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RESEARCH ARTICLE

PREVALENCE OF MIDDLE MESIAL CANALS IN MANDIBULAR FIRST MOLARS IN PATIENTS VISITING A DENTAL INSTITUTE IN EASTERN INDIA

[1]Dr. Mukesh Kumar, [2]Dr. Rishav Singh and *,[3]Dr. Sankalp Verma

[1]Department of Conservative Dentistry & Endodontics, Dr B.R. Ambedkar Institute of Dental Sciences & Hospital, Patna
[2]Department of Pediatric & Preventive Dentistry, Hazaribag College of Dental sciences & hospital, Hazaribag, Jharkhand, India
[3]Department of oral Medicine and Radiology, Bhabha College of Dental Sciences, Bhopal, India

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ABSTRACT

Aim: to determine the frequency of middle mesial (MM) canals in mandibular first molars in Eastern Indian population.
Materials and methods: All mature mandibular first molars endodontically treated between March 2014 and March 2016were included in the study. After instrumenting the main canals, the clinician inspected the mesial developmental groove and, if found, was negotiated, cleaned, shaped, and recorded.
Results: A total of 200 first molars were treated during the specified period, of which 27% had negotiable MM canals. The frequency of MM canals was 37% in patients 11–30 years old, 33.3% in patients 31–50 years old, and 29.6%in patients >50 years. Statistical analysis revealed a significant relationship of different age groups with the incidence of MM canals ($P < 0.05$). A significant relationship was also found between the detection rate of two canals in distal root and the presence of MM canals ($P < 0.05$) with gender having no influence.
Conclusion: The presence of MM canals is quite high in Eastern Indian population. Younger patients had a higher incidence of MM canals. Mandibular first molars with two separate distal canals showed a tendency to have MM canals.

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INTRODUCTION

The main goal of endodontic therapy is to prevent or heal apical periodontitis. From a biomechanical perspective this means cleaning, shaping, and disinfection that would allow for three-dimensional obturation of the root canal system (Schilder, 1967; Schilder, 1974). However, the complexity of the root canal anatomy presents clinical challenges and difficulties that often jeopardize the primary goal of such therapy (Hess, 1921; Peters, 2004). Knowledge of both normal and abnormal anatomy dictates the parameters of root canal therapy and can directly affect the probability of success (Segura-Egea *et al*., 2002). The mandibular first molar typically presents with 2 well-defined roots, a mesial root characterized by a flattened mesiodistal surface and widened buccolingual surface, and a distal root mostly straight with a wide oval canal or 2 round canals (Skidmore and Bjorndal, 1971). Two roots with two canals in mesial root and one to two canals in distal root is a common occurrence. (Vertucci, 1984) Nevertheless, the incidence of variation is quite high including seven to eight canals separate distolingual and mesiobuccal (MB) roots, C-shaped canals, isthmus, and an additional third canal in the mesial root. (Reeh, 1998; Arora *et al*., 2015) The middle mesial (MM) canal, an occasional entity, lies in the developmental groove between the MB and mesiolingual (ML) canals. (Goel *et al*., 1991) Since its first reporting by Vertucci and Williams (1974) as well as Barker *et al*. (1974) in 1974, the MM canal has been extensively studied. Its incidence has been reported to be 0–46%. (Skidmore and Bjorndal, 1971; Azim *et al*., 2015; Nosrat *et al*., 2015; deToubes *et al*., 2012; Karapinar-Kazandag *et al*., 2010) Pomeranz *et al*. (1981) classified MM canals into three categories.

Corresponding author: Dr. Sankalp Verma,
Department of oral medicine and radiology, Bhabha College of Dental Sciences, Bhopal, India.

- **Fin:** The file passes freely between the main mesial canal (ML or MB) and the MM canal (transverse anastomosis)
- **Confluent:** The MM canal merges with the main mesial canals in the apical third
- **Independent:** The MM canal originates as a separate orifice and ends with a separate apical foramen.

MATERIALS AND METHODS

The study was conducted in Department of Conservative Dentistry and Endodontics, name of college over a 2-year period ranging from March 2014 to March 2016. A total of 200 mature mandibular first molars were included in this study. After local anesthesia access cavities were prepared and the mesial and distal canals located. Glide path was established with stainless steel K-files #8, #10, #15 (Dentsply) and coronal halves prepared using rotary nickel-titanium (Ni-Ti) instruments (Protaper Universal). The developmental groove between the main mesial canals was troughed 1–2 mm by ultrasonic tips (Start X™, Dentsply) away from the furcation in the mesio-apical direction. After troughing, a DG 16 endodontic explorer was carefully moved over the groove. If the explorer detected a catch at any point in the groove, exploration and negotiation of that point was done with #6, #8, and #10 K files. Working length (WL) was established and confirmed with periapical radiographs. Biomechanical preparation of the root canals was performed up to the established WL. Irrigation was done with 6% sodium hypochlorite and 17% ethylenediaminetetraacetic acid (Glyde, Dentsply) between each file size. The canals were then dried with paper points, and the master cone periapical radiographs were taken from mesial angulation. Obturation was done with guttapercha (GP) and AH Plus sealer. Final radiographs were taken after teeth were permanently restored. The incidence of MM canals, their course and location with respect to main mesial canals were recorded and categorized using the Pomeranz classification. (Arora *et al*., 2015)

RESULTS

Of the 258 molars treated, 54 (27%) had negotiable MM canals. The incidence of MM canals based on age, gender, and number of distal canals is shown in Table 1. There was a significant decrease in the incidence of MM canals with an increase in age. Patients in the younger age group (11–30 years) had a significantly higher percentage of MM canals (37%) compared to those in middle age (30–50 years) and older age groups (>50 years), respectively ($P < 0.05$). The distribution of MM canals based on gender was found to be non-significant ($P > 0.05$). Two distal canals were present in 74% (148/200) of teeth with an MM canal.

Among the teeth without MM canals, only 34% (68/200) had two distal canals. A significant relationship was found between the occurrence of MM canals and presence of two distal canals ($P < 0.05$). Of the 54 located MM canals,75.3% showed confluent anatomy merging with either the MB or ML canals, 21.9% showed fin anatomy and only 2% showed independent MM canals with separate orifices and apical foramen.

DISCUSSION

Meticulous cleaning, shaping and filling of the root canal system are requsites for a successful root canal treatment. Unfortunately, canal preparation is adversely influenced by the highly complex, intricate and variable root-canal anatomy and the relative inability of the operator to visualize this anatomy from radiographs. Hence, root canal preparation is not only important but also demanding for the clinician. Since its first mention in literature in 1974 the incidence of MM canal has been reported by various authors in both in vivo and in vitro studies (Reeh, 1998; Arora *et al*., 2015; Goel *et al*., 1991; Vertucci and Williams, 1974; Barker *et al*., 1974; Skidmore and Bjorndal, 1971; Azim *et al*., 2015; Nosrat *et al*., 2015). 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). Mortman and Ahn (2003) suggested that the third mesial canal is not an accessory or extra canal rather sequelae of instrumenting the isthmus between MB and ML canals. However, these accessory canals when negotiated, cleaned, and shaped can constitute a pathway into the otherwise inaccessible isthmus providing access for removal of bacterial biofilms and necrotic tissue. This might reduce the number of failures of non-surgical root canal therapy in mandibular molars. Age of the patients appeared to be a determining factor influencing the incidence of MM canals. The incidence rate in our study decreased with an increase in age. The results are in agreement with the previous studies reporting the impact of age on MM canals (Arora *et al*., 2015; Goel *et al*., 1991; Vertucci and Williams, 1974; Barker *et al*., 1974; Skidmore and Bjorndal, 1971; Azim *et al*., 2015; Nosrat *et al*., 2015). In our study, the most common configuration was confluent anatomy followed by fin anatomy while only four cases showed independent anatomy. These findings are consistent with those of previous studies (Azim *et al*., 2015; Nosrat *et al*., 2015; Karapinar-Kazandag *et al*., 2010).

Conclusion

The high frequency of MM canals reported in this study is an alarm for clinicians to ensure high success rates in endodontic treatments of mandibular first molars.

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Supplementary file

Table showing the prevalence of middle mesial canal in mandibular first molar

MM canals	Age			Gender		Distal canal	
Present	11-30	31-50	>50	M	F	One	Two
	20	18	16	18	09	14	40
	(37%)	(33.3%)	(29.6%)	(64.2%)	(34.6%)	(26%)	(74%)

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