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CASE STUDY

REVASCULARIZATION OF AN IMMATURE PERMANENT TOOTH – A CASE REPORT

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ABSTRACT

Background: Regenerative endodontic procedures and biological principles have now replaced the conventional apexification procedures in the treatment of immature, necrotic teeth. Stem cells from the pulp and / or periodontium contribute to continued root development when regenerative procedures are followed.

Report: A maxillary anterior tooth with a necrotic pulp and immature apex was irrigated with sodium hypochlorite with minimal instrumentation and then dressed with tri-antibiotic paste consisting of ciprofloxacin, metronidazole and tetracycline. At a subsequent visit a blood clot was evoked in the canal by irritating periapical tissues and the canal sealed with mineral trioxide aggregate followed by glass ionomercement.

Results: Evaluation revealed continued apical development and closure; and narrowing of the canal space.

Conclusions: Initial management of immature teeth with necrotic pulp should involve irrigation with sodium hypochlorite. However, intracanal medicaments such as calcium hydroxideare contraindicated as they inhibit root growth. Regenerative endodontics with continued root growth may reduce the risk of fracture and premature tooth loss associated with traditional 'apexification' procedures where the root remains thin and weak.

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INTRODUCTION

Formulating the treatment of a necrotic pulp in an immature tooth with an open apex presents a unique remonstrance to the clinician. Earlier, dentists solely confided in the use of apical barriers and traditional apexification procedures or to treat immature teeth with pulpal necrosis. Apexification procedures advocate the use of prolonged use of calcium hydroxide dressings to facilitate the establishment of a calcified barrier against which theobturation material can be placed . Although apexification has proven to be highly predictable (Yates, 1988; Ghose *et al.,* 1987), it has the downside of multiple appointments arranged over a period of months and an additional risk of increased susceptibility to cervical fracture (Andreasen *et al.,* 2002; Doyon *et al.,* 2005). The technique of placing an artificial apical barrier involves utilizing a barrier material to be placed at the apex to enhance the obturation procedures by encompassing the obturation material within the canal.

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Pro Root Mineral Trioxide Aggregate (MTA) (Dentsply Tulsa Dental, Tulsa, OK) has been advocated as the material of choice (Hachmeister *et al.,* 2002 Felippe *et al.,* 2006). It is predictable and successful technique (Holden *et al.,* 2008; Witherspoon *et al.,* 2008) and also decreases the incommodious number of appointments (Simon *et al.,* 2007). However, the disadvantage associated with both the traditional apexification and artificial apical barriers is that neither allows for thickening of the root wall or continued development of the root. Iways *et al* in 2000 published one of the first revascularization research attempts in a case report where the immature tooth was irrigated and disinfected with two antimicrobial agents, metronidazole and ciprofloxacin with concluding results of successful revascularization (Iways, 2001). Banchs and Trope in 2004 established a new treatment protocol for the management of the open apex called ''revascularization.'' In revascularization , the disinfection of the canal is performed with both sodium hypochlorite (NaOCl) and chlorhexidine (CHX) along with an intermediate intracanal dressing of a combination of three antibiotics (ciprofloxacin, metronidazole, and minocycline)as described by Hoshino *et al.,* 1996. At the following appointment, the paste is cleared away and bleeding is induced into the canal. The canal is sealed with MTA, and a bonded restoration is placed.

Revascularization procedures grant the advantage for an increase in the root wall thickness as well as the length of the root. Also, the treatment time decreases. Bose R et compared revascularization with placement of Ca $(OH)_2$ or formocresol (13). Triple antibiotic group showed increased root wall thickness whereas only increase in the root length was seen in the $Ca(OH)_2$ group. The following case report presents with a case of an immature non vital tooth with an open apex wherein revascularization was chosen treatment modality and obtained favorable results.

CASE REPORT

A 17 year-old male patient reported to the dental specialty hospital with a chief complaint of discolored anterior tooth since 1 year. On clinical examination, the tooth did not respond to vitality testing which included thermal testing and electric pulp testing. Responses to percussion, palpation, and probing pocket depths were all within normal limits.Radiographic examination revealed an open apex in relation to the concerned tooth (21) with noticeable periapical changes (Fig. 1).

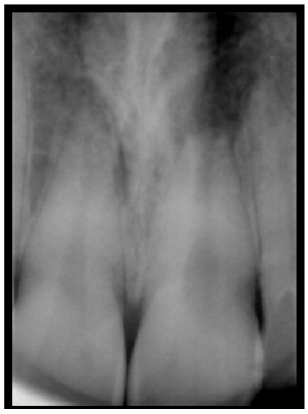

Fig. 1. Pre Operative Radiograph

The tooth was diagnosed with a necrotic pulp. The dental history revealed that the patient had suffered a dental trauma 5 years back. Revascularization was decided as the treatment plan due to the young age of the patient and increasing success rates of the protocol (Andreasen, 2002). At a subsequent appointment,under local anesthesia and rubber dam isolation, access was made to the pulp space wherein the necrotic pulp was confirmed clinically (Fig. 2).

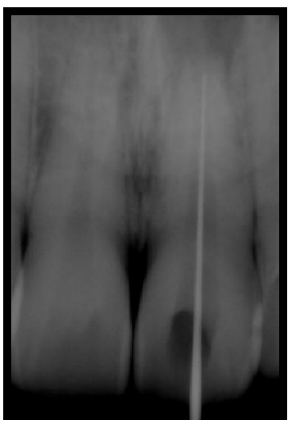

Fig. 2. Clinical examination of the necrotic pulp

The canal was irrigated copiously with 3% sodium hypochlorite (NaOCl) and dried with sterile paper points. A thick creamy paste of equal proportions of metronidazole, ciprofloxacin, and tetracycline mixed with sterile water was placed into the canal space with a lentulospiral in a slow-speed hand piece followed by condensing of the paste with pluggers. The access cavity was closed with cotton pellets and intermediate restorative material. The patient was recalled 11 weeks later wherein he was found to be asymptomatic. Under local anesthesia and rubber dam isolation, the tooth was re-accessed. The antibiotic paste was found to be intact in the canal space and was irrigated using 10 mL of 3% NaOCl and 10 mL of sterile water. The apical areas beyond the confines of the root canal were stimulated with a sterile endodontic file to induce bleeding into the canal space. Approximately 15 minutes were allowed for the blood clot to reach a level that approximated the cementoenamel junction (Fig3).

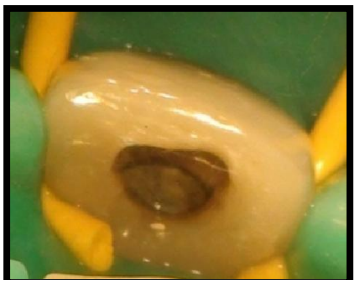

Fig. 3. Blood clot formation at the CEJ

White mineral trioxide aggregate, MTA (Dentsply) was mixed with sterile water and applied over the blood clot. A cotton pellet moist with sterile water was placed over the MTA and left protected by the rubber dam (Fig 4).

Fig. 4. MTA plug placed at the coronal third

The moist cotton pellet was removed from the MTA after approximately an hour (Fig 5).

Fig. 5. MTA plug as seen radiographically

This was followed by placement of a glass ionomer permanent restoration. The patient was found to be asymptomatic at the 6-month follow-up evaluation. The right central incisor was within normal limits regarding percussion, palpation; pocket probing depths. It was nonresponsive to stimulation with thermal testing. Radiographic evaluation showed significant apical development of the tooth (Fig. 6).

Fig. 6. 3 month follow up

The patient returned for another follow-up assessment after 1 year wherein the tooth remained asymptomatic, with normal responses to percussion, palpation, pocket probing depths, and mobility. However, the tooth remained nonresponsive to thermal testing. Radiographic evaluation revealed continued apical development and closure; and narrowing of the canal space (Fig. 7).

Fig. 7. 6 month follow up

DISCUSSION

The present case advocates revascularization as a potential treatment option for necrotic, infected root canal spaces. Whether the new vital tissue is truly pulp or pulp-like is of little knowledge but there is continued development of the root canal walls and apex, which strengthens the tooth against future fracture. Even if the consequences include tissue in the canal space undergoing necrosis and consequent infection, conventional endodontic therapy would produce much better results than it been attempted with the open apex (Cvek, 1992). Also, vitality will likely be maintained if calcification of the root canal space continues to progress leading to pulp canal obliteration (Robertson, 1997 and 1998). Case selection plays a major role in this treatment protocol. It is mainly indicated in cases of pulp necrosis with an immature apex that is open greater than 1 mm in a mesiodistal dimension radiographically. Ideally, the size of the apical opening should be sufficient enough to allow in growth of vital tissue. According to Kling (Kling *et al.,* 1986) an apical opening greater than 1 mm mesiodistally was associated with successful revascularization of avulsed permanent teeth and no revascularization in teeth with a smaller apical opening. The treatment procedure is comparatively less challenging than the other traditional techniques of treating necrotic immature teeth with open apices. Also, in cases of failure of the attempted revascularization procedure fails, the traditional options of treatment i.e. $Ca(OH)_2$ apexification or MTA apexification followed by a conventional root filling can be carried out. This case demonstrates the possibility of revascularization of necrotic infected root canal system in vivo. However, with further research and advancements the traditional techniques for treatment of such teeth may be replaced if revascularization is shown to be predictable in controlled research models.

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