

Two Varied Morphologies Of Mandibular First Molar With Three Distal Root Canals: Case Report

Running Title: Mandibular First Molar With 3 Distal Root Canals

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ABSTRACT: Mandibular first molars are the first posterior teeth to erupt in permanent dentition and are those that most often suffer from caries. They are also the teeth that exhibit considerable anatomical variation and abnormalities regarding the number of roots and root canals. Therefore the clinician should know the various morphologic aberrations occurring in this tooth before starting the treatment. The present case report is intended to provide a clinical insight of one such variation. The case reports presents with two mandibular first molars with 3 distal root canals and one root. The teeth was treated endodontically with the help of dental operating microscope and CBCT and successfully managed.

Keywords: mandibular first molar, three distal root canals, Gulabivala classification, root canal morphology.

1. INTRIDUCTION:

Of all the phases of anatomic study in human system, one of the most complex is the pulp cavity morphology ⁽¹⁾. Mandibular first molars are the first posterior teeth to erupt in permanent dentition and are those that most often suffer from caries ⁽²⁾. They are also the teeth that exhibit considerable anatomical variation and abnormalities regarding the number of roots and root canals ⁽³⁾. The average time of eruption is 6 years and average age of calcification is 9-10yrs. It has an approximate length of 21mm and generally has two roots (97.8%) but rarely has three roots (2.2%) ⁽⁴⁾. The mesial root shows a distal curvature in 84% of cases and is straight in 16% whereas the distal root is straight in 74% of cases and has a distal curvature in 21%. The tooth generally has three canals (64.4%) but rarely has two canals (6.7%) and four canals (28.9%) ⁽⁵⁾. The variations in the morphologic features of the

tooth can be due to various factors like age, external factors during odontogenesis and racial/genetic factors⁽⁶⁾. And the occurrence of multiple root canals has been hypothesized to occur due to secondary dentine deposition during tooth maturation which will lead to formation of a dentinal partition inside the canal cavity vertically dividing it and thus creating additional root canals⁽⁷⁾.

Skidmore & Bjorndal⁽⁸⁾ (1971) observed that 88.8% of distal roots of the mandibular first molar have only one canal whilst 28.9% have two canals. The existence of three separate distal canals was first observed in two extracted mandibular first molars by Quackenbush⁽⁹⁾ (1986). The incidence of three distal canals was found to be 1.7%⁽¹⁰⁾ with an incidence range of 0.2- 3%⁽⁷⁾ which is very rare and the purpose of this article is to give the clinician insights about such occurrences. To illustrate by means of case report the clinical procedures followed to do root canal treatments on first mandibular molars with an unusual root canal anatomy and the value of Cone Beam Computed Tomography (CBCT) and surgical operating microscope is also illustrated.

2. CASE REPORT:

Case 1:

A 37-year-old female patient reported with a chief complaint of pain in lower right back tooth region of jaw since one month. The pain was intermittent, dull and aggravated on mastication. On clinical examination, a deep disto-occlusal carious lesion was seen in tooth 46, the tooth was tender to vertical percussion and with no mobility. Periodontal probing was within the physiological limits. There were no abnormality or tenderness detected on palpation of the buccal and palatal aspects of the tooth. Pulp sensibility testing was done with an electric pulp tester caused a premature response. The pre-operative radiograph revealed disto-occlusal radiolucency approximating the pulp space, with widening of the periodontal ligament space seen in the mesial root [Figure 1A]. From the clinical and radiographic examination, a diagnosis of chronic irreversible pulpitis with symptomatic apical periodontitis was established in relation to 46. Non-surgical endodontic treatment was advised for the involved tooth. The examination of the radiograph of the involved tooth did not indicate any variation in the root canal anatomy.

Local anaesthesia was induced using 1.8 ml of 2% Lignocaine and Adrenaline (Xylocaine; AstraZeneca Pharma Ind Ltd, Bangalore, India). The tooth was isolated using rubber dam and an endodontic access opening was established. The orifices of mesiobuccal, mesiolingual, distobuccal and distolingual were apparent and were initially located. The floor of the pulp chamber was viewed under dental operating microscope (Carl Zeiss Meditec AG, Germany), and with the help of this magnification and exploration of the chamber floor with DG16 (Hu-Friedy, Chicago, IL), a third distal canal orifice was located. The patency was confirmed with ISO #10 K-files. The orifices were enlarged using Gates Glidden drills upto size 2 [figure 1B].

To confirm this unusual morphology, a Cone Beam Computed Tomographic imaging (CBCT) of the tooth was done with a tube voltage of 100 KV and a tube current of 8 mA. The cross- sections of 0.5mm thickness were obtained in axial, transverse, and sagittal planes and were analyzed by CS 3D imaging software (Carestream Dental LLC) to find out the canal morphology. The CBCT scan slices revealed five canals, 2 in mesial root: mesiobuccal (MB), mesiolingual (ML), and 3 in distal root: distobuccal (DB), mid distal (MD) and distolingual (DL) [Figure 1C]. Working lengths were determined using an apex locator (Root

ZX; Morita, Tokyo, Japan) which was confirmed by intraoral periapical radiographs [Figure 1D].

Cleaning and shaping was performed using Neoendo Flex rotary instruments (Orikam, India) in a crown down technique. All the distal canals were enlarged upto size 20 and .06 taper and mesial canals to size 25 and .06 taper [Figure 1E]. Irrigation was performed using 2.5% sodium hypochlorite and 17% EDTA. All the canals were finally flushed with saline. The canals were dried with absorbent paper points and obturation of canals was done with gutta percha and AH plus sealer (Maillefer, Dentsply, Konstanz, Germany) [Figure 1F]. Then, a composite core restoration was done. The patient was advised for a full coverage porcelain crown. The patient was asymptomatic at the three month follow-up [Figure 1G].

Case 2

A 33-year-old female patient reported with a chief complaint of pain in the lower right back tooth since 3 months. The pain was spontaneous and aggravated on chewing. Past medical and dental history was non-contributory. On intraoral examination, there was a carious exposure of the pulp and the tooth was tender to vertical percussion. A provisional diagnosis of acute irreversible pulpitis with apical periodontitis was made. Radiographic evaluation of the involved tooth (# 46) revealed outlines of three canals in distal root [Figure 2A]. Local anaesthesia was administered and rubberdam isolation was done.

Access preparation was made in the right mandibular first molar and two orifices were located mesially (buccal and lingual) and three were located distally (buccal, middle and lingual) on observing under operating microscope and manual exploration [figure 2B]. Negotiation was done with 10K file and working length was measured with electronic apex locator and confirmed with periapical radiograph [figure 2C]. The canals were prepared using hand K-files till no. 20 followed by NeoEndo file (Orikam, India) till size 25, 0.06 taper in mesial root canals and size 20, 0.04 taper in distal root canals [figure 2D]. During preparation, the canals were lubricated and irrigated with EDTA and 2.5% NaOCl. Calcium hydroxide dressing was done in all the root canals and temporary restoration was done for two weeks. Later the canals were coated with AH plus sealer and obturated in the lateral compaction technique and the tooth was restored with composite resin [Figure 2E].

3. DISCUSSION

In all previous cases reported between 2000-2020 ^(7,11-19) [Table 1] including the present case, morphological variations have occurred in the distal root/canal of the right mandibular first molar, except for Ghoddusi et al. 2007 ⁽³⁾ case report where such variation was on the left side. Quackenbush ⁽⁹⁾ noted that the extra root occurred unilaterally about 40% of the time, predominantly on the right side. Lee et al. 2006⁽¹⁵⁾, Chandra et al. 2009⁽¹⁹⁾ have evaluated the bilateral occurrence of any morphological variation in the distal root/canals, using SCT, and both reported no aberrant findings in the contra-lateral tooth. Presence of three separate distal root canals bilaterally has also been demonstrated in two extracted mandibular first molars by Quackenbush ⁽⁹⁾. The canal morphology of distal root canals was Gulabivala type 9 (3-1) in both the cases which is similar to that reported by Martínez-Berná et al ⁽²⁰⁾. The age of patients in the present case report is between 30-40 years which is a young adult age group. As the age of young adult patient increases, the probability of finding the second canal in the distal root of mandibular first molar decreases ⁽²¹⁾. As with increasing age, the tooth is exposed to various insults leading to calcification of the orifice or canal itself but the prevalence is high in intermediate age groups ⁽²²⁾.

To locate accessory canal orifices a clinician should more carefully inspect the pulp chamber floor⁽⁷⁾, should have a thorough understanding of tooth morphology, should use angulated radiographs, should explore the root canal under the surgical operating microscope and should do a detailed exploration of the interior of the tooth⁽⁷⁾. Improved visualization of root canal orifices in the surgical operating microscope could increase the number of root canal orifices located in mandibular molars. De Carvalho and Zuolo (2000)⁽²³⁾ observed that after examination with the operating microscope, an additional were located. They concluded that a combination of CBCT scanning and the surgical operating microscope are a very useful aid in locating and identifying root canals. A limited field of view (FOV) machines are preferred over larger field of view machines in the present case report as missed root canals require a high resolution for adequate interpretation. Another advantage of the limited FOV is a decreased radiation exposure for the patient⁽²⁴⁾. The use of proper technique and armamentaria improve the precision of treatment and thereby the prognosis.

4. CONCLUSION

Clinician's awareness of the morphological variations occurring in the root canal systems plays a major role in determining the treatment outcome. With use of dental operating microscope and cone beam computed tomography imaging the vision of clinician is further enhanced. This case report reinstates to look for the unusual in usual, which is to look for morphologic variations in every tooth.

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Conflict Of Interest: Nil

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TABLES AND FIGURES

Table 1: Review of case reports published from jan 2000-jan 2020

Author	year	No of roots	No of distal roots	No of canals	No of distal canals
Kottoor	2010	2	1	5	3
Beyraghshamshir	2019	2	1	5	3
Elhadi	2018	2	1	5	3
Barletta	2008	3	2	5	3
Y. Kimura	2000	3	2	5	3
Seung-Jong Lee	2006	4	3	5	3
Shweta Jain	2011	2	1	5	3
Mariana Domingos	2019	2	1	5	3
		2	1	5	3
		2	1	5	3
Kirici	2019	2	1	5	3
Chandra	2009	2	1	5	3

Figure 1:(A): pre-operative radiograph, (B): orifice location (mesiobuccal-MB; mesiolingual-ML; distobuccal-DB; mid distal-Mid D; and distolingual-DL),(C) CBCT image showing 5canals, (D) working length determination, (E) master cone, (F) obturation and post endo restoration, (G) follow-up radiograph.

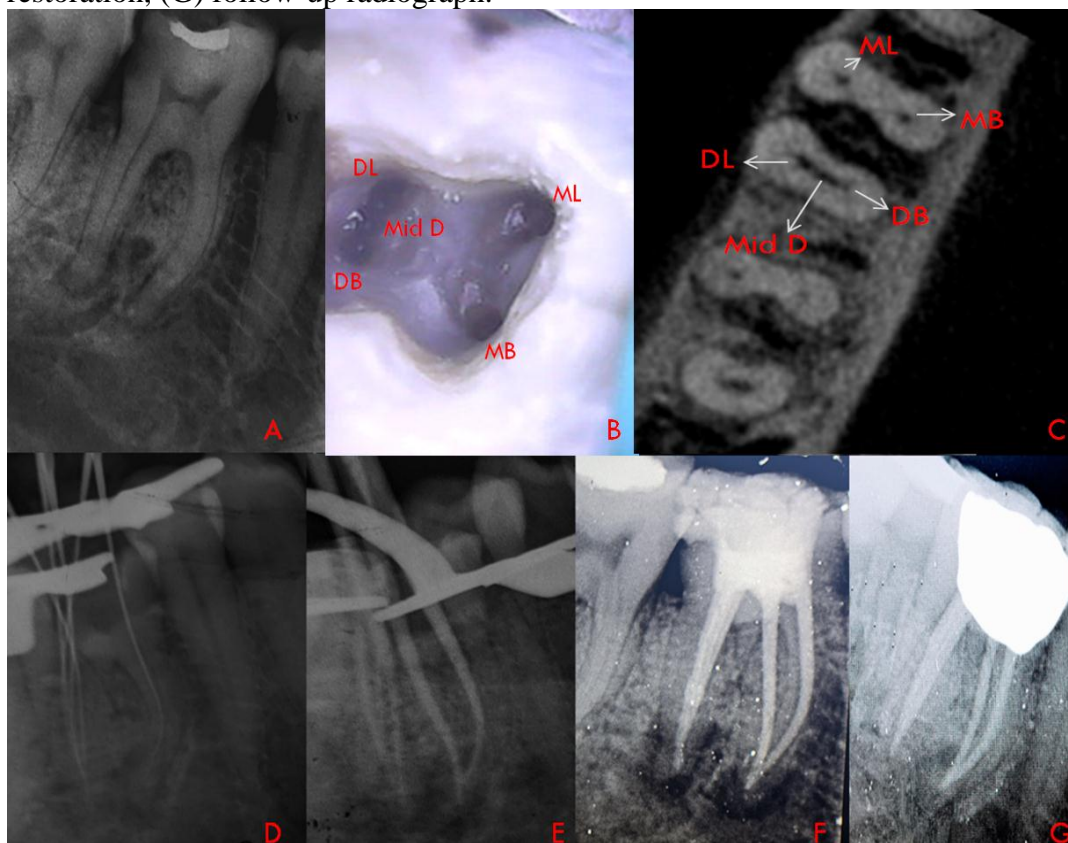


FIGURE 2:(A): pre-operative radiograph, (B): orifice location, (C) working length determination, (D) master cone, (E) obturation and post endo restoration.

