CASE REPORT

Mgement of a traumatic immature central incisor by apexianafication using biodentin: a case report

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Abstract

When an immature permanent tooth with open apex undergoes trauma, it results in incomplete root formation that triggers the development of periapical pathology. The management of such cases poses a great endodontic challenge as it is difficult to maintain the obturating material confined within the root canal without encroaching into periapical area. Apexification is a technique for inducing closure of the non-vital permanent teeth at the apex. In apexification a mineralized calcified barrier is formed. Hence this case report present the use of biodentine to form an apical plug in open apex followed by complete root canal obturation using gutta percha without any complication.

Keywords- Immature Permanent tooth, Open apex, biodentin, apexification

Introduction

Root development is a normal biological process, where the apex of the root typically closes within three years after the tooth erupts. However, if the tooth undergoes any trauma during this period, it can hinder the closure of the root apex. Consequently, the root canal may widen, with thin walls and the apex may fail to close.[1] Thin root dentin walls make the tooth susceptible to fractures. In such instances, it's necessary to use mineralized tissue to close the apical foramen or to create an artificial apical barrier.

This facilitates the compaction of the root filling material and promote apical seal.[2] Apexification involves removing inflamed or necrotic pulp from the root canal and disinfecting the canal for apical closure. The primary aim of this procedure is to generate a hard tissue barrier that serves as an apical stop, facilitating efficient filling of the canal.[3,4] A few dental materials have been introduced for this purpose,calcium hydroxide, MTA ,biodentin, PRF, PRP, bioceramics etc.

In this case report we used Biodentin as an calcified barrier which was introduced in 2009 by Septodont. Three advantages of using biodentin as an apical barrier are: faster setting time of about 12 min, higher mechanical properties, and better handling characteristics. [5]

Case Report

A 14-year-old male patient reported to the department of Pediatric and Preventive Dentistry with the chief complaint of broken tooth in the upper front tooth region, 3 months back. Patient had a history of trauma 3 months back.

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On general examination, patient had no significant dental and medical history. Extra- oral examination showed symmetrical face, no abnormalities of the lips, the left and right mandibular salivary glands were unaffected and painless. Intra-oral examination revealed Ellis Class IV fracture irt 21. Hygiene of the oral cavity was good. Tenderness to vertical percussion was positive. Electric pulp testing was done irt 11,12, 21, and 22 which confirmed that #21 was non-vital. The radiographic examination of the tooth revealed a wide canal with an open apex (Figure 1). Clinical and radiographic examination indicated pulp necrosis.

Figure 1

Under rubber dam isolation a conventional endodontic access cavity was prepared. A periapical radiograph was taken to determine the working length of the teeth and it was found to be 18.5mm. Biomechanical preparation was done using K-file. Root canal debridement was done using alternate irrigation with 2.5% NaOCl, EDTA and saline. The root canal was then dried with sterile paper points and triple antibiotic paste (minoclycine, metronidazole and ciprofloxicin) was placed in the root canal and the patient was recalled after 15 days. In the recall visit, the tooth was again isolated under rubber dam, the triple antibiotic paste dressing was removed by hand instrumentation and irrigation was done with 2.5% NaOCl and saline. The root canal was then dried with sterile paper points and the triple antibiotic paste was again placed inside the canal and the access cavity was sealed by cavit (temporary restoration) and the patient was recalled after another 15 days.

In the third visit, triple antibiotic paste was removed and irrigation was carried out using saline and radiographically the reduction of the periapical lesion can be appreciated. The mixture of Biodentine™ was then prepared. Material was placed inside the canal in increments. The material was then delicately pushed towards the apex with a root-canal plugger. Several increments were required to form a plug of adequate thickness (>3 mm),which was confirmed radiographically (figure 2).

Figure 2

The canal was then obturated using gutta percha (figure 3).The access cavity was sealed with GIC

Figure 3

and the patient was referred to the department of orthodontics for the remaining needful treatment.

Six months post-operative follow-up (figure 4) revealed restored aesthetics and function, absence of any clinical signs or symptoms of periradicular pathosis, resolution of periapical

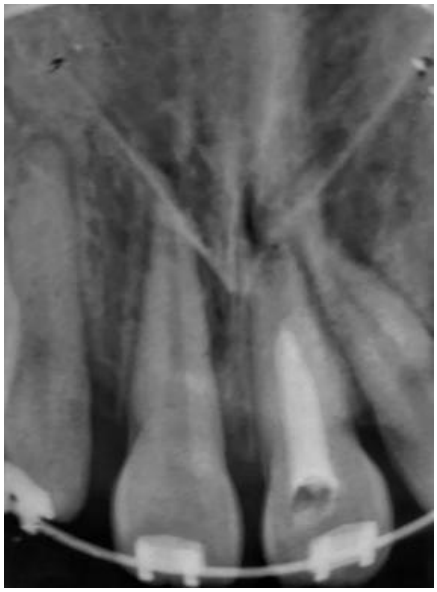

Figure 4

rarefaction, and a thin layer of calcific tissue formed apical to the Biodentine barrier.

Discussion

The primary objective of apexification is to establish a protective barrier at the tooth apex, effectively blocking the entry of bacteria and toxins from the root canal into the periapical tissues. This barrier is crucial for facilitating the compaction of obturating material within the root canal.[6,7] It is supposed to create an environment to permit deposition of cementum, bone and periodontal ligament to continue its function of root development.[8] Under ideal conditions, residual pulp tissue and the odontoblastic layer may form a matrix, such that the subsequent calcification can be guided by the reactivated epithelial cell rests of Malassez or nonperiapical pluripotent cells within bone.[9,10] The formation of a barrier is also influenced by factors such as the extent of inflammation and pulp necrosis, displacement during trauma, and the frequency of calcium hydroxide dressings, which might complicate or delay treatment.[11]

The aim of treatment in such cases is to create this barrier to halt the penetration of harmful substances from the root canal into the periapical tissue. Calcium hydroxide has been the traditional material of choice for induction of apical calcific barrier. But the time required by Calcium hydroxide to induce root end closure limits it use,as it takes much longer time.[12,13] It has a number of drawbacks, including treatment time variability, unpredictability of apical closure, difficulty in patient follow-up, failure to control infection, infection recurrence, cervical fracture, and an increased risk of root fracture.[6,7] Following the introduction of mineral trioxide aggregate (MTA) by Torabinejad et al., it has emerged as the preferred material for apexification procedures.[14] However, challenges such as extended setting time, potential for discoloration, poor handling properties, susceptibility to

washout, and high cost are notable drawbacks associated with its use.[7]

Biodentine is a novel bioactive cement used as a dentin substitute. Its composition includes a powder containing tricalcium silicate, dicalcium silicate, calcium carbonate, calcium oxide, zirconium oxide, and calcium hydroxide. One of its notable advantages is its shorter setting time, taking only 12 minutes, in contrast to MTA, which requires 2 hours and 45 minutes to set.[15] Other superior qualities of biodentin over MTA includes:

- Its consistency is more optimal for clinical application compared to MTA.
- The presentation of Biodentine ensures improved handling and safety compared to MTA.
- Unlike MTA, Biodentine doesn't necessitate a two-step obturation process due to its faster setting time, reducing the risk of bacterial contamination.
- There's a possibility that Biodentine exhibits greater biomineralization ability than MTA.[16]

Other recent materials used for apexification are the scaffolds which are the solid materials used for cell location and also help in differentiation and proliferation by acting as transport for growth factors, nutrients and gases. Minimal inflammatory reaction is seen with this.

Types of Scaffold Used For Apexification are

1) PRP (PLATELET RICH PLASMA)
2) PRF (PLATELET RICH FIBRIN)
3) POLYMERS
4) BIOCERAMICS

PRP(Platelet rich plasma)

Benefits of PRP include elevated rates of angiogenesis and revascularization, which are fundamental for a successful RET. Drawback is that it is limited in the young patients from drawing blood using special instruments and reagents.[17]

Platelet Rich Fibrin (PRF) It is the second-generation platelet concentration.Benefit of slow release of growth factor for 7-14 days.[18]

Polymers

a) POLYGLYCOLIC ACID (PGA)
b) POLYACTIC ACID (PLA)
c) POLY-LACTIC -COGLYCOLIDE
d) POLY-L-LACTIC ACID (PLLA)

PGA was used in suture of head and neck implant of bone, regeneration, cartilage repair.No inflammatory response was seen. PLLA promotes pulp cell differentiate into endothelial cells and odontoblast.[19,20] PLGA shows dentin like tissue and pulp like tissue formed around 3-4 months.[21] Drawbacks are due to low PH it causes localized inflammatory reaction.[22]

Bio ceramics

Most widely used are

1) CALCIUM PHOSPHATE CERAMICS, including Hydroxyapatite, beta tricalcium phosphate (β -TCP). Biphasic Calcium Phosphate.

Advantages Bone regeneration

- Biocompatibility
- Low immunogenicity
- Osteoconductive
- Mechanical strength is increased by adding SIO2
- And ZnO also helps in crystallization.

Combination of poly (D, L-Lactide-co-glycolide)] and ceramics (- TCP) showed excellent results in mechanical and physicochemical properties.[23]

Conclusion

Biodentine can be used as an effective alternative to MTA. Biodentine as a material of choice for single visit apexification as well as uncooperative children is a new boon in effective management of teeth with open apex. It also enables treatment under general anesthesia or deep sedation because of the shorter treatment time provided.

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