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TREATMENT OF AN IMMATURE PERMANENT TOOTH WITH BIODENTINE: 2 CASE REPORTS OF APEXIFICATION

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ABSTRACT Management of the cases with open apices has gained popularity in recent years. A new calcium silicate-based material has recently been introduced as a dentine substitute, whenever original dentine is damaged. This case report describes apexification in a maxillary central incisor with the necrotic pulp and open apex using Biodentine as apical barrier. Following cleaning and shaping, calcium hydroxide was placed as an intracanal medicament for 1 month. A plug of Biodentine of 5mm thickness was placed using hand fitting pluggers. The reminder of canal was filled with gutta percha by roll cone technique and access cavity was restored with GIC. 3 months follow up revealed restored function esthetic and function, absence of clinical signs and symptoms, resolution of periapical rarefication.

KEYWORDS : Apexification, Apical barrier, Calcium hydroxide, MTA, Biodentine.

INTRODUCTION

Calcium hydroxide was used for many years to induce apical closure by the formation of apical barrier followed by root canal treatment for the immature apex with necrotic pulp (1) until 1993 when MTA became the chosen material to induce the formation of apical barrier (2) because of its sealing properties and biocompatibility (3). However prolonged setting time, handling difficulty, and possible coronal staining with MTA (4-5) had led to research of alternative material.

In 2009 Biodentine (Septodent, St Maur des Fosses, France) was introduced as a tricalcium silicate cement. Biodentine is supplied as powder capsules composed of tricalcium silicate, calcium carbonate, and zirconium oxide are mixed with liquid containing water, calcium chloride to accelerate setting, and modified polycarboxylate as plastifying agent (6-8). The powder is mixed with liquid for 30 seconds in an amalgamator. Biodentine possess excellent handling characteristics because of excellent viscosity and short setting time which is about 12 minutes. This material can be used for dentine substitution in formation of apical barrier in apexifiacton treatment (9). Regarding its mechanical properties and biocompatibility, Camilleri et al (10) have reported superior results compared with MTA, because greater apposition of hydroxideapetie was observed on the Biodentine surface when exposed to tissue fluids (10). The present case is a report of an asymptomatic permanent tooth 21 with pulp necrosis and periapical abscess that was treated with apexification procedure with Biodentine.

CASE REPORT

Two patients came to the department of conservative dentistry and endodontics of Farooqia dental college Mysore they underwent standard history taking, clinical and radiographic examination, and evaluation of risk/benefits which resulted in the decision to perform endodontic treatment. Patients were fully instructed about the procedure, postoperative care, follow-up examinations and alternative treatment options. They gave written informed consent for the intervention and were included in an ongoing study evaluating the clinical behavior of Biodentine in different situations.

DESCRIPTION OF THE CASES

The first case was a 20 year old male with the chief complain of restored and discolored upper left front tooth. He gave a history of trauma 10 years back. Patient did not give any history of swelling and pus discharge. The tooth was treated by another private practitioner dentist he had done incomplete RCT and restored the tooth with composite resin material 4 years back. Patient is having no relevant medical history. Intraoral examination revealed Ellis class IV fracture and discoloration in relation to tooth 21. Palpation and percussion of tooth does not reveal any tenderness. The tooth was not mobile and periodontal probing around the tooth was within physiological limits. The radiographic examination of the tooth revealed a wide canal with an open apex, marked periapical radiolucency. Clinical examination and radiographic examination indicted pulp necrosis with chronic apical periodontitis. The available treatment options were discussed with the patient and root canal therapy with calcium hydroxide dressing, followed by apexification with Biodentine was selected Figure 1

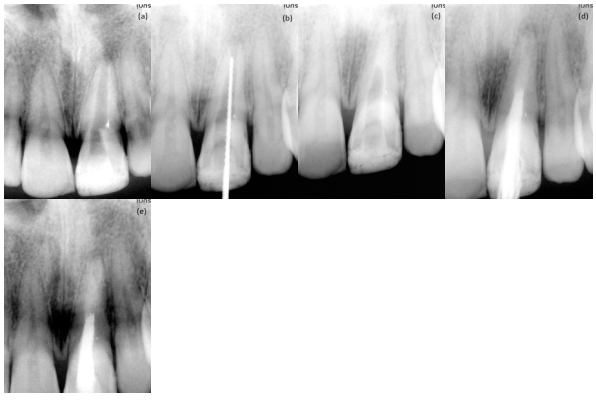

Figure 1. Case 1. (a) Preoperative radiograph showing 21 open apex and periradicular radiolucency (b) working length (c) confirming the placement of Biodentine apical barrier (d) back filling with gutta percha using roll cone technique (e) 3 month follow up showing resolution of periapical radiolucency.

Second case was of a 10year old girl was referred to Farooqia Dental college and hospital for the treatment of tooth 11 and 12. One year prior the patient had suffered a dental trauma, and tooth 11 and 12 had been treated by another private practice dentist. The patient reported pain in the maxillary right and left incisor. Clinical examination showed that tooth 11 had an oblique fracture of the crown, and the probing depth was within normal limits. Sensitivity tests (heat, cold, and electrical pulp testing) of the tooth gave no response. The tooth was tender to percussion, and no mobility was observed. A periapical radiograph of the tooth showed that the coronal fracture does not reach to mesial pulp horn in respect to 11, and no radiolucency was observed at the periapical area of the root. The root apex was not fully formed (Fig. 2b). The clinical diagnosis of tooth 11 and 12 was previously initiated therapy and symptomatic apical periodontitis. The apexification treatment was explained to the patients parents, and the decision for apexification instead of revascularization was made primarily because the diameter of the open apex was not more than 1 mm, which may be difficult to induce bleeding. Another reason was that the radiographic analysis comparing both central incisors showed that roots length and thickness of walls were different for both teeth. The apexification treatment with Biodentine was elected with the informed consent of patients parents. The available treatment options were discussed with the patient and root canal therapy with calcium hydroxide dressing, followed by apexification with Biodentine was selected as a treatment option Figure 2.

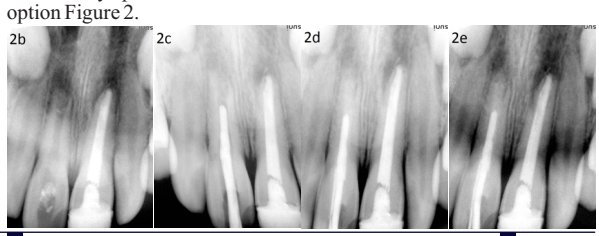

Figure 2. case 2. (2b) is a preoperative radiograph, (2c) checking the master cone,(2d) filling of biodentine and obturation, (2e) follow up after 1 month

A conventional endodontic access cavity was established for both cases. A working length was established 1mm short of radiographic apex with #80 k-file (Mani, INC., Utsunomiya tochigi, Japan) and was recorded for reference. The canal was gently instrumented to #110 k-file using circumferential filing motion with copious irrigation with normal saline solution and chlorehexidine solution (Asep RC) the canal was dried with paper points, and radiolucent calcium hydroxide intracanal medicament was placed in the canal and tooth was temporised with a cotton pellet and cavit G.

After one month the calcium hydroxide was removed mechanically using H-files to the working length, while irrigating with alternatively with normal saline and chlorehexidine solutions after this canal was dried with paper points.

Biodentine was mixed according to manufacturer's instructions Figure 3. It is carried into the canal with the help of an amalgam carrier and was condensed to working length by using pre-fitted hand pluggers. Several increments were required to form an apical plug of 5mm thickness, which was confirmed radiographically. Following the placement of the Biodentine, butt end of paper point was used to clear out any excess material from the walls. After 12 minutes the hardness of Biodentine was examined using a plugger to confirm its set. The canal was back filled with roll cone gutta percha technique using zinc oxide as a sealer. The access cavity was then restored with GIC. After treatment follow up revealed absence clinical symptoms of periradicular pathosis, tooth was restored with all ceramic crown.

DISCUSSION

Traditionally, the apexification method involves application of calcium hydroxide until the completion of root end closure (10-11). However, the disadvantage of long-term technique includes delayed treatment, difficulty in following up with patient, unpredictability of apical seal, and the risk of root fracture because of presence of thin walls (12). Filling of root canal for long time weaken the tooth structure (13). Apexification is defined as a method of including calcified apical barrier or continued apical development of an incompletely formed root in the teeth with necrotic pulp (2).

Biodentine has been developed as a permanent dentine substitute material whenever original dentine is damaged (14-15).

Biodentine consists of a powder in capsule and liquid in a pipette. The powder mainly consists of tricalcium silicate and dicalcium silicate. In addition, the powder also contains calcium carbonate, calcium oxide, iron oxide, and zirconium oxide. The liquid for mixing with the cement powder consists of calcium chloride and water-soluble polymer. Tricalcium silicate and dicalcium silicate are the main components of powder and they regulate the setting reaction calcium carbonate and calcium chloride is added for both biocompatibility and calcium content (16). They act as fillers improving the mechanical properties of the cement improving the mechanical properties of cement (16). Iron oxide is added to impart shade to cement. While as, zirconium is added serves as a radiopacifier. Calcium-chloride present in the liquid acts as accelerating agent and improves the physicochemical properties of the set cement. The hydrosoluble polymer is based on a polycarboxylate and it reduces the amount of water required by the mix, while maintaining the consistency of the mixture (14).

The ability of calcium silicate to interact with water leads to the setting and hardening of the cement (14-17). The powder is mixed with 5 drops of liquid in a capsule and triturated for 30 seconds tricalcium silicate mixes with water components and leads to the formation of hydrated calcium silicate gel and calcium hydroxide. This dissolution process occurs at the surface of the surface of each grain of calcium silicate. The hydrated calcium silicate forms a gel and the excess of calcium hydroxide tend to precipitate at the surface of the particles (14-17). Placement of Biodentine as a plug is technique sensitive. Restricting the material to the confines of the root apex is crucial. Sealing material extruded apically may set before it disintegrates and gets resorbed. This might result in the persistence of inflammatory process, which may complicate or even prevent repair of the tissue (18). To overcome this problem use of sterile absorbable collagen membrane is advocated. The material absorbs water and expands and also has a haemostatic effect (19). The collagen membrane absorbs fully in 10-14 days allowing new bone to gradually fill the defect.

The marginal sealing ability of Biodentine is attributed to its ability to produce surface apatite crystals when in contact with phosphates available in tissue fluids (20). Biodentine shows apatite crystal formation after immersion in the phosphate solution, indicate its bioactivity (21). Han and Okiji compared calcium and silicon uptake by adjacent root canal in the presence of phosphate buffered saline using Biodentine and Proroot MTA. The results showed that both materials formed a tag like structure composed of the material itself or calcium or phosphate rich crystalline deposits. The thickness of the calcium and silicon rich layers increased over time, and the thickness of calcium and silicon layer was significantly larger in Biodentine compared to MTA after 30 and 90 days. These finding leads to the notion that apatite formation contributes not only to leakage reduction by filling the gap along the interface but also via dentine interactions such as intrafibrillar apatite deposition (22).

Boidentine represents greater improvement compared to the other calcium silicate dental material. In contrast with MTA, the mechanical properties of Biodentine was similar to those of natural dentine. The material is stable, less soluble, non-resorbable, hydroplillic, easy to prepare and place, needs much less time for setting, produces a tighter seal and has a greater radiopacity (14-18). Due to its improved material properties, Biodentine has a distinct advantage over its closest alternatives in the treatment of the teeth with open apex.

CONCLUSIONS

Biodentine is a boon in effective management of teeth with open apex. The positive clinical outcome in this case is encouraging for the use of Biodentine in immature teeth with necrotic pulp and wide-open apices.

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