



# Middle Mesial Canal: A Common Finding—A Report of Three Cases

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## ABSTRACT

**Aims and objectives:** To present clinical case report of three mandibular first molar with middle mesial canal of independent and confluent type.

**Case Report:** Three patients with chief complaint in mandibular first molars were referred for endodontic treatment. All the three mandibular first molar showed presence of middle mesial canal and, in one case, extra root was observed. 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. 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. 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:** Middle mesial canal, Mandibular first molar, Dental operating microscope.

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## INTRODUCTION

Endodontic success depends on adequate canal debridement and complete filling of the canal. Studies have shown that main reason for the failure of endodontic treatment in case of molars is the missed canals.<sup>1</sup> Canals are missed either due to lack of knowledge or failure to identify and skill to negotiate it. To have proper cleaning

and shaping of canals, every clinician should have thorough knowledge of root, and root canal anatomy is necessary. Mandibular first molar is found to have many anatomical variations, like multiple canals in both mesial and distal root, extra root as in radix entomolaris, radix paramolaris, C-shaped canal anatomy, etc.

Third canal in the mesial root of mandibular first molar is middle mesial (MM) canal similarly in distal root it is middle distal canal. Incidence of middle mesial canal is 1 to 15%.<sup>2</sup> Since Vertucci and Williams<sup>3</sup> first reported the presence of a MM canal in a mandibular molar, there have been multiple case reports of aberrant canal morphology in the mesial root.<sup>4,5</sup> In a clinical evaluation of 100 mandibular molars, Pomeranz et al<sup>6</sup> found that 12 molars had MM canals in their mesial roots and classified them into three morphologic categories as follows: fin, confluent and independent. According to their classification, an independent canal implies the canal originated as a separate orifice and terminated as a separate foramen, and only two cases were identified as independent. Goel et al<sup>2</sup> reported mandibular first molars had MM canals in 15.0% of specimens. Among these MM canals, only 6.7% of MM canals were independent.

This paper reviews the endodontic management of three cases, of a mandibular first molar with three mesial canals in the mesial root.

## CASE REPORTS

### Case 1

A 18-year-old female patient was referred to the department of endodontics with the chief complaint of intermittent pain in the lower right back teeth since last 4 to 5 months. Medical history was noncontributory. Clinical examination revealed a deep secondary caries in right mandibular first molar. The clinical and radiographic findings led to a diagnosis of chronic irreversible pulpitis of the right mandibular first molar, necessitating endodontic therapy. Radiographic evaluation of the involved tooth indicated a deep, carious lesion under temporary restoration approximating the pulp with apparently normal periapex (Fig. 1A). Under local anesthesia using 2% lignocaine with 1:80,000 adrenaline (Lignox, Indoco Remedies Ltd, India). An endodontic access cavity was established with rubber dam isolation. Investigation of

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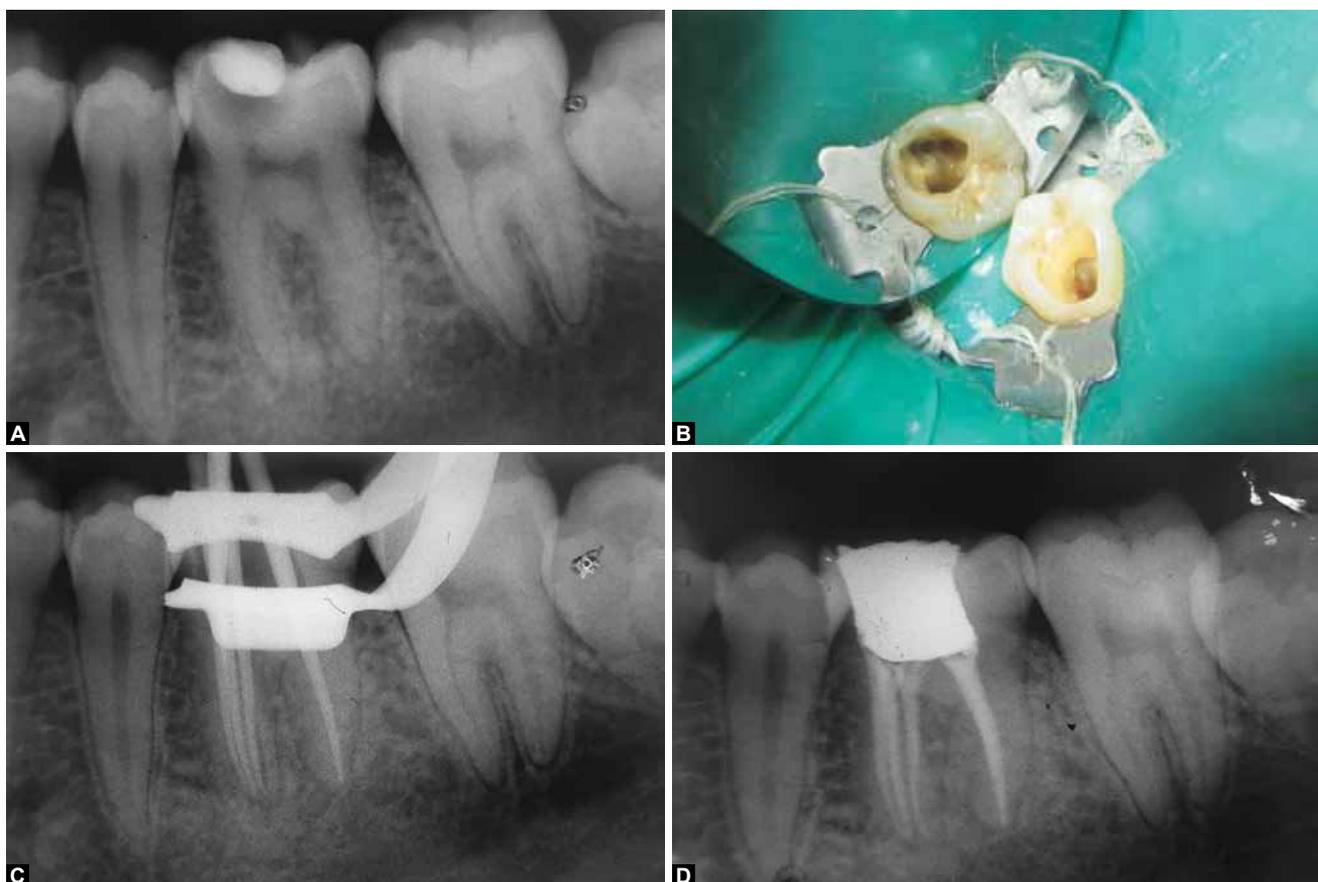


the root canal system was initially performed with the aid of an endodontic explorer, and the canals were explored with a no. 10 Kfile (Mani Inc, Tochigi, Japan), two canals mesially and single canal distally were located initially. Access cavity is observed under microscope (Seiler Precision Microscope) and presence of third mesial canal was detected in between the two mesial canals (mesiobuccal, middle mesial and mesiolingual) (Fig. 1B). The additional canal was explored with a no. 10 K-file (Mani Inc, Tochigi, Japan). Individual canal instrumentation was performed using a crown down preparation with ProTaper nickel-titanium (NiTi) rotary instruments (Maillefer, Dentsply, Ballaigues, Switzerland). Copious chemical irrigation was performed with 5.25% sodium hypochlorite solution and EDTA (Glyde, Maillefer, Dentsply, Ballaigues, Switzerland). The root canals were dried with paper points (Maillefer, Dentsply, Ballaigues, Switzerland).  $\text{Ca}(\text{OH})_2$  is placed as an intracanal medicament. Master cone radiograph was taken (Fig. 1C) Obturation was performed after 2 weeks with resin sealer (AH plus, Dentsply, DeTrey Konstanz, Germany) and cold lateral condensation of gutta-percha (Maillefer, Dentsply, Tulsa, OK) and access is sealed with permanent restoration. Postobturation radiograph revealed three distinct orifices

with three separate apical terminations of mesial canals (Fig. 1D). So, it was a case of independent middle mesial canal (Pomeranz's classification).

## Case 2

A 16-year-old male patient reported with spontaneous pain in lower left back tooth indicative of chronic irreversible pulpitis with left mandibular first molar. Radiographic examination showed deep carious lesion approaching pulp with apparently normal periapical tissue and extra distal root (Figs 2A and B). After anesthesia and rubber dam placement, access cavity was prepared. Totally five distinct orifices-3 located mesially (mesiobuccal, middle mesial and mesiolingual) and two distally (distobuccal and distolingual) was detected (Fig. 2C). The canals were explored with no. 10 K-file (Mani, Inc, Tochigi, Japan). The working length radiograph confirmed the presence of 5 distinct orifices and four apical terminations (Fig. 2D). Chemomechanical preparation was performed using the ProTaper NiTi rotary files and the root canals were obturated with cold, laterally condensed gutta-percha (Maillefer, Dentsply, Ballaigues, Switzerland) and resin sealer (AH plus sealer-Maillefer, Dentsply, Ballaigues, Switzerland) after confining



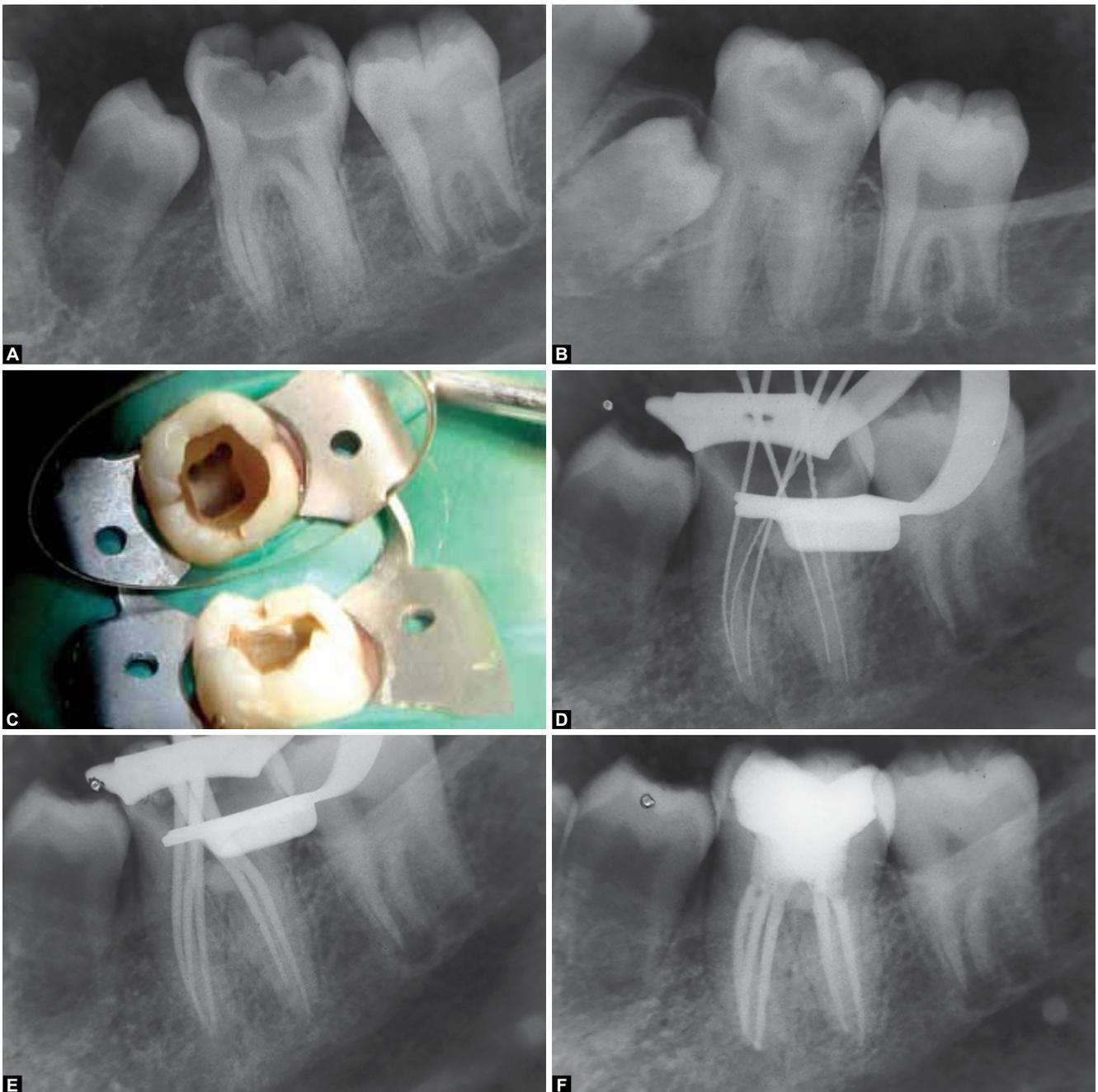
**Figs 1A to D:** (A) Preoperative intraoral periapical (IOPA) of 46 showing carious lesion approaching to pulp, (B) clinical photograph showing three canals in mesial root of right mandibular first molar, (C) master cone X-ray revealing independent type of middle mesial canal and (D) postobturation IOPA

with master cone radiograph (Fig. 2E). Postobturation radiograph revealed the presence of confluent middle mesial canal originated as a separate orifice but joined in the apical third of the mesiobuccal canal and an extra distal root suggesting radix endomolaris (Fig. 2F).

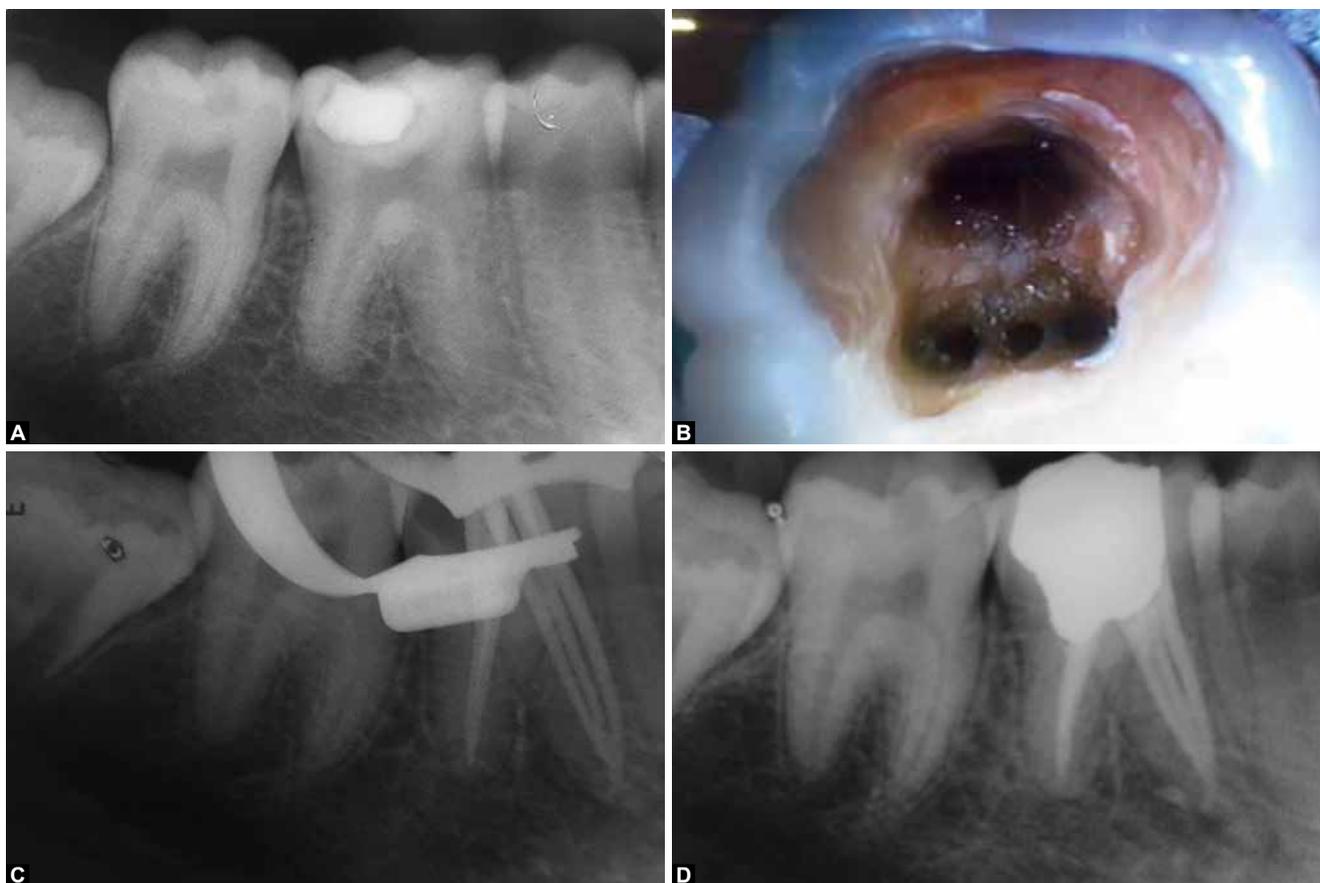
**Case 3**

A 14-year-old male patient reported with spontaneous pain in lower right back tooth. Endodontic treatment was planned due to irreversible pulpitis (Fig. 3A). After anesthesia and rubber dam placement, access cavity was prepared and pulp tissue was removed. Totally

four distinct orifices-3 located mesially (mesiobuccal, middle mesial, and mesiolingual) and one distally were detected on inspection using operating microscope (Fig. 3B). The working length radiograph confirmed the presence of four canals and mesial canals joined in the apical third to exit as one. Chemomechanical preparation was performed using rotary ProTaper files and obturated with cold, laterally condensed gutta-percha (Maillefer, Dentsply, Ballaigues, Switzerland) and resin sealer (AH plus, Maillefer, Dentsply, Ballaigues, Switzerland) (Fig. 3C). Postobturation radiograph revealed confluent middle mesial canal (Fig. 3D).



**2A to F:** (A and B) Preoperative IOPA showing carious lesion approaching to pulp and presence of additional distal root, (C) clinical photograph shows existence of five root canal orifices, (D) working length IOPA revealed five canals with three canals in mesial root, (E) master cone IOPA and (F) postobturation IOPA with confluent type of middle mesial canal



**Figs 3A to D:** (A) Preoperative IOPA, (B) access cavity as seen under microscope shows three orifices in mesial root of mandibular right first molar, (C) master cone IOPA and (D) confluent type of middle mesial canal as seen in postobturation IOPA

## DISCUSSION

Several studies report anatomical variation in the mandibular first molar including the presence of middle mesial canal in mesial root. Fabra<sup>7</sup> in his study on 760 mandibular molars reported that (2.6%) had three canals in the mesial root. Among those in (65%) cases, the third canal joined the mesiobuccal canal in the apical third of the root and, in (30%), they converged with the mesiolingual canal, also in the apical third; the third canal ended as an independent canal in only one case. Walker<sup>8</sup> cites three canals in the mesial root of the mandibular first molars as an infrequent occurrence. While a third canal in the mesial root of mandibular first molars may not be a very frequent discovery, a review of the literature indicates that its prevalence is 0 to 15%.<sup>9,10</sup>

Preoperative radiographic analysis is critical for endodontics. Multiple angled periapical views help to reveal the presence of roots and canal systems. However, these may be of little value in the identification of a mid mesial canal system in a mandibular molar. The use of ultrasonic tips with their abrasive coatings helps to remove dentin conservatively. The working end of these tips are 10 times smaller than the smallest round bur and consequently they can be introduced into the wall/floor angles of the pulp chamber to look for hidden systems.<sup>11</sup>

The use of such tips eliminates the bulky heads of conventional handpieces which often obstruct vision and allows this 'chasing' to be carried out under direct vision. Any instrumentation on the floor of the pulp chamber should only be carried out under direct vision because of the risk of perforation.

The classical 'white line' between the mesiobuccal and mesiolingual orifices should invite further exploration in this area. This area can be chased and subsequently explored with small hand files for a 'catch'. Illumination and magnification will play a huge role in the identification of this anatomical feature if present. It can be found anywhere in the pulp chamber wall/floor fold between the mesiobuccal canal and the mesiolingual canal orifices. The use of dental operating microscope provides enhanced lighting and visibility and identifies subtle color changes, better understanding of floor map, fine instrumentation, coaxial illumination and magnification.<sup>12,13</sup>

Pomeranz et al<sup>6</sup> classified middle mesial canal into three morphologic categories as fin, confluent and independent. According to their classification, an independent canal implies the canal originated as a separate orifice and terminated as a separate foramen and is usually rare. In present case series, case 1 has independent type of middle mesial canal, whereas in other two cases it is confluent.

The preparation of this accessory canal system should be done cautiously and conservatively. The geometry of the mesial root shows it to be hourglass shaped and so a preparation in the mid section of the root is automatically closer to the danger zone increasing the possibility of a perforation. Difficulties in cleaning and shaping the mesial root canal system during conventional root canal treatment can result in failure. The highly variable anatomy of mandibular molars indicates the need for careful examination of the root anatomy to find every pathway and its possible portal of exit in this complicated system.

Failure to recognise the anatomy of a root canal system and developmental anomalies might lead to inadequate debridement of the root canal system and thus contribute to unfavorable endodontic treatment outcome and the subsequent need for retreatment or surgical intervention.<sup>11</sup>

## CONCLUSION

The presence of the mid-mesial canal in the mesial root of the mandibular first molar is reported to have an incidence of one to 15%. This canal may be located anywhere between the mesiobuccal and mesiolingual orifices. The canal itself may be independent with a separate foramen or may join apically with either the mesiobuccal or mesiolingual canals. Canal preparation is a key factor in endodontic success. The clinician should be aware of the possibility of a mid-mesial canal and should explore for its presence rather than leave it to chance.

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