Biodentine for Apical Barrier for Immature Necrotic Permanent Teeth: Report of Cases

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ABSTRACT

Introduction: Treatment of traumatized non-vital teeth with an open apex requires elimination of bacteria from the root canal system and induction of apical closure for favorable outcome and to confine the root canal filling within the canal. A new calcium silicate based cement as Biodentine was introduced by Septodont in 2010

Case report: This article describes the successful treatment of 5 traumatized permanent central incisors with open apex using Biodentine. After access opening and biomechanical preparation, the interappoinment dressing of either calcium hydroxide or triple antibiotic paste was placed in the canals. Later, Biodentine apical plug was placed in the apical part.The remainder of the canal was back filled with gutta-percha and access cavity restored with composite resin followed by full crown. The patients were followed for 1 year. All patients were asymptomatic clinically and radiographically.

Conclusion: Biodentine seems to be a promising material to be used in apical barrier formation procedure.

Keywords: apical barrier, Biodentine™, open apex, apical plug

INTRODUCTION

Traumatic injury to an immature permanent tooth leads to loss of pulp vitality and arrested root development. Thus, endodontic management of these teeth in young pediatric patients is a great challenge. The walls are divergent and wide open apex makes debridement and obturation difficult.[1] An Apical root closure may result from apexification or bridge formation. Apexification is defined as a method to induce a calcified barrier in a root with an open apex or continued apical development of an incomplete root in a tooth with necrotic pulp.[2]

Various techniques were used to induce the apexification process. The most common traditionally used medicament is Calcium Hydroxide. It was first introduced by Kaiser and Frank in 1960's. The approximate time for induction of calcified apical barrier varies between 6 months and 24 months. Although technique is efficient with predictable outcomes, it has several disadvantages like prolonged treatment time, chances of reinfection and risk of cervical fracture.[3]

An alternative to apexification with calcium hydroxide is formation of an artificial apical barrier technique using MTA. Literature suggests that MTA is biocompatible with cementogenic properties and has superior sealing ability. But it has certain disadvantages like questionable antimicrobial activity, difficult to handle, potential for discolouring the tooth.[4]

To overcome the disadvantages of MTA, a new calcium silicate based material, Biodentine™ (Septodont, Saint–Maur–Des-Fosses, France) has been introduced in 2009 claiming to be a revolutionary material capable of offering a bioactive and biocompatible replacement for dentine. The endodontic indications of the novel material are similar to MTA but are reported to offer several advantages including better consistency, improved handling, quicker setting time(12 minutes).[5]

The following case series describes successful management of traumatized permanent anterior teeth with open apex with Biodentine apexification followed by root canal treatment and full crown restoration.

CASE REPORT

5 necrotic single rooted teeth with open apices were treated in the Department of Pedodontics and Preventive Dentistry, Hitkarini Dental College and Hospital, Jabalpur. Patients were between 8 and 12 years old. Medical histories of all patients were non –contributory. In all the cases, none of the teeth responded to the vitality testing (Digitest, Parkell, Farmingdale, NY, USA). All of the teeth had normal periodontal probing and showed physiologic mobility. Palpation and percussion tests were carried out.

A summary of data of cases in the first visit are shown in Table 1. Informed written consent were obtained from all patients.

Treatment procedure: After local anaesthesia with 2% lidocaine and 1:2,00,000 adrenaline(Ligno-Ad,Vishal Dentocare Pvt Ltd, Ahmedabad, India) and rubber dam isolation, root canals were accessed using endo-access bur (Dentsply, Maillefer, Switzerland). BMP was done with alternate irrigation of 5.25%sodium hypochlorite and saline and gently filing with size 50K file (Dentsply, Maillefer, Ballaigues, Switzerland). Then, the root canals were dried with size 50 paper points (Dentsply, Maillefer,Switzerland). In all the 5 teeth treated, either triple antibiotic paste (prepared by mixing ciproflocaxin, metronidazole and cefaclor in the ratio of 1:1:1 with propylene glycol)or calcium hydroxide with iodoform (Metapex) as an intracanal medicament was placed in the canal and teeth were sealed with IRM (Cavitemp, Ammdent).

After 2 weeks, the patients were recalled and intracanal medicament were removed by irrigating with alternating solutions of 5.25% Sodium hypochlorite and saline. The canals were then dried with paper points.

Apical plug placement and obturation: After the canals have been dried till the working length, Biodentine™ cement powder

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How to cite this article: Shilpi Gupta, Kanchi Upadhyay, Tapas Kumar Sarkar, Soumik Roy. Biodentine for apical barrier for immature necrotic permanent teeth: report of cases. International Journal of Contemporary Medical Research 2016;3(11):3382-3384.

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Case number	Tooth no	Gender	Age	Interappointment clinical dressing	Clinical presentation
1.	11 and 21	M	13	Metapex in 21 and 3 mix in 11	Buccal swelling, sinus tract, pus discharge
2.	11 and 21	F	11	3 mix	Buccal swelling, pain in palpation
3.	11	M	9	Metapex	Pain, swelling with labial mucosa,active pus discharge.

Table-1: Data of the patients at the first visit

Case no.	Follow –up
1.	12 months
2.	10 months
3.	13 months

Table-2: Summary of follow –up periods

1.	Temporary enamel replacement
2.	Permanent dentine replacement
3.	Pulp protection in deep carious lesions
4.	Restoration of cervical and or radicualr lesion
5.	Direct and indirect pulp capping.
6.	Pulpotomy
7.	Repair of furcation and root perforation
8.	Repair of internal and external resorption.
9.	Apexification and apexogenesis.
10.	Retrograde root end filling

Table-3: Clinical indications

Constituent	Function
Powder	
Tricalcium silicate	Main component
Calcium carbonate	Filler material
Zirconium oxide	Radioopacifier
Dicalcium silicate	Traces
Calcium oxide	Traces
Iron oxide	Traces
Liquid	
Hydrosoluble polymer	Water reducing agent
Calcium chloride	Decreases the setting time

Table-4: composition of Biodentine ™

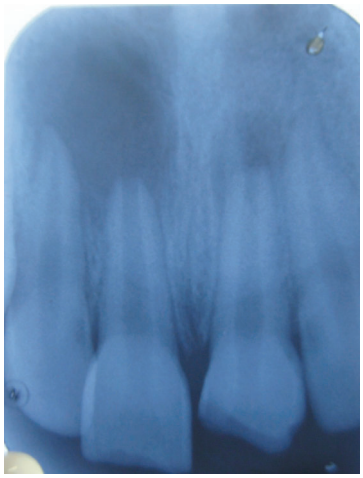

Figure-1a: Preoperative periapical radiograph of teeth 11 and 21

in a capsule and liquid (Septodont, Saint-Maur-Des-Fausses, France) were mixed in a triturator for 30 seconds. When the capsule was opened, the mix had putty like consistency. The Biodentine was dispensed onto a mixing pad and was delivered

Figure-1b: Follow up radiograph after 12 months

Figure-2a: Preoperative periapical radiograph of teeth 11 and 21

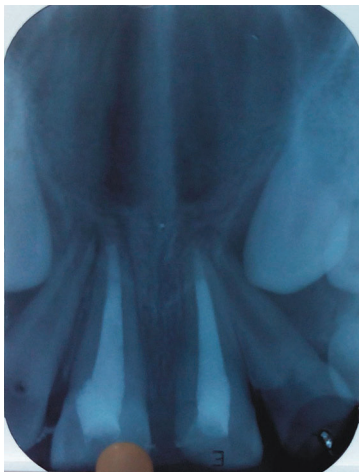

Figure-2b: Follow up radiograph after 10 months

to the dried canals using a sterile amalgam carrier and gently adapted to the apical portion of the canals using endodontic

pluggers (GDC, India) until an apical plug of 4-5 mm was reached. Correct placement of Biodentine apical plug was assessed radiographically. After checking the setting of Biodentine, the canals were obturated with gutta percha (Meta Biomed, Korea) and sealer Apexit Plus (Ivoclar Vivadent,Leichtensen). Finally, all teeth were provided permanent restoration.

The patients were followed clinically and radiographically at 3 month intervals till 1 year. Summation of treatment and follow-up periods are represented in Table 2. The mean follow-up time was 6 months. All the patients treated were clinically and radiographically successful till date with no clinical signs or symptoms of buccal swelling, sinus tract, sensitivity to percussion/palpation and showed no abnormal changes in radiograph (figures 1-2).

DISCUSSION

Literature suggests that goal of apexification procedure is to obtain an apical barrier to prevent the passage of toxins and bacteria into periapical tissues from root canal. Technically, this barrier is required for compaction of root filling material.[6]

MTA as an apexification material has the ability of hard tissue induction with a high degree of structural integrity when used as the apical plug in open apex teeth. Studies have shown high clinical and radiographic success rates.[7] But it has disadvantages like prolonged setting time.

Recently, Biodentine with Active Biosilicate Technology, was introduced by Septodont in September of 2010, "a new class of dental material which could conciliate high mechanical properties with excellent biocompatility, as well as bioactive behaviour. Its clinical applications are summarized in Table 3.

Biodentine™, a new endodontic material is composed of powder in a capsule and liquid in a pipette. The composition of the powder and liquid is shown in the Table 4.

Usually calcium silicate based cements have longer setting times(i.e in hours). But Biodentine has a shorter setting time of 12 min as compared to MTA which is 2 hours and 45 min.[6] This is attributed to high specific surface size of particles, adding Calcium Chloride as accelerator to liquid phase, and decrease in liquid content.[6] In apexification procedure, short setting time will eliminate the need for two step obturation as in MTA and reduced the risk of bacterial contamination.[8]

Literature suggests that high alkaline pH and release of calcium ions are required for a material to stimulate mineralization in the process of hard tissue healing. Further, an invitro study that evaluated pH and calcium ion release of materials, has found the results to be similar for both MTA and Biodentione when used as a root end filling.[9] In another study, the uptake of calcium and silicon released from MTA and Biodentine into root canal dentine was found to be higher for the latter.[10]

Biodentine has bioactive properties, and has mechanical properties similar to those of natural dentine. The compressive strength, elasticity modulus and microhardness are comparable with that of natural dentine. The material is stable, less soluble, hydrophilic, needs much less time for setting, produces a tighter seal.[5] Thus Biodentine as a new endodontic biomaterial, has advantages over MTA in treatment of teeth with open apex.

CONCLUSION

The conclusion from the present case reports needs to be further evaluated with longer prospective studies with Biodentine. There are few studies on biodentine apexification in the literature so more studies and longer follow-up is essential to ensure success of the treatment

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 27-10-2016; **Published online**: 09-12-2016