Case study

One-Step Apexification by Platelet-Rich Fibrin and Biodentin- A Case Report

Abstract- Apexification is a procedure for treating and preserving immature permanent teeth that have lost pulp vitality to induce a calcific barrier in a root with the incomplete formation or open apex of a tooth with necrotic pulp. With the advent of newer biomimetic and bioactive materials in the market, these treatment protocols have succeeded in achieving more predictable, successful treatment outcomes.

Keywords- Apexification, Platelet Rich Fibrin (PRF), Biodentin, open apex

Introduction

Trauma to the dentition during the period of root formation may cause incomplete development of the root resulting in an open apex.[1] Dental trauma injuries are responsible for 30% of pulpal necrosis in an immature permanent tooth. These injuries often result in the subsequent incomplete development of root apices.[2] The absence of a natural apical constriction in a nonvital young permanent tooth makes endodontic treatment a challenge.[3]

In the past, techniques suggested for the management of a nonvital tooth with an open apex were restricted to leaving the canal untreated, instrumentation alone, custom fitting the filling material, short fill, paste fill, and apical surgery.[4] However, due to the limited success enjoyed with these procedures keen interest was generated in the phenomenon of continued apical development (Apexogenesis), or establishment of apical barrier (Apexification).[5]

Apexification is a method of inducing apical closure through the formation of mineralized tissue in the apical region of a nonvital tooth with an incompletely formed root (open apex).[4] Traditionally, calcium hydroxide is the material of choice to induce apexification. Due to certain drawbacks such as prolonged treatment duration and unpredictable apical barrier formation.[3]

Several materials have been used to induce the hard tissue barrier such as Mineral Trioxide Aggregate (MTA), Biodentine, Endosequence, etc.[6] MTA has several disadvantages which include delayed setting time (2 hours and 45 min), poor handling characteristics, and high cost.[7]

Biodentine (Septodont, Saint Maur des Faussés, France) a new calcium silicate-based cement, is like MTA, except for zirconium oxide added to the powder of Biodentine, as a setting accelerator and a water-reducing agent in liquid. This reduces the setting time to 12 min and increases the compressive strength. Biodentine is superior in its handling properties and push-out bond strength and has been claimed to be a bioactive dentin substitute for the repair of root perforations, apexification, and retrograde root filling by manufacturers.[8]

In one-step apexification using MTA, the technical problem encountered is controlling the overfill or underfill of MTA. The use of a matrix material helps to overcome this shortcoming. PRF is an immune platelet concentrate, which can be used as a matrix, it also

promotes wound healing and repair. PRF which is a second-generation platelet concentrate can be used as a resorbable matrix material against which an apical barrier can be placed.[3]

The aim of this case report is to describe the management of an immature tooth (with open apex) with a one-step apexification procedure with Biodentin apical barrier and autologous PRF membrane as an internal matrix.

Presentation of Case

A 16-year-old male patient, reported to the Department of conservative dentistry and endodontics, with a chief complaint of fracture in the right and left upper front teeth since 6 years. The patient had a history of trauma to the region at the age of 10 years, which was asymptomatic then. The medical history was not significant. clinical examination revealed an Ellis class II fracture in the permanent maxillary left central incisor. Teeth were non-tender on percussion irt 21(Figure 1.a). On vitality examination, teeth were nonvital.

FIG.1 a.PREOPERATIVE IMAGE b. PREOPERATIVE RADIOGRAPH

A radiographic image revealed an open apex and an associated periapical lesion irt 21 [Figure 1.b].

The final diagnosis was made Ellis class II fracture and pulpal necrosis irt 21

The final treatment plan is nonsurgical root canal treatment with a single visit apexification procedure using an apical plug of Biodentin.

After the administration of local anesthesia, a rubber dam was placed and an access cavity preparation was done. Working length was determined with an apex locator (Root ZX, Morita, Tokyo, Japan), and Root canal preparation was done with a no. 80 k file (DentsplyMaillefer, Ballaigues, Switzerland) using circumferential filing motion. Root canal debridement was done using alternate irrigation with 1% NaOCl and saline and final irrigation with 2% chlorhexidine. The canal was dried with the paper point, and triple antibiotic paste (metronidazole, minocycline, and ciprofloxacine) was placed as an intracanal medicament for 1 week and the access cavity was sealed with a temporary restoration.

On recall, the canal was copiously irrigated and dried with sterile paper points. It was decided to use the PRF membrane as an internal matrix against which biodentin would be placed as an apical barrier.

PRF membrane was prepared using the procedure described by Dohan et al., blood (8.5 ml) was drawn by venipuncture of the antecubital vein. This blood was collected in a 10 ml sterile glass tube without anticoagulant and was centrifuged immediately at 3000 revolutions/min (rpm) for 10 min. After the centrifugation, the resultant in the glass tube consisted of the topmost layer of acellular platelet-poor plasma, PRF clot in the middle and red blood cells at the bottom [Figure 2]. The PRF clot was squeezed in a piece of sterile gauze to obtain a PRF membrane was introduced into the canal and was gently compacted using finger pluggers to form an apical barrier at the level of the apex. [Figure 3.a].

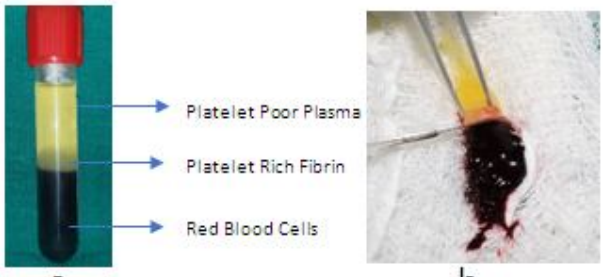

Fig.2 (a) & (b) PREPARATION OF PRF MEMBRANE

Biodentine (Septodont, Saint Maur des Faussés, France) was mixed according to the manufacturer's instructions and was placed and consensed with finger plugger (GDC, India) to obtain a 5 mm apical plug [Figure 3. b].

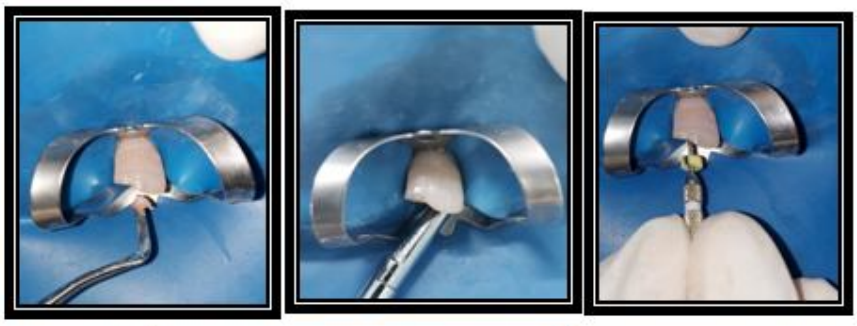

Fig.3 a.PLACEMENT OF PRF

b.PLACEMENT &CONDENSATION OF BIODENTINE

After the initial set, the remainder of the canal was obturated by the thermoplasticized gutta-percha technique (E and Q Plus-Meta BioMed, Korea) [Figure 4.a]. The access cavity was then sealed with composite restoration (Filtek Z350 XT: 3M-ESPE) and the fracture was restored with composite restoration irt 11,21. [Figure 4.b]. Follow-up radio graph at 1 year showed complete healing of the lesion [Figure 5]

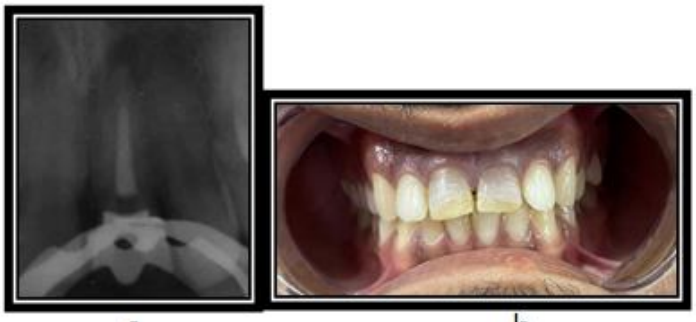

Fig 4

a. OBTURATION BY THERMOPLASTISIZED GUTTA PERCHA
b. b. POST–OPERATIVE IMAGE

Fig 5 FOLLOW-UP AFTER 1 YEAR

Discussion

The management of a nonvital tooth with an open apex consists of the induction of a natural or artificial apical barrier that can act as a stop for the obturating material.[9] The conventional apexification procedure is the induction of the formation of an apical barrier while the recent approach is to form an artificial apical barrier by the placement of an apical plug.[6]

$Ca(OH)_2$ is the material of choice for apexification. Previous studies have shown a 100% success rate for this technique, with the mean time required for the barrier formation being 12–19 months.[10] Patient compliance is a problem with such long-term and multiple appointment procedures, moreover, prolonged contact with calcium hydroxide alters the intrinsic property of root canal dentine making it more susceptible to fracture.[11]

Various materials proposed for this purpose include tricalcium phosphate, calcium hydroxide, freeze-dried bone, freeze-dried dentine, collagen calcium phosphate, and proplast.[3] Biodentine, introduced by Septodont in September 2010, is a bioactive dentine substitute based on "Active Biosilicate Technology". Its compressive strength, elasticity modulus, and microhardness are comparable with that of natural dentine. It can create a tag-like crystalline structure within the dentinal tubules which may contribute to the micromechanical bond between dentin and novel calcium silicate material. In addition, as the setting time is less, the completion of treatment on the same day is made possible unlike MTA, which requires a two-step technique.[8] Biodentine induces mineralization by expressing markers of odontoblasts and increases transforming growth factor beta 1 secretion from pulpal cells.[12]

The major problem information of an artificial barrier at the apex is the need to limit the material to the apex, preventing over-extrusion, which may complicate or prevent the repair of tissue.[13] Various materials used as a matrix are calcium hydroxide, hydroxyapatite, resorbable collagen and calcium sulfate. PRF is an immune platelet concentrate which has been used as a matrix.

Contains growth factors including transforming growth factor beta, vascular endothelial growth factor, and platelet-derived growth factor.

• Platelet rich fibrin stimulates osteoblasts, gingival fibroblasts, and periodontal ligament cells proliferation as a mitogen

• Platelet rich fibrin is an immune platelet concentrate, collecting all the constituents of a blood sample favourable to healing and immunity on a single fibrin membrane

• Does not dissolve quickly after application

Platelet rich fibrin membrane has a soft consistency and it inherently contains some amount of moisture, still it serves as a good matrix material for placement of biodentin.

In the present case canal disinfection was achieved by irrigation with NaOCl and chlorhexidine. NaOCl is known to be toxic, especially in higher concentrations. There is an increased risk of pushing the irrigant beyond the apex in immature teeth with open apices, therefore a lower concentration of 1% NaOCl was used in the present case. Further disinfection was achieved using triple antibiotic paste.[3]

Conclusion

The use of Biodentine in creating a calcific apical barrier explores a new paradigm in the field of apexification. The combination of PRF as a matrix and Biodentin as an apical barrier can be considered as a good option for one-step apexification procedure. This innovative procedure is predictable and less time consuming with a high overall success rate and good patient compliance.

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