Mineral Trioxide Aggregate Apexification for a Traumatised Immature Permanent Tooth: A Case Report

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Abstract

Here, we will discuss about a case of 18-year-old boy who came with a chief complaint of fractured upper front tooth. The history of the trauma revealed by the patient was the patient has a fall from the bed when he was 10 years old but did not get any treatment done at that point of time. Proper diagnosis was made with the help of radiological investigations. The available treatment options were discussed with the patient's parents and root canal therapy, using mineral trioxide aggregate, as an apical barrier was carried out in his upper right front teeth.

Keywords: Mineral Trioxide Aggregate, Apexification,Traumatized immature permanent tooth

Introduction

Pulpal involvement as a consequence of trauma or caries in immature permanent teeth can trigger the loss of pulpal vitality as well as directly affect root development, resulting in short roots with very thin walls producing a greater risk of fracture and thus hindering the treatment conventional ducts.[1]

Hence, the treatment for such pathologies is elimination of necrosed pulp, disinfection of root canal space followed by sealing of apical zone and allowing it to form a calcific barrier which is called apexification.

Apexification is a procedure of induction of a calcified apical barrier in the apical zone of an incompletely formed root, in which the pulp is diagnosed as necrotic.[2]

The apexification may involve one or multiple monthly appointments to place calcium hydroxide ($Ca(OH)_2$) inside the root canal and achieve the elimination of the intracanal infection, which stimulates calcification and produces the apical closure. After several monthly appointments, radiologically, the walls of the root canal of the tooth should show more thickness and a rounded apex, which allows the root canals to be sealed with conventional techniques using gutta-percha and a sealant.[3] $Ca(OH)_2$ can alter the mechanical properties of dentin and make these teeth more susceptible to root fracture.[4,5] The traditional use of $Ca(OH)_2$ to achieve apexification is being gradually replaced by mineral trioxide aggregate (MTA) as a one-step technique.[6,7] The MTA can be placed as an apical plug with previous applications intracanal with $Ca(OH)_2$ to produce the disinfection of the same[8] or even the MTA can be used as a material of canal filling.[9]

Due to the lack of an apical constriction, an alternative to standard root canal treatment, apexification, or root end closure has been advocated.[10]

Case Report

An 18-year-old boy reported to the department with fractured upper right and left central incisors. The medical history was not contributory. No significant family history was revealed. Extraoral findings were unremarkable. Clinically, we found that there was complicated crown fracture irt upper right central incisor and Ellis class IV fracture irt upper left central incisor [Figure 1]. No mobility was seen. On electric pulp testing, both the incisors showed no response. An intraoral periapical

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radiograph showed an incomplete formation of root apex with periapical lesion irt upper left central incisor [Figure 2]. On the basis of clinical and radiographical findings, a diagnosis of traumatized young permanent immature teeth was made with respect to upper left central incisor.

Investigations

An intraoral periapical radiograph was taken which showed incomplete root formation with wide open apex in upper left central incisor with periapical pathology was seen. Electric pulp testing was carried out which showed that the upper left central incisor was non-responsive.

Treatment

In the first appointment, the tooth was isolated under rubber dam and access cavity preparation was done, working length was determined and cleaning and shaping of both the central incisors was done. Copious irrigation was done with saline and 5.25% sodium hypochlorite followed by calcium hydroxide intracanal medicament was placed. The patient was recalled after 10 days.

In the second appointment, MTA apexification was carried out for upper left central incisor and root canal therapy was completed irt upper right central incisor. MTA (Dentsply, Tulsa Dental, Johnson City, Tennessee, USA) was mixed with distilled water according to the manufacturer's instructions and carried to the canal with an amalgam carrier. Apical plug of about 3 mm of MTA was placed and confirmed radiographically [Figure 3]. A sterile cotton pellet moistened with sterile water was placed over the canal orifice and the access cavity was sealed with Cavit (3 M ESPE, Seefeld, Germany). After 72 h, the hard set of MTA was confirmed and the remainder of the root canal was obturated with thermoplasticised gutta-percha [Figure 4] (Obtura II, Obtura Spartan, Fenton, Missouri, USA). In the same visit, the access cavity was restored with composite.

After 2 weeks, the patient was recalled for his aesthetic rehabilitation. As there was minimum crown structure left, a fiber post and core was placed in the upper right central incisor [Figure 5]. The rest of the crown structure was then built with the help of a composite and crown cutting was performed in the upper right central incisor (11), and the upper left central incisor (21) was aesthetically rehabilitated using composite build-up [Figure 6].

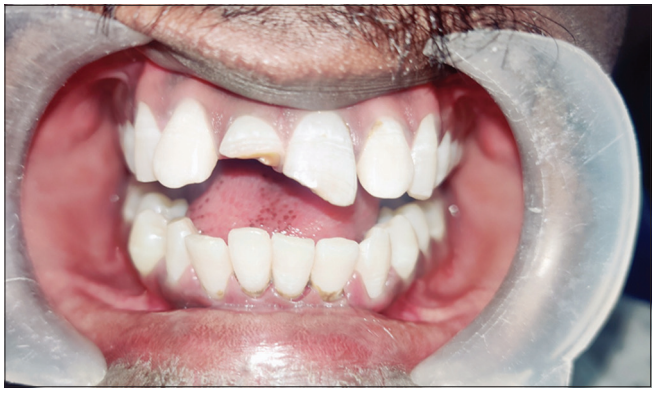

Figure 1: Pre-operative clinical photograph

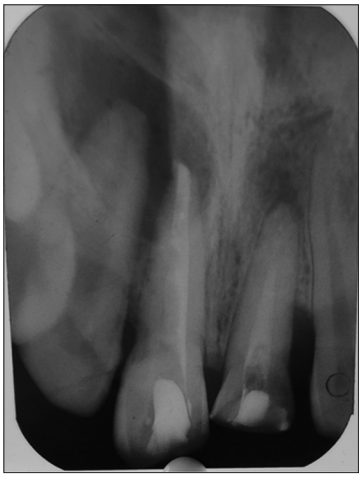

Figure 3: MTA apexification done irt 21

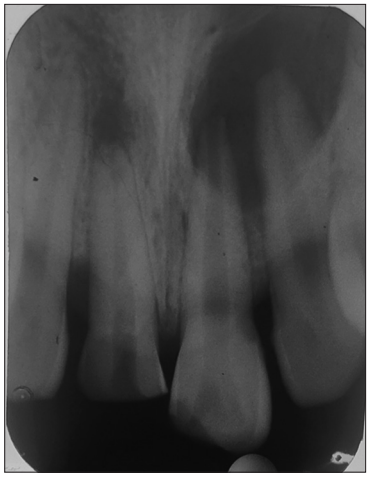

Figure 2: Pre-operative radiograph showing immature apex irt 21

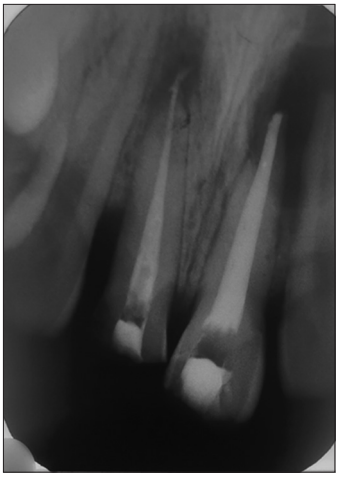

Figure 4: Obturation done irt 21 using thermoplasticized gutta percha

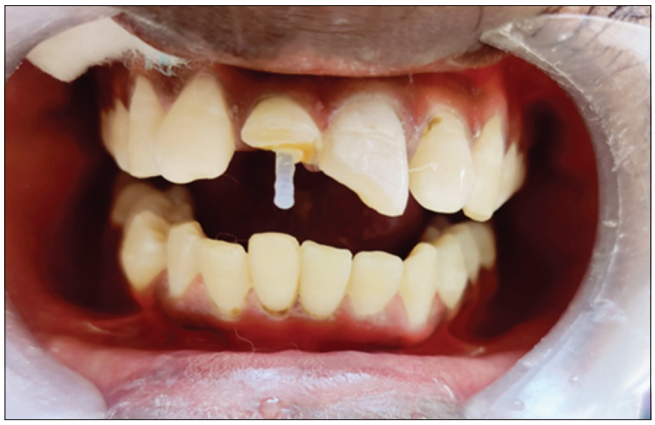

Figure 5: Pre-fabricated fiber post-cementation done irt 11

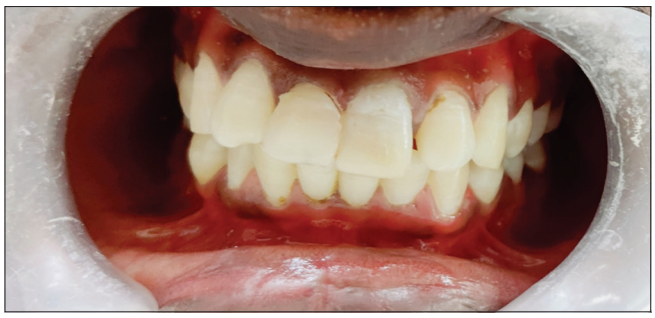

Figure 6: Core build up done using composite irt 11, 21

Discussion

Dental injuries are very common in children between 6 and 10 years of age. A serious complication of these traumas is pulp necrosis whose prevalence varies with the type of traumatism from 1% to 6% for crown fractures to nearly 100% for intrusions. Pulp necrosis of permanent immature teeth implies the interruption of root formation and apical closure. It is then necessary to implement a therapy, called apexification to induce a hard calcific barrier at the apical end of the root, to achieve definitive root canal filling.[11]

The completion of root development and closure of the apex occurs up to 3 years after eruption of the tooth. The treatment of these tooth with immature apex is more challenging for the clinician. Depending on the vitality of the affected pulp, two approaches are possible-apexogenesis or apexification.[12] Apexogenesis is defined as "a vital pulp therapy procedure performed to encourage continued physiological development and formation of the root end." 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."[13] However, the success of the therapy depends on proper diagnosis, history taking, and treatment planning.

A variety of materials have been proposed for induction of apical barrier formation. Calcium hydroxide ($Ca(OH)_2$) has become the material of choice for apexification; it is bactericidal with an alkaline pH that may be responsible for stimulating apical calcification.[14]

Despite its popularity for the apexification procedure, $Ca(OH)_2$ therapy has some inherent disadvantages, including variability of treatment time, unpredictability of apical closure, difficulty in patient follow-up, and delayed treatment.[15] Furthermore, it has some tissue altering and dissolving effects.[16] Therefore, the search continues for procedures and materials that may allow for more natural continued apical closure in teeth with immature apices.

The US Food and Drug Administration approved MTA in 1998 as a therapeutic endodontic material for humans.[17-19] MTA has been shown to have superior sealing ability to amalgam, zinc oxide eugenol, intermediate restorative material, and super-ethoxybenzoic acid.[20-23] MTA has also been shown to have superior characteristics as a direct pulp-capping agent when compared with $Ca(OH)_2$ in animals and humans in the root canal, which would result in intracanal bone formation and arrest of root development.[24-26]

MTA is a material which has less leakage, better antibacterial properties, high marginal adaptation, short setting time (4 h), and a pH of 12.5 and is more biocompatible. Scaffolding is provided for hard-tissue formation by MTA. It stimulates the production of interleukins and cytokines release. Hence, it is capable of promoting hard-tissue formation. Clinicians may restore the tooth after setting of MTA. Thus, the fracture resistance of teeth with thin dentinal walls increases. MTA can be used in teeth with pulp necrosis and inflamed periapical lesions because it may set in moist environments.[27]

In the MTA plug technique, root canals must be disinfected with temporary calcium hydroxide before placing MTA for 2 weeks. This is because performing chemomechanical preparation alone is not effective for complete elimination of microorganisms. Hence, we used calcium hydroxide, in this case, in between the appointments in the root canal for disinfection.

Conclusion

Careful examination of the case and thorough history of the trauma should be taken. Calcium hydroxide dressing between appointments is the utmost important step for successful outcome. MTA apexification can be considered as a replacement for calcium hydroxide in the treatment of traumatized immature permanent teeth.

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