CASE REPORT

Apexification of A Permanent Immature Central Incisor: A Case Report

Farah Afroz Khan[1], Yawar Ali Abidi[1], Maham Muneeb Lone[1], and Samira Adnan[1]

ABSTRACT

Aim: To report the induction of apical root development in an open apex central incisor with necrosed pulp by calcium hydroxide

Summary: A 27-year-old female patient came to dental OPD with ache and discoloration of tooth #11 with a history of dental trauma. There was negative response on pulp sensitivity test on tooth #11. Periapical radiograph showed incomplete root formation with wide canal, divergent foramina, and fragile dentinal walls of tooth #11. After giving local anaesthesia on her first appointment, access was opened, working length was measured and pulp was extirpated. Chemo-mechanical debridement was done with 2.5% sodium hypochlorite solution and application of calcium hydroxide paste was placed. Access was then closed and patient was recalled for subsequent appointments. After a duration of nine-months, radiograph showed the evidence of complete root development with closure of foramina opening. Canal was filled with sealer and Gutta-Percha by thermo-chemical compaction.

Key words: Apexification, calcium hydroxide, foraminal closure

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INTRODUCTION

Trauma to the anterior teeth is a common occurrence in infancy[1]. Any trauma to immature tooth before root completion causing concussion, luxation, fracture, or avulsion of tooth, may result in loss of vitality and disruption in root development and short thin walls pose a huge risk of fracture[2]. Pulpal necrosis in such cases may lead to periapical abscess formation and tooth discoloration that would require endodontic treatment[3]. The incompletely developed permanent tooth serves as a challenge in diagnosis and treatment to the clinician. Endodontic treatment becomes difficult in such cases due to a wide canal, lack of apical stop against which root filling material can be curtailed, and thin dentinal walls[4]. Closure of root apex is essential in tridimensional sealing of root canal for the prevention of microleakage and to increase the prognosis of the endodontic treatment[5]. The induction of apical closure known as apexification is defined as "a procedure of induction of a calcified barrier in the apical zone of an incompletely formed root with necrotic pulp"[6]. As a result, a bone-like calcified barrier is formed called osteocementum[7]. This barrier can be attained through Ca (OH)2 which forms a biologic hard tissue barrier. An artificial apical plug can also be formed through MTA or other bioceramic material[8]. Apexification with Ca (OH)2 is known to have a 90% success rate[9].

The aim of this report is to illustrate the efficiency and capacity of calcium hydroxide to form a biological barrier in an immature tooth with incomplete root formation.

CASE:

A 27-year-old female visited the dental clinic of the Sindh Institute of Oral Health Sciences at Jinnah Sindh Medical University, Karachi in January 2019 with the chief complaint of poor aesthetics due to the discoloration of her upper front tooth. History revealed that the patient had a fall when she was 9 years old. The discoloration was present for the past 8-10 years but had progressively increased over the past couple of years. Treatment had been abandoned due to financial constraints.

1 Operative Dentistry, Sindh Institute of Oral Health Sciences, Jinnah Sindh Medical University, Karachi, Pakistan

Correspondence: Dr. Farah Afroz Khan, FCPS II Resident, Operative Dentistry, Sindh Institute of Oral Health Sciences, Jinnah Sindh Medical University, Karachi, Pakistan

Email: farah.afroz@jsmu.edu.pk

There was no obvious swelling or asymmetry on her extra-oral examination while intra-oral examination exhibited discolored tooth#11 and porcelain fused to metal crown on tooth#21. The rest of the dentition was sound with mild fluorosis and the patient had a healthy periodontium.

Tooth #11 was not tender on palpation and percussion also showed a negative response to pulp vitality tests. Radiographs showed wide apex and thin walls with no radiolucency on periapical area of tooth#11. Tooth # 21 was root canal treated. Tooth #11 was diagnosed as immature tooth with pulp necrosis secondary to trauma. After discussing various treatment options with the patient, it was decided to carry out apexification with Ca (OH)2 as the most suitable treatment option for tooth#11 and re-endodontic treatment for tooth#21. As the patient was asymptomatic for #21 and had no major aesthetic concern, she refused any treatment for tooth #21(Fig 01).

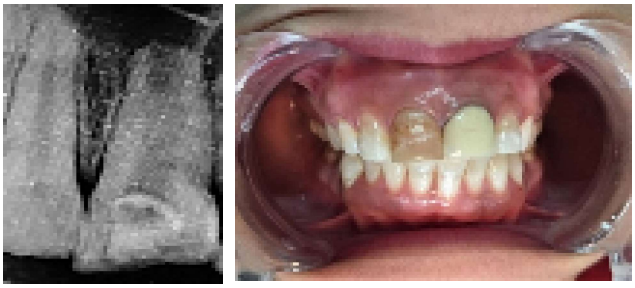

Figure 01: (a) Pre-op radiographic evaluation, (B) Pre-op clinical evaluation.

Treatment was initiated after obtaining written informed consent from the patient. The treatment consisted of multiple visits and was completed in the duration of 10 months. After ensuring adequate local anaesthesia by injecting lidocaine (2% Lignocaine with 1:100,000 epinephrine) isolation was done with rubber dam. Access was opened through palatal surface. Pulpectomy was done and working length was confirmed on periapical radiograph with conventional endodontic 45K-file (Fig 02). Sodium hypochlorite 2.5% was used for thorough irrigation and disinfection. Canal preparation was done up to 60-K file. Later on canal was dried with paper points and dressed with Calcium hydroxide with Iodoform dressing (Metapaste, Metabiomed, USA) up to the apex with the help of endodontic plugger. Dressing was confirmed with the help of periapical radiograph. Cotton was placed within the coronal part of the canal and the access was sealed with Cavit (3M, USA), a temporary filling material. Patient was advised to retain good oral hygiene and instructed to avoid her anterior teeth for tearing or biting and was recalled after one month.

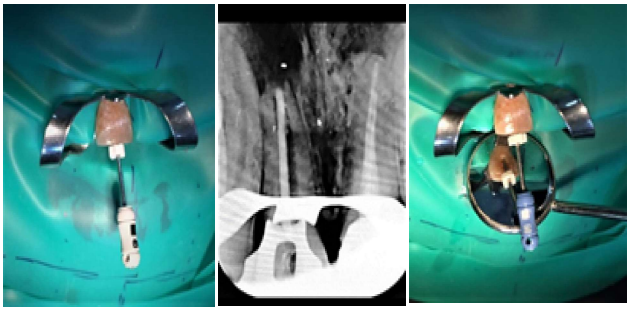

Figure 02: (a) Working length measurement, (b) Radiographic confirmation of working length, (c) Obtaining MAF

At recall appointment after one month, radiograph was taken to evaluate the periapical condition of tooth#11. As patient was asymptomatic, she was advised follow-up visits at 3-months intervals, for the next nine months. At each recall visit, a radiograph was taken to evaluate the periapical condition and success of procedure. To minimize chances of coronal leakage, the temporary filling material was replaced at each visit.

At six-month follow-up, the periapical radiograph showed signs of an apical barrier formation, albeit incomplete. The patient was therefore called for follow-up after another three months. Periapical radiograph at nine-month follow-up revealed complete apical barrier formation, without any signs and symptoms of periapical radiolucency (Fig 03).

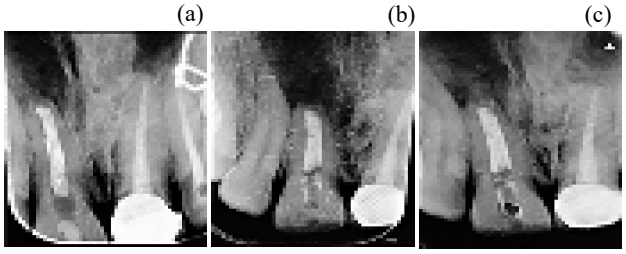

Fig 03. (a) radiograph at nine-month interval, (b) raiograph at six-month interval, (c) radiograph at nine-month interval.

After removal of temporary filling and calcium hydroxide dressing, the apical barrier was palpated with the help of Gutta-Percha of size #35. Absence of any exudate or bleeding from the apical area was ensured. Canal was then thoroughly irrigated with NaOCl, washed with water and dried with paper points. Ca (OH)2 sealer (Sealapex, Kerr, SA) was then coated on the canal walls with the help of a paper point. Thermoplasticized injectable Gutta-Percha using the Calamus 3D Obturation system (Dentsply Sirona, USA) was then used to fill the canal space. Access of the cavity was thoroughly cleaned and restored with light cure resin composite (Fig 04).

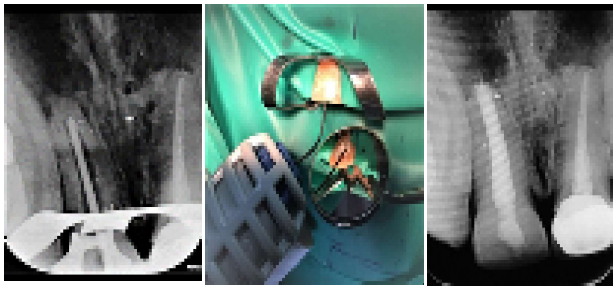

Figure 04 (a) Confirmation of apical stop with #35 Gutta-Percha (b) Obturation with Calamus Obturation System (c) Restoration of access cavity with composite resin

DISCUSSION

Apexification with calcium hydroxide anticipates apical barrier in 74% to 100% of cases[10,11]. According to Guerrero F *et al*[12], apexification with calcium hydroxide showed the formation of more thickened walls and a rounded apex. It is an intra-canal medicament which has historically been used in apexification procedure due to its biological and healing performance[13]. It is a strong base with poor water solubility. It can be mixed with different substances to induce apical barrier such as camphorated monochlorophenol, distilled water, saline, anaesthetic solutions, chlorhexidine, and cresatin. The PH of Ca (OH)2 plays a great role in mineralization action. Alkaline pH induces hard tissue formation by the activation of alkaline phosphatases and neutralization of lactic acid secreted by osteoclast[14]. High pH of calcium hydroxide provides antibacterial activity in the apical and periapical soft tissue[15]. According to Masmoudi F *et al*[16], when it comes in contact with connective tissue, calcium hydroxide causes superficial necrosis of about 1-1.5 mm thickness. Under this necrosed zone, fibroblastic cells induce fibrous matrix formation. Later on, fibroblast segregate into odontoblast and form tubular dentine (orthodentine). At the periodontal ligament level, fibroblastic cells differentiate into cementoblast and osteoblast to form osteoid tissue. A higher survival rate has been seen for the Stem Cells of Apical Papilla (SCAP) when the dentine was exposed to Ca (OH)2[17,18].

Despite of its property of making biological apical barrier, alkaline pH also denatures the dental organic proteins thus upsurges the risks of fracture[19,20]. However, studies have shown that chances of root fracture are correlated more to the phase of root development than to the enduring use of calcium hydroxide[21]. Apexification with Ca (OH)2 requires a protracted treatment time to produce acceptable results. Studies showed that long term follow up visits of about five-months up-to twenty-motnhs could couple with poor patient compiliance which can adversely affect treatment outcomes[22].

An alternative material which has gained popularity in recent years for apexification is MTA. Studies have shown that there is no substantial difference in the treatment results among these two medicaments[16]. Even though MTA has the advantage of shortening the time of treatment significantly; apexification with calcium hydroxide has an advantage over MTA pertaining to better elongation of apical root length[23]. Limitation of using MTA for apexification include its long setting time, ability to cause tooth discoloration, difficulty in handling at the root-end and an increased risk of adverse periapical reactions[24]. From clinical point of view, apexification procedure with MTA is an expensive treatment modality and is not easily affordable by patients, especially those presenting to a public sector hospital. A study has shown that, in addition to the thin dentinal walls still present after single-shot apexification, there is not as much quantifiable rise in root dimensions with MTA[25]. Another study has revealed that both MTA and calcium hydroxide have similar weakening effect on dentine properties[26].

CONCLUSION

In this case report, a clinically acceptable apical barrier was formed after calcium hydroxide apexification. Irrespective of the multiple visits and long term treatment plan associated with it, apexification is most suitably performed by the use of calcium hydroxide as it forms a biological apical plug.

Authors' contribution: FAK: Conceived the idea, performance, clinical and radiographical evaluation and wrote the case report. YAA: Evaluated the clinical and radiographical data and reviewed the final report. MML: Performed the clinical and radiographical evaluation and co-edited the case report. SA: Performed the clinical and radiographical evaluation and co-edited the case report.

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