# The use of Endoguide for treatment of calcified root canals: clinical case reports

Ana Luisa **OLIVEIRA**[1]
Nathalia Lobato **NIEMEYER**[1]
Luanna **SALES**[1]
Renata **PEREZ**[2,4]
Vinícius **MACHADO**[3,5]
Renata Costa Val **RODRIGUES**[6,7]

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## ABSTRACT

**Introduction:** Endodontic treatment in teeth with calcified root canals is extremely challenging. During the procedure of locating the root canal, an excessive amount of residual dentin can be removed, which may lead to a greater risk of tooth fracture. In addition, pulp calcification is the most common reason for root perforation during endodontic treatment. **Methods:** Considering the importance of developing safe and efficient techniques for endodontic treatment of partially or completely calcified root canals, these two clinical cases were conducted in accordance with the therapeutic strategy recently described in the endodontic literature. **Results:** Endoguide made endodontic treatment safer and more effective in the two reported cases **Conclusion:** The endodontic guide used in the present cases have helped to locate the calcified root canal and to prevent iatrogenies during location..

**Keywords:** Endodontics. Diagnostic Imaging. Dental Pulp Calcification.

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[1] Universidade Veiga de Almeida, Faculdade de Odontologia (Rio de Janeiro/RJ, Brazil).
[2] Corpo de Bombeiros Militar do Estado do Rio de Janeiro (Rio de janeiro, Brazil).
[3] Clínica particular (Belo Horizonte/MG, Brazil).
[4] Doutora em Clínica Odontológica, Universidade Federal Fluminense (Niterói/RJ, Brazil).
[5] Especialista em Radiologia, Faculdade São Leopoldo Mandic (Campinas/SP, Brazil).
[6] Universidade Veiga de Almeida, Faculdade de Odontologia, Departamento de Endodontia (Rio de Janeiro/RJ, Brazil).
[7] Doutora em Endodontia, Universidade Estácio de Sá (Rio de Janeiro/RJ, Brazil).

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Contact address: Renata Perez
Rua Felipe Camarão, 157/403, Maracanã, Rio de Janeiro/RJ - CEP: 20.550-165
E-mail: renataperez36@gmail.com

## Introduction

Mechanical stress caused by excessive forces during mastication can damage periodontal and pulp tissues. The phenomenon of angiogenesis in occlusal trauma, which affects the pulp tissue , involves the formation of new blood vessels and production of mineralized tissue as a defense mechanism. As a consequence, the root canal system may undergo partial or total obliteration.[1,2] In most cases, however, pulp space with some pulp tissue remains.[3,4]

It is important to note that the mechanism of calcification is considered a sign of pulp vitality and, thus, endodontic treatment will only be suggested if there is clinical and radiographic evidence of pulp necrosis.[5,6]

Endodontic treatment in teeth with calcified root canals is extremely challenging. During the procedure of locating the root canal, excessive amount of residual dentin can be removed, which may lead to a greater risk of tooth fracture. In addition, pulp calcification is the most common reason for root perforation during endodontic treatment.[4,7]

In recent years, dealing with these cases requires adequate knowledge of dental anatomy, proper radiographic and tomographic examinations, and bright illumination and magnification under the operating microscope. This is necessary to detect different coloration of secondary dentin that is normally whitish or opaque and the pulp chamber floor that is darker and grayish.[8]

Recently, a new treatment for calcified teeth has been developed. This technique proposes the combined use of cone-beam tomography and optical surface scanning for planning and produce an endodontic guide for more efficient and safe access to the obliterated root canal.[4,5,6,9]

Thus, the aim of this study is to describe two case reports using this new technique.

## Methods

A 59-year-old male patient presented for endodontic treatment of tooth #21. The tooth had crownfracture that required the use of an intra-radicular post and crown.

Pulp calcification had been observed at radiographic examination, which made it difficult to locate the root canal (Fig 1 A). Cone-beam computed tomography (CBCT) had been requested for better planning of the case. After signature of the consent form by the patient and approval of the ethics committee CAAE 26306913.9.0000.5280, endodontic treatment was performed.

The first session was performed using an operating microscope (D.F. Vasconcelos, São Paulo, SP, Brazil) and TOS-E1ultrasound tip (CVDentus, São José dos Campos, SP, Brazil), but we did not succeed to locate the root canal.

Due to difficulty and risk of perforation, the patient was informed that the endodontic guide (Endoguide), a new method to locate calcified canals, would be used to aid this operative stage.

A new cone-beam computed tomographic (CBCT) examination was carried out to create a 3D model to plan and prepare the endodontic guide for precise introduction of the bur to locate the canal (Fig 1 B and C).

In the following session, a specific trephine bur provided with Endoguide had been used with pumping rotating movements (8000 rpm) with sterile water irrigation to gain access to root canal in the obliterated portion until the apical third had been reached. This was followed by a #10 K-file (Dentsply, Maillefer, Ballaigues, Switzerland).

The root canal was accessible at 9 mm from the apex. After using the guide and locating the root canal, ML Twisted File Adaptive system kit (SybronEndo, Orange, CA) was used during preparation up to instrument #50.04, powered by Elements motor (SybronEndo, Orange, CA, USA). The root canal was sealed in the same session using ML3 guttapercha cone (SybronEndo, Orange, CA, USA) and AH-Plus endodontic sealer (Dentsply, Maillefer, Ballaigues, Switzerland). The endodontic guide proved a safe, sophisticated, and clinically feasible method to locate the calcified root canal, preventing root perforation in teeth with pulpal calcification (Figs 1 D and 2 A and B).

A 31-year-old female patient presented for orthodontic treatment, and examination revealed a fistula and extensive periapical lesion in tooth #41, thus requiring endodontic treatment.

Radiographic examination showed pulp calcification in the cervical and middle thirds, which would

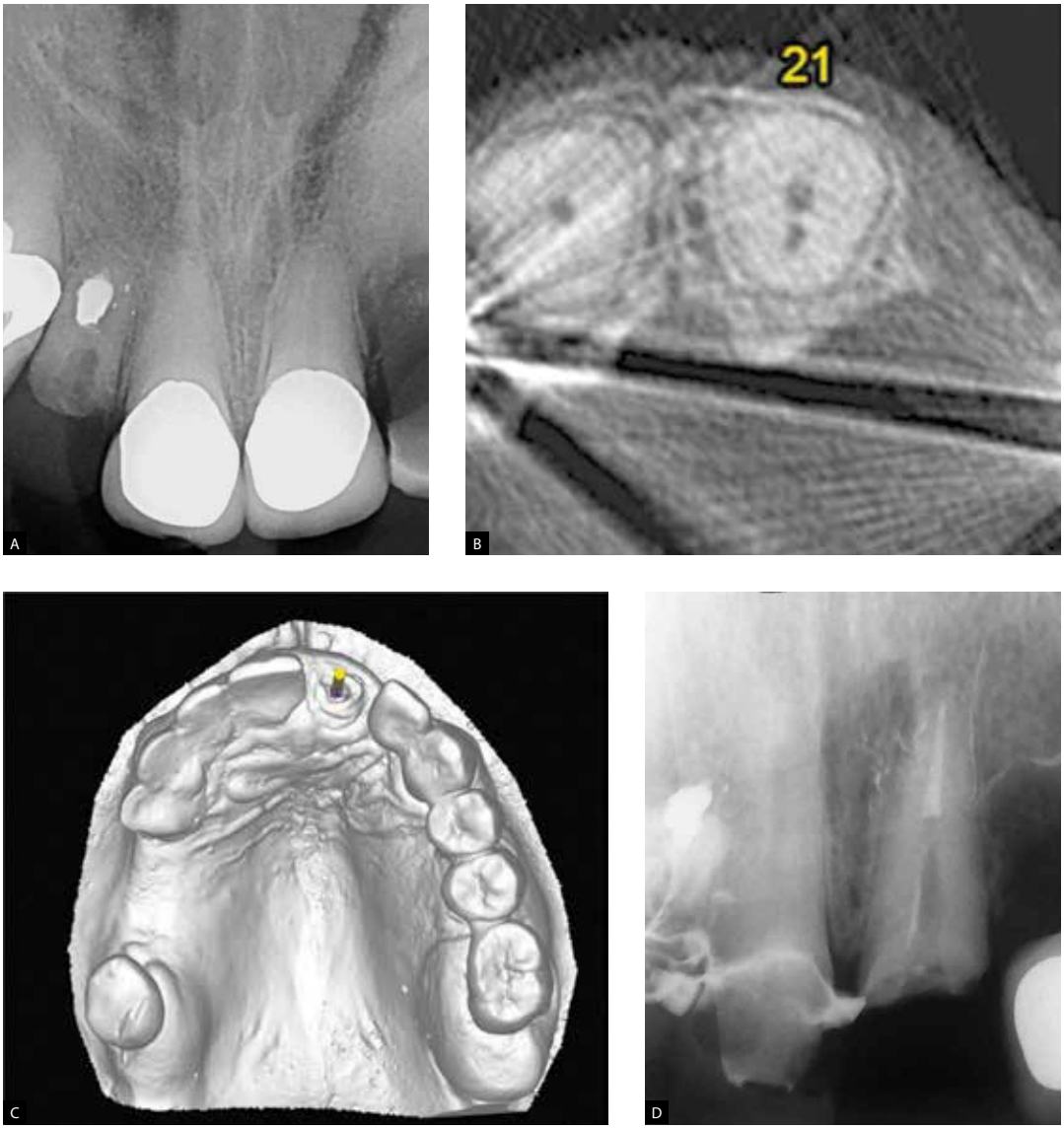


**Figure 1. A**) Initial radiograph. **B**) Cone beam computadorized tomography. **C**) 3D model. **D**) Final radiography.

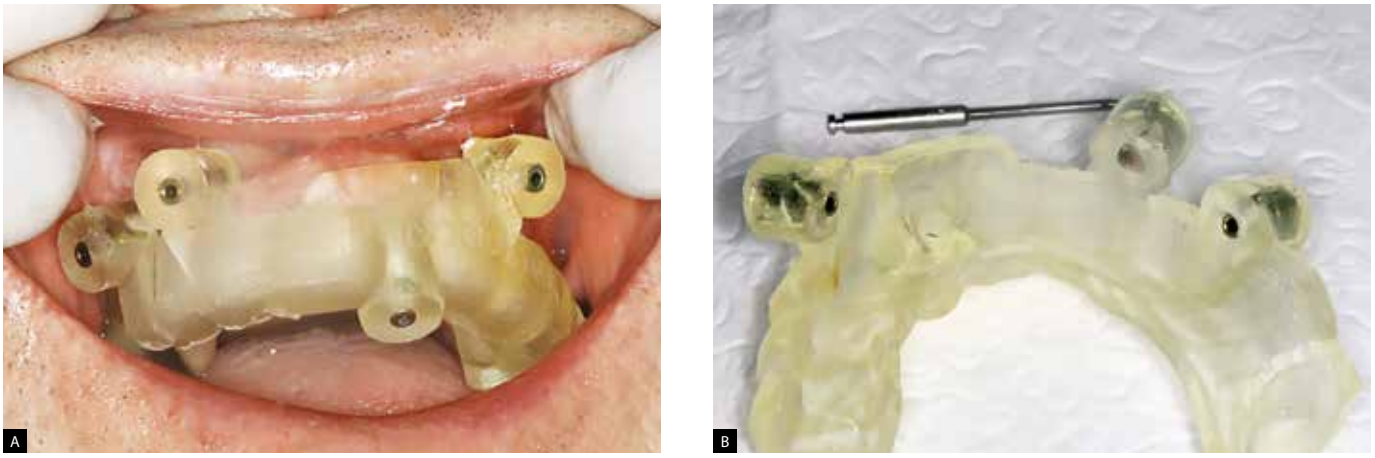


**Figure 2. A**) Endoguide positioned for adaptation evaluation. **B**) Endoguide and drill used in root canal location.

make locating the root canal difficult (Fig 3 A). Cone-beam computed tomography (CBCT) was requested to verify the existence of canal lumen to plan the case (Fig 3 B). CBCT confirmed the existence of the canal lumen and the case was planned accordingly. After signature of the consent form by the patient and approval of the ethics committee CAAE 26306913.9.0000.5280, the endodontic treatment was performed.

Endoguide was proposed to the patient to assist location of the root canal and to enable endodontic treatment implementation. Impression and scanning of the model were carried out, followed by preparation of the endodontic guide and precise introduction of the bur tip to locate the root canal (Fig 3 C).

On the first attempt using Endoguide, the root canal was not located. This was probably due to impression distortion. A new impression was carried out in addition silicone (Elite HD+, Zhermack, Rome, Italy) and a new endodontic guide was prepared (Figure 3 D and E). In the following session, after stabilization of the guide with the metallic rings of 8 mm, the trephine bur had been used with pumping rotating movements (8000 rpm) with sterile water irrigation to gain access to root canal followed by a K hand file #10 (Dentsply, Maillefer, Ballaigues, Suíça). The ML Twisted File Adaptive system kit (SybronEndo, Orange, CA) had been used for the preparation and the size 50 and .04 taper instrument and Elements motor (SybronEndo, Orange, CA) were used to finalize the procedure. The canal filling was carried out in the following session using ML3 gutta-percha cone (SybronEndo, Orange, CA) and AH-Plus endodontic sealer cement (Dentsply, Maillefer, Ballaigues, Switzerland) after application of intracanal medication (Callen/ PMCC paste, SSWhite, Rio de Janeiro, Brazil) between each session (Fig 3 F).

The endodontic guide used in the case assisted the localization of the calcified root canal, prevented iatrogenies such as root perforation during location, as well as allowed adequate disinfection of the root canal. The procedure is a sophisticated method for locating calcified root canals (Fig 4).

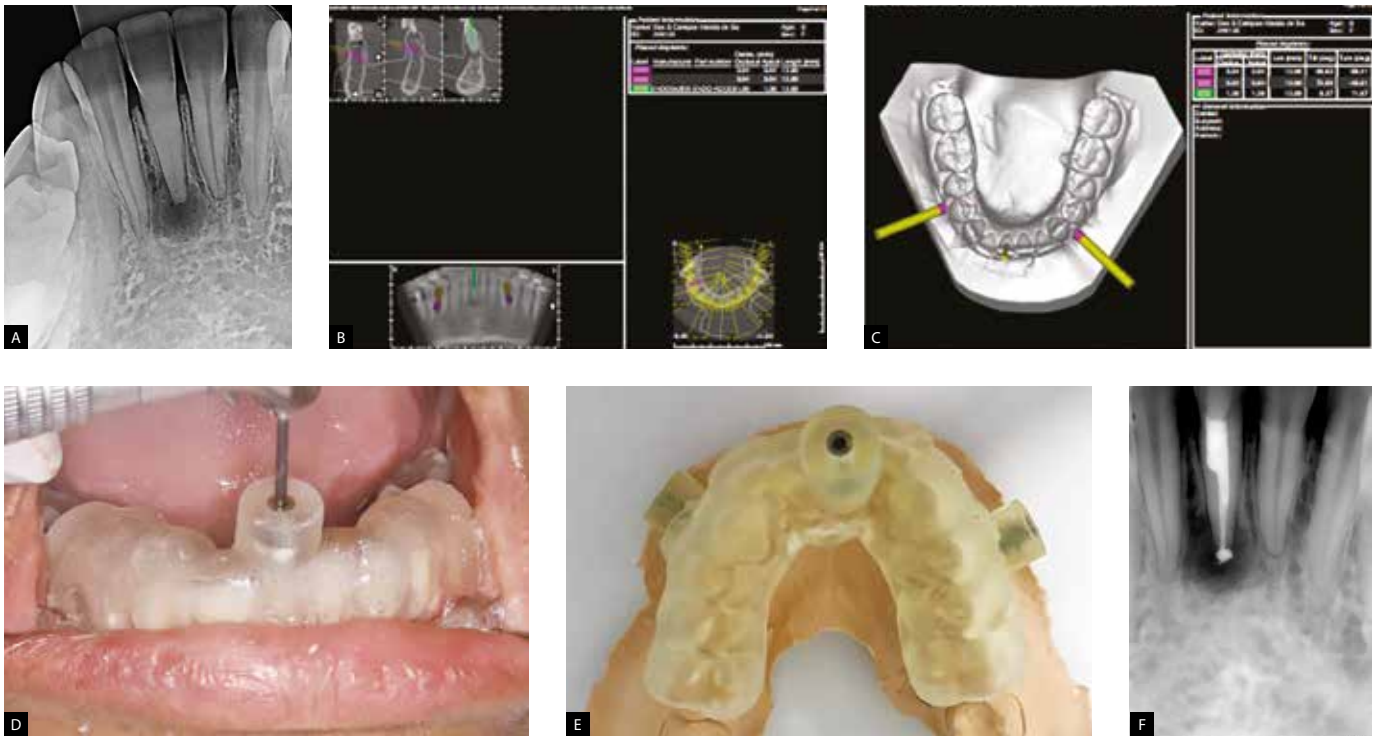


**Figure 3. A**) Initial radiography. **B**) Cone beam computadorized tomography. **C**) 3D model. **D**) First positioned Endoguide. **E**) Second Endoguide after new impression. **F**) Final radiography.

**Figure 4.** Radiography after first intervention.

## Results

The endoguide made the endodontic treatment safer and more effective in the two reported cases.

## Discussion

In the present reports, we discussed two cases of teeth with calcified root canals that required endodontic treatment. The obliteration of the root canal system can occur due to physiological aging and/or external injuries such as friction, caries, trauma, previous procedures, among other factors.[10,11] There are cases when the calcification in the root canal system is located in the apical third, which increases the risk of perforation.[3,4,5,9]

Recently, a new endodontic triad procedure has been developed to treat teeth with calcified root canals. Several authors, such as Khademi et al, recommend the triad technique as it consists of the combined use of the microscope, cone-beam tomography, and the preparation of an endodontic guide that allows a more accurate and safer access to the root canal.[4,5,9] This new triad procedure does not focus on removing bacteria, but rather on preserving pericervical dentin. The operative microscope allows the preparation of a much smaller and more precise access, drastically lower than the traditional access, often individualized by root, or even by canal, the tomography works as an image guide, directing the treatment in a way that complements the microscope.[2,9]

The guided endodontic approach has been proved to be accurate enough to consider a safe method for treating teeth with calcified pulp. In addition to providing several advantages, such as tooth structure conservation and reduced chair time, the main characteristic of guided endodontics is a low risk of root perforation, since endodontic treatment in teeth with calcified root canals may be a challenge even for the most experienced practitioners.[4,5] Once the confection of the printed template is very important, all details should be observed, such as a proper impression and an accurate scan of the impression to avoid the occurrence of errors during the root canal localization with the bur[5].

According to several authors, the limitation of this type of endodontic approach is the loss of root substance and canal geometry modifications depending on the size of the bur.[12,13] To achieve guided preparation, direct access to the root canal is required. However, the loss of root substance may be much greater if an attempt to locate the root canal is carried out without guidance, even when using the orientation microscope.[4] Furthermore, the bur does not need reach the previously established root-end. Instruments such as specific hand files may be used inside the root canal at certain depths to verify if it is accessible, thereby reducing the loss of further root substance. Some authors argue that another possible disadvantage of using the bur for root canal location is dentinal cracks.[14,15] Some studies have shown that mechanical preparation of the root canal results in dentinal defects such as fatigue fissures and cracks. On the other hand, due to the precise planning and location of the access cavity, teeth with calcified root canals may present higher fracture resistance if more dentine is preserved.[4,5,7,8,9,10,15] The concomitant irrigation during the use of the bur is important to avoid the heating of the dentin and consequent microcracks or lesions in the periodontal ligament, such as external cervical resorption.[16]

When the conventional endodontic treatment is not feasible or successful, the implant is an alternative. But compared with an implant the total cost of the guided endodontic approach seems considerably lower.[17] The guided endodontic approach seems to be safe and a clinically feasible method to locate root canals and prevent root perforation in teeth with calcified root canals that cannot be predictably accessed by traditional endodontic therapy. In addition to calcified root canals, guided endodontic procedures may provide easy and accurate access and treatment of specific root areas, which is usually difficult due to resorptions, perforations, or fractured endodontic instruments.[4]

Image-guided endodontics is a strategy to preserve dentin, plan access and maintain the root canal system shape using direct guided access with the purpose of restoring balance as well as evaluating treatment response.[9]

## Conclusion

The endodontic guide used in the present cases helped to locate the calcified root canal and to prevent iatrogenies such as root perforation during location, as well as allowing disinfection to be performed properly, which makes it a very sophisticated, fast and accurate method for locating calcified root canals.

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