Case Report

Navigating Complexity: Cone-beam Computed Tomography -Assisted Endodontic Management of Two Distobuccal Canals in a Maxillary Second Molar: A Case Report

Shikha Jaiswal[1], Sanjeev Tyagi[1], Krupa Kapadia[1], Harshita Karwatkar[1]

[1]Department of Conservative Dentistry and Endodontic, Peoples Dental Academy, Bhopal, Madhya Pradesh, India.

Abstract

Variations in root canal anatomy are critical to the success of endodontic treatment. This case report presents a maxillary second molar with two distinct distobuccal canals, each with separate apical foramina, an uncommon anatomical configuration. The variation was identified radiographically and confirmed through a detailed clinical examination. Root canal treatment was successfully performed to address the complexity. This report emphasizes the importance of radiographic evaluation, understanding root canal morphology, and meticulous treatment planning in managing rare anatomical variations.

Keywords: Apical foramina, Distobuccal canal, Maxillary second molar, Root canal morphology.

Introduction

A comprehensive understanding of tooth anatomy and root canal morphology is paramount to the success of endodontic therapy. Root canal treatment aims to eliminate microbial infection from the root canal system and prevent reinfection by thoroughly cleaning, shaping, disinfecting, and sealing the canal spaces. Achieving this goal requires complete debridement of the entire root canal system, which can be difficult in the presence of complex or aberrant canal anatomy.[1] Morphological variations, particularly in posterior teeth such as maxillary molars, are common and pose significant challenges for endodontic procedures. Failure to recognize and treat all canals, especially accessory or unusual ones, can lead to persistent periapical pathosis and ultimately result in treatment failure.[2]

Maxillary molars, especially the second molars, exhibit considerable anatomical complexity and variability. The most frequently encountered configuration in maxillary second molars includes three roots-mesiobuccal (MB), distobuccal (DB), and palatal (P)-each typically containing a single canal. However, anatomical studies and case reports have documented significant variations, including the presence of an additional canal in the MB root (commonly referred to as MB2), or occasionally, multiple canals in the DB or P roots.[3]

Access this article online

Website: www.jrad.co.in

DOI: https://doi.org/10.53064/jrad.2024.16.3.694

The root canal morphology of these teeth has been widely studied using various techniques, including canal staining and clearing, conventional radiography, and advanced imaging technologies, all of which have contributed to a growing awareness of the anatomical possibilities within the maxillary molar region.[4]

One of the earliest and most comprehensive studies on root canal morphology was conducted by Vertucci, who described multiple configurations within single roots and emphasized the importance of locating and treating all canal systems.[3] More recent studies have built upon this work, reporting a wide range of canal morphologies and reinforcing the necessity of using advanced diagnostic tools to detect such variations. Jafarzadeh *et al*. reported a rare case of a maxillary second molar with three separate buccal roots, illustrating that significant deviations from the standard anatomical pattern can and do occur in

Address for correspondence: Dr. Shikha Jaiswal, Postgraduate, MDS, Department of Conservative Dentistry and Endodontic, Peoples Dental Academy, Bhopal, Madhya Pradesh, India.
Email: shikhajaiwal0@gmail.com

Received: May. 29, 2025; **Accepted:** Jun. 25, 2025; **Published:** Jun. 26, 2025

How to cite this article: Jaiswal S, Tyagi S, Kapadia K, Karwatkar H. Navigating Complexity: Cone-beam Computed Tomography-Assisted Endodontic Management of Two Distobuccal Canals in a Maxillary Second Molar: A Case Report. J Res Adv Dent 2025;16(4):1-3.

clinical practice.[5] Similarly, Stone and Stroner documented instances where maxillary molars contained more than one P canal, further highlighting the need for heightened clinical suspicion when unusual anatomy is suspected.[6]

Conventional intraoral periapical radiographs remain the primary imaging modality used in endodontic diagnosis; however, their two-dimensional limitations-such as superimposition of anatomical structures and distortion-can make it difficult to detect additional canals or complex root systems.[7] These limitations can result in untreated canal systems, incomplete debridement, and ultimately, treatment failure. To address these challenges, cone-beam computed tomography (CBCT) has emerged as a superior diagnostic modality, offering three-dimensional visualization of root and canal anatomy with relatively low radiation exposure compared to conventional computed tomography (CT) scans.[8] CBCT imaging allows clinicians to assess internal tooth structures with high accuracy, making it invaluable in cases involving suspected anatomical anomalies or complex canal systems.

Zhang *et al*. utilized CBCT to evaluate the canal morphology of maxillary molars in a Chinese population and reported considerable variability, including the presence of additional DB and MB canals.[9] In a separate in vitro study, Matherne *et al*. compared conventional digital imaging with CBCT and found that digital radiography failed to detect at least one canal in approximately 40% of the teeth examined when CBCT was used as the gold standard.[10] These findings underscore the critical role of CBCT in enhancing the detection of accessory canals and facilitating accurate diagnosis and treatment planning.

This case report highlights the diagnosis and successful endodontic management of a maxillary second molar with two distinct DB canals, each with a separate apical foramen-an uncommon anatomical variation that could have easily been missed without the aid of CBCT. The report emphasizes the importance of careful clinical and radiographic evaluation, appropriate use of magnification, and advanced imaging techniques to ensure that all components of the root canal system are adequately addressed. Early and accurate identification of anatomical variations is essential not only for treatment success but also for minimizing the risk of post-treatment complications and improving long-term prognoses.

Case History

A 34-year-old male reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of continuous, lingering pain in the right upper posterior region for the past 3 days. The pain intensified when lying down. The patient's medical history was non-contributory.

Intraoral examination revealed a distoproximal carious lesion in the maxillary right second molar (tooth 17). The tooth was non-responsive to electric pulp testing, suggesting loss of vitality.

A periapical radiograph showed a distoproximal carious lesion involving the pulp, supporting the clinical findings.

Based on the subjective symptoms, clinical findings, electric pulp testing, and radiographic evaluation, a diagnosis of irreversible pulpitis was established. Endodontic therapy was planned and initiated.

The tooth was anesthetized and isolated using a rubber dam. Caries removal was carried out using an endo-access bur (Dentsply Maillefer) through the carious approach. Upon accessing the pulp chamber, initial exploration with a DG16 endodontic explorer revealed three canal orifices (Figure 1a), presumed to be the MB, DB, and P canals later CBCT reveled persence of 4 canals (Figure 1b).

Canal patency was established using ISO #10 K-files. A working length radiograph unexpectedly revealed a missed MB canal and two distinct DB canals (Figure 2a). Given this unusual anatomy, a CBCT scan was advised to confirm the canal configuration. CBCT imaging confirmed the presence of two separate DB canals, one MB canal, and one P canal, all with independent apical foramina.

Further caries removal revealed mesial extension, allowing better access. An Endo Z bur was used to refine the access cavity, facilitating the location of the previously missed MB canal. Working length was determined using an apex locator (NSK) and confirmed radiographically (Figure 2b).

Biomechanical preparation was performed using a hybrid technique. Manual instrumentation was carried out up to ISO #20 K-files, followed by rotary instrumentation with Hero Gold (MicroMega) up to 20.06 taper. Irrigation was performed using copious amounts of 3% sodium hypochlorite (NaOCl) and normal saline.

Master cones were selected and verified radiographically (Figure 2c). Canals were dried with sterile paper points and obturated using gutta-percha cones coated with AH Plus sealer via the lateral condensation technique (Figure 2d). The access cavity was sealed with glass ionomer cement as a temporary post-obturation restoration.

Discussion

Understanding the internal anatomy of teeth, particularly in complex regions such as the maxillary posterior segments, is pivotal for achieving clinical success in endodontic treatment.[1] Failure to locate, instrument, and obturate all canals within a tooth may lead to persistent infection and ultimately, treatment failure.[2] The root canal morphology of maxillary second molars has been studied extensively and is known to be highly variable, with the presence of extra canals not uncommon.[3]

Jafarzadeh *et al.* reported successful endodontic retreatment of a maxillary second molar with three separate buccal roots, underscoring the potential for multiple canal systems within individual roots.[5] Similarly, Stone and Stroner identified cases

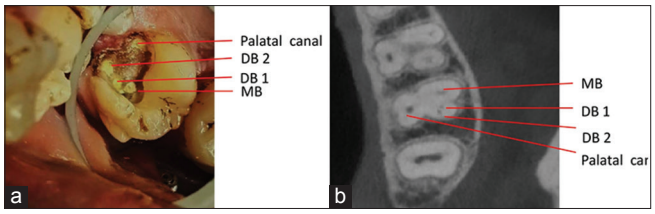

Figure 1: (a) Clinical view of canal location, (b) cone-beam computed tomography imaging showing two distobuccal canal in maxillary 2nd molar

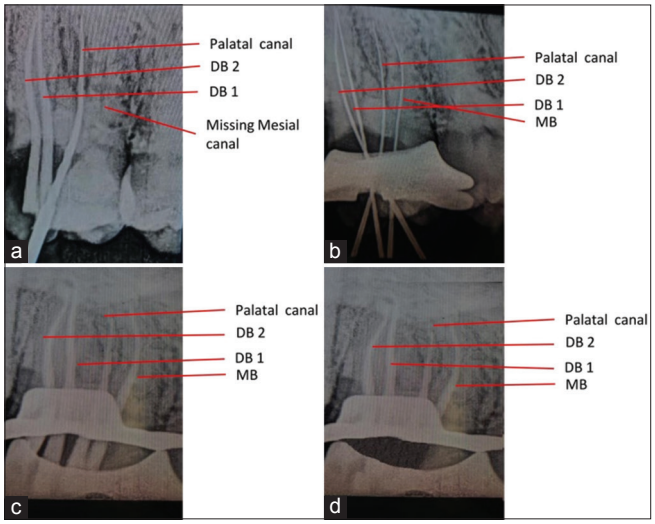

Figure 2: (a) Missing mesiobuccal canal, (b) Working length Radiovisiography (RVG), (c) Master cone RVG, (d) Obturation RVG

with multiple P canals, further highlighting the morphological complexity of maxillary molars.[3]

In clinical practice, traditional two-dimensional radiographs may not adequately reveal such variations due to overlapping anatomical structures and limitations in angulation.[3] As demonstrated in this case, the initial working length radiograph revealed an unusual appearance of the DB root, which prompted further investigation through CBCT imaging. CBCT provides superior diagnostic accuracy by enabling three-dimensional visualization of internal root canal anatomy and has proven to be effective in identifying additional root canals and apical foramina.[5]

Zhang *et al.* used CBCT to evaluate maxillary molar morphology in a Chinese population and identified a wide range of anatomical configurations, reinforcing its utility in endodontic diagnosis.[5] Furthermore, Matherne *et al.* compared conventional digital imaging with CBCT and found that traditional methods failed to detect at least one root canal system in nearly 40% of teeth when compared to CBCT imaging.[10] This illustrates the importance of utilizing advanced imaging techniques in complex clinical scenarios.

In the present case, the use of CBCT was crucial in identifying two distinct DB canals in a maxillary second molar, each with a separate apical foramen. This rare anatomical variation, if left undetected, could have resulted in incomplete canal debridement and suboptimal treatment outcomes. The CBCT findings guided the clinician in successful canal negotiation, working length determination, and obturation.

Ultimately, clinicians must maintain a high index of suspicion and utilize all available diagnostic tools when faced with anatomical anomalies. The integration of magnification, enhanced illumination, and CBCT can significantly improve the detection of complex canal systems, leading to better clinical outcomes.

Conclusion

This case report highlights the critical importance of a thorough understanding of root canal anatomy and the utilization of advanced diagnostic tools such as CBCT in endodontic practice. The identification of two separate DB canals with independent apical foramina in a maxillary second molar-an uncommon anatomical variation-emphasizes the potential complexity that clinicians may encounter. Accurate diagnosis and careful management of such variations are essential to ensure complete cleaning, shaping, and obturation of the root canal system, ultimately improving treatment outcomes and preventing failure. Incorporating magnification, detailed clinical examination, and three-dimensional imaging significantly enhances the clinician's ability to detect and treat complex canal morphologies, thereby promoting long-term success in endodontic therapy.

References

1. Ahmed HM, Versiani MA, De-Deus G, Dummer PM. A new system for classifying root and root canal morphology. Int Endod J 2017;50:761-70.
2. Cleghorn BM, Christie WH, Dong CC. Root and root canal morphology of the human permanent maxillary first molar: A literature review. J Endod 2006;32:813-21.
3. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol 1984;58:589-99.
4. Fenelon T, Parashos P. Prevalence and morphology of C-shaped and non-C-shaped root canal systems in mandibular second molars. Aust Dent J 2022;67:S65-75.
5. Jafarzadeh H, Javidi M, Zarei M. Endodontic retreatment of a maxillary second molar with three separate buccal roots. Aust Endod J 2006;32:129-32.
6. Stone LH, Stroner WF. Maxillary molars demonstrating more than one palatal root canal. Oral Surg Oral Med Oral Pathol 1981;51:649-52.
7. Fava LR, Dummer PM. Periapical radiographic techniques during endodontic diagnosis and treatment. Int Endod J 1997;304:250-61.
8. Patel S, Dawood A, Whaites E, Pitt Ford T. New dimensions in endodontic imaging: Part 1. Conventional and alternative radiographic systems. Int Endod J 2009;42:447-62.
9. Zhang R, Yang H, Yu X, Wang H, Hu T, Dummer PM. Use of CBCT to identify the morphology of maxillary permanent molar teeth in a Chinese subpopulation. Int Endod J 2011;44:162-9.
10. Matherne RP, Angelopoulos C, Kulild JC, Tira D. Use of cone-beam computed tomography to identify root canal systems *in vitro*. J Endod 2008;34:87-9.