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Patient Comfort and Recovery: A Comparison of MTA and Biodentine for Apexification in Young Permanent Central Incisors: 2 Case Reports

[1]Dr. Himani, PG Student, Department of Pediatric and Preventive Dentistry, Himachal Dental College, Sundernagar

[2]Dr. Vinay Thakur, Associate Professor, Department of Pediatric and Preventive Dentistry, Himachal Dental College, Sundernagar

[3]Dr. Vasundhara Pathania, Associate Professor, Department of Pediatric and Preventive Dentistry, Himachal Dental College Sundernagar

[4]Dr. Arpan Sud, PG Student, Department of Pediatric and Preventive Dentistry, Himachal Dental College, Sundernagar

[5]Dr. Nandini, PG student, Department of Pediatric and Preventive Dentistry, Himachal Dental College, Sundernagar

Corresponding Author: Dr. Himani, PG Student, Department of Pediatric and Preventive Dentistry, Himachal Dental College, Sundernagar

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Abstract

This case study aims to document a successful treatment of traumatized immature young permanent central incisors. An effective treatment option for immature permanent teeth with an open apex is apexification. It is described as a technique to create a calcified barrier in a root that has an open apex or in teeth with necrotic pulp tissue where the apical growth of an incompletely formed root continues. These case series detail two case reports of young immature permanent teeth with open apices that underwent an apexification treatment using both MTA and Biodentine. After that additional obturation was finished. Excellent biocompatibility has been demonstrated by both materials, which are beneficial for the efficient treatment of teeth with an open apex. That is a far more practical and less time-consuming process.

Keywords: Asymptomatic Apical Growth, Biodentine, Dental Trauma.

Introduction

Dental trauma to the anterior dentition is common in the young adolescent children accounting for around 5% of all injuries [1]. Patients with traumatic dental injuries are most likely to have open apices. Since successful endodontic management of an open apex depends on the establishment of an apical matrix, managing an open apex is a continuing problem. An effective treatment for immature permanent teeth with an open apex is

apexification [2]. Root development is due to the continuous deposition of dentin and cementum by stimulation and differentiation of Hertwig's Epithelial Root Sheath and surrounding undifferentiated progenitor cells [3]. Trauma, caries, or other pulpal diseases disturb dentin production, compromising root completion. Apexification is a safe and effective way to treat immature permanent teeth with an open apex. Because of the limitations of the conventional apexification process using calcium hydroxide, substitute biocompatible materials such as MTA and Biodentine have been developed [4]. The following case report compares the effect of use of MTA and Biodentine to induce root end closure in a different patient with open apices in traumatised maxillary young permanent central incisors.

Case Report-1

A 8 year old female patient accompanied by her parents reported to the department of pedodontics and preventive dentistry, Himachal Dental College, Sundernagar, Mandi, H.P with the chief complaint of broken tooth in the upper front tooth region of the mouth. The history of trauma due to fall occurred about 2 years ago. The medical history of patient was non-contributory. On clinical examination it was found that there was crown fracture in 21 associated with sinus tract observed at the apex of the tooth w.r.t 21. Fig.1 (a), (b). On radiographic examination showed wide open apical foramen w.r.t 21. Large radiolucent region observed around the apex of the tooth (Fig.2). A diagnosis of according to WHO 873.62 – Complicated fracture, crown facture with pulpal involvement was made. On pulp vitality test tooth denoted negative response. So, apexification with MTA was planned as a treatment option.

Treatment Plan

The treatment plan was discussed with the patient and consent was taken. After the access opening of 21 the working length radiograph was taken with bent file at the tip (0.5-1mm) to 90 degree using an endodontic gauge (Dentsply Maillefer) (Fig. 3). The canals were prepared with nickel titanium rotary files- Protaper Gold. The orifices and the coronal parts were prepared with Sx file and canals were irrigated with saline (0.9%w/v). The canals were dried with sterile absorbent paper points and Triple antibiotic paste (containing minocycline, ciprofloxacin and metronidazole ratio (1:1:1) with propylene glycol as vehicle was placed for disinfection of root canals and the access cavity was sealed with cavit. Patient was recalled after 2 weeks. On the second visit, the Triple antibiotic paste was removed with copious irrigation with normal saline and the apical portion of the canals were prepared with F1 and F2 files. In between rinsing was done with solution of 3% NaOCL in combination with 17% EDTA. After finishing the preparation and drying the canal with absorbent paper point, suitable pluggers were selected to condense MTA. MTA (Angelus, Londrina, PR, Brazil) was mixed with distilled water to a consistency of wet sand and placed in increments in the apical region of canal in tooth 21 using a MTA carrier. MTA was condensed with light pressure using prefitted hand pluggers until entire apical portion of the canal was filled with MTA with 5mm of thickness (Fig.4). Wet sterile cotton was placed in the canal above MTA. The next appointment was scheduled after 24 hours hard set of MTA was confirmed. Remaining root canal was obturated using lateral condensation technique with gutta percha cone with respect to 21 followed by composite build up (Fig. 5,6). The patient was asymptomatic and was kept on 3, 6 and 9 months follow-up.

Figure 1(a): Pre - Operative

Figure 1(b)

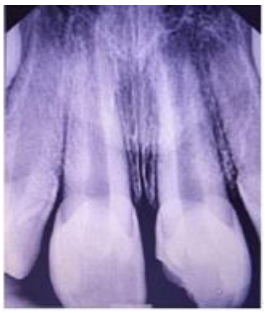

Figure 2: Pre-Operative IOPA

Figure 3: Working Length

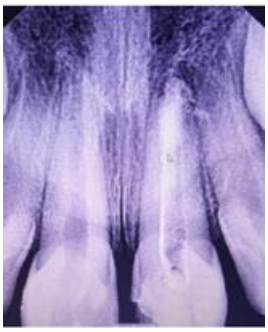

Figure 4: MTA Plug (4-5mm)

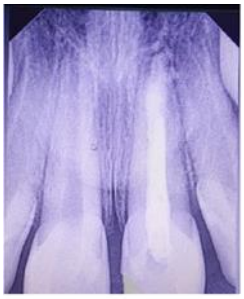

Figure 5: Post Obturation

Figure 6: Post Operative

Case Report – 2

A 8 yr old female patient accompanied by her parents reported to the Department of Pedodontics and Preventive Dentistry, Himachal Dental College, Sundernagar, Mandi, H.P with a chief complaint of broken teeth in upper front tooth region of mouth since 6 days (fig. 7). History of trauma due to fall occurred about 6 days ago while playing at home.

Extraoral examination revealed lacerations on the chin and lower lip. Intraoral examination revealed crown fracture w.r.t 11, 21. Radiographic findings showed incomplete root formation w.r.t 12,11,21,22 (Fig. 8). According to WHO classification 873.61 – Uncomplicated fracture – Involving enamel & dentin but no pulpal exposure w.r.t 11, 21 and 873. 67 - Extrusion w.r.t 22 was made as a final diagnosis.

Treatment plan

In the same visit, direct composite restoration done in relation to 11 and Indirect pulp capping was done w.r.t 21. As grade II mobility was assessed clinically hence it was decided to stabilize the tooth with composite splinting for 4-6 weeks (Fig. 9)**.** After 4 weeks follow-up radiograph was taken and it was seen that External

Inflammatory Lateral Resorption has started in both the central incisors fig. 10).

It was observed that both central incisors had become non-vital. According to WHO classification 873.62 – complicated fracture, crown with pulpal involvement w.r.t 11,21 was made as a final diagnosis. Apexification of both the central incisors with Biodentine was planned as a treatment option. On the same day access opening was done and working length radiograph was taken (fig. 11). Calcium hydroxide as a intracanal medicament was placed for 2 weeks. After that calcium hydroxide dressing was removed and Triple antibiotic paste (containing minocycline, ciprofloxacin and metronidazole (1:1:1)) with propylene glycol as the vehicle was placed for disinfection of root canals and the access cavity was temporized with Cavit for 2 weeks. On recall visit, the triple antibiotic paste was cleaned from the canal by circumferential filing and copious irrigation with normal saline. The shaping of the canal was done using modified crown down technique with nickel titanium rotary files Pro Taper Gold. The orifices and the coronal part were prepared with Sx files and shaping of coronal and middle third of the canals were done with shaping files S1 and S2 and the apical portion of canals were prepared with F1and F2 files. In between rinsing was done with solution of 3% NaOCL in combination with 17% EDTA. After finishing the preparation and drying the canal with absorbent paper point, suitable pluggers were selected to condense Biodentine. Biodentine (Septodont, St.Maur-des Fosses, France) capsule was tapped on a hard surface to diffuse the powder. After this, five drops of manufacturer's supplied liquid were dispensed into the capsule. The capsule then placed in triturator for 30 sec. After mixing, Biodentine was placed in the apical region of 21 using a MTA carrier. The material was then condensed with suitable prefitted plugger until the apical portion of the canal was filled with biodentine, and after 15 minutes obturation was done using F2 gutta percha cone (21) and the tooth was restored with composite. In the next visit for other tooth (11) the technique will be same biodentine plug was made and after 15 minutes it was obturated with gutta percha (fig. 12 (a), (b)). The patient was asymptomatic and was kept on 3, 6 and 9 months follow-up.

Figure 7: pre-operative

Figure 8: pre-operative IOPA

Figure 9: Splinting

Figure 10: External Inflammatory lateral Resorption

Figure 11: Working Length

Figure 12 (a): Biodentine plug followed by obturation

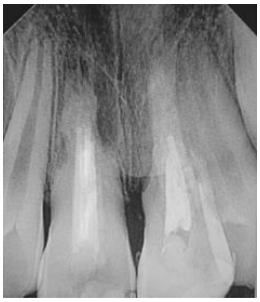

Figure 12 (b)

Figure 13: Post—operative

Discussion

In the past, techniques for management of the open apex in non-vital teeth were confined to custom fitted gutta-percha cones, but this is not advisable as the apical portion of the root is frequently wider than the coronal portion, making proper condensation of the guttapercha impossible [5]. Management of open apex in non –vital teeth have multiple options such as apexification, or revascularization technique. Revascularization technique has an advantage of formation of pulp dentin complex. It establishes defense mechanisms of pulp. However, long-term follow-up and uncertainty of results is a disadvantage [6]. In RET cases, intracanal medication was removed when preparing to induce bleeding or inject scaffolds. At the regeneration stage, leaving the root canal unfilled as the regenerative tissue develops may be conducive to bacterial proliferation if residual bacteria remain. As a result, the RET group was more likely to fail in the treatment of periapical inflammation than the apexification group. When applied to an open apex, MTA, a bioactive cement, encourages the formation of new cementum and PDL. The high pH produces an antibacterial environment, and MTA works by releasing calcium ions that promote cell adhesion and proliferation. Calcium silicate, bismuth oxide, calcium carbonate, calcium sulfate, and calcium aluminate are the primary ingredients. It comprises a hydrophilic powder that, when combined with water, forms a hydrated gel of calcium hydroxide and calcium silicate. According to Holland et al.'s theory, an apical barrier is created when the tricalcium oxide in MTA combines with tissue fluids to generate calcium hydroxide [7]. Eli-Meligy and Avery compared MTA and CH clinically and radiographically as materials to induce apexification in 15 children, each with 2 necrotic immature permanent teeth. The 12-month follow-up revealed failure in only 2 teeth treated with CH because of persistent periradicular inflammation and tenderness to percussion. It has also been shown that use of calcium hydroxide weakens the resistance of the dentin to fracture. None of the MTA-treated teeth showed any clinical or radiographic pathology. [8]. However, there are few concerns regarding MTA such as its long setting time i.e 3 hours, poor handling characteristics, low resistance to compression,

low flow capacity, limited resistance to washout before setting, possibility of staining of tooth structure [9]. These disadvantages necessitate more ideal restorative material.

Biodentine is a new bioactive dentin substitute cement, which is composed of powder that consists of tricalcium silicate, dicalcium silicate, calcium carbonate, calcium oxide, zirconium oxide, and CH. The liquid for mixing with the cement powder consists of a water-soluble polymer and calcium chloride, which accelerates the setting reaction [10]. Biodentine has a shorter setting time of 12 minutes, as compared with that of MTA, which is 2 hours 45minutes. The powder is mixed with 5 drops of liquid and activated in the dental triturator for 30 seconds. This material is clinically indicated for permanent dentin replacement, direct and indirect pulp capping, pulpotomy, repair of furcation and root perforations, retrograde root-end filling, and apexification [11]. Many authors have demonstrated the viability of a fibroblast cell line in contact with Biodentine and MTA. Examination by scanning electron microscopy revealed cells adhering to most of the Biodentine surface after 24 hours [12]. Zhou et al showed that human gingival fibroblasts in contact with Biodentine and MTA attached to and spread over the material surface at 7 days of culture [13]. Lee et al suggest the use of Biodentine as well as MTA and Bio aggregate as root-end filling materials because in contact with mesenchymal stem cells they induce osteoblast differentiation [14]. Several studies underscored the importance of the combination of specific local biological microenvironment and circulating soluble calcium and inorganic phosphate levels to achieve bone regeneration [14]. Based on the results of this case, the nonsurgical management of teeth with necrotic pulps and incomplete apex formation with MTA and Biodentine was successful.

Conclusion

As bioactive dental materials, MTA and Biodentine can be effectively employed to close open apices at the root end. The creation of an appropriate apical seal and superior biocompatibility are the main benefits of these material as an apical barrier. The host response was same with both the materials. It was concluded that both the materials shows pariapical healing equally good.

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