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Guided endodontic treatment of the upper premolar with calcification in the cervical third: A case report

Tratamento endodôntico guiado do pré-molar superior com calcificação no terço cervical: Relato de caso

Tratamiento endodontico guiado del premolar superior con calcificación en el tercio cervical: Reporte de un caso

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Abstract
Endodontic treatment in teeth with calcification can be a challenge, which can cause risks to the treatment such as perforations or deviations. The objective of this research was to describe, through a case report, the use of guided endodontics as a complement to access in a tooth with calcification in the cervical third. A 42-year-old female patient, she was referred for endodontic treatment of the right upper premolar. An attempt at conventional endodontic treatment was made, but without success in both canals, and thus an endodontic guide was proposed. This guide was planned and created, followed by access using a 1.3mm diameter cylindrical drill. After the canals were accessed, endodontic treatment was followed with a rotary system and completed in two sessions. The use of the surgical guide proved to be safe for accessing canals with calcification in the cervical third of upper premolars, preventing treatment failures.
Keywords: Cone beam computed tomography; Guided endodontics; Pulp canal calcification; Treatment planning.

Resumo
O tratamento endodôntico em dentes com calcificação pode ser um desafio, podendo acarretar riscos ao tratamento como perfurações ou desvios. O objetivo desta pesquisa foi descrever, através de um relato de caso, a utilização da endodontia guiada como complemento ao acesso em dente com calcificação no terço cervical. Paciente do sexo feminino, 42 anos, foi encaminhada para tratamento endodôntico de pré-molar superior direito. Foi feita uma tentativa de tratamento endodôntico convencional, mas sem sucesso em ambos os canais, e assim foi proposta um guia cirúrgico endodôntico. Esse guia foi planejado e confeccionado, seguido de acesso com broca cilíndrica de 1,3mm de diâmetro. Após o acesso aos canais, o tratamento endodôntico foi continuado com sistema rotatório e concluído em duas sessões. A utilização do guia cirúrgico mostrou-se seguro para acesso a canais com calcificação no terço cervical de pré-molares superiores, evitando falhas no tratamento.
Palavras-chave: Tomografia computadorizada de feixe cônico; Endodontia guiada; Calcificação pulpar; Planejamento de tratamento.

Resumen
El tratamiento de endodoncia en dientes con calcificación puede ser un desafío, lo que puede ocasionar riesgos al tratamiento como perforaciones o desviaciones. El objetivo de esta investigación fue describir, a través de un reporte de caso, el uso de la endodoncia guiada como complemento al acceso en un diente con calcificación en el tercio cervical. Paciente femenina de 42 años, remitida para tratamiento de endodoncia en premolar superior derecho. Se intentó un tratamiento endodóncico convencional, pero sin éxito en ambos canales, por lo que se propuso una guía quirúrgica endodóntica. Esta guía fue planificada y creada, seguido del acceso mediante una broca cilíndrica de 1,3 mm de diámetro. Una vez accedidos a los canales, se siguió el tratamiento de endodoncia con un sistema rotatorio y se completó en dos sesiones. El uso de la guía quirúrgica demostró ser seguro para acceder a canales con calcificación en el tercio cervical de los premolares superiores, previniendo fracasos del tratamiento.
Palabras clave: Tomografía computarizada de haz cónico; Endodoncia guiada; Calcificación del canal pulpar; Planificación del tratamiento.

1. Introduction

The root canal system (RCS) can sometimes be entirely or partially calcified with layers of dentin deposits and is caused by trauma, caries, abrasion or even physiological aging of the tooth (Andreasen et al., 2015).

Calcification with or without coronal darkening is not a reason for endodontic intervention and it is only advised when irreversible pulpitis or apical periodontitis is present (Kiefner et al., 2017; Vinagre et al., 2021).

The use of fine drills, diamond burs or even ultrasonic inserts are commonly used in these cases, however, they generate risks of failure due to the difficulty of accessing the RCS even with the use of magnification and intraoperative periapical radiographs (de Cunha et al., 2009; Siddiqui, 2014).

The impact of CBCT in endodontic was able to overcome several limitations of periapical radiographs, such as the elimination of overlaps, the possibility of image navigation, the quality of images in high resolution and contrast, in some software it is possible to apply filters to the image in order to to better visualize structures (Bueno & Estrela, 2019).

The endodontic is increasingly advancing with technologies, helping to provide effective treatment. In the case of calcification treatments, the endodontic surgical guide can be used. With this innovative technique, through intraoral scanning and Cone Beam Computed Tomography (CBCT), a guide is 3D printed and a digital path is designed for the drill to reach a specific location (Ali et al., 2019).

Virtual planning and guided access procedure for calcified root canals can preserve tooth structure and prevent accidents such as deviations and perforations. Procedural errors can negatively impact the success of endodontic treatment and contribute to infections in inaccessible apical areas (Nabavi et al., 2022).

In view of this, the aim of this study was to report a clinical case of entodontic treatment of an upper right premolar with calcification in the cervical third using an endodontic surgical guide.

2. Methodology

This case report has been written according to Preferred Reporting Items for Case reports in Endodontics (PRICE) 2020 guidelines (Nagendrababu et al., 2020), as well as on the methodological precepts that govern the academic community (Pereira et al., 2018; Estrela, 2018; Yin, 2015; Toassi & Petry, 2021).

The patient was duly informed through the free and informed consent form which was signed and authorized the research in accordance with Resolution nº 466/2012 MS (Brazil - National Health Council, National Research Ethics Commission) and this study was reviewed and approved by the institutional ethics committee- Certificate of Presentation of Ethical Review: 79282024.9.0000.5688 (# 6.871.422).

3. Case Report

A 42 years old caucasian woman, attended the dental school (Cascavel, Brazil), in endodontics course for the treatment upper right second premolar with asymptomatic pulpal necrosis. In the first moment, the tooth was opened and an attempt was made to locate the canals, but without success. A Cone Beam Computed Tomography (CBCT) R100 Morita (J. MORITA, Irvine, California, USA) examination of tooth 15 was requested and it was found that both the buccal and palatine canal had a calcified barrier in the cervical third, which was not seen on the initial radiograph. In addition, it was also possible to note that the canals ended in a single foramen.

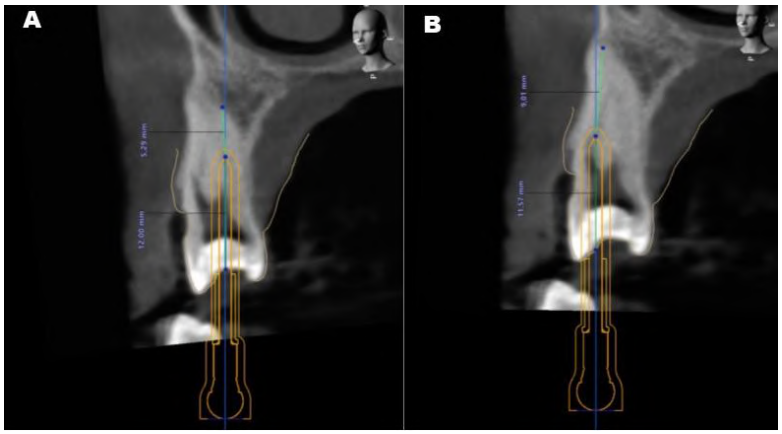
A new attempt to access the canals, with a K-type C-pilot 10 file (VDW, Munich, Germany) and also with a 3195 diamond bur (KG Sorensen, Cotia, Brazil) at high speed under refrigeration, performing wear from 1 to 2 mm in the apical direction, followed by successive periapical radiographs to verify that there were no deviations in the path. As it was not successful, a new procedure was proposed for accessing the canals following the guided endodontic protocol.

A new CBCT of the upper arch was requested with the ORTHOPANTOMOGRAPH® OP300 tomograph (KAVO, Germany) and digital scanning of the same arch with the iTero element® scanner (ALIGN TECH, California, USA). All planning was carried out and sent for approval by the dentist who would perform the procedure and the course's teaching staff. In the analysis of the planning, it was requested that the guide of the vestibular canal undergo a rectification in the orientation of the access drill.

After the planning was approved, it was sent for resin printing on the ®P40 3D printer (Straumann Group, Germany) with two guides, one for the palatine canal and the other for the buccal canal.

To access the canals, it was necessary to use a surgical drill (NEODENT/STRAUMANN, Curitiba, Brazil) guided with 1.3 mm in diameter and 28 mm for the length. According to the planning, in the palatine canal, the drill would have a reach of 12mm to access the canal, staying at a distance of 5.29 mm from the apex and at the buccal canal, the drill reach would be 11.57mm, finished with a distance of 9.01mm from the apex (Figure 1). In both canals, the safety zone around the drill was 0.8mm.

Figure 1 – A- image of the tomographic section with a schematic drawing of the drill directed in the palatine canal; B- - image of the tomographic section with a schematic drawing of the drill directed towards the buccal canal.



Source: Authors.

The guide fitting test was carried out and soon afterwards the drill was attached to the X Smart Plus motor (Dentisply Sirona, Baden, Switzerland), with a speed was 1000 RPM and torque 4N, driven first in the palatine canal in all its length. Then, in this same root canal, exploration was carried out with a 10 tip K file (Dentisply Sirona, Baden, Switzerland).

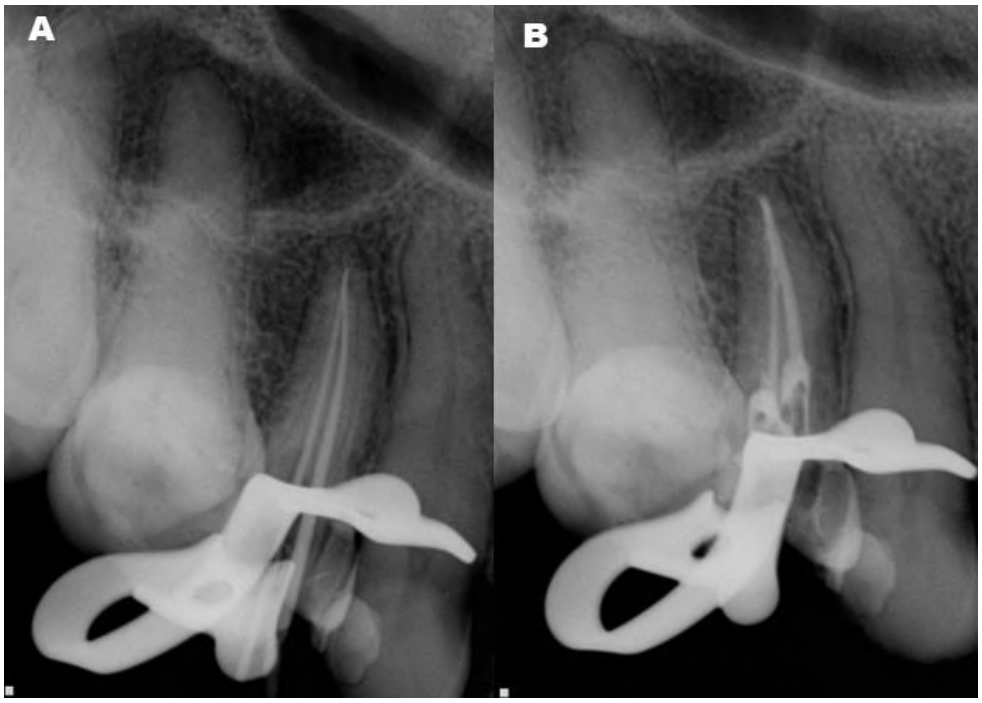
Soon after, access to the buccal canal began, following the same procedures as for the palatine canal. After the drill reached the planned length, exploration was performed with a 10 k file (Dentisply Sirona, Baden, Switzerland) but without success.

Instrumentation of the palatine canal was performed with LOGIC system files: 15.04, 20.04 and 25.04 (Easy dental equipment, Belo Horizonte, Brazil), in a rotary motion with 950 RPM and 4N of torque. Then the tooth was medicated with calcium hydroxide past and the patient was rescheduled for a next visit, in order to try to access the buccal canal.

In another visit, an attempt was made to access the buccal canal again. The guide was adapted, the process was repeated and then, with a 10-type K file, the canal was finally accessed. Then, instrumentation was continued with manual files up to the flexofile 30 file (Dentisply Sirona, Baden, Switzerland).

With the instrumentation performed, the cone test was performed and obturation (Figure 2). The hybrid technique of Tagger and AH plus cement (Dentisply Sirona, Baden, Switzerland) was used and provisionally restored with Glass Ionomer Cement (GIC). Then, a final CBCT was requested (Figure 3) and sent to the patient to perform the definitive rehabilitation of the dental element.

Figure 2 - A- X-ray test of the cone; B- X-ray demonstrating the obturation.



Source: Authors.

Figure 3 - Final tomographic image – coronal section.

Source: Authors.

4. Discussion

According to research by Alghamdi and Shakir (2020), the presence of bacteria in root canals that remained after endodontic therapy can lead to treatment failure. The most commonly found bacteria is *Enterococos faecallis* and its presence is generally noticed in teeth with pulp necrosis. The present work justifies the conduct taken since the tooth was initially necrotic and there was no success in the first approach to finding the canals, making it necessary to construct an endodontic guide.

This case report describes a method to facilitate endodontic treatment in teeth with difficult-to-access calcified canals. These cases are classified at the highest level of difficulty by the American Association of Endodontists due to the fact that a predictable treatment outcome can be challenging (Alan & Law, 2005).

Tay et al. (2022) researched the importance of CBCT in the endodontic treatment plan and concluded that tomography is an important means of diagnosis and that more than 50% of plans change after evaluation of CBCT. This approach corroborates the present study that, after such an examination, the treatment plan was changed; previously, access would be through high-speed, free-handed drills and then using directional guide drills.

Complementary imaging exams are essential, as they allow greater visualization of details of the tooth and adjacent structures, both for treatment predictability and for creating the access guide (Bueno et al., 2021).

Kihara et al. (2020) evaluated the importance of intraoral scanning, whose fidelity helps in creating the guide, as it allows a better copy of the anatomy of the patient's arches. This fact is important for the guide to fit perfectly and conventional impressions have distortions as they are influenced by temperature and humidity and affect the guide's fidelity. The present work performed the scanning and this allowed the faithful creation of the guide purchased by fitting it.

CBCT are important allies for endodontics, allowing visualization of structures that a 2D x-ray image may not show. Furthermore, the combination of CBCT with optical surface scanning allowed the creation of surgical guides previously used

only in implant dentistry and now also used in endodontics, for example, in the location of extra canals, access to calcified canals, endodontic surgeries, and removal of fiberglass pin (Patel, 2019). The presente research demonstrated the fundamental importance of this combination of tomographic reconstruction image with the use of digital scanning to conclude the clinical case of calcification.

Ultrasonic inserts, diamond drills, manual files and straight exploration probes are also widely used in attempts to access canals whose mouth is calcified or obstructed, however in this mode there is a risk of accidents occurring and therefore great caution is needed when planning the procedure case (Connert et al., 2019). In the present study, access was attempted using a diamond tip and manual files, but without success and with a deviation from the canal trajectory, with a risk of root perforation.

Koch et al. (2022) researched the use of guides and their creation on four different printers and all of them presented a high level of precision, varying in deviations with averages of 0.31 to 0.68mm. In the present study, access to the vestibular canal led to a small deviation and was accessed in a second session, perhaps due to these deviations in common findings in the research mentioned above.

Even though it is successful in most cases where guided endodontics is used, there are limitations to this technique such as opening the patient's mouth, since the surgical guide and drill coupled to the endodontic motor take up considerable space in the patient's mouth. . Furthermore, the width of the drill used must be checked, as it is necessary to have a safety space around the drill to avoid drilling the tooth root. And knowing that the drill used for access has a rigid structure, calcifications in curvatures or after them mean that the guide is not very suitable for the case, so the possibilities for carrying out the treatment must be carefully analyzed (Connert et al., 2018).

5. Conclusion

Guided endodontics proved to be effective, as the approach proved to considerably reduce the clinical time to access the canals, with minimal risk of perforation. Even though there may be limitations in resolving similar cases, the technique proves to be quite effective when carried out correctly. It is always important to evaluate all possibilities to resolve complex cases and the use of CBCT is an important means of planning treatment for calcified teeth.

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