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# Revascularization and Apexification: A Boon to the Treatment of Immature Young Permanent Teeth

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**Abstract:** ***Management of young permanent teeth with an open apex associated with apical periodontitis poses clinical challenges because of several reasons: difficult to achieve proper cleaning and disinfection of the overall dentinal wall, particularly at the diverged apex. In this case, specific approaches with minimal instrumentation and apical sealing through apexification by means of hard tissue barrier induction with calcium hydroxide or MTA and reinforcement of the thin dentinal walls. Even though, apexification with calcium hydroxide is a successful procedure but it is time-consuming and there is no root lengthening and it has been estimated that 30% of the teeth that have undergone calcium hydroxide apexification can fracture during or after endodontic treatment. In this study compared clinical and radiographic outcomes of endodontic treatment performed in immature non-vital permanent teeth, by apexification(calcium hydroxide or apical barrier with MTA ), versus revascularization.***

**Keywords:** immature permanent teeth, calcium hydroxide apexification, revascularization

## 1. Introduction

Management of young permanent teeth with an open apex associated with apical periodontitis poses clinical challenges because of several reasons: difficult to achieve proper cleaning and disinfection of the overall dentinal wall, particularly at the diverged apex.[1] Furthermore, the widened apical foramen lower the chances of proper sealing, under-developed root structure and the presence of thin apical root creates a significant risk of fracture.[2] These challenges postulate specific approaches with minimal instrumentation and apical sealing through apexification by means of hard tissue barrier induction with calcium hydroxide or MTA and reinforcement of the thin dentinal walls.[3]Eventhough, apexification with calcium hydroxide is a successful procedure but it is time consuming and requires patient's cooperation. However, there is no root lengthening and it has been estimated that 30% of the teeth that have undergone calcium hydroxide apexification can fracture during or after endodontic treatment.[4]

The concept of revascularization of tooth involves further root development and reinforcement of dentinal walls by deposition of hard tissue thus strengthening the root against fracture.[5]The open apex of young tooth allows new tissue to grow into the pulp space quickly. The pulp is necrotic but usually not degenerated and infected; thus it acts as a scaffold into which the new tissue can grow.[5] Proper infection control is essential for successful regenerative endodontic procedures. Different methods of disinfection using calcium hydroxide and antibiotic pastes have been used. Under ideal circumstances, the successful outcome is defined as healing of the periapical lesion, continuation of root development, and positive response to vitality tests. Despite highly successful results, there are reports of lack of root development following treatment.[6]A retrospective study on comparison of apical plug technique versus regenerative endodontic treatments has shown similar survival and success rates for both treatments. So, a very few well-designed prospective trial on comparison of these two treatment approaches. The purpose of this paper is to present and compare the outcome of apexification vs. revascularization endodontic treatment in two non-vital bilateral immature maxillary central incisors.

## 2. Case Report

A 9 year-old female reported to the Department of Pedodontics and Preventive Dentistry of Christian dental college with complain of a sharp, continuous pain in upper front teeth since 4 days. The patient gave a history of impact trauma in the same region one year back. Clinical examination of the patient revealed Ellis class 3 fracture in upper right and left central incisors. The teeth were tender on percussion. The response to electric pulp test (Analytic Technology, Redmond, WA, USA) was negative. The response to the cold test on the left and right central incisors was also negative. Periapical radiographs showed radiolucent lesions at apex on both maxillary central incisors (Fig 1). Both teeth had immature roots with blunderbuss canal. The final diagnosis was pulp necrosis with symptomatic apical periodontitis for both central incisors. After explaining the condition of the teeth and possible treatment modalities, an informed consent was obtained from the patient's parent.

**Treatment for right central incisor-**

Apexification procedure was performed according to guidelines of the International Association of Dental Traumatology. After local anaesthesia administration the tooth was isolated using a rubber dam and accessed with the help of a high speed round, straight fissure diamond burs (diameter 014, Endo ZR bur). The working length was determined radiographically. The necrotic pulp tissue was removed with K files along with copious irrigation with normal saline and 5.25% of sodium hypochloride (NaOCl).[2]Calcium hydroxide powder was mixed with 0.2% chlorhexidinegluconate to a creamy consistency, which was carried into the canal using a lentulospiral. Then the access cavity was temporarily sealed. After 1 week patient was recalled, the canal was irrigated with 5.25% NaOCl. Calcium hydroxide was mixed with saline to a thick consistency and placed into the canal after drying it. Following this glass-ionomer restoration was done. The calcium hydroxide dressings were replaced after 1, 3, 6, and 8 months.[4]

**Treatment for maxillary left central incisor-**

The process of local anesthesia, rubber-dam isolation, access cavity preparation, instrumentation and irrigation was performed. After this triple antibiotic (ciprofloxacin, metronidazole, and cefaclor) paste mixed with sterile saline was placed into the canal for 3 weeks.[6]During the second appointment, the tooth was asymptomatic. An anesthetic without vasoconstrictor was given to prevent constriction of the blood vessels in the apical region when bleeding is mechanically induced. After careful removal of the temporary restoration the medicament was removed by gentle irrigation. A sterile #20 K-file was used to penetrate into the apical tissues 2 mm past the apical foramen to initiate bleeding into the root canal. Bleeding was induced till approximately 3 mm apical to the CEJ. Estimated mean time for the establishment of a stable blood clot is 10 minute.[9]The stability of clot was confirmed with the reverse end of a large sterile paper point. After this the clot was carefully covered with MTA cement and restored with composite restoration.

**Treatment outcome and follow up**

After 1, 3, 6, 9 months of follow up both teeth were found to be clinically sound. At 15 months follow-up, on radiographic examination (fig.1a) right central incisor showing a calcific barrier is formed at the junction of middle and apical 3rd of root normal PDL and the lesions were completely healed. In addition, (fig.1a) the left central incisor showed an increase in root length/wall thickness and formation of the apex. Clinically, no tooth discoloration was noted; however, the restorations had marginal discoloration and were successfully replaced.

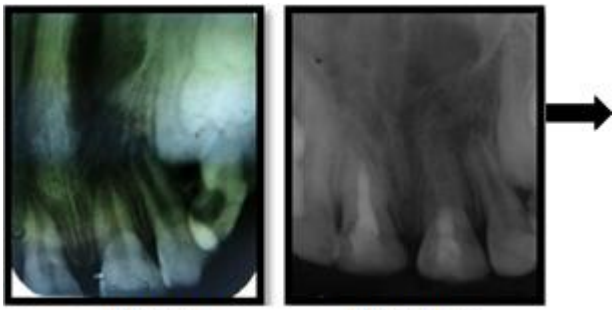

Figure 1 Figure 1 (a)

## 3. Discussion

Traditionally, the apexification was the method that involves application of calcium hydroxide until completion of root-end closure.[1] However, the disadvantages of this long-term method include delayed treatment, difficulty in following up with patients, unpredictability of an apical seal, and the risk of root fractures because formed calcific bridge was porous in nature and break easily.[2,]Filling of the root canals with calcium hydroxide dressing for extended periods may weaken tooth structure. To overcome the drawback of calcium hydroxide apexification, MTA had been introduced by Torabinejad and co-workers became the material of choice for apexification therapy because of excellent biocompatibility and sealing ability,[7]but do not increase the fracture resistance of the walls, as strengthening or reinforcing of the thin, fragile blunderbuss canals is not achieved.[8] Therefore, regeneration of tissues rather than their replacement with artificial substitutes is an emerging and exciting field in the health sciences.A revascularization procedure is an alternative, biologically based treatment that has been introduced for immature teeth with necrotic pulp.[9,10]

## 4. Conclusion

Calcium hydroxide has several disadvantages, in particular the prolonged duration to induce hard tissue formation and frequent fracture of tooth because of the thin dentinal walls. Currently, the process of revascularization showed an increase in root length and dentinal wall thickness as well as formation of the apex with fewer visits as compared to apexification which required multiple visits and only led to formation of apical barrier with no increase in root length or dentinal wall thickness. Thus it can be concluded that revascularization can be considered as a better treatment option.

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