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Case Report

Renaissance of the tooth fairy!!!

Manisha Behl [1]*, Samriti Jindal [2], Shivani Sharma [3],Priyanka Shahi [4],Nishat Shahi [4],Vikram Khanna [5]

[1] *MDS, Pediatric and Preventive Dentistry.*
[2] *Reader, Department of Pediatric and Preventive Dentistry, Guru Nanak Dev Dental College and Research Institute, Sunam*
[3] *MDS, Periodontology and Implant ology.*
[4] *Senior Lecturer, Department of Pediatric and Preventive Dentistry, MM Mullana Dental College,Ambala*
[5] *Assistant Professor, Department of Oral Medicine and Radilogy, KGMC, Lucknow.*
**Corresponding author E-mail: dr.manisha.pedo@gmail.com*

Abstract

Regenerative endodontic procedures have brought novelty in the arena of dentistry. Stem cell research has paved its way into conserving and utilizing the multipotent stem cells for tissue growth. One such procedure is revascularization which utilizes the apical stem cells for root lengthening and reinforcement in traumatized tooth with an open apex. The present clinical case report has shown that revascularization results in successful root lengthening and apical closure in lesser appointments than conventional specification procedure without weakening the dentinal walls.

Keywords: *Regenerative endodontics, stem cell research, revasularisation, open apex, apexification.*

1. Introduction

Treatment of a traumatized young permanent tooth with an immature apex has always been a matter of concern for a pediatric dentist. A variety of treatment options like conventional calcium hydroxide apexification, single sitting MTA apexification, apexification with Colla cote, Tricalcium phosphate etc ; have been practiced in the past.
Regenerative endodontics is a biologically-based procedure designed to predictably replace damaged, diseased, or missing structures, including dentin and root structures as well as cells of the pulp-dentin complex, with live viable tissues, preferably of the same origin, that restore the normal physiologic functions of the pulp-dentin complex. The advantages of pulp revascularization lie in the possibility of further root development and reinforcement of dentinal walls by deposition of hard tissue, thus strengthening the root against fracture.

2. Case report

An 8 year old Punjabi Sikh boy reported to the Department of Pediatric and Preventive Dentistry, Sunam for the evaluation of a traumatized upper right maxillary central incisor. The history revealed that the trauma occurred 2 months back and the patient did not get any treatment for the same. On clinical examination, the tooth was found to have a fracture involving enamel, dentin and a clinical pulpal exposure was observed. The tooth was also found to be associated with an intra-oral sinus (Fig 1).

Fig. 1: Tooth 11 associated with an intra-oral sinus

Electric pulp testing was inconclusive. RVG revealed involvement of pulp with periapical radiolucency (Fig 2), an Incomplete root apex a buccal sinus tract that traced to the apex of the tooth.

Fig. 2: RVG revealing involvement of pulp with periapical radiolucency

The observations were suggestive of chronic peri-apical infection in relation to an immature tooth with three possible lines of treatment viz. conventional apexification with calcium hydroxide, single sitting MTA apexification or revascularization procedure.

The parents were explained in detail about all the treatment options along with pros and cons of each procedure. They opted for the latter due to lesser appointments and greater preservation of natural tooth tissue and an informed written consent was obtained for the same.
After rubber dam isolation and gaining access to the root canal system (fig 3), purulent hemorrhagic drainage was obtained, and the necrotic nature of the pulp was confirmed.

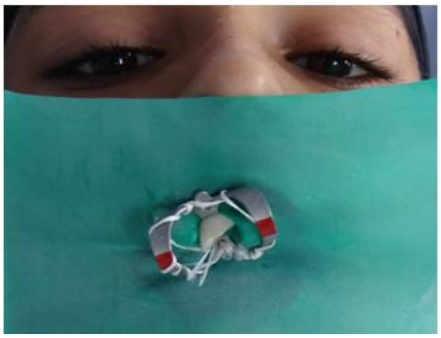

Fig. 3: Rubber dam isolation

A needle was placed to within 1 mm of the apex, and the canal was slowly flushed with 20 ml of 5.25% NaOCl and 10 ml of 3% hydrogen peroxide. The canal was dried with paper points, and a mixture of ciprofloxacin, metronidazole, and minocycline paste was prepared into a creamy consistency and placed with an amalgam carrier into the canal (fig 4).

Fig. 4: Placement of Triple Antibiotic Paste into the canal

The access cavity was closed with 4 mm of Coltosol (Coltene Whale dent, Switzerland Co.).
The patient returned 21 days later, asymptomatic, reporting no pain postoperatively. The sinus tract was healed. The access was opened and the canal again flushed with 14 ml of 5.25% NaOCl. The canal appeared clean and dry, with no signs of inflammatory exudate. An endodontic file was introduced into the canal until vital tissue was felt at a depth of 2 mm excess of the working length into the canal space. An explorer was used to irritate the tissue gently to create some bleeding into the canal. The bleeding was stopped at a level of 3 mm below the level of the CEJ and left for 15 min so that the blood would clot at that level. After 15 min, the presence of the blood clot to approximately 3 mm apical of the CEJ was confirmed. Mineral trioxide aggregate *(MTA; Densply Tulsa Dental, Tulsa, OK)* was carefully placed over the blood clot till the CEJ, followed by a wet cotton pellet and Coltosol (fig 5).

Fig. 5: Placement of MTA in the canal.

Two weeks later, the patient returned, asymptomatic, and the Coltosol and cotton pellet were replaced with a bonded resin restoration which was followed by a composite build up (fig 6).

Fig. 5: Composite Buildup of the traumatised tooth after revascularisation.

The patient was scheduled for recall examination and advised to call if he was in pain or if swelling or a recurrence of the sinus tract developed.
At the 6-month recall, the patient was asymptomatic, with no signs of the sinus tract. The radiograph showed complete resolution of the radiolucency .At 18-month follow-up examinations, the patient continued to be asymptomatic, with no signs of the sinus tract and there was an indication of continued development of the apex of the tooth (fig 7).

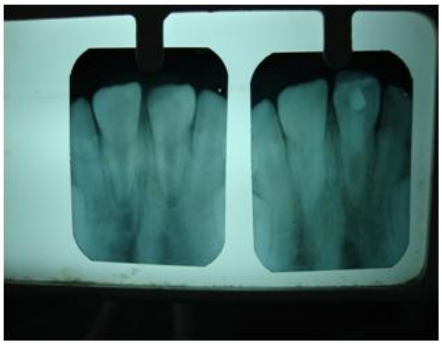

Fig. 7: Pre-Operative and post-operative IOPA indicating closure of the root apex.

Pulp testing was still inconclusive. At the 2-year follow-up, the patient continued to be asymptomatic, and closure of the apex and thickening of the dentinal walls was obvious. The tooth responded positively to the vitality test.

3. Discussion

Collectively, there has been a tremendous increase in our clinical tools (i.e., materials, instruments, and medications) and knowledge

from the trauma and tissue engineering fields during the last decade.

Moreover, recent case reports from multiple investigators support the feasibility of developing biologically based regenerative endodontic procedures designed to restore a functional pulp-dentin complex. The possible cause of continued root formation can be attributed to the presence of viable pulp cells at the apical end of the root canal. Hertwigs epithelial root sheath cells are resistant to necrosis and they exert an inductive influence on the viable cells of the apical region. As a result, lateral strengthening and reinforcement of the root results.

Root formation can also be attributed to presence of multipotent dental pulp stem cells which get incorporated into dentinal walls which deposits tertiary dentin.

Reasoning can be given to the proliferation and growth of the periodontal stem cells into the apical end and lateral wall of the root.

Pecking of the apical end of the root canal beyond the working length can result in transplantation of the viable mesenchymal bone stem cells into the canal lumen.

Blood clot formation during the revascularization procedure serves as a rich source of platelet-derived growth factor, vascular endothelial growth factor (VEGF), platelet-derived epithelial growth factor, and tissue growth factor and could stimulate differentiation, growth, and maturation of fibroblasts, odontoblasts, cementoblasts, etc from the immature, undifferentiated mesenchymal cells in the newly formed tissue matrix.

Strengthening and reinforcement of the dentinal walls is also as a result of the absence of bio mechanical preparation while debriding the root canal which can weaken the root canal walls. Instead various root canal medicaments have been used in various research papers (viz calcium hydroxide ; Chueh & Huang ,Triple antibiotic paste ;Banchs & Trope , Formocresol ;Shah & Logani).Grossman proposed the use of a polyantibiotic paste (named PCBS), and an antifungal version with the addition of nystatin (named PCBN). Iwaya *et al.* used an antibiotic cocktail in the initial visit and Ca (OH) 2 during the final visit. Banchs and Trope did not advocate Ca (OH) 2 due to its potentially damaging effect on the apical tissue. Instead the antibiotic cocktail, a mixture of minocycline, ciprofloxacin, and metronidazole (Sato *et al.)* was adopted as a common intracanal medicament.

Revascularization procedure has definite advantages over the conventional apexification procedure such as reduced treatment time and also after placement of intracanal medicament, it can be completed in a single visit as infection control is achieved appreciably. It is also very cost-effective, because the number of visits is reduced, and no additional material in every subsequent visit (such as TCP, MTA) is required.

Obturation of the canal is not required unlike in calcium hydroxide– induced apexification, with its inherent danger of splitting the root during lateral condensation. However, the biggest advantage is that of achieving continued root development and strengthening of the root as a result of reinforcement of lateral dentinal walls with deposition of new dentin/hard tissue.

The limitations are lesser than the advantages but still noticeable. First and foremost being that long-term follow up results are as yet not available. Some studies have reported calcification of entire canal, compromising esthetics and potentially increasing the difficulty in future endodontic procedures if required. In case, the tooth in question requires post and core placement, revascularization procedure should not be considered because the vital tissue in apical two thirds of the canal cannot be violated for post placement.

4. Conclusion

Traumatic injuries in a young permanent tooth have been conventionally treated with calcium hydroxide. Many other materials have been used for apexification including tricalcium phosphate (TCP), collagen calcium phosphate, bone growth factors, osteogenic protein, but none has truly replaced calcium hydroxide. However, calcium hydroxide–induced apexification has several limitations. It might require 6 –24 months for barrier formation. The barrier formed is often porous and not continuous or compact and therefore requires obturation of the canal after barrier formation, with all its inherent problems of achieving a fluid-tight seal without splitting the tooth. Even if successful, apexification can only induce a hard tissue barrier at the apex. Further development of the root does not take place. Intracanal calcium hydroxide dressing can also make the tooth brittle because of its hygroscopic and proteolytic properties. By filling the canal with calcium hydroxide, a physical barrier is created that prevents migration of multipotent undifferentiated mesenchymal cells into the canal and regeneration of tissues at the lateral dentinal walls. Revascularisation procedure has paved its way altogether in the treatment of traumatized tooth with an open apex overcoming the above mentioned disadvantages of the conventional closure of the apical barrier.

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