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SINGLE VISIT- APEXIFICATION USING MTA AND AUTOLOGOUS PRF AS AN INTERNAL MATRIX. A CASE SERIES.

Dentistry

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ABSTRACT

Endodontic treatment is challenging in teeth with a blunderbuss canal and an open apex due to difficulties in attaining an apical seal. Nonsurgical one-step apexification using materials such as mineral trioxide aggregate has been proposed to overcome the shortcomings of the traditional long-term calcium hydroxide apexification technique. In order to create an apical plug, there has to be some matrix against which MTA can be placed. Platelet-rich fibrin (PRF), a second-generation platelet concentrate, can be employed as a matrix material against which MTA can be condensed. This case series aims to present the treatment of an immature tooth with an open apex using a one-step apexification using autologous PRF membrane as an interior matrix and MTA as an apical barrier.

KEYWORDS

One- step Apexification, autologous PRF, internal matrix, Mineral trioxide Aggregate

INTRODUCTION

Attaining an appropriate apical seal is a fundamental goal of root canal treatment. Pulpal necrosis in immature teeth results in the cessation of root development, making endodontic treatment with traditional techniques and materials difficult.[1] Furthermore, because of their thin walls, these teeth are prone to fracture after treatment.[2,3] Apexification has traditionally been done with calcium hydroxide paste because of its biological and therapeutic properties.[4] Calcium hydroxide, regardless of brand, has been shown to be effective in forming apical barriers in 74–100% of cases.[5]

Calcium hydroxide-induced apexification has various limitations, despite its long history of usage in apexification.[6] 1) The porosity of the calcified apical barrier during treatment may confound the apexification results.[7] 2) Long treatment time may increase the risk of root fracture using $Ca(OH)_2$ as a root canal dressing.[3] 3) Poor patient compliance due to increased duration of treatment. 4) The toxicity of calcium hydroxide-induced apexification is its main drawback, which outweighs benefits like its antimicrobial action.[8] To overcome these limitations Mineral trioxide aggregate (MTA) can be used for apexification procedure. In vivo investigations in dogs; revealed that MTA is more predictable with hard-tissue development as compared to calcium hydroxide.[9] Many authors have advocated for a one-visit apexification protocol using MTA, which has significant advantages over traditional calcium hydroxide methods.[10,11]

Single visit Apexification is defined as the non-surgical condensation of a biocompatible substance into the apical end of the root canal. The aim is to create an apical stop that will allow the root canal to be filled instantly.[12] There is no attempt to close the root end. Instead, an artificial apical stop is formed. An apical matrix is required for controlled MTA compaction, analogous to the "modified matrix concept," in which perforation repair was conducted utilizing resorbable collagen as a matrix prior to MTA insertion.[13] A variety of materials, including tricalcium phosphate , calcium hydroxide , freeze dried bone and freeze-dried dentin, have been proposed for this purpose.[14-17] PRF is an intimate assemblage of cytokines, glycanic chains, and structural glycoproteins entwined inside a progressively polymerized fibrin network, all of which have well-documented synergistic effects on healing processes. So, it can be used as internal matrix against which MTA can be condensed.[18] This case series aims to present cases with necrosed pulp and apical pathosis that were treated successfully using a one-step apexification with MTA and autologous PRF as the internal matrix.

Case 1

A 19-year-old male patient reported to the department of conservative dentistry and endodontics with a chief complaint of a discolored maxillary anterior tooth. Clinical examination revealed fractured teeth in both the upper right and upper left central incisors. The patient had a history of trauma that occurred 10 years back. There was no significant medical history recorded. The tooth elicited negative responses on both electric and thermal pulp testing during clinical examination. The tooth was not sensitive to percussion. Radiographic examination revealed an incompletely developed root apex around the upper right central incisors with periapical radiolucency and widening of periodontal ligament space irt 21. (Figure 1A). The apexification treatment was explained to the patient, and treatment was started with the patient's informed consent.

Under rubber dam isolation, endodontic access cavity was made and working length was established 1mm short of apex. (Figure 1B) Right maxillary central incisor was instrumented with K-files#130 (Mani, Japan) while left central incisor was prepared till F4 Protaper universal rotary file followed by copious irrigation with 1.25% sodium hypochlorite (Septodont Healthcare India Pvt., Ltd., Mumbai) and normal saline. Sterile paper points were used to dry the canals, and calcium hydroxide paste was applied as an intracanal medicament. The access cavities were temporized with provisional restorative material cavit. (3M ESPE,Germany) The patient was recalled after 2 weeks.

After a 2-week period of disinfection, the patient was asymptomatic. The root canals were flushed off of calcium hydroxide paste by irrigation with 1.25% sodium hypochlorite and 17% liquid EDTA Smear Clear (Sybron Endo, CA, USA) and canals were dried with sterile paper points. It was decided to perform single visit apexification with MTA in right central incisor by placing MTA as an apical barrier and PRF membrane as an internal matrix.

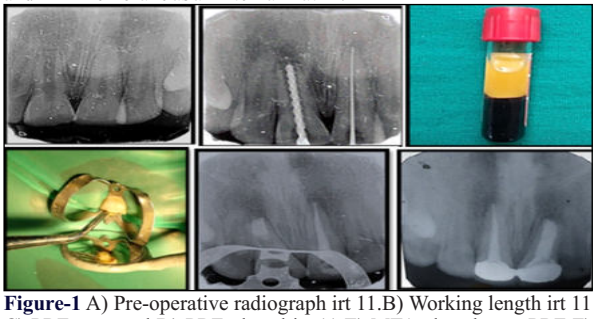

Figure-1 A) Pre-operative radiograph irt 11.B) Working length irt 11 C) PRF prepared D) PRF placed irt 11 E) MTA placed over PRF F) Post-operative view

Figure2 A) Follow up after 6 months B) Follow up after 1-year C) Pre-operative clinical picture D) Post-operative clinical picture

Platelet rich fibrin was prepared using the protocol described by Dohan et al., blood was drawn and collected in a 10 ml sterile glass tube without an anticoagulant. It was immediately centrifuged at 3000 revolutions/min (rpm) for 10 min. The resultant in the glass tube after centrifugation consisted of an acellular platelet poor plasma layer on top, a PRF clot in the middle, and red blood cells at the bottom. (Figure 1C). To obtain PRF membrane, the PRF clot was squashed into a piece of sterile gauze. The PRF membrane was gently packed using hand pluggers to produce an internal matrix upon which MTA can be condensed. (Figure 1D) MTA Angelus (Angelus, Londrina, Brazil) was then mixed with normal saline according to the manufacturer's instructions and compacted using micro apical placement (MAP) system (Produits Dentaires SA (Dentsply Tulsa Specialist, Switzerland) and plugger against the PRF membrane.

A sterile moist cotton pellet was placed over the MTA, and the access cavity was sealed with Cavit. (Figure 1E) The patient was recalled after 24 hours and backfilling was performed using calamus dual obturation unit (Dentsply Maillefer, Switzerland) in right central incisor while the left central incisor was obturated with F4 GP points.PFM crown was placed irt 11 and 21. (Figure 1F) Patient was recalled after 6,12 months for follow up. (Figure 2 A, B) One-year follow-up revealed resolution of periapical radiolucency irt 11and 21.

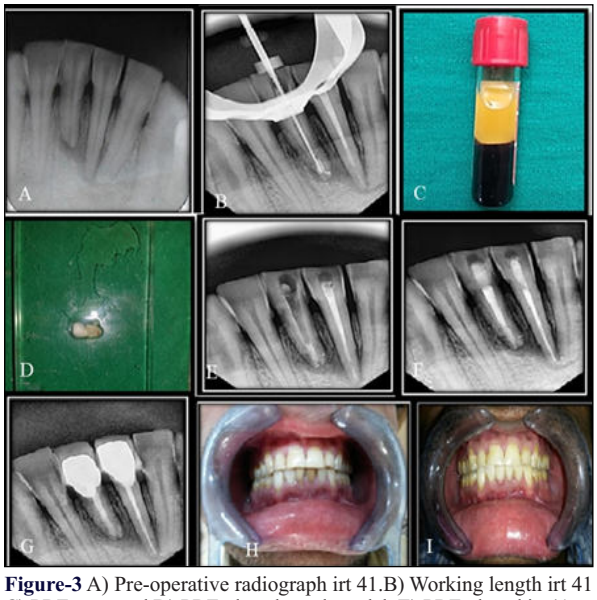

Figure-3 A) Pre-operative radiograph irt 41.B) Working length irt 41 C) PRF prepared D) PRF placed on glass slab E) PRF placed in 41 as matrix over which MTA was condensed F) Post-operative radiograph G) Follow up after 1-year H) Pre-operative clinical picture I) Post-operative clinical picture

Case 2

A 22-year-old patient reported to department of conservative dentistry and endodontics with chief complaint of pain and discoloured lower front teeth. (Figure 3 H)- Patient had a history of trauma 14 years back due to road accident. Clinical examination revealed Ellis class IV fracture irt 31 and 41. The teeth were tender on percussion. Both thermal and electric pulp test revealed no response. Radiographic examination demonstrated open apex and periapical radiolucency irt 41. Endodontic treatment was initiated in tooth number 31 and 41 after taking patient's informed consent. Working length was determined. Calcium hydroxide disinfection, irrigation protocol, formation of MTA apical plug with PRF as an internal matrix and obturation with thermoplasticized gutta-percha irt 41 was similar to case 1. (Figure 3 A-F). 31 was obturated with F2 gutta percha and restored with resin composite. All ceramic crown was placed irt 31and 41. (Figure 3I) At 12 months follow up, a periapical radiograph demonstrated complete resolution of periapical radiolucency. (Figure 3G)

DISCUSSION

The goal of treating teeth with incomplete root apex is to seal the communication between the root canal system and the periapical tissues.[19]Apexification using calcium hydroxide had previously been regarded as the gold standard intervention for the management of non-vital, immature incisors.[20] Apexification of non-vital, immature permanent teeth has typically been accomplished with a non-setting calcium hydroxide root canal dressing, with periodic replacement and apical barrier evaluation.[21,22]

MTA is a material of low solubility, which has a basic pH, similar to that of calcium hydroxide, of approximately 12. pH rises during its setting period and it remain maintained in long-term studies.[23] MTA is a bioactive alkaline silicate cement that has the ability to generate early and enhanced alkaline phosphatase activity in fibroblast populations, which may help with the mineralization process.[24] By activating immune cells to release lymphokines and bone coupling factors essential for bioremineralization and healing of osseous periapical defects, this osteoinductive and cementogenic material stimulates cementum and PDL regeneration.[25,26]

In the present case series, Platelet rich fibrin (PRF) was used as an internal matrix over which MTA was condensed. It is slowly remodelled and has a complex architecture of strong fibrin matrix with desirable mechanical properties, similar to a blood clot.[27]PRF contains a plethora of growth factors such as platelet-derived growth factor (PDGF), transforming growth factor 1 (TGF 1), insulin-like growth factor (IGF), and others, all of which exhibit diverse potent local properties such as cell migration, cell attachment, cell proliferation, and cell differentiation.[28]

CONCLUSION-

It can be concluded that using PRF as a matrix and MTA as an apical barrier to create an artificial root-end barrier is a good alternative. PRF which is a second-generation platelet concentrate can be used as a resorbable matrix over which MTA condensation can be done.

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