Suggesting a new therapeutic protocol for traumatized permanent teeth: Case report

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ABSTRACT

Introduction: The case reported herein consists of two teeth of one single patient, initially immobilized with a semi-rigid retainer used for 15 days without endodontic intervention. **Objective:** The aim of this article is to report a case of two teeth with extrusive luxation treated with a filling paste of calcium hydroxide, 2% chlorhexidine gel and zinc oxide. **Methods:** After a one-month follow-up, patient's teeth did not present evidence of pulp vitality. Radiographic examination revealed signs of external resorption. Endodontic treatment was carried out in association with a new treatment protocol using intracanal dressing applied in one single session and remaining in the root canal for four years. **Results:** The filling paste remained in the root canal for 24 months without being replaced. The case presented improvements in periapical lesions without inflammatory resorption. **Conclusion:** The filling paste proves to be successful and effective in treating traumatized teeth with root resorption.

Keywords: Endodontics. Calcium hydroxide. Tooth socket. Extrusive luxation. Dental trauma. Chlorhexidine gel. Zinc oxide.

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Introduction

There is a high incidence of dental trauma in the general population. It may occur in adults and children, but it is more common among children and young adults. Dental trauma is mainly caused by fall, collision, bicycle or car accidents and sports practice, all of which may lead to a wide variety of dental trauma.[1-4] A total of 85.39% of incisor trauma occurs probably due to their positioning in the arch.[5,6]

Traumatic injury is classified under a variety of names, among which luxation is the most common. It includes trauma of tooth displaced from its original position, in which case it is classified according to the direction in which the tooth has been displaced, namely: concussion, subluxation, extrusive luxation, lateral luxation, intrusive luxation and avulsion.[7,8] Damages caused by trauma not only affect hard tissues and dental pulp, but also affect supporting tissues alone or in combination. In extreme cases, trauma may lead to tooth loss.[6] Extrusive luxation is the partial displacement of a tooth, causing it to come out of the socket. According to Andreasen et al,[9,10] it accounts for 64% of dental trauma cases. Complications arising from this type of trauma may occur weeks or years after the accident.[11]

Calcification, pulp necrosis and root resorption are the most common sequelae of trauma.[7,12] The latter has the worst prognosis[13,14] and, according to the American Association of Endodontics,[15] it is associated with physiological and pathological processes that result in dentin, cementum and alveolar bone loss. Additionally, it may be classified as inflammatory or replacement resorption.[16]

Several authors[17-20] assert that extrusive luxation may be treated by repositioning extruded incisors and using a semi-rigid immobilization, both of which do not interfere in occlusion or function. Immobilization must be kept for approximately 15 days, according to the individual characteristics of each case. Retention is performed with orthodontic wire and light-cured resin and it aims at regenerating periodontal fibers. Also, it is extremely important that the clinician perform patient's clinical as well as radiographic follow-up, as cases of pulp necrosis and inflammatory root resorption require endodontic therapy.

Endodontic treatment of reimplanted teeth require the use of intracanal dressing to supplement disinfection and restrain or ease the inflammatory process of resorption. The procedure most commonly used before root canal filling is the use of calcium hydroxide periodically changed and associated with different vehicles. This intracanal dressing is used for having excellent antimicrobial activity and inhibiting the action of cells involved in root resorption.[21-31]

A new therapy associating calcium hydroxide, 2% chlorhexidine gel and zinc oxide has been recently proposed for treatment of avulsed teeth.[32,33,34] The combination of these substances results in a provisional filling paste that remains in the root canal for a long period of time, thereby eliminating the need for restorative procedures and yielding satisfactory results,[32,35,36] except for cases of replacement resorption which are a continuous process.[32] This filling paste provides the patient with comfort, requires less visits to the dentist, and proves less expensive as it does not need to be replaced. In cases of incomplete root formation, it promotes apical closure and relieves clinical signs and symptoms of traumatized teeth for a period of 9 months.[33] Furthermore, it promotes periapical repair in teeth with inflammatory root resorption.[33] Such properties are explained by its high capacity of diffusing throughout the root dentin, inhibiting bacterial growth in the outer root surfaces[37,38] and, therefore, yielding satisfactory results.

Thus, the aim of this article is to report a case of two teeth with extrusive luxation treated with a filling paste of calcium hydroxide, 2% chlorhexidine gel and zinc oxide.

A case report

A 17-year-old male patient sought the Service of Dental Trauma at the School of Dentistry, Piracicaba (FOP-UNICAMP) with dental history of trauma in teeth #11 and #21. Emergency assistance was provided at the Santa Casa hospital of Limeira/SP where extrusive luxation of teeth #11 and #21 was diagnosed. Dental trauma occurred as a result of sports practice. A semi-rigid retainer was installed and kept for 15 days. Subsequently, the patient was referred to FOP-UNICAMP for further treatment.

He sought the services of FOP-UNICAMP a month after the trauma had occurred. His initial clinical and radiographic exams revealed teeth #11 and #21 with no pulp vitality, pain at vertical/horizontal percussion or palpation. Periapical radiograph (Fig 1) revealed complete root formation, external root resorption and

periapical lesion of traumatized teeth. Since it was a case of pulp necrosis, endodontic treatment was recommended and carried out with a putty paste made of calcium hydroxide associated with 2% chlorhexidine gel and zinc oxide (2:1:2).

After crown opening and complete isolation, the septic-toxic medication was neutralized and biomechanical preparation of the crown-apex was carried out with Gates Gliden bur #5,4,3 (Dentsply/Maillefer, Ballaigues, Switzerland) with a view to decontaminating the cervical and middle third of teeth #11 and #21. Odontometry was performed with an electronic apical locator (Novapex, Forum Technologies, RishonLeZion, Israel). Root canals underwent manual instrumentation to their working length with #45 files (Dentsply/Maillefer, Ballaigues, Switzerland). During the instrumentation procedure, 2% chlorhexidine gel (Endogel, Essencial Pharma, Itapetininga/MG, Brazil) was inserted into the root canal at each change of instrument, followed by irrigation with 5 ml of saline solution.

Smear layer was removed by irrigation with 3 ml of 17% EDTA for 3 minutes, followed by final irrigation with saline solution. Root canals were dried with absorbent paper points (Konne Indústria e Comércio de Materiais Odontológicos Ltda., Belo Horizonte/MG, Brazil) and filled with a paste of calcium hydroxide P.A. (Biodinâmica Quim. e Farm. Ltda., Ibiporã/PR, Brazil) associated with 2% chlorhexidine gel (Endogel, Essencial Pharma, Itapetininga/MG, Brazil) and zinc oxide (S.S. White Artigos Dentários, Ltda., Rio de Janeiro/RJ, Brazil). The paste was coltosol or putty-consistent and was prepared in a 2:1:2 ratio. It was inserted by increments with medium and fine medium vertical condenser (KonneIndústria e Comércio de Materiais Odontológicos Ltda., Brazil) throughout the entire root canal. Afterwards, a periapical radiograph was taken to ensure that the filling procedure had been properly performed. Root canals were then sealed with coltosol (Vigodent S/A Indústria e Comércio, Rio de Janeiro/RJ, Brazil) and composite resin (Filtek Z350, 3M Dental Products, Saint Paul, USA) (Fig 2).

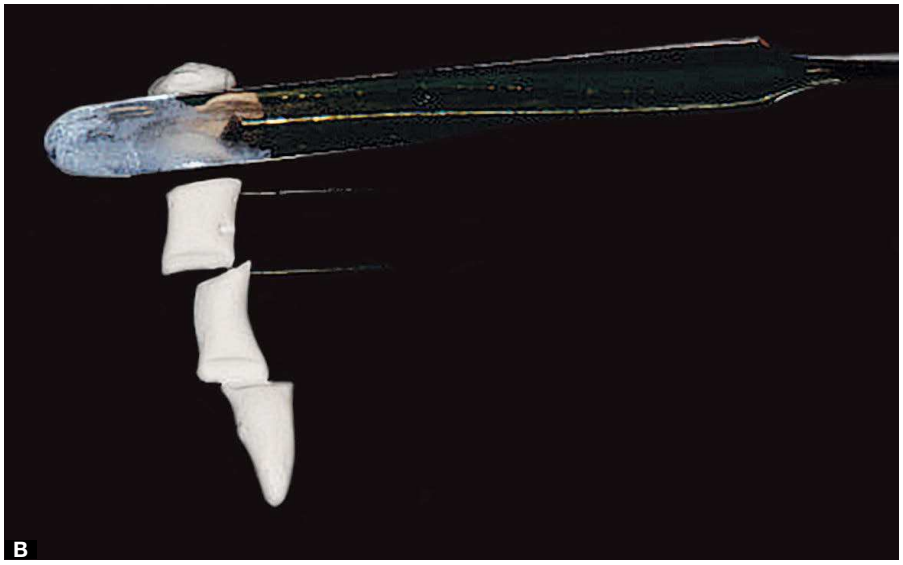
Every 3 months, the patient went back to the university for clinical and radiographic follow-up sessions that revealed the presence of intracanal medication/paste completely filling the canal, thus eliminating the need for removal. After 12 months of treatment, the clinician observed remission of periapical lesion (Fig 3A). After 24 months of follow-up, exams revealed the intracanal medication filling the entire root canal, thus eliminating the need for removal. Periapical lesion a remission and interruption of inflammatory resorption were observed (Fig 3B).

Discussion

Endodontic treatment is a predictable way of preserving a tooth in cases of dental trauma. Treatment success and high-quality immediate restoration aim at restoring patient's esthetics and function for years. Thus, endodontic treatment is considered a safe and feasible option.[39]

Cases in need of endodontic treatment due to trauma have led to different therapeutic protocols used to minimize potential sequelae. The use of sodium hydroxide,[40] polymyxin B-Otosporin,[41] Lysozymes,[42] formocresol,[43] chlorhexidine[44,45,46] and calcium hydroxide, in different associations[47,48], has been reported.

Figure 1. Initial radiograph 30 days after trauma and after removal of semi-rigid retainer.



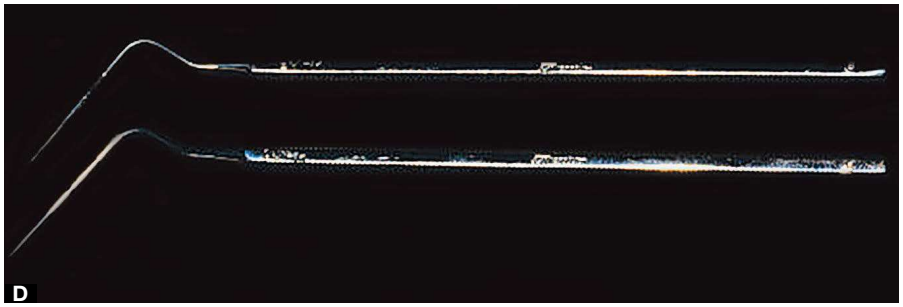
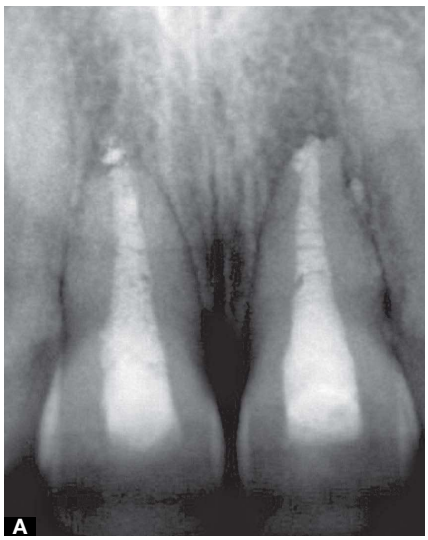


Figure 2. A) Calcium hydroxide P.A; 2% chlorhexidine gel (Endogel) and zinc oxide used as intracanal dressing in a 2:1:2 ratio. **B**) Final consistency. **C**) Final radiograph revealing the quality of insertion of the intracanal dressing. **D**) Vertical condenser used to insert the intracanal dressing.



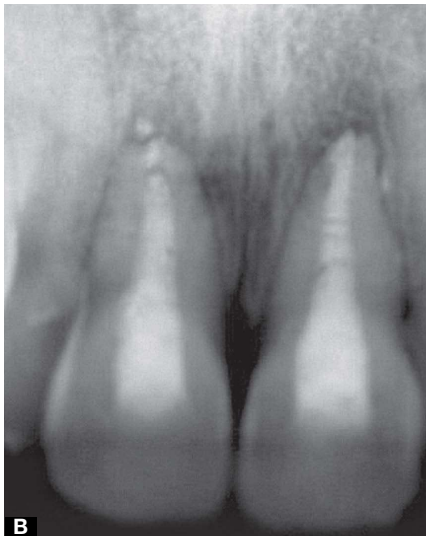


Figure 3. A) 12-month follow-up radiograph. **B**) 24-month follow-up radiograph.

Some authors[24,49,50] recommend that calcium hydroxide be used as intracanal dressing applied with periodic changes and at different time intervals, given that it is considered the most effective intracanal medication of all.[51,52,53] According to Pacios et al,[54] calcium hydroxide yields satisfactory clinical results and may be used in association with different vehicles, for instance, distilled water, chlorhexidine, propylene glycol, anaesthetic solution, PMCC and PMCC + propylene glycol. However, this case report did not implement periodic changes and, for this reason, disagrees with the aforementioned studies. Conversely, it corroborates Felippe et al[35] who asserts that there is no need for applying calcium hydroxide past with periodic changes in teeth with incomplete root formation and incomplete root canal systems.

Even though calcium hydroxide is the most used intracanal medication, it cannot be considered as universal, given that it is not effective against all types of bacteria present in root canal systems.[55] Since chlorhexidine presents highly satisfactory antimicrobial properties, it is important that it be used in association with calcium hydroxide. Calcium hydroxide associated with chlorhexidine aims at enhancing the antimicrobial properties of the former, keeping its biological characteristics as well as its mechanisms of physical barrier.[47] Zinc oxide is a yellowish, white, thin, odorless, amorphous, insoluble in water or ethanol, radiopaque and slightly antiseptic powder[56] that may be present in endodontic cement[57] and gutta-percha cones.[58]

Based on the aforementioned benefits, this case report aimed at assessing the results yielded by a therapeutic protocol using the three elements together: calcium hydroxide, 2% chlorhexidine gel and zinc oxide mixed together to form a coltosol-consistent paste that did not dissolve and could be applied in one single session, thus eliminating the need for periodic changes during trimestrial control. The outcomes of this research corroborate those of previous studies.[32,33,59,60,61]

Due to the fact that the intracanal paste used during the procedure did not dissolve, as revealed by radiographic exams, it is suggested that complete root canal filling was guaranteed by zinc oxide, since calcium hydroxide and chlorhexidine gel had already been dissolved.[32,59] Similar results were yielded by our study in which a 24-month follow-up was performed. During this period, the intracanal dressing did not have to be periodically changed; periapical repair was achieved and root resorption was stabilized, thereby proving the effectiveness of the medication in the long run and eliminating the need for replacement inside the root canal. Gomes et al[31] and Souza-Filho et al[62] also conducted studies in which the intracanal dressing was not periodically replaced. The authors observed that during the follow-up phase, zinc oxide possibly functions as an inert material that provides root canal sealing and, as a consequence, prevents contamination and allows periapical repair. In addition to that, they concluded that the medication can remain inside the root canal for a period not greater than 4 years. Those results disagree with the studies by Moorer and Genet[63] who suggested that additional researches be conducted to further investigate the biological properties of zinc oxide, given that these authors do not consider it as an inert material.

The association of calcium hydroxide, 2% chlorhexidine gel and zinc oxide (2:1:2 ratio) was previously studied.[37,38,47,62,64,65] These *in vitro* studies demonstrated the antimicrobial action of the mixture, as well as its capacity of keeping an alkaline pH and its proper consistency when inserted into the root canal. Furthermore, the association of calcium hydroxide, 2% chlorhexidine gel and zinc oxide proves to have a high diffusion capacity in the root dentin, thus causing inhibition of bacterial growth in outer root surfaces — as previously mentioned — which may have favored root resorption control.

Conclusion

Based on the results of this study and the findings of the literature, it is reasonable to conclude that:

- The filling paste of calcium hydroxide, 2% chlorhexidine gel and zinc oxide (2:1:2 ratio) proves effective in treating traumatized permanent teeth with complete root formation and extrusive luxation. This intracanal dressing stimulates periapical lesion repair and interruption of inflammatory resorption.
- The technique allows treatment to be performed within one single session, as the intracanal medication remains active afterwards. Additionally, it proves advantageous for the patient due to being inexpensive and having shorter chair time.
- Due to having a cortisol-consistency, the provisional filling paste of calcium hydroxide, 2% chlorhexidine gel and zinc oxide (2:1:2 ratio) is easily inserted into the root canal. Additionally, it favors radiographic visualization.

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