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CASE REPORT

Endodontic Management of Open Apex using Biodentine as an Apical Matrix

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ABSTRACT

Nonvital immature teeth with open apex and thin dentinal walls are difficult to treat via conventional endodontic therapy. Resorbable ceramic, tricalcium phosphate, calcium hydroxide, surgicel/amalgam, freeze-dried bone, or dentin has been conventionally used in such cases for a long time. However, due to their various shortcomings, mineral trioxide aggregate (MTA) became the material of choice. Another material with largely improved handling properties, Biodentine™ (Septodont, St. Maur-des-Fossés, France) was introduced in 2011. It is a calcium silicate-based material and manufacturers claim that it can be used for crown and root dentin repair treatment, repair of perforations or resorptions, apexification, and root end fillings. This case report presents the successful management of a symptomatic, traumatized, necrotic permanent maxillary central incisor with wide open apex using Biodentine as an artificial apical barrier.

Keywords: Apexification, Apical barrier, Biodentine.

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INTRODUCTION

Proper assessment of the affected tooth is critical in determining an accurate diagnosis and prescribing the appropriate treatment plan. The complete formation of root and closure of the apical foramen occurs up to 3 years after the eruption.[1] Injuries during this period may cause pulpal inflammation or necrosis, and subsequently incomplete development of the dentinal walls and root apices which allow the penetration of bacteria and their irritants.

The management of a nonvital tooth with open apex consists of the induction of a natural or artificial apical barrier which can act as a stop for the obturating material. 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."[2] Conventional apexification procedure induces the formation of an apical barrier while the recent approach forms an artificial apical barrier by the placement of an apical plug.

A number of materials have been used for creating an artificial apical barrier, including resorbable ceramic, tricalcium phosphate, calcium hydroxide, Surgicel/amalgam, freeze-dried bone, or dentin. Among the various materials mentioned, mineral trioxide aggregate (MTA) is currently considered as one of the most promising materials because of its superior biocompatibility, less cytotoxicity due to its alkaline pH, and presence of calcium and phosphate ions resulting in capacity to attract blast cells and promote favorable conditions for cementum deposition.[3] However, MTA has certain disadvantages like high solubility, prolonged setting time of approximately 2 hours and 45 minutes[4] as well as the difficult handling characteristics.

Recently, a novel bioactive dentin substitute named Biodentine has been introduced by Septodont, St. Maur-des-Fossés, France in September 2010 and was made available from January 2011. It is an interesting alternative to conventional calcium hydroxide-based materials. It is a cement for stimulating hard tissue formation, i.e., the formation of reactive or reparative (tertiary) dentin.[5] Biodentine is similar to MTA in its basic composition with the addition of setting accelerators which is calcium chloride that not only results in fast setting but also improves the handling properties and strength. Biodentine is superior to MTA since its consistency is better suited to the clinical use, ensures a better handling and safety, does not require a two-step obturation and as the setting is faster, there is a lower risk of bacterial contamination.[6]

This article describes the successful management of a symptomatic, traumatized, necrotic permanent maxillary central incisor with wide open apex using Biodentine as an artificial apical barrier.

CASE REPORT

A 30-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, with a chief

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Fig. 1: Preoperative radiovisiograph showing open apex with maxillary right central incisor

Fig. 2: Working length radiovisiograph of maxillary right central incisor

complaint of dull pain and swelling in relation to upper front tooth region for the past 2 months. The patient had a history of trauma to the permanent maxillary right central incisor (#11) at the age of 8 years. Medical history was noncontributory and the clinical examination revealed the presence of sinus tract in relation to fractured tooth (#11).

The concerned tooth did not respond to both electric and thermal pulp testing. Radiographic examination revealed a large blunderbuss canal with periapical lesion in relation to involved tooth (Fig. 1). Based on the history and the radiographic findings, a provisional diagnosis of chronic periapical abscess was made in relation to immature necrotic maxillary right central incisor.

After explaining the treatment procedure, informed consent was obtained from the patient. Access opening was done under rubber dam application and working length was determined with ISO size # 80 K-file (Dentsply Maillefer, Ballaigues, Switzerland) (Fig. 2).

Biomechanical preparation was done till ISO size #120 stainless steel K-file (Dentsply, Maillefer) with copious irrigation of normal saline. Canal was dried using sterile paper points (Dentsply Maillefer, Ballaigues, Switzerland) and calcium hydroxide as intracanal medicament (RC Cal, Prime Dental) was placed for 2 weeks. The patient was recalled after 2 weeks and the involved tooth was found to be asymptomatic. The access cavity was reopened; under rubber dam isolation copious irrigation was done with NaOCl solution; and the root canal was dried with sterile paper points. A 4 mm diameter of absorbable gelatine sponge (collaplug) was inserted in the canal with the help of pluggers to serve as an apical barrier. A slight discomfort shown by the patient revealed that it had reached the periapical tissues. Subsequently, Biodentine (Septodont, St. Maur-des-Fossés, France) was mixed according to manufacturer's protocol to a paste like consistency in a triturator and delivered to the canal

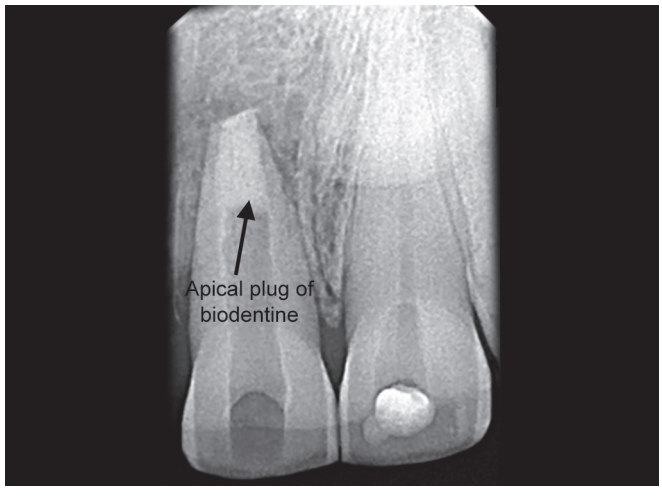

Fig. 3: Radiovisiograph showing placement of apical plug of Biodentine of 5 mm thickness

using amalgam carrier and condensed with Schilder's pluggers until a thickness of 5 mm (Fig. 3).

A postoperative radiograph was taken to confirm apical barrier and the access cavity was closed with temporary filling material IRM (Caulk/Dentsply, Milford, DE, USA).

After 15 minutes the temporary filling was removed and the set of Biodentine (Septodont, St. Maur-des-Fossés, France) was evaluated.

The root canal was obturated by thermo plasticized gutta-percha technique (Obtura – Spartan). The access cavity was then sealed with the composite resin restoration. A radiograph confirmed the completion of the endodontic therapy (Figs 4 and 5).

DISCUSSION

The goal of apexification is to obtain an apical barrier to prevent the passage of toxins and bacteria into periapical tissues from the root canal. Technically, this barrier

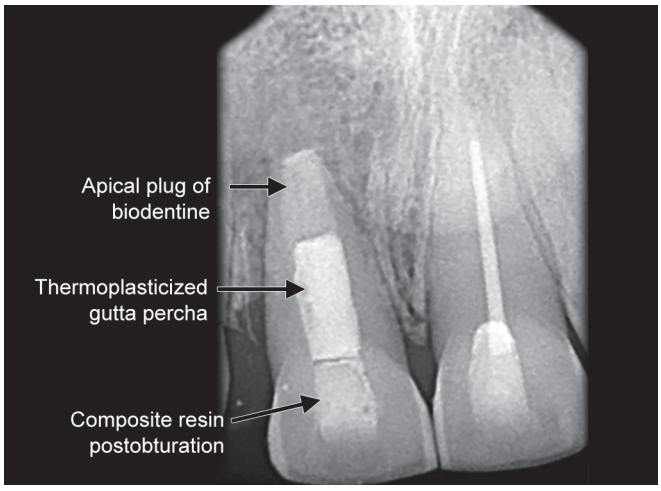

Fig. 4: Radiovisiograph showing postobturation of maxillary right central incisor

Fig. 5: Three-month follow-up radiovisiograph showing healed periapical lesion

is necessary to allow compaction of root filling material.[7] Using a suitable biocompatible material reduces leakage in the sealing material and allows favorable response of the periodontal tissues for periapical healing and apexification.

Calcium hydroxide has been used in the conventional apexification technique to create an environment conducive to the formation of an apical barrier formed by osteo-cementum tissue at the end of the root canal in teeth with open apices. However, it has certain drawbacks like the long duration of therapy (3–21 months), susceptibility of the tooth to fracture during treatment, and susceptibility of the root canal to reinfection due to a temporary seal in the tooth.[8]

With the introduction of MTA, a more convenient and less time taking technique by placing a plug of MTA in apical 4 mm of the root canal was conceptualized.[9] But, the question of root canal reinforcement still lingered, since the rest of the canal was obturated by root canal filling material. 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.[10] With the introduction of Biodentine (Septodont, St. Maur-des-Fossés, France), a dentin replacement material, apexification, and root canal reinforcement could be achieved simultaneously. Biodentine consists of powder mainly containing tricalcium and dicalcium silicate, the principal component of Portland cement, as well as calcium carbonate with zirconium dioxide serving as a contrast medium. The liquid consists of calcium chloride in aqueous solution with an admixture of polycarboxylate. The components are mixed in a triturator for 30 seconds and can be used for 12 minutes.[5] During the setting of Biodentine, the released calcium ions get incorporated into the adjacent dentin, thus forming an integrated apatite layer. This Biodentine–dentin interaction (biomineralization) leads to active chemical bonding without any interphase, thus acting like a monoblock.[11]

Biodentine has varied applications in the field of endodontics. It has a place in managing perforations of root canals, pulp floor, internal and external resorption and in serving as a retrograde root canal filling material.[5] Many studies have been performed to demonstrate the bioactivity of Biodentine in clinical situations because it was able to stimulate initiation and development of mineralization.[5] Studies on management of large periapical lesion using Biodentine as retrograde restoration showed positive response in treatment outcome.[7] Research suggests that a high pH and released calcium ions are required for a material to stimulate mineralization in the process of hard tissue healing. Sulthan[12] carried out a study to evaluate the pH and calcium ion release of MTA and Biodentine™ when used as root end fillings. He concluded that Biodentine™ presented alkaline pH and ability to release calcium ions similar to that of MTA.

Biodentine can be used as an effective alternative to MTA as highlighted through this case presentation. Apexification with Biodentine requires significantly less time.[11] This can lessen the treatment time between the patient's first appointment and the final restoration. The importance of this approach lies in the effective cleaning and shaping of the root canal, followed by apical seal with a material that favors regeneration. In addition, there is reduced potential for fracture of immature teeth with thin roots, because of immediate placement of bonded core within the root canal.[13] In the present case, calcium hydroxide was used as intracanal medicament for 2 weeks to make the canal dry and free from infection. Use of calcium hydroxide for such a short-term does not adversely affect the fracture resistance of the tooth.[14]

A total of 5 mm barrier thickness is significantly stronger and shows less leakage than a barrier of 2 mm thickness.[15] In this case, we placed Biodentine of 5 mm thickness in the apical region. There are only few published literatures on clinical use of Biodentine as an apical plug in teeth with open apices, and hence it was proposed to use it in one of the clinical cases.

The only limitation of Biodentine is that it cannot be used in the presence of moisture. Hence, proper isolation is mandatory while using Biodentine. In the present case, the use of Collaplug as apical matrix not only served in limiting the Biodentine to root canal but also provided an isolated environment for setting of Biodentine.

CONCLUSION

This case report emphasizes the novel approach of using Biodentine to achieve apexification of the case with an open apex and large periapical lesion. The use of Biodentine has been demonstrated to induce faster periapical healing for apexification of the case with large periapical lesions. The material is still under study and many more advancements in its clinical applications are expected in near future. Although the efficacy of Biodentine as a dentin substitute is yet to be clinically proven for its therapeutic indications, it may be a promising material for apexification.

REFERENCES

1. Bhasker SN. Orban's oral histology andembryology. 11th ed. St Louis (MO): Mosby-Year Book; 1991.
2. American Association of Endodontists. Glossary of endodontitc terms. 7th ed. Chicago (IL): American Association of Endodontists; 2003.
3. Kubasad GC, Ghivari SB. Apexification with apical plug of MTA-report of cases. Arch Oral Sci Res 2011;1:104-107.
4. Torabinejad M, Hong C, McDonald F, Pitt Ford TR. Physical and chemical properties of a new root-end filling material. J Endod 1995 Jul;21(7):349-353.
5. Dammaschke T. A new bioactive cement for direct pulp capping. Int Dent Afr 2010;2(2):64-69.
6. Pawar AM, Kokate SR, Shah RA. Management of a large periapical lesion using Biodentine TM as retrograde restoration with eighteen months evident follow up. J Conserv Dent 2013 Nov-Dec;16(6):573-575.
7. Komabayashi T, Spångberg LS. Comparative analysis of the particle size and shape of commercially available mineral trioxide aggregates and Portland cement: a study with a flow particle image analyzer. J Endod 2008 Jan;34(1):94-98.
8. Chosak A, Eidelman E. Rehabilitation of a fractured incisor using patient's natural crown: a case report. J Dent Child 1964;31(1): 19-21.
9. Lamb EL, Loushine RJ, Weller RN, Kimbrough WF, Pashley DH. Effect of root resection on the apical sealing ability of mineral trioxide aggregate. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2003 Jun;95(6):732-735.
10. Parirokh M, Torabinejad M. Mineral trioxide aggregate: a comprehensive literature review – Part III: clinical applications, drawbacks, and mechanism of action. J Endod 2010 Mar;36(3):400-413.
11. Han L, Okiji T. Bioactivity evaluation of three calcium silicate-based endodontic materials. IEJ 2013 Sep;46(9):808-814.
12. Sulthan IR, Ramchandran A, Deepalakshmi A, Kumarapan SK. Evaluation of pH and calcium ion release of mineral trioxide aggregate and a new root-end filling material. E J Dent 2012;2(2):166-169.
13. Steinig TH, Regan JD, Gutmann JL. The use and predictable placement of Mineral Trioxide Aggregate in one-visit apexification cases. Aust Endod J 2003 Apr;29(1):34-42.
14. Hasheminia SM, Norozynasab S, Fezianfard M. The effect of three different calcium hydroxide combinations on root dentin microhardness. Res J Biol Sci 2009;4(1):121-125.
15. Kubasad GC, Ghivari SB. Apexification with apical plug of MTA-report of cases. Arch Oral Sci Res 2011;1(2):104-107.