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CASE REPORT

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Variation in location of the distobuccal root canal in a permanent maxillary second molar: A case report

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Key Clinical Message: Clinicians should be aware of the variations in the number of roots and root canals and the peculiar or eccentric location of root canals. An intraoperative CBCT can be very useful in improved visualization of the anatomical variations.

Abstract: This case report describes the unusual location of the distobuccal root canal in a maxillary second molar with root fusion. On access opening, three distinct root canal orifices, the mesiobuccal canal, palatal canal, and a third orifice closer to the palatal canal, were seen, giving an illusion of an additional palatal canal. An attempt was made to search for the distobuccal canal in its usual position, leading to the gouging of the pulp chamber floor. An intraoperative limited field of view cone-beam computed tomography (CBCT) revealed the root orifice adjacent to the palatal canal was the distobuccal canal. CBCT also revealed fusion of both the buccal and palatal roots in the root's coronal and middle third region, but they were not fused apically.

KEYWORDS
cone-beam computed tomography, distobuccal, fused roots, maxillary second molar, variation

1 | INTRODUCTION

The root canal system is highly complex and variable.[1] Numerous case reports and earlier studies have reported variations in maxillary molars.[2–4] Variations have been mostly reported in the form of extra canals being present. However, Zhang et al., in an in vitro study, found maxillary second molars to have more variations than the first molars.[5] Most of the earlier studies have focused on the Mesiobuccal (MB) root of the maxillary first molar, as it frequently has two root canals with variations in the root canal pattern.[6,7]

The case reports published in the literature pertaining to the variations in maxillary second molar are most frequently in relation to the alterations in the number of roots or root canals. Kottor et al. reported a case of a maxillary second molar with five roots and five separate canals in each of these roots.[8] In contrast, Ahuja et al. reported a case of a maxillary second molar with a single root and single canal.[9] Regarding the distobuccal (DB) root canal, variations have been reported in the form of one additional canal (DB2) being present or fused with the MB canal. Fusion can also occur between one or both the buccal roots with the palatal (P) root.[10–14] Fusion of the roots is more common in maxillary second molars, which could result in complete or partial fusion of the root canals.[15,16]

For successful endodontic treatment, clinicians should be aware of the variations in the number of roots and root canals and the peculiar or eccentric location of root canals as described in this case report. This case report highlights the anatomic variation of the distobuccal root canal in a maxillary second molar and its management with the aid of an intraoperative limited field of view (FOV) Cone-beam computed tomography (CBCT), along with a literature review of variations reported in distobuccal roots and root canals in human maxillary second molar. The case presentation is based on the Preferred Reporting Items for Case reports in Endodontics (PRICE) 2020 guidelines.[17]

2 | CASE PRESENTATION

A 34-year-old male patient reported to the department with a chief complaint of pain in his upper left back tooth for the past 10 days. History revealed an intermittent, localized throbbing type of pain, occurring during the night and aggravated during mastication. The patient's medical history was noncontributory. Clinical intraoral examination revealed deep occlusal caries in the maxillary left second molar (27) with tenderness to percussion. The tooth had an old amalgam restoration on the occlusal surface. The tooth mobility was within physiological limits, and the gingival attachment apparatus was normal. Thermal and electric pulp testing (Parkel Electronics Division, Farmingdale, New York, USA) elicited a negative response. The preoperative intraoral periapical radiograph (IOPA) revealed occlusal radiolucency involving pulp space with no periapical radiolucency (Figure 1A,B). Extra orally, no swelling was noticed. From the clinical and radiographic findings, a diagnosis of pulpal necrosis with symptomatic apical periodontitis was made, and endodontic treatment was initiated after obtaining consent from the patient.

The tooth was anesthetized by using 1.8 mL (30 mg) of 2% lidocaine containing 1:200,000 epinephrine (AstraZeneca Pharma India Ltd., Bengaluru, India). Isolation was done using a rubber dam (Coltene Whaledent, Inc., Ohio, USA), and access opening was initiated using an endo access bur (#1) in high speed (Dentsply Sirona, Tulsa, USA) under a dental operating microscope (Prisma DNT Microscope, Labo America, Inc., California, USA). The pulp chamber floor examination with a DG-16 endodontic explorer (Hu-Friedy, Chicago, USA) revealed three distinct root canal orifices, the MB canal, and P canal, and another orifice in close approximation to the P canal, giving an illusion of an additional P canal (Figure 1C). An attempt was made to search for the DB canal in its usual position, but without success, this led to the gouging of the floor in that area (Figure 1C). As the DB canal was not identified in its usual location and a canal orifice was seen unusually placed between the buccal and P canal, an intraoperative limited FOV-CBCT was taken after obtaining consent from the patient. CBCT images of the maxillary second molar revealed fusion of both the buccal and palatal roots in the coronal and middle third region of the root, but

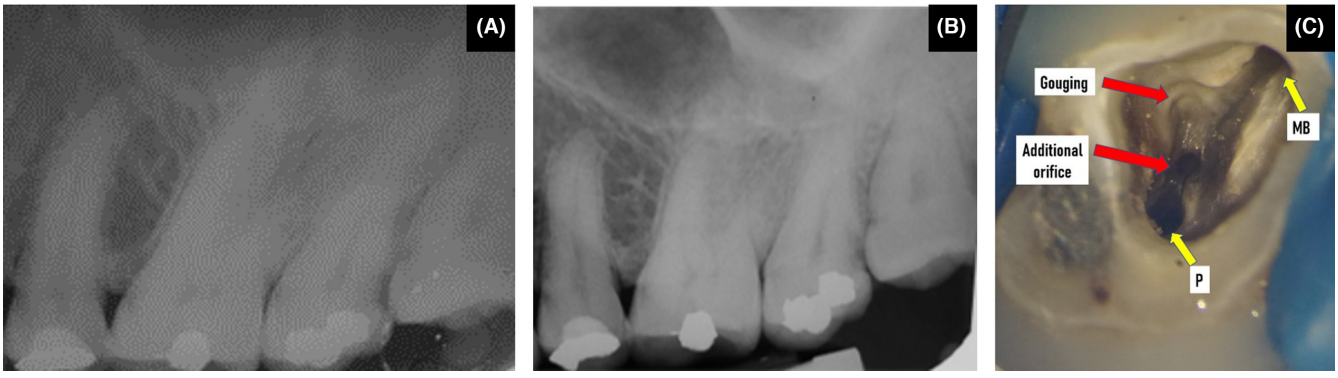

FIGURE 1 (A,B) Preoperative intraoral periapical radiograph of 27. (C) Pulp chamber floor of 27 showing the presence of an additional orifice in close approximation relation to the palatal (P) orifice and subsequent gouging in the distobuccal region adjacent to the Mesiobuccal (MB) orifice.

apically they were separate. CBCT images confirmed the canal adjacent to the P orifice to be the DB canal. Even though the roots were fused partially, the canals remained separate (Figure 2A–F). The coronal section of the tooth in the CBCT scan also revealed early periapical radiolucency in the palatal root, which was not evident in the two-dimensional IOPA (Figure 2D). Working length was determined using IOPA and an electronic apex locator (Root ZX; Morita, Tokyo, Japan). Shaping and cleaning were performed using ProTaper Gold (Dentsply Maillefer, Ballaigues, Switzerland) and the crown-down technique. The MB and DB canals were enlarged to ProTaper F2 (25/08), and the P canal was enlarged until ProTaper F3 (30/09). The instrumentation was performed using 2.5% sodium hypochlorite solution and normal saline. Final irrigation was performed with 2.5% sodium hypochlorite solution (Sisco Research Laboratories Pvt. Ltd., Mumbai, India), 17% EDTA (Prime Dental Product Pvt Ltd, Mumbai, India), and normal saline. The canals were medicated with Calcium hydroxide paste (Calcicur, VOCO, Cuxhaven, Germany) using a lentulo spiral (Dentsply Maillefer, Ballaigues, Switzerland), and the access cavity was sealed with Cavit (3M ESPE Dental Products, St Paul, MN, USA). The patient was asymptomatic during recall after 2 weeks. Calcium hydroxide was removed, and obturation was done by single cone obturation technique using F2 and F3 Gutta-percha (Dentsply Maillefer, Ballaigues, Switzerland) and AH plus resin sealer (Dentsply Maillefer Company, Tulsa, OK, USA) (Figure 3A). The access cavity was sealed using resin composite (Z-100; 3M ESPE Dental Products, St Paul, MN). The patient was asymptomatic during a follow-up period of 1 year (Figure 3B).

3 | DISCUSSION

Root fusion occurs due to disturbance in Hertwig's epithelial root sheath during developmental stages. It can also occur due to fusion in the furcation area or deposition of cementum over time.[18] Root fusion is a common entity in maxillary second molars compared with the first molars.[4] Fusion of roots can result in partial or complete fusion of the root canals and can lead to intracanal communications or canal divisions that are challenging to shape and clean.[19]

In this case report, the root canals remained separate without any communication. Based on Zhang et al. classification for fused roots in maxillary second molars, this tooth can be classified as a Type 5 pattern, where the P root is fused with MB and DB roots.[15] According to the recent classification of anomalies by Ahmed et al., it can be classified as $(RF^{5})^{3}27MB/DB/P$.[20]

In maxillary second molars, the three roots are grouped closer together, making the orifices form a flat triangle to almost a straight line. DB orifice is closer to the MB orifice and is usually located in the midpoint when a line is

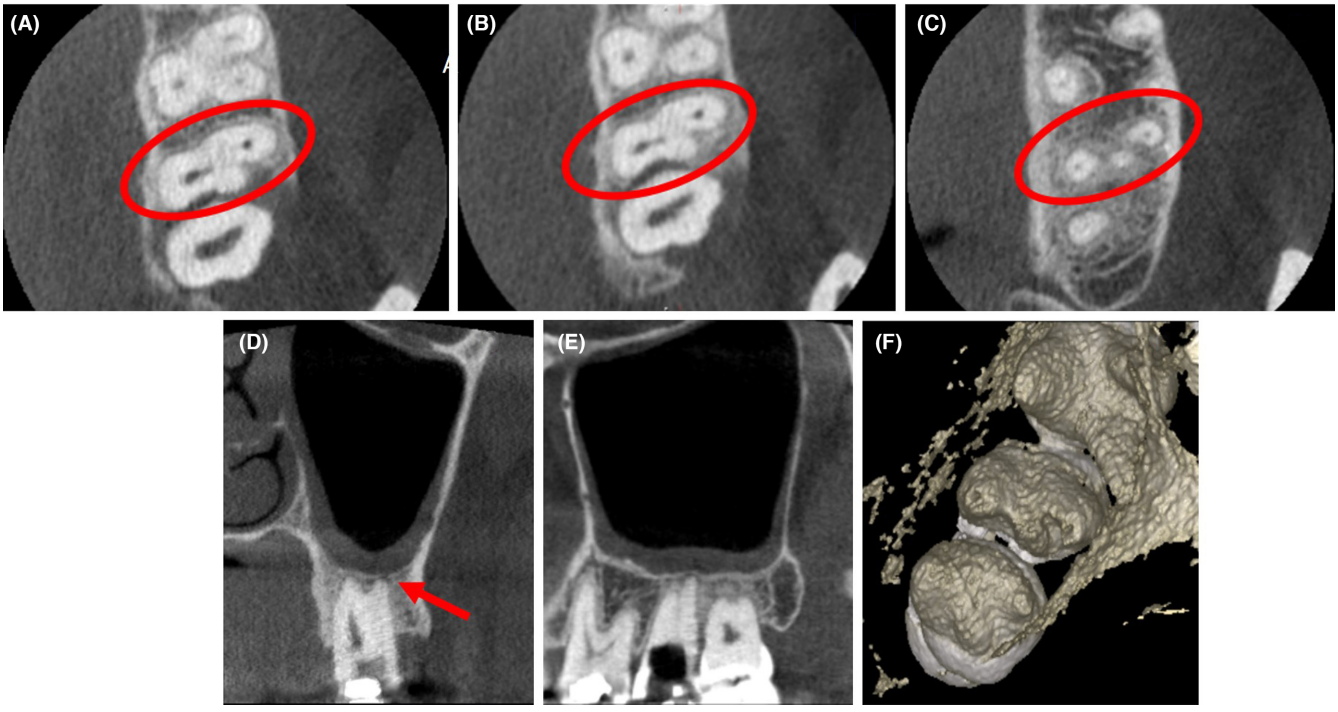

FIGURE 2 CBCT images of 27. (A–C) Axial images in the cervical, middle, and apical region of the tooth. (D) Coronal section showing the apical split of roots and early periapical radiolucency in the palatal root (red arrow). (E) Sagittal section showing gouging of the floor. (F) Apical 3-dimensional image of roots.

drawn from the MB to P orifices (Figure 4A).[21] However, there are few cases reports on the variation of DB roots or root canals (Table 1). These variations are in the form of an extra root or root canal present close to the main DB canal. Variations in the DB root canals in literature are also present in the form of partial or complete fusion to either MB or P canals forming C-shaped canals or fusions leading to double- or single-rooted maxillary second molars.[8–14] These case reports also point to the fact that when a root canal orifice deviates from its actual position, there always is a need for careful inspection and exploration for possible additional canals.

In the present case report, the search for the DB canal in its usual position led to the gouging of the pulpal floor. The intraoperative CBCT revealed that the roots were fused in the coronal and middle third, with the DB root placed palatally. Hence, the peculiar canal located just buccal to the P root canal orifice was the DB canal, which seemed to give an illusion of an additional P canal (Figure 4B). All three root canals also showed Vertucci Type I root canal pattern with no intracanal communications with each other. To the best of our knowledge, no case report on such peculiarity in the position of the DB canal orifice has yet been published in the literature.

In an earlier study by Han et al. done in the Chinese population, the average distance between the DB and P canals was 3–5 mm, and between MB and DB canals was 1.5-3 mm.[22] The distance between the DB and P orifice was only 0.6 mm, and between DB and MB orifice was 3.9 mm in the present case when calculated using the measuring tool in the CBCT software (Planmeca Romexis version 5.2.0R). The smaller mesiodistal diameter of 8 mm of the involved teeth, partial root fusion, and/or palatal positioning of the DB root could have been the possible

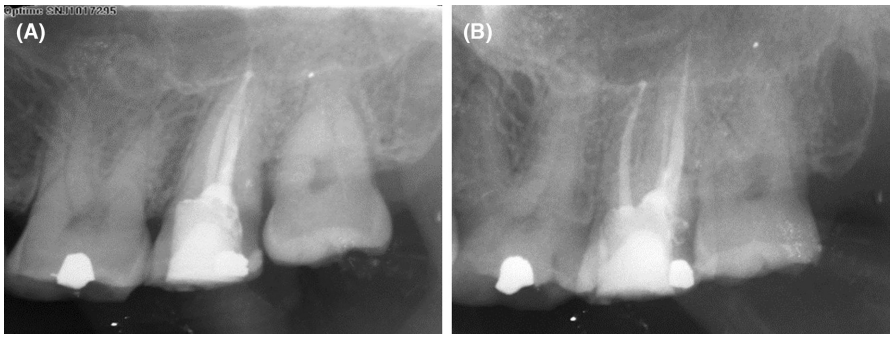

FIGURE 3 (A) Immediate postoperative radiograph. (B) Postoperative radiograph after 1 year.

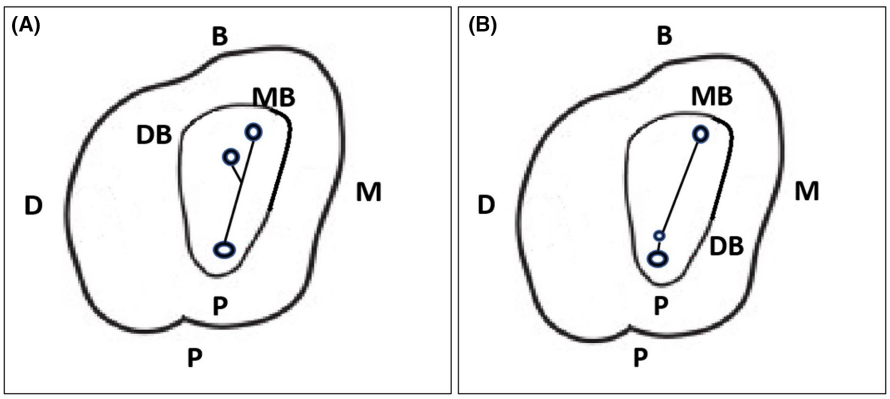

FIGURE 4 (A) Illustration of the normal location of the Distobuccal (DB) root canal orifice in relation to the Mesiobuccal (MB) and Palatal (P) root canal orifices. (B) Illustration of the unusual location of the DB root canal orifice in a close approximation of the Palatal (P) root canal orifice. B, buccal; D, distal; M, mesial.

TABLE 1 Variation reported in distobuccal roots and root canals in human permanent maxillary second molars.

Author, year	Gender	Ethnicity	No. of roots	No. of canals	Canals present
Kottoor et al.,[8]	Male	Not mentioned	5	5	MB1, MB2, DB, DP, MP
Ahmad Fahid et al.,[10]	Male	British	4	4	MB, DB1, DB2, L
Mitthra Suresh et al.,[11]	Female	Not mentioned	1	6	3MB, 2DB, 1P
Chang Zeng et al.,[12]	Female	Chinese	4	5	MB1, MB2, DB1, DB2, P
Osvaldo Zmener et al.,[13]	Male	Not mentioned	4	4	3B, 1P

Abbreviations: B, Buccal; DB, Distobuccal; DP, Distopalatal; L, Lingual; MB, Mesiobuccal, MP: Mesiopalatal, P: Palatal.

reason(s) for the unusual position of the DB canal in the current case report.

The spatial relationship between the roots and adjacent anatomical structures and the position and shape of anatomical structures inside the root to be treated is often difficult to assess using a conventional 2-D radiograph.[23] Using CBCT in such complex cases enables us to understand the internal root canal anatomy better.[24–26]

4 | CONCLUSION

Unusual root canal morphology of the maxillary molars is invariably a norm, and it should be visualized during the planning phase of endodontic treatment. This will help the treating clinician deliver a customized treatment plan to the patient precisely. This case report highlights the variability of the root morphology. It further describes the exact variation in the root canal system of a maxillary second molar, that is, the DB root canal close to the P root canal orifice with partially fused roots. An intraoperative CBCT aided in the better understanding and management of this particular root canal anatomy, followed by the precise execution of the treatment plan.

AUTHOR CONTRIBUTIONS

Anisha Mishra: Conceptualization; formal analysis; investigation; writing – original draft. **Velmurugan Natanasabapathy:** Conceptualization; formal analysis; investigation; writing – original draft. **Dinesh Kowsky:** Formal analysis; investigation; resources; software. **Jitendra Sharan:** Supervision; validation; writing – review and editing. **anand marya:** Resources; validation; visualization; writing – review and editing.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest related to this publication. This work did not receive any funding.

DATA AVAILABILITY STATEMENT

Data related to this paper are available for consultation if requested.

PATIENT CONSENT STATEMENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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