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Case Report

Dentistry Section

Navigating and Managing Eight Canals in a Maxillary First Molar: A Case Report

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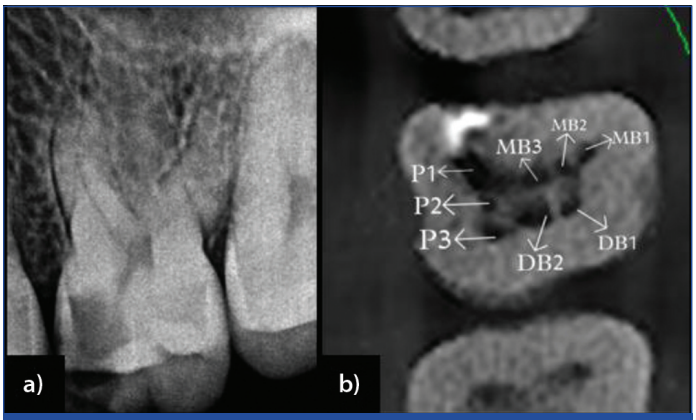
ABSTRACT

Understanding the existence of an additional root and atypical root canal anatomy is essential because it impacts the manner in which endodontic therapy occurs. For endodontic procedures to be performed successfully, a thorough knowledge of the basic anatomy of root canals and their possible variations is essential. The anatomical features of permanent maxillary molars are characterised by three roots and canals consisting of one palatal and two buccal roots and root canals. The most frequently encountered kind of root canal is the second Mesiobuccal (MB) root canal. The outcome of treatment for maxillary first molars is significantly affected by the frequent occurrence of root canal variations. It may be easy to avoid iatrogenic errors and guarantee success by having an in-depth knowledge of root canal morphology and being able to anticipate any potential morphological changes with the help of Cone Beam Computed Tomography (CBCT) and Dental Operating Microscope (DOM). This case report documents the successful endodontic treatment of a maxillary 1st molar with three roots and eight root canals under a dental operating microscope. The root canal anatomy was confirmed using CBCT analysis.

Keywords: Cone beam computed tomography, Maxillary molars, Operating microscope, Root canal therapy, Root morphology

CASE REPORT

A 25- year-old male patient presented to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain in the upper left posterior region for one week. The pain was intermittent in nature throughout the day, non-radiating, aggravated by taking hot and cold food and relieved after taking over-the-counter medications. There was no past dental or medical history reported by the patient. On clinical examination, the left maxillary first molar had deep mesio-occlusal caries without any periapical abscess or sinus tract. Periodontal examination revealed a normal probing depth of 2 mm and the tooth was tender to vertical percussion. Electric pulp testing (SybronEndo, Orange, CA) showed early response, whereas the cold test (Endofrost, coltene) showed abnormal response as compared to the contralateral control tooth. A pre-operative radiograph revealed mesio-occlusal radiolucency extending to the pulp chamber with the widening of the periodontal ligament space; it did not reveal any variation in the anatomy [Table/Fig-1a]. These findings led to a diagnosis of irreversible pulpitis with symptomatic apical periodontitis for which root canal therapy was recommended.



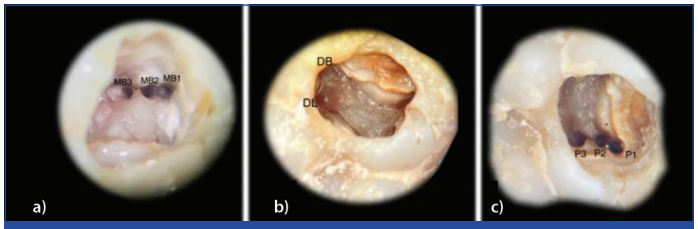
[Table/Fig-1]: a) Pre- operative IOPA wrt 26; b) CBCT wrt 26.

Written informed consent was taken from the patient before starting the procedure. Caries excavation and pre-endodontic build-up were done on the mesial aspect of the tooth using bulk fill composite (3M dental products, St Paul, MN). After injecting local anaesthesia with 1:200,00 epinephrine (NEON), a rubber dam was placed and a conventional access opening was done with an endo access bur and endo Z bur (Dentsply Maillefer, Ballaigues, Switzerland). Initially, two mesiobuccal canals (MB, MB2), A distobuccal canal and two palatal canals (P1, P2) were found. While viewing the pulp chamber under the Dental Operating Microscope (DOM) (Carl Zeiss), one additional mesiobuccal canal (MB3), a distobuccal canal (DP) and a third palatal canal (P3) were located using DG 16 endodontic explorer (Hu- Friedy, USA). The triangular access was then modified into a trapezoidal shape so as to get the straight-line access for all the canals. Coronal enlargement of each orifice was performed by ProTaper Sx rotary file (Dentsply, Switzerland). The patency of the canal was confirmed with ISO #10 K-files (Mani, Japan). All the canals were dried, and no medicament was placed in the canals. A sterile cotton was placed on the pulp chamber and Cavit (3M ESPE Dental Products, St Paul, MN) was used to seal the access cavity.

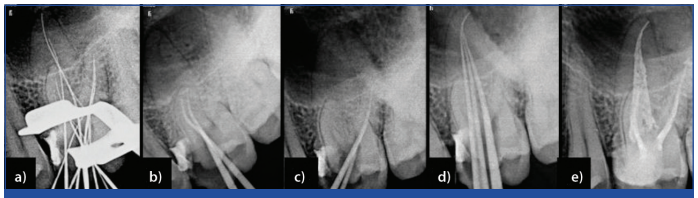
To confirm the unique root canal morphology, it was decided to perform the CBCT scanning (Planmeca). The CBCT scan slices revealed eight canals (three mesiobuccal, two distobuccal and three palatal) in the left maxillary first molar [Table/Fig-1b].

At the second visit, the working length was determined using an electronic apex locator (Root ZX; Morita, Tokyo, Japan) and a radiograph was taken to confirm the working length. Cleaning and shaping of the canal were done using nickel-titanium rotary instrument (Hero shaper gold files- Micro Mega) using crown-down technique. The MB1, MB2, DB1, DB2 [Table/Fig-2a,b] were enlarged till 25/04, MB3 was enlarged till 20/04, P1, P2 [Table/Fig-2c] were enlarged till 30/06 and P3 was enlarged till 25/06. During cleaning and shaping, the root canal irrigation was done with normal saline, 3% sodium hypochlorite and 17% ethylene diamine tetraacetic acid using passive ultrasonic agitation. Master cone fit was checked and confirmed radiographically [Table/Fig-3a-d]. The final rinse was performed using 2% chlorhexidine digluconate. The canal was dried using absorbent paper points (Dentsply) and obturation was done using the cold lateral compaction technique using AH Plus resin (Dentsply Maillefer, Ballaigues, Switzerland) and gutta-percha (Dentsply Maillefer, Ballaigues, Switzerland). A post-

obturation radiograph was taken to confirm the seal [Table/Fig-3e]. Post-endodontic restoration was done using a posterior composite filling material. (Z100; 3M ESPE Dental Products, St Paul, MN) and the patient was advised to have a full coverage porcelain crown. The patient was asymptomatic clinically and radiographically. No periapical changes were noted at the two-month follow-up, the patient had no post-operative pain or discomfort, and was then referred for coronal restoration.



[Table/Fig-2]: a) DOM showing MB1, MB2, MB3; b) DOM showing DB, DL; c) DOM showing P1, P2, P3.



[Table/Fig-3]: a): Working length wrt 26; b) Master cone selection for mesial canals; c) Master cone selection for distal canals; d) Master cone selection for mesial canals; e) Obturation wrt 26.

DISCUSSION

In this paper, we reported an anatomic variation of eight canals in maxillary first molar with three palatal, three mesiobuccal and two distobuccal canals. According to literature, the frequency of MB2 canals in the mesiobuccal root was reported to be 92.85% ex vivo assessments, 95.63% clinical studies, and 95.45% using CBCT. Meanwhile, the corresponding figures for the distobuccal root (DB2) were 1.15% Ex vivo and 3.75% clinical studies, and for the palatal root (second palatal canal) were 2.05% ex vivo, 0.62% clinical, and 4.55% CBCT [1]. The incidence of extra root canals in the palatal root of maxillary molars is 1.4% [2,3]. Apart from this, the complexities of maxillary 1st molar include six root canals in a single root, two root canals, five root canals, six root canals, seven and eight canals, additional palatal root and C-shaped canals [4].

Endodontic therapy has advanced extensively as a result of the use of endodontic microscopes. By utilising an endodontic microscope to magnify images, clinicians can detect root canals that are hard to see with the naked eye [5].

In this case, the CBCT scanning helped to confirm the presence of several extra canals and provided a better knowledge of the complex root canal anatomy. The CBCT axial images showed the mesiobuccal root had a Sert and Bayirli type XVIII canal configuration [6]. The distobuccal root presented with a Vertucci type IV canal pattern [7]. The palatal root showed a Sert and Bayirli type XVIII canal configuration [6]. In the apical area, MB1, MB2, and MB3 joined to exit as one, P1, P2and P3 joined to exit as one and the DB1 and DB2 exit as separate canals.

Endodontic success depends on eliminating microbial toxins, and vital and necrotic pulp tissue remains from the root canal system [8]. It has been discovered that all multirooted teeth include extensive isthmuses, anastomosis, fins, cul-de-sacs, and other canal system components that are challenging to debride with mechanical instrumentation [9]. Therefore, chemical irrigation using sonics and ultrasonics should be an essential part of root canal debridement because it allows for cleaning beyond what might be achieved by root canal instrumentation alone [10].

The development of radiographic techniques, especially the application of CBCT, has also been helpful for complex endodontic treatments [11]. Traditional X-rays only show the form of the tooth in two dimensions, whereas CBCT can provide a 3-dimensional view of the tooth [12]. and helps in detecting extra root canals, which may be missed with a routine radiograph.

The DOM offers enhanced magnification and focused illumination, enabling precise visualisation of complex pulpal anatomy and detection of additional or aberrant canals that may be overlooked with unaided vision. Its routine use reduces the incidence of missed canals—one of the leading causes of endodontic failure—and supports more conservative, accurate, and ergonomically favourable clinical procedures. Incorporating the DOM into everyday endodontic practice, therefore, elevates the standard of care and contributes to improved treatment outcomes and long-term prognosis [13,14].

CONCLUSION(S)

This manuscript demonstrates the successful endodontic management of the left maxillary first molar with eight canals. It also highlights the need for the clinician to have thorough knowledge of anatomic variations that can occur in any tooth, and the maxillary first molar is no exception. Careful examination of radiographs and the internal anatomy of teeth is essential. It is recommended that the clinician employ increased magnification and advanced diagnostic tools, such as CBCT, to guarantee the detection and localisation of additional canals.

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