

# Apexification without periodic changes of intracanal medicament and MTA apical plug: 5-year follow-up

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## ABSTRACT

**Objective:** The objective of this report was to present a case of apexification in traumatized teeth treated with two different therapies for immature teeth. **Methods:** An 11-year-old male patient was referred to the Dental Trauma Service of the College of Dentistry — Piracicaba (UNICAMP), with enamel dentin fracture in the maxillary central incisors associated with subluxation caused by a bicycle fall 3 years before. The radiographic examination revealed immature teeth. After necrotic pulp had been diagnosed, the treatment plan comprised apexification with intracanal medicament at the right central incisor and MTA apical plug in the left central incisor. The intracanal medicament protocol

was performed with an obturation paste composed of calcium hydroxide, 2% chlorhexidine gel and zinc oxide without periodic changes. The MTA plug sealed the apical third of the root canal while the middle and cervical thirds were sealed with coltosol. **Results:** After an 8-month follow-up, apical closure of both teeth could be observed, without dissolution of intracanal dressing. After a 5-year follow-up, the teeth did not present symptomatology and the periapical lesions were repaired. **Conclusion:** Based on the results of this study it is reasonable to conclude that both apexification therapies may be concluded within a few sessions and may provide clinical success and comfort to the patient.

**Keywords:** Endodontics. Necrotic dental pulp. Tooth root.

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## Introduction

Dental trauma may be considered a world health issue, since it promotes great impact on the quality of life of young people, and generally requires multidisciplinary planning<sup>1</sup>. Its incidence is high mainly among children and adolescents aged between 7 and 10 years old<sup>2</sup>. Considering the occurrence of dental trauma episodes with young people who present developing tooth, the conduct adopted should take into account a treatment that stimulates natural root formation.

When immature teeth require endodontic treatment, the therapy must create conditions for obturation and definitive rehabilitation of the tooth. The most traditional treatment is apexification.<sup>3</sup> This technique includes decontamination of the root canal with chemical-mechanical preparation associated with intracanal dressing, with a view to inducing apical closure of these teeth. The calcified barrier formed at the blunt open apex has been described as cementum-like tissue or osteodentine.<sup>4,5</sup> The intracanal medicament will act as an adjunct to disinfection, stimulating apical closure and preventing or stopping inflammatory resorption.<sup>6</sup> Pastes composed of calcium hydroxide and Mineral Trioxide Aggregate (MTA) are the most widely used to induce the formation of a calcified apical barrier and are highly successful.<sup>7,8,9</sup> Whereas calcium hydroxide must be replaced in the interior of the canal, causing treatment to last longer, apexification may be performed in one or two sessions when an apical plug of MTA is used. The MTA plug creates an apical barrier allowing definitive obturation in little time<sup>10</sup>.

Recently, an alternative to apexification has emerged as a result of a variety of studies and case reports that show promising results of pulp revascularization in necrotic immature teeth.<sup>11,12</sup> Meanwhile, there are situations in which revascularization may not be the first choice of treatment due to the need of rehabilitation with intraradicular retainers and the presence of root resorption. Despite the fact that there are some unsolved issues concerning pulp revascularization, apexification is still considered a well-known and successful procedure with follow-up studies being carried out for a long time.<sup>9,13</sup>

Thus, the aim of this work was to report a case of dental trauma in immature teeth treated with two apexification protocols: calcium hydroxide — not periodically replaced — and MTA apical plug.

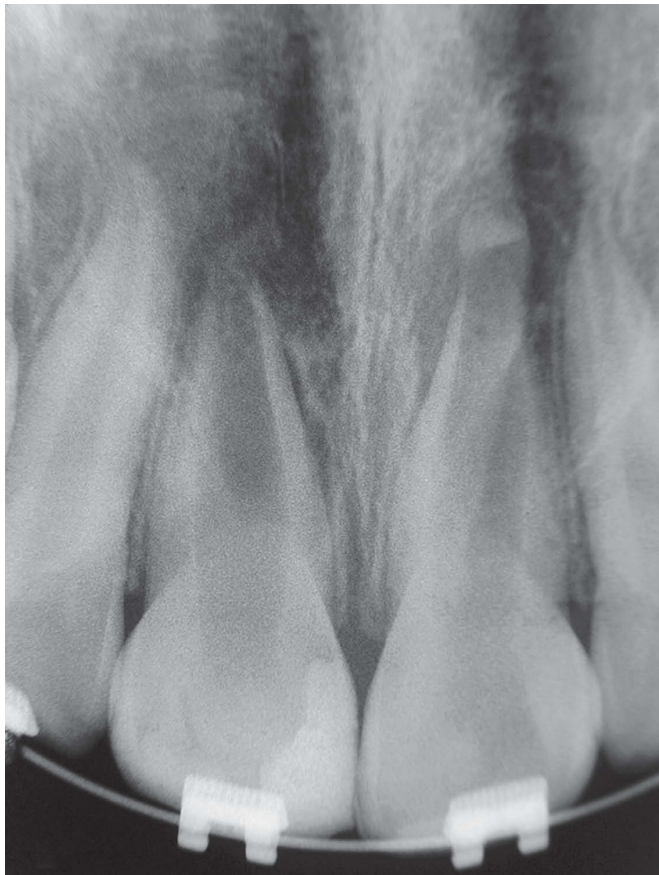
## Case report

An 11-year-old male patient was referred to the Dental Trauma Service of the College of Dentistry — Piracicaba (UNICAMP) due to a bicycle fall happening 3 years before. Dental trauma history and clinical exam revealed enamel dentin fracture in the maxillary central incisors associated with subluxation. The fractured incisors presented adhesive restorations and were subjected to orthodontic treatment. Radiographic examinations revealed immature root canals, absence of root fracture and presence of periapical lesions in both incisors (Fig 1). During the first visit, cold and electric pulp tests showed negative responses for both incisors and the patient reported no pain upon percussion nor palpation.

Based on the negative responses of pulp vitality tests and the presence of radiolucent lesion, treatment planning comprised two apexification protocols: a paste of calcium hydroxide was applied to #11 tooth and it was not periodically replaced during treatment, whereas for #21 tooth, a MTA apical plug was used. The orthodontist was advised not to apply excessive force to the referred teeth before endodontic treatment was finished.

The right central incisor was anesthetized, isolated with rubber dam and accessed by means of diamond burs (KG Sorensen™, Barueri, Brazil) with copious sterile saline solution. The root canal was disinfected with 2% chlorhexidine gel (Endogel, Itapetinga, Brazil), irrigated with sterile saline solution and instrumented by the crown-down technique and manual K-files (Dentsply/ Maillefer, Petrópolis, Rio de Janeiro, Brazil). Thereafter, root canals were dried with absorbent paper cones (Dentsply, Petrópolis, Rio de Janeiro, Brazil) and dressed with intracanal medicament composed of an obturation paste manipulated with calcium hydroxide, 2% chlorhexidine gel and zinc oxide in the proportion of 2:1:2 (Fig 2). This paste remained unchanged, acting as a temporary root canal filling material.

The left central incisor was subjected to the same procedures of access, isolation, decontamination and instrumentation of the right incisor. In order to make the apical plug, the MTA (Angelus™, Londrina, Brazil) was prepared with distilled water, inserted into the apical third of the root canal with condensers (Konne™, Belo Horizonte, Brazil) and radiographically checked (Fig 3).

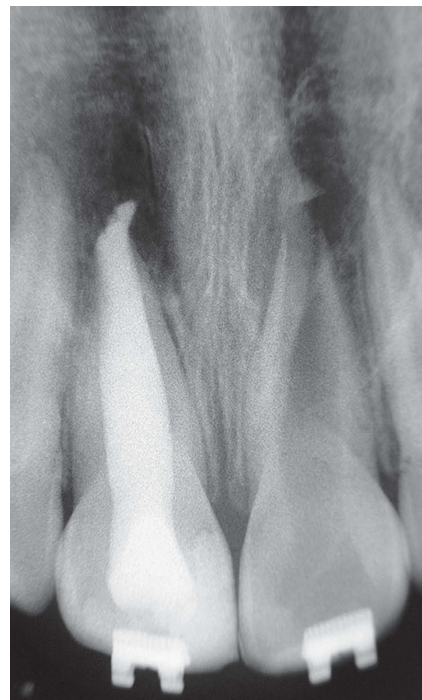
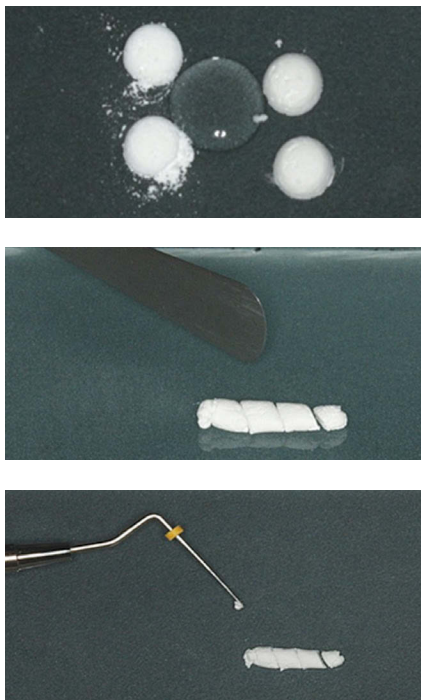


**Figure 1.** Initial periapical radiograph revealing immature teeth and periapical lesions associated to right and left central incisors.

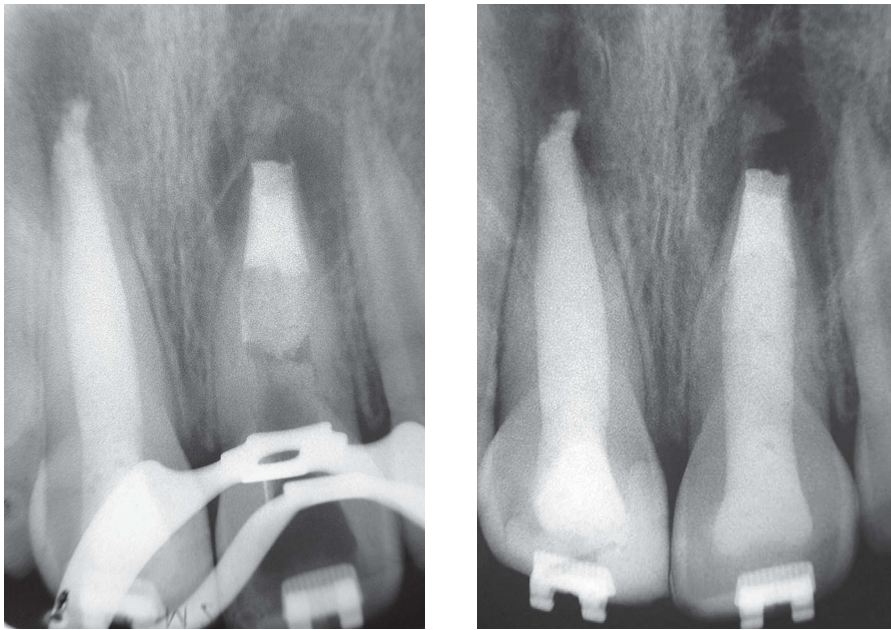
As for obturation of the middle and cervical thirds, coltosol (Coltene/Whaledent™, New Jersey, USA) increments were inserted, followed by fixed coronary restoration with composite resin (Filtek 3M Espe™, Sumaré, Brazil) (Fig 3). After a seven-month follow-up, radiographic examination revealed deposition of mineralized tissue in the apical region of the incisors, confirming the occurrence of apexification. In addition, reduction in periapical radiolucency and absence of root resorption (Fig. 4). After eight months, the obturation paste of the right central incisor was removed, and the tooth was filled with gutta-percha and Endomethasone cement (Septodont™, Paris, France). The left incisor remained with the MTA apical plug and obturation. After five years, the teeth presented neither symptomatology, nor root resorption, proving apexification therapy to be successful when performed with different techniques at the same patient, suggesting that both treatments may be equally efficient.

## Discussion

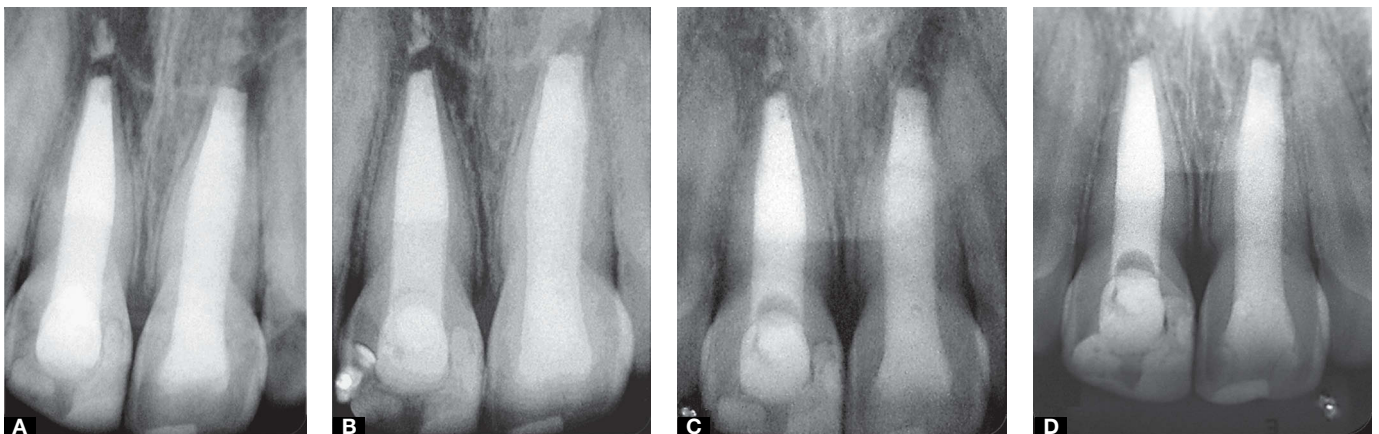
The prevalence of pulp necrosis in immature teeth affected by dental luxations is not high (13.6%) when compared to the prevalence of necrosis in teeth with completely formed apex (63.7%)<sup>2</sup>.



**Figure 2.** Obturation paste manipulated with calcium hydroxide, 2% chlorhexidine gel and zinc oxide in the proportion of 2:1:2. Radiographic exam after insertion of obturation paste.



**Figure 3.** MTA apical plug production.



**Figure 4.** **A)** 6-month follow-up. **B)** 12-month follow-up. **C)** 4-year follow-up. **D)** 5-year follow-up.

Immature teeth with pulp necrosis require treatments which minimize anatomical difficulties presented by these teeth. Some of these treatments include apexification with periodic changes of intracanal medicament, apexification with MTA apical plug and, recently, pulp revascularization.<sup>14,15</sup> Two of these options were employed in the present case, which proved to be efficient to repair the periapical region and stimulate apical closure.

In the present report, the patient did not seek dental treatment soon after trauma occurred, and such condition increases the probability of sequelae such as root resorption and pulp necrosis.<sup>2,16</sup>

The evaluated teeth presented no root resorption, which may be explained not only by the effective action of the obturation paste associated with an appropriated coronal sealing that prevented bacteria leakage through dentinal tubules, but also by the fact that the type of trauma was not considered severe.

Many therapeutic protocols have been proposed for the treatment of immature traumatized teeth with the aim of achieving long-term clinical and radiographic success. Previous studies that employed the same obturation paste also demonstrated apical closure and remission of clinical signals and symptoms, besides absence of external inflammatory root resorption.<sup>17,18,19</sup>

In addition, filling the root canal with this paste promoted satisfactory apical sealing, preventing bacterial infiltration and percolation to the periapical region, ensuring good conditions for appropriated repair with deposition of mineralized tissue. In vitro studies carried out with this paste have also demonstrated that this association presents antimicrobial activity and capacity of maintaining root canal pH alkaline.<sup>20,21</sup>

Apexification therapy performed with periodic changes of intracanal medicament may have some disadvantages such as the need for multiple sessions for changes of the intracanal medicament and higher costs. Moreover, some researchers have reported an increase in the susceptibility to root fracture in these teeth.<sup>22,23</sup> In an attempt to improve the limitations of traditional apexification, a therapy including the production of an apical MTA barrier in the open apex tooth has emerged with the advantage of being possible to conclude the treatment in single or double visits, and presenting the same probability of success of conventional apexification.<sup>9</sup> This result was also observed in the present case. Studies have compared the action of calcium hydroxide and MTA, and some of them suggest that MTA may release less calcium ions and hydroxyl, which would reduce the inductive action of apical development.<sup>24,25</sup> In addition, other authors believe that MTA may calcify root canal, which would hinder future intracanal procedures. Furthermore, the high costs and the possibility of promoting crown discoloration are some other

disadvantages of MTA treatment<sup>26</sup>. In both teeth reported, no differences were observed in either one of both therapies, which proved to be clinically and radiographically successful, without crown discoloration. Many studies suggest that definitive obturation with gutta-percha and cement should be performed after apical closure induced by calcium hydroxide.<sup>14</sup> However, it has been proposed that this obturation paste composed of calcium hydroxide, 2% chlorhexidine gel and zinc oxide may be capable of promoting appropriate sealing at the root canal, eliminating the need for obturation with gutta-percha.<sup>17,18,19</sup> The cases presented are in accordance with this assertion, since they showed favorable prognosis at clinical and radiographic follow-up. In addition, no paste dissolution was observed even after months. Nevertheless, further studies are necessary to demonstrate clinical and radiographic results with longer follow-ups.

## Conclusions

Using the obturation paste composed of 2% chlorhexidine gel, calcium hydroxide and zinc oxide without periodic changes, promoted satisfactory clinical and radiographic results for the traumatized teeth. The apexification procedure carried out with this paste demonstrated similar results to the MTA apical plug procedure, showing advantages such as lower costs and decrease in chairtime. Thus, this obturation paste represents a promising alternative to the treatment of traumatized teeth, especially in immature teeth.

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