

IDENTIFICATION OF MIDDLE MESIAL CANAL OF MANDIBULAR FIRST MOLAR: CASE REPORT USING CONE-BEAM COMPUTED TOMOGRAPHY

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INTRODUCTION

Successful root canal treatment depends on adequate cleaning, shaping and filling of the root canal system.¹ Root canal is a complex system having aberrant canal configurations, accessory canals, lateral canals, fins, cul-de-sacs, deltas, bifurcations, isthmuses and anastomoses.² The complexity of the root canal system is the major challenge for an endodontist from both technical and microbiologic point of view. It is, therefore, considered important to have thorough knowledge of variations in tooth/canal anatomy which can aid in location and negotiation of canals as well as their subsequent management.³ For a successful treatment outcome, careful interpretation of angled radiographs, proper access preparation and a detailed exploration of the interior of the tooth are essential prerequisites.⁴ Song et al. (2004) reported that inability to locate the canals contribute 19.7% failure of root canal treated cases. These missed or untreated canals contain necrotic tissue and bacteria that contribute to the chronic symptoms and nonhealing periapical lesions.⁵

Mandibular first molar is the tooth with most varied morphology. It is the first permanent tooth to erupt in oral cavity, hence prone to caries and likely to require an early endodontic treatment.⁶ The usual canal distribution of mandibular first molar is two canals in the mesial root and one or two canals in the distal root. The prevalence of middle mesial canal in mandibular first molar has been reported to be 2.07 – 13.3%.⁷

The purpose of this article is to report the successful endodontic treatment of mandibular first molar with

five root canals (three mesial canals and two distal canals) using dental operating microscope and cone-beam computed tomography as adjunctive aids.

CASE REPORT

A 19-year old female patient was referred to the Department of Conservative Dentistry and Endodontics, with chief complaint of pain in right lower back region. The patient revealed the history of intermittent pain from last one month, which had increased in intensity from the past 5 days. Clinical examination revealed carious mandibular right first molar (46). Intraoral draining sinus was present on buccal vestibule in relation to tooth 46. The tooth was tender to percussion. Pre-operative radiograph revealed an occlusal carious lesion approaching the pulpal space, furcation and periapical radiolucency around the mesial root. Patient gave no response to heat and electric pulp testing. Diagnosis of pulpal necrosis with chronic apical periodontitis was established in relation to right mandibular first molar (46).

After local anesthesia, tooth was isolated under rubber dam. The access cavity was prepared with Endo Access bur and Endo Z bur (Dentsply, Tulsa, Tulsa, OK). Initially four canals were located, two mesials (mesiobuccal and mesio lingual) and two distals (distobuccal and distolingual). After viewing the chamber under operating microscope (Global Surgical corporation, St. Louis, Missouri), a groove was revealed which connected mesiobuccal and mesiolingual canal orifices. Then, careful exploration with an endodontic explorer (DG16; Hu-Friedy, Chicago, IL, USA) was done and an additional canal orifice was found. Coronal enlargement was performed with a nickel-titanium ProTaper SX rotary file (Dentsply Maillefer, Ballaigues, Switzerland) to improve the straight-line access. Root canals were explored with ISO #15 K-files. CBCT scanning was used to confirm and ascertain the unusual root canal morphology. All the root canals were dried and a sterile cotton pellet was placed in the pulp chamber and Cavit G (3M ESPE Dental Products, St Paul, MN) was used to seal the access cavity. A cone-beam computed tomography scan was done with an informed consent of the patient which revealed five canals (3 mesials and 2 distals) in right mandibular first molar.

Working lengths of the canals were obtained using electronic apex locator (IPEX, NSK Dental equipments, Japan) and confirmed radiographically (figure 1D).

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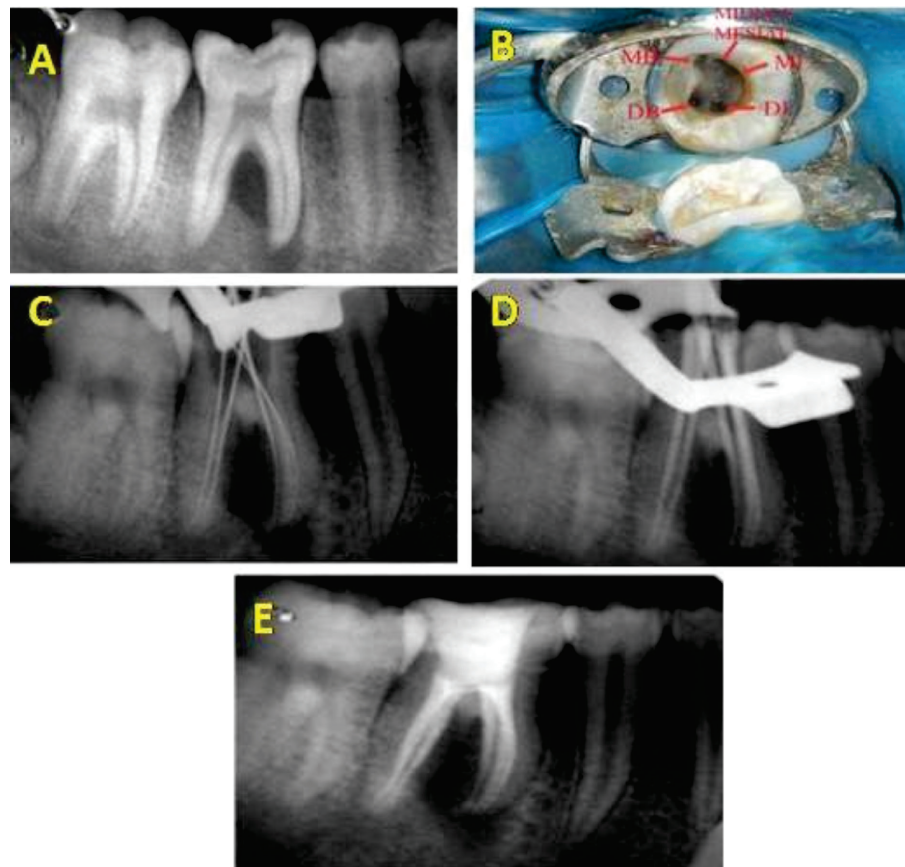


Fig 1 (a): Preoperative radiograph of tooth 46. (b) Access opening showing five canals. (c) Working length radiograph showing three mesial and two distal canals. (d) Master cone radiograph (e) Post-obturation radiograph.

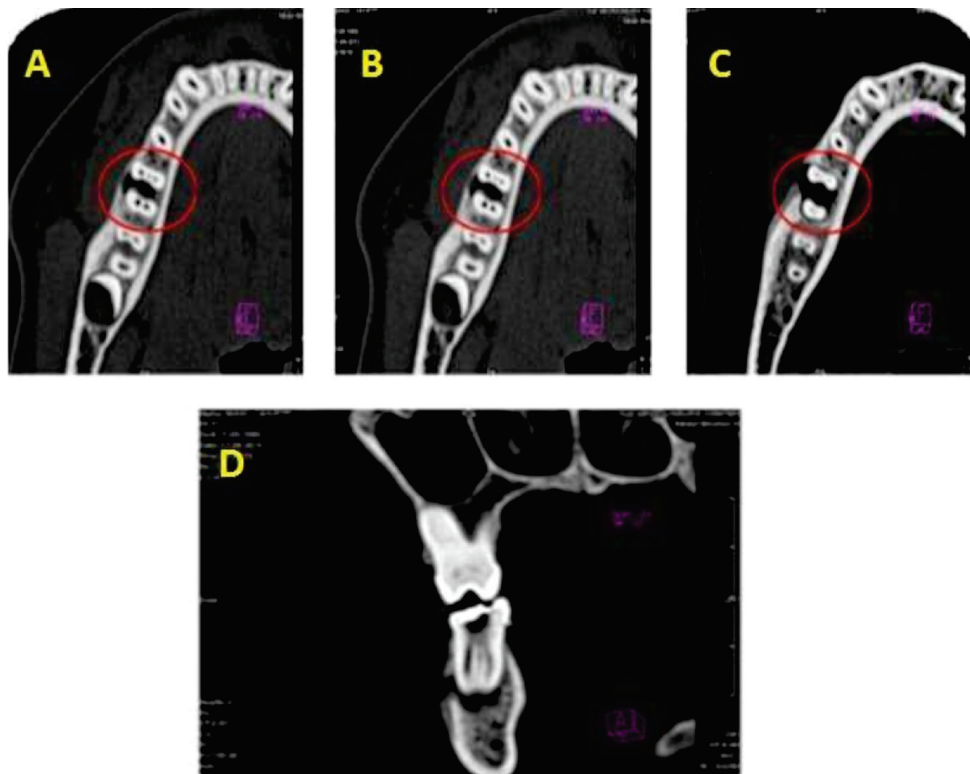


Fig 2 (a): Saggital section of CBCT image of mandibular arch showing three mesial and two distal canals in tooth 46 at coronal third (b) At middle third (c) At apical third (d) Vertical section of CBCT image of tooth 46.

Cleaning and shaping was performed using ProTaper nickel-titanium rotary instruments (Dentsply Maillefer) with a crown-down technique. During root canal preparation, irrigation was done using normal saline, 2.5% sodium hypochlorite solution and 17% EDTA. 2% chlorhexidine digluconate was used as a final irrigant and sonic agitation was done using Endoactivator (Dentsply, Tulsa, Tulsa, OK). After the canal preparation was done, absorbent points (Dentsply Maillefer) were used to dry the canals and obturation was performed using cold lateral compaction of gutta-percha (Dentsply Maillefer) and AH Plus resin sealer (Maillefer Dentsply, Konstanz, Germany). A final radiograph was taken to establish the quality of the obturation. After completion of root canal treatment, the tooth was restored with a posterior composite filling material (Z100; 3M ESPE Dental Products, St Paul, MN) and a post-operative radiographs were taken (figure 1E). The patient experienced no post-treatment discomfort and was subsequently referred for appropriate coronal restoration. Patient was instructed to recall for a follow-up after 6 months.

DISCUSSION

Identification and treatment of extra canals is the cornerstone to successful endodontic practice. A wide variation and complexity of root canal systems exist. So, an endodontist should know the morphology of the pulp chamber of the teeth he will treat. All root canals should be accessed, cleaned and shaped to receive a hermetic filling of the entire root canal space. Incomplete cleaning, shaping and obturation of any root canal will lead to almost certain root canal treatment failure.⁹

Weine (1969) divided the position of one or two canals within a root into four basic types.⁶ Vertucci (2005) described a much more detailed canal system and identified eight pulp space configurations.⁴ Recently, 14 new additional canal types were reported by Sert and Bayirli (2004) highlighting the complexity of root canal systems.¹⁰ Among these anatomic variances, multiple canals in the mesial root of mandibular molars have been reported in the literature as having an incidence of 2.07% up to 13.3% of the examined cases. The first evidence of an independent third mesial canal with its own access orifice and apical foramen was described by Vertucci and Williams (1974) and by Barker et al (1974).¹¹ Although many authors have agreed on the presence of three foramina in the mesial root, only a few have reported the presence of three independent canals, which presents itself as a rare anatomic variant.¹²

Radiographic examination using conventional intraoral periapical views is important for the evaluation of the canal configuration. However, it has its inherent limitation to assess the root canal system completely. Conventional multidetector computed tomography (CT) imaging has been widely used in medicine since the 1970s and was introduced in the endodontic field in 1990. Recently, cone beam CT (CBCT) imaging is capable of providing accurate, submillimeter-resolution images in formats allowing 3D visualization of the complexity of the maxillofacial region.¹³ CBCT acquires the data using single sweep of a cone-shaped x-ray source and reciprocal detector around the patient's head. The efficient use

of the radiation beam and the elimination of the need for a conventional image intensification system used in conventional computed tomography scanners result in a huge reduction in radiation exposure.¹⁴ Matherne et al suggested that CBCT imaging is useful even in identifying the root canal system.¹² In this case report, we confirmed the presence of three mesial

canals that were independent throughout their course in the root using CBCT imaging.

New technologies, such as the dental operating microscope and dental loupes should not be underestimated as they offer magnification and illumination of the operating field and substantially improve the visualization of root canal orifices.⁵ Additionally, use of micro-openers, properly designed access cavity, champagne bubble test, transillumination, use of piezoelectric ultrasonics, looking for the rules of symmetry, red line test, white line test and perio-probing are important tools for locating root canal orifices.¹⁵

CONCLUSION

Treating additional aberrant canals can be challenging, but the inability to find root canals may cause failures. The evaluation of CBCT images can result in better understanding of root canal anatomy, which enables the clinician to investigate the root canal system and to clean, shape, and obturate it more efficiently. But, CBCT should not be performed by dentists with inadequate training and experience.

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