Conservative Dentistry Journal Vol. 15 No. 2 July-December 2025; 49-51

Case Report

Two-rooted maxillary central incisor incidental finding in CBCT

Sanaz Heidarkhan Tehrani[1], Mehdi Amiri Siavoshani[1], Mahsa Khademi Ghohroudi[1], Amirreza Mehdizadeh[1], Sana Baghizadeh[2]

[1]Assistant professor, Department of Oral and Maxillofacial Radiology, TeMS.c., Islamic Azad University, Tehran, Iran

[2]Researcher, TeMS.c., Islamic Azad University, Tehran, Iran

ABSTRACT

Background: *Understanding the intricacies of the root canal system and its anatomical/morphological diversities is vital for achieving optimal results in root canal treatments. The effectiveness of endodontic therapy is a function of a comprehensive understanding of tooth anatomy and its potential alterations.* ***Purpose:*** *This case presents the importance of 3D radiography for endodontic diagnostic and treatment planning. The availability of 3D radiography has significantly enhanced endodontics' diagnostic and curing planning aspects.* ***Case:*** *A female patient was referred for radiographic evaluation of her remaining teeth and edentulous area for implant placement.* ***Case Management:*** *Evaluation was conducted by cone-beam computed tomography using Paxi3D with field of view (FOV) 9*12,200 micrometer resolution. A maxillary central incisor with two distinct roots and root canals was identified and discovered by a 3D radiography.* ***Discussion:*** *Given the infrequent occurrence of two-rooted maxillary central incisors, conducting a thorough radiological and clinical inspection before starting endodontic treatment is of great necessity.*

Keywords: *Cone-beam computed tomography (CBCT); Dental anatomy; Endodontic management; Maxillary central incisor*

Correspondence: Sanaz Heidarkhan Tehrani, Assistant professor, Department of Oral and Maxillofacial Radiology, TeMS.c., Islamic Azad University, No.9, 9TH Neyestan st, Pasdaran Ave, Tehran, Iran. E-mail: sanazhtehrani@gmail.com

INTRODUCTION

Understanding morphological diversities in the root canal system's anatomy significantly influences dental procedure results, particularly in endodontic treatments. Existing literature suggests that maxillary central incisors typically exhibit a single-rooted form with a single canal in approximately 100% of cases.[1,2] Nevertheless, there have been documented cases in the literature reporting maxillary central incisors with multiple root canals.[3,4] Furthermore, double-rooted maxillary central incisors seem uncommon, with only a limited number of clinical case reports published on this phenomenon.[5,6]

Despite the necessity of periapical radiographs (PAR) for diagnosis, performing, and planning endodontic treatment, limited applications of periapical radiographs in root canal morphology alterations have been reported.[5] Cone-beam computed tomography (CBCT) is an efficient method for addressing the constraints of traditional radiography and achieving enhanced image resolution. [7]This technique can be applied to identify and pinpoint abnormal dental roots and additional canals and altered morphology.[8,9] The reported case provides a detailed account of a maxillary incisor with two roots accidentally identified by CBCT imaging.

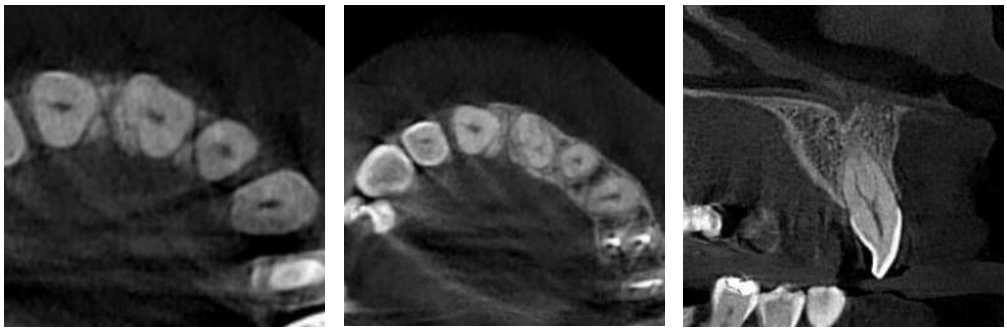
CASE

A female patient, 44 years of age, was directed to a private radiology office in Tehran, Iran, to evaluate the edentulous area in the right posterior segment of the upper jaw and dental implant placement. Informed consent and inform to consent were obtained from the patient, and the radiographic procedure were explained thoroughly to the patient.

CASE MANAGEMENT

Evaluation was conducted by CBCT (Pax i3D, Vatech, Gyeonggi-do, Korea) sections (FOV 9*12, 200 µm resolution). It was accidentally found that the left upper central incisor has an additional root with two separate root canal spaces in the tooth and an individual outline; one root was placed buccally and other one was placed distopalatally (figure 1a ,1b). Each root had only one orifice and apical foramen. The mentioned tooth had no periapical or periodontal lesion and was clinically asymptomatic (figure 1c). Additionally, the intraoral examination showed that the contralateral tooth (right upper central incisor), which was single-rooted, had an incisogingival groove running along the facial surface (figure 2a). After careful

DOI: https://doi.org/10.20473/cdj.v15i2.2025.49-51



a b c

Figure 1. CBCT scan of the maxillary left central incisor: a) Axial view from the CEJ level, b) Axial view from mid root level and c) corrected sagittal view.

a b

Figure 2. Clinical intraoral photograph. a) frontal, b) occlusal view

examination, coronal mesiodistal diameter and the number of teeth were found to be normal and proportional; therefore, neither germination nor fusion occurred (figure 2b). Further evaluation revealed nasal septal deviation, mucosal thickening, and concha bullosa.

DISCUSSION

As previously mentioned, most upper central incisors have a single canal and root.[4] Nevertheless, over time, there has been a growing number of reported cases highlighting alterations in maxillary central incisor anatomy. Hence, performing a more detailed examination before endodontic treatment is important even in the most routine cases.[6]

The development of additional roots occurs through the division or bending of Hertwig's epithelial root sheath, resulting in distinct roots that may exhibit diverse morphological characteristics. If additional roots are present in the maxillary central incisors, they can occur either mesiodistally or labiolingually.[10] Various factors were suggested for multiple roots/root canals in anterior teeth, including ethnicity, gender, age, disease, and developmental abnormalities. However, dental trauma, especially intrusive luxation to primary teeth, may divide the cervical loop and form two roots in the mesiodistal orientation of the succeeding tooth.[11]

Parallel intraoral periapical radiographs are the standard imaging technique in diagnosis and successful root canal treatment planning has been reported without three-dimensional imaging even in rare root morphology .[12] However, in cases where the root canal anatomy is more intricate, these radiographs may be unclear or unsuitable for treatment planning. [7]CBCT proves highly valuable in situations involving intricate anatomies like taurodontism, gemination/fusion, dens invaginatus, and cases where additional canals/roots beyond the normal count are suspected. Specifically, it reveals details such as the course and number of canals, the existence of isthmus and apical branches, and the remaining dentine thickness. [13]

In the absence of CBCT, periapical radiographic images from various angles [13] or utilization of more advanced tools such as dental operating microscope could be considered an alternative. [12] In contrast to diaphanization, a process involving chemical therapies to make the tooth translucent, CBCT scans reconstructed with voxel sizes ranging from 125 to 250 µm demonstrate a reported accuracy of 90% in recognizing the canal numbers and detailing the Vertucci structure of the root canal system.[14]

Dalili et al. assessed the precision of CBCT in identifying the quantity and delineating the root canal shapes, comparing the outcomes to the widely accepted method of tooth clearing and staining, often considered the benchmark technique. The accuracy rate for correctly diagnosing the number of root canals using CBCT in their work is 92.1%.[15]Neelakantan et al. evaluated the precision of different methods in examining the canal and root structure of removed human teeth. Their findings indicated that CBCT demonstrated comparable accuracy to the gold standard of tooth clearing and staining. Notably, the accuracy of CBCT surpassed that of spiral CT and conventional digital radiography.[16]

Certain practitioners promote the regular application of CBCT for the initial examination of root canal anatomy before commencing endodontic procedures. They also suggest follow-up CBCT scans to assess the results of root canal therapy.[17] On the contrary, some practitioners are less inclined to request CBCT scans. In this respect, they report worries over elevated radiation exposure and associated risks, a perceived absence of significant advantages, additional costs for the patient, and space constraints.[18] The choice to undergo scans can also be impacted by the achieved endodontic credentials and the accessibility of on-site CBCT.[19]

Despite the growing utilization of CBCT among endodontists [20] it is not a sufficiently precise diagnostic tool for evaluating highly delicate and variable anatomy of altered root canals.[21] Although the radiation dose in dental imaging is generally minimal, it should be recognized that three-dimensional imaging involves a higher radiation exposure to the patient. Therefore strict adherence to the *As Low As Reasonably Achievable* (ALARA); As *Low As Diagnostically Acceptable* (ALADA) and *As Low As Diagnostically Acceptable, being Indication-oriented and Patient-specific* (ALADAIP) principles should remain a fundamental consideration in clinical practice.[22]

Routine inspection of root canal anatomy using CBCT is not recommended. Nevertheless, clinicians should be mindful of the possibility of anatomical alterations, even in teeth with apparently less intricate anatomy (e.g., the maxillary central incisor). Hence, exploring alternative imaging techniques, like CBCT, becomes crucial for accurate diagnosis and more reliable treatment in analogous situations.

REFERENCES

1. Estrela C, Bueno MR, Couto GS, Rabelo LE, Alencar AH, Silva RG, Pecora JD, Sousa-Neto MD. Study of Root Canal Anatomy in Human Permanent Teeth in A Subpopulation of Brazil's Center Region Using Cone-Beam Computed Tomography - Part 1. Braz Dent J. 2015;26(5):530-6.
2. Martins JNR, Marques D, Mata A, Caramês J. Root and root canal morphology of the permanent dentition in a Caucasian population: a cone-beam computed tomography study. Int Endod J. 2017;50(11):1013-26.
3. Chaniotis A, Filippatos CG. The Use of a Novel Approach for the Instrumentation of a Cone-beam Computed Tomography-discernible Lateral Canal in an Unusual Maxillary Incisor: Case Report. J Endod. 2017;43(6):1023-7.
4. Wang J, Zhang W, Zhou L. A maxillary center incisor with three independent roots and three root canals: A case report. Medicine, 2020;99(33), e21761.
5. 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.
6. Al-Madi EM. Maxillary Central Incisor with Two Roots; A case report. Saudi Endod J 2020; 10:162-4.
7. Sarsam W, Davies J, Al-Salehi S. The role of imaging in endodontics. Braz Dent J. 2025;238(7): 448–457.
8. Mabrouk R, Berrezouga L, Frih N. The Accuracy of CBCT in the Detection of Dens Invaginatus in a Tunisian Population. Int J Dent. 2021; 2021:8826204.
9. Tahmasebi M, Heidarkhan Tehrani S, Mehmani F, Mesgari H, Mehdizadeh A. Anatomical Correlation Between Mandibular Third Molar Position and Retromolar Nerve Variations: A CBCT Study. J Res Dent Maxillofac Sci. 2025; 10 (2) : 159-167.
10. Namaei Ghasemi S, Forghani M, Karimpour S. Endodontic Management of a Maxillary Central Incisor with two Roots: A Case Report and Literature Review: maxillary central incisor with two roots. Iran Endod J. 2023;18(3):174-80.
11. Gomes de Oliveira N, Ricardo Oliveira Passos C, Espíndola-Castro LF, Reis de Melo Júnior PM, Alves Sayão Maia SM, de Vasconcelos Carvalho M. The Use of Cone-Beam Computed Tomography in the Endodontic Treatment of a Maxillary Central Incisor With Two Roots: Case Report. Compend Contin Educ Dent. 2021;42(1):e1-e4.
12. Yadav S, Nawal RR, Talwar S. Endodontic Management of Maxillary Central Incisor with Rare Root Canal Anatomy. Cureus. 2020;12(4):e7851.
13. AAE and AAOMR Joint Position Statement: Use of Cone Beam Computed Tomography in Endodontics 2015 Update. Oral Surg Oral Med Oral Pathol Oral Radiol. 2015;120(4):508-12.
14. Ji Y, Wen S, Liu S, Zhu M, Yao M, Wang T, Lin Z. Could cone-beam computed tomography demonstrate the lateral accessory canals? BMC Oral Health. 2017;17(1):142.
15. Dalili Kajan Z, Taramsari M, Khosravi Fard N, Kanani M. Accuracy of Cone-beam Computed Tomography in Comparison with Standard Method in Evaluating Root Canal Morphology: An In Vitro Study. Iran Endod J. 2018;13(2):181-7.
16. Neelakantan P, Subbarao C, Subbarao CV. Comparative evaluation of modified canal staining and clearing technique, cone-beam computed tomography, peripheral quantitative computed tomography, spiral computed tomography, and plain and contrast medium-enhanced digital radiography in studying root canal morphology. J Endod. 2010;36(9): 1547-51.
17. Cheung MC, Parashos P. Current endodontic practice and use of newer technologies in Australia and New Zealand. Aust Dent J. 2023;68(3):186-96.
18. Martins JF, Georgiou AC, Nunes PD, de Vries R, Afreixo VM, da Palma PJ, Shemesh H. CBCT-assessed outcomes and prognostic factors of primary endodontic treatment and retreatment: a systematic review and meta-analysis. J Endod. 2025;51(6):687-706.
19. Krug R, Connert T, Beinicke A, Soliman S, Schubert A, Kiefner P, Sonntag D, Weiger R, Krastl G. When and how do endodontic specialists use cone-beam computed tomography? Aust Endod J. 2019;45(3):365-72.
20. Duong C, Zhu Q, Aseltine RH Jr, Kuo CL, da Cunha Godoy L, Kaufman B. A Survey on Cone-beam Computed Tomography Usage Among Endodontists in the United States. J Endod. 2023;49(11):1559-1564.
21. Pires M, Martins JNR, Pereira MR, Vasconcelos I, Costa RPD, Duarte I, Ginjeira A. Diagnostic value of cone beam computed tomography for root canal morphology assessment - a micro-CT based comparison. Clin Oral Investig. 2024;28(3):201.
22. Mendonça RP, Estrela C, Bueno MR, Carvalho TCASG, Estrela LRA, Chilvarquer I. Principles of radiological protection and application of ALARA, ALADA, and ALADAIP: a critical review. Braz Oral Res. 2025;39:e14.

DOI: https://doi.org/10.20473/cdj.v15i2.2025.49-51