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RESTORING ORIGINAL CANAL TRAJECTORY POST COMPLETE OBSTRUCTION: GUIDED ENDODONTICS CASE REPORT

RESTAURAÇÃO DA TRAJETÓRIA ORIGINAL DO CANAL APÓS OBSTRUÇÃO COMPLETA: RELATO DE CASO DE ENDODONTIA GUIADA

RESTAURACIÓN DE LA TRAYECTORIA ORIGINAL DEL CONDUCTO DESPUÉS DE UNA OBSTRUCCIÓN COMPLETA: INFORME DE UN CASO DE ENDODONCIA GUIADA

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ABSTRACT

Objective: This study describes the case of a 75-year-old patient with pain in tooth 22. Methodology: To construct this case report, it was necessary to use as a basis an existing and published work, a study that addressed and taught how a case report article should be written, what its structure should be, what methodology should be applied to acquire works that are full of proven scientific evidence and how this type of article should be approached. Thus, the work of Yin (2001) was the study that served as a guide during the preparation of this case report. Results: Guided Endodontics uses imaging technologies and computer-aided design to plan and perform procedures in challenging cases, such as root canal calcification. Radiographic analysis revealed calcification of the root canal. The procedure involves Cone Beam Computed Tomography and intraoral scanning for virtual planning of the endodontic guide, which was 3D printed and fixed in the patient's maxilla to access the canal using a specific drill. After instrumentation of the canal and removal of the smear layer, the canal was filled with bioceramic

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cement. Conclusion: The patient returned three years after filling of the root canal system, observing the success of endodontic therapy, concluding the effectiveness of Guided Endodontics in the treatment of root canal calcification, providing satisfactory and predictable clinical results.

Keywords: Cone-Beam Computed Tomography. Endodontics. Intraoral Scanning. Pulp Calcification. Root Canal Treatment.

RESUMO

Objetivo: Este estudo descreve o caso de uma paciente de 75 anos com dor no dente 22. Metodologia: Para construir este relato de caso, foi necessário utilizar como base um trabalho já existente e publicado, um estudo que abordasse e ensinasse como um artigo de relato de caso deve ser escrito, qual deve ser sua estrutura, qual metodologia deve ser aplicada para adquirir trabalhos que sejam repletos de evidências científicas comprovadas e como esse tipo de artigo deve ser abordado. Assim, o trabalho de Yin (2001) foi o estudo que serviu de guia durante a elaboração deste relato de caso. Resultados: A Endodontia Guiada utiliza tecnologias de imagem e design auxiliado por computador para planejar e executar procedimentos em casos desafiadores, como a calcificação do canal radicular. A análise radiográfica revelou calcificação do canal radicular. O procedimento envolve Tomografia Computadorizada de Feixe Cônico e escaneamento intraoral para planejamento virtual do guia endodôntico, que foi impresso em 3D e fixado na maxila do paciente para acesso ao canal usando uma broca específica. Após a instrumentação do canal e remoção da camada de esfregaço, o canal foi obturado com cimento biocerâmico. Conclusão: O paciente retornou após três anos após a obturação do sistema de canais radiculares, observando-se sucesso da terapia endodôntica, conclui-se a eficácia da Endodontia Guiada no tratamento da calcificação do canal radicular, proporcionando resultados clínicos satisfatórios e previsíveis.

Palavras-chave: Tomografia Computadorizada de Feixe Cônico. Endodontia. Escaneamento Intraoral. Calcificação Pulpar. Tratamento de Canal Radicular.

RESUMEN

Objetivo: Este estudio describe el caso de un paciente de 75 años con dolor en la muela 22. Metodología: Para la construcción de este reporte de caso fue necesario utilizar como base un trabajo existente y publicado, estudio que abordó y enseñó como se debe redactar un artículo de reporte de caso, cuál debe ser su estructura, qué metodología se debe aplicar para adquirir trabajos llenos de evidencia científica comprobada y cómo se debe abordar este tipo de artículos. Así, el trabajo de Yin (2001) fue el estudio que sirvió de guía durante la elaboración de este reporte de caso. Resultados: La endodoncia guiada utiliza tecnologías de imágenes y diseño asistido por computadora para planificar y realizar procedimientos en casos desafiantes, como la calcificación del conducto radicular. El análisis radiológico reveló calcificación del conducto radicular. El procedimiento implica una tomografía computarizada de haz cónico y un escaneo intraoral para la planificación virtual de la guía endodóntica, que fue impresa en 3D y fijada a la mandíbula del paciente para acceder al canal mediante una fresa específica. Después de la instrumentación del conducto y la eliminación de la capa de barro, el conducto se obturó con cemento biocerámico. Conclusión: El paciente regresó tres años después del obturación del sistema de conductos radiculares, observando el éxito de la terapia endodóntica, concluyendo la efectividad de la

Endodoncia Guiada en el tratamiento de la calcificación del conducto radicular, brindando resultados clínicos satisfactorios y predecibles.

Palabras clave: Tomografía Computarizada de Haz Cónico. Endodoncia. Escaneo Intraoral. Calcificación Pulpar. Tratamiento de Conductos Radiculares.

INTRODUCTION

Chemomechanical preparation of the root canal system is a fundamental step for the success of root canal therapy (Nabavi *et al*., 2022). The objectives of endodontic treatment may not be achieved in cases of partial or total obliteration of pulp spaces. Pulp calcification is characterized as radiographic evidence of increased dentin production, mainly in response to trauma. The result of this process is a calcified canal, which does not necessarily indicate diseased pulp (Kulinkovych-Levchuk *et al*., 2022). Although many approaches to treat calcified canals have been described, even the most experienced endodontists may encounter difficulties in achieving patency and performing adequate cleaning and shaping (Tavares *et al*., 2020).

In addition to trauma-induced calcification, an increase in dentin deposition in the root canal system is also observed as a result of various other stimuli, such as caries, pulpotomy or restorative therapy, after orthodontic treatment, or in elderly patients due to lifelong dentin deposition (Connert *et al*., 2022). Endodontic treatment in these cases is extremely challenging, with the possibility of complications or failures (Zargar & Amiri, 2023). Evidence shows that the higher the degree of calcification, the greater the difficulty in locating and instrumenting root canals, hindering adequate chemomechanical preparation, which may compromise the success of root canal treatment (Peña-bengoa *et al*., 2022).

Cone Beam Computed Tomography (CBCT) is a promising and valuable tool in the treatment of complex endodontic cases and the management of procedural errors. Guided endodontics technique is successfully used in locating calcified canals and in access cavities extended apically (Shaban *et al*., 2023). In such cases, if root canal treatment is indicated, the treatment is more challenging compared to a tooth with a wide and patent canal. Access to the cavity will be difficult to align correctly, and there is an increased likelihood of failure during treatment. (Moreno-Rabié *et al*., 2020).

According to Goga *et al*. (2008), with age, the pulp spaces of teeth decrease in size due to the deposition of secondary and tertiary dentin. When tooth wear, caries, or operative intervention are present, this process becomes more evident.

As described by Decurcio *et al*. (2021), the drill used for the vast majority of guided approaches has a diameter of 1.3 mm. Subsequently, a marking is made with the guide already positioned to carry out the initial wear, aiming for the chosen point. After the operative steps, the next step is to perform the guided endodontic approach. For this, an electric motor in continuous rotation with a speed adjusted to 800 RPM and a torque of 4.0 Ncm is required. After re-verifying the perfect position of the guide, it should be stabilized with manual support and constant irrigation.

METHODOLOGY

In order to construct this case report, it was necessary to use an existing and published work as a basis, a study that addresses and teaches how a case report article should be written, what its structure should be, what methodology should be applied to acquire works that are filled with proven scientific evidence and how this type of article should be approached. Thus, the work of Yin (2001) was the study that served as a guide during the preparation of this case report. In order to obtain the maximum number of doctoral theses, master's theses, course completion works and other renowned articles and books to bring richness to the work, searches were carried out with the following descriptors registered in DeCs: Cone Beam Computed Tomography; Endodontics; Intraoral scanning; Pulp calcification; Root canal treatment. To complete the article with more information, searches were also carried out in the following databases: BVS/BIREME, CAPES Periodicals Portal, PUBMED Central, Science Direct, The Cochrane Library, PROSPERO in conjunction with Google Academy. Gray literature was also used, bringing a range of important and essential information to the work.

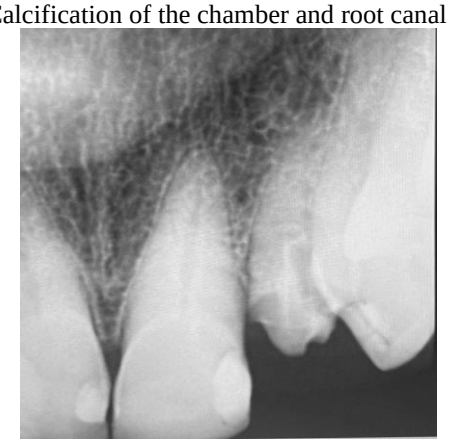
CASE REPORT

This case report has been written according to Preferred Reporting Items for Case reports in Endodontics (PRICE) 2020 guidelines. A 75-year-old female patient, leucoderma, ASA1 (American Society of Anesthesiology), presented to our institute with a complaint of pain, along

with a need for rehabilitative treatment. Despite negative results on the cold sensitivity test and lateral percussion test, the patient reported pain upon vertical percussion examination, suggesting an early stage of apical periodontitis. Radiographic analysis revealed root canal calcification, rendering conventional endodontic treatment unfeasible in tooth 22 (Figure 1).

The decision was made to utilize Guided Endodontics technique to facilitate instrumentation of the calcified canal. The patient is aware of and consents to the study process. The patient was then directed to Cone Beam Computed Tomography (CBCT) and intraoral scanning, initiating the virtual planning of the endodontic guide. On tomography, calcification of the root canal was confirmed (Figure 2).

Figure 1 - Calcification of the chamber and root canal of tooth #22



Source: Authors

Figure 2. A and B) Tomography confirmed calcification of the root canal in the cervical and apical third

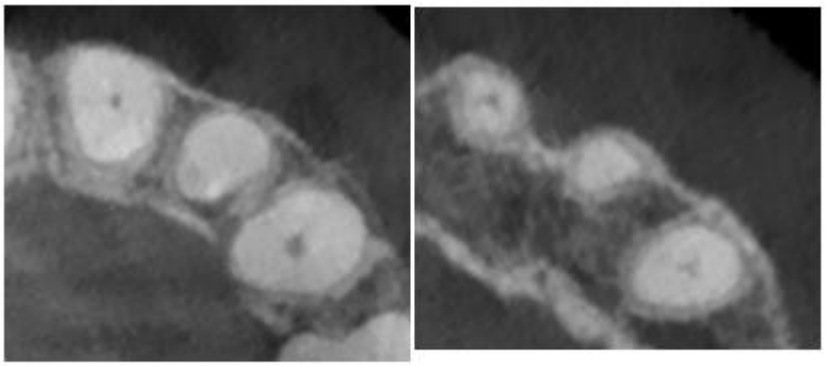


Figure 2 - A Figure 2 - B

Source: Authors

The DICOM files from the CBCT and the STL files from the intraoral scanning were imported and overlaid in MeshMixer® and Invesalius® software. The CAD-CAM process was

performed by measuring the tooth length and drill angle. The guide design was developed by applying the components to the virtual model, subsequently, the guide was exported in STL format and 3D printed, marking the CAM phase (Figure 3).

Figure 3. A) Virtual planning of the guide body and fixation points planning; B) Milling the drill angle planning; C) Intraoral Scanning

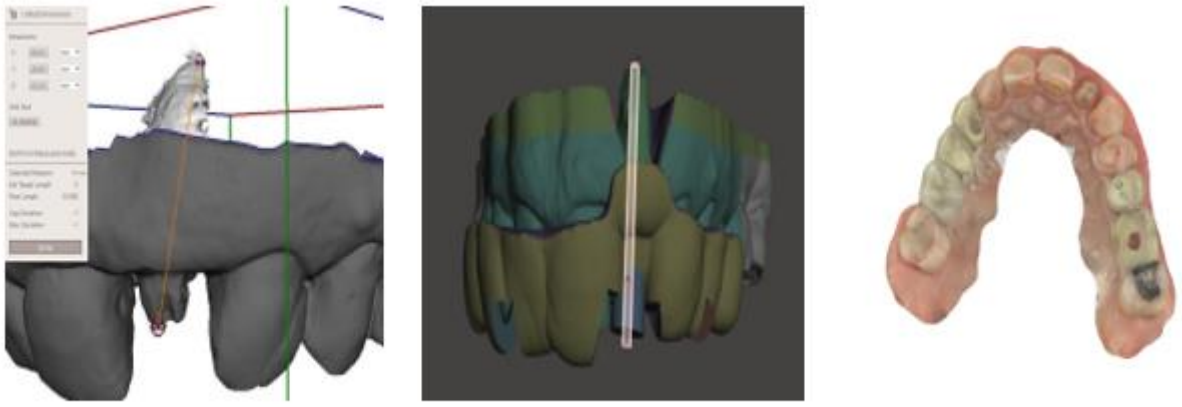


Figure 3 - A Figure 3 - B Figure 3 - C

Source: Authors

The study model and the guide were subjected to disinfection using 0,12% Chlorhexidine Digluconate. Subsequently, the guide was positioned in the dental arch, and its fit was in accordance with the previous planning.

Local anesthesia using 2% lidocaine with epinephrine 1:200000 (Alphacaine, DFL, Rio de Janeiro, RJ, Brazil) was administered through anterior superior alveolar nerve block, and the guide was then fixed in the patient's maxilla (Figure 4 - A). Canal access was initiated using a 1.3 mm drill bit (Neodent), attached to an XSmartPlus endodontic motor (Dentsply Maillefer) (Figure 4 - B), configured to 800 RPM and 4 N torque, in "pecking" movements, up to 15.8mm depth, with constant irrigation of sterile saline solution to prevent drill overheating (Figure 4- C).

Figure 4. A) Fixation of the guide; B) Drill (Neodent); C) Access drill.

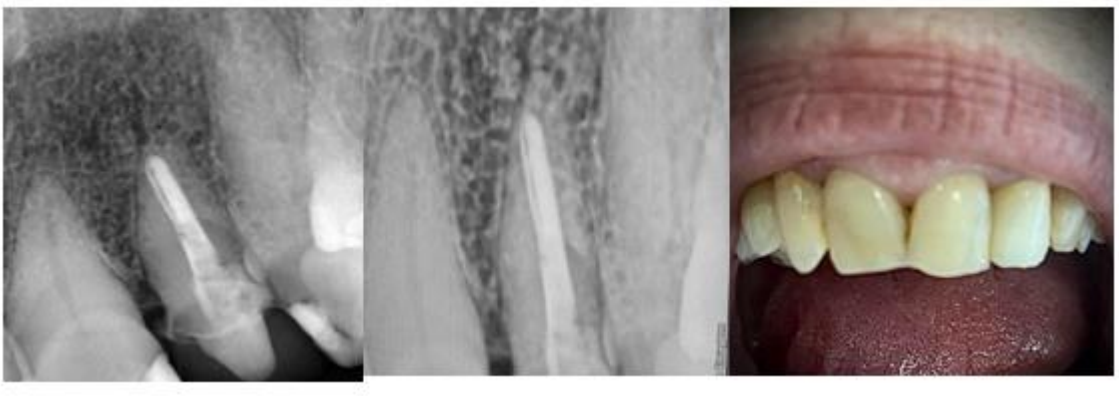
Figure 4 - A Figure 4 - B Figure 4 - C

Source: Authors

After reaching the desired length, the endodontic guide was removed, and the tooth was isolated with rubber dam isolation. Continuing, Electronic apex locator measurement of the real working and real tooth length was performed using Propex Pixi (Dentsply), along with a glide path using hand files. Canal instrumentation was then carried out using the Reciproc system (VDW, Munich, Germany) with R50 file, with abundant irrigation of 2.5% NaOCl. Next, the canal was irrigated with 17% EDTA to remove the smear layer, employing the agitation protocol both in the irrigating solution and in the EDTA itself, using the Easy Clean system (Easy, Brazil). Subsequently, it was irrigated with saline solution and dried with absorbent paper points (Dentsply Maillefer). After the master cone fit check (Figure 5-A), the canal was obturated with a single R50 gutta-percha cone (VDW, Munich, Germany) and Bio-C Sealer bioceramic cement (Angelus), and temporarily restored with Coltosol temporary cement (Coltene) and RIVA A2 light-cured glass ionomer cement (SDI). Clinical and radiographic proservation performed 3 years after obturation of the root canal system (Figure 5 - B) and the presence of a single fixed prosthesis was found, rehabilitating the correct form of the dental element (Figure 5 - C).

Figure 5. A) Obturated canal; B) 3 years follow-up; C) Tooth rehabilitated

Figure 5 - A Figure 5 - B Figure 5 - C



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DISCUSSION

Managing calcified canals, as described in this clinical case study, is inherently linked to the challenges faced in conventional endodontic treatment. In the case of the presented patient, the presence of root canal calcification made conventional endodontic treatment difficult, necessitating the use of more advanced techniques such as Guided Endodontics. In this context, it is important to consider the complications associated with root canal treatment in calcified teeth. Teeth with complete obliteration of the root canal are susceptible to technical failures during endodontic treatment, such as root perforation or inaccessible root canals. These complications can result in significantly reduced healing rates post-treatment. The study mentioned by Connert *et al*. (2022) demonstrated successful management of calcified root canals, with a success rate of 80% after a 3-year observation period. However, negotiating root canals in such cases can be a time-consuming and challenging task. The clinical case presented illustrates the practical application of these technological advances in Guided Endodontics.

In the present study, a total root canal calcification was observed in a 75-year-old patient, which made conventional endodontic treatment difficult. This condition is consistent with the findings of Goga *et al*. (2008), who observed a decrease in the size of the pulp chamber due to the deposition of secondary dentin with increasing age. Additionally, the study mentioned by the authors revealed a progressive deposition of calcified masses originating from the root pulp, which aligns with the observation of canal calcification in the elderly patient in the context of this research. The relationship between patient age and root canal calcification is an important phenomenon to consider. This association suggests that as patients age, there is a greater

likelihood of encountering calcified root canals. In our case, the total obstruction precluded any reference to the original canal angulation. Thus, the utilization of the drill necessitated precise navigation through the calcified tissue, highlighting the complexity and innovation involved in the procedure. The success of the treatment was confirmed by the absence of symptoms after a 3-year follow-up and no signs of lesions in radiographs. The impacts of this phenomenon are relevant both in clinical practice and in research. Better understanding these processes may lead to the development of more effective strategies for the diagnosis and treatment of pulp calcification across different age groups.

The ability of CBCT to provide detailed three-dimensional images of dental anatomy allows for precise planning of endodontic treatment, especially in complex cases like the one presented. In the case at hand, performing CBCT and intraoral scanning was fundamental for the development of the endoguide procedure. This guided approach allowed for the creation of a personalized endodontic guide, facilitating instrumentation of the calcified canal. The precision provided by CBCT is crucial for avoiding damage to surrounding anatomical structures during periapical surgery, as mentioned by Moreno-Rabié *et al*. (2020). Furthermore, the detailed visualization offered by CBCT allows for a better understanding of the extent of root canal calcification, guiding treatment planning and reducing the risk of intraoperative complications. In our study, we rigorously followed the guidelines proposed and available in the scientific literature for performing Guided Endodontics. The detailed description of the specific operative protocol provided by Decurcio *et al*. (2021) was instrumental in guiding our clinical practice. One of the most relevant aspects was the use of the same 1.3 mm diameter drill for the initial drilling, as described by the authors. This standardization ensured consistency and predictability in clinical outcomes, enhancing our confidence in executing the procedure. Furthermore, this clinical case adhered to the authors' recommendations regarding the torque and rotations per minute (RPM) of the electric motor, setting it to 800 RPM and a torque of 4.0 Ncm. These parameters were crucial to ensure the effectiveness and safety of the procedure, minimizing the risk of complications. By adopting the guidelines established in the scientific literature, it is possible to integrate research-based evidence with clinical practice, promoting predictable and consistent outcomes in Guided Endodontics.

In summary, the interaction between clinical practice and scientific research is essential for advancing the management of cases involving calcified teeth and improving endodontic techniques. The integration of research-based evidence with the utilization of this technique

opens new perspectives for modern endodontics. In this context, case studies play a crucial role in the scientific literature, providing valuable insights into the effectiveness and applicability of Guided Endodontics in clinical practice.

CONCLUSION

Thus, after all the examinations and procedures performed, the effectiveness of Guided Endodontics in the treatment of root canal calcification is concluded, providing satisfactory and predictable clinical results.

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