Journal of Applied Dental and Medical Sciences
NLM ID: 101671413 ISSN:2454-2288
Volume 8 Issue 4 Oct-Dec 2022
https://www.ncbi.nlm.nih.gov/nlmcatalog/101671413
www.joadms.org

CASE REPORT

One-Step Apexification: A Case Report

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ARTICLE INFO

Keywords: Blunderbuss canal and open apex, One-step apexification, Biodentine, Bone graft, One step apical barrier placement

ABSTRACT

A tooth with blunderbuss canal and open apex with periapical lesions can be an endodontic challenge because of difficulty in obtaining an apical seal, and existing thin radicular walls which are susceptible to fracture. To overcome the limitations of traditional long‑term calcium hydroxide apexification procedures, nonsurgical one-step apexification using a calcium silicate based material such as MTA/ Biodentine has been suggested. The one-step apexification has been described as a non-surgical compaction of the biocompatible material at the apical end of the root canal, thus creating an apical stop and enabling an immediate filling of the root canal. However, adequate compaction of Biodentine in teeth with wide open apices can be an arduous task, and an internal matrix is required for controlled placement of Biodentine as a obturation material. So, initially the open apex is condensed with bone graft material(B-OSTIN) by non-surgical procedure(with the help of GP condenser).This material helps in osseoconduction and healing of the periapical lesions. This case report presents the endodontic management of immature permanent teeth with open apices using bone graft material and one step apical barrier placement of Biodentine.

Introduction

As it can be difficult to achieve an apical seal on an immature permanent tooth with a blunderbuss canal and an open apex, and because the existing radicular walls are thin and brittle, endodontic treatmentcan be challenging.[1]

Traditional methods for causing apexification in juvenile permanent teeth with open apices, pulpal necrosis, and periradicular disorders use the longterm administration of calcium hydroxide (Ca(OH)[2].

Sadly, there are a number of drawbacks to using Ca(OH)2 for apexification procedures, including a lengthy treatment period of several months, a lack of patient motivation, a risk of reinfection due to the loss of intermediate coronal restoration, the formation of "Swiss cheese" porous callus bridges, aesthetic issues, the inability to encourage continued root development and thickness of lateral dentinal walls, and a high pH that encourages necrotic and degenerative changes[2,3].

The idea of "one step apexification" with components like Biodentine was suggested to address all of these drawbacks.

In order to create an apical stop that would allow the root canal to be promptly filled, one step apexification is the nonsurgical compaction of a biocompatible material into the apical end of the root canal.[4] Tricalcium phosphate, freeze-dried bone, freeze-dried dentin, collagen calcium phosphate, Proplast (a porous material made of polytetrafluoroethylene and carbon fibre), and mineral trioxide aggregate (MTA) are some of the materials that have been suggested for this use[5,6,7,8,9].

The extrusion of these materials into the periodontal tissue is one of the technical issues connected to their placement. Because its placement in the region of bone loss offers a base on which the sealing material can be placed and packed, the use of an artificial barrier ormatrix is advised. A number of substances, such as calcium hydroxide, hydroxyapatite, absorbable collagen, calcium sulphate, andautologous platelet rich fibrin

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membrane, have been suggested for use in the creation of matrices [10,11,12,13].

MTA has been the most frequently used material for onevisit apexification out of everything else.Due to their exceptional biocompatibility, regeneration capacities, antibacterial qualities, and sealing abilities, they have garnered a lot of interest[14,15].MTA still has some drawbacks, such as a lengthy setting time, poor handling properties, low compression resistance, low flow capacity, limited resistance to washout before setting, the potential to stain tooth structure, the presence of arsenic, and its high cost.[16,17]

More optimal restorative materials with sufficient biological and mechanical qualities are required as a result of these drawbacks.In order to preserve the qualities and therapeutic applications of MTA without its drawbacks, Biodentine (Septodont, Saint-Maur-des-Fossés, France) a novel calcium silicate-based material has just been introduced.

The purpose of this paper is to describe how Biodentine combined with absorbablegel(Abgel absorbable gelatin sponge USP) and bone graft material (B-OSTIN)as a matrix was able to successfully close theroot apex of a pulpless permanent maxillarycentral incisor with a wide open apex.

CASE REPORT

The primary complaint of a 21years old male patient who visited the Department of Conservative Dentistry and Endodontics wasa broken and discoloured upper left front tooth.He described his past trauma from two years ago.The patient gave no information on any prior edoema or pus discharge.There was no additional important dental or medical history discovered, and there were no recorded drug sensitivities.

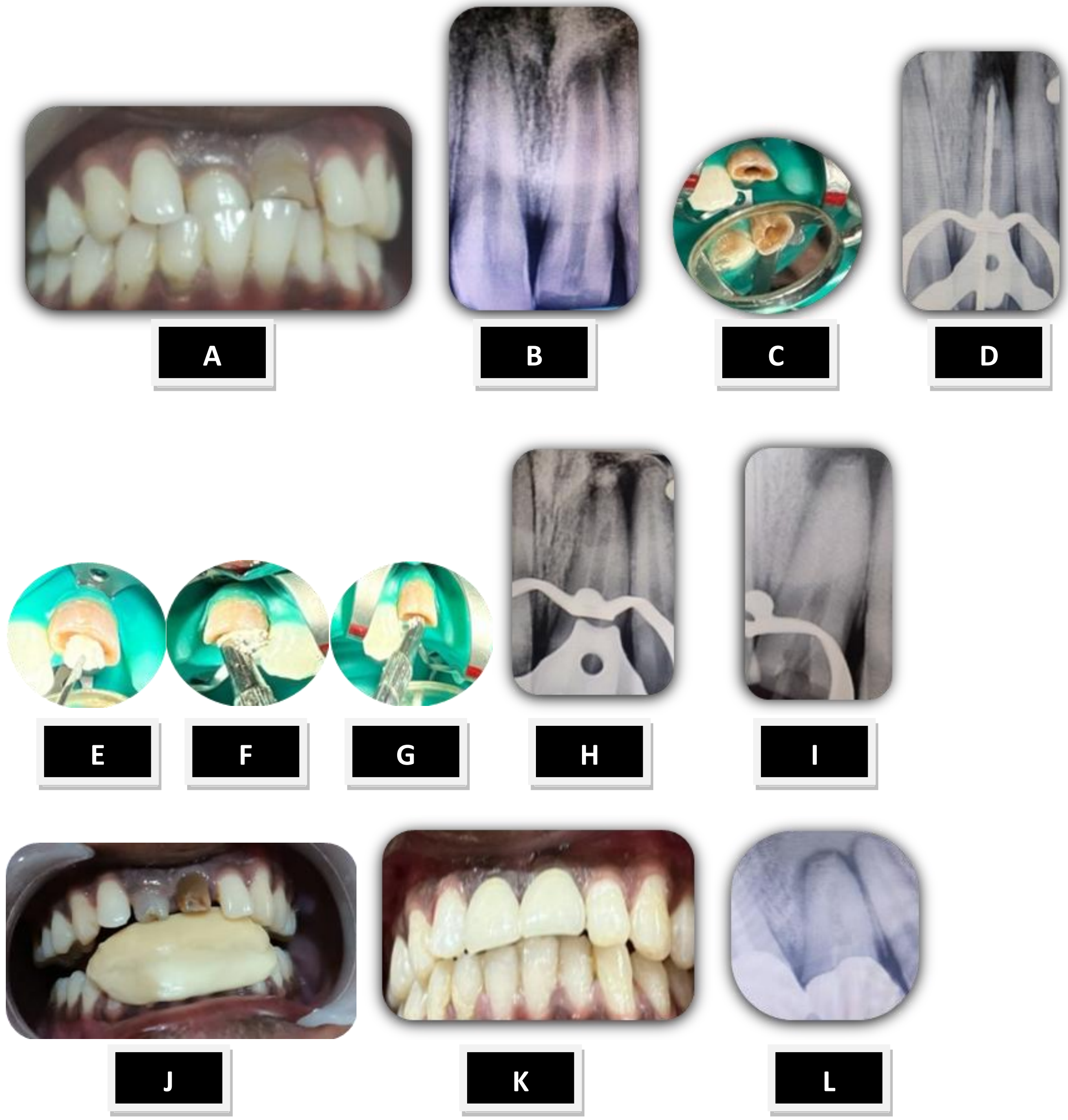
Upon doing an intraoral examination, it was discovered that tooth #21 had a cross bite as well as generalised stain, calculus, and Elli's Class IV fracture and discoloration (Figure 1a).The concerned tooth was sore to the touch and to percussiontesting.Because the tooth was immobile,periodontal probing around it was safe and within physiological bounds.(Parkell Electronics Division,Farmingdale, NY) Electric pulp testingproducedno reaction, although nearby teeth did. When the tooth was radiographed, it showed a largecanal with an open apex and a noticeable radiolucency periapically.

Pulp necrosis and chronic apical periodontitis were found upon clinical and radiographic assessment.Following a discussion of the patient's treatment choices, root canal therapy utilising a calcium hydroxide dressing and apexification with Biodentine employing a matrix containing absorbable gel and bone graft material were chosen as the best course of action.

A traditional endodontic access cavity was created after rubber dam isolation.The working length was determined radiographically with a #100 Kfile 1 mm below the radiographic apex because the apex locator gave inconsistent canal length readings. This measurement was recorded for future use.With gentle instrumentation utilising 120, 130, and 140 Kfiles and extensive irrigation of 3% sodium hypochlorite solution, the canal was cleaned.Calcium hydroxide was placed as an intracanal medication, the canal was dried with sterile paper points, and the access cavity was temporarily sealed with a cotton pellet and Cavit.

After a month, the tooth was once more isolated beneath a rubber dam, the calcium hydroxide wasremoved, and alternating solutions of 3% sodium hypochlorite solution and17% ethylenediaminetetraacetic acid were used to rinse the tooth.After that, sterile salinewas used as a final rinse.A little piece of absorbable gel was cut to fit the canal's width after the canal had been dried with paper points.To create a matrix, the membrane was inserted throughcompressed with prefitted hand pluggers just beyond the apex into the bony gap created by the periapical lesion.Thenbone graft material was placed beyond the apex with the help of the amalgam carrierand condensed with using the hand pluggers.

According to the manufacturer's directions, Biodentine was blended. Utilising pre-fitted handpluggers, it was compressed against the bone graft material after being delivered into the canal by an amalgam carrier. A 5 mm thick apical plug was formed over several steps, andthis was validated radiographically (Figure 2d). The butt end of a paper point was used to remove any extra material from the walls after Biodentine had been laid over the



A. PRE-OPERATIVE CLINICAL SITUATION B.PRE-OPERATIVE RADIOGRAPH C. ACCESS OPENING OF #21 D. WORKING LENGTH DETERMINATION USING #100 K FILE E. PLACEMENT OF ABSORBABLE GEL F. PLACEMENT OF BIODENTINE G. PLACEMENT OF BONE GRAFT MATERIAL H. RADIOGRAGH OF APICAL SEAL FORMATION I. POST PLACEMENT J.CROSS-BITE CORRECTION BY USING CATALANS APPLIANCE K.POST OPERATIVE RADIOGRAPH L. SIX-MONTH POST-OPERATIVE FOLLOW –UP :THE PERIAPICAL LESIONIS SUBSIDED

barrier. A plugger was used to test the Biodentine's hardness after 12 minutes to ensure that it hadset.After that the cavity was temporarily sealed with a cotton pellet and Cavit and recalled thepatient after 7 days.

On the next appointment, fibre post was placed with help of the duel cure resin cement andcore was built up using flowable composite resin.Root-canal treatment was also performed in respect to #11 in sitting visit#21 and #11 were restore with all-ceramic crown.

Six-month postoperative follow-up revealed restored aesthetics and function, absence of any clinical signs or symptoms of periradicular pathosis, resolution of periapical rarefaction, and a thin layer of calcific tissue formed apical to the Biodentine barrier.

DISCUSSION

When the original dentine is damaged, Biodentine has been created as a permanent dentine replacement material. The substance with mechanical qualities similar to dentin can be employed on both crowns and roots.A liquid in a pipette and powder in a capsule make up biodentine.The sol-gel process is used in a lab to create the highly purified powder.The powder's major ingredients are tricalciumsilicate and dicalcium silicate.The powder also includes iron oxide, zirconium oxide, calcium carbonate, and oxides of calcium and calcium.Calcium chloride and a water soluble polymer are both present in the liquid that is to be combined with the cement powder.

The major ingredients in the powder, tricalcium silicate and dicalcium silicate, control the setting reaction.For both biocompatibility and calcium content, calcium carbonate and calcium oxide are added [18].They serve as fillers, enhancing the cement's mechanical characteristics[19].The setting and hardening of the cement is caused by the interaction of calcium silicate with water.[19,21]

The mixture has a viscosity similar to putty and is reminiscent of phosphate cement.Compared to MTA, which requires 2 hours 45 minutes to set, Biodentine does so in only 12 minutes[19]. In the case of apexification, a shorter setting time decreases the potential of bacterial contamination and avoids the necessity for two steps of obturation, as with MTA [22].

Microleakage occurs most frequently when gutta-percha is utilised as a backfilling material during the apexification operation.[23] When exposed to microbes and their byproducts, research has shown that no known approach with different procedures of cold or warm compaction of gutta-percha can dependably form a coronal bacterial-tight seal.[24] Thus, the quest for alternatives to gutta-percha as an obturating substance is currently a popular endodontic research topic.

When compared to MTA, biodentine has a higher compressive strength, a shorter setting time (9–12 min), less solubility, and superior handling properties. Biodentine has the unique ability to continuously increase compressive strength over the course of several days. After a month, it can reach 300 MPa, which is nearly similar to the compressive strength of natural dentin (297 MPa).[25]

Biodentine placement as an apical plug is technique-sensitive. It's important to keep the content inside the boundaries of the root apex.Extruded sealing material may set before it breaks down and is reabsorbed.This could lead to the inflammatory process continuing, which could make tissue repair difficult or impossible[26].Lemon developed the root perforations in 1992 to address these issues. He suggested using amalgam to seal the perforation. This amalgam would be compressed against a carefully inserted exterior matrix of hydroxyapatite, acting as an externalbarrier or matrix.To recreate the outside morphology of roots and other structures, an alternative external matrix made of sterile absorbable membrane has been suggested.

To reconstruct the outside shape of the root and make the sealing material more adaptable, an alternative usage of a sterile absorbable membrane as an external matrix has been suggested.This substance has a haemostatic action in addition to expanding and absorbing moisture.[11]Within 10 to 14 days, the membrane completely dissolves, allowing new bone to progressively cover the defect.

In some instances of inadequate root formation, deliberate overinstrumentation of the periapical region to induce a blood clot that will cause apical closure has also been proposed as an alternate treatment[27]. As post-core treatment was already recommended for the tooth, one step apexification with Biodentine was chosen in this instance.

The case was complicated with the presence of trauma from occlusion and single central incisor tooth crossbite which may act as contributory factor of periapical lesion.[28] To manage Catalans appliance was used and in 3 weeks time the single tooth crossbite as well as anterior traumatic bite was corrected. It looks like this made the periapical lesion to heal faster.

Several materials – including calcium hydroxide paste, calcium hydroxide powder and other alternatives – have been used in the past in an effort to create the apical barrier.[29] The osteo-conductive potential of these material makes it suitable for the creation of the apical barrier before MTA placement. We used Septodont R.T.R.- Bone Graft Material , made of ß-tricalcium phosphate granules of synthetic origin, which is available in convenient syringe form application.

CONCLUSION

One- step Apexification using Biodentine, a unique biocompatible substance, is a breakthrough in the care of teeth with open apex. The use of Biodentine in immature teeth with necrotic pulp and wide-open apices is encouraged by the case's successful clinical outcome.

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