



ENDODONTIC MANAGEMENT OF SIX CANALS IN MANDIBULAR FIRST MOLAR : A CASE REPORT.

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ABSTRACT

This case report presented here shows the endodontic treatment of an uncommon case of mandibular first molar with six canals. Even though such a finding is clinically uncommon but numerous case studies have been reported. Therefore, a thorough knowledge of the anatomy of root canal systems, the variations, correct assessment of the pulp chamber floor, use of operating microscope, taking proper radiographs plays a major role in management of such cases.

KEYWORDS : Mandibular first molar, six canals, operating microscope, endodontic therapy.

INTRODUCTION

Mandibular molars commonly require endodontic therapy in dentistry. The mandibular molar has mesial root that commonly has a mesiolingual and mesiobuccal canal, while the distal root commonly has a single root canal. A narrow connection is present between mesial and distal canals that has pulp tissue, which is called the isthmus. This area of isthmus is responsible for anatomical variations like middle canals.¹

Barker et al.¹ and Williams and Vertucci² were the initial researchers that demonstrated an extra and independent canal in the mandibular molar's mesial root. Badanelli and Martinez-Berna³ found an extra canal in the distal root of mandibular molars. After that, many researchers have reported independent extra canals in the mandibular molars that are commonly called as intermediate canals,⁴ mesio-central canals,⁵ third mesial canal,⁶ accessory mesial canals⁷ and middle mesial canals.^{8,9}

Management of extra canals is important, because missing them may cause failure. Mandibular first molars having six roots are rare, but these cases can be carefully evaluated both radiographically and clinically, for identifying any anatomical anomaly. Uptil now, the occurrence in mandibular molar having greater than two canals has been mentioned in few case reports.

The prevalence percentage of middle mesial canal (MMC) in the mandibular molar is 1%–15%.¹⁰⁻¹⁴ Ahmed et al.¹⁵ and Kottoor et al.¹⁶ reported an occurrence of three canals in distal and mesial roots to be 3% and 4%. The prevalence of configuration types in middle canals in lower molar in discussed in Table 1.

Intraoral periapical radiograph is necessary for the assessment of the canal number and morphology although it has its inherent limitation. However, precise inspection of root canal configuration may be evaluated by discrete diagnostic methodologies such as magnifying loupes, dental microscope and auxiliary diagnostic aids like CBCT may be employed.

Table 1: Prevalence of configuration types in the middle canal

AUTHOR	YEAR	MMC (%)	INDEPENDENT (%)	FIN (%)	CONFLU ENT (%)
Sherwani et al ¹⁷	2016	28.3	2.7	21.9	75.3
Nosrat et al ¹⁸	2015	20	20	33.3	46.7
Mukhaimer et al ¹⁹	2014	3.1	0	0	3.1
Karapinar-Kazadang et al ⁷	2010	20	-	-	0
Chen et al ²⁰	2009	6	6	-	-
Shahi et al ²¹	2008	0.95	-	-	0.95
Peiris et al ²²	2007	4.52	1.2	-	3.3
Villegas et al ²³	2004	5	5	-	-
Gulabivala et al ²⁴	2002	6.7	0.7	-	6
Goel et al ²⁵	1991	15	6.6	-	8.3
Fabra - Campos et al ⁴	1989	2.6	0.1	-	2
Vertucci and Williams ²	1974	1	1	-	-
Barker et al ¹	1969	1	1	-	-

CASE REPORT

A 15-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, Inderprastha Dental College and Hospital, with the chief complaint of pain in the

posterior left mandibular region for the past two weeks.

The medical history of patient was noncontributory. On clinical examination, a carious mandibular first left molar (36) with severe pain on percussion was unveiled. The preoperative radiograph of 36 (Figure 1) showed deep occlusal radiolucency reaching pulp. The radiograph also showed Periodontal ligament space widening. The provisional diagnosis of chronic irreversible pulpitis, requiring endodontic treatment was made.

Inferior alveolar nerve block was administered using 2% Lignocaine with 1:80,000 epinephrine which was followed by isolating the concerned tooth using rubber dam. After excavation of all carious tissue, the preparation of access cavity was made by an endo access bur (Dentsply, Maillefer, Switzerland) (Figure 2).

Root canals were repeatedly flushed with 2% sodium hypochlorite (Sigma-Aldrich Corporation, Bangalore, India) for removing necrotic pulp tissue and microorganisms. After which, the root canals were carefully inspected that revealed four canal orifices (mesiobuccal, mesiolingual, distobuccal and distolingual) initially.

However, on thorough observation under microscope with 5X magnification and exploration using endodontic explorer (DG 16, Hu Friedy, Chicago, IL) at the floor of the pulp chamber, revealed an additional canal orifice located between mesiobuccal and mesiolingual canals (Figure 3). On doing further inspection with the help of DG 16 explorer on the distal aspect of the pulp chamber, an extra canal orifice was revealed in close proximity to distolingual canal. Therefore, in total six canal orifices were found with three orifices in each root. The additional canals were called middle mesial and middle distal in the mesial and distal roots respectively.

Patency of the canals were ascertained using a 10 K-file (Dentsply, Maillefer, Switzerland). The pulp tissue was removed and the working length of all six canals was measured using apex locator and was confirmed using intraoral periapical radiograph (figure 4). The canal orifices were widened with Protaper Universal Shaping files S1 and SX (Dentsply, Maillefer, Switzerland), and later chemo-mechanical preparation was carried out using Protaper Universal Rotary files (Dentsply, Maillefer, Switzerland) till F1 in a crown down manner.

The irrigation protocol was followed using 5mL of 2.5% sodium hypochlorite solution (Chemdent, Vensons India) and 17% EDTA (Glyde File Prep, Dentsply, Maillefer, Switzerland) alternatively. Between the use of each irrigating solution, saline was used for preventing an acid/base reaction between EDTA and sodium hypochlorite, for having a greater efficient action of the chemicals on the tissues.

The F1 protaper master cones (Dentsply, Maillefer, Switzerland) were selected by tug back and radiographic confirmation (Figure 5). After drying the canals with absorbent points, the canals were obturated using gutta-percha cones and Sealapex sealer (Sybron endo, Kerr Dental) using single cone obturation technique. A radiograph was taken to confirm the obturation (Figure 6) and the access cavity was sealed with a Glass Ionomer Cement.

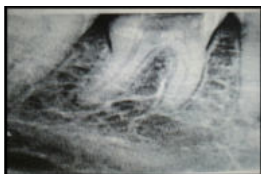


Figure 1 : Preoperative Radiograph



Figure 2 : Access Cavity



Figure 3 : Access Cavity Under Operating Microscope (5x Magnification)

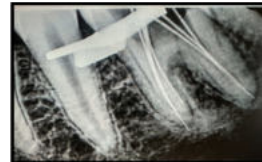


Figure 4 : Working Length



Figure 5 : Master Cone

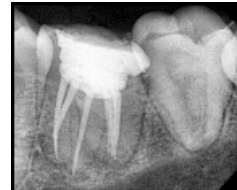


Figure 6 : Obturation

DISCUSSION

The mandibular first molar is one of the first permanent tooth to erupt and is generally described as a group of teeth with two roots, mesial, and distal root. It is the most prevalent tooth to undergo restoration and root canal treatment. The occurrence of two canals in the mesial root and one in the distal root of mandibular molars is 65 % and the percentage of two canals in the distal root is 30 % .²⁵ The incidence of MMC has been reported to vary between 1 % and 15 % and that of middle distal canal in mandibular first molar to vary between 0.2 % and 3 % .²⁶

Pomeranz et al.⁸ classified MMCs into three types (Figure 7).

According to the author,

- (i) canal can run independently from the orifice to the apex (independent) (Figure 7a),
- (ii) an isthmus may be present between the MMC/MDC and the MB or ML canal during any stage of its course from the orifice to the apex (fin) (Figure 7b),
- (iii) canal can join the MB or ML canals before exiting from the apex (confluent) (Figure 7c and d).

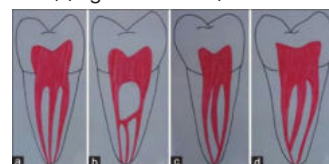


Figure 7: Pomeranz et al., medial mesial canal classification showing independent configuration (a), fin configuration (b), confluent configuration to mesiobuccal canal (c) and to mesiolingual canal (d)

Some research articles report the third canal to be located equidistant to both the main canals, while others report it to be closer to one of the main canals. Sherwani et al.¹⁷ observed that, in 67% of cases from an Indian population, the MMC orifice was located in the middle of the MB and ML orifice and 20% had the orifice closer to the ML canal, while the remaining 12% had the orifices located closer to the MB canal. In contrast, Karapinar-Kazandag et al.⁷ reported a higher number of canals closer to either the ML or the MB canal in their study which employed magnifying loupes.

Nosrat et al.,¹⁸ reported that the Middle Mesial Canal was located in close proximity to the Mesiolingual canal in major cases, which was followed by, in the middle of the Mesio Buccal and Mesiolingual canals. De Toubes et al.,²⁷ in his study, identified that majority of the MMC was in close proximity to the MB (46%) than to the ML (31%) canal, whereas 23% were located at the center.

There are many case reports showing variations in the location of the middle mesial canal orifice. Deepalakshmi et al.²⁸ reported four cases of MMC in mandibular first molar where middle mesial canal was located at equidistance between the two mesial canals. De Moor RJ et al.,²⁹ demonstrated two cases of MMC, where one was located equidistant from the two main canals of left mandibular first molar and the other was located close to the MB canal of right mandibular first molar.

Middle canals have been reported in Asians, Europeans, North and South Americans and Africans. Nosrat et al.¹⁸ and Versiani et al.³⁰ found differences in the incidence of MMC between White (12.2%) and non-White (29.4%) patients and Brazilian and Turkish populations, respectively.

Sherwani et al.¹⁷ observed that MMC is more commonly found in mandibular first molars which have two distal canals (45.4%) than in those with one distal canal (13.7%). However, Nosrat et al.¹⁸ does not found any significant association between Middle Mesial Canal and the presence of distinct distal canals.

Many case reports have reported that three or more canals are more likely to be present in younger patients. The underlying reason maybe that roots with age undergo different stages of development. The eruption time of mandibular first molar is 6–7 years whereas, apical closure is completed at 8–9 years. The completion of canal differentiation starts at 3–6 years after root completion. It is seen that ages from 12 to 20 years had mixed patterns of canal morphology, hence these periods are referred as transition period for canal differentiation.

Hess³¹ suggested that differentiation of the root canals occur due to deposition of secondary dentine within the root canal at the apical, cervical and middle thirds in the mesiodistal direction that results in root canal separation. Therefore, when the tooth has one mesial canal in the mandibular molar, it maybe due to incomplete differentiation of root canals.

Although several anatomical variations of mandibular first molars are reported in the literature, but they are not commonly documented by many dentists clinically. In the present case report, there was easy location of the 6 canals by following the anatomy of the floor of pulp chamber and through the application of basic techniques and concepts. The extra canals in mandibular molars are commonly hidden by a dentinal projection that is light in color in comparison to the floor of pulp chamber. Thus, judicious interpretation of radiographs, accurate access cavity preparation and a thorough pulp chamber exploration under magnification, are the basic prerequisites for a favourable endodontic treatment outcome.

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