

Endodontic management of mandibular first molar with seven canals using cone-beam computed tomography

ANKUR MAHESH BANODE, VANDANA GADE, SANJAY PATIL, JAYKUMAR GADE¹

Abstract

The endodontic treatment of a mandibular molar with aberrant canal configuration can be diagnostically and clinically challenging. Successful endodontic therapy thus depends on the clinician's ability to anticipate and look for these aberrant variations. A mandibular first molar with seven canals represents a rare anatomical variant, particularly when four canals are found in distal root. Based on *in vitro* studies, its incidence is reported to be between 0.2% and 3%. With the advent of cone-beam computed tomography (CBCT) as an adjunctive diagnostic aid, the determination of root canal anatomy in teeth with complex canal configurations has become more precise. The present case report discusses successful nonsurgical management of radix entomolaris along with middle mesial canal and middle distal canal in mandibular first molar with seven canals (four canals in distal and three in mesial) employing CBCT as an adjunctive diagnostic aid to conventional radiography.

Keywords: Cone-beam computed tomography, mandibular first molar, seven root canals

Introduction

For the success of endodontic therapy, adequate knowledge of the root canal system is imperative. Inability to appreciate the internal anatomy of the tooth, accompanied by inadequate endodontic treatment, is the main cause of root canal therapy failure.^[1] Success rate of endodontically treated teeth has been reported to be 87.79% and is still lower for mandibular first molars reaching around 81.48%.^[2] It has been reported that the incidence of missed roots or canals among the teeth requiring retreatment was as high as 42%.^[3] In case of mandibular first molar, 86% of missed canals are found in the distal root and 14% in the mesial roots.^[4] This could be credited to the considerable anatomic disparity and anomalies of roots and root canals, intracanal communications, and curvatures not evident in conventional radiographs. Therefore, knowledge of radicular tooth

anatomy and possible root canal variations is mandatory for the clinicians. To precisely detect, search, and decontaminate root canal system, cone-beam computed tomography (CBCT) can be used to aid the confirmatory diagnosis of root canal morphology.

The usual root canal morphology of mandibular first molar is the presence of two roots with either three or four root canals.^[5] Moreover, only 0.2–3% prevalence rate is observed with the third distal canal in distal root within different ethnic groups.^[6] Only, few cases have been reported and even less documented in the literature regarding four canals in distal root.^[7,8] This case report discusses the endodontic management of a rare anatomical variation in root canal system of mandibular first molar with seven canals confirmed by CBCT and successfully treated.

Case Report

A 25-year-old patient reported in the Department of Conservative Dentistry and Endodontics with the chief complaint of pain in the lower right back region of jaw since past 1 week. Patient's medical history was noncontributory. Clinical examination revealed that tooth #46 had mesio-occlusal deep caries. The tooth was tender to percussion and gave delayed response to electric pulp tester. A preoperative, intraoral periapical radiograph [Figure 1a]

Departments of Conservative Dentistry and Endodontics and
¹Prosthodontic Dentistry and Implantology, Swargiya Dadasaheb
Kalmegh Smruti Dental College and Hospital, Nagpur,
Maharashtra, India

Correspondence: Dr. Ankur Mahesh Banode,
Old Shukrawari, Shakardara Road, Near Murlidhar Temple,
Nagpur - 440 009, Maharashtra, India.
E-mail: ankurbnd848@gmail.com

Access this article online	
Quick Response Code: 	Website: www.contempclindent.org
	DOI: 10.4103/0976-237X.183055

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Banode AM, Gade V, Patil S, Gade J. Endodontic management of mandibular first molar with seven canals using cone-beam computed tomography. *Contemp Clin Dent* 2016;7:255-7.

showed radiolucency on the occlusal aspect, involving the pulp chamber of the first molar and an additional root (radix). There was slight widening of apical periodontium. Hence, a clinical diagnosis of symptomatic irreversible pulpitis with apical periodontitis was made and, therefore, root canal therapy was planned.

The patient was anesthetized by way of right inferior alveolar nerve block using 2% solution of lignocaine hydrochloride containing 1:80,000 adrenaline (LIGNOX 2% A, Warren, Indoco Remedies LTD, Mumbai) followed by rubber dam application for isolation. Endodontic access cavity was prepared with Endo Access Bur (Dentsply Mallifer, Switzerland) in a high-speed air rotar handpiece (NSK, Japan), and the pulp chamber was repeatedly flushed with 5% sodium hypochlorite (Vishal Dentocare Pvt. Ltd., No 1 GF Vijay Complex Ground Floor, Vasna, Vishal, Ahmedabad, India). Initial inspection of the pulp floor revealed five canal openings with two distal and one mid-mesial (MM) canal openings apart from the two mesial canals. Coronal enlargement was then done with the help of nickel-titanium ProTaper orifice shaper (SX) (Dentsply, Maillefer, Bellaigues, Switzerland) to improve the straight line access and relocation of the canal orifices. This was followed by the exploration of sixth canal with the help of DG-16 explorer

because of the presence of radix. This led to the unearthing of sixth canal, which was for radix and was detected lingual to distolingual (DL) canal. As the DL canal appeared to be oval in shape, two canals were suspected in the same. This was then confirmed radiographically, which showed the presence of two separate canals that was then considered to be distal center. The additional radix entomolaris (Re) canal was located lingual to DL canal under operative microscope (Seiler Microscope) [Figure 1b]. Hence, it was confirmed that the three-rooted right mandibular first molar had seven canals in total with six orifices as DL and mid-distal (MD) canals shared the same orifice [Figure 2a]. Chemomechanical preparation was then scheduled in the next appointment before which the patient was sent for CBCT to confirm the unusual morphology [Figure 2b and c]. In coronal third of CBCT view, four distal root canals, i.e., distobuccal, MD, DL, and Re could be observed while in middle third of CBCT view, three mesial canals, i.e., mesiobuccal, MM, mesiolingual (ML) were seen. Patient was asymptomatic during the second appointment. Cleaning and shaping of all canal was done by crown-down method using copious irrigation with 5% sodium hypochlorite solution with the help of K3XF file system (SybronEndo). Coronal third of root canal was instrumented first, with 0.12 and 0.10 tapered K3XF files followed by middle third with 0.08 and 0.06 taper and apical third with 0.04 taper. All the canals were instrumented till number 25 and 4% tapered K3XF. Master cone for each canal was selected as number 25 and 4% taper Gutta-percha points (Dentsply Mallifer, Switzerland) [Figure 1c]. Obturation was performed using cold lateral compaction of Gutta-percha [Figure 1d]. The tooth was then



Figure 1: (a) Preoperative radiograph of mandibular right first molar. (b) Working length radiograph with a file placed in each of the three mesial canals, three distal canals, and radix entomolaris. Arrow showing mid-distal canal. (c) Master cone placed in each of the seven root canals of mandibular right first molar. (d) Final obturation of the mandibular right first molar. Arrow showing mid-distal canal. (e) Postobturation radiograph (f) postobturation radiograph (distal angulation)

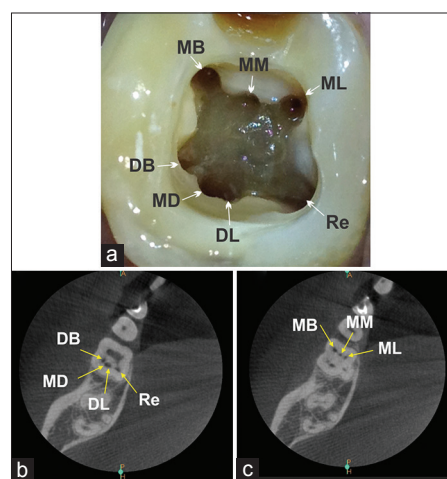


Figure 2: (a) Clinical view of the access cavity preparation showing seven distinct root canal orifices; mesiobuccal, mid-mesial, mesio-lingual, distobuccal, mid-distal, distolingual, and radix entomolaris. (b) Cone-beam computed tomography scan view at the coronal third showing four distinct root canals; distobuccal, mid-distal, disto-lingual and radix entomolaris. (c) Cone-beam computed tomography scan view at the middle third showing three distinct root canals; mesiobuccal, mid-mesial and mesiolingual

restored with posterior composite resin followed by crown [Figure 1e and f]. Patient was asymptomatic during follow-up period of 3 months.

Discussion

The mandibular molar generally has two separate roots with round or elliptical canal in the distal root and two canals in the mesial root. In 35% of cases, four canals are present. Sometimes, the “extra” canal is found in the mesial root which is termed as middle mesial canal (MMC) and was first reported by Vertucci and Williams in 1974. The incidence rate of MMC varies from 1% to 15%.^[9]

The presence of additional third root which can be found distolingually is termed as “Radix Entomolaris.” This was first mentioned by Carabelli in 1844. In Indian population, the frequency of Re is <5%.^[9]

According to Pomeranz *et al.*, the MMC in this case can be classified as confluent because the prepared canal originated as a separate orifice but apically joined to ML canal.^[10] Here, middle distal canal was found confluent at the junction of middle and apical one-third with DL canal.^[10] This indicates the presence of separate orifice of the middle distal canal. Similarly, according to Carlsen and Alexander, Re in this case is classified as type A because of distally located cervical part of the Re with two normal distal root components.^[9]

It has been postulated that secondary dentine apposition during tooth maturation will form a dentinal vertical partition in the canal cavity, thus creating extra root canals.^[9] Other possible reasons for the presence of extra roots and canals include role of external factors during odontogenesis, penetrate of an atavistic gene and racial genetic factors.

In this case, K3XF file system was used as it has a unique cross-sectional design, a slightly positive rake angle for greater cutting efficiency, wide radial lands, and a peripheral blade relief for reduced friction. K3XF provides an extraordinary new level of flexibility and resistance to cyclic fatigue due to R-phase™ technology.

A significant limitation in conventional radiography is that it yields a two-dimensional image of a 3D object, which

results in overlapping of the overlying structures. Therefore in this case report, the use of CBCT as a diagnostic tool in endodontics has been highlighted. In the present case, CBCT analysis was done to verify the presence of additional canals.

Conclusion

Endodontic treatment of multi-rooted teeth is always challenging task due to complex variations associated with them. Main reason for endodontic failure is due to clinician’s inability to locate and access aberrant root canals. For successful root canal treatment, knowledge of dental anatomy, careful interpretation, and utilization of latest diagnostic tools are required. Technical advancement such as ultrasonic and CBCT plays an important role in successfully managing above case with complex anatomic variation.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Vertucci FJ. Root canal morphology and its relationship to endodontic procedures. *Endod Topics* 2005;10:3-29.
2. Swartz DB, Skidmore AE, Griffin JA Jr. Twenty years of endodontic success and failure. *J Endod* 1983;9:198-202.
3. Hoen MM, Pink FE. Contemporary endodontic retreatments: An analysis based on clinical treatment findings. *J Endod* 2002;28:834-6.
4. Witherspoon DE, Small JC, Regan JD. Missed canal systems are the most likely basis for endodontic retreatment of molars. *Tex Dent J* 2013;130:127-39.
5. Vertucci FJ. Root canal anatomy of the human permanent teeth. *Oral Surg Oral Med Oral Pathol* 1984;58:589-99.
6. Kottoor J, Sudha R, Velmurugan N. Middle distal canal of the mandibular first molar: A case report and literature review. *Int Endod J* 2010;43:714-22.
7. Ghoddusi J, Naghavi N, Zarei M, Rohani E. Mandibular first molar with four distal canals. *J Endod* 2007;33:1481-3.
8. Baziar H, Daneshvar F, Mohammadi A, Jafarzadeh H. Endodontic management of a mandibular first molar with four canals in a distal root by using cone-beam computed tomography: A case report. *J Oral Maxillofac Res* 2014;5:e5.
9. Ballullaya SV, Vemuri S, Kumar PR. Variable permanent mandibular first molar: Review of literature. *J Conserv Dent* 2013;16:99-110.
10. Pomeranz HH, Eidelman DL, Goldberg MG. Treatment considerations of the middle mesial canal of mandibular first and second molars. *J Endod* 1981;7:565-8.