

Single Visit Apexification Using Biodentine- A Case Report

Running title: Single visit apexification

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ABSTRACT

Apexification is a process of formation of a hard tissue barrier at the root terminus in a necrotic, immature, permanent tooth that has lost the capacity for further root development. Biodentine, a tricalcium silicate based cement has recently been introduced as a biocompatible dentin replacement material. This case report presents single visit apexification in a maxillary central incisor with necrotic pulp with open apex using Biodentine. After initial cleaning and shaping of root canal, an apical plug of Biodentine of 4 mm thickness was formed in apical third of root canal. The tooth was obturated using gutta-percha and access cavity was restored with composite resin followed by porcelain fused metal crown. Twelve months follow up revealed improved aesthetics and restored function, without any clinical signs and symptoms, periapical radiolucency was resolved, and a thin layer of calcific tissue formed apical to the Biodentine barrier. The positive clinical & radiographic outcome in this case is encouraging for the use of Biodentine as an apical plug in single visit apexification procedures.

Key words: Apexification, apical barrier, Biodentine, immature tooth.

INTRODUCTION

Apexification is method to induce closure of the apical third of root canal of an immature permanent tooth with necrotic pulp by forming calcific barrier or the continued apical development. The goal of this treatment is to control or eliminate periapical inflammation of pulp origin, promote closure of the apical foramen by hard tissue, obtain an apical barrier to allow compaction of root filling material, achieve valuable root length in some situations which would have been otherwise lost compromising the periodontal support of the tooth.

Traditionally, calcium hydroxide paste was the preferred material for apexification until 1993 when mineral trioxide aggregate (MTA) was introduced by Torabinejad¹. MTA is known for its biocompatibility & better root canal sealing². It promotes odontoblastic differentiation³, & has good radiopacity⁴. However, the prolonged setting times, handling difficulties, and possible coronal staining associated with MTA^{5,6} had led to a search for other alternative materials.

In recent years there has been a persistent search for improved biocompatible materials applicable to endodontic practice, such as calcium silicate cements, freeze dried bone, freeze-dried dentin, collagen calcium phosphate etc.

Biodentine (Septodont, St Maur des Fosses, France) was introduced as tricalcium silicate cement in 2009. Biodentine is supplied in capsules containing powder which is composed of tricalcium silicate, calcium carbonate, and zirconium oxide that are mixed with liquid containing water, calcium chloride to accelerate setting, and modified polycarboxylate as a plasticizer⁷. Biodentine has better handling properties compared to MTA because of its excellent viscosity and short setting time, which is about 12 minutes. This material can be used for pulp capping, pulpotomy, internal and external resorption, formation of apical barriers in apexification treatment, regenerative procedures etc⁸. This biocompatible non cytotoxic dentin replacement material forms needle like crystals resembling apatite at dentin interface. The material induces

odontoblast like cell differentiation stimulates biomineralization & promotes hard tissue formation. The only disadvantage with biodentine is its low radiopacity⁷.

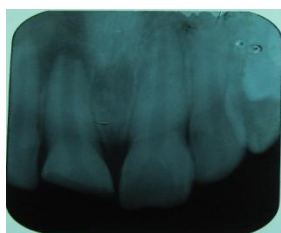
CASE REPORT

A 9-year old female patient reported to the Department of Pedodontics & Preventive Dentistry with a chief complaint of fractured and discolored upper right front tooth. She gave a history of trauma 1 year back. There was no history of swelling or pus discharge. Intraoral examination revealed generalized Elli's Class IV fracture in relation to tooth #11. Tenderness on percussion was absent. The mobility was within physiological limits.

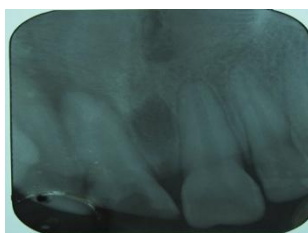
Pulp was non-vital as Electric pulp testing produced no response in the fractured tooth. The radiographic examination of the tooth revealed a wide canal with an open apex and a marked periapical radiolucency. Clinical and radiographic examination revealed pulp necrosis with chronic apical periodontitis. The treatment planned was root canal therapy with calcium hydroxide dressing for 2 weeks, followed by apexification with Biodentine.

Following rubber dam isolation, a conventional endodontic access cavity was established following which the working length was established radiographically 1 mm short of the radiographic apex with a # 30 K-file (MANI, INC., Utsunomiya Tochigi, Japan) and was recorded for reference. The canal was gently instrumented to #70 K-files using a circumferential filing motion with copious irrigation with 5.25 % sodium hypochlorite solution (Septodont, USA). The canal was dried with sterile paper points, and calcium hydroxide was placed as an intracanal medicament for 2 weeks. In next visit the tooth was again isolated under rubber dam and the calcium hydroxide was removed mechanically using hand H-files to the working length, while rinsing with alternating solutions of 3% sodium hypochlorite solution and 17% ethylene diamine tetra acetic acid (Prevest Denpro Ltd., Jammu, India). A final rinse with sterile saline was performed.

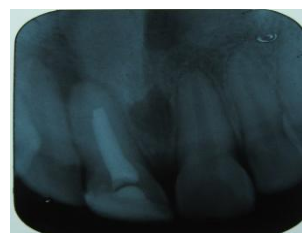
Biodentine was mixed according to the manufacturer's instructions. It was carried into the canal with the help of the cement carrier and was pushed with the help of endodontic plugger till apical third. After biodentine had set the tooth was obturated in the same appointment. In the next appointment porcelain fused metal (PFM) crown was given. The patient was followed till 12 months at the end of which tooth was completely free from signs & symptoms.



Pre operative



Apical Biodentin plug



Post operative

DISCUSSION

Apexification is defined as a method of inducing a calcified apical barrier or continued apical development of an incompletely formed root in teeth with necrotic pulp¹. Biodentine is tricalcium silicate based cement with shorter setting time of 12 minutes & better handling characteristics than that of MTA, which has setting time of 2 hours 45 minutes. This material has shown promising results when used for dentin replacement, direct and indirect pulp capping, pulpotomy, repair of furcation and root perforations, retrograde root-end filling, and apexification⁹. Biodentine lacks cytotoxicity & genotoxicity, and it stimulates hard tissue formation & also promotes continuation of root elongation.

Pawar AM¹¹ et al reported management of non vital central incisors with open apices using calcium hydroxide and biodentine in a case series. They concluded that the time duration for apical closure with biodentine was superior to calcium hydroxide and biodentine apical plug technique can be an effective substitute for mineral trioxide aggregate and calcium hydroxide.

Lee et al¹¹ suggest the use of Biodentine as well as MTA and Bioaggregate as root-end filling materials because in contact with mesenchymal stem cells they induce osteoblast differentiation.

The calcium ions and Si-OH groups of calcium silicate cements induce apical sealing through the deposition of apatite onto the surface of the root¹².

The sealing property of biodentine is due to its ability to produce CH during hydration, which in contact with the phosphates of tissue fluids form a calcium phosphate phase¹³. The alkaline caustic effect of CH degrades the collagenous component of the interfacial dentin, leading to the formation of a porous structure that facilitates the permeation of high concentrations of calcium, hydroxyl and carbonate ions. The tag-like structures alongside an interfacial layer called the mineral infiltration zone increase mineralization in this region¹⁴.

This case report presented apexification treatment using biodentine. The favorable clinical and radiographic outcome demonstrated that Biodentine may be an efficient & effective alternative to the conventional apexification materials.

Conflict of interest: The authors disclose no conflict of interest.

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