ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 9(C), pp. 28837-28840, September, 2018

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Case Report

NON-SURGICAL MANAGEMENT OF AN IMMATURE PERMANENT TOOTH WITH LARGE PERIAPICAL LESION - A CASE REPORT

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DOI: http://dx.doi.org/10.24327/ijrsr.2018.0909.2742

ARTICLE INFO

Article History:

Received 13th June, 2018
Received in revised form 11th July, 2018
Accepted 8th August, 2018
Published online 28th September, 2018

Key Words:

Non Surgical Endodontics, Non-vital teeth, Apexification, Calcium Hyrdroxide and MTA.

ABSTRACT

Pulp necrosis of immature permanent teeth with periapical pathology represents a significant challenge for clinical management as root development ceases and open apices remain. Currently there is a paradigm shift in the management of such cases from traditional surgical procedures towards non-surgical apexification procedures using artificial apical barriers. The aim of this paper is to present a case of non-surgical management of a traumatized tooth with large periapical lesion using MTA for single step apexification.

INTRODUCTION

The ultimate goal of endodontic therapy should be to heal the involved teeth to a state of health and function with surgical intervention being the last modality of treatment. All inflammatory periapical lesions should be initially treated with conservative nonsurgical procedures. Surgical intervention is recommended only after nonsurgical techniques have failed. Various studies have reported a success rate of up to 85% after endodontic treatment of teeth with periapical lesions. A high percentage of 94.4% of complete healing of periapical lesions following nonsurgical endodontic therapy has also been reported.

Traumatic injuries to young permanent teeth are common and are said to affect 30% of children (Leonardo *et al* 1993)[1]. The majority of these incidents occurs before root formation is complete in the 8 to 12 year age range and most commonly involve maxillary anterior teeth (Sheehing *et al* ,1997)[2]. These injuries often result in pulpal inflammation or necrosis and subsequent incomplete development of dentinal wall and root apices. The completion of root development and closure of the apex occurs up to 3 years after eruption of the tooth (Raymond *et al* ,1984)[3]. The treatment of pulpal injury during this period provides a significant challenge for achieving complete debridement, canal disinfection and optimal sealing of the root canal system. Depending upon the vitality of the affected pulp, two approaches are possible-Apexogenesis or Apexification.

The non-vital tooth with immature apical formation, requires a specially tailored treatment plan, different from other patients, often times requiring much more than 1 year to complete, depending on the degree of apical immaturity. As always, success is related to accurate diagnosis and a full understanding of the biological processes to be facilitated by the treatment (Mary rafter *et al*, 2005)[4]. Before 1966 the clinical management of a "Blunder buss" canal usually required a surgical approach for the placement of an apical seal into the often fragile and flaring apex (Howard Sheldon *et al*,2002)[5]. Apicoectomy further reduces the root length resulting in a very unfavourable crown root ratio. The limited success enjoyed by these procedures resulted in significant interest in the phenomenon of continued apical development or establishment of an apical barrier, first proposed in the 1960s. This process of apical closure is more biologic and less traumatic than the classic technique of apicoectomy and obturation of the apex with gutta percha or a retrograde amalgam (Mandel *et al* – 1996, Iain *et al*-1998) [6,7].

The main objective of apexification is to place an artificial barrier at the apex to prevent the extrusion of filling materials during obturation. The chosen material is MTA for its sealing ability and its biocompatibility. Mineral trioxide aggregate

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(MTA) was developed by Mahmoud Torabinejad at Loma Linda University in the year 1993 as root end filling material. MTA has the advantage over calcium hydroxide that it can be done in a single visit procedure (Kombayashi *et al*,2008).[8] Apexification using MTA has several advantages as it neither gets resorbed nor weakens the root canal dentin and also sets in wet environment. MTA helps in the formation of cementum and osteoid-like tissue because of its alkaline pH and release of calcium and phosphorus ion (Kombhayashi *et al*, 2008).[8] In the present case report, we intend to report the radiographic and clinical findings of an immature traumatized teeth exhibiting repair of extensive periapical lesion associated with apical periodontitis after successful endodontic treatment using MTA as an apical plug.

Case Presentation

A twenty year old young male patient with the chief complaint of discolouration and pain in the upper left front tooth region, reported to the Department of Conservative Dentistry and Endodontics. He had a history of trauma 12 years back and had undergone root canal treatment which was incomplete. On intra oral examination, his maxillary left central incisor was tender on percussion. Pulp sensibility tests gave negative responses for the 21. No sinus tracts were present on the labial or palatal gingiva (Fig- 1).

FIG 1 : INTRA ORAL PRE-OPERATIVE PHOTOGRAPH

Preoperative radiograph revealed the presence of a large periapical radiolucency with wide open apex in relation to 21. The diagnosis of pulp necrosis with symptomatic apical periodontitis was made for tooth 21 and the aetiology being trauma. The treatment plan of the tooth included nonsurgical endodontic re-treatment with single step apexification using MTA.

Treatment Procedure: (Fig 2 A - G)

Under local anaesthesia (Lignocaine 2% 1:80000 Adrenaline) and rubber dam isolation, access cavity was prepared and the working length was established at approximately 1 mm short of the radiographic apex. The root canal was prepared by using manual K-files with the circumferential filing motion as it was already wide. Irrigation was performed with copious amounts of 2.5% sodium hypochlorite with addition of 17% EDTA, which were frequently delivered by a small needle approximately 3 mm short of the working length. The canal was finally dried with sterile paper points. Since it is a retreatment case, disinfection was done with a calcium hydroxide paste- Metapex (MetaBiomed, Korea). The paste was placed with a lentulospiral and then condensed at the canal orifice with a hand plugger. The access cavity was closed with a sterile cotton pellet and temporary filling material.

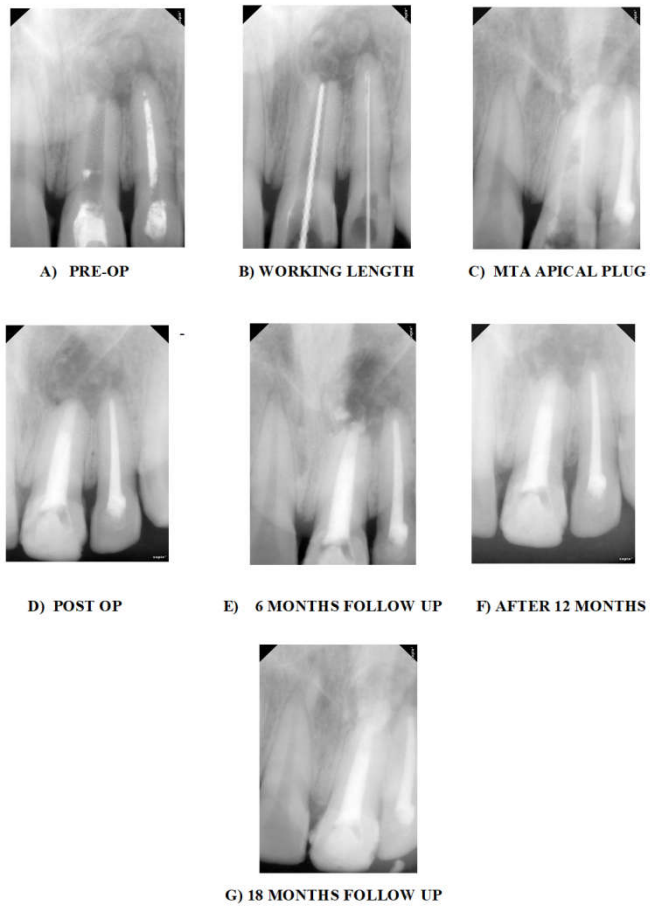

FIG 2: STEPWISE RADIOGRAPHIC PICTURES OF THE PROCEDURE

After a 2-weeks interval, Calcium hydroxide dressing was removed by instrumentation and irrigation with 2.5% NaOCl and 17% EDTA. The root canal was dried with sterile paper points. MTA (Pro- Root MTA, DentsplyMaillefer, Ballaigues, Switzerland) was mixed according to manufacturer's instructions and was placed with MTA carrier to the canal orifice. The MTA mixture was then adapted to the canal walls using a thick gutta-percha cone which was placed 3mm shorter than the working length. The correct position of the MTA mixture was verified with a digital radiograph. A wet sterile paper point of size 60 was then placed in the coronal part of the root canal and access cavity was closed with a temporary filling material for the setting of the MTA. (Donald *et al*, 1990)[10].The temporary filling material and paper point was removed after two days and the set of the MTA was gently tested. The rest of the canal was obturated with roll technique of the gutta-percha with a root canal sealer, Seal Apex (SybronEndo, Orange, CA). Coronal restoration was completed with a hybrid composite resin (Clearfil ST, Kuraray Medical Co., Japan).

The case was reviewed radiographically using the paralleling technique at the first visit, after performing the apical plug, after the filling of the canal and coronal restoration, and at the 6, 12 and 24 months follow-up appointments (Kleier *et al*, 1991).[11] Healing was identified when a reduction of the periapical radiolucent area could be seen, and when the periodontal ligament space was normal without initial apical periodontitis. Clinically, treatment was considered successful when symptoms such as pain, swelling, labial sinus tract, or

tenderness to apical and gingival palpation or percussion, were absent. In the absence of clinical signs and/or symptoms, healing was classified according to the radiographic appearance against the following criteria: (i) complete healing: complete regeneration of the periodontal ligament space; (ii) incomplete healing: substantial reduction (more than 50%) in the diameter of the periapical lesion; and (iii) unsatisfactory healing: no reduction or an increase in the diameter of the periapical lesion. The periapical status of the tooth were examined using periapical index scoring system (PAI), proposed by Orstavik *et al* 1986.[12].

DISCUSSION

Immature permanent teeth with necrotic pulp pose special challenges during endodontic procedures not only because of the wide-open root apex but also because of the thin dentin walls. Apexification is defined as ‘‘a method of inducing a calcified barrier in a root with an open apex or the continued apical development of an incompletely formed root in teeth with necrotic pulp (Kleier et al, 1991).[11].

The use of Calcium hydroxide was first introduced by Kaiser in 1964 who proposed that this material mixed with camphorated parachlorophenol (CMCP) would induce the formation of a calcified barrier across the apex (Gamze et al, 1997)[13]. This procedure was popularized by Frank who emphasized the importance of reducing contamination within the root canal by instrumentation and medication and decreasing the canal space temporarily with a resorbable paste (Mackie *et al*, 1994)[14]. Calcium hydroxide is used because it biologically stimulates the hard tissue, it is easy to prepare, and any material beyond the apex is rapidly resorbed and has a high alkalinity. Calcium hydroxide has been widely used for the induction of hard tissue barrier. However, this material requires 5–20 months to form the hard tissue barrier. It has also been shown that the use of calcium hydroxide weakens the resistance of the dentin to fracture (Mehmet *et al*, 1997) [15].

The use of MTA as apical plug in the treatment of immature non-vital teeth has enormous potential to simplify a complex procedure (Mohammed torabinejad)[16]. One of the most significant aspects of MTA in relation to its use as an apical plug in immature non-vital teeth is its ability to induce a cemental tissue in the periradicular region of the tooth. MTA’s ability to promote formation of hard tissue presents the potential of a biological seal of cementum over the material (torabinejad *et al*, 1999)[17]. Numerous leakage studies (Torabinejad *et al*. 1993) have demonstrated that MTA leaks significantly less than many restorative materials, including amalgam, Intermediate Restorative Material (IRM), Super EBA, and traditional root canal filling material of gutta-percha and sealer. Additionally, MTA offers the added advantage of setting even in the presence of blood (jose *et al*,1995) [18.] Furthermore, the high pH of MTA (reported to be 10.2, rising to 12.5 at 3 hours and thereafter), which is similar to CH, may be one of the factors that promotes hard tissue formation[16].

Shabahang and coworkers (1999) focused on evaluating MTA’s role in periradicular healing when placed as an apical plug in open apex teeth. They histomorphometrically examined hard tissue formation and inflammation after treating teeth with open apices in dogs with osteogenic protein-1, MTA, and CH. While the amount of hard tissue formation and degree of inflammation in each tooth was not statistically different among the three materials, MTA induced hard tissue formation most consistently. In another study that compared the healing of immature non-vital teeth in monkeys treated with MTA or traditional CH apexification, MTA displayed less inflammation and a greater amount of hard tissue formation (Torabinejad *et al*, 1999)[17].

Torabinejad reported the ingredients in MTA as tri calcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide that were responsible for the chemical and physical properties of aggregate[16]. The powder consists of fine hydrophilic particles that set in the presence of moisture. The hydration of the powder results in a colloidal gel with a pH of 12.5 that will set in approximately 3 hours. MTA has a compressive strength equal to intermediate restorative material and Super – EBA but less than that of amalgam. MTA consists of fine hydrophilic particles that set in the presence of moisture in approximately 4 hours. The final obturation was carried out at a subsequent visit to avoid dislocation of the MTA plug beyond the apex (Torabinajed *et al*, 1999)[17].

McCormick *et al*. have hypothesized that debridement of the root canal and removal of the necrotic pulp tissue and microorganisms along with a decrease in pulp space are the critical factors in apexification. A number of authors have described apical closure without the use of a medicament (Giuliani *et al*, 2002)[19]. Cooke and Robotham hypothesize that the remnants of Hertwig’s epithelial root sheath, under favorable conditions, may organize the apical mesodermal tissue into root components. They advise avoidance of trauma to the tissue around the apex .In this MTA plug technique, root canals were disinfected with temporary calcium hydroxide dressing before placing MTA for two weeks. This is because performing chemo mechanical preparation alone is not effective for the complete elimination of microorganisms. Hence, we used calcium hydroxide dressing for two weeks in these cases and is supported by theories by Vojinovic and Dylewski (Mandel *et al*, 1996)[20].

Overall, the results of several studies show that MTA plugs are effective in treating immature permanent teeth with necrotic pulps. The advantages of apexification that uses an MTA plug are reduced treatment time and a more predictable barrier formation. This technique of one-step apexification offers an alternative to those drawn out cases with several medicament changing appointments that often resulted in a failed attempt at root-end closure. Based on this case report it is evident that Mineral trioxide aggregate showed clinical and radiographic success as a material to induce root-end closure in immature necrotic permanent teeth and MTA is a better replacement for calcium hydroxide for the apexification procedure.

Previous studies have compared surgical and nonsurgical procedures in endodontic retreatment and found that healing rates were higher for the surgical retreatment one year postoperatively, but four years postoperatively there were no differences in the outcome (Kvist and Reit 1999)[20]. It has been suggested that surgical treatment should be avoided if nonsurgical treatment is an option, due to a better outcome of conventional treatment and because of patient discomfort in relation to the treatment (Iain *et al*, 1998)[21].

CONCLUSION

Apexification with MTA provide an alternative treatment option for surgical approach in this case with better results. Prospective clinical trials comparing these alternative techniques are required. Successful obturation of an incompletely developed non-vital tooth forms only one part of the treatment for such teeth. Complete rehabilitation of these teeth requires that all the other associated problems be taken into consideration while formulating a treatment plan.

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How to cite this article:

Palaniselvi, K and Hemalatha, P.2018, Non-Surgical Management of An Immature Permanent Tooth With Large Periapical Lesion - A Case Report. *Int J Recent Sci Res.* 9(9), pp. 28837-28840. DOI: http://dx.doi.org/10.24327/ijrsr.2018.0909.2742

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