World Journal of Clinical and Medical Case Reports

Case Report
Published: 01 Jan, 2024

Endodontic Re-treatment with Calcium Hydroxide Apexification

Malakar S[1], Vishal G[2] and Aamna R[3]*

[1]Department of Dentistry, DEIC at Medinipur Medical College and Hospital, India

[2]Department of Oral and Maxillofacial Surgery, Institute of Dental Sciences, India

[3]Department of Dentistry, Sri Ram Murti Smarak Institute of Medical Sciences, India

Abstract

The procedure of apexification includes the mineralized apical barrier formation and here it has been done with calcium hydroxide paste, owing to its healing properties. This clinical report presents a case of 14 years old female patient reported with a chief complaint of pain in upper front tooth region for 2 months and revealed the history of trauma 4 years back, clinical examination showed discolored tooth in relation to 21 which was tender on percussion. Radiographic examination revealed the history of faulty Root Canal Treatment (RCT) and relatively short root with open apex associated with periapical radiolucency. Calcium hydroxide apexification was planned followed by subsequent endodontic treatment. Beginning of apical barrier formation was noticed after 3 months, and the barrier was appeared to be accomplished by 12 months. Clinical and radiographic examinations after 1 year follow up defined the success of the treatment.

Keywords: Apexification; Calcium hydroxide; Hertwig's epithelial root sheath; Endodontic treatment; Immature permanent teeth

Introduction

International Association of Dental Traumatology documented that one out of every two children suffer from a dental injury most often at the age of 8 to 12 years [1]. Dental injuries to anterior teeth in children, affect mastication, speech, esthetics and create a psychological impact due to damage of tooth structure at an early age. Depending on the severity and intensity of trauma to teeth [2], pulp necrosis is a serious complication and its dispersion varies with the type of traumatism from 1% to 6% of crown fractures to closely 100% for intrusion injuries. The pulp necrosis of permanent underdeveloped teeth either due to trauma or caries, having underdeveloped roots pose a weighty challenge. Root development in permanent teeth occurs generally 3 years after eruption of the teeth, root development take place through the constantly deposition of dentine and cementum by differentiation of Hertwig's Epithelial Root Sheath (HERS) and undifferentiated progenitor cells. Discontinuation of this process by trauma or infection can lead to deficient root development causing an open apex and a funnel shaped canal called as "blunder buss" canal [3,4]. Cessation of normal root development occurred by entire devastation of Hertwig's epithelial root sheath, however it doesn't mean that there is termination of deposition of hard tissue at the root apex, there can be no further differentiation of odontoblasts even once the sheath has been devastated but hard tissue can be formed by cement oblasts that are existent in the apical region and by fibroblasts of the dental follicle and periodontal ligament, after the injury they undergo differentiation to become hard tissue producing cells [5]. So, the option like calcific barrier formation at the root apex to achieve the definitive root canal filling is recommended [3].

Conventionally, the procedure that has been used is calcium hydroxide apexification that causes disinfection of the root canals, completion of endodontic treatment is detained until root-end closure is done by apexification [6].

Hermann in 1921 introduced Calcium hydroxide in dental profession [7]. Kaiser in 1964 reported the use of calcium hydroxide for apexification [6]. Calcium hydroxide is a white odorless powder having a molecular weight of 74.08. The material is a strong base with a high pH of 12.5 and is only slightly water soluble with a solubility of 1.2 g/l at a temperature 25°C. The dissociation of Calcium hydroxide into calcium ion and hydroxyl ions resulted in local increment of pH. High pH

OPEN ACCESS

Correspondence:
Gaurav Vishal, Department of Oral and Maxillofacial Surgery, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India

Received Date: *25 Nov 2023*
Accepted Date: *28 Dec 2023*
Published Date: *01 Jan 2024*

Citation:
Malakar S, Vishal G, Aamna R. Endodontic Re-treatment with Calcium Hydroxide Apexification. World J Clin Med Case Rep. 2024; 2(1): 1007.

of calcium hydroxide is responsible for irritation of the pulp tissue, which promotes formation of dentin by the liberation of bioactive molecules such as Bone Morphogenic Protein and Transforming Growth Factor-Beta 1 [7]. Calcium hydroxide material has been used in apexification procedure for long time, the treatment protocol involves the repeated stimulations with calcium hydroxide over 6 to 8 months duration until the apical closure is achieved [3].

Calcium hydroxide has been considered as the gold standard for apexification because of predictable efficient results and no adverse periapical reaction. Its efficacy has been demonstrated by several researchers through several clinical and long-term studies with success rate ranging between 74% to 100% [2].

Case Presentation

A 14-year-old female patient reported with a chief complaint of pain in the upper front tooth region in the last 2 months and revealed the history of trauma 4 years back. Clinical examination showed discolored tooth in relation to (irt) 21 which was tender on percussion. Radiographic examination revealed the history of faulty Root Canal Treatment (RCT) and open apex associated with periapical radiolucency (Figure 1).

The patient was explained that initially a conservative endodontic approach had been planned with the aim of achieving microbiological control, periapical healing and apical closure. If such approach would not show satisfactory result, then periapical surgery might be needed.

At the initial appointment restoration was removed followed by gutta percha retrieval, access to the canal established, working length was determined 19 mm i.e., 2 mm short from the radiographic apex. The canal was then instrumented till 80 size Hedstrom files and irrigated with 1.0% sodium hypochlorite and normal saline solution. After drying with paper point the canal was filled with calcium hydroxide mixed in propylene glycol and the access cavity was sealed with zinc oxide.

A week apart, the symptoms had subsided and after thorough irrigation and cleaning, calcium hydroxide paste was again packed into canal and the access cavity was sealed. After every 3 months, Intra Oral Periapical Radiograph (IOPAR) was taken to check the progress of treatment (Figure 2).

Figure 1: Preoperative.

Figure 2: 3 Months follow up.

Figure 3: 6 Months follow up.

Figure 4: 9 Months follow up.

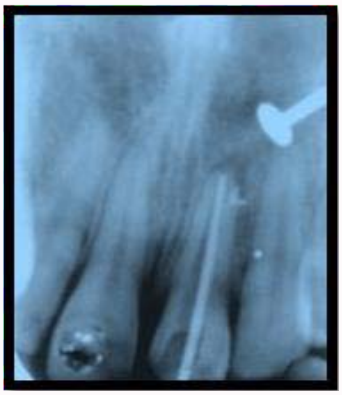

Figure 5: 12 Months follow up with master cone.

Figure 6: Post-obturation.

After 6, 9 and 12 months follow up, when clinical and radiographic examination validated the apical bridge formation (Figures 3-5). The canal was obturated with gutta-percha cones and restored with glass ionomer cement (Figure 6).

After a week of obturation, clinical examination of 21 was done to check if there was any postoperative complication, as there was no complain, the patient was asked to visit after 3 months for crowning.

As 3 months later, clinically and radiographically the tooth was asymptomatic and the prognosis was satisfactory so a porcelain fused to metal crown was cemented.

Discussion

Presented case resulted in successful apexification, the efficacy of Calcium Hydroxide for apexification has been attributed to its alkaline pH (pH=10.5) and antibacterial properties which provides a conducive environment for healing as well as for regeneration of apical and periapical tissues by activating alkaline phosphatase enzyme and increasing the activity of calcium dependent pyrophosphatase enzyme [8].

A study by Ballesio et al. narrated three types of apical barrier formation (i) a physiologic development of apical portion with a final root length, similar to contralateral tooth (ii) origination of a cap like hindrance and (iii) an apical development with the final root length.

Various authors were reported the success rate respectively with the use of different formulations of calcium hydroxide for apexification [1] which were ranging from by authors like Sheehy and Roberts, 74% to 100%, Gu et al., 94%, and Morse et al., 100%.

Calcium hydroxide has antimicrobial action, the release of hydroxyl ions from calcium hydroxide damages the bacterial cellular component by chemically altering the lipopolysaccharide, as well as biological properties of bacteria are also affected, and early proof indicates that high pH of calcium hydroxide may contribute to its osteoinductive property. Histologically, over the apical foramen the calcified tissue that formed has been recognized as an osteoid or cementoid substance. The time needed to attain apexification is about 6 to 24 months (mean 1 year ± 7 months) however it can take up to 4 years also [6]. Sheehy and Roberts found that the average time for apical barrier formation with calcium hydroxide is nearly 5 to 20 months [1]. In present case it took 12 months for completion of apexification.

In dental literature there are dissimilar thoughts as how often calcium hydroxide paste should be changed to produce apexification. According to Tronstad et al., calcium hydroxide paste replacement is favorable at every 3 to 6 months. Cohen & Burns suggested that it should be replaced only if there is radiographic evidence of the resorption of paste. Chosack & Cleaton-Jones suggested that once the calcium hydroxide is placed, there is no benefit by its replacement either monthly or after 3 months for at least 6 months. In the present case calcium hydroxide was replaced at every 3 months interval [6].

Klein and Levy clarified the successful apical barrier formation by using calcium hydroxide mixed in Cresatin [5]. Afterwards researchers suggested to mix calcium hydroxide with saline, sterile water or distilled water to reduce the potential of cytotoxicity. Heithersay successfully tried the combination of Calcium hydroxide and methylcellulose (Pulpdent Corporation, Watertown, MA, USA). In the present case calcium hydroxide was mixed with propylene glycol to reduce solubility in tissue fluids and to achieve rigid consistency [6].

Calcium hydroxide is a gold standard for apexification with the limitation of long time-span of the entire treatment, multiple visits needed requiring patients' cooperation and increased risk of root fracture using calcium hydroxide as a long-term root canal dressing material [6].

Mineral Trioxide Aggregate (MTA) can also be used as an alternative to calcium hydroxide with the benefit of shorter treatment time, with minimum delay before placing a final restoration, remove the over lasting alkaline effect of calcium hydroxide and coronal leakage. However, there is inadequate proof about its healing superiority. Moreover, MTA shows some drawbacks, such as difficulty in handling, prolonged setting time, irreversible application and higher cost [8].

Revascularization can be an alternative choice for apexification too, there are few restrictions to this approach such as: Bleeding into the canal space is essential, and this treatment choice is not suggested in cases where post and core is the definitive restorative treatment plan as the vital tissue in apical 2/3 of the canal cannot be violated for post placement [9].

Several other substances have been tried to induce apexification, such as tricalcium phosphate, collagen calcium phosphate and osteogenic protein-1.

Conclusion

This case report illuminates that calcium hydroxide provides a viable method to achieve root end closure in an immature tooth. Despite of some limitations of this material, this technique permitted the satisfactory apexification treatment.

References

1. Ghosh S, Mazumdar D, Ray PK, Bhattacharya B. Comparative evaluation of different forms of calcium hydroxide in apexification. Contemp Clin Dent. 2014;5(1):6-12.
2. Damle S, Bhattal H, Loomba A. Apexification of anterior teeth: A comparative evaluation of mineral trioxide aggregate and calcium hydroxide paste. J Clin Pediatr Dent. 2012;36(3):263-8.
3. Beslot-Neveu A, Bonte E, Baune B, Serreau R, Aissat F, Quinquis L, et al. Mineral trioxide aggregate versus calcium hydroxide in apexification of non-vital immature teeth: Study protocol for a randomized controlled trial. Trials. 2011;12(1):174.

4. Kaur H, Chaudhary S, Tangde P. MTA: Boon to apexification. J Oral Health Comm Dent. 2013;7(2):114-8.

5. Rafter M. Apexification: A review. Dent Traumatol. 2005;21:1-8.

6. Paulindraraj S, Venkatesan R, Suprakasam S, Christopher A. Apexification-then and now: A review. Int J Dent Med Res. 2015;1(6):193-6.

7. Baranwal R, Singh BD, Dubey A, Avinash A. Review article: Calcium hydroxide in dentistry. Chettinad Health City Med J. 2016;5(1):30-3.

8. Silveira CM, Sebrão CC, Vilanova LS, Sánchez-Ayala A. Apexification of an immature permanent incisor with the use of calcium hydroxide: 16-year follow-up of a case. Case Rep Dent. 2015;2015:984590.

9. 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. J Conserv Dent. 2012;15(1):68-72.