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ENDODONTIC MANAGEMENT OF MIDDLE MESIAL CANAL IN MANDIBULAR FIRST MOLAR: CASE SERIES

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ABSTRACT
The knowledge both of the conventional root canal anatomy and aberrant root canal anatomy is required to identify, clean and seal the root canals of the human teeth, especially mandibular molars which show significant variations when compared to other teeth. This case report discusses the identification and management of middle mesial canal in mandibular first molar.

INTRODUCTION:

The essential requirement for any endodontic therapy is to be aware about the minute details of the root canal anatomy. Root canal system is one of the most complicated structures in human. Identification, debridement and sealing all the portals of exit of the root canal system using three dimensional obturation is an essential for successful endodontic therapy.(1)
The mandibular molars are subjected to variations in their morphology and anatomy. The variation can be in terms if additional roots (distolingual and mesiobuccal roots), additional canals (middle mesial canal and mid distal canal) and peculiar shape (C-shape canal).(2–5)
The incidence of occurrence of an extra canal in mesial root of mandibular first molar ranges from 1-22.7%. The middle mesial canal is an accessory canal usually located between mesiobuccal and mesiolingual orifice, usually located close to the mesiobuccal orifice(6). Middle mesial canal has a shorter orifice in comparison to its counterparts. Middle Mesial Canal is classified into three types, namely: A fin, A confluent, and an independent type(7).

For visualization of the middle mesial canal, clinicians have to using various diagnostic aids which includes Cone beam computerized tomography, dental operating microscopes and magnification devices. Radiographically, SLOB rule can used to identify the canal using periapical radiographs(8).

CASE REPORTS

CASE 1

A 26-year-old male patient, was referred to our department for pain management in relation to left mandibular 1st molar tooth (FDI-36). The tooth was symptomatic, percussion test observed positive response. Preoperative radiograph revealed radiolucency involving enamel dentin and pulp in the coronal third of the tooth and periapical radiolucency suggestive symptomatic irreversible pulpitis with symptomatic apical periodontitis Pulp testing using electric pulp tester and cold test which showed delayed response when compared to contra lateral tooth (**FIGURE 1**). Local anesthesia (2% Lignocaine with 1:200000 adrenaline) was administer through inferior alveolar nerve block technique. Medium thickness rubber dam 6*6 Inch (Hygienic; Coltene Whaledent) was used in isolation of 36. Access cavity was reestablished using Endo Access Bur (Dentsply Sirona, UK) and modified using Endo Z bur (Dentsply Sirona, UK). Working length was determined by electronic apex locator (Woodpecter V) by placing five 15 size k files in the mesio-buccal, mesio-lingual, middle mesial, distobuccal and distolingual canal respectively. The working length measurements were confirmed with the help of digital radiographs. The mesial root canal system was confirmed to be Vertucci type VIII. Cleaning and shaping of the canals were done by crown down technique using ProTaper Gold rotary system (Dentsply Sirona, UK). 3ml of 3% NaOCl was used for irrigation during instrumentation. 3ml of 17% EDTA liquid was used as the final irrigant and washed with saline. calcium hydroxide was placed as intracanal medicament for 1 week. After 1 week, Master cone verification was done with radiographs and tug back was observed. The canals were dried with appropriate sized paper points. The canal was obturated with gutta percha using matched single cone technique along with AH plus sealer. Patient was recalled after one week and observed to be asymptomatic. Endo crown was prepared and cemented.

CASE 2

A 24-year-old male patient, was referred to our department for pain management in relation to right mandibular 1st molar tooth (FDI-36). The tooth was symptomatic, percussion test revealed positive response. Preoperative radiograph revealed radiolucency involving enamel dentin and pulp in the coronal third of the tooth and periapical radiolucency suggestive symptomatic irreversible pulpitis with symptomatic apical periodontitis Pulp testing using electric pulp tester and cold test which showed delayed response when compared to contra lateral tooth (**FIGURE 2**). Local anesthesia (2% Lignocaine with 1:200000 adrenaline) was administer through inferior alveolar nerve block technique. Medium thickness rubber dam 6*6 Inch (Hygienic; Coltene Whaledent) was used in isolation of 46. Access cavity was reestablished using Endo Access Bur (Dentsply Sirona, UK) and modified using Endo Z bur (Dentsply Sirona, UK). Working length was determined by electronic apex locator (Woodpecter V) by placing five 15 size k files in the mesio-buccal, mesio-lingual, middle mesial, distobuccal and distolingual canal respectively. The working length measurements were confirmed with the help of digital radiographs. The mesial root canal system was confirmed to be Vertucci type VIII. Cleaning and shaping of the canals were done by crown down technique using ProTaper Gold rotary system (Dentsply Sirona, UK). 3ml of 3% NaOCl was used for irrigation during instrumentation. 3ml of 17% EDTA liquid was used as the final irrigant and washed with saline. calcium hydroxide was placed as intracanal medicament for 1 week. After 1 week, Master cone verification was done with radiographs and tug back was observed. The canals were dried with appropriate sized paper points. The canal was obturated with gutta percha using matched single cone technique along with AH plus sealer. Patient was recalled after one week and observed to be asymptomatic. Endo crown was prepared and cemented.

CASE 3

A 23-year-old female patient, was referred to our department for pain management of mandibular right first molar (FDI-46). The tooth was symptomatic, tender on percussion was observed. Preoperative radiograph revealed radio-opacity in the coronal one third and root canals of the tooth suggestive of previously initiated root canal with periapical radiolucency suggestive of periapical abscess (**FIGURE 3**). Pulp testing using electric pulp tester and cold sprayed showed no response when compared to contra lateral tooth. CBCT was taken to visualize the root canal anatomy which revealed the middle mesial canal. Local anesthesia (2% Lignocaine with 1:200000 adrenaline) was administer through IANB technique on the 46. Medium thickness rubber dam 6*6 Inch (Hygienic; Coltene Whaledent) was used in isolation of 46. Access cavity was reestablished using Endo Access Bur (Dentsply Sirona, UK) and modified using Endo Z bur (Dentsply Sirona, UK). Gutta percha retrieval was done using retreatment files (Hyflex remover). Working length was determined by electronic apex locator (Woodpecter V) in the mesio-buccal, mesio-lingual, middle mesial, distobuccal and distolingual canal respectively. The working length measurements were confirmed with the help of

digital radiographs. Cleaning and shaping of the canals were done using ProTaper Gold rotary system (Dentsply Sirona, UK). 3ml of 3% NaOCl was used for irrigation during instrumentation. 3ml of 17% EDTA liquid was used as the final irrigant and washed with saline. calcium hydroxide was placed as intracanal medicament for 1 week. After 1 week, Master cone verification was done with radiographs and tug back was observed. The canals were dried with appropriate sized paper points. The canal was obturated with gutta percha using matched single cone technique along with AH plus sealer. Permanent entrance filling was done using hybrid composite restoration. Patient was recalled after one week and observed to be asymptomatic. Post endodontic restoration was completed.

DISSCUSION

Among the Indian population many authors have reported the presence of middle mesial canals in mandibular 1st and 2nd molars(2,6). Conventional radiographic techniques coupled with SLOB rule has helped clinicians visualize the root canal anatomy and execute a better action plan to clean and shape the root canal system. Many studies suggest the use of magnification along with ultrasonic in better identification of middle mesial canal. The middle mesial canal is predominately located deep into the isthumus (2mm) between mesiobuccal and mesiolingual canal. Use of ultrasonics tips to locate middle mesial canal is advised as they are less invasive and more predictable(9,10). The ultrasonics tips also allow a good vision when compared to conventional handpiece which is often bulky.
Based on the Pomeranz et al.'s classification, Middle Mesial Canal is classified into three types, namely: A fin, A confluent, and an independent type. 1 case report was an independent type will 2 and 3 were confluent type(2). Majority of the middle mesial canal joins with the lingual canal

TABLE 1: The prevalence of middle mesial canal in Indian population was observed

Serial no	author	year	Percentage
1.	Goel et al(6)	1990	22.7%
2	Shriya R Singi et al(11)	2023	5.7%
3	Girija S Sajjan et al(12)	2021	4.5%
4	Iqbal et al(13)	2022	21.8%
5	Sherwani et al(14)	2016	28.3%

Majority failure of root canal therapy is due to the presence of undetected canal or missed canals which leads to apical periodontitis. It be observed that 42% of the failure happens due to missed canals(15).
MMC was more prevalent in mandibular first molar when compared to mandibular second molar. While overall prevalence of MMC was higher on the left side compared to right side (13)
The two main processes by which accessory roots form are either breaking the Hertwig's epithelial root sheath (HERS) into two identical roots or folding the HERS to generate an independent root with a variety of physical characteristics. A number of theories have been put forward; however, the precise cause of accessory roots is still unknown. These include variations in ethnicity, a variety of illnesses and developmental abnormalities, genetics, local traumatic traumas, and outside pressure.(16,17)
Mortman et al observed that Middle mesial canal was not a separate canal but an instrumentation space of isthumus(18), while other authors observed it to be a separate canal formed by HERS. It is also reported that preparation of canal till 25/4 is identified to be appropriate as large taper preparations leads to canal transportation and instrument separation(19)
The use of advance diagnostic tools like CBCT and treatment tools like microscopes and magnification is required to examine the mandibular molars for additional canals(8). Failure to detect the additional canals leads to unsuccessful endodontic therapy. Knowledge of aberrant root canal morphology is necessary for all clinicians

CONCLUSION

Although mandibular molars mostly have 3-4 canal, the presence of mmc should be considered. As such, endodontists shall be aware of possible anatomical variations and make use of auxiliary resources when appropriate, such as CBCT, to ensure correct diagnosis and, consequently, successful root canal treatment. In addition, a careful endodontic exploration as well as radiographs from several different angles may lead to suspicion or identification of additional canals and is Certainly essential to give the highest possible chance for success.

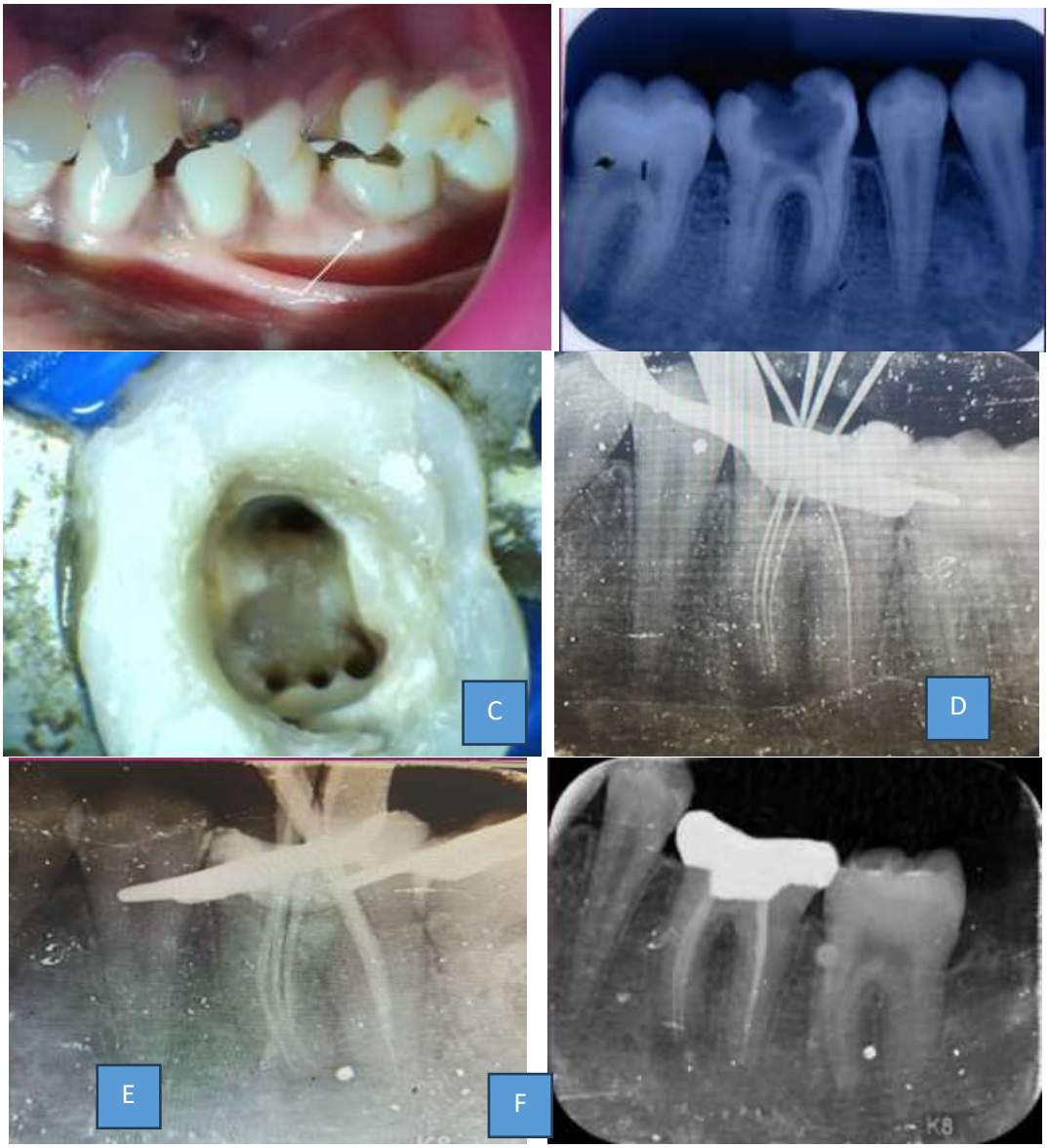

FIGURE 1: (A) Clinical Image (B) Preoperative Radiograph (C) Access Cavity (D) Working Length Radiograph (E) Master-cone Radiograph (F) Obturation Radiograph

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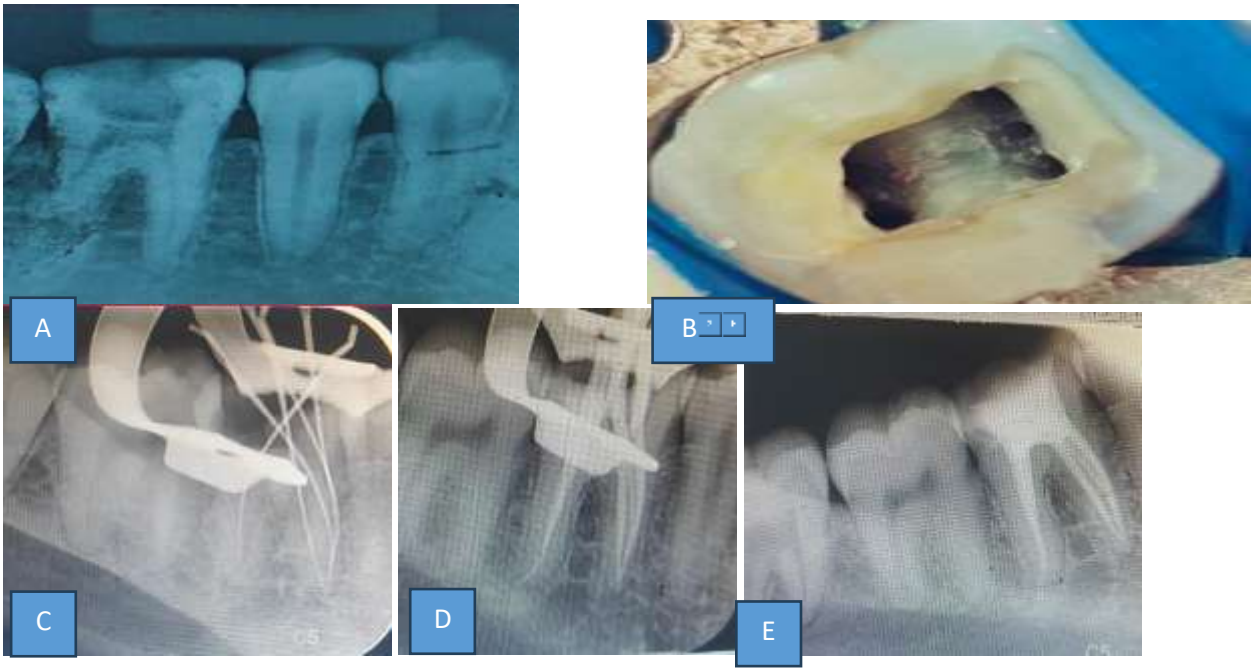

FIGURE 2: (A) Clinical Image (B) Access Cavity (C) Working Length Radiograph (D) Master-cone Radiograph (E) Obturation Radiograph

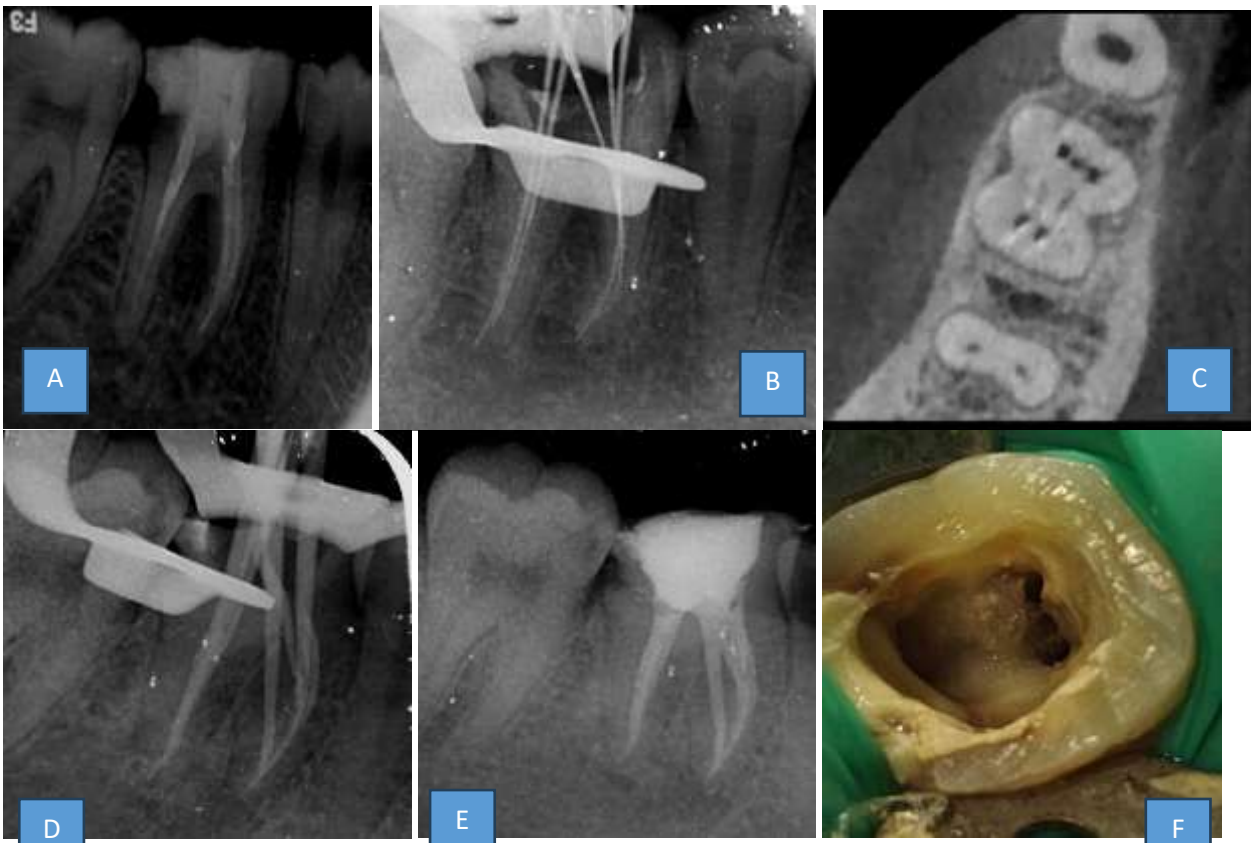

FIGURE 3: (A) Preoperative Radiograph (B) Working length and GP Retrieval Radiograph (C) CBCT (D) Master cone Radiograph (E) Obturation Radiograph (F) Access cavity Radiograph

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