Revascularization of an Immature Necrotic Permanent Mandibular Second Molar

Yazeed M. Alharbi
Endodontic Senior Registrar, Specialty Dental Centre in Jeddah, Ministry of Health, KSA

Introduction

Pulpal necrosis in immature teeth results in the cessation of root development. Consequently, achieving an apical seal with conventional endodontic techniques and materials, a major objective of root canal treatment (Schilder . 1967), becomes difficult.In addition, their thin radicular walls predispose them to fracture on the long run(Cvel. 1992). The classical approach to endodontically manage necrotic immature teeth involved the induction of an apical barrier consequent to long-term intra-canal calcium hydroxide. Beside the long time required to accomplish the treatment, it has been claimed that the prolonged exposure of radicular dentin to calcium hydroxide might alter its mechanical properties making it more prone to fracture. Hence, the utilization of Mineral Trioxide Aggregate (MTA) apical plugs has been alternatively practiced (Andreasen et al. 2002). Despite providing the opportunity for immediate apical seal, MTA apical plugs do not result in any appreciable gain in root length or width(Bose R, *et al*, 2009).
An optimum intervention for a necrotic immature tooth would be a regenerative approach of radicular pulp tissue capable of promoting the continuation of root development and apical closure. Such maneuver would concomitantly lead to thickening of radicular dentin that would subsequently reinforce the root making it more resistant to fracture (Shah N. *et al.* 2008).
This poster illustrates a case report for revascularization of an immature previously initiated therapy second mandibular molar with symptomatic apical periodontitis.

Case Report

A 14-years-old Saudi male with insignificant medical history was referred to the endodontic clinic for managing immature previously initiated therapy #47 with symptomatic apical periodontitis. Clinically, the offending tooth was temporized, tender to percussion and did not respond to cold testing when compared to the control tooth (#46). A bitewing and parallel conventional periapical radiographs were taken (Fig.1). Tooth #47 exhibited apical lucency, broken lamina dura around mesial and distal roots with open apices.

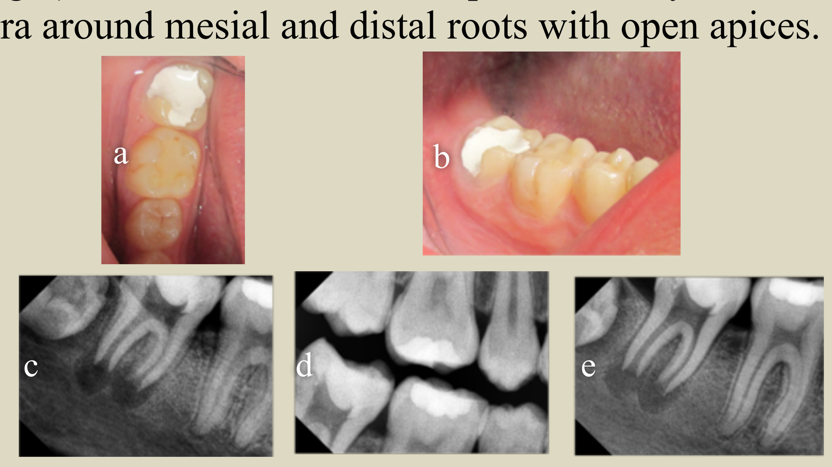

Figure 1. Preoperative clinical photographs (a, b) and radiographs (c, d & e) of right mandibular second molar

Diagnosis and Treatment plan:
Endodontic diagnosis was previously initiated with symptomatic apical periodontitis. After a comprehensive discussion of the risks, complication and possible outcomes of the different treatment options, parental consent was obtained for revascularization.

Treatment procedures:
The tooth was anaesthetized with 2% lidocaine with 1:100,000 epinephrine, and an access cavity was prepared under rubber dam isolation. Under a dental operating microscope (Seiler, New York, USA), access refinement was attempted and four orifices with wide canals were located. No purulent exudates or hemorrhage were observed in the chamber. Working length was estimated radiographically using K-files (Fig.2). Irrigation protocol included a slow and careful irrigation of 20 mL of 5.25% sodium hypochlorite (NaOCl) delivered using double-sided vented needle gauge 27 inserted 2 mm short of the established working length. After dryness of the canals, calcium hydroxide paste was applied. The tooth was then temporarily sealed with a cotton pellet and Cavit (3M ESPE, Seefeld, Germany).

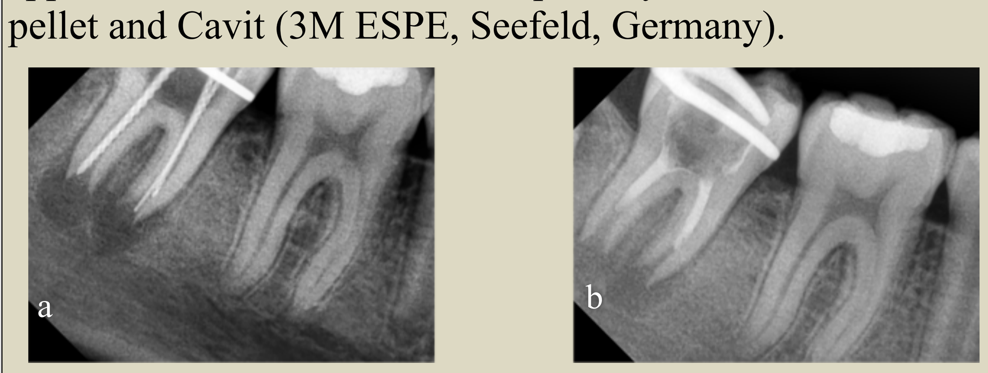

Figure 2. (a) Working length radiograph. (b) Radiograph after calcium hydroxide application..

After two weeks, the patient was asymptomatic and the tooth showed no tenderness to percussion and palpation. The tooth was isolated with rubber dam and the temporary restoration was removed. Calcium hydroxide paste was removed using 10 mL of 5.25% NaOCl and the canal was dried with absorbent points (Dentsply, Maillefer, Switzerland). The tissue apical the tooth was nudged using an ISO 50 K-file to induce fresh bleeding and a blood clot was formed 4 mm apical to the cementoenamel junction. After 15 minutes, white MTA (Dentsply Tulsa Dental, Tulsa, OK, USA) was placed over the blood clot. A wet cotton pellet was placed against the MTA, and the tooth was restored temporarily with Cavit. One day later, the temporary restoration was removed, and the MTA setting 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 (Filtek A110; 3M Dental Products, St Paul, MN, USA) (Fig.3).

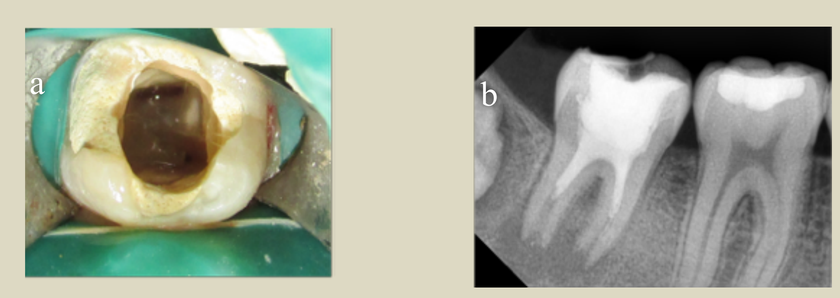

Figure 3. (a) Clinical photograph of the access cavity (b) Post-operative radiograph after root canal disinfection, placement of MTA over the blood clot, coronal restoration of glass ionomer and composite. .

At the 6-month follow-up, the tooth was functional, without tenderness to percussion and palpation. At one year follow-up examination, the patient continued to be asymptomatic, with an indication of continued root development and complete resolution of the apical lucency (Fig.4).

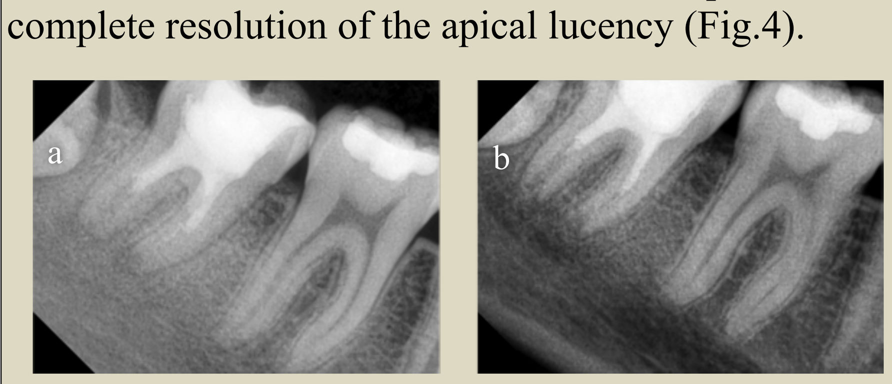

Figure 4. (a)Six months and (b)One-year follow-up radiograph.

At 18-months follow-up (Fig.5), the tooth continued to be asymptomatic and functional. Apical closure and dentinal wall thickening were evident along with attainment of root length. Cold testing gave negative response and the tooth remained asymptomatic.

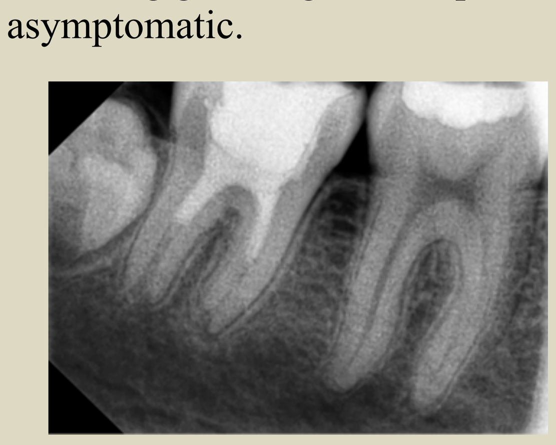

Figure 5. A 18-months follow-up radiograph showing increased root length and formation of apical closure.

Discussion

In 2001, Iwaya *et al.* published a case report describing a new treatment procedure for the management of the immature teeth called "revascularization.". Other authors adapted the term 'revascularization' without questioning until Huang & Lin (2008) considered that 'revascularization' did not encompass the actual healing and repair process that takes place in these clinical cases (Huang & Lin 2008). The term 'revitalization' used by earlier studies attempting to revive tissues in the pulp space would perhaps describe the phenomenon more accurately (Nevins et al. 1976).
There are numerous challenges in treating immature permanent teeth with a diagnosis of pulp necrosis. Three general treatment options are calcium hydroxide apexification, mineral trioxide aggregate (MTA) apexification, and revascularization. Although MTA apexification treatment has a high success rate with a greatly decreased number of appointments and time to completion, the treatments neither strengthen the root nor foster further root development. Jeeruphan *et al.* (2012) compared the radiographic and survival outcomes ofimmature teeth treated with either regenerative Endodontic or apexification Methods, they conclude the revascularization was associated with significantly greater increases in root length and thickness in comparison with calcium hydroxide apexification and MTA apexification as well as excellent overall survival rates.
Endodontists are at the forefront of addressing the developments that must be made in tissue engineering in order to further pulp regeneration in the future. Hargreaves et al. recommended three major components of pulp regeneration which require further research for the development of pulpal regeneration: a) a reliable cell source capable of differentiating into odontoblasts: b) an appropriate scaffold to promote cell growth and differentiation, and c) signaling molecules, both growth factors and other compounds, that are capable of stimulating cellular proliferation and directing cellular differentiation (Hargreaves *et al*. 2008).

Conclusion

This report of pulp revascularization shows that disinfection of the root canal in association with intracanal dressing composed of calcium hydroxide paste leads to satisfactory root development in necrotic immature teeth.

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