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Case Report

Revascularization of A Necrotic Immature Permanent Central Incisor: A Case Report

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Abstract

Background: Revascularization is a valuable treatment in necrotic immature teeth that allows the continuation of root development.

Case Report: This article describes the successful revascularization treatment of an immature maxillary permanent central incisor that was diagnosed with asymptomatic apical periodontitis. The tooth was asymptomatic and functional clinically and radiographically during the follow-up period of 1 year and 5 months.

Conclusion: The follow-up showed evidence of progressive thickening of the dentinal walls, development of root length and apical closure.

Keywords: Revascularization; Necrotic

Introduction

The treatment of pulpal necrosis in an immature tooth with an open apex presents an unique challenge to the dental practitioner. Previously, multiple-visit apexification with calcium hydroxide was the treatment of choice in necrotic immature teeth, which aimed at formation of an apical hard tissue barrier [1]. An alternative technique for apexification is by placing an artificial barrier in apical portion of the root canal. The material of choice for this technique is mineral trioxide aggregate (MTA), which has been shown to have a high success rates and will reduce the number of required clinical sessions [2,3]. Both of these apexification methods share the same disadvantage of not allowing the continuation of root development resulting in fragile root structure [2].

Revascularization is a regenerative treatment and a biologically based alternative approach to treat necrotic immature teeth. Unlike apexification and artificial apical barrier techniques, it allows for continuation root development [3]. This case report describes a case of successful revascularization in necrotic immature central incisor using MTA with a follow-up period of 1 year and 5 months.

Case Report

A 13-year-old boy reported for evaluation and treatment of a discolored maxillary right central incisor (Tooth 11).The patient was accompanied by his father who reported that his son had suffered a traumatic injury to the upper right front tooth about a month ago with loss of the coronal fragment and root canal treatment. The medical history of the patient was non-contributory. Clinical examination revealed that the tooth had an Ellis class III fracture, and mobility and periodontal probing were within physiological limits. Pulp vitality was negative on cold and electric pulp testing. Remaining crown discoloration was seen and radiographic examination revealed that the tooth had an unsatisfactory obturation and incompletely developed apex with a periarticular radiolucency (Figure 1 A). A diagnosis of previously root canal treated with asymptomatic apical periodontitis was made for tooth 11.

The father was informed about the limitations and advantages of revascularization as a treatment modality, and an informed consent was obtained. The tooth was anaesthetized with 2% lidocaine with 1: 100,000 epinephrine, and an access cavity was established

under rubber dam isolation. A single gutta percha cone was retrieved with help of H files. The working length was estimated radiographically using a size 60 K-file (2mm short of radiographic apex) followed by minimal filing of root canal walls. Coronal third of the root canal was widened passively with Gates Glidden drill size # 4 (Dentsply Maillefer, Tulsa, OK, USA). The canal was passively irrigated with 20 mL of 5.25% NaOCl for 20 min and then dried with absorbent points (Dentsply Maillefer). A freshly prepared antibiotic paste consisting of ciprofloxacin, metronidazole and minocycline (100 mg of each drug in a 0.5- mL total volume) was placed into the canal using a lentulo-spiral. The access cavity was sealed with 4mm thick Cavit (3M Espe, Seefeld, Germany).

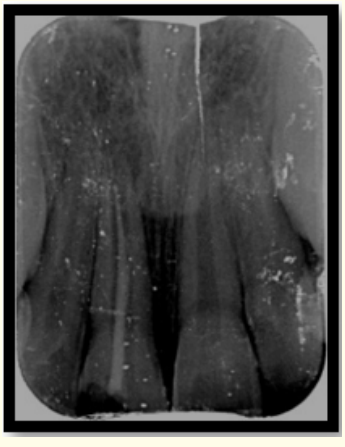

Figure 1 A: *Long cone periapical radiograph of tooth 11 one month after injury.*

Figure 2: *Complete GP retrieval done and triple antibiotic paste placed and cavit as entrance filling.*

At the 3-week follow-up appointment, the patient was asymptomatic, and the tooth showed no tenderness to percussion and palpation. Under local anesthesia and rubber dam isolation, the temporary restoration was removed. The triple antibiotic paste was removed using 10 mL of 5.25% NaOCl and 10ml of saline. Final irrigation was done with 17% EDTA (10 mL) and the canal was dried with absorbent points (Dentsply Maillefer). The periapical tissue in the tooth was lacerated using an ISO 60 K-file to induce fresh bleeding, and a blood clot was formed 3 mm apical to the cementoenamel junction (CEJ). After 15 min, white MTA (Dentsply Tulsa Dental, Tulsa, OK, USA) was placed over the blood clot. Although MTA placement resulted in it being packed further apically than desired, the MTA was left undisturbed. A wet cotton pellet was placed against the MTA, and the tooth was restored temporarily with Cavit (3M Espe). One day later, the temporary restoration was removed, and the MTA set was verified. An approximately 2-mm-thick layer of glass ionomer cement (Fuji; Fuji Corporation, Osaka, Japan) was placed over the set MTA cement, and the tooth was restored with composite resin (Te-Econom plus A1;Ivoclar Vivadent). At the 3-month follow-up, the tooth was functional, without sensitivity to percussion and palpation, and normal periodontal findings. At the 18 month follow-up, the tooth continued to be asymptomatic and functional. Apical closure and dentinal wall thickening was evident along with increase in root length.

3A

3B

Figure 3: *A. MTA and GIC filling; B. MTA and composite.*

Figure 4: *3 Month review.*

Figure 5: *18 Months review.*

Discussion

Revascularization is the forerunner of regenerative endodontic procedures. Components needed for successful regenerative endodontics include absence of intracanal infection, a good coronal seal to prevent reinfection, a physical scaffold to promote cell growth and differentiation, as well as signaling molecules for the growth of stem cells [4]. To date, four types of human dental stem cells have been isolated and characterized: (i) dental pulp stem cells (DPSCs), (ii) stem cells from exfoliated deciduous teeth (SHED), (iii) stem cells from apical papilla (SCAP) and (iv) periodontal ligament stem cells (PDLSCs) [5].

Minimal instrumentation is done. Root dentinal walls are so thin that any instrumentation makes them weaker and more susceptible to future fractures, and also, the formation of a smear layer could occlude the dentinal tubules [3]; however, in the present case, Gates Glidden drills were used passively in the coronal one-third of the canal to facilitate irrigation, placement of triple antibiotic dressing and placement of MTA cement on the blood clot. Recently, Trevino., *et al.* at [6] suggested that irrigation protocols that include 17% EDTA appear to promote smear layer removal, attachment of stem cells to the root canal dentinal wall and release of growth factors from dentin. Most of the revitalization regeneration procedures use a triple antibiotic paste, sometimes called Hoshino's paste. The paste contains 200 mg ciprofloxacin, 500 mg metronidazole and 100 mg minocycline, which must be mixed by a compounding pharmacist [7]. Discoloration of the clinical crown is mentioned in some of the revascularization reports possibly due to the presence of minocycline in the triple antibiotic paste and/or use of grey MTA [8]. Reynolds., *et al.* at [9] recommended the use of a special device (Root Canal Projector) during the introduction of triple antibiotic pastes to prevent coronal discoloration. Thibodeau., *et al*. [10] and Trope., *et al.* [11] reported successful use of cefaclor instead of minocycline in triple antibiotic paste, which might be an effective approach to prevent the discoloration caused by minocycline. Sealing the dentinal tubules in the chamber and use of the dentin-bonding agent have been suggested to prevent or reduce the intensity of the discoloration caused by application of triple antibiotics [9].

Animal studies showed that in cases of thickened walls, there was a cementum- like tissue formed along the inner dentin wall termed as intracanal cementum-like tissue, and the lumen was often filled with bone-like tissue [12-14]. Induction of bleeding and subsequent formation of blood clot might serve as a scaffold for the periapical cells including mesenchymal stem cells to migrate into the root canal and eventually induce new tissue formation within the space [10].

Conclusion

The follow-up showed evidence of progressive thickening of the dentinal walls, increase of root length and apical closure.

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