

# Pulp Canal Calcification Associated with Periapical Lesion as Dental Trauma Sequelae – Clinical-surgical Treatment

Michelle Zardin Furich, Cristina Braga Xavier, Luis Eduardo Rilling Nova Cruz<sup>1</sup>, Josué Martos<sup>1</sup>

Department of Oral and Maxillofacial Surgery, School of Dentistry, Federal University of Pelotas, <sup>1</sup>Department of Semiology and Clinics, Faculty of Dentistry, University Federal of Pelotas, Pelotas, RS, Brazil

## Abstract

The objective of this report is to describe a surgical treatment in a traumatized tooth presenting pulp canal calcification (PCC) and periapical pathology. Three months after a patient had suffered injuries by luxation in the right central mandibular incisor, complete calcification of root canals was radiographically observed in addition to a radiographic image compatible with apical periodontitis. The chosen treatment was endodontic surgery and apical root sealing with mineral trioxide aggregate endodontic cement. After 4 months, the tooth showed complete apical repair. We concluded that the endodontic surgery is a procedure specifically indicated for cases of impossibility of conventional endodontic treatment, as in teeth with PCC.

**Keywords:** Apical surgery, dental trauma, pulp canal calcification

## INTRODUCTION

Traumatic injuries in young permanent teeth affect approximately 20%–30% of permanent teeth and crown fractures/luxation is the most frequently observed.<sup>[1]</sup> The highest incidence of anterior dental trauma occurs between 7 and 12 years old, and dental luxation can be considered like a serious occurrence, which makes the prognosis dependent on the actions taken immediately after the trauma.

The natural evolution of the dental trauma by luxation can be the occurrence of pulp healing, pulp canal calcification (PCC), or pulp necrosis, depending on the energy of the trauma and the different types of luxation.<sup>[2]</sup> PCC is sequelae of traumatized teeth and is reported to develop more often in teeth that suffered concussion and luxation injuries,<sup>[3–5]</sup> or even in avulsed and reimplanted teeth.<sup>[6]</sup>

Some studies suggest that against a possible evolution of PCC after a trauma, a prophylactic endodontic intervention should be adopted.<sup>[4]</sup> The only definitive criteria for a surgical or endodontic intervention in pulp calcification obliteration should be the appearance of periapical rarefaction, radiographically evident.<sup>[7,8]</sup>

Pulp canal obliteration is a frequent finding associated with pulpal revascularization after traumatic dental injuries that

affect the pulpal neurovascular supply.<sup>[9]</sup> The process of PCC is more complex than a simple mineralization of the pulp, where a particular response of the cells results in an abnormal and reparative tissue.<sup>[10]</sup>

Interestingly when calcific metamorphosis of the pulp is diagnosed during orthodontic treatment, its etiology should be assigned to concussion dental trauma, rather than to orthodontic treatment.<sup>[11]</sup> Dental trauma to the permanent dentition can lead to clinical complications and its management is a great challenge.<sup>[12]</sup>

Clinical management of pulpal obliteration is still considered controversial. One established protocol for managing teeth with pulp canal obliteration is based on the signs and symptoms properly organized on a treatment decision flowchart.<sup>[3]</sup> Krastl *et al.*<sup>[13]</sup> describe a new method to locate an obliterated root canal in a tooth with PCC and periapical pathology by using a guided endodontic template. For symptomatic teeth that

**Address for correspondence:** Dr. Josué Martos,  
Department of Semiology and Clinics, Faculty of Dentistry, University  
Federal of Pelotas, Gonçalves Chaves Street, 457, Pelotas,  
RS 96015-560, Brazil.  
E-mail: josue.sul@terra.com.br

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present radiographically complete PCC and evident presence of apical lesion, the elective treatment is the periradicular surgery.<sup>[8,14]</sup>

This case reported describes a surgical treatment in a traumatized tooth presenting PCC and periapical pathology.

## CASE REPORT

A 7-year-old male patient sought dental care due to trauma of the permanent mandibular right central incisor. In the anamnesis, the patient described that he had suffered a trauma in an anterior–superior direction on an accidental impact at school. The patient kept the teeth in position with the help of gauze compresses until he reached the emergency room, where the urgent care protocol was performed.

The patient reported no headache, nausea, vomiting, amnesia, drowsiness, fainting, epistaxis, diplopia, or other systemic change. The teeth were intact, with no root or crown fracture although they presented luxation. During the clinical examination, a low sensitivity to palpation in mandibular left central incisor and mandibular right central incisor was verified, in addition to a slight mobility of both teeth. In these teeth, periapical radiographic examination verified the correct position of the teeth, a complete rhizogenesis, and a discrete thickening of the periodontal ligament space [Figure 1a].

Traumatized elements have gone through periodic monitoring, and after 26 months a visible pulp calcification and a decrease in pulp response to sensitivity tests in mandibular right central incisor [Figure 1b] were observed. At 48 months, a full pulp calcification of root canal and a radiographic image compatible with apical periodontitis combined with a negative response to pulp vitality test on the same tooth [Figure 1c] were clearly evident. The periapical lesion associated with mandibular right central incisor had regular borders and was seen along the apical and lateral root surfaces. Clinically, the dental crowns of the teeth that had suffered luxation were not with any chromatic alteration [Figure 2a].

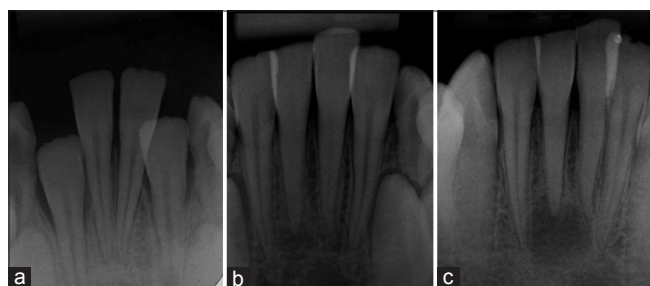
Faced with the need and impossibility of conventional endodontic treatment of permanent mandibular right central incisor, because of extreme calcification of the root canal, the clinical planning established was the periapical surgery and apical root sealing with mineral trioxide

aggregate (MTA)-based endodontic cement. Family members of the patient was informed about the clinical planning and consented in undergone to it.

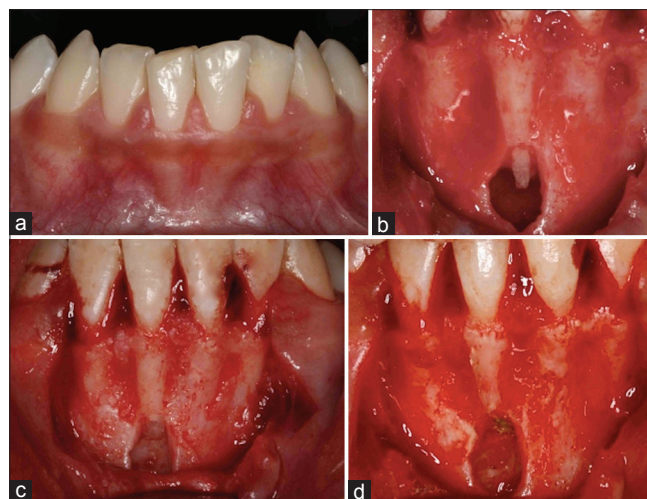
The procedure was performed under local anesthesia with 2% lidocaine with 1:100,000 epinephrine (Mepiadre, DFL Indústria e Comércio S.A., Rio de Janeiro, RJ, Brazil). A full-thickness mucoperiosteal flap was elevated, and a spherical burs #5 (Microdent, São Paulo, SP) associated with a micro-Ochsenbeinchisel (Hu-Friedy Mfg. Co., Chicago, IL, USA) were used to cut and scrape the bone to access the root apical area of the mandibular right central incisor [Figure 2b]. Apical curettage and cyst removal was performed using lucas surgical curette size #87 (Hu-Friedy Mfg. Co., Chicago, IL, USA). After that, 2 mm of the root apical area was cut, with the aid of a size #702 bur (Komet, Brasseler GmbH and Co., Lemgo, Germany) [Figure 2c]. During and after the cutting procedure, the surgical site was irrigated with physiologic saline solution.

The lesion was circumferentially separated from the bony crypt and the tooth. Using Gracey curettes, the granulation tissue in the apical and lateral root surfaces of the mandibular central incisors was curetted. The surgical site was washed with sterile saline solution after the complete removal of the lesion. The regularization of the cavity borders was made and the retrograde filling was done with MTA [Figure 2d].

The mucoperiosteal flap was sutured in position and a periapical radiograph was taken to confirm the accuracy of the retrograde filling of the permanent mandibular right central incisor. Histopathological examination revealed a dense fibrous connective tissue richly vascularized and intensely infiltrated by predominantly mononuclear inflammatory cells and some foamy macrophages, conclusively revealing a diagnosis of periapical granuloma. The patient was periodically clinical examined after 3, 6, and 12 months. Patient was asymptomatic during all the follow-up periods. At 2-month follow-up, a radiograph of the mandibular central incisors



**Figure 1:** (a) Radiograph condition at initial examination after injury. (b) Evaluation at 26 months after luxation. (c) Radiograph evidence of pulp canal calcification and periradicular lesion



**Figure 2:** (a) Clinical aspect of the traumatized central incisor. (b) Surgical access and apical curettage of the apical region. (c) Cutting the root apical area. (d) Retrograde filling with mineral trioxide aggregate

was taken, which confirmed the good progress of the surgical procedure [Figure 3a].

During the clinical and radiographic follow-up examination at 27 months, satisfactory healing of the luxated tooth was observed with no significant apical alteration [Figure 3b]. The patient at this time had initiated an orthodontic treatment.

## DISCUSSION

The pulp calcification metamorphosis is a present reality in some teeth that have suffered some type of trauma.<sup>[5,6,9-11]</sup> Important and decisive factors in the evolution from the most varied degrees of this metamorphosis are the root development stage and severity of dental trauma. In this context, the degree of root development and the width of the apical foramen tend to develop less pulpal damage compared with those teeth with completely root formed. This assertion is in agreement with the clinical case presented that showed a complete root formation at the moment of trauma and that later developed periapical pathology.

Following extrusive luxation, calcific metamorphosis of the pulp is very likely to occur.<sup>[15]</sup> In most cases, new vascular formation occurred in association with reparative dentin deposition on the root walls and within the pulp. In some cases, dentin deposition occupied the entire pulp space over time, with no other types of nonodontogenic hard tissues being observed in a rat model.<sup>[15]</sup>

The literature shows that the incidence of PCC in luxated permanent teeth (3.8%–24%) followed by pulp necrosis (1%–16%) is relatively variable and proportionally too low to support a preventive or prophylactic endodontic intervention.<sup>[7,8]</sup>

In situations such as in PCC associated with apical periodontitis, the apicectomy with placement of a retrograde filling may be considered.<sup>[3,9]</sup> This is in agreement mainly by the difficulties relating to the apical access through root canal, in the case of appearance of periapical pathology. We preferred the more conservative approach in relation to the dental structures, and the surgical access to the apex proved that the canal

permeability was only in the apical third. The crown wear would have been ineffective and the surgery would be the option to follow.

Although PCC does not require immediate therapeutic decision when detected, its periodic clinical and radiographic observation is essential, in any case of dental trauma. This periodic clinical control is justified because a root resorption may occur, requiring in such circumstances immediate therapeutic procedures. The PCC in this clinical case was an expected event as a result of severe injuries such as extreme luxation that had occurred. In the case of avulsion and replantation of teeth with incomplete root formation, there is the possibility of revascularization before the obliteration of the root canal and may be partial or total.<sup>[5,8]</sup> The appearance of periapical pathology in these cases of pulp canal obliteration is a major challenge. Because of this, the surgical access to instrumentation and filling via root apex could be the alternative.<sup>[3]</sup>

The clinical approach to the diagnosis of PCC may be immediate endodontic intervention<sup>[4]</sup> or endodontic treatment only when there is presence of periapical radiolucency suggestive of pulp necrosis.<sup>[7]</sup>

The clinical evaluation evidencing crown color changes associated with radiographic aspects such as pulp canal obliteration or apical radiolucency will define the appropriate treatment strategy. After 8 months of the initial dental trauma and all the therapeutic measures adopted, we can observe a favorable outcome for the patient.

## CONCLUSION

The presented surgical approach procedure in teeth with PCC and apical pathology proved to be safe and clinically effective.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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**Figure 3:** (a) Radiograph follow-up at 2-month postsurgery. (b) Evidence of periapical healing at 27-month radiograph follow-up

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