



## CASE REPORT

# Variant Anatomy of Mandibular First Permanent Molar: A Case Series

<sup>1</sup>Pratima R Shenoj, <sup>2</sup>Rajesh Kubde, <sup>3</sup>Gautam P Badole, <sup>4</sup>Pooja Singare

## ABSTRACT

The advent of new dental imaging techniques and equipments, dental operating microscopes and loupes in endodontics have proved to be a boon for clinicians today. One of the causes of endodontic failure is missed canals. These technologies have greatly improved the ability to detect the presence of extra canals and thus seem to improve the success rate of endodontic treatment and the prognosis of endodontically treated tooth. The present article is a case series describing the endodontic management of two mandibular first permanent molars, one having two roots with six canals and other with three roots and five canals.

**Keywords:** Cone beam computed tomography, Dental operating microscopes, Five root canals, Middle distal canal, Middle mesial canal.

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## CASE REPORTS

### Case 1

A 20-year-old male patient reported to the department of conservative dentistry and endodontics with chief complaint of pain in his lower left back region. The medical history was noncontributory. Thorough clinical examination revealed deep mesial caries with 36 with pain on vertical percussion. Pain associated was continuous in nature and aggravated on biting. Radiographic examination revealed deeply carious 36 with two roots showing pulpal involvement and periapical widening (Fig. 1A). After a clinical and radiographic finding final diagnosis of chronic irreversible pulpitis with symptomatic apical periodontitis was made, endodontic treatment was planned for the involved tooth.

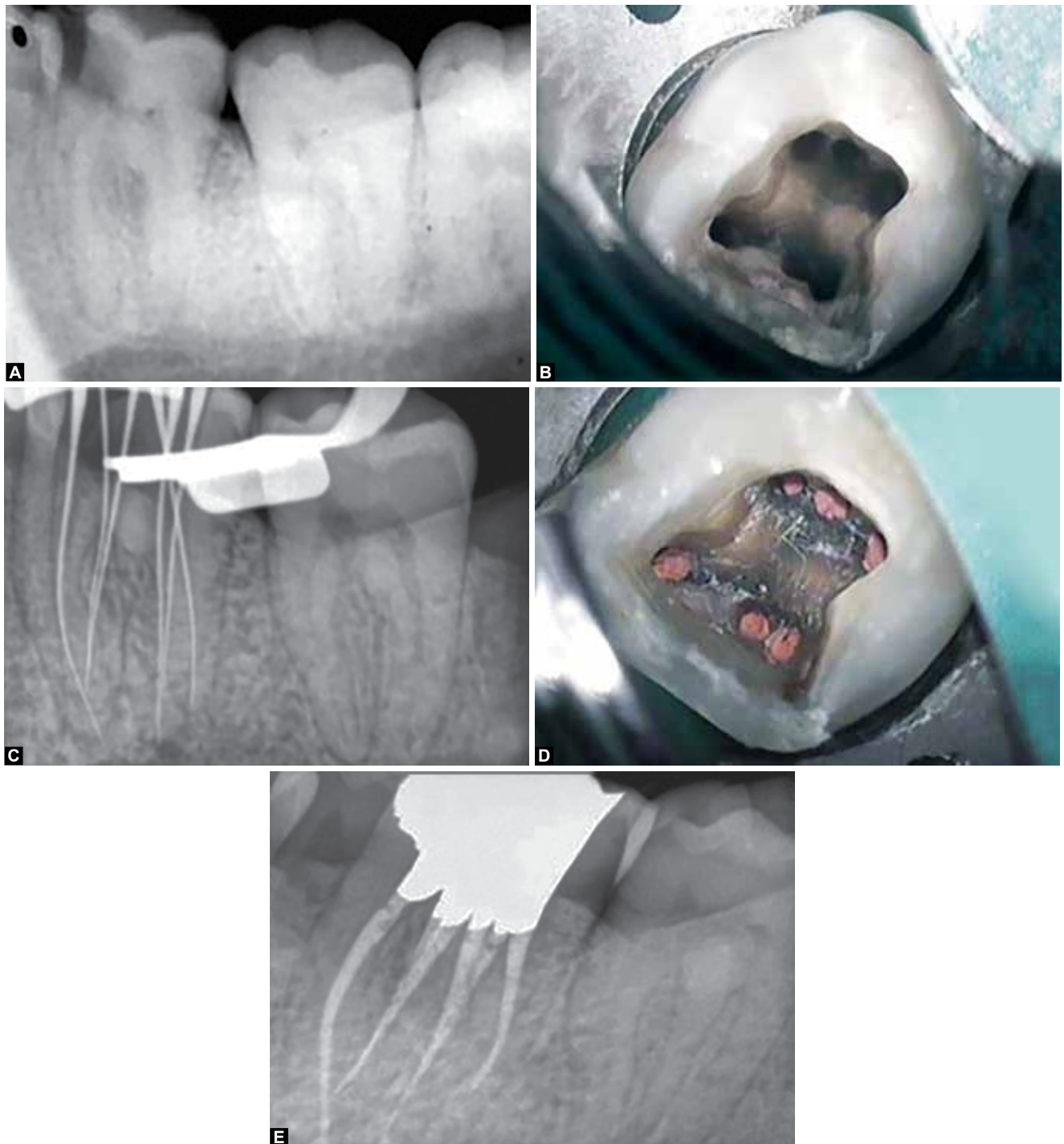
Following local anesthesia with 2% lignocaine having 1:2,00,000 epinephrine (Neon Laboratories, Mumbai, India), endodontic access cavity was made under rubber dam isolation using endoaccess bur no.1 (Mani, Tochi GI, Japan). The carious coronal pulp was removed and the chamber irrigated with 3% sodium hypochlorite (Vishal Dentocare Pvt Ltd, Gujarat, India). On examination with DG-16 endodontic explorer (Hu-Friedy, Chicago, IL, USA), the floor of the pulp chamber showed 4 canals (two on mesial side and two distally). On careful inspection, under endomicroscope, middle mesial and middle distal canals were located between the previously identified two mesial and two distal canals. The middle mesial canal was closely associated with mesiobuccal orifice while middle distal orifice was located centrally between the two distal ones. The orifices were then enlarged with Gates Glidden Drills (Mani, Tochi GI, Japan) till GG no. 3 (Fig. 1B).

Patency of the canals was established with the help of 15 no. K-file (Mani, Tochi GI, Japan). Working length was determined using apex locator (Propex II, Dentsply, Maillefer) and confirmed with radiograph (Fig. 1C). The diagnostic radiograph demonstrated the presence of six canals, four of which presented separately (two mesial and two distal) and two remaining canals seemed to merge into one in the middle third of the root (Fig. 1C). All the canals were biomechanically prepared in a crown down manner using rotary ProTaper files (Dentsply, Maillefer, Switzerland) upto size F2 except the middle distal and middle mesial canals which were prepared till F1. Irrigation in between the instrumentation was performed using 2.5% sodium hypochlorite (Prime Dental Products, Thane, India), normal saline, 17% EDTA (Pulpdent Corporation, Watertown, MA), and 2% chlorhexidine gluconate (Endo-CHX; Prime Dental Product, Mumbai, India). The canals were dried with paper points (Dentsply Tulsa, OK, USA) and an intracanal dressing of calcium hydroxide paste (Calicur, VOCO, Germany). In the next appointment, 1 week later, the tooth was asymptomatic. The calcium hydroxide was removed and final irrigation was performed with 2% chlorhexidine. All the canals were dried with paper points (Dentsply Tulsa, USA) and obturated using AH Plus sealer (Dentsply, Tulsa, USA) and gutta-percha cones (Dentsply, Switzerland) corresponding to the last file used (Fig. 1D).

<sup>1</sup>Professor, <sup>2</sup>Associate Professor, <sup>3</sup>Reader  
<sup>4</sup>Postgraduate Student

<sup>1-4</sup>Department of Conservative Dentistry and Endodontics, VSPM Dental College and Research Centre, Nagpur, Maharashtra, India

**Corresponding Author:** Gautam P Badole, Reader, Department of Conservative Dentistry and Endodontics, VSPM Dental College and Research Centre, Nagpur, Maharashtra, India, Phone: 09665410655, e-mail: badole\_g15@yahoo.co.in



**Figs 1A to E:** (A) Preoperative radiograph of 36, (B) endoscopic image of 36 showing 6 canal orifices, (C) working length radiograph of 36 showing six canals, (D) endoscopic image of 36 showing obturated 6 canals and (E) postobturation radiograph of 36

Postobturation radiograph was taken which showed distinct four canals at the apex and remaining merged in the middle third of the root (Fig. 1E). Postobturation restoration was done with silver amalgam. The patient was kept on follow-up and he reported no postoperative sequelae.

**Case 2**

A 19-year-old female patient reported to the department of Conservative Dentistry and Endodontics with chief complaint of pain in her lower right back region.

On clinical examination, deep occlusal caries could be seen with 46 with pain present on vertical percussion. Pain was continuous in nature and aggravated on biting. Radiographic examination revealed deep caries with pulpal involvement. On keen observation, distinct supplemental distal root was identified on radiograph (Fig. 2A). After a clinical and radiographic finding final diagnosis of chronic irreversible pulpitis with symptomatic apical periodontitis was made with 46, endodontic treatment was scheduled for the involved tooth.

Following local anesthesia with 2% lignocaine having 1:2,00,000 epinephrine (Neon Laboratories, Mumbai, India), endodontic access cavity was made under rubber dam isolation using endoaccess bur no. 1 (Mani, Tochi GI, Japan). On examination with DG-16 endodontic explorer (Hu-Friedy, Chicago, IL, USA), the floor of the pulp chamber showed four canals (two on mesial side and two distally). On careful inspection under endomicroscope, a third canal was located between the previously identified two distal canals and the orifices were then enlarged with Gates Glidden Drills (Mani, Tochi GI, Japan) till GG no. 3.

Working length was determined using apex locator (Propex II, Dentsply, Maillefer) and confirmed radiographically. The working length radiograph demonstrated the presence of five canals, three of which presented separately, (two mesial and one distal) and the remaining two distal canals seemed to merge into one in the apical third of the root (Fig. 2B).

All the canals were biomechanically prepared in a crown down manner using rotary ProTaper files (Dentsply, Maillefer, Switzerland) upto size F2, except middle distal which was prepared till F1. In the next visit, 1 week later, all the five canals were obturated with AH

Plus sealer (Dentsply, Tulsa, USA) and gutta-percha cones (Dentsply, Switzerland) corresponding to the last file used. Postobturation radiograph and cone beam computed tomography (CBCT) was taken to confirm the pattern of obturated canals (Figs 2C and D). Post-obturation restoration was done with silver amalgam. The patient was kept on follow-up and she reported no postoperative sequelae.

## DISCUSSION

Many a times, dental clinicians have the perception of a definite number of roots/or canals in a given tooth. However, reviews of literature have shown documentation on deviations from the normal tooth morphology and canal anatomy. Therefore, when the root canal treatment is to be performed, the clinician should be aware of the variations in the root canal morphology.

Majority of the mandibular molars have two roots: mesial and distal and their usual distribution is two canals in the mesial roots and one or two in the distal root. Martinez and Badanelli (1985)<sup>1</sup> reported the case of mandibular first molar with six canals while Reeh (1998)<sup>2</sup> reported mandibular first molar with seven



**Figs 2A to D:** (A) Preoperative radiograph of 46 showing supplemental distal root, (B) working length radiograph of 46 showing five canals, (C) postobturation radiograph of 46, (D) CBCT image showing five canals

canals. The third mesial and distal canal is defined as being independent when a distinct coronal orifice and apical foramen are observed, or confluent when converging into one of the other two main canals and terminating at a common apical foramen.<sup>2</sup> It has been postulated that dentin is partially deposited along the length of the root leading to formation of three canals that converge in either two foramina or one foramen.<sup>1</sup>

A major variant of mandibular first molar is the presence of an additional third root; a supernumerary root which can be found distolingually. This macrostructure, which is first mentioned in the literature by Carabelli (1844) is called radix entomolaris (RE).<sup>3</sup> In European populations it has been reported that a separate RE is present in the mandibular first molar with a maximum frequency of 3.4 to 4.2%.<sup>4-6</sup> In Eurasian and Indian populations the frequency is less than 5%.<sup>7</sup> The dimensions of RE can vary from a short conical extension to a mature root with normal length and root canal. The distolingual root may be separate from or partially fused with the other roots.<sup>8</sup>

Baugh and Wallace (2004) in a review of literature reported that the incidence of middle mesial canal in mandibular first molar is 1 to 15%.<sup>9</sup> But the presence of three canals in distal root of the mandibular first molar is a rare occurrence. Skidmore and Bjorndal (1971)<sup>5</sup> reported that 88.8% of distal roots of mandibular first molar have only one canal while 28.9% have two canals. Review of literature shows only few studies reporting the incidence of three distal canals in mandibular first molar. From the reports of various studies, one can see that the incidence of three distal canals in mandibular first molar is reported to be 0.2 to 3%.<sup>10-17</sup> This case series describes the endodontic management of two mandibular first molars in patients of Indian origin, one having two roots with six canals and other with three roots and five canals.

In case 1, the middle mesial and middle distal canals were found confluent with their respective mesiobuccal/distobuccal canals at the middle of the root showing Vertucci type II configuration. In case 2, as far as mesial root was concerned, the two mesial canals were classified as independent since they originated as separate orifices and terminated as separate foramina. In distobuccal root, the two canals were termed as confluent as they originated as two different orifices but apically joined each other. In distolingual root, one canal was found from orifice to apex.

Fabra-Campos<sup>18</sup> in his case report suggested that the intermediate canal should not be enlarged as much as the main canal because of the danger of perforation. Hence, in both the present cases, biomechanical preparation of the intermediate canals was carried upto only F1. Walker and Quackenbush (1985)<sup>19</sup> reported that the extra root occurred unilaterally in about 40% cases, predominantly

on right side. In case 2 also, morphological variation occurred in distal root canal of right mandibular first molar. Pattanshetti et al<sup>20</sup> did a study comparing the distribution of number of types of canals according to age groups. He came to a conclusion that as age progresses, the frequency of finding extra canals in distal root of mandibular first molar goes down. It can be explained by the fact that as age advances, the tooth is exposed to various insults, such as caries, attrition leading to calcification of orifices or the calcification of canal itself.<sup>21</sup>

Diagnostic aids such as CBCT, Dentscan, multiple preoperative radiographs, examination of the pulp chamber floor with a sharp explorer, troughing of the grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, performing the sodium hypochlorite 'champagne bubble test,' and visualizing canal bleeding points are all important aids in locating the root canal orifices.<sup>22</sup> Not only these, dental operating microscopes and loupes also have greatly aided in locating extra canals.

## CONCLUSION

The increasing frequency of studies reporting the anatomical variations in mandibular first molar has alerted the clinicians to more carefully inspect the floor of the pulp chamber to locate the possible accessory canal orifices. It is mandatory that the clinician should possess thorough knowledge of not only the normal anatomy but also of the aberrations too. The recently introduced diagnostic instruments and armamentaria in endodontics along with clinician's knowledge can prove to be of great help in improving the treatment outcome and overall prognosis of the tooth.

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