

Chronic pulp canal obliteration after dental trauma and orthodontic treatment: a case report

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ABSTRACT

Introduction: To describe the endodontic treatment of lower incisors with pulp canal obliteration (PCO) and apical periodontitis after dental trauma and long-term orthodontic treatment. **Methods:** A female 22-year-old patient sought dental care at the endodontic centre reporting to have suffered a dental trauma in the antero-inferior region, followed by a 5-year orthodontic treatment. Two years after the conclusion of an orthodontic treatment, radiolucent lesions involving the lower central incisors were observed and endodontic treatment was unsuccessfully initiated by a general practitioner, who could not locate the root canals due to PCO. The endodontic treatment was conducted and the root canals were located by using an optical microscope at 25x magnification. One-quarter clockwise and counter-clockwise insertion, retraction and rotation movements, all common to pre-curved #10 K-files, were performed until reaching the

apical patency. Instrumentation of the root canals were carried out by using the pre-enlargement technique, with a calcium hydroxide, paramonochlorophenol and glycerine-based paste being used as intracanal medication for 15 days, followed by thermoplastified obturation and restoration with photopolymerisable resin. **Results:** After 12 months, the patient showed no signs or symptoms and the periradicular lesions of the lower central incisors were completely healed. **Conclusions:** The PCO caused by the association of dental trauma with long-term orthodontic treatment may have evolved into pulp necrosis and consequently to apical periodontitis. A protocol of localization, exploration, cleaning and shaping, plus use of intracanal medication and root canal filling, prevented iatrogenic complications and allowed the case to be successful.

Keywords: Dental pulp calcification. Orthodontics, corrective. Tooth injuries.

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Introduction

Traumatized teeth can have sequels due to the pulp response to trauma. These sequels are the result of the impaired blood flow, being directly related to the type of trauma and developmental stage of the root at the moment of lesion.^{1,2} Pulp events after trauma include the following: living pulp, pulp canal obliteration (PCO) and necrosis.³ The PCO has an incidence ranging from 4% to 22% in all traumatized teeth,⁴ which is related to moderate traumas such as subluxation and concussion,^{5,6} occurring more frequently in teeth with incomplete root formation. In cases of more severe traumas such as extrusion, intrusion and lateral luxation, pulp necrosis is more likely to occur, particularly in teeth with incomplete root development.⁶⁻⁹

Orthodontic movement of previously traumatized teeth represents a challenge.¹⁰ Increased overjet is considered a risk factor for dental trauma in addition to being one of the main indications for orthodontic treatment. Therefore, because of the high incidence of trauma in incisor teeth among patients with increased overjet,¹¹ these individuals are commonly submitted to orthodontic procedures.¹¹ According to the literature, traumatized teeth with PCO are more likely to have pulp necrosis during the final stages of orthodontic treatment because obliteration and decreased pulp content reduce the capacity of teeth to compensate the decrease blood flow occurring during orthodontic treatment.^{10,11,12} Therefore, these teeth should be radiographically monitored and orthodontic treatment should also be reduced or even avoided.⁹

Once the pulp necrosis is diagnosed, endodontic treatment should be carried out. However, the root canal space becomes reduced due to PCO, making it difficult to locate and explore the root canal and thus increasing the risk of deviation and perforation.^{13,14} The objective of the present case report was to describe a PCO and periapical lesion. These teeth had been traumatized before being submitted to long-term orthodontic treatment.

Case report

A 22-year-old female patient sought dental care at the endodontic center of the local dental faculty reporting to have suffered a fall when she was practicing artistic gymnastic exercises, which happened 7 years earlier. According to the patient, her chin skin had been injured due to the trauma and then sutured. After some months, the patient underwent orthodontic treatment for esthetic reasons and was informed that no clinical procedure should be performed before completion of the orthodontic treatment, which lasted 5 years. This suggests that no radiographic sign of periapical lesion after the trauma was identified. A retainer was placed on the lingual face of the lower incisors after conclusion of the orthodontic treatment. After two years, a routine radiographic exam revealed a radiolucent image involving teeth 31 and 41 (Fig 1A). A general practitioner removed the retainer and began the endodontic treatment, but no root canal was located due to obliteration.

During the clinical exam, it was found that the crowns of the lower central incisors were sealed with temporary sealing material and the teeth were sensitive to percussion, but there was no pain on palpation. The sensitivity test response was negative in both teeth. Radiographic exam revealed partial pulp obliteration in both teeth as well as radiolucent images associated with their apical roots. Moreover, a radiographic image was suggestive of deviation from the original root canal trajectory in the coronal portion of the lower central incisor on the left side (Fig 1B). It was recommended, therefore, that endodontic treatment should be performed by a specialist.

An optical microscope with 25x magnification was used to increase the field of view and help to locate the root canals in association with bubble test and color differentiation between normal and calcified dentine. Based on the bubble test, small bubbles are released from the root canal entry due to oxygenation when the pulp tissue is in contact with 5.25% sodium hypochlorite.^{15,16} Location, exploration and working length (WL = 15.5 mm) of the right lower central incisor were

initially performed by using a #10 K-file (Fig 2A). During exploration of the mandibular canal of the left central incisor, it was observed that the original pathway had been mesio-buccally deviated (Fig 2B). Therefore, a Gates-Glidden bur #2 was used lingually and distally in order to improve the initial coronal preparation before the deviation point. This procedure allowed the coronal third to be enlarged and the original trajectory re-directed. A curved #10 K-file was inserted into the root canal and whenever there was any resistance, the file was pulled back and rotated one-quarter to the right to advance and surpass the obliteration. If there was more resistance, the file was again pulled back and rotated one-quarter to the left in order to find the original pathway. These movements were repeated until the file could advance towards the apical patency (Fig 2C). The working length was established at 17 mm.

The root canal was manually shaped by using Kerr files (Dentsply Maillefer, Tulsa, USA) according to the pre-enlargement technique. The apical stop was performed in both teeth by using a #35 K-file along

the working length. The irrigating solution used during the cleaning and shaping procedures was 5.25% sodium hypochlorite. After completing the shaping, 17% EDTA was used for 3 minutes to remove the smear layer. Next, the root canals were irrigated again with 5.25% sodium hypochlorite, neutralized with 5 ml of saline solution, dried and filled with calcium hydroxide paste mixed with paramonochlorophenol and glycerine as intracanal medication. After 15 days, no signs or symptoms were observed and the root canals were filled by using the technique of vertical condensation of warm gutta-percha¹⁷ and pulp canal sealer cement (SybronEndo; Sybron Dental Specialties Inc, Orange, CA, USA) (Fig 3A). Next, the teeth were restored with photopolymerisable resin (Filtek Z350 XT 3M ESPE, Brazil). After 12 months, the patient had no symptom and the radiographic exam showed complete regression of the radiolucent images associated with the apices of the lower central incisors, thus indicating a repair of the periradicular tissues (Fig 3B).

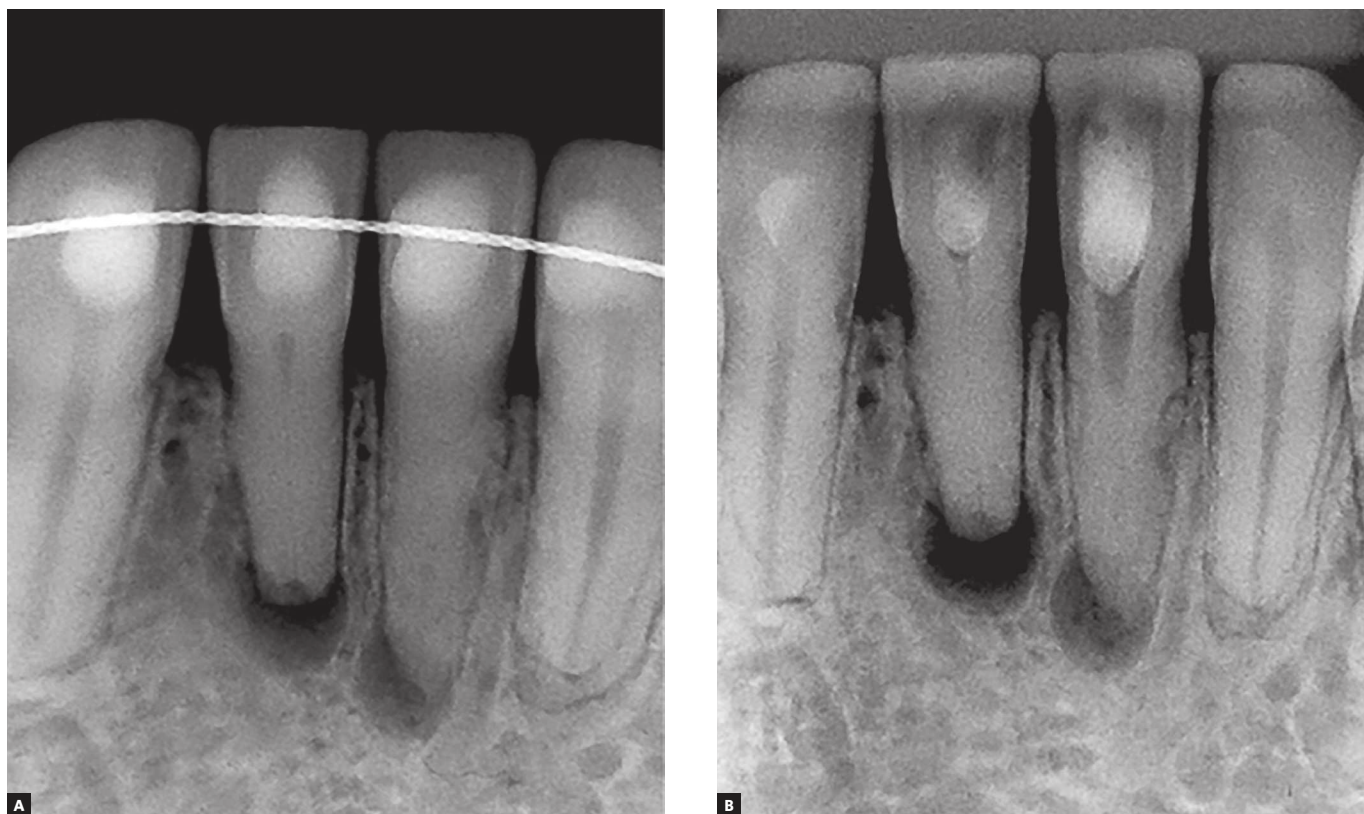


Figure 1. Radiographic analysis of the case. **A)** Radiography obtained before the first intervention. **B)** Initial radiography obtained at the time of the first appointment at the endodontic graduate clinic.

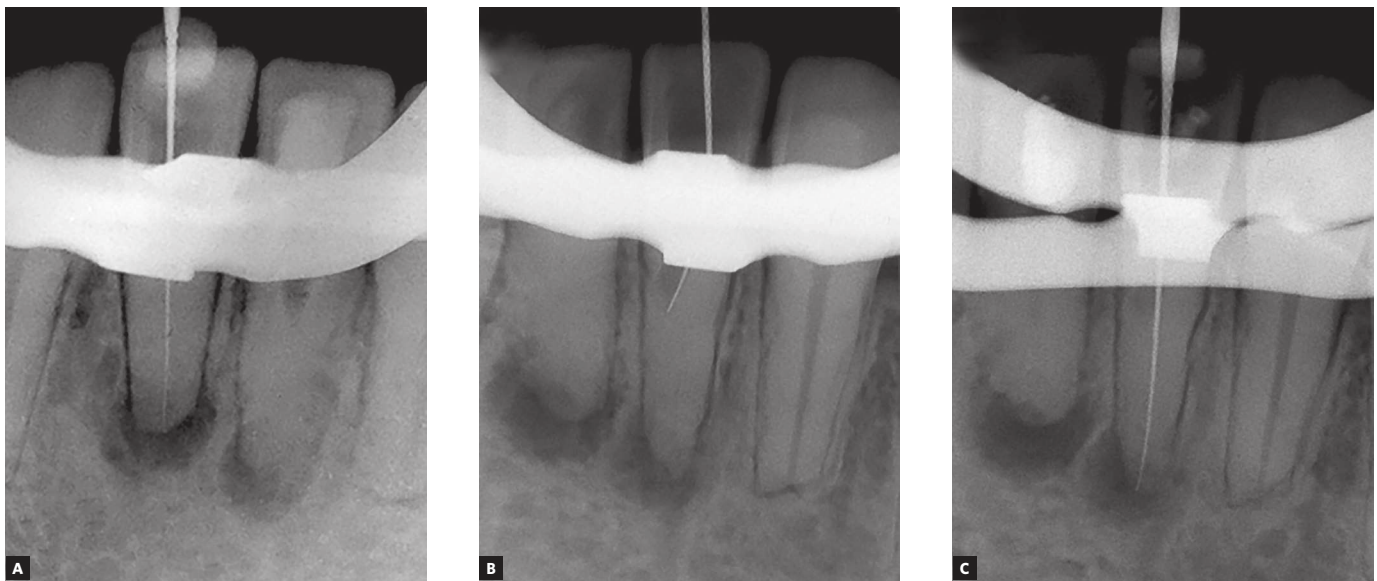


Figure 2. Radiographic analysis of the case. **A)** Establishment of the working length for the right mandibular central incisor. **B)** Original path of the left mandibular central incisor deviated towards the mesiobuccal direction. **C)** Establishment of the working length for the left mandibular central incisor.

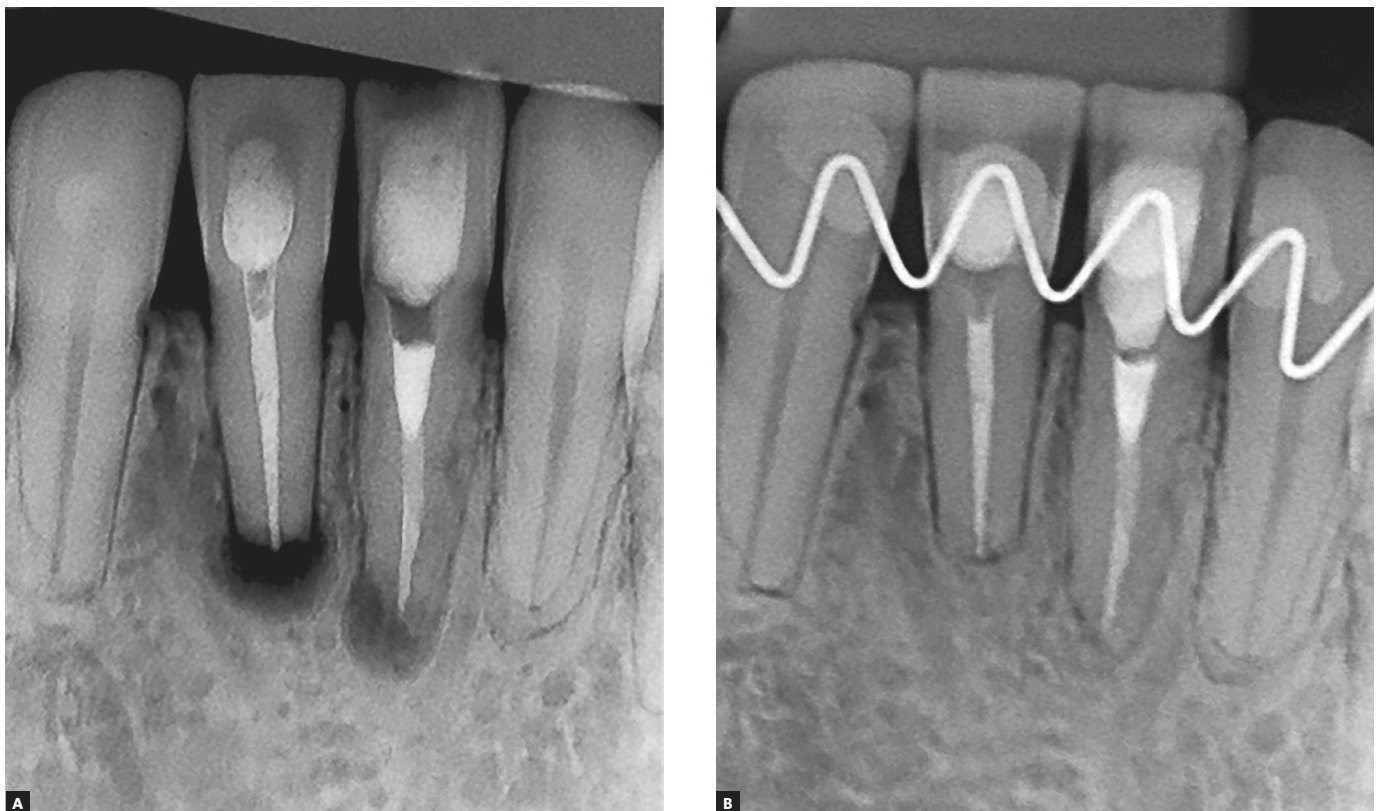


Figure 3. Radiographic analysis of the case. **A)** Final radiograph. **B)** Follow-up of 12 months.

Discussion

The dental trauma described in the present case was probably a subluxation, which resulted in PCO of the root canal. According to the literature, the highest incidence of pulp necrosis is associated with severe traumatic injuries.^{3,5,7,8} PCO can be clinically diagnosed in traumatized teeth within three months following the dental trauma, but it is usually diagnosed after one year.^{1,3,6,7,8,13} In our case report, the endodontic treatment was initiated in the same year in which the trauma occurred, suggesting that pulp canal obliteration had not been diagnosed and therefore the patient was instructed to avoid any treatment. Had the pulp canal obliteration been diagnosed and followed up during and after the orthodontic treatment, the condition described here and the risks of endodontic treatment could have been minimized. According to Bauss,¹⁰ it should be emphasized that orthodontic movement after dental trauma may be accounted for the progression of PCO into necrosis.

Endodontic therapy in teeth with partial or total PCO is difficult or even impossible.⁴ Consequently, there is no consensus on whether endodontic intervention should be performed soon after the obliteration is diagnosed or only after other complications have occurred, such as symptoms or presence of apical periodontitis.^{4,14} Some authors^{9,14,18} suggest that endodontic treatment is unnecessary when there is no evidence of apical periodontitis because of the low incidence of pulp necrosis in teeth with PCO, which ranges from 7% to 16%.⁴ Others recommend that endodontic treatment should be initiated soon after the PCO is diagnosed, since this condition can increase the risk of pulp necrosis and infection due to the impaired blood flow.^{19,20} In this sense, the follow-up of traumatized teeth should be performed, especially those with pulp canal obliteration, in order to allow for endodontic intervention before complete canal obliteration. Oginni et al⁶ recommend endodontic intervention in cases of sensitivity to percussion, even without radiographic evidence of apical lesions. In addition, endodontic treatment is recommended when color difference in one tooth with PCO affects dental esthetics and the tooth does not respond to external bleaching procedures.²¹

The difficulty in locating an obliterated root canal, in association with the practitioner's inexperience, leads to iatrogenic complications (e.g. deviation from the original trajectory of the root canal and perforation) as any minor mistake regarding the pathway towards the cavity can result in major consequences.⁴ It is difficult to locate obliterated root canals in lower incisors because these teeth have a complex root anatomy and small size.¹³ In our case report, a mesio-buccally deviated pathway almost resulted in root perforation. The use of optical microscope for locating obliterated canals is recognized and approved in the literature.^{16,22,23} In our case report, it increased the field of view so that a slight color difference could be noticed between the canal wall dentine and the darker dentine deposited within the canal.¹⁵ In addition, optical microscope also allowed for better visualization of the bubbles emerging from the canal due to oxygenation of the pulp tissue by sodium hypochlorite. Therefore, both knowledge on root anatomy and the practitioner's skills allowed the root canal pathway to be located and explored.^{15,16}

According to McCabe et al,⁴ there are a few studies reporting endodontic results in teeth with PCO. Our case report showed repair of periradicular tissues following adequate protocol of cleaning, instrumentation and filling. The successful endodontic treatment are related to the use of calcium hydroxide in association with camphorated paramonochlorophenol as intracanal medication, which enhances the capacity of elimination of resistant bacteria surviving the chemo-mechanical preparation.²⁴

In conclusion, the PCO caused by the association of dental trauma with long-term orthodontic treatment may have evolved into pulp necrosis and apical periodontitis as a result. Therefore, it is evidently necessary to follow up clinically and radiographically those teeth with history of trauma due to the possibility of sequels, such as pulp canal obliteration. However, a prophylactic endodontic intervention can prevent possible complications in teeth with PCO submitted to orthodontic treatment. The present case report suggests that a protocol for localization, exploration and instrumentation should be followed in order to avoid iatrogenic events, such as deviation from the original canal pathway and perforation of the root.

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