# Thermoplastic gutta percha obturation of immature non-vital teeth using biodentine as a novel apical barrier: A Case report

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**Abstract:**

The aim of endodontic therapy and complete canal space obturation is to inhibit pathogenic microbes from infecting and recolonizing the root canal. Incomplete root development may be affected by traumatic injury,dental caries or any other pulpal pathosis in young patients; such immature tooth may present a challenge and adds difficulty in root canal obturation due toimproper apical seal.In such cases endodontic treatment should emphasize on sealing a considerable communication of root canals and the periradicular tissue, thus providing a barrier or seal against which root canal obturating material can be condensed. This case reports present use of biodentine in apexification procedure and instant apical barrier in open apex teethfor thermoplastic obturation technique in single visit.

**Keywords**: Non-vital teeth; Open apex; Biodentine; Thermoplastic obturation.

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## INTRODUCTION:

The prime objective of endodontic management of infected pulp teeth's to prevent invasion of pathogenic microorganism and their recolonizing in root canal system. It is accomplished only with biomechanical preparation and cleaning of root canals and to seal it hermetically, apically as well as laterally, with biologically compatible materials.[1, 2] but it becomes difficult in teeth with deficient root development. Incomplete root development mostly observed in teeth with traumatic injuries or caries or other pulp al pathogenesis.[3]Endodontic management of immature wide-open apex tooth with a pulp necrosisand apical periodontics is a one of the

challenging and time taking task. Obturation along with proper apical sealing should be emphasized in such case for long-term success. Apexification is one such popular treatment modality practiced since long time.

Apexification is a procedure of inducing a calcified barrier at the apex of a non-vital tooth with incomplete root formation.[4]Without establishing apical barrier it is very difficult to get complete apical seal after root canal obturation. Calcium hydroxide has been commonly used for the induction of apical barrier but major drawback of this material is the micro leakage occurring during the formation of hard tissue barrier (which is comprised of unevenly organized cementum-like mass, soft tissue and calcified mass).[5-7]Also it requires 5–20 months to form the hard tissue barrier, multiple visits, patient compliance, re-infection due to loss of temporary restoration, and also predisposition of the tooth to fracture.[8]These facts should be considered in endodontic treatment of immature young permanent teeth.

Biodentine is newly developed calcium silicate based material introduced after MTA. The physical as well as chemical properties exhibited by biodentine are comparable to certain Portland cement derivatives.[9]The biocompatibility of biodentine has also been proven experimentally.[10]Consideringall its properties, Biodentine has been used in root repair, apexification, perforations and retrograde root end filling and it act as a bioactive dentin substitute.

The aim of this case reports is to present use of biodentine as an apexification material and instant apical barrier for thermoplastic obturation technique in single visit.

**CASE REPORTS**

**Case I**

A 12 years old female patient reported with complaint of pain in upper front teeth region of jaw. Patient was undergoing orthodontic treatment. Patient had faced trauma due to direct object hitting to upper right central incisor two months back. Medical history was not contributory. Clinical examination revealed tooth discoloration with no loss of tooth structure, confirming Ellis Class IV fracture with 11. Patient was having tenderness on slight percussion without any abnormal tooth mobility. The periapical radiograph showed widening of PDL space with loss of surrounding lamina dura in periapical region. It was observed that root apex was not completely developed. Based on clinical and radiographic findings tooth was diagnosed with pulp necrosis with periapical pathology and apexificationusing biodentine was planned. A written consent was taken from the patient after explaining the treatment protocol. The tooth 11 was accessed and radio graphically working length determined. Biomechanical preparation of root canal was achieved with circumferential filing in conjunction with copious amount of 2.5 % sodium hypochlorite irrigation. A volume of 3 ml of 17% ethylene diamine tetra acetic acid (EDTA) solution was used for smear layer elimination followed by NaOCl and a final rinse of saline was used. After complete drying of canal space calcium hydroxide medicament paste was injected in the root canal, and temporary closed dressing given. After one week, tooth was reopened, and the root canal was flushed with copious saline to remove residues of the aqueous calcium hydroxide and dried with sterile paper points. Biodentine (Septodont, Saint-Maur-des-Fosses, France) was mixed following the manufacturer's protocol and was carried to the access cavity using a messing gun and material was pushed apically with hand plugger, several increments were required to form a plug of sufficient thickness (4 mm). Materials were condensed till it becomes uniformly adapted to dentine/canal walls and apex and checked radio graphically. Material

was allowed to set for few minutes, after verifying the set material canal was obturated using thermoplastic gutta percha obturating gun (Denjoy Cordless Gutta Percha Obturation System) and the complete canal obturation was confirmed radio graphically and the access cavity was closed using composite resin. After 3 months, a clinical and radiographic follow up showed no signs and symptoms of any infection or inflammation. (**Fig.1**)

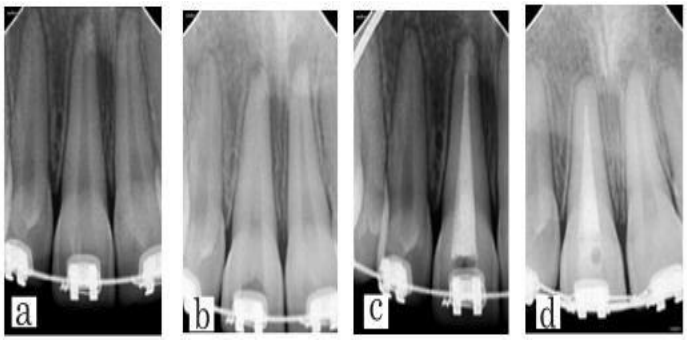


**Fig: 1. showing radiograph of Preoperative (a), Biodentine apical plug (b), thermoplastic obturation (c), 9 months follow up (d).**

**Case II**

An 11 years old male patient reported with complaint of pain in upper front teeth region of jaw. Patient gave history of trauma due to direct object hitting to upper central incisors three months back. Medical history included anomaly of right hand since birth. Clinical examination revealed tooth discoloration with loss of tooth structure of both the incisors, confirming Ellis Class II fracture with 11 and 21. Patient was having tenderness on slight percussion without any abnormal tooth mobility. The periapical radiograph showed widening of PDL space with loss of lamina dura in periapical region. It was observed that root apex was not completely developed. Based on clinical and radiographic findings tooth was diagnosed with pulp necrosis with periapical pathology. After discussing all the treatment options with patient's parents, apexification using biodentine was planned. The tooth 11 and 21 were accessed simultaneously and radiographic working length was determined. Biomechanical preparation of root canals was achieved with circumferential filing in conjunction with copious amount of 2.5 % sodium hypochlorite irrigation. A volume of 6 ml of 17% ethylene diamine tetraacetic acid (EDTA) solution was used for complete smear layer removal followed by NaOCl and a final rinse of saline was used. After complete drying of canal space calcium hydroxide medicament paste was injected in the root canals and temporary restoration placed in access cavity. One week later, tooth was reopened and the root canal was flushed with copious saline to remove residues of the calcium hydroxide medicament and dried with sterile paper points. Biodentine (Septodont, Saint-Maur-des-Fosses, France) was mixed according to the manufacturer's protocol and was carried to the access cavity using a messing gun and material was pushed apically with hand plugger in both the teeth, similar to previous case several increments were required to form a plug of sufficient thickness (4 mm). A material was condensed till it becomes uniformly adapted to canal walls and apex and checked radio graphically. Material was allowed to set for few minutes, after verifying the setting of material, canal was obturated using thermoplastic gutta percha obturating gun (Denjoy Cordless Gutta Percha Obturation System) and the complete canal obturation was confirmed radio graphically and the access cavity was closed using composite resin. After 3 months, a clinical and radiographic follow up showed no signs and symptoms of any infection or inflammation. (**Fig.2)**

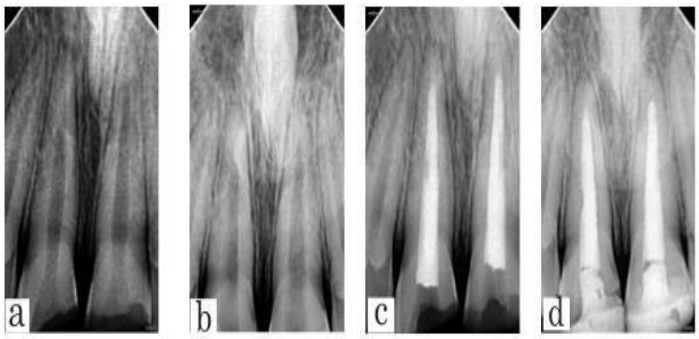


**Fig: 2. showing radiograph of Preoperative (a), Biodentine apical plug (b), thermoplastic obturation (c), 8 months follow up (d).**

**Discussion**

Trauma to the anterior teeth is prevailing type of injury occurring in children. Injury to the teeth during the development stage hampers the complete root formation because of injury to the her twig epithelial root sheath, which is more vulnerable to inflammatory reaction and this inflammatory reaction hinders the root development.[11-14]

Management of such open apex teeth is often challenging task to pedodontist, such tooth/teeth requires development of apical matrix barrier against which effective endodontic procedure can be accomplished with long-term success. We come across cases of trauma to the teeth where root development is not entirely achieved and having large apical foramen than the normal tooth, and in such cases we try to do endodontic treatment in conventional manner. Improper sealing of apex in such condition may leads to endodontic treatment failure after an unpredictable period of time.[15, 16] Also to achieve a 3 D /thermoplastic obturation in such tooth is quite challenging because of chances of overfilling of obturating materials through large apical foramen.[17]

Apexification is a feasible option for treatment of such permanent tooth. Apexification induces a calcified barrier in a root with an open apex or continued apical development of an incompletely formed root in non-vital teeth. The intent of this treatment is to attain an apical barrier and to seal the apex properly. Technically, this apical seal or barrier is obligatory for root filling material compaction and to prevent apical overfilling of obturating materials and also a leakage through apex of the tooth.[18]

Many materials have been recommended for apical barrier formation. Previous studies recommended calcium hydroxide as a permanent apical barrier.[19]Considering the drawbacks of calcium hydroxide as mentioned before, newer materials like MTA and Biodentine has gained enormous popularity in clinician for treatment of immature non-vital teeth. Apexification using MTA is an alternate treatment procedure in immature non-vital teeth but the long setting time of Pro-Root MTA, challenging handling characteristics, discoloration potential (gray MTA), low washout resistance and high material cost are some of the shortcoming of this material.[20, 21]

Biodentine is suggested as an effective alternative to MTA as emphasized through this case report. Biodentine has overcome the limitations of MTA and so the calcium hydroxide.[22]Biodentine has shown excellent biocompatibility and sealing capability and is less cytotoxic than other materials presently used.[23] Previous studies have investigated the bioactivity of biodentine by examining its effects on activation of pulp progenitor cellsand confirmed that Biodentine is encouraging dentine regeneration by stimulating odontoblast differentiation from progenitor cells of pulp.[24]It is new bioactive dentin substitute cement. It is available in a powder-liquid system; powder comprised of Tri-calcium silicate, Di-calcium silicate, Iron oxide, Zirconium oxide, Calcium carbonate and oxide while liquid comprise of Calcium chloride, Hydro soluble polymer. Comparing the setting time of MTA i.e. 2 hours

45 minutes, Biodentine has a shorter setting time of 12minutes.[25, 26] Zanini et al stated that Biodentine induces differentiation of mesenchymal cells into odontoblast-like cells and upsurge of murine pulp cell proliferation and biomineralization.[27]

In a study of Kokate et al. about the micro leakage of glass ionomer cement (GIC), MTA, and Biodentine when used as a retrograde filling material it was found that Biodentine exhibited the least microleakage.[28] The 24-h push-out strength of MTA was less than that of Biodentine.[29] Considering all the significance of biodentine this case report stresses the novel approach of using Biodentine for apical sealing to use thermoplastic gutta-percha obturation with single visit apexification of the cases with incomplete root development. The findings in this report suggest that using biodentine as an apical seal/barrier with thermoplastic gutta percha obturation can be a good option for long-term successful treatment of immature non-vital teeth.

**Conclusion**

Biodentine has been widely used with various endodontic application including vital pulp therapies, apexification, retrograde filling, endodontic obturation, perforation repair. The main significant advantage of biodentine is, it helps in apical barriers formation with proper sealing of apex.So single visit apexification using biodentine as an apical barrier and thermoplastic obturation is a new boon in successful management of immature teeth, which has predictable positive results with less time consumption.

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