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Guided Endodontic Approach in Teeth with Pulp Canal Obliteration and Previous Iatrogenic Deviation: A Case Series

Julia Mourão Braga Diniz [a,b], Henrique França Diniz Oliveira [c,d], Rodrigo Carvalho Pinto Coelho [b], Flávio Manzi [e], Fernanda Evangelista Silva [f], Vinícius Carvalho Machado [g], Antônio Paulino Ribeiro Sobrinho [h], Warley Luciano Fonseca Tavares [h*]

a Faculdades Padre Arnaldo Janssen, Belo Horizonte, MG, Brazil; b Centro Universitario de Belo Horizonte, Belo Horizonte, MG, Brazil; c Centro Universitário Newton Paiva, Belo Horizonte, MG, Brazil; d Faculdade de Odontologia da Universidade Federal de Minas Gerais, Brazil; e Pontífica Universidade Católica, Belo Horizonte, MG, Brazil; f Pontífica Universidade Católica, Belo Horizonte, MG, Brazil; g CEO Slice Group, Brazil; h Faculdade de Odontologia da Universidade Federal de Minas Gerais, Brazil

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**Corresponding author*: Warley Luciano Fonseca Tavares, Faculdade de Odontologia da Universidade Federal de Minas Gerais, Brazil.

E-mail: warleyt@hotmail.com

ABSTRACT

Pulp canal obliteration (PCO) is a challenging clinical scenario in which canals must be located in progressively narrowing roots. Recently, proof of concept papers have, in parallel, introduced the combination of cone-beam computed tomography and surface scans for the construction of guides to pilot the negotiation and preparation of partially or completely obliterated pulp chambers and canals in anterior and posterior teeth. Authors' purpose is to describe the treatment approach for teeth with PCO and previous iatrogenic deviation using guided endodontic technique. The clinical cases reported here show that technological evolutions should make guided endodontic procedures more widespread because their execution is relatively fast and safe even in the cases of root canal deviation. Treatment of teeth with pulp canal obliteration with deviations or perforation may be more effective with designed 3D printed access guides that seems to be a safe and clinically feasible method to locate root canals.

Keywords: Cone-beam Computed Tomography; Guided Endodontics; Pulp Canal Obliteration

Introduction

The root canal system (RCS) can be partially or completely obliterated as result of different factors, such as caries, restorative procedures, harmful oral habits, friction and trauma [1-5]. Pulp Canal Obliteration (PCO) or calcific metamorphosis (CM), is a physiological process of aging or a pulp response to trauma that is characterized by the deposition of hard tissue within the root canal space that ultimately determines pulp atrophy by reducing its original volume [3].

Fortunately, only a small percentage of teeth with PCO develops pulp necrosis and becomes infected. However, when pulpitis or apical periodontitis is detected during clinical or radiographic examination, the endodontic treatment is recommended [6]. These teeth provide an endodontic treatment challenge [1].

Recently, clinical studies confirmed the positive impact of cone-beam computed tomography (CBCT) on treatment planning, decision-making and execution of the endodontic therapy because of its enhanced appreciation of anatomically complex RCS and identification of the spatial location of extensively obliterated canals [7]. CBCT allows three-dimensional visualization without overlapping adjacent structures, which facilitates the identification of the root canals, their directions, degrees of obstruction and dimensions [8, 9].

Negotiation of calcified teeth requires patience and expertise of the operator. Early referral to an endodontist is recommended if difficulties are experienced in locating canals in those teeth [6]. The combination of CBCT images, dental operative microscopy and ultrasonic tips allows working at greater depth within the pulp chamber safely, with a low risk of iatrogenic injury [10].

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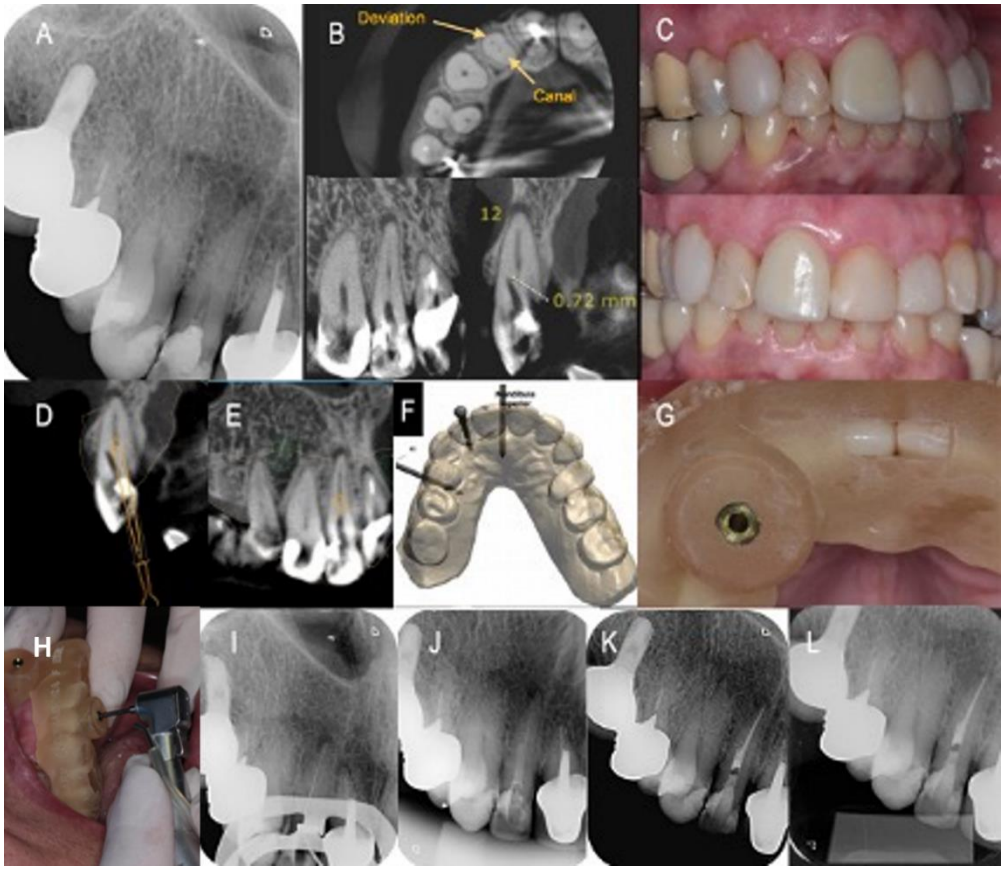

Figure 1: *A)* Preoperative radiographic image showing partial obliteration and perapical bone resorption; *B)* CBCT axial, coronal and sagital images showing periapical bone resorption, partial obliteration of the root canal and buccal deviation; *C)* Discolored maxillary lateral incisor: frontal and lateral views; *D, E, F)* 3D root canal planning; *G, H)* The prototyped surgical guide; *I)* #15 K file in the working length; *J)* Intracanal dressing with calcium hydroxide after instrumentation; *K)* The final radiograph; *L)* The radiograph at 12-month follow up

Currently, "guided endodontics" was revealed as an alternative solution for endodontic treatment of partially or completely calcified root canals [11-13]. The combined use of CBCT and intraoral optical scanning may be a useful tool for safer interventions in complex calcified root canal cases [14]. Guided access through root calcifications may help to avoid accidents such as deviations and perforations and improve the treatment success. In addition, guided access has been already reported in the literature as a safe and predictable technique in anterior teeth [15-17].

PCO is related in up to 75% of perforations during location and negotiation of calcified canals [18]. The present case series describes the endodontic treatment of 3 upper incisors with calcified root canals and iatrogenic access deviation using the guided endodontics technique. This study aimed to show the effectiveness of these technical procedures for solving complex clinical calcified root canals cases even in the presence of previous deviation.

Cases Reports

Case 1. A 68-year-old female patient was referred for endodontic treatment of the right maxillary lateral incisor with history of spontaneous pain in different periods throughout the days. No probing depths and mobility were recorded. The patient did not present any relevant medical history. Clinical examination revealed the presence of percussion sensitivity and negative response to thermal and electrical pulp sensibility tests (Pulp tester, Odous de Deus, Belo Horizonte, Brazil) (Endo Ice, Maquira , Maringá, Brazil) and slightly tooth discoloration. The periapical radiographic image revealed an obliterated pulp chamber and possible deviation (Figure 1A). An experienced endodontist tried unsuccessfully to access the root canal orifice. CBCT exam was performed and confirmed root canal obliteration as well as a buccal iatrogenic deviation created during clinical access (Figure 1B). Due to the presence of PCO and deviation, location of the root canal was judged to be difficult and associated with a high risk of perforation.

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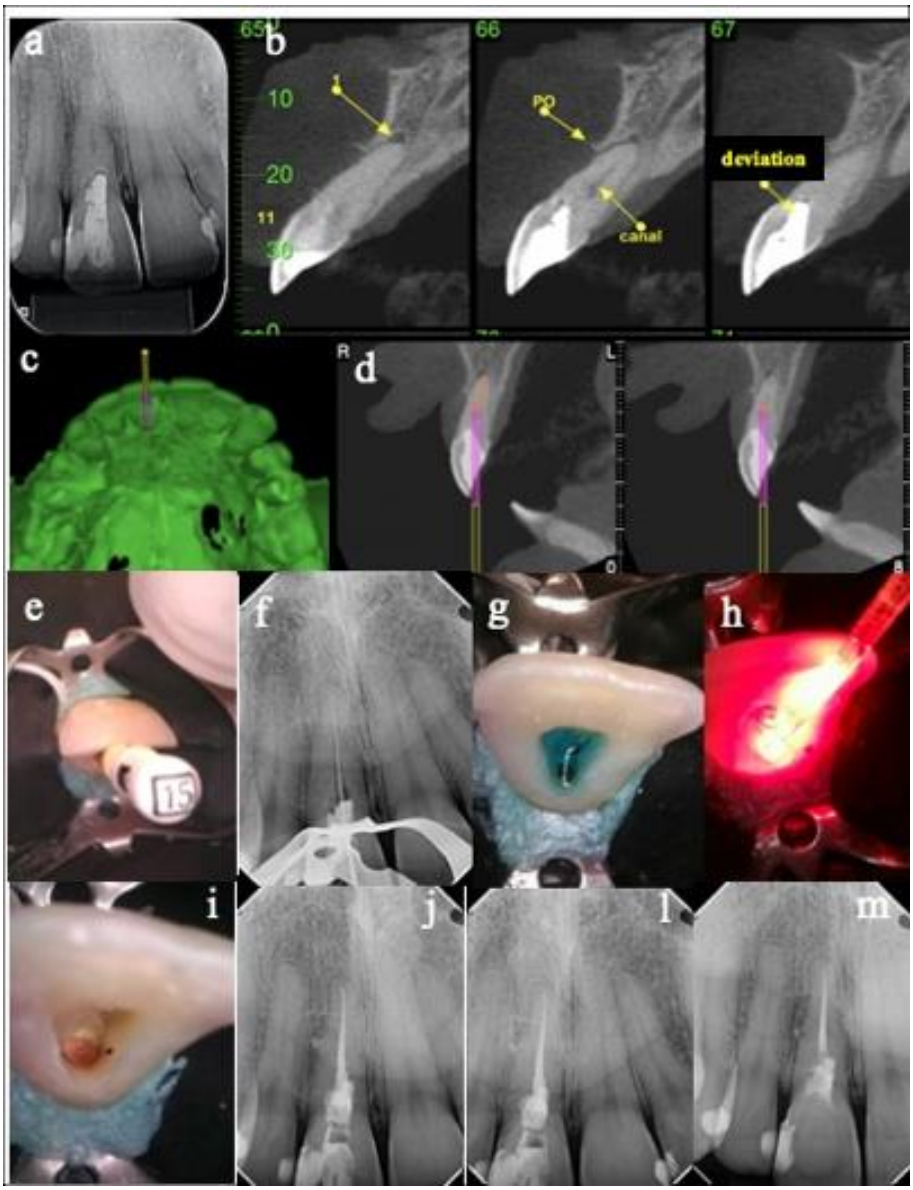

Figure 2: *A)* Preoperative radiographic image showing partial obliteration; *B)* CBCT sagital images showing periapical bone resorption, partial obliteration of the root canal and a buccal deviation; *C)* A 3D model of the oral cavity; *D)* 3D root canal planning; *E, F)* #15 K file in the working length; *G)* Use of methylene blue solution as a photosensitizing agent and pre-irradiation for photodynamic therapy; *H)* Optical fiber in position and irradiation with low intensity laser; *I)* clinical view after obturation; *J)* The final radiograph; *K)* 15 days control radiograph; *M)* The radiograph at 12-month follow up

Case 2. A 31-year-old male patient with a history of trauma involving the right maxillary central incisor 17 years before, was referred to a private clinic for the endodontic treatment of the calcified root canal. The clinical examination revealed a slightly discolored upper right central incisor. The tooth presented apical periodontitis and positive sensitivity to percussion and palpation tests. Previously, another endodontist tried unsuccessfully to access the root canal orifice. Radiographic examination showed PCO as well as a possible iatrogenic deviation (Figure 2A). Location of the root canal was judged to be difficult and associated with a high risk of perforation. The patient was referred to a radiological center where tomographic examination and intraoral scanning were performed. CBCT imaging identified periapical bone resorption and confirmed pulp obliteration that extended to the middle third of the root canal as well as the presence of buccal deviation (Figure 2B).

Case 3. A 47-year-old male patient with a history of trauma, was referred for endodontic treatment of the right maxillary lateral incisor after the occurrence of an extensive coronary fracture. Another endodontist tried unsuccessfully to access the root canal

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orifice previously. The tooth was asymptomatic, and clinical view showed an extensive access with root canal deviation (Figure 3B). Radiographic examination showed a partial root canal obliteration (Figure 3A). In the CBCT, the presence of PCO on the cervical portion of the root canal was confirmed and deviation in the cervical third could be identified (Figure 3C, 3D). After completing the access under local anesthesia, with the use of the dental operative microscope, the clinician could not locate the entry of the root canal safely. As the location of the root canal was judged to be difficult and associated with a high risk of perforation, guided endodontics was chosen as the best alternative for the case.

Before starting the treatment process, other treatment options (extraction, extraction and replacement with implant or bridges) were explained to the patients and after final decision (root canal treatment with guided endodontic approach), informed consent was obtained from all three patients.

Building the endodontic guide

The 3-dimensional (3D) documentation was obtained by CBCT imaging with the following settings: 0.12 mm voxel, 14 bits gray scale, 26.9 sec x-ray exposure, 120 kV, and 37 mA (iCAT; Imaging Sciences International, Hatfield, PA, USA) and TRIOS Color Pod intraoral scanner (3Shape A/S, Copenhagen, Denmark). Two study models were created based on those images. A virtual planning software (Simplant 15.0 Pro; Materialise, Brussels, Belgium) was used to match the CBCT scan and the surface scan based on the radiographically visible structures. The Simplant software was set to design the drill to access the root canal for each guide. The drill diameter was determined according to the radicular width obtained by the CBCT examination. A virtual copy of the drill (Neodent Drill for Tempimplants, Ref.: 103179; JJGC Ind. e Comercio de Materiais Dentários SA, Curitiba, Brazil) was incorporated in the software and was superimposed on the CBCT-acquired image in a position that allowed to correct the previous deviation of the root canal path leading to the apical root canal. To ensure that the tip of the instrument reached the space of the remaining apical root canal, the position of the drill was verified in 3 dimensions in the axial, sagittal, and coronal views. Anchorage guides for stabilization purposes were virtually planed to the surgical procedure. A virtual guide was designed using coDiagnosticX software (Dental Wings GmbH, Chemnitz, Germany). This model was exported as an stereolithography (STL) file, sent to a 3D printer (Objet Eden 260V, Material: MED610; Stratasys Ltd, Minneapolis, MN, USA), and the respective guide was produced [19].

Clinical procedures

The guides were positioned on the teeth and checked for complete adjust. The positioning of the drill in the mouth was checked and then the guides were fixed under local anesthesia. Guided pins used for stabilization were milled using a 1.3 mm diameter drill (Neodent Drill for Tempimplamts, Ref: 103179; JJGC Indústria e Comércio De Materiais Dentários SA, Curitiba, PR, Brazil). To access the original calcified root canals, the same bone cutting drill at a speed of 1200 rpm was utilized under copious irrigation with saline until it reached the length of the visible root canal at CBCT. Then the guides were removed, and absolute isolation of the operative field was performed. The working length was determined by an apex locator (Root ZX mini; J Morita, Fushimi-ku, Kyoto, Japan), introducing a #15 K-file (Dentsply Maillefer, Ballaigues, Switzerland) into the canal. The chemical mechanical preparation was performed using ProTaper nickel-titanium files (ProTaper Next, Dentsply Maillefer, Ballaigues, Switzerland) under constant irrigation with 5.25% sodium hypochlorite until an X3 instrument reached the working length. The RCS was filled using a gutta-percha cone (Dentsply Maillefer, Ballaigues, Switzerland) associated with root canal sealer (AH-Plus -Dentsply DeTrey GmbH, Konstanz, Germany) with vertical condensation technique. The case reports 1 and 2 were performed in 2 sessions with the use of calcium hydroxide P.A. (Lenza Farm, Belo Horizonte, Minas Gerais, Brazil) and glycerin as intracanal medication for 15 days. The case report 3 was performed in a single session (Figure 3J).

Clinical follow up

The patients (case reports 1 and 2) were clinically and radiographically evaluated at 15 days (Figures 1K and 2I), 6 and 12 months (Figures 1l and 2M) after the initial procedures. The patient (case report 3) was clinically and radiographically evaluated at 15 days after the initial procedures (Figure 3J). At the 15-day follow-up visit, all the patients were asymptomatic and were referred for prosthetic rehabilitation.

Discussion

Radiography represents an essential part of the contemporary management of endodontic problems, from diagnosis and treatment planning to outcome evaluation; however, it is well established that conventional radiographic techniques have limitations [9]. These include the two-dimensional nature of the images produced, overlapping of anatomical structures [20], and various degrees of geometric distortion [21]. CBCT largely overcomes these limitations. In 2019, a committee of experts convened by the European Society of Endodontology (ESE), based on the recent review articles, updated the position statement of the ESE CBCT, published in 2014 and defined the

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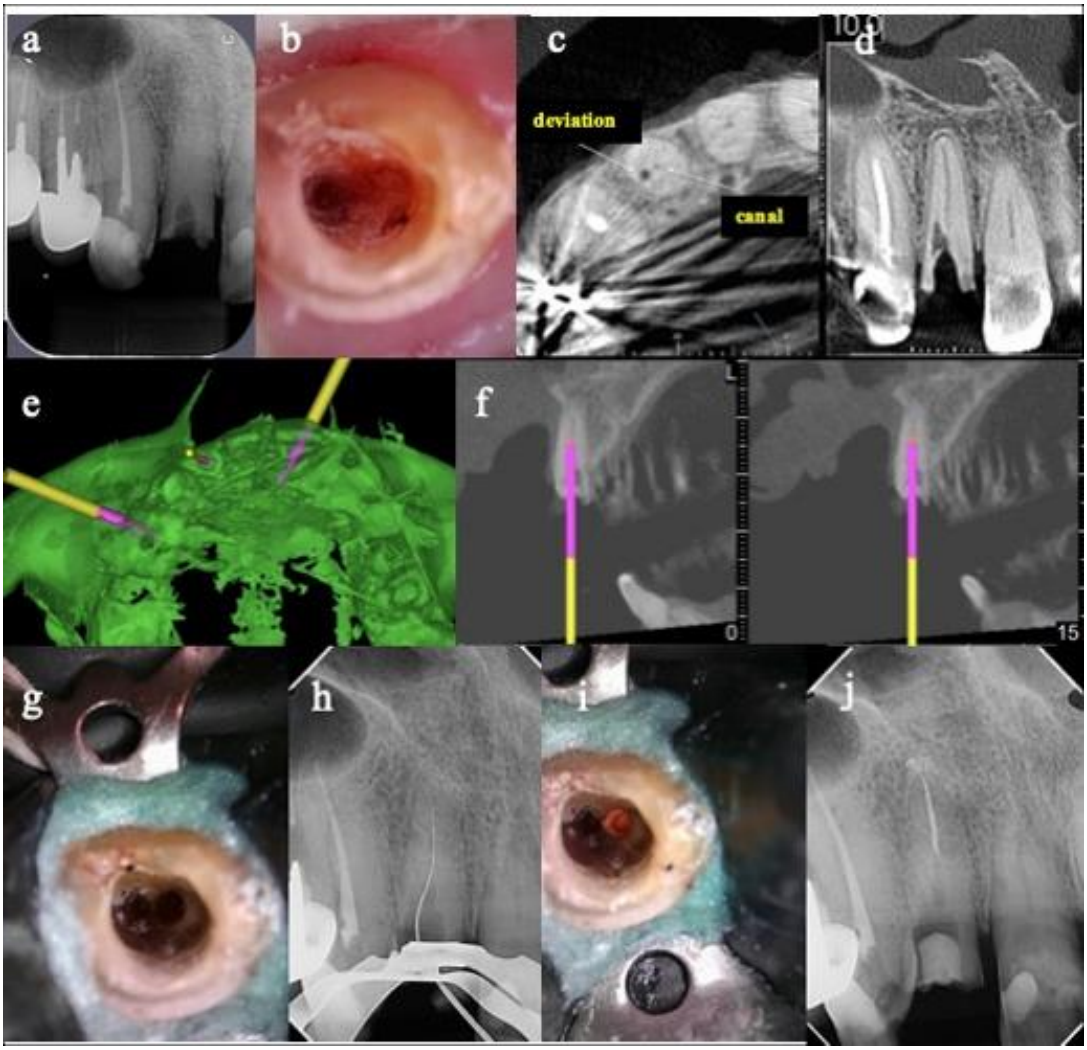

Figure 3: *A)* Preoperative radiographic image showing partial obliteration of the root canal and an extensive coronary fracture; *B)* Preoperative clinical view of the pulp chamber; *C)* CBCT axial imagem showing partial obliteration of the root canal and a distal deviation; *D)* CBCT coronal image showing partial obliteration of the root canal and a distal deviation; *E)* A 3D model of the oral cavity; *F)* 3D root canal planning; *G)* Clinical view after the localization of the root canal and cleaning and shaping procedures; *H)* Working length radiograph; *I)* Clinical view of the deviation after obturation; *J)* The final radiograph

application of CBCT in Endodontics [22]. In this context, the CBCT image has become an essential tool for the diagnosis and treatment of endodontic problems, such as the identification and location of obliterated root canals, also taking into account the possibilities of guided endodontics [9].

Pulp canal obliteration usually occurs as a result of trauma and usually affects the anterior teeth of young adults. It is generally accepted that the frequency of PCO depends on the extent of the luxation injury and the stage of root formation [3]. Most studies suggest that up to 25% of all teeth with post-traumatic PCO may develop pulp necrosis and periapical changes in the long term [23, 24]. These cases are classified at the highest difficulty level by the AAE, even to the most experienced practitioners. The access to root canals in a tooth with PCO and subsequent canal preparation can be time-consuming and difficult, even when using an operative microscope [5]. Complications may include creating an overextended access cavity, deviation from the original path with the risk of root perforation during the treatment [3].

Inspired by the guided implant, Pinsky *et al.* [25] introduced the use of computer-designed surgical guides for periapical surgery. This procedure allowed for more accurate localization of the apices and proved to be useful in performing osteotomies close to anatomical structures, such as the lower alveolar nerve and mental foramen [26]. Recently, in order to achieve predictable and safe results, the concept of guided endodontics has been reported [14-17]. The guided endodontic technique consists of accessing and locating root canals with severe calcification using guidance models created

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by tomographic planning. Pre-clinical studies have reported a high accuracy and a reduced chair time of the procedure [27, 28]. An observational study of 50 patients carried out by Buchgreitz *et al.* [29] demonstrated that guided access cavity preparation and canal location were completed and there were no failures. Additionally, a systematic review described the guided access cavity preparation and guided surgery as being highly accurate and successful techniques [14].

In this study, we present 3 case reports where previous attempts to access root canals generated iatrogenic deviations, which could be resolved with the aid of guided endodontic technique. In the second clinical case, albeit radiographic exam did not show periapical bone resorption, it was identified in the CBCT. It is well accepted that CBCT imaging has the ability to detect more teeth with periapical bone loss than conventional radiography [30, 31]. In the cases presented, experienced endodontists unsuccessfully attempted to access and locate the root canals with the aid of CBCT images, and the use of a dental operative microscope and ultrasonic tips. It is well-known that even with the use of the dental microscope in the negotiation of extremely calcified root canals, there is a high risk of deviation, perforation or at least over preparation of the root canal [32]. Due to the presence of deviation with a high risk of accidents and complications, guided endodontics was the choice of treatment for these cases.

The location of the obliterated canal and adequate cleaning of the contaminated region after root canal deviations are challenging. In this case series, the guided endodontic technique allowed the resumption of the original anatomical trajectory after the unsuccessful attempts to locate the severely calcified canals. Casadei *et al.* [33] used this technique to perform the guided access after root deviation and perforation, which permitted the cleaning and modelling of the root canal throughout its full extension and, in addition, the repair of the perforation. Buchgreitz *et al.* [29], also implemented guided root canal treatments in fifty serial cases of single-rooted teeth with PCO. The rapidity and predictability of this technique are also noteworthy and can be considered an important aid in the treatment of accidents and complications in endodontics [19].

Recently, it has been shown that a widespread utilization of CBCT is taken place in everyday endodontic practice [34]. The use of scanning techniques has also increased in dentistry. Technological evolution and the combination of CBCT and 3D prints should make guided endodontic procedures more accessible and widespread in endodontics [29]. Although this method has demonstrated to be fast and secure, a learning curve exists as in any other technique. The professional's ability to perform tomographic and virtual planning is essential to the success of the final result [19]. The clinical cases presented here show that such technological evolution should make guided endodontic procedures more accessible and widespread.

Conclusions

Endodontic treatment in cases of severely calcified root canals is a challenge and is associated with an increased rate of technical failures. The guided endodontic technique seems to be a safe and clinically feasible method for locating root calcified canals, especially when it cannot be accessed by conventional endodontic strategies. Treatment of teeth with pulp canal obliteration with deviations or perforation may be more effective with designed 3D printed access guides.

Conflict of Interest: 'None declared'.

References

1. Andreasen FM, Zhjie Y, Thomsen BL, Andersen PK. Occurrence of pulp canal obliteration after luxation injuries in the permanent dentition. Dental Traumatology. 1987;3(3):103-15.
2. Agamy HA, Bakry NS, Mounir MM, Avery DR. Comparison of mineral trioxide aggregate and formocresol as pulp-capping agents in pulpotomized primary teeth. Pediatr Dent. 2004;26(4):302-9.
3. McCabe PS, Dummer PM. Pulp canal obliteration: an endodontic diagnosis and treatment challenge. Int Endod J. 2012;45(2):177-97.
4. Fleig S, Attin T, Jungbluth H. Narrowing of the radicular pulp space in coronally restored teeth. Clin Oral Investig. 2017;21(4):1251-7.
5. Kiefner P, Connert T, ElAyouti A, Weiger R. Treatment of calcified root canals in elderly people: a clinical study about the accessibility, the time needed and the outcome with a three-year follow-up. Gerodontology. 2017;34(2):164-70.
6. Moule AJ, Moule CA. The endodontic management of traumatized permanent anterior teeth: a review. Aust Dent J. 2007;52(1 Suppl):S122-37.
7. Chogle S, Zuaitar M, Sarkis R, Saadoun M, Mecham A, Zhao Y. The Recommendation of Cone-beam Computed Tomography and Its Effect on Endodontic Diagnosis and Treatment Planning. J Endod. 2020;46(2):162-8.
8. Venskutonis T, Plotino G, Juodzbalys G, Mickevičienė L. The importance of cone-beam computed tomography in the management of endodontic problems: a review of the literature. J Endod. 2014;40(12):1895-901.
9. Patel S, Brown J, Semper M, Abella F, Mannocci F. European Society of Endodontology position statement: Use of cone beam computed

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tomography in Endodontics: European Society of Endodontology (ESE) developed by. Int Endod J. 2019;52(12):1675-8.
10. de Toubes KMS, de Oliveira PAD, Machado SN, Pelosi V, Nunes E, Silveira FF. Clinical Approach to Pulp Canal Obliteration: A Case Series. Iran Endod J. 2017;12(4):527-33.
11. Freire BB, Vianna S, Nascimento EHL, Freire M, Chilvarquer I. Guided Endodontic Access in a Calcified Central Incisor: A Conservative Alternative for Endodontic Therapy. Iran Endod J. 2021;16(1):56-9.
12. Moreira ML, Toubes KM, Júnior GM, Tonelli SQ, Carvalho MVd, Silveira FF, Nunes E. Guided endodontics in nonsurgical retreatment of a mandibular first molar: a new approach and case report. 2020.
13. Tavares WLF, de Carvalho Machado V, Fonseca FO, Vasconcellos BC, Magalhães LC, Viana ACD, Henriques LCF. Guided endodontics in complex scenarios of calcified molars. Iran Endod J. 2020;15(1):50-6.
14. Moreno-Rabié C, Torres A, Lambrechts P, Jacobs R. Clinical applications, accuracy and limitations of guided endodontics: a systematic review. Int Endod J. 2020;53(2):214-31.
15. Fonseca Tavares WL, Diniz Viana AC, de Carvalho Machado V, Feitosa Henriques LC, Ribeiro Sobrinho AP. Guided Endodontic Access of Calcified Anterior Teeth. J Endod. 2018;44(7):1195-9.
16. van der Meer WJ, Vissink A, Ng YL, Gulabivala K. 3D Computer aided treatment planning in endodontics. J Dent. 2016;45:67-72.
17. Krastl G, Zehnder MS, Connert T, Weiger R, Kühl S. Guided Endodontics: a novel treatment approach for teeth with pulp canal calcification and apical pathology. Dent Traumatol. 2016;32(3):240-6.
18. Kvinnsland I, Oswald RJ, Halse A, Grønningsaeter AG. A clinical and roentgenological study of 55 cases of root perforation. Int Endod J. 1989;22(2):75-84.
19. Maia LM, de Carvalho Machado V, da Silva N, Brito Júnior M, da Silveira RR, Moreira Júnior G, Ribeiro Sobrinho AP. Case Reports in Maxillary Posterior Teeth by Guided Endodontic Access. J Endod. 2019;45(2):214-8.
20. Bender IB, Seltzer S. Roentgenographic and direct observation of experimental lesions in bone: I. 1961. J Endod. 2003;29(11):702-6; discussion 1.
21. Forsberg J, Halse A. Radiographic simulation of a periapical lesion comparing the paralleling and the bisecting-angle techniques. Int Endod J. 1994;27(3):133-8.
22. Haffajee AD, Socransky SS, Patel MR, Song X. Microbial complexes in supragingival plaque. Oral Microbiol Immunol. 2008;23(3):196-205.
23. Oginni AO, Adekoya-Sofowora CA, Kolawole KA. Evaluation of radiographs, clinical signs and symptoms associated with pulp canal obliteration: an aid to treatment decision. Dent Traumatol. 2009;25(6):620-5.
24. Jacobsen I, Kerekes K. Long-term prognosis of traumatized permanent anterior teeth showing calcifying processes in the pulp cavity. Scand J Dent Res. 1977;85(7):588-98.
25. Pinsky HM, Champleboux G, Sarment DP. Periapical surgery using CAD/CAM guidance: preclinical results. J Endod. 2007;33(2):148-51.
26. Mortman RE. Technologic advances in endodontics. Dent Clin North Am. 2011;55(3):461-80, vii-viii.
27. Zehnder MS, Connert T, Weiger R, Krastl G, Kühl S. Guided endodontics: accuracy of a novel method for guided access cavity preparation and root canal location. Int Endod J. 2016;49(10):966-72.
28. Connert T, Krug R, Eggmann F, Emsermann I, ElAyouti A, Weiger R, Kühl S, Krastl G. Guided Endodontics versus Conventional Access Cavity Preparation: A Comparative Study on Substance Loss Using 3-dimensional-printed Teeth. J Endod. 2019;45(3):327-31.
29. Buchgreitz J, Buchgreitz M, Bjørndal L. Guided root canal preparation using cone beam computed tomography and optical surface scans - an observational study of pulp space obliteration and drill path depth in 50 patients. Int Endod J. 2019;52(5):559-68.
30. Patel S, Wilson R, Dawood A, Foschi F, Mannocci F. The detection of periapical pathosis using digital periapical radiography and cone beam computed tomography - part 2: a 1-year post-treatment follow-up. Int Endod J. 2012;45(8):711-23.
31. de Paula-Silva FW, Wu MK, Leonardo MR, da Silva LA, Wesselink PR. Accuracy of periapical radiography and cone-beam computed tomography scans in diagnosing apical periodontitis using histopathological findings as a gold standard. J Endod. 2009;35(7):1009-12.
32. Nanjannawar GS, Vagarali H, Nanjannawar LG, Prathasarathy B, Patil A, Bhandi S. Pulp stone--an endodontic challenge: successful retrieval of exceptionally long pulp stones measuring 14 and 9.5 mm from the palatal roots of maxillary molars. J Contemp Dent Pract. 2012;13(5):719-22.
33. Casadei BA, Lara-Mendes STO, Barbosa CFM, Araújo CV, de Freitas CA, Machado VC, Santa-Rosa CC. Access to original canal trajectory after deviation and perforation with guided endodontic assistance. Aust Endod J. 2020;46(1):101-6.
34. Setzer FC, Hinckley N, Kohli MR, Karabucak B. A Survey of Cone-beam Computed Tomographic Use among Endodontic Practitioners in the United States. J Endod. 2017;43(5):699-704.

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