Mandibular First Molar with Multiple Canals- Report of Three Cases

Vandana Bhardwaj,[1] Naina Garg,[2]

ABOUT THE AUTHORS

1. Dr. Vandana Bhardwaj,
Senior Resident,
Department of Conservative Dentistry & Endodontics,
Post Graduate Institute of Dental Sciences, University of Health Sciences,
Rohtak, Haryana, India.

2. Dr. Naina Garg,
Post Graduate Student,
Department of Conservative Dentistry & Endodontics,
Post Graduate Institute of Dental Sciences,
University of Health Sciences,
Rohtak, Haryana, India.

Corresponding Author:

Dr. Vandana Bhardwaj,

Senior Resident,
Department of Conservative Dentistry & Endodontics,
Post Graduate Institute of Dental Sciences,
University of Health Sciences,
Rohtak, Haryana, India.
Phone Number: 00946751008
E-mail:
doc.vanbhardwaj@gmail.com
nainagarg28@gmail.com

Abstract

Aim: To present clinical case report of three mandibular first molar with middle mesial canal, middle distal canal and radix paramolaris.
Introduction: Morphological variations in root canal system anatomy should always be considered at the beginning of treatment. Once endodontic treatment has been initiated, proper access cavity preparation is a basic prerequisite for the investigation and successful detection of all root canal orifices.
Case Description: Three patients with chief complaint in mandibular first molars were referred for endodontic treatment. Two patients had extra canal in their mandibular first molar and third patient had additional canal with supernumerary root. With aid of proper diagnostic and radiographic techniques the endodontic treatment was performed.
Conclusion: Good knowledge of the potential aberrant canal morphology in mandibular molar will help clinician to successfully recognize and treat these difficult cases. The incidence of extra buccal root and canal variations are rare, every effort should be made to find and treat all canals for successful clinical results. Better illumination and magnification under microscope help in locating hidden canals.

KEYWORDS: Additional Canal, Mandibular First Molar, Microscope.

Introduction

It is generally accepted that inability to recognize the presence of and to adequately treat all of the canals of the endodontic system may be a major cause of the failure of root canal therapy.Numerous in vitro and in vivo studies on the morphology of mandibular first molars have provided new data relating to the presence of extra roots, additional root canals, lateral canals or transverse canal anastomoses between two or three canals in the mesial root.
In 1974, Vertucci and William, as well as Barker et al[1, 2] described the presence of an independent middle mesial canal in mandibular first molar. In almost all of the clinical cases reported until today, this canal joined the mesiobuccal or mesiolingual canal in the apical third.[3]Additionally, Stroner et al and Beatty and Iterian [4,5] have reported more obscure cases in which third canal was located in the distal root. Prevalence of third canal in distal root is 0.7-3% as studied by different authors.[6-9]
Bolk [10]reported the occurrence of a buccally located additional root: radix paramolaris(RP). This macrostructure is very rare and occurs less frequently than the radix entomolaris (RE). The prevalence of RP, as observed by Visser[11]was found to be 0% for the first mandibular molar, 0.5% for the second and 2% for the third molar. Other studies also reported RP in first mandibular molars.[12] Till date clinical cases depicting RP are scarce. Calberson et al[13] in 2007, reported single case of RP in relation to mandibular first molar.

Case 1

A 36 year old male was referred for endodontic treatment of the mandibular left first molar with large carious lesion that had invaded pulp. The patient reported very acute pain particularly at night and on drinking anything cold. The tooth responded to cold test (Roeko Endo-Frost,Coltene Whaledent,Germany).The pulp chamber was opened,

and one distal and two mesial canal orifices were located using an endodontic explorer (DG-16 Endodontic Explorer, Ash Instruments, Dentsply, Gloucester, United Kingdom). The root canals were explored with a K-file ISO 15 (Dentsply Maillefer, Ballaigues, Switzerland).Upon visual inspection under microscope ((Möller Wedel International, Rosengarten, Wedel), a dark line was observed between the mesiobuccal canal orifice and the mesiolingual canal orifice of the pulp chamber floor. Upon careful exploration of the groove between the mesiobuccal and mesiolingual orifice, there was a stick with an endodontic explorer. Initially, three orifices on mesial side were appreciated as separate orifices (Fig.1c).The pulp chamber floor showed four orifices corresponding to 4 root canals (Fig. 1a,b): mesiobuccal (MB), mesiolingual (ML), middle mesial (MM), and distal (D). The canal length was determined electronically using an apex locator (Root ZX; Morita, Tokyo, Japan) and the root canals were shaped with Pro Taper rotary instruments (Dentsply Maillefer). During preparation, the root canals were disinfected with a sodium hypochlorite solution (5%). The root canals were filled with gutta-percha and AH Plus sealer(Dentsply-Maillifer) using lateral condensation (Fig.1e) after reconfirming the working length with gutta percha cones (Fig. 1d). The opening cavity was sealed with Kalzinol (BB trading corporation Ltd, Mumbai) and the patient was referred for the permanent coronal restoration.

Case 2

A 23-year-old man whose medical history was noncontributory presented to the dental clinic with spontaneous pain in the right molar area. The patient presented severe lingering pain to cold water applied to the isolated tooth. Tooth was non-responsive on percussion and palpation. Diagnosis of irreversible pulpitis without apical periodontitis of the right mandibular first molar was made. After administering local anesthesia, rubber dam isolation, previous restoration, and all carious tissue were removed, and an adequate endodontic access was made. Observation of pulp chamber with aid of microscope (Möller Wedel International, Rosengarten, Wedel) revealed additional third canal in distal root (Fig. 2a). The pulp chamber floor showed five orifices corresponding to five root canals: mesiobuccal (MB), mesiolingual (ML), distobuccal(DB), and distolingual(DL) and middle distal(MD) (Fig. 2b) . Working lengths were estimated by using an electronic apex locator (Root ZX; Morita, Tokyo, Japan) and then confirmed with a radiograph (Fig. 2c). All canals were cleaned and shaped with Protaper rotary instruments (Dentsply-Maillefer, Ballaigues, Switzerland) under copious irrigation with 5% sodium hypochlorite. After preparation, the gutta-percha cones were inserted into the root canals and working length was reconfirmed (Fig. 2d). All canals including the middle distal canal were obturated with gutta-percha and sealer (AH-plus, Dentsply-Maillifer) (Fig.2e).The patient experienced no post treatment discomfort and was subsequently referred for appropriate coronal restoration.

Case3

A 42 year old male whose medical history was non contributory was referred for endodontic treatment of mandibular right first molar with a history of severe pain for 2 days. The pain kept him awake at night and was radiating up the side of his face. The tooth was very sensitive to percussion and was nonresponsive to cold test (Roeko Endo-Frost,Coltene Whaledent,Germany). A radiograph showed a deep restoration approximating the pulp (Fig. 3b). A diagnosis of necrotic pulp with acute apical periodontitis was made. Upon opening the pulp chamber, four canals were found: two mesial and two distal canals. Inspection of pulp chamber under microscope (Möller Wedel International, Rosengarten, Wedel) revealed third canal in mesial root (Fig.3a). Working length was determined electronically with the help of apex locator (Root ZX; Morita, Tokyo, Japan) and was confirmed radiographically (Fig.3c). The root canals were disinfected with 5% sodium hypochlorite and shaped with K-files (Dentsply Maillefer, Switzerland) and Protaper (Dentsply-Maillefer, Ballaigues, Switzerland). Angled master cone radiograph revealed extra mesial root identified as Radix Paramolaris (Fig.3d).The root was filled with gutta percha and AH- plus sealer (Dentsply-Maillifer)(Fig.3e). Lastly, pulp chamber was sealed with Kalzinol (BB trading corporation Ltd, Mumbai) before placing permanent restoration.

Discussion

Morphological variations in root canal system anatomy should always be considered at the beginning of treatment. A thorough understanding of tooth morphology, angulated radiographs, exploring the root canal under the surgical operating microscope and a detailed exploration of the interior of the tooth are essential prerequisites for a successful treatment outcome. Additionally, there are multiple concepts, armamentaria and instruments that are useful to find these aberrant canals. These include the use of micro-openers, properly designed access cavity, bubble test, champagne test, transillumination, use of piezoelectric ultrasonics, looking for the rules of symmetry, red line test, white line test and perio-probing.

Several studies have shown that dental operating microscope significantly increases the dentist's ability to locate and negotiate canals. In the present case series dental operative microscope had a significant role in locating additional canals.

Reports have been presented by Pomeranz et al[3], and Goel et al[6]on the incidence of third mesial canals in mandibular molars, with an occurrence ranging from 1% to 15% in vivo. However, in vitro studies have not reported such a high prevalence of three mesial canals, with most studies showing an incidence of either 0% or 1%.[14,15] Pomeranz et al[3] classified three separate morphological possibilities in the mesial root: 1) Fin--when an instrument could pass freely between the mesiobuccal or mesiolingual canal and the middle mesial canal; 2) Confluent--when the prepared canal originated as a separate orifice but apically joined the

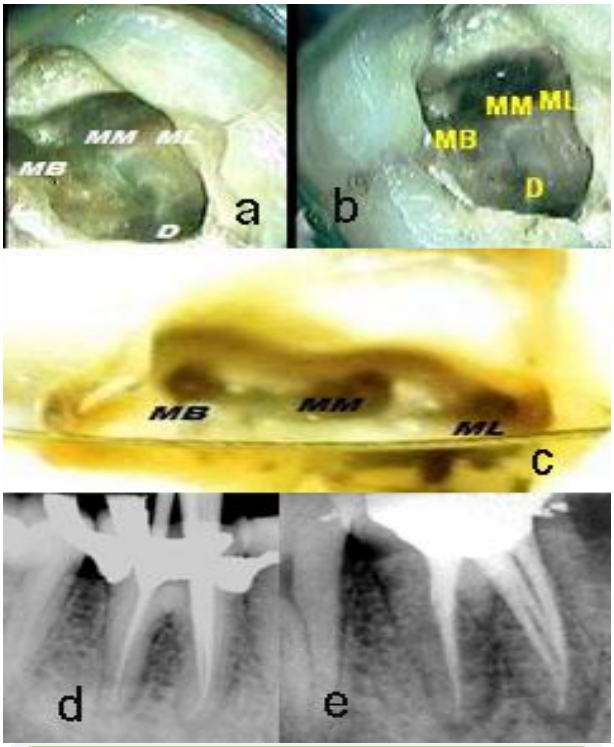

Figure 1. (a, b) occlusal view of the pulp chamber floor with the orifice of the(MB, mesiobuccal; MM, middle mesial; ML, mesiolingual; D, distal).(c)Orifice location of middle mesial (MM). (d) Gutta cone fit. (e) Postoperative radiograph.

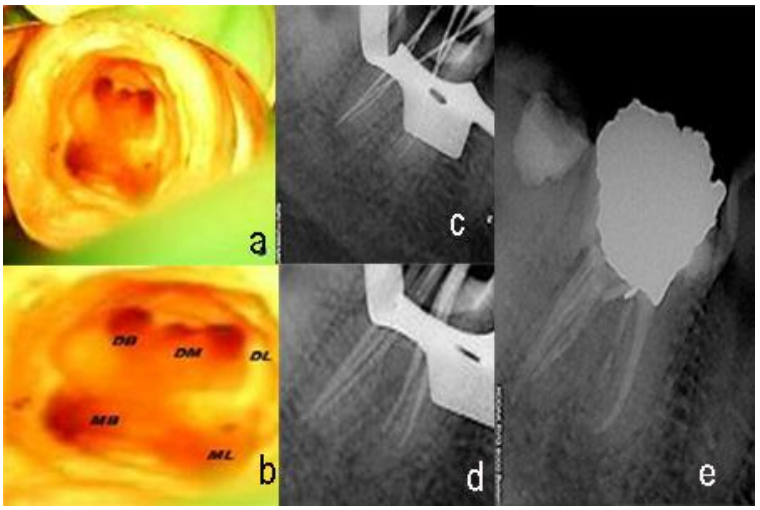

Figure2. (a,b)occlusal view of the pulp chamber floor with the orifice of the (MB, mesiobuccal; ML, mesiolingual; DB, distobuccal;MD,middledistal;DL,distolingual).(c) Length determination. (d) Gutta cone fit. (e) Postoperative radiograph.

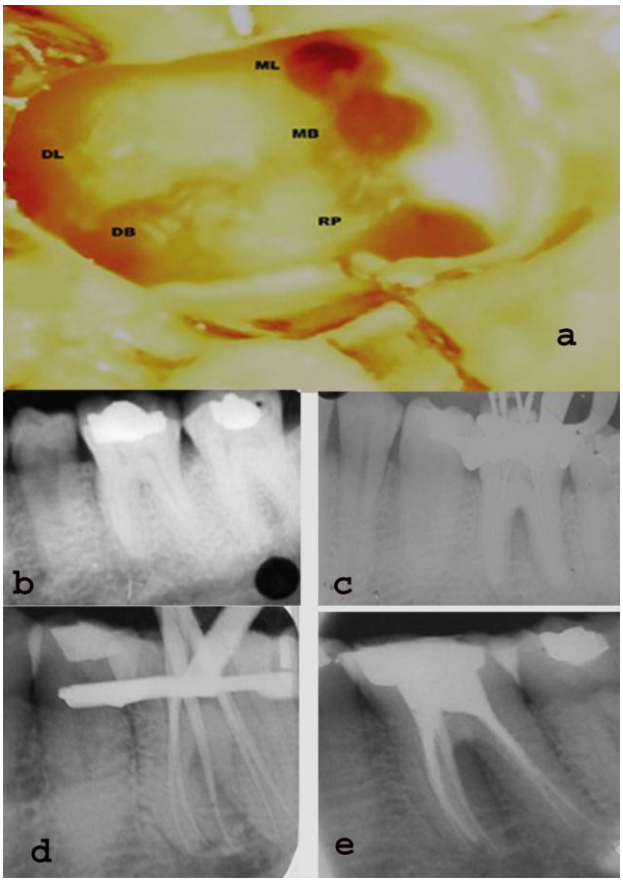

Figure 3. (a) clinical image of the opening cavity to reveal the orifice of the radix paramolaris (MB mesiobuccal; DB distobuccal;DL distolingual; ML mesiolingual;RP, radix paramolaris). (b)Preoperative radiograph. (c) Length determination. (d) Gutta cone fit. (e) Postoperative radiograph.

mesiobuccal or mesiolingual canal; and 3) Independent--when the prepared canal originated as a separate orifice and terminated as a separate foramen. According to this classification, first case have confluent type configuration (Fig. 1e).

Recently, Kottor et al[16] described the endodontic management of a mandibular first molar in a patient of Indian origin, having three distal canals within a single distal root. Our second case described the additional middle canal in the distal root. The presence of a middle distal canal was confirmed after careful exploration of all three canals (Fig.2a,b). According to Sert & Bayirli[8], this pattern has been described as Type XV canal configuration (i.e.distobuccal and mid-distal joined at the middle third of the root canal and exiting through a single apical foramen whilst the distolingual had a separate canal orifice and foramen).

Like the number of root canals, the number of roots may also vary. An additional root at the mesiobuccal side is called the radix paramolaris (RP). The identification and external morphology of this root complex, containing a buccal supernumerary root, was described by Carlsen and Alexandersen[12]. The dimensions of the RP can vary from a 'mature' root with a root canal, to a short conical extension. This additional root can be separate or nonseparate. They described two different types: types A and B. Type A refers to an RP in which the cervical part is located on the mesial root complex; Type B refers to an RP in which the cervical part is located centrally, between the mesial and distal root complexes. The third case reported in this article is rare showing three independent canal orifices exiting in three separate apical foramina (Fig.3a,d) with Type A radix paramolaris.

Certainly, the limitation of the two-dimensional radiograph for the assessment of the three-dimensional root configuration of a tooth and the fact that at least two periapical radiographs taken from two

different horizontal angles are recommended for proper identification of three-rooted mandibular molars which held true for present case of radix paramolaris(Fig.3d).Apart from a radiographical diagnosis, clinical inspection of the tooth crown and analysis of the cervical morphology of the roots by means of periodontal probing can facilitate identification of an additional root.

Conclusion

Treating additional canal can be challenging, but the inability to find hidden root canals may cause failure. Good knowledge of the potential aberrant canal morphology in mandibular molar will help clinician to successfully recognize and treat these difficult cases The incidence of extra buccal root and canal variations are rare, every effort should be made to find and treat all canals for successful clinical results. Better illumination and magnification under microscope help in locating hidden canals.

References

1. 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.
2. Vertucci F,Williams.Root canal anatomy of the mandibular first molar. JNJ Dent Assoc. 1974;48:27–8.
3. Barker, BCW, Parsons, KC, Mills, PR, Williams, GL. Anatomy of root canals. III. Permanent Mandibular molars. Aust Dent J 1974;19:408–13.
4. Beatty R, Krell K. Mandibular molars with five canals: report of two cases. JADA;114:802–4.
5. Stroner W, Remeikis N, Carr G. Mandibular first molar with three distal canals. Oral Surg 1984;57:554–7.
6. Goel NK, Gill KS, Taneja JR (1991) Study of root canals configuration in mandibular first permanent molar. Journal of Indian Society of Pedodontics and Preventive Dentistry 8, 12–4.
7. Gulabivala K, Opasanon A, Ng YL, Alavi A (2002) Root and canal morphology of Thai mandibular molars. International Endodontic Journal 35, 56–62.
8. Sert S, Bayirli GS (2004) Evaluation of root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population. Journal of Endodontics 30, 391–8.
9. Ahmed HA, Abu-bakr NH, Yahia NA, Ibrahim YE (2007) Root and canal morphology ofpermanent mandibular molars in a Sudanese population. International Endodontic Journal 40,766–71.
10. Bolk L. Welcher Gebi_reihe gehören die Molaren an? Z Morphol Anthropol 1914;17:83–116.
11. Visser JB. Beitrag zur Kenntnis der menschlichen Zahnwurzelformen. Hilversum:Rotting 1948;49 –72.
12. Carlsen O, Alexandersen V. Radix paramolaris in permanent mandibular molars:identification and morphology. Scan J Dent Res 1991;99:189 –95.
13. Calberson, Roeland J. De Moor, andChristophe A. Deroose, The Radix Entomolaris and Paramolaris: Clinical Approach in Endodontics. JOE—Volume 33, Number 1, January 2007
14. Vertucci F. Root canal anatomy of the human permanent teeth.Oral Surg 1984;58:589-99.
15. Sidow SJ, West LA, Liewehr FR, Loushine RJ. Root canal morphology of human maxillary and mandibular third molars. JEndod 2000;26(11):675-8
16. Kottoor, R. Sudha & N. Velmurugan Middle distal canal of the mandibular first molar: a case report and literature review International Endodontic Journal, 43, 714–722, 2010