Case Report

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Endodontic Treatment of a Non–Vital Tooth with Open Apex and Apical Periodontitis Using Bio dentine and Platelet Rich Fibrin as Apical Matrix: A Case Report

Neha Pol[1]* Rahul Rao[2] Ashish Jain[3] Joel Devaraj[4] Harshil Patel[5]

[1]PG Student, Department of Conservative Dentistry and Endodontics, Bharati Vidyapeeth Deemed to be University Dental College, Navi Mumbai, India.

[2]PG Guide and Professor, Department of Conservative Dentistry and Endodontics, Bharati Vidyapeeth Deemed to be University Dental College, Navi Mumbai, India.

[3]Professor and Head, Department of Conservative Dentistry and Endodontics, Bharati Vidyapeeth Deemed to be University Dental College, Navi Mumbai, India.

[4]PG Student, Department of Conservative Dentistry and Endodontics, Bharati Vidyapeeth Deemed to be University Dental College, Navi Mumbai, India.

[5]PG Student, Department of Conservative Dentistry and Endodontics, Bharati Vidyapeeth Deemed to be University Dental College, Navi Mumbai, India.

ABSTRACT

Background: An immature tooth with pulpal necrosis and periapical pathology imposes a great difficulty to the endodontist. The main difficulty in treating such cases include disinfection of the root canal with standard protocols that use endodontic files, filling the root canal with an open apex that provides no barrier for stopping the root filling material before impinging on the periodontal tissues, and the susceptibility of the teeth to fracture because of their thin roots. Traditionally calcium hydroxide was used in such cases which was replaced with MTA (Mineral Trioxide Aggregate). Bio dentine has been recently introduced as the “the first all-in-one, bioactive and biocompatible material for damaged dentin replacement”. This case report demonstrates the use of Bio dentine as an obturating, reinforcing and apexification material along with PRF as an apical matrix.

Keywords: Open apex, Biodentine, PRF, Apical matrix.

INTRODUCTION

Traumatic injuries to young permanent teeth are very common and it affects nearly 30% of children [1]. The majority of these incidents occur before root formation is complete [2] and may result in pulpal inflammation or necrosis. Trauma to the tooth during the stage of root development leads to loss of aesthetics along with incomplete closure of apex resulting in loss of apical constriction and hence producing a greater risk of fracture and thus hindering the conventional treatment. 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.

Materials like tricalcium phosphate [3,4], calcium hydroxide [3,5] , freeze dried bone 6 and freeze-dried dentin [7] and MTA have been proposed for induction of apical closure in pulpless teeth to produce more favorable conditions for conventional root canal filling. Biodentine™ is a new calcium silicate based cement of the same type as MTA ® . It exhibits physical and chemical properties similar to those described for certain Portland cement derivatives [8]. Its biocompatibility has also been

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***Correspondence Dr. Neha Pol.**
Department of Conservative Dentistry and Endodontics, Bharati Vidyapeeth Deemed to be University Dental College, Mumbai, India.
Email: nehapol27@gmail.com

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validated experimentally by Laurent et al. [9]. Based on all its properties, Biodentine™ has been claimed to be a bioactive dentin substitute for the repair of root perforations, apexification and retrograde root filling by the manufacturers. It is a cement for stimulating hard tissue formation, i.e the formation of reactive or reparative (tertiary) dentin [10].

One of the inherent problems associated with this technique is the extrusion of the material across the apex. The use of an artificial barrier or a matrix placement in the area of bone destruction is advised as it provides a base on which the sealing material can be placed and packed. Several materials have been advocated to create a matrix. These include calcium hydroxide, hydroxyapatite, absorbable collagen, calcium sulphate, and autologus platelet rich fibrin membrane (PRF) [11,12] . The aim of the present article is use of biodentine for the successful closure of root apex in a pulpless permanent maxillary central incisor with wide open in combination with a platelet rich fibrin (PRF) as matrix.

CASE REPORT

A 23 year old male patient reported to the OPD of Department of conservative dentistry and endodontics with the chief complaint of discolored tooth in upper right front tooth. He gave a history of trauma 8 years back. The patient did not give any history of swelling or pus discharge. No other significant dental or medical history was found and no known drug allergies were noted. Intraoral examination revealed Elli's Class IV fracture and discolouration in relation to tooth #21 (Figure 1).

Fig 1: Intraoral preoperative photograph Elli's Class IV fracture and discolouration in relation to tooth #21.

Palpation and percussion test of the involved tooth did not reveal any tenderness. The tooth was not mobile and periodontal probing around the tooth was within physiological limits. Electric pulp testing (Parkell Electronics Division, Farmingdale, NY, USA) of the involved tooth gave no response, whereas response was obtained on adjacent teeth. The radiographic examination of the tooth revealed a wide canal with an open apex and a marked radiolucency periapically (Figure 2). Clinical and radiographic examination indicated pulp necrosis with chronic apical periodontitis. Considering the amount of surgical trauma, age and apprehensiveness of the patient, nonsurgical root canal therapy with calcium hydroxide dressing, followed by apexification with Biodentine using a matrix with Platelet rich fibrin (PRF) was selected.

Fig 2: Pre-operative radiograph showing open apex with left maxillary central incisor.

Fig 3: A conventional endodontic access cavity preparation.

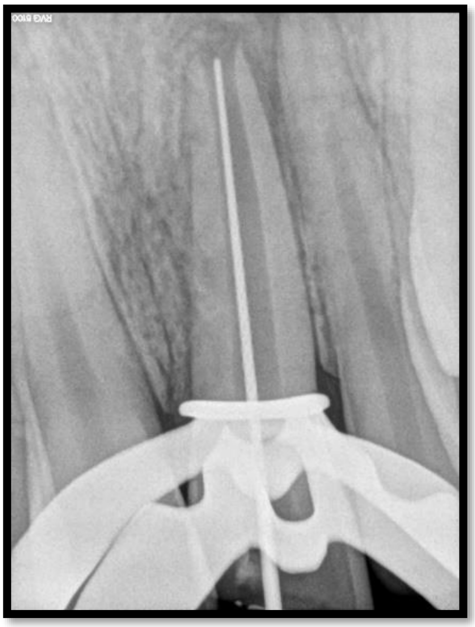

Fig 4: Working length radiograph.

Following rubber dam isolation, a conventional endodontic access cavity was established with the help of Endo access bur (DENTSPLY Maillefer Ballaigues, Switzerland) (Figure 3). Working length was determined with ISO size # 40 K file (DENTSPLY Maillefer Ballaigues, Switzerland) (Figure 4). Canal dedridement and cleaning was performed using circumferential filing technique with ISO # 90 K-file with copious irrigation using 5.25 % sodium hypochlorite and saline simultaneously. Canal was dried using sterile paper points (DENTSPLY Maillefer Ballaigues, Switzerland) and calcium hydroxide dressing was placed. Calcium hydroxide was placed for subsequent visits scheduled at one week interval.

Fig 5: Remi R-8C centrifugation system.

In the subsequent appointment, under isolation, calcium hydroxide dressing was removed by hand instrumentation and irrigation with 5.25% NaOCl. The root canal was then dried with sterile paper points (Dentsply Maillefer, Bellaiguise, Switzerland). Simultaneously PRF membrane preparation was carried out, while the clinical procedure was being performed.

Fig 6: After centrifugation.

Fig 7: PRF membrane

A 8.5 ml sample of whole blood was drawn by venipuncture of antecubital vein of the patient's right arm and transferred into a 10 ml sterile glass test tube without anticoagulant and was immediately centrifuged (REMI Laboratory Instruments, Mumbai, India) at 3000 revolutions per minute for 10 minutes (Figure 5). The resultant product consisted of three layers: topmost layer consisting of acellular platelet poor plasma, platelet rich fibrin (PRF) clot in the middle and red blood cells at the bottom (Figure 6). With a sterile tweezer the PRF clot was removed and squeezed between sterile gauze to drive out fluids trapped between in the fibrin to obtain an autologous PRF membrane (Figure 7). The freshly prepared PRF membrane was fragmented, and incrementally placed into the root canal and gently compacted using pre-fitted hand pluggers slightly beyond the apex in order to achieve a matrix at the level of the apex. Biodentine was mixed according to the manufacturer's instructions and was carried into the canal with the help of MTA carrier and condensed with Schilder's pluggers.

Fig 8: Post Obturation Radiograph

Fig 9: Follow up after 6 months.

Following which an post operative radiograph was taken and the access cavity was closed with temporary filling material Cavit (3M ESPE, St. Paul, MN, USA). Patient was recalled after 24 hours, no pain or discomfort was reported in the treated tooth. The temporary filling was removed and the set of Biodentine (Septodont, St. Maur-des-Fossés, France) was evaluated followed by permanent restoration with composite resin (3M Filtek Z350 XT) (Figure 8). Tooth preparation was carried followed by impression making, fabrication and luting of porcelain fused to metal crown thus restoring back the esthetics of the patient. Follow up after six months showed an asymptomatic tooth and a healed periapical lesion (Figure 9).

DISCUSSION

Apexification induces a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp' (American Association of Endodontists 2003). The objective of this treatment is to obtain an apical barrier inorder to prevent the passage of toxins and bacteria into periapical tissues from the root canal. Technically, this barrier is necessary to allow compaction of root filling material [13, 14]. Calcium hydroxide has a higher success rate of apical barrier formation, but has a drawback which requires a long term follow-up. Using a suitable biocompatible material reduces leakage in the sealing material and allows favorable response of the periodontal tissues for periapical healing and apexification. Previous studies have described the disadvantages of calcium hydroxide apexification such as failure to control infection, recurrence of infection and cervical fracture [15].

Apexification using MTA provides an alternative treatment modality in immature pulpless teeth. The long setting time of ProRoot MTA is a major shortcoming of the material, apart from difficult handling characteristics, discoloration potential (gray MTA), low washout resistance and high material cost [16,17]. Biodentine can be used as an effective alternative to MTA. The presence of setting accelerator in Biodentine results in faster setting (12 minutes) thereby improving its handling properties and strength. This is an advantage over MTA (4 hrs), since a delayed setting time studied by Torabinejad M et al, leads to an increased risk of partial material loss and alteration of the interface during the finishing phase of the procedure [16,18,19].

During the setting of Biodentine, the compressive strength increases 100 MPa in the first hour and 200 MPa at 24th hour and it continues to improve with time over several days until reaching 300 MPa after one month [20] which is comparable to the compressive strength of natural dentine i.e 297 MPa [21]. A study conducted by Grech L et al., showed that Biodentine had highest compressive strength when compared to other tested materials due to low water/cement ratio used in Biodentine [19]. Biodentine is found to be associated with high pH (12) and releases calcium and silicon ions which stimulates mineralization and create “mineral infiltration zone” along dentin-cement interface imparting a better seal. Caron G et al., have found that Biodentine exhibits superior sealing properties than MTA [22]. Biodentine dentin interaction (biomineralization) leads to active chemical bonding without any interphase, thus acting like a monoblock [23]. It has an elastic modulus of 22GPa which is very close to that of dentin 18.5GPa [24].

It is crucial for biodentine to limit to apex and not extrude otherwise this extruded material may cause irritation and persistence inflammatory reaction. It may also complicate the repair process [25]. In the present study PRF was used as apical matrix over which Biodentine was placed. PRF derived from the blood has a healing property and is easily accepted by the body. It consists of platelets, leukocytes, cytokines and stem cells [26]. PRF has osteogenic property. It contains platelets which can release platelet-derived growth factor (PDGF) and insulin-like growth factor (IGF), upto one week [27]. There is an evolution in the endodontic materials to perform apexification through an apical barrier, and among them, we have the repair cement biodentine which is presenting favorable clinical and radiographic results, which can be an effective alternative when performing an apexification [28,29].

CONCLUSION

The case highlights the novel approach of using biodentine, a bioactive-biomimetic material, that shows encouraging results. Biodentine shows potential for use of apexification, obturation and reinforcement in management of immature teeth with open apex while acting as a monoblock. However, such cases necessitate long term follow-up in order to evaluate success.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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