Case Report

Endodontic Management of a Maxillary First Molar with Seven Root Canals Using Spiral Computed Tomography

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ABSTRACT

The main objective of this case report is to present a rare root canal configuration of maxillary molar with seven root canals; three mesiobuccal, two palatal and two distobuccal canals diagnosed during treatment procedure confirmed by spiral computed tomography. A thorough knowledge of root canal morphology, proper clinical and radiographic examination, and use of dental operating microscopes are necessary for successful clinical outcomes. This article highlights the variations in the morphology of maxillary first molar and use of the latest techniques in successful diagnosis and negotiation of the additional canals.

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Introduction

A thorough knowledge of aberrant anatomies of the root canal system plays a very critical role in diagnosis, treatment planning and the consequent success of the endodontic therapy. The incidence and significance of variations in root canal morphology like apical ramifications, extra canals, apical deltas, or lateral canals have been very well documented in the literature. [1-2]

The root canal morphology of maxillary first molars has been discussed in the literature for more than fifty years. Maxillary first molars usually have three roots and of which the mesiobuccal root is developmentally wider in buccolingual direction. Therefore, four root canals in maxillary first molar are commonly detected. The morphological complexity and variations of maxillary first molar include five to eight canals; single root with single canal, two root canals, C-shaped canal and extra palatal root. [3-10] Few authors have reported the incidence of approximately 1.9 to 4.30% for two canals in the distobuccal root. [11] Previous reports were mostly based on radiographic examination of the teeth. Radiographs are the 2D images of 3D objects. The most accurate method of determining the root canal morphology is the serial sectioning of the teeth which is clinically impossible. Therefore, other diagnostic aids like spiral computed tomography (SCT) are useful in such conditions.

This case report presents the successful endodontic treatment of an unusual morphology of maxillary first molar with three roots and seven root canals, i.e. three root canals in the mesiobuccal root, two in the distobuccal and two in the palatal root which was confirmed by SCT.

Case Report

A 40-year-old man was reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain in the upper left posterior region for the past ten days. Medical history was noncontributory. Clinical examination revealed a deep carious lesion in

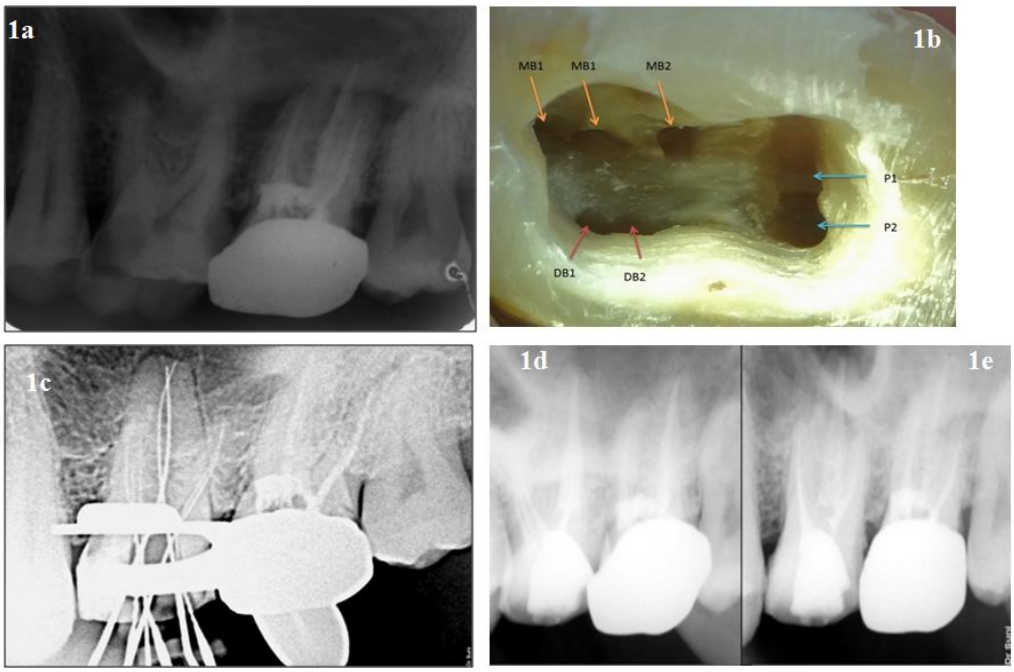

Figure 1a: Preoperative radiograph, **b:** Microphotographs with seven canal orifices (Indirect View)**, c:** Working length radiograph**, d and e:** Post-operative obturation radiograph.

maxillary left first molar (tooth # 26). The tooth was tender on percussion, and the pain was spontaneous, which got aggravated on chewing. There was no evidence of swelling, sinus tract, or periodontal pocket. Pulp vitality testing using tetrafluoroethane (Endo-Ice, Hygenic Corp., Akron, OH) caused severe lingering pain. On conventional intraoral periapical radiograph, a mesio-occlusal radiolucency approaching the pulp space with widened periodontal ligament space in relation to the mesiobuccal root was appreciated (Figure 1a). Based on the clinical and radiographic findings, a provisional diagnosis of symptomatic irreversible pulpitis with apical periodontitis was made. The clinical condition was explained to the patient and non-surgical endodontic treatment was planned.

Caries was excavated from mesio-proximal aspect of the involved tooth and was restored with high strength Glass-Ionomer restorative material (Chem FlexTM; Dentsply, Tulsa, OK, USA) to facilitate optimal isolation. After administration of the local anesthesia (2% lignocaine with 1:100,000 epinephrine) conventional endodontic access under rubber dam isolation was done using an Endo Access bur and Endo Z bur (Dentsply Maillefer; Tulsa, OK, USA).The pulp chamber was irrigated with 3% NaOCl to remove the coronal pulp tissues. After this, five root canals were located (MB1, MB2, P1, P2 and DB1) with the aid of DG-16 endodontic explorer (Hu-Friedy, Chicago). Further, the pulp chamber was examined under a dental operating microscope (DOM) (Zeiss; Oberkochen, Germany) and the conventional access cavity was modified to a rhomboidal shape to improve the accessibility and visibility. During exploration of the pulpal floor, two additional canal orifices (MB3 and DB2) were accidentally located. (Figure 1b). Coronal enlargement of the canals was done with a NiTi Hero Shaper endoflare (Micro-mega, Besancon, France) to achieve straight line access. All canals were negotiated with # 10 K-files (Dentsply Maillefer, Tulsa, OK, USA). Working length was determined with the help of electronic apex locator (Root ZX; Morita, Tokyo, Japan) and then confirmed by radiograph (Figure 1c). The pulp tissues were extirpated, and a sterile cotton pellet was placed in the pulp chamber and then sealed with an intermediate restorative material (Cavit; 3M ESPE Dental Products, St Paul, MN). To confirm this unusual morphology, SCT imaging was performed after taking informed consent from the patient. The transverse CT slices of the Dentascan (Siemens Germany) at different level revealed three mesiobuccal canals with three separate orifices and three foramina with a very thin dentinal separation between them, 2 palatal canals with 2 separate foramina and 2 distobuccal canals with 2 separate orifices and one foramen (Figure 2b).

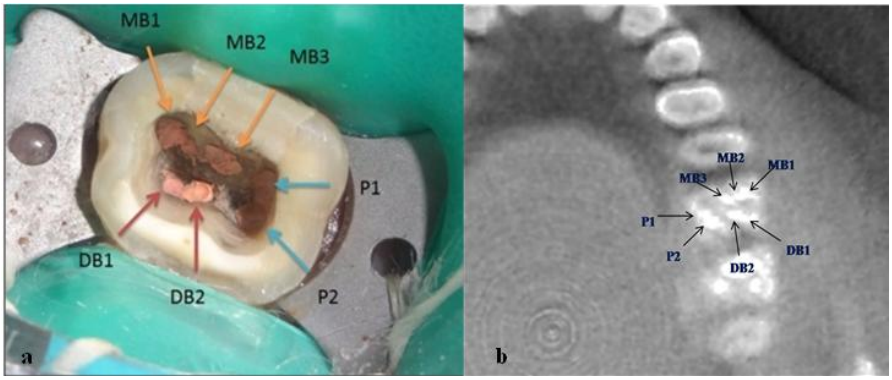

Figure 2a: Microphotographs showing obturated canal orifices **b:** Dentascan; MB- Mesiobuccal, P-Palatal & DB-Distobuccal

On the next visit after 1 week, cleaning and shaping were performed using Hero shapers 4% and 6% nickel-titanium rotary instruments (Micro-mega; Besancon, France) in a crown-down fashion. During shaping, 17% EDTA was used as lubricant and copious irrigation was performed with 3% NaOCl and normal saline. The canals were dried with absorbent paper points and calcium hydroxide paste as an intracanal medicament was placed inside the canals, and the access cavity was sealed with IRM (Dentsply De Trey GmbH, Konstanz, Germany). The patient was recalled after 2 weeks and was found asymptomatic. The temporary restoration was removed. The canals were irrigated copiously with normal saline and dried with absorbent paper points (Dentsply Maillefer). Obturation was performed using cold lateral compaction of gutta-percha (Micro-mega) with AH Plus Sealer (Dentsply Maillefer). Radiographs were taken to confirm the quality of obturation (Figures 1d and 1e). The post obturation microphotograph of access cavity was shown in Figure 2a. The tooth was then restored with composite resin core (3M dental products; St Paul, MN).

Discussion

The variations of root canal morphology, especially in multi-rooted teeth are a constant challenge for successful endodontic therapy. Traditionally, the mesiobuccal root of the maxillary first molar has generated more clinical investigation and research than the other roots. [12] Presence of the third canal (MB3) in the mesiobuccal root is very rare. [6] The incidence of two palatal canals is very low as reported in few case studies. [13] Stone and Stroner studied the morphology of the palatal root in maxillary molars and reported the variations like single root having two canals with distinct orifices and foramina or single root having one canal with one orifice and two distinct foramina and two roots each having a single canal with one orifice and foramen. [14] The most unusual feature of the present case is the presence of two canals in the DB root and MB3 in the mesiobuccal root.

The probability of endodontic failure will increase if the practitioner is not skilled enough to detect, locate, negotiate, and instrument any root canal. Various methods have been recommended for negotiation of extra canals during examination and treatment protocol such as vigilant dentinal map assessment and exploration with DG 16 endodontic explorer; multiple radiographs at different horizontal angulations; champagne test with sodium hypochlorite, staining of the pulp chamber with dye (1% methylene blue). [15] For troughing the line angles of the pulpal floor or removal of a small tooth structure or calcification, special round burs, thin tapered finishing burs and ultrasonic tips are also very useful. All aforementioned methods give us a clue to detect the missing or extra canals, and to avoid iatrogenic access opening errors and excessive tooth removal.

Recently, the use of advanced technology such as computed tomography, dental operating microscopes (DOM), has been proven as a boon for negotiation and instrumentation of the extra canals and their configurations. Proper access opening and its modifications such as trapezoidal, rectangular, rhomboidal, ovoid shapes under magnification have been reported as keys to the successful negotiation of root canals and to ensure adequate straight-line access to improve visibility. [13, 16-18] Stropko [17] reported the incidence of 73.2% and 93% MB2 canals in first molars with or without using the microscope, and 90% of the MB2 were negotiable to the apex. He classified it as a canal if he could instru-

ment 4 mm into it. However, Buhrley *et al.* [19] had reported the highest (71.1%) frequency of MB2 canal detection with the help of DOM followed by dental loupes (62.5%) and no magnification the least (17.2%)**.** In the present case, we had identified seven distinct root canal orifices with the help of SCT and a dental operating microscope.

Radiographs are one of the important tools for detecting any anatomic variations, but not completely reliable method because of its inherent limitations, especially two dimensional representations of three dimensional objects causing superimposition of images. [20-21] The details of the soft tissues and skeletal structures can be easily assessed with the help of the computerized transverse axial scanning (CT). [22] In this report, an SCT imaging or volume acquisition CT was done using the dental software (Dentascan; GE Healthcare, USA) to find out the three dimensional detail of the maxillary first molar. An inherent advantage of SCT is the quick acquisition of raw projection data which can be transformed as trans-axial images, like multiplanar or three-dimensional reconstructions without taking extra time. [23] The reconstruction of superimposed structures at arbitrary intervals is also possible with SCT thereby increasing the resolution of small objects. [24]

Conclusion

Occurrence of seven canals in maxillary first molar is rare. Careful examination and investigation, is necessary to detect additional canals. It is very important for a clinician to have thorough knowledge of canal configurations and anatomic variations of the root canal system. Moreover, they should have the skill to detect and shape the canal efficiently for a better outcome and successful endodontic treatment. Hence, the clinicians should acquaint themselves with advanced endodontic equipments and technologies such as dental microscope, conventional CT, SCT and so on to get additional information of aberrant anatomies.

Conflict of Interest

The authors deny any conflict of interest that could influence their work.

References

[1] Jung IY, Seo MA, Fouad AF, Spångberg LS, Lee SJ, Kim HJ, et al. Apical anatomy in mesial and mesiobuccal roots of permanent first molars. J Endod. 2005; 31: 364-368.

[2] Marroquín BB, El-Sayed MA, Willershausen-Zönnchen B. Morphology of the physiological foramen: I. Maxillary and mandibular molars. J Endod. 2004; 30: 321-328.

[3] Beatty RG. A five-canal maxillary first molar. J Endod. 1984;10: 156-7.

[4] Bond JL, Hartwell G, Portell FR. Maxillary first molar with six canals. J Endod. 1988; 14: 258-260.

[5] Kottoor J, Velmurugan N, Sudha R, Hemamalathi S. Maxillary first molar with seven root canals diagnosed with cone-beam computed tomography scanning: a case report. J Endod. 2010; 36: 915-921.

[6] Kottoor J, Velmurugan N, Surendran S. Endodontic management of a maxillary first molar with eight root canal systemsevaluated using cone-beam computed tomography scanning: a case report. J Endod. 2011; 37: 715-719.

[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: 687-691.

[8] Ma L, Chen J, Wang H. Root canal treatment in an unusual maxillary first molar diagnosed with the aid of spiral computerized tomography and in vitro sectioning: a case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009; 107: e68-e73.

[9] Dankner E, Friedman S, Stabholz A. Bilateral C shape configuration in maxillary first molars. J Endod. 1990; 16: 601-603.

[10] Di Fiore PM. A four-rooted quadrangular maxillary molar. J Endod. 1999; 25: 695-697.

[11] Thomas RP, Moule AJ, Bryant R. Root canal morphology of maxillary permanent first molar teeth at various ages. Int Endod J. 1993; 26: 257-267.

[12] 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: 813-821.

[13] Aggarwal V, Singla M, Logani A, Shah N. Endodontic management of a maxillary first molar with two palatal canals with the aid of spiral computed tomography: a case report. J Endod. 2009; 35: 137-139.

[14] Stone LH, Stroner WF. Maxillary molars demonstrating more than one palatal root canal. Oral Surg Oral Med Or-

al Pathol. 1981; 51: 649-652.

[15] Hargreaves KM, Cohen S, Berman LH, editors. Cohen's pathways of the pulp. 10th ed. St. Louis, Mo: Mosby Elsevier; 2011. p. 137.

[16] Ghoddusi J, Mesgarani A, Gharagozloo S. Endodontic retreatment of maxillary second molar with two separate palatal roots: a case report. Iran Endod J. 2008; 3: 83-85.

[17] Stropko JJ. Canal morphology of maxillary molars: clinical observations of canal configurations. J Endod. 1999; 25: 446-450.

[18] Christie WH, Thompson GK. The importance of endodontic access in locating maxillary and mandibular molar canals. J Can Dent Assoc. 1994; 60: 527-536.

[19] Buhrley LJ, Barrows MJ, BeGole EA, Wenckus CS. Effect of magnification on locating the MB2 canal in maxillary molars. J Endod. 2002; 28: 324-327.

[20] Slowey RR. Radiographic aids in the detection of extra root canals. Oral Surg Oral Med Oral Pathol. 1974; 37: 762-772.

[21] Hildebolt CF, Vannier MW, Pilgram TK, Shrout MK. Quantitative evaluation of digital dental radiograph imaging systems. Oral Surg Oral Med Oral Pathol. 1990; 70: 661-668.

[22] Hounsfield GN. Computerized transverse axial scanning (tomography). 1. Description of system. Br J Radiol. 1973; 46: 1016-1022.

[23] Kalender WA, Seissler W, Klotz E, Vock P. Spiral volumetric CT with single-breath-hold technique, continuous transport, andcontinuous scanner rotation. Radiology. 1990; 176: 181-183.

[24] Metgud S, Metgud R, Rani K. Management of a patient with a taurodont, single-rooted molars associated with multiple dental anomalies: a spiral computerized tomography evaluation. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009; 108: 81-86.