

Endodontic Management of a Maxillary First Molar with Seven Root Canals Diagnosed Using Cone Beam Computed Tomography – A Case Report

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Abstract

The main objective of root canal treatment is thorough cleaning and shaping of the entire pulp space and its complete filling with an inert filling material. A major cause of post-treatment disease is the inability to locate, debride, or adequately fill all canals of the root canal system. The form, configuration, and number of root canals in the maxillary first molars have been discussed for more than half a century. Maxillary first molar present with three roots and three canals with occurrence of second mesiobuccal canal between 18-96%. With the advent of improved magnification, there are reports of multiple root canals in the maxillary first molars. Non-surgical endodontic therapy of a left maxillary first molar with three roots and seven root canals was successfully performed under a dental operating microscope. The diagnosis of multiple root canals was confirmed with the help of cone beam computed tomography images.

Keywords: Aberrant canal anatomy, Cone beam computed tomography, Dental operating microscope, Maxillary first molar.

INTRODUCTION

A major pre-requisite for endodontic therapy is a thorough knowledge of canal morphology and its frequent variations. Morphological variations in root canal anatomy play an important role in the success of root canal therapy.^[1] The inability to locate, clean, and adequately obturate all canals of the root canal system has been attributed to the foremost common causes of treatment failures, especially in permanent maxillary first molars.^[2] The incidence of second mesiobuccal (MB2) canal has been reported to be between 18% and 96.1%.^[3,4] Other variations include one,^[5] four,^[6] and five^[7] roots and unusual morphology of root canal systems within individual roots. Case reports with five^[8] and six^[9] root canals or with a C-shaped canal configuration^[10] have also been reported earlier. Martínez-Berná and Ruiz-Badanelli^[11] reported six root canals with MB3, two distobuccal (DB2), and one palatal, whereas De Almeida-Gomes *et al.*^[9] and Bond *et al.*^[12] reported six root canals with MB2, DB2, and two palatal. Maggiore *et al.*^[13] reported the maxillary first molar having six canals with MB2, three palatal, and DB1, whereas Adanir^[14] reported a clinical case having four roots (MB, mesiopalatal [MP], DB, and palatal) and six canals with MB1, MP2, DB2, and one palatal. Alavi *et al.*^[15] and Thomas

et al.^[16] reported the incidence of two canals in the DB root as 1.90% and 4.30%, respectively, and few other case reports have noted two canals in the DB root.^[7,10,12,17] The incidence of two root canals in the palatal root of maxillary molars has been reported to be 2–5.1%.^[18]

CASE REPORT

A 35-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, New Horizon Dental College and Research Institute, Sakri, Bilaspur, Chhattisgarh, with the chief complaint of spontaneous pain in the upper left posterior region of the jaw for the past 5 days. The patient gave a history of intermittent pain for the past 2 months, which had increased in intensity in the preceding 5 days. The tooth gave prolonged sensitivity to hot and cold. On clinical examination, a deep disto-occlusal carious lesion, which was tender on

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percussion, with no mobility, was seen in tooth #26 (Figure 1). Vitality testing of the involved tooth with an electronic pulp tester (Parkell, USA) gave an early response. A pre-operative radiograph revealed disto-occlusal radiolucency approaching the pulp space. From the clinical and radiographic examination, a diagnosis of symptomatic irreversible pulpitis was made and non-surgical endodontic treatment was recommended.

A radiographic evaluation of the involved tooth did not indicate any variation in the root canal anatomy. Local anesthesia was induced using 1.8 mL of 2% lignocaine and adrenaline (XICAINE®; ICPA HEALTH PRODUCTS LTD, India). After caries excavation, the distal surface of the tooth was built up with composite resin (Shofu Beautifil II Japan) to enable optimal isolation. A rubber dam was placed and a conventional endodontic access opening was established.

Initially, the MB1, DB1, and two palatal canals (MP and the distopalatal) were located. When viewing the floor of the pulp chamber under a dental operating microscope (Seiler, Germany), three additional root canal orifices (MB2, MB3, and DB2) were located and conventional triangular access was modified to a trapezoidal shape, to improve access to the additional canals (Figure 3). The patency of the canal was confirmed with ISO #10 K-files (Mani, Japan). To confirm this unusual morphology, it was decided to perform cone beam computed tomography (CBCT) imaging of the tooth.



Figure 1: Pre-operative radiograph

Two sterile cotton pellets were placed in the pulp chamber and Cavit G (3M ESPE Dental Products, St Paul, MN) was used to seal the access cavity. Informed consent was obtained from the patient, and a multislice CBCT scan of the maxilla was performed with a tube voltage of 100 KV and a tube current of 8 mA. The involved tooth was focused and the morphology was obtained in the transverse, axial, and sagittal sections of 0.5-mm thickness. The CBCT scan slices revealed seven canals (MB3, two palatal, and DB2) in the left maxillary first molar (Figure 2a, b, and b1). The CBCT images provided valuable information regarding the canal configuration and confirmed the seven canals that were not clearly seen in the conventional radiograph. At the next appointment, after 3 days, the patient was asymptomatic. The working lengths were determined with the help of an apex locator (Root ZX, J Morita, Tokyo, Japan), under rubber dam isolation, and intraoral periapical radiographs of the MB, DB, and palatal roots were taken to confirm the working lengths (Figure 4). Cleaning and shaping were performed using nickel–titanium rotary instruments HyFlex CM 4% and 6% Rotary files (Coltene Whaledent AG Altstätten Switzerland), using the crown-down technique.

During root canal preparation, irrigation was performed using 2.5% sodium hypochlorite solution. Final rinsing of the canals was performed using 2% chlorhexidine digluconate (Asep RC, Stedman Anabond, Chennai, India) together with passive ultrasonic agitation. A saline wash was performed. The canals were dried with absorbent paper points (Dentsply Maillefer, Ballaigues, Switzerland) and obturation was performed using cold lateral compaction of the gutta-percha (Dentsply Maillefer, Ballaigues, Switzerland) and AH plus resin sealer (Dentsply Maillefer, Switzerland). A radiograph was taken to establish the quality of the obturation (Figures 5 and 6) and post operative clinical view after severing of gutta-percha at the orifices using a heated instrument (Figure 8). After completion of root canal treatment, the tooth was restored with a posterior composite (Shofu Beautifil II Japan) followed by full coverage porcelain fused to a metal crown (Figure 7). The patient was asymptomatic at the 8-month follow-up.

DISCUSSION

Before undergoing root canal treatment, prior knowledge of the roots and root canal anatomy of the teeth is required. In the maxillary molars, anatomic variations are common, with

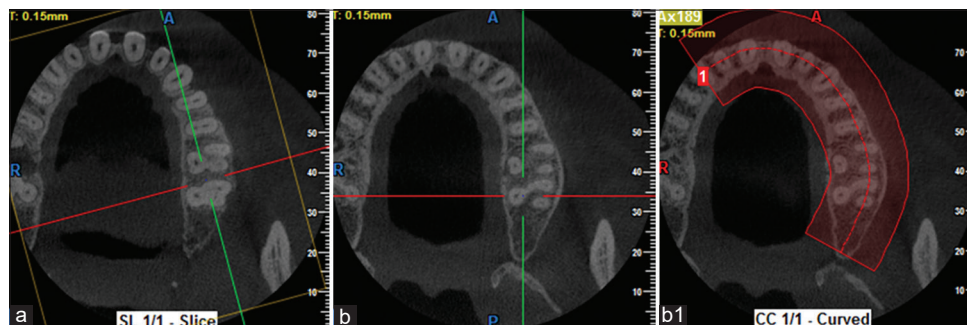


Figure 2: (a, b, and b1) Coronal and apical section cone beam computed tomography view

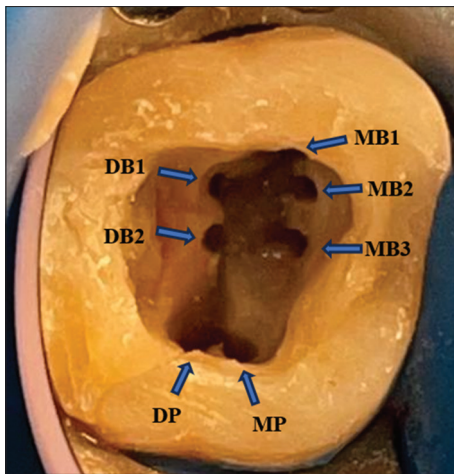


Figure 3: Access cavity image



Figure 6: Post-obturation radiograph

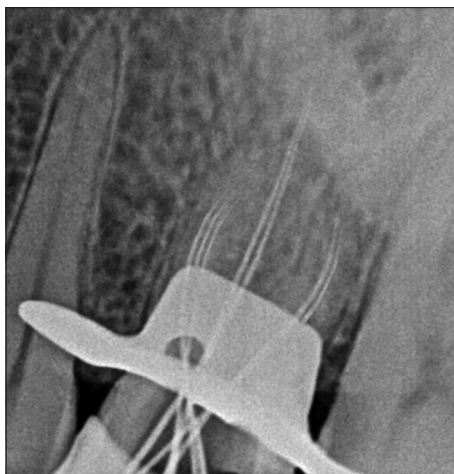


Figure 4: Working length determination



Figure 7: Porcelain fused to metal crown cementation



Figure 5: Master cone selection

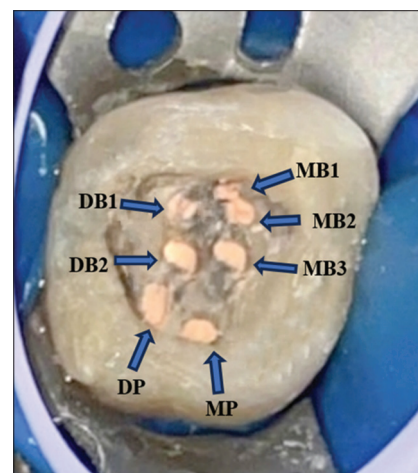


Figure 8: Post-operative clinical view after severing of gutta-percha at the orifices using a heated instrument

the number of canals, from one to eight. Vertucci identified eight pulp space configurations.^[19] Recently, 14 new additional canal types were reported by Sert and Bayirli, highlighting the complexity of the root canal systems.^[20]

In this case, CBCT scanning was used for a better understanding of the complex root canal anatomy. It helped to confirm the presence of multiple canals, which were

Table 1: Variation of canal configuration in maxillary first molars with seven or more root canals

Author	No. of roots	No. of root canals	Canal configuration		
			MB	DB	P
Kotoor <i>et al.</i> (2016)22	3	7	3	2	2
Kotoor <i>et al.</i> (2011)22	3	8	3	3	2
Badole <i>et al.</i> (2014)22	3	7	3	2	2
Raghavendra <i>et al.</i> (2014)22	3	7	3	2	2
Martins (2014)22	3	7	4	2	1
Kumar (2014)22	3	7	3	2	2
Almeida <i>et al.</i> (2015)22	3	8	3	2	2
Nayak <i>et al.</i> (2015)22	3	7	3	3	1
Munavalli <i>et al.</i> (2016)22	3	7	3	2	2
Rodrigues E <i>et al.</i> (2016)22	3	7	3	2	2
Ajith H <i>et al.</i> (2018)22	3	7	3	2	2

otherwise not able to be identified, except through the microscope.

Of the various comprehensive maxillary first molar *ex vivo* studies in dental literature, Baratto reported a maxillary first molar with three roots and seven root canals. Of the 140 extracted maxillary first molars evaluated, only one tooth showed seven root canals, which contained MB3, DB3, and one palatal canal. The frequency of the MB2 canals in the MB root was reported to be 92.85% (based on *ex vivo* results), 95.63% (based on clinical results), and 95.45% (based on CBCT results), whereas the corresponding figures for the DB2 root were 1.15% (*ex vivo*) and 3.75% (clinical) and those for the palatal root (second palatal canal) were 2.05% (*ex vivo*), 0.62% (clinical), and 4.55% (CBCT).^[21] Additional MBs were commonly found in the age group of 20–40 years.^[21]

A CBCT scan and surgical operating microscope confirmed the diagnosis of three roots and seven canals in the left maxillary first molar, namely MB1, MB2, MB3, DB1, DB2, MP, and DP. Maxillary first molars with more than six canals are rare and few cases have been reported in endodontic literature (Table 1).^[1]

CONCLUSION

Thorough knowledge of root canal anatomy is an essential pre-requisite for endodontic success. The current knowledge that aberrant canals are more common than assumed earlier is increasingly being proven again and again. The clinician should use increased magnifications and advanced diagnostic aids such as CBCT, to ensure identification and location of additional canals.

REFERENCES

- Ajit H, Srinidhi SR, Jay K, Niranjana D, Omkar B. Endodontic management of maxillary first molar with 7 canals - A case report. *Mod App Dent Oral Health* 2018;2:162-4.
- Weine FS, Healey HJ, Gerstein H, Evanson L. Canal configuration in the mesiobuccal root of the maxillary first molar and its endodontic significance. *Oral Surg Oral Med Oral Pathol* 1969;28:419-25.
- Kulild JC, Peters DD. Incidence and configuration of canal systems

in the mesiobuccal root of maxillary first and second molars. *J Endod* 1990;16:311-7.

- Buhrley LJ, Barrows MJ, BeGole EA, Wenckus CS. Effect of magnification on locating the MB2 canal in maxillary molars. *J Endod* 2002;28:324-7.
- Gopikrishna V, Bhargavi N, Kandaswamy D. Endodontic management of a maxillary first molar with a single root and a single canal diagnosed with the aid of spiral CT: A case report. *J Endod* 2006;32:687-91.
- Christie WH, Peikoff MD, Fogel HM. Maxillary molars with two palatal roots: A retrospective clinical study. *J Endod* 1991;17:80-4.
- Barbizam JV, Ribeiro RG, Tanomaru Filho M. Unusual anatomy of permanent maxillary molars. *J Endod* 2004;30:668-71.
- Ferguson DB, Kjar KS, Hartwell GR. Three canals in the mesiobuccal root of a maxillary first molar: A case report. *J Endod* 2005;31:400-2.
- De Almeida-Gomes F, Maniglia-Ferreira C, Carvalho de Sousa B, dos Santos RA. Six root canals in maxillary first molar. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;108:e157-9.
- Dankner E, Friedman S, Stabholz A. Bilateral C shape configuration in maxillary first molars. *J Endod* 1990;16:601-3.
- Martínez-Berná A, Ruiz-Badanelli P. Maxillary first molars with six canals. *J Endod* 1983;9:375-8.
- Bond JL, Hartwell G, Portell FR. Maxillary first molar with six canals. *J Endod* 1988;14:258-60.
- Maggiore F, Jou YT, Kim S. A six-canal maxillary first molar: Case report. *Int Endod J* 2002;35:486-91.
- Adanir N. An unusual maxillary first molar with four roots and six canals: A case report. *Aust Dent J* 2007;52:333-5.
- Alavi AM, Opasanon A, Ng YL, Gulabivala K. Root and canal morphology of Thai maxillary molars. *Int Endod J* 2002;35:478-85.
- Thomas RP, Moule AJ, Bryant R. Root canal morphology of maxillary permanent first molar teeth at various ages. *Int Endod J* 1993;26:257-67.
- Hulsmann M. A maxillary first molar with two disto-buccal root canals. *J Endod* 1997;23:707-8.
- Stone LH, Stroner WF. Maxillary molars demonstrating more than one palatal root canal. *Oral Surg Oral Med Oral Pathol* 1981;51:649-52.
- Vertucci FJ. Root canal morphology and its relationship to endodontic procedures. *Endod Topics* 2005;10:3-29.
- Sert S, Bayirli GS. Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population. *J Endod* 2004;30:391-8.
- Kim Y, Lee SJ, Woo J. Morphology of maxillary first and second molars analyzed by cone-beam computed tomography in a Korean population: Variations in the number of roots and canals and the incidence of fusion. *J Endod* 2012;38:1063-8.
- Rodrigues E, Brait AH, Galvão BF, da Silva EJ. Maxillary First Molar with 7 Root Canals Diagnosed Using Cone-beam Computed Tomography. Korea: The Korean Academy of Conservative Dentistry; 2017