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Case Report

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Effectiveness of Calcium Hydroxide in the Treatment of Incomplete Rhizogenesis: Case Report

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Abstract:

The use of calcium hydroxide has widely spread in recent decades due to its easy availability and use, its low cost, and the fact that it is often used in cases of apexification, showing great success in inducing an apical hard tissue barrier in the immature open apex. Its effectiveness has been demonstrated by clinical studies and long-term success rates ranging between 74% and 100%. The apexification technique aims to obtain an apical barrier that prevents the passage of toxins and bacteria into the periapical tissue from the root canal and to create a conducive environment for the production of a mineralized tissue barrier or root formation at the complete formation of the immature root. Thus, the aim of this study is to demonstrate the effectiveness of calcium hydroxide as an apical plug with incomplete root formation, preventing the leakage of the filling material.

Key Words: Apexification, apical plug, calcium hydroxide

Introduction

Currently, traumatized teeth treatment with incomplete root formation is an endodontic challenge. They have a wide root canal with thin walls and are usually divergent for the apex, which complicates the permanence of the filling material within the biological limits.[1]

Among the factors that lead to incomplete root formation, dental trauma is the most common, affecting mainly the upper central incisors.[2] Depending on the degree, this damage can compromise the neurovascular bundle and result in the pulp necrosis of the dental element,[3] which will prevent the root formation by deposition of dentin.[4] For many years, the best treatment option would be to stimulate the formation of an apical barrier through apexification, filling the duct with a calcium hydroxide until anatomical conditions were obtained that promoted safe root canal filling.[5]

Calcium hydroxide is the most used intracanal medication and is considered the best option due to its antimicrobial activity and excellent biological properties.[6] However, the formation of this apical barrier and complete closure of the root apex can range from 3 to 24 months and demands the cooperation of the patient. Due to the constant medication changes, the slowness of the treatment may result in the weakening of the root structure and reinfection. This is due to the provisional restorer material, which does not present adequate resistance.[7,8]

Therefore, this paper aims to discuss, through a clinical report, the success of endodontic treatment of a tooth with incomplete root formation. Calcium hydroxide will be used as an apical plug to avoid the extravasation of endodontic filling. This is a low-cost technique, enabling its execution in patients that do not have financial resources and its wide use in developing countries.

Case Report

The I.R.C. patient, male, 11 years old, attended the specialization course in endodontics at the Clinic of Integrated Learning Center, with a trauma history and subsequent fracture of the left upper central incisor (21). It was reported that the trauma had occurred 2 years ago and that 4 months ago he had attended urgent care due to the presence of a dentoalveolar abscess.

During the clinical examination, a fracture and darkening of the tooth crown was discovered. There was a lack of mobility, and the tooth responded negatively to semiotic tests of horizontal percussion and apical palpation. However, the tooth responded positively in the vertical percussion test. After the initial radiograph diagnosis (Figure 1a), an incomplete root formation of the dental element was discovered, with the presence of a wide root canal, thin walls, and a radiolucent image in the periapical region, suggestive of chronic apical periodontitis.

Treatment possibilities were evaluated and were mentioned to the patient. Among these, revascularization was discarded due to the prolonged necrosis condition beyond the previous intervention; a plug with mineral trioxide aggregate (MTA) was discarded due to the high cost, and this left apexification with calcium hydroxide. The treatment could not be done with constant medication changes and the difficulty of the patient's periodic return. It was then decided to create an apical plug with calcium hydroxide with the aim of containing the filling material, allowing for long-term apical barrier formation, and healing of the periapical lesions.

In the first session, after absolute isolation, the access surgery was conducted, and the emptying and neutralization of the septic content were made performed with Kerr® type files (Dentsply Ind. E. Com. Ltda. Rio de Janeiro, Brazil) and irrigation with sodium hypochlorite at 2.5%. The root canal was instrumented by 20 mm (working length - WL) with file Kerr® #120, concomitant with irrigation using sodium hypochlorite solution at 2.5%. Subsequently, the irrigation was held with ethylene diaminetetraacetic acid 17%, neutralization was performed with sodium hypochlorite, and the canal was dried with paper points (Dentsply Ind. & Com., Ltd. Rio de Janeiro, Brazil). Next, the root canal was filled with the calcium hydroxide paste Callen PMCC® (SSWhite Artigos Dentários Ltda. Rio de Janeiro, Brasil) (Figure 1b).

After 30 days, the radiographic examination demonstrated an absence of the dissolution of intra-root canal medication and of symptomatology in endodontic semiotic tests, and the definitive filling of the root canal was then opted for although there was not complete apical formation (Figure 1c).

After the removal of the medication and the drying of the root canal, an apical plug of calcium hydroxide of approximately 2 mm was made, aided by a gutta-percha cone previously molded to the root canal (Figure 1d).

After the radiograph, to confirm the positioning and locking of the cone molded in the WL (Figure 1e), the tooth was filling with sealer AH Plus® and accessories cones (Dentsply Ind. E Com. Ltda. Rio de Janeiro, Brazil).

After cutting with heated instruments, the cones were vertically condensed, and the coronary sealing was held with temporary cement (Figure 1f).

After 3 months of completion of the treatment, the patient presented an absence of symptoms and the dissolution of the overflowed calcium hydroxide (Figure 1g).

In the control of one year, an absence of symptoms and complete remission of the periapical lesion was observed, demonstrating the success of the case (Figure 1h).

Discussion

The treatment for this case of an incomplete root formation involved an apical plug of calcium hydroxide. The patient was treated in only two sessions due to the slow process of apexification and because the treatment was extensive with the possibility of abandonment by the patient. Furthermore, there was high risk of trauma recurrence in the region, with a complex fracture that would preclude the tooth permanence.[7,9] Moreover, the proteolytic properties and hygroscopic of the calcium hydroxide, when used for a long period, can induce

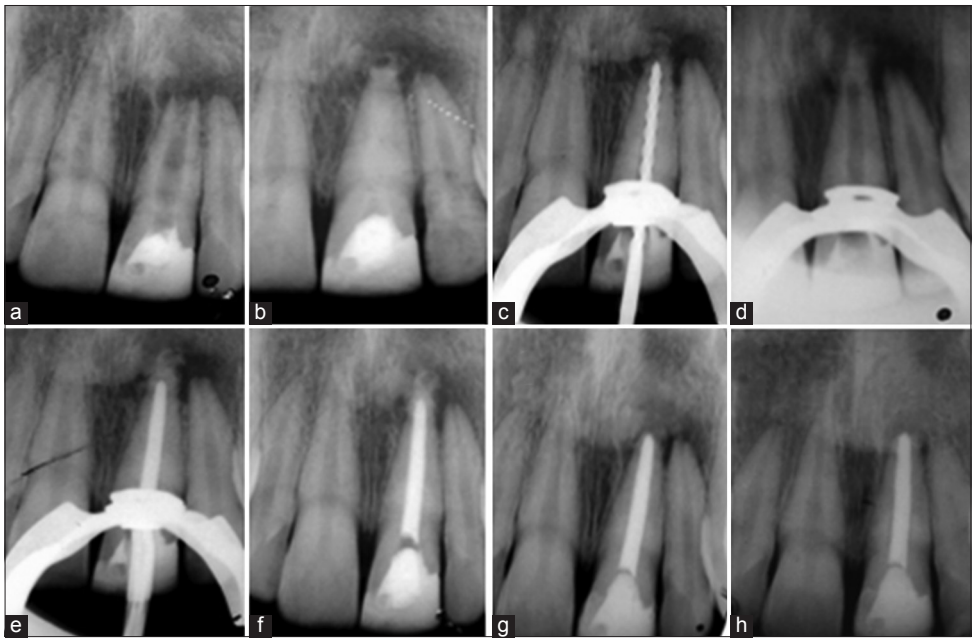

Figure 1: (a) Diagnostic radiography, (b) medication intra-root canal, (c) radiography of the absence of calcium hydroxide, (d) radiography after the creation of the calcium hydroxide plug, (e) cone test radiography, (f) final radiography, (g) radiographic control after 3 months, (h) radiographic control after 1 year.

degradation of the organic portion of the dentin, making it fragile.[10]

The apical plug made with calcium hydroxide can be considered a safe and effective treatment.[5] While the general mechanisms of action are not fully understood, nowadays this medication is still a widely used material for endodontic purposes due to its high alkalinity and bactericidal effect.[11]

In this case, the attempt to insert the apical plug occurred with an extravasation of calcium hydroxide in the periradicular tissues. However, in the presence of large chronic periapical lesions, deliberate placement of the calcium hydroxide beyond the boundaries of the root canal and in the periradicular tissue has been defended. It can be speculated that there could be a direct effect on epithelial tissues and cystic linings, and thus, it would favor the periapical healing and would stimulate bone repair.[12]

It is known that calcium hydroxide is a soluble medication and that, therefore, the apical barrier formed is not definitive. In addition, calcium hydroxide residues could affect the adhesion of the endodontic sealers or could contribute significantly to the appearance of gaps in the interface dentin/sealer, favoring the colonization of microorganisms. However, the sealer used in this case was the AH Plus. Studies show that the residual calcium hydroxide in the radicular dentin increases the sealing and the quality of the filling.[13] Furthermore, it has been reported that the calcium hydroxide improves the bond strength of AH Plus sealer in radicular dentin.[14]

The calcium hydroxide was used as an intracanal medication for over 1 month for decontamination and to receive the filling material with greater safety. In a study conducted by Damler *et al.*, 2016, the authors showed that the apical barrier formation was induced by calcium hydroxide in 81.81% of the sample with an average formation of 5.33 months.

The quest to search for an ideal material is never ending especially in the field of material sciences. Since the evolution of dentistry, various materials are hypnotized, formulated, and applied both *in vivo* and *in vitro* and standardized to obtain maximum benefit from the material. Till now in the field of material sciences, no ideal material is generated which is considered as the gold standard since all the formulated materials have pros and cons.[15] It is noteworthy that techniques using the apical plug of MTA or revascularization are satisfactory alternatives for cases of incomplete root formation with necrosis;[16] such as the newer bio-ceramic materials, calcium enriched mixture (CEM) cement has emerged, which was first introduced by Asgary *et al.*[17]

However, careful clinical monitoring and radiographic control are crucial in any of the techniques.

Conclusion

This clinical report described the treatment of maxillary central incisor diagnosed with chronic apical periodontitis, and the use of calcium hydroxide as an apical plug to avoid the extravasation of the endodontic obturation. This treatment was presented as a good low-cost option and demonstrated satisfactory results that were evident in a short time.

Acknowledgments

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