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Case Report

REGENERATIVE TREATMENT OF IMMATURE, TRAUMATIZED MAXILLARY CENTRAL INCISORS: REPORT OF A CASE

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ABSTRACT

The purpose of this report is to present the case of a patient wherein revascularization of the necrotic infected pulp space of an immature permanent maxillary central incisor tooth was induced in vivo by stimulation of a blood clot from the periapical tissues into the canal space. This was achieved after disinfecting the canal space with a topical antibiotic paste followed by inducing a blood clot scaffold from the periapical tissues. This treatment approach offers great potential to avoid the need for traditional apexification with calcium hydroxide or the need to achieve an artificial apical barrier with mineral trioxide aggregate. Furthermore, this treatment approach can help rescue infected immature teeth by physiologically strengthening the root walls.

Keywords: Apexification; Open Apex; Apex Formation; Maturogenesis; Revascularization

INTRODUCTION

The traumatic injury of an immature permanent tooth can lead to the loss of pulp vitality and arrested root development. The consequences of interrupted development include a poor crown-root ratio, a root with very thin walls, an increased risk of fracture, and an apex that is open[1]. The traditional endodontic management of such cases typically includes debriding the root canal, disinfecting the space, and final obturation of the system preceded either by an apexification procedure or by developing an apical barrier by using materials such as mineral trioxide aggregate (MTA)[2]. The apexification clinical procedure, which consists of applying calcium hydroxide as an intracanal medication to induce an apical closure over time, has a certain predictability of success[3]. Its disadvantages are the necessity of multiple visits during a relatively long period of time (an average of 12 months) and the fact that there is no expectation that the root canal walls will be strengthened[4].

An alternative to traditional apexification is to place an artificial barrier at the apex to prevent the extrusion of filling materials during obturation. The material of choice is MTA for its sealing ability and its biocompatibility. This latest technique is convenient because it is faster than the traditional apexification. The case can be finalized within 2 appointments, and a hard tissue barrier eventually forms against the MTA. However, even this alternative approach has the same disadvantage of a tooth with thin dentinal walls and no further root development[4].

Another new procedure utilising the pulp regenerative technique has been introduced that has been reported to treat the non-vital, infected immature traumatized teeth. This regenerative process has been termed as revascularization, revitalization or maturogenesis. The common aspect of all regenerative modalities is intra canal disinfection followed by formation of a sterile blood clot inside the pulp cavity. The emphasis is laid on the importance of sterile blood clot and granulomatous tissue within the pulpal cavity. 'Rule' documented root development and apical barrier formation in cases of pulpal necrosis[5]. Various possible explanations have been given to explain the reason for the occurrence of apexogenesis/maturogenesis in these infected immature permanent teeth. One of the most probable explanation include the presence of mesenchymal stem cells residing in the apical papilla, also known as stem cells of apical papilla (SCAP), which are the multi-potent dental pulp stem cells, and are resistant to necrosis/infection. However, the exact etiology,

pathogenesis or histo-pathological events that occur in this regenerative process are still not known[5]. This report documents a case of an 8 year old boy who suffered trauma to his maxillary central incisors and was successfully treated by the pulp regenerative procedure using MTA.

CASE REPORT

An 8 year old boy reported to the Department of Pediatric and Preventive Dentistry, Sunam, Punjab, India. The patient suffered a traumatic injury to the maxillary central incisors about 1 month earlier. Immediately after trauma, there were no symptoms, but subsequently after a few days, he started experiencing pain in the upper front tooth region. Pain was sharp, sudden and evoked on cold and hot stimuli, lingering in nature. Later, it became spontaneous and was not even relieved on medication when he decided to visit a dentist. The medical history was unremarkable.

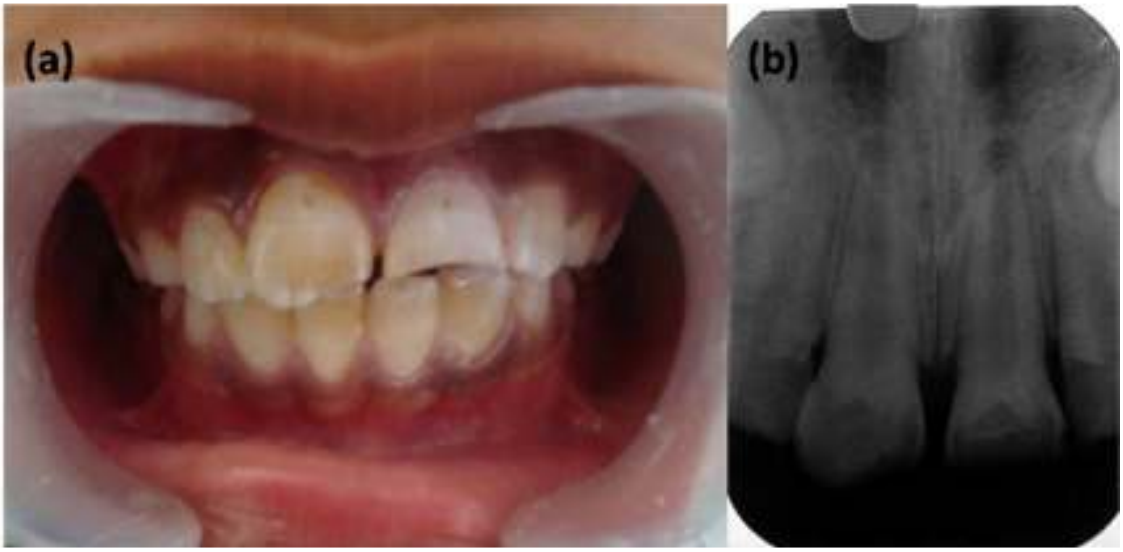

Figure 1: Pre-operative (a) photograph (b) intra-oral peri-apical radiograph revealing pulpal exposure in teeth 11 and 21

The clinical examination (figure 1a) revealed the fracture of right and left permanent maxillary central incisors involving enamel, dentin and pinpoint pulpal exposure in tooth 11 and a frank pulp exposure in tooth 21. There was no response evoked on electric pulp testing indicating non-vital teeth. The teeth were tender to palpation and percussion. Intraoral periapical radiographic examination (figure 1b) showed that the teeth had immature roots with open apices but with no peri-apical radiolucency. The apical diameter as measured on the radiograph was found to be more than 1 mm indicating an increased potential for revascularization. The treatment plan was explained and an informed written consent was taken.

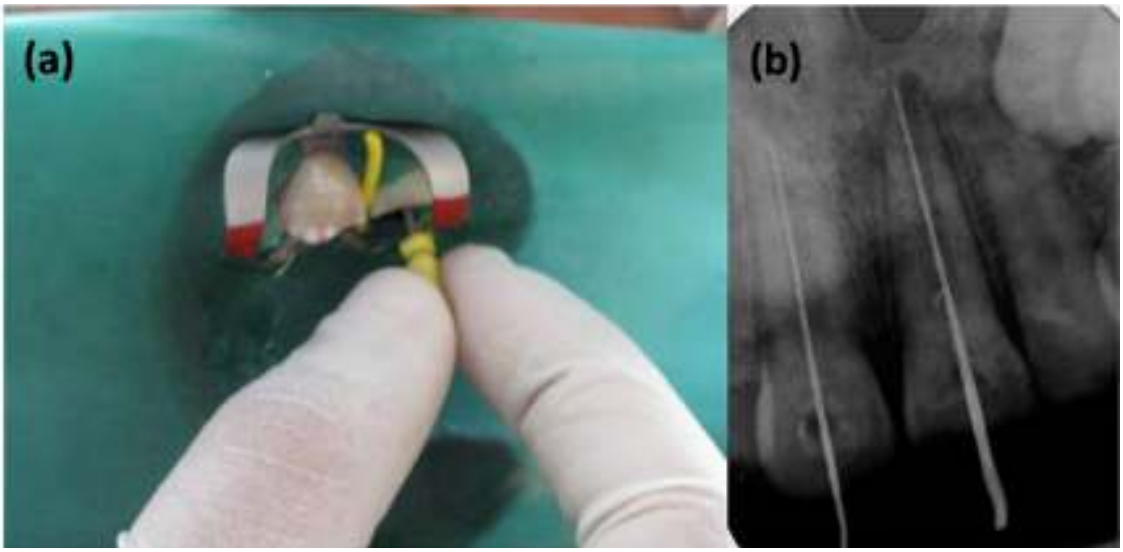

Figure 2: Per-operative (a) photograph (b) intra-oral peri-apical radiograph

Under local anaesthesia and rubber dam isolation, access cavities were made in teeth 11 and 21 followed by a minimal instrumentation with K files (figure 2). Copious irrigation was done with 5 % NaOCl and 3 % hydrogen peroxide alternately

with normal saline as the last irrigation. Then, intracanal antimicrobial medication consisting of equal parts of 400 mg metronidazole, 250 mg ciprofloxacin and 100 mg minocyclin made into a paste form was placed in the canals using an endodontic plugger. The access cavities were sealed with a 2mm Cavit as an inner layer and 3mm restorative Glass Ionomer Cement as an outer layer.

After two weeks, the patient was asymptomatic. Under rubber dam isolation, access was gained and irrigation done with 5% sodium hypochlorite and normal saline. Using a sterile #45 K-file, periapical over instrumentation was done in both the teeth to induce bleeding into the canals 3-4 mm below the CEJ. It was allowed to clot for 15 min and then mineral trioxide aggregate (MTA Angelus, Dentsply) was placed against the clot. The access cavity was sealed with a moist cotton pellet and cavit followed by glass ionomer cement.

After 24 h, the restorations and the moist cotton pellets were removed, set of MTA verified and the teeth restored with a base of GIC and light cure composite resin.

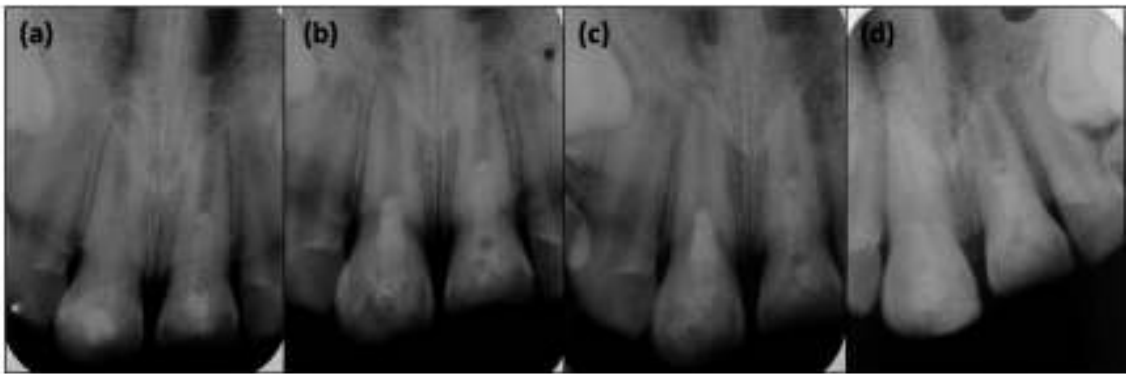

Figure 3: Follow-up radiographs at (a) 1-month (b) 3months (c) 6months (d) 12months showing successful root completion in teeth 11 and 21

The patient was reviewed after 1, 3, 6 and 12 months (figure 3) and was found to be asymptomatic. Intraoral peri-apical radiographic examination revealed continuous root development with the narrowing of apex and absence of any pathological signs and symptoms.

DISCUSSION

The traditional approach for treating this case of a traumatized immature permanent tooth would have been either apexification with calcium hydroxide medication or apexification with MTA. However, the apexification treatment does not induce further thickening of dentinal walls or an increased root length. During the procedure of apexification, the canal space is filled with $Ca(OH)_2$ which may not allow ingrowth of vital tissue, thereby leading to a short and weakened root. An alternative treatment of revascularization is preferred[4]. A more conservative approach for this type of case would be to perform a regenerative procedure by not instrumenting the root canal and instead using only copious irrigation and the application of antimicrobial agents to preserve any remaining vital pulp tissue in the apical region. The outcome of the conservative treatment depends on the type and duration of infection, the state of the pulp at the time treatment is started, the host, and the size of the open apex[4].

This case showed positive criteria for attempting revascularization of infected root canal spaces with some form of vital pulp like tissue present in the apical papilla. The desired results in the form of continuous development of the root canal walls and apex were obtained without any pathological signs and symptoms.

Case selection is important while performing this procedure[6]. It has been reported that for pulp revascularization to be successful, teeth with open apices are considered to be an excellent option. An apical diameter of at least 1 mm (mesiodistally) radiographically is necessary to allow ingrowth of vital tissue[7]. The chance for revascularization of a reimplanted tooth increases by 18% if the apex is open >1.1 mm[8]. There may be a presence of a periradicular radiolucency or a negative vitality test but these factors do not barr a tooth to be considered as a potential candidate in case selection as vital pulp tissue or apical papilla may be present in the canal and at the apex[9]. The new tissue may grow from remnants of pulpal tissue or from the apical papilla which contains stem cells[4]. Various explanations have been given to explain why revascularization can occur in these infected immature permanent teeth. These include the presence of mesenchymal stem cells present in the apical papilla, also known as stem cells of apical papilla (SCAP), which are the multipotent dental pulp stem cells, and resistant to necrosis and infection[5].

Sterilization of the root canal i.e. the removal of infection from the canal space plays an indispensible role in revascularization[6]. The use of triple antibiotic paste (metronidazole, minocycline and ciprofloxacin) as intracanal bactericidal medication is being advocated in reducing endodontic pathogens and in disinfection of the root canal[10].

MTA has a property of setting in moist environment so it can be placed over the blood clot. It has excellent anti-microleakage property and biocompatibility and also has been documented to form a dentin bridge in direct pulp capping procedures[11]. MTA takes around 3-4 h for initial setting with maturation increasing with time[12].

Continuous follow up is necessary in such cases as the canal tissue may undergo necrosis or the calcification of the canal space may occur, suggesting failure of the revascularization procedure. Thus, necessitating root canal therapy including traditional treatment options such as apexification using $Ca(OH)_2$ or apical barrier technique with MTA, if the

revascularization procedure fails. However, if revascularization is a success, it may well replace traditional treatment modalities for non-vital immature teeth.

CONCLUSION

Considering the relative advantages and potential risks, this emerging concept of revascularisation can serve as a rationale for conducting future prospective clinical trials comparing conventional endodontic treatment procedures versus regenerative endodontic treatment procedures in clinical conditions of the necrotic immature permanent tooth.

REFERENCES

1. Webber RT. Apexogenesis versus apexification. Dent. Clin. North. Am. 1984; 28:669 –97.
2. Kerekes K, Heide S, Jacobsen I. Follow-up examination of endodontic treatment in traumatized juvenile incisors. J. Endod. 1980; 6:744–8.
3. Rafter M. Apexification: a review. Dent. Traumatol. 2005; 21:1– 8.
4. Cotti E, Mereu M, Lusso D. Regenerative Treatment of an Immature, Traumatized Tooth with Apical Periodontitis: Report of a Case. J. Endod. 2008; 34:611– 616.
5. Aggarwal V, Miglani S, Singla M. Conventional apexification and revascularization induced maturogenesis of two non-vital, immature teeth in same patient: 24 months follow up of a case, Journal of Conservative Dentistry 2012; 15(1):68-72.
6. Kumar ARP, Subbiya A. Regenerative endodontic therapy of non-vital immature maxillary incisors: Working protocol and a case report. Journal of Interdisciplinary Dentistry 2011; 1(1):55-57.
7. Kling M, Cvek M, Mejàre I. Rate and predictability of pulp revascularization in 10 therapeutically reimplanted permanent incisors. Endod. Dent. Traumatol. 1986; 2:83–9.
8. Sarkar NK, Caicedo R, Ritwik P, Moiseyava R, Kawashima I. Physicochemical basis of the biologic properties of mineral trioxide aggregate. J. Endod. 2005; 31:97–100.
9. George T, J.Huang. A paradigm shift in endodontic management of immature teeth: conservation of stem cells for regeneration. J. Dent. 2008; 36:379-86.
10. Hoshino E, Kurihara-Ando N, Sato I, Uematsu H, Sato M, Kota K, et al. In-vitro antibacterial susceptibility of bacteria taken from infected root dentine to a mixture of ciprofloxacin, metronidazole and minocycline. Int. Endod. J. 1996; 29:125-30.
11. Torabinejad M, Higa RK, McKendry DJ, Pitt Ford TR. Dye leakage of four root end filling materials: effects of blood contamination. J. Endod. 1994; 20:159-63.
12. Roberts HW, Toth JM, Berzins DW, Charlton DG. Mineral trioxide aggregate material use in endodontic treatment: A review of the literature. Dental Materials 2008; 24:149-64.

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