dentinal walls are prone to fracture. Management of open apex can be done using mineral trioxide aggregate (MTA) which can be placed in apical 3-4 mm. For a better prognosis in such fractured susceptible thin dentinal walls, internal radicular reinforcement with various adhesive materials like glass ionomer cement, composites is suggested.This case report describes a management of immature apex case in a 19 year old patient with apical stop (MTA) and radicular reinforcement.

Keywords: Apexification, Intra radicular rehabilitation, Mineral trioxide aggregate, Open apex, Reinforcement with composite, Thin root dentinal wall.

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INTRODUCTION

Traumatic injuries are more commonly seen in the Maxillary anterior teeth due to its position in the jaw.[1] Trauma to Young permanent teeth result in pulpal inflammation or necrosis with termination of root development and conceded apical closure.[2] Endodontic and restorative management of such cases are challenging because of partial closure of the apex and thin dentinal walls.[3] The challenges faced while treating such teeth includes: partial debridement due to the wider apical diameter, lack of natural apical constriction, thin dentinal walls which are prone to fracture.[4] With Conventional endodontic treatment it is difficult to achieve an apical hard tissue barrier against which a root canal filling can be compacted.To overcome these problems, apexification or root end closure technique has been introduced.[5]

Apexification is defined as a process of inducing a calcified barrier in a root with an open apex.[6] Various materials have been recommended for use in the apexification process. Frank in 1966 first explained the apexification using calcium hydroxide.[7] Calcium hydroxide is bactericidal with an alkaline Ph that may be responsible for stimulating apical calcification. In spite of its popularity, it has some drawbacks including unpredictability of treatment time, difficulty in patients follow up, delayed treatment,the role of infection caused in the canal in between the appointments and it decreases the fracture resistance of the tooth.[8]

Mineral trioxide aggregate (MTA) was introduced as a as root end filling material by Mahmoud Torabinejad at Loma Linda University in the year 1993. This colloidal gel get solidifies to a hard structure and can be used for closure of perforations.[9] Sarkar et al described the propensity of MTA to discharge calcium and its capability to form hydroxyapatite and concluded that sealing ability, biocompatibility and dentinogenic

activity of MTA is attributed to these physicochemical reactions forming dentin bridge.[10] The initial and final setting time of MTA was found to be 45 minutes and 2 hours 45 minutes respectively.[8,9]

Apexification using MTA has several benefits over calcium hydroxide as it can be done in a single visit, it gets neither resorbed nor weakens the root canal dentin and always sets in a wet environment. MTA aids in the development of cementum and osteoid-like tissue because of its alkaline pH and discharge of calcium and phosphorus ion.[11]

The difficulty in repairing weakened roots is the fact that the left over root dentine is thin and therefore more susceptible to breakage.[12] Most of these teeth are upper incisors and in young patients the treatment options for replacement are restricted. Reinforcement the root in some way should help to lessen the hazard of fracture. Root canal treated teeth with weak canals should be preferably strengthened before final restoration. Light polymerized composite resin can be help in the reinforcement, as it absorbs and distributes forces evenly as compared to metals, and increases resistance to breakage, resulting in an improved prognosis. Composite resin materials which can bond to dentin, has the potential to internally rebuild the root, and are able to provide dimensional and structural reinforcement.[5,13]

When the weakened root is internally rebuilt with appropriate adhesive dental materials, the root is dimensionally and structurally strengthened to support and retain a post and core for sustained function of the tooth[14].Also greater the composite thickness bonded to the inner portion of the root canal the better the ability to reinforce it. With this in mind it is recommended that a plastic post is selected that will result in a post space within the composite with a small diameter.In addition, a tooth-coloured, clear or white post which can be bonded to the composite with an adhesive resin luting cement would also be advantageous[5]. Weakened teeth restored by this techniquehave been shown to be 50% extra resistant to fracture than those without composite resin reinforcement.[14-16]

Aim of this case report is to highlight the use of MTA as a apical plug and composite and fibre post as canal reinforcement and post and core material in a fractured immature tooth.

CASE REPORT

A 19-year-old female patient reported with the complaint of fractured discoloured upper front tooth.(Figure 1) Patient gave history of fall 11 years back. Clinical examination revealed discolored and fractured maxillary right central incisor. The fracture was present in the middle third of the crown. No mobility was present. Extraoral examination did not reveal any significant changes. Intra oral periapical radiograph showed incompletely formed apex as well as thin dentinal walls in apical region associated with a periapical radiolucency in relation to right maxillary right central incisor.(Figure 2) Tooth elicited negative response on thermal as well as electric pulp testing. Hence, diagnosis of Ellis class IV fracture leading to pulpal necrosis was made.

Patient was explained about the condition and the treatment modalities for the treatment of the same. As the patient was concerned about esthetics & wanted to finish her treatment in less number of appointments, so it was decided to use artificial root – end barrier with MTA & then radicular reinforcement with composite followed by post and core build up with fiber post followed by PFM (Porcelain fused to Metal) Crown Fabrication.

Figure 1: Fractured discoloured upper front tooth

Figure 2: Incompletely formed root apex

On first visit, root canal treatment was initiated for 11 under LA. A conventional access cavity was prepared in the palatal surface of the central incisor using endo access bur. The working length was measured radiographically with a K-file (Mani) and recorded for reference. (Figure 3) The canal was then gently prepared with minimal instrumentation and irrigation was performed with 2.5% NaOCl(Deor) and saline. The canal was dried with sterile paper point. And calcium hydroxide (Metapex) dressing was placed for disinfection of root canal.(Figure 4) The access cavity was sealed with cavit (3M ESPE). Patient was recalled after 2-week.

Figure 3: Working length was measured radiographically with a K-file

Figure 4: Calcium hydroxide (Metapex) dressing placed

On second visit, the calcium hydroxide dressing was removed by rinsing with alternating solutions of 2.5% NaOCl and 17%EDTA (DEOR). 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. An apical barrier of 3-4 mm was established using MTA.(Figure 5) A moist cotton pellet was placed over the MTA for 48 hours to achieve optimum setting of MTA by double hydration mechanism and access cavity was sealed cavit(3M ESPE). Patient was recalled after two day.

Figure 5: Apical plug placed

On third visit, the setting of MTA was confirmed using finger plugger. The canal reinforcement was carried out as the remaining dentinal thickness of the canal was very less. Glass fibre post system was selected with the

objectives of reinforcing the tooth. The canal was etched with 35% phosphoric acid for 15 s, was washed with an endodontic irrigation syringe, and was dried using cotton pellet. A thin coat of dentin bonding agent was applied using a microapplicator tip and was light cured for 20 s using light curing gun. A flowable composite resin was placed into the canal. The plastic light transmitting post was lightly coated in vaseline and inserted centrally into the root canal. Excess material was removed from the access cavity and a light-curing tip was placed at the end of the plastic post. The post was then removed with a rotating and pulling motion. In the space left after post removal, glass fibre post was luted with the dual cured resin cement (RelyXTM, 3M ESPE) and the resin was cured for 40 s. (Figure 6)

Figure 6: quartz fibre post was luted with the dual cured resin cement

Then the core build up was done with composite resin (3M ESPE) and cured. Next, the tooth preparation was done using a flat end diamond bur with shoulder margin at the labial surface and chamfer at lingual surface.(Figure 7) Impression was taken using putty Speedex rubber base impression technique,(Figure 8) cast was poured using die stone and the model was sent to the lab for fabrication of metal ceramic crowns. The crown was cement and occlusion was checked.(Figure 9) The patient was recalled for 3, 6, 9 months. The patient was asymptomatic and radiographs showed good healing.(Figure 10, Figure 11, Figure 12)

Figure 7: tooth preparation

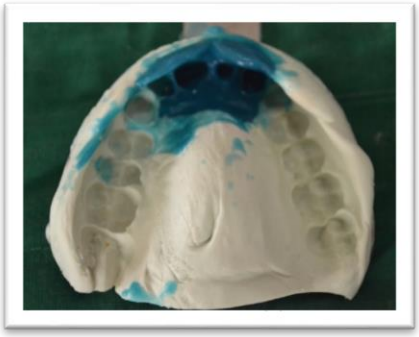

Figure 8: Impression taken

Figure 9: Crown cemented

Figure 10: 3 Months follow up

Figure 11: 6 Months follow up

Figure 12: 9 Months follow up

DISCUSSION

The success of endodontic therapy relies on attaining a complete seal at the apical area. The root canal treatment of nonvital immature anterior teeth after trauma remains problematic because of necrotic pulp tissue, large open apices, divergent root walls, thin dentinal walls, and frequent periapical lesion. The primary objective of root end material is the closure the apical portion of the canal and to obtain hermetic seal between periodontium and the root canal system.[17] The apical closure aids in compacting the obturating material into the canal promising for single visit apexification.[9]

During long apexification technique, the root canal is vulnerable to reinfection and is more prone to fracture.[12] Therefore, one step apexification was planned for this case. MTA had been showed good sealing capacity, good marginal adaptation and a high degree of biocompatibility.[10] MTA as an apexification material forms a seal between the material and the tooth[9]. Buchanan has suggested the use of MTA in conventional endodontic treatment to repair apices larger than >0.7 mm, such as those that have been subjected to over instrumentation during endodontic treatment, results in a loose apical constriction[18]. The material contains fine hydrophilic particles of tricalcium silicate, tricalcium aluminate, tricalciumoxide and silicate oxide. When mixed with sterile water it forms a colloidal gel that sets within three to four hour.[5,9]During the maturation of MTA, there is development of an appetite like interfacial which fills in the gap formed during the shrinkage phase and increases the fracture resistance of the root canal walls. MTA has an alkaline Ph and has superior biocompatibility and cytotoxicity. MTA provides a favorable environment for the cementum deposition because of the presence of calcium and phosphorus ion which induces osteoblastic or cementoblastic activity and provides favorable environment for cementum deposition. This novel procedure decreases the treatment time. Importance of this method lies in thorough cleaning of root canal followed by apical seal with material that helps in regeneration.[19]

The histological assessment of this biocompatible material carried out on Cynomolgus monkeys following periradicular surgery and root-end filling with MTA has displayed no signs of periradicular inflammation.[20] MTA has been reported to stimulate cytokine release[21] and the production of interleukins[22] which indicates that it is a bioactive material capable of encouraging hard tissue formation, unlike other currently available root-end filling materials.[20]

The main objective of post and core is to substitute the lost tooth structure. Such teeth that have large canals which are tough to restore with metal posts, as these well adapted cast post and cores lead to shadowing and graying of the root surface, which, in turn, leads to the discoloration of the tooth's gingival margin. Further, restoration with a cast metal post and core is contraindicated

because they cause vertical fracture if the tooth due to the wedging action caused by the cast post.[23] The recent studies have proved that the fiber post bonded to the tooth provides a monobloc effect and increases the strength and integrity of the tooth and makes the tooth extra resistant to fracture. Composite resin was used to replace the lost dentinas it reinforces the tooth and the modulus of elasticity of composite is near to that of dentin.[24] The modulus of elasticity of a cast post and core is higher therefore it can cause root fracture.[25] Reinforcement of tooth with weak radicular dentin using composite resin and a fiber post plays a vital role to improve the fracture resistance of root..[26]

CONCLUSION

Endodontic treatment has advanced considerably over the last two decades leading to a greater knowledge, clinical success and concomitant cost of endodontic treatment. Managing a tooth with open apex with a biocompatible material MTA has become a one step method. This innovative technique is acceptable and less time-consuming one. The management of a structurally weakened root through conservative method by reinforcement with flowable composite and glass fiber post can be a simple and efficient technique for the treatment of immature anterior traumatized teeth with excellent esthetic and functional results. Such teeth restored with this method best serve the needs of the patients.

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