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Endodontic management of open apex in permanent teeth using Biodentine and Platelet – rich fibrin membrane barrier as an internal matrix: A case report

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ABSTRACT
When a tooth has an open apex, endodontic treatment is required to close it. Because calcium hydroxide has its drawbacks, calcium hydroxide cannot be used in all cases. Although Mineral Trioxide Aggregate (MTA) has shown to be a viable material for Apexification, the lengthy setting time and poor handling qualities of MTA have raised some concerns. In this case report Biodentin and Platelet – Rich Fibrin Membrane (PRF) were used as an apical matrix barrier in the treatment of open apex. Autologous fibrin matrix PRF contains a considerable supply of platelet and leukocyte cytokines, which promote healing by releasing growth factors. Apexification patients with significant periapical lesions that can be treated with Biodentin and PRF have shown excellent outcomes and rapid healing with the use of these two products.
Keywords: Apexification, Biodentine, MTA, Calcium hydroxide.

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INTRODUCTION

Root canal cleaning and obturation are the ultimate goals of endodontics. It is more difficult to perform effective endodontic therapy on teeth with large openings at the crown or apex, sometimes known as "blunderbuss canals." In many circumstances, the most difficult part is getting an apical seal. Thin dentinal walls make it more susceptible to breakage. [1] [2] Controlling the compaction of obturating material is difficult when there is no apical constriction. A platform for obturation is needed in these circumstances in order to restrict a potential path of exchange and communication between the root canal and the periradicular area. Apexification refers to the creation of a calcified barrier in the apical portion of an open root. The most widely accepted method for promoting root barrier production is calcium hydroxide, which has been used in a variety of ways in apical barrier creation [6] and is regarded the gold standard. Some downsides include the necessity for several visits and a reduction in tooth fracture resistance, as well as a greater risk for reinfection since the temporary repair is lost. An apical barrier may also be formed by various materials, according to the literature. Although these materials tend to protrude beyond the apex, they may harm the periodontal tissue. It is possible to insert and pack sealing material against the apical stop provided by the deployment of an artificial barrier or matrix. This includes calcium hydroxide, MTA and Biodentine, absorbable collagen as well as autologous platelet-rich fibrin membrane (PRF) matrix.[9][11].

PRESENTATION OF CASE

One week before his arrival to the Department of Endodontics and Conservative Dentistry, an 18-year-old male patient had sought treatment for a discoloured maxillary right central incisor at a private dental clinic. On the tooth's lingual surface, a temporary repair could be visible. There was a traumatic incident in the patient's dental history when he was only 13. In the past, there had been no signs of inflammation or pus discharge. During clinical examination, the tooth did not elicit any pain when palpated or tapped on. There was no reaction to both thermal and electric pulp tests. Radiographic examination showed a tooth with a radiolucent region around the root of the tooth's apex that was still developing. [Figure. 1(a) and 1(b)]

Figure 1(a). Preoperative radiograph

Figure 1(b). Preoperative clinical photograph

Informed permission was gained after a thorough discussion with the patient about treatment choices. Apexification using Biodentine and PRF membrane as the apical matrix was chosen after root canal treatment with calcium hydroxide dressing. Following the placement of a rubber dam, a periapical radiograph was obtained to evaluate the working length of the endodontic access aperture under local anaesthetic. [Figure 2].

Figure 2. Working length determination

An 80 K-file was used to do biomechanical preparation using the usual preparation method. Alternate irrigation with 2.5 percent NaOCl and saline was used to remove the debris from the root canal. Side-vented irrigation needles (R C Twents irrigation needle, Prime Dental, Mumbai, India) were used to irrigate passively with irrigation points 1mm short of the radiographic apex. Finally, using sterile paper points, we dried the canals of the teeth. The access cavity was sealed with cotton pellets and Cavit G after calcium hydroxide (Metapex, Meta Biomed, Korea) was applied to the root canal (3M ESPE, Germany The patient no longer had any symptoms after a two-week course of disinfection. The teeth were assessed, and the calcium hydroxide dressing was removed using a H file and alternating solutions of 2.5 percent NaOCl and 17 percent liquid EDTA (Prime Dental, Mumbai, India). Normal saline was used to complete the procedure. Next, sterile paper points were used to dry up the root canal (Meta Biomed, Korea). A single phase of apexification using Biodentine and PRF apical membrane was agreed upon. 30 minutes before the clinical procedure, the PRF membrane was prepared in accordance with Dohan et al's protocol for this operation. [10] In this investigation, 8.5 millilitres of whole blood were taken from the antecubital vein by venipuncture. It took ten minutes to spin 10,000 mL of patient blood at 3000 rpm, and the results were instantly available. Plaquets lacking in platelets were found to be the most abundant kind of red blood cells, followed closely by PRF clots. The PRF clot was retrieved, and fluids were squeezed out to obtain a PRF membrane. To create an internal matrix at the apex of the PRF membrane, hand pluggers were used to pack the membrane.

Figure 3(a). PRF membrane

Figure 3(b). Layers of PRF membrane

Trituration was carried out for 30 seconds using the Biodentine capsule, which had been lightly tapped on a hard surface (to disperse the powder) before five drops of liquid from a single-dose dispenser were added to the capsule. The Biodentine combination was thus ready to be used. The amalgam carrier was used to transport the Biodentine into the canal, where it was condensed against the PRF matrix using hand pluggers. As seen by radiographs, many steps were necessary to establish a sufficient apical plug (>4 mm) In order to verify that the Biodentine had cured, a plugger was used. A thermoplasticized gutta-percha was used to fill the channel [Figure 5]. A composite restoration was used to close the access cavity, and an all-ceramic crown was used to replace the discoloured tooth [Figure 6]. The endodontic treatment was verified by a radiograph. 24 months after discharge, the patient was found to be healthy and free of clinical symptoms. A follow-up x-ray indicated that the periapical radiolucency had fully healed and that the periradicular tissues had fully regenerated.

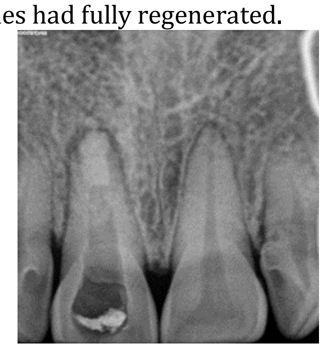

Figure 4. Apical plug formed with Biodentine

Figure 5. Backfill with Thermoplasticized gutta percha

Figure 6. Post-operative full ceramic crown

DISCUSSION

Long term calcium hydroxide treatment has shown to be an effective method of Apexification, however extended-term calcium hydroxide therapy has its drawbacks. These include poor bridge quality and long bridge formation times. The nonsurgical condensation of a biocompatible material into the root canal's apical end is what Morse et al. calls Apexification. [11] The goal here is to establish an apical stop that will enable the root canal to be filled as quickly as possible. Rather from attempting to close the root and end, an artificial apical stop is established at the apex instead. MTA by Torabinejad et al. is one amongs the materials that have been offered for Apexification. Biocompatibility[12], hard tissue development, sealing ability, and non-sensitivity to blood are only a few of the benefits of MTA's versatility and effectiveness. A few issues with MTA include its lengthy setting time and poor handling features; low washout resistance before setting; the likelihood of staining tooth structure; the presence and release of arsenic; and its expensive price. These draw criticism. [13] [14]

For these reasons, the adoption of more perfect materials was necessary. Biodentine was released in 2010 and is identical to MTA in its fundamental composition with the addition of setting accelerator, calcium chloride with water reducing agent; it not only results in quick setting but also increases handling qualities and strength. [15] Calcium carbonate, zirconium dioxide and tricalcium silicate are the primary ingredients in powder (Zr02). When compared to MTA, which has a setting time of 2 hours and 45 minutes, this material's mechanical qualities are greater and its handling characteristics are better, giving it three benefits over MTA's Ca3Si05-based counterpart.“Biodentine's mechanical properties are similar to those of dentin, making it an excellent material for crown applications such as pulp protection, direct and indirect pulp capping, and pulpotomy. Internal and external root resorption, Apexification, perforation repair and root end filling material are just a few of the root treatment options available.”

Beside from being more clinically useful, Biodentine has other advantages to MTA, including the fact that it does not need a second obturation phase and is less susceptible to bacterial contamination thanks to its quicker setting time.

According to a research by Zaini et al, “Biodentine is bioactive because it causes differentiation of odontoblast-like cells and enhances the proliferation and biomineralization of murine pulp cells.”[16] A more uniform structure and reduced porosity were also found in Biodentine over MTA, according to the research. [17] Enhancing Biodentine powder with a softener has been found to enhance its physical and functional properties and flexibility. [18] An important part of this process is the hydration reaction. “A hydrated calcium silicate gel and calcium hydroxide are the byproducts of the hydration of tricalcium silicates. Calcium silicate hydrated gel surrounds the unreacted tricalcium silicate grains in the set mixes, making them water-resistant on the outside. The dentin-like radiopacity of Biodentin helps distinguish between freshly created osseous barriers.” [19]

Another option is to utilise PRF as an internal matrix over which the sealant may be applied. PRF is a tetramolecular matrix comprising leukocytes, platelets, and stem cells, which serves as a biodegradable scaffold for epithelial cell migration to the surface of the tissue. PRF may transport and release growth factors from cells engaged in tissue regeneration over a period of up to four weeks. [20]

Choukroun and Dohan in France created platelet-rich fibrin (PRF) as a novel idea in platelet gel therapy [21]. Choukroun's PRF is a platelet- and growth factor-rich fibrin membrane that may be used in a variety of applications. Wounded edges heal more quickly with the PRF membrane because it acts as a matrix. Because of this, we have included case study that demonstrates the effectiveness of PRF membrane and Biodentine in treating teeth with radiolucencies at the root apices and periapical regions nonsurgically.

CONCLUSION

In the endodontic treatment of immature permanent teeth, biocompatible materials like Biodentine and PRF membranes, when used in conjunction with suitable instruments and obturation procedures, are a good choice. Many of the drawbacks of relying on calcium hydroxide and MTA have been overcome by the use of Biodentine, which is accompanied by superior results and makes it a promising material of choice for single-visit Apexification.

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