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Non-surgical Endodontic Management of a Maxillary Central Incisor with Vertucci's Type V Morphology: A 57-month Follow-up Case Report

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Abstract

Maxillary central incisors typically exhibit a single root and canal. The presence of two roots with separate canals, as defined by Vertucci's type V morphology, is extremely rare and presents diagnostic and technical challenges for nonsurgical endodontic treatment. This report describes the endodontic management of a maxillary right central incisor (tooth #11) exhibiting a sinus tract, negative responses to pulp sensibility tests, and radiographic evidence of apical periodontitis in a 24-year-old female patient. Cone-beam computed tomography (CBCT) revealed a two-rooted anatomy with independent canals splitting at the middle third. Under magnification, access was refined using ultrasonic tips. The palatal root canal was prepared with NiTi CM rotary files, while the wider buccal canal was instrumented with stainless steel K-files. Both canals were disinfected using passive ultrasonic irrigation with 2.5% sodium hypochlorite and 17% EDTA, followed by intracanal calcium hydroxide medication. Obturation was completed using the single-cone technique with a bioceramic sealer. Radiographic follow-up at 14 and 57 months confirmed complete periapical healing and absence of symptoms, demonstrating long-term clinical success. Atypical root canal anatomy in maxillary incisors necessitates advanced imaging/magnification. The use of CBCT, NiTi CM files, and bioceramic sealers enabled accurate diagnosis, conservative canal shaping, and a successful long-term outcome in this rare morphology case.

Keywords: Cone-beam Computed Tomography; Endodontic; Root Canal Anatomy; Ultrasonic

Introduction

The Endodontic success depends on an efficient disinfection and the obturation process of the root canal system. For this reason, a deep knowledge of the root and the pulp cavity anatomy is mandatory for a precise management of the treatment [1].

The root morphology of the maxillary central incisor is well-known, and it is generally presented as a tooth with a single root and a single root canal [2-5]. The description of two or more root canals in maxillary central incisors is extremely rare, and it is limited to case reports in the literature [6-11]. When additional roots or root canals are present, the endodontic treatment can represent a great challenge for the professional [11].

Pre-operative radiograph is always necessary to assess the root structure. Mesiodistally root/canal bifurcation can be easily detected in 2D radiographs, yet angulated images will be required to identify roots bifurcated buccolingually. However, angulation is not always useful, as it can cause distortion and superimposition of other anatomical structures [12]. In cases where anatomical variations are suspected, a request for a cone-beam computed tomography (CBCT) scan may be useful [13, 14]. The CBCT support is a beneficial tool for diagnosis and decision-making in the case [10, 13]. Furthermore, many other technologies are also available nowadays to favor all phases of the endodontic complex treatment cases.

Based on the importance that clinicians should be aware of possible anatomical variations even in teeth with seemingly less complex anatomy as the maxillary central incisors [15], the purpose of this paper is to report the challenges and management solutions in a two-rooted maxillary central incisor non-surgical endodontic treatment.

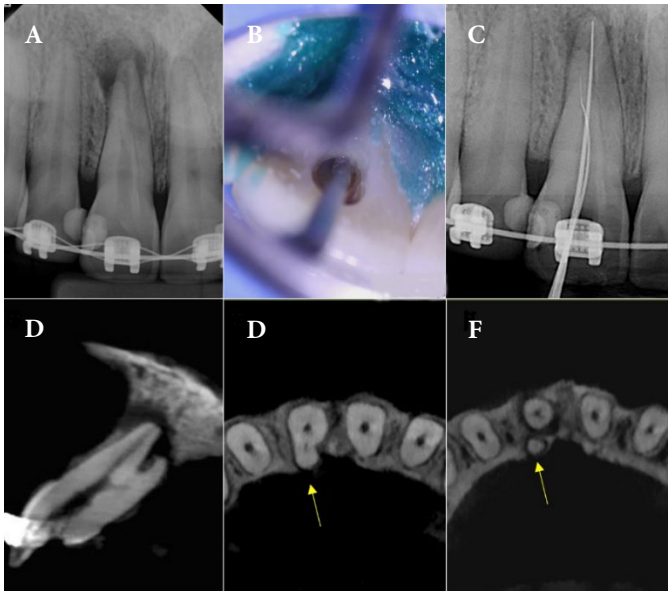

Figure 1. *A*) An initial X-Ray; *B*) E6D ultrasonic tip wearing out the cervical palatine dentin interference; *C*) files reaching the working length; *D*) Two root canals on the CBCT scan in sagittal section; *E & F*) Axial sections; note the additional canal in the palatine region (yellow arrows)

Case Presentation

A 24-year-old white woman presenting good health (ASA I) was referred for an endodontic treatment in a private clinic. Her main complaint was about mild spontaneous pain localized in the maxillary right central incisor. In a clinical and intra-oral examination, the maxillary central incisor (#11) presented a color alteration, and a sinus tract was identified at the vestibular surface at the level of the apex. The probing depth was normal. A moderate response to percussion/palpation tests was present, and the cold test with a refrigerant spray (Endo-Frost Roeko; Coltene, Langenau, Germany) was negative in comparison to contralateral teeth. The periapical radiograph showed apical periodontitis and the presence of two root apices (Fig.1A). Because of that, the CBCT was requested. The CBCT acquisition was carried out in high resolution, 75 µm voxel size, 90 kV, 6.30 mA, and a small field-of-view (5×5 FOV). The exam was dynamically analyzed in the CS 8100 set's software (Carestream, Trophy, France). The 3-D images revealed two roots and two independent root canals bifurcated buccolingually from the middle root third. Besides this anatomic fact, the images displayed an extensive osteolytic lesion with perforation of the vestibular and palatine cortical plates (Figs. 1D-F).

Based on a clinical examination and periapical radiograph /CBCT images' data, the diagnosis was necrotic pulp with a chronic apical abscess, and a non-surgical endodontic treatment plan for the tooth was indicated. Before the endodontic intervention, informed consent was obtained from the patient.

In the first session, tooth #11 was isolated with a rubber dam. With the use of an operatory microscope, the access to the cavity was performed in the center of the lingual surface with a high-speed diamond bur (#1013 and #3082 KG Sorensen, Cotia, Brazil). An ultrasonic tip E6D (Helse Ultrasonic, Santa Rosa de Viterbo, SP, Brazil) was used at the palatine region of the root canal to provide a straight-line access as far as the split region of the two root canals (Fig.1B). This approach was necessary to localize the extra palatal root canal (PRC). The initial negotiation and the glide path of the PRC were accomplished with K-files #08 and #10 (Easy Bassi, Belo Horizonte, Brazil). The pre-flaring of the lingual root canal was performed with rotary files Logic (Easy, Brazil) #15, #25, and #30 tips and .03 taper. The patency of the lingual root canal was achieved with a K-file #08, and its measure was determined with an electronic apex locator (Root ZX II; J Morita, Kyoto, Japan). The working length (WL) was established at the apical foramen (Fig. 1C). The rotary files described above were used at the WL, and an apical enlargement was performed with a master apical file #35 tip and a 0.01 taper Logic rotary file.

The vestibular root canal (VRC) was originally wide, and because of that, its negotiation was easier than the extra PRC. Regarding the VRC, the same procedures were used to establish the WL, and its preparation was performed with stainless steel K-files (Dentsply Maillefer, Tulsa, USA) until a master apical file #55 tip.

During all the mechanical preparation of the root canals, the 2.5% sodium hypochlorite (Fórmula e Ação Farmácia de Manipulação, São Paulo, Brazil) solution was applied. A total volume of 60 mL was delivered at both root canals, which was activated (passive ultrasonic irrigation) by an ultrasonic tip E1 (Helse, Brazil). The activations of the solution were performed after the final mechanical preparation in 3 times of 1-min each. To remove the smear layer, the root canals were rinsed with 5 mL of 17% Ethylene diamine tetraacetic acid (EDTA) solution (Fórmula e Ação Farmácia de Manipulação, São Paulo, Brazil) and activated in the same way as the sodium hypochlorite was done [16]. The final irrigation was performed with cold saline solution, and the root canals were filled with calcium hydroxide paste (UltraCalTM XS; Ultradent, South Jordan, USA), which remained there for 21 days.

In the second session, the patient turned up asymptomatic with no presence of the sinus tract. The paste UltraCalTM XS was removed with 2.5% sodium hypochlorite irrigation added to the master apical file used in the mechanical preparation in the first appointment. The sodium hypochlorite and EDTA were activated again as in the previous session. Before drying the root canals, copious irrigation with a cold saline solution was applied.

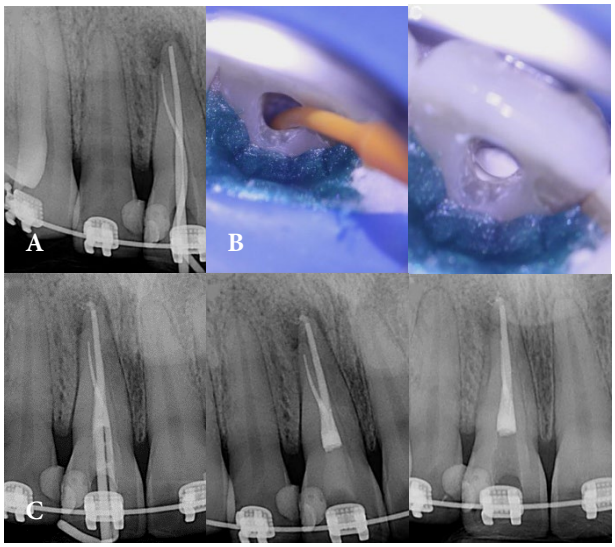

Figure 2. *A)* Master gutta-percha cones test; *B)* Insertion of bioceramic sealer and its appearance after its placement in the root canals; *C)* Post-operative periapical radiographs with different angulations showing the quality of obturation of the root canals

The obturation procedure was performed by the single-cone technique with a bioceramic sealer (Bio C Sealer; Angelus, PR, Brazil). The ready-to-use bioceramic sealer was injected into the root canal up to 4 mm short of the WL with the use of plastic syringes and needles provided by the manufacturer (Figs. 2B & 2C). Before de injection of the sealer, the master gutta-percha cone #60 (Dentsply Maillefer, Tulsa, USA) was first inserted in the VRC. The master cone of the PRC was hard to insert because the space inside the root canal, until the split region, was almost filled by the master gutta-percha cone of the VRC. Consequently, the access to the palatine root canal was almost blocked. To overcome this problem, an FF accessory gutta-percha cone (Dentsply Maillefer, Tulsa, USA) was customized to a #30. The smallest taper of the FF gutta-percha cone allowed its direct access to the PRC (Fig. 2A). In the sequence, the patient was X-rayed to ensure the correct position of the master gutta-percha cones. After the injection of the sealer as described above, the cones were put and the excess gutta-percha was cut at the cemento-enamel junction (CEJ), and the coronal part of gutta-percha was condensed with a gentle pressure using an endodontic plugger. Finally, the cavity access was restored with SDR flow composite resin (Dentsply, Brazil). The patient was informed about the satisfactory initial outcome of the case and appreciated the resolution of symptoms without surgical intervention. However, the patient was alerted that the main result of the case should be evaluated at least 6 months after the end of the second session, and the recall appointments to follow up on the case would be very important. The sequence of the treatment can be seen in Figs. 1 and 2.

Discussion

An adequate shaping to cleaning and obturation of the root canal system, together with the placement of a sealing coronal restoration, are the main procedures toward achieving the endodontic success [17]. Therefore, a good understanding of root canal anatomy is essential to manage complex cases as the present one.

The diagnostic radiograph revealed the presence of two root apices, supporting the assumption of an additional root canal. However, further information regarding root canal anatomy such as localization, size, curvature, and diameter was essential for proper case management. Therefore, a CBCT scan was requested, and the three-dimensional images proved to be valuable in confirming the diagnosis and guiding the decision-making process throughout all phases of this complex case.

In accordance with current position statements on CBCT use, the entire CBCT volume was evaluated in all three planes, and the main findings were documented [18]. The CBCT provided critical information, including the location of the canal bifurcation in the middle third of the root, the palatal positioning of the additional root canal, the narrower and shorter morphology of the palatal root canal (PRC) compared with the vestibular root canal (VRC), the presence of a convex dentinal wall at the PRC entrance, a periapical lesion, and fenestration of both the vestibular and palatal cortical plates.

These findings were essential for defining appropriate clinical strategies for managing the present case. Thus, three-dimensional imaging is indispensable for the diagnosis and treatment of teeth with unusual anatomy, which is consistent with previously published case reports [12, 15, 19, 20] that highlight the usefulness of CBCT for precise evaluation and management of uncommon internal anatomy in maxillary central incisors.

During all procedures of the treatment, the dental operating microscope (DOM) was used. The DOM is an unquestionable tool in the armamentarium of modern endodontic therapy [7]. The use of ultrasonics under magnification of a microscope represents the perfect match to manage complex cases, as the operator can appreciate the direct sight of the structures that require selective wear to preserve surrounding anatomy while achieving the intended effect [21]. The use of the E6D ultrasonic tip was decisive in accessing the PRC, and it provided minimal wear on the dentinal walls at the cervical third or the root canal. Other clinicians/researchers have also used the DOM and the ultrasonic tip as in the current case [8, 12, 15, 19, 20].

Although the worn-out palatine dentin has been performed to reach the entrance of the PRC at the split region, it was not enough to allow the introduction of mechanized files in a straight form of the instrument. The Niti CM files Logic (Easy,

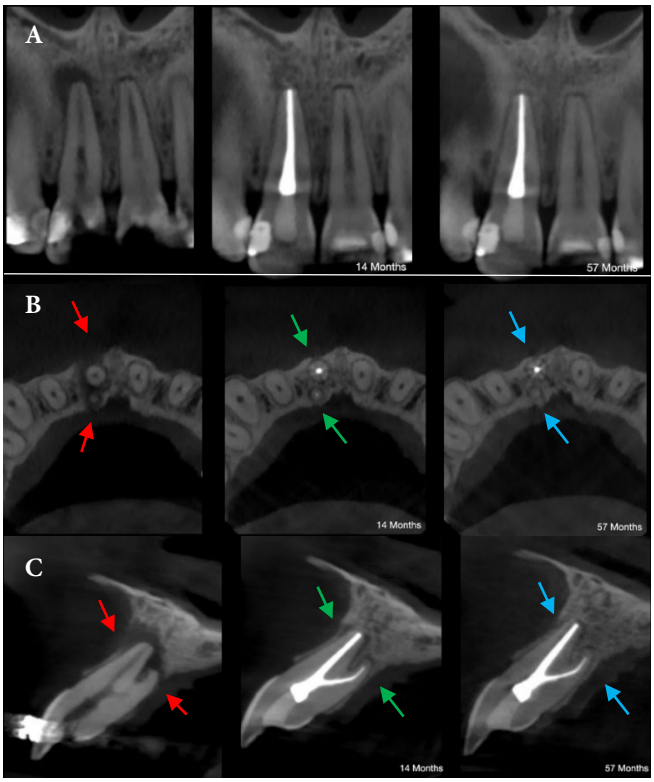

Figure 3. *A)* Comparison of CBCT images: Follow-up at 14 and 57 months. Coronal plane; *B)* Axial plane; *C)* Sagittal plane.
Note: the complete bone healing has already reached 14 months (green arrows). The last follow-up at 57 months (blue arrows) ensures the success of the case

Brazil) were applied in the PRC because this kind of NiTi alloy allows for pre-bending the tip of the file and reaches the entrance of the root canals of hard access [22]. The improvement of flexibility and fatigue resistance of CM NiTi alloy could develop rotary files with larger tips and smaller tapers [23]. Currently, we can perform more conservative root canal preparations, shaping, and better clean the critical regions, such as the apical thirds, without weakening the tooth [24]. The 0.03 taper was decisive in the present case to manage the mechanical preparation of the PRC since it was a root canal with a thinner dimension.

For the root canal system obturation procedure, the way the cement is inserted into the root canal, and the ability of bioceramic cements to support the remineralization process of osteolytic lesions [25] made Bio C Sealer our first cement option for use in conjunction with gutta-percha cones. The introduction of gutta-percha cones was experienced and x-rayed many times before inserting the sealer inside the root canals, allowing the operator to avoid mistakes as blockage of the entrance of the PRC or the bending/deformation of the tip of the master gutta-percha cone.

There are no long follow-ups in endodontic treatments filled with bioceramic sealer in the current literature. Although the complete healing of the lesion could be observed at 14 months, it is important to follow up the cases in which new materials as bioceramic sealers, were used in the long term. The last follow-up at 57 months ensures the success of the case. The comparison of the follow-ups' CBCT images can be seen in Fig. 3.

Although the maxillary central incisor usually has one root canal, endodontists and general practitioners should be aware of an unexpected root canal morphology. Knowing what to expect and find, and where to look for them, are key points in endodontics. The advances in current endodontic therapies as CBCT, dental operating microscopes, CM files, bioactive sealers, and variations in the taper of gutta-percha cones, favor managing complex cases. Repeated radiographs to verify crucial phases of the treatment are also valuable. All those resources were used in the specific clinical cases, and their use was very helpful in achieving success in this non-surgical endodontic treatment of a maxillary central incisor with Vertucci's type V morphology.

Last but not least, a single case report presents important limitations that must be considered when interpreting its findings. Because it involves only one patient, the results cannot be generalized to the wider population, and the absence of a control group prevents the establishment of robust conclusions as the strategies adopted in the present report have highly case-dependent applicability for the successful management of a maxillary central incisor with Vertucci's Type V configuration. Therefore, although case reports contribute to hypothesis generation and to the documentation of uncommon clinical scenarios in endodontics, their findings should be interpreted with appropriate caution.

Conclusion

The use of advanced technologies (*e.g.*, CBCT imaging, dental operating microscope, and ultrasonic tip) and materials (*e.g.*, bioceramic sealer) available in the current endodontics was decisive in achieving success in the treatment of this specific maxillary central incisor with Vertucci's type V morphology.

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Conflict of interest
None.

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Authors' contributions

Conceptualization: KFSP; Methodology: EJZ/ FNA; Formal Analysis and Investigation: EJZ; Writing-Original Draft Preparation: EJZ/ FNA/ KFSP; Writing-Review and Editing: KFSP; Supervision: FNA. All authors read and approved the final manuscript.

References

1. Calvert G. Maxillary central incisor with type V canal morphology: case report and literature review. J Endod. 2014;40(10):1684-7.
2. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol. 1984;58(5):589-99.
3. Consoli Lizzi EP, Chaintiou Piorno R, Aranda CM, Gualtieri AF, Rodríguez PA. Maxillary incisor internal root anatomy evaluated by cone-beam computed tomography in a population of the Autonomous City of Buenos Aires, Argentina. Acta Odontol Latinoam. 2021;34(2):188-94.
4. Altunsoy M, Ok E, Nur BG, Aglarci OS, Gungor E, Colak M. A cone-beam computed tomography study of the root canal morphology of anterior teeth in a Turkish population. Eur J Dent. 2014;8(3):302-6.
5. da Silva EJ, de Castro RW, Nejaim Y, Silva AI, Haiter-Neto F, Silberman A, et al. Evaluation of root canal configuration of maxillary and mandibular anterior teeth using cone beam computed tomography: An in-vivo study. Quintessence Int. 2016;47(1):19-24.
6. Krishnamurti A, Velmurugan N, Nandini S. Management of single-rooted maxillary central incisor with two canals: a case report. Iran Endod J. 2012;7(1):36-9.
7. Aznar Portoles C, Moinzadeh AT, Shemesh H. A Central Incisor with 4 Independent Root Canals: A Case Report. J Endod. 2015;41(11):1903-6.
8. Gondim E, Jr., Setzer F, Zingg P, Karabucak B. A maxillary central incisor with three root canals: a case report. J Endod. 2009;35(10):1445-7.
9. Miranda Candeiro GT, Parente Viana FL, Camelo Paiva H, Luiz Caldeira C, Faga Iglecias E, Gavini G. Endodontic Retreatment of a Maxillary Central Incisor with Two Root Canals in a Patient with Cleft Lip and Palate. Iran Endod J. 2019;14(3):235-9.
10. Levin A, Shemesh A, Katzenell V, Gottlieb A, Ben Itzhak J, Solomonov M. Use of Cone-beam Computed Tomography during Retreatment of a 2-rooted Maxillary Central Incisor: Case Report of a Complex Diagnosis and Treatment. J Endod. 2015;41(12):2064-7.
11. Yadav S, Nawal RR, Talwar S. Endodontic Management of Maxillary Central Incisor with Rare Root Canal Anatomy. Cureus. 2020;12(4):e7851.
12. Namaei Ghasemi S, Forghani M, Karimpour S. Endodontic Management of a Maxillary Central Incisor with two Roots: A Case Report and Literature Review. Iran Endod J. 2023;18(3):174-80.
13. Fayad M. The impact of cone beam computed tomography in endodontics: a new era in diagnosis and treatment planning. ENDODONTICS: Colleagues for Excellence American association of endodontists. 2018.
14. Patel S, Brown J, Semper M, Abella F, Mannocci F. European Society of Endodontology position statement: Use of cone beam computed tomography in Endodontics: European Society of Endodontology (ESE) developed by. Int Endod J. 2019;52(12):1675-8.
15. Mahadevan M, Paulaian B, Ravisankar SM, Arvind Kumar A, Nagaraj NJ. Endodontic Management of Maxillary Central Incisor with Two Roots, and Lateral Incisor with a C-shaped Canal; A Case Report. Iran Endod J. 2023;18(2):104-9.
16. Mohammadi Z, Shalavi S, Giardino L, Palazzi F, Asgary S. Impact of Ultrasonic Activation on the Effectiveness of Sodium Hypochlorite: A Review. Iran Endod J. 2015;10(4):216-20.
17. Gillen BM, Looney SW, Gu LS, Loushine BA, Weller RN, Loushine RJ, et al. Impact of the quality of coronal restoration versus the quality of root canal fillings on success of root canal treatment: a systematic review and meta-analysis. J Endod. 2011;37(7):895-902.
18. de Menezes S, Batista SM, Lira JOP, de Melo Monteiro GQ. Cyclic Fatigue Resistance of WaveOne Gold, ProDesign R and ProDesign Logic Files in Curved Canals In Vitro. Iran Endod J. 2017;12(4):468-73.
19. Jafari Z, Kazemi A, Shiri Ashtiani A. Endodontic Management of a Two-Rooted Maxillary Central Incisor Using Cone-Beam Computed Tomography: A Case Report. Iran Endod J. 2022;17(4):220-2.
20. Bhattacharyya A, Majumder G, Maity AB, Datta S. A rare case of persistent postendodontic symptomatic maxillary central incisor with aberrant canal configuration confirmed by cone-beam computer tomography and its nonsurgical management by retreatment. J Conserv Dent. 2023;26(3):359-63.
21. Mendes EB, Soares AJ, Martins JNR, Silva E, Frozoni MR. Influence of access cavity design and use of operating microscope and ultrasonic troughing to detect middle mesial canals in extracted mandibular first molars. Int Endod J. 2020;53(10):1430-7.
22. Patel S, Brown J, Pimentel T, Kelly RD, Abella F, Durack C. Cone beam computed tomography in Endodontics - a review of the literature. Int Endod J. 2019;52(8):1138-52.
23. Ruiz-Sánchez C, Faus-Llácer V, Faus-Matoses I, Zubizarreta-Macho Á, Sauro S, Faus-Matoses V. The Influence of NiTi Alloy on the Cyclic Fatigue Resistance of Endodontic Files. J Clin Med. 2020;9(11).
24. Tavares K, Pinto JC, Santos-Junior AO, Duarte MAH, Guerreiro-Tanomaru JM, Tanomaru-Filho M. Effect of Additional Apical Preparation on Retreatment of Curved Root Canals Filled with Different Sealers. Eur J Dent. 2023;17(3):636-41.
25. Pereira KFS, da Silva SO, Bastos HJS, Tomazinho LF, do Nascimento VR, Junqueira-Verardo LB, et al. Bioceramic Cements: Supporting in Remineralization of Osteolytic Lesions in Endodontic-periodontal Diseases: A Report of Two Cases. Iran Endod J. 2023;18(4):264-70.

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