

Frequency of Middle Mesial Canals in Mandibular First Molar in Malabar (North Kerala) Population without Advanced Aids – An *In Vivo* Study

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ABSTRACT

Introduction: This study was undertaken in department of conservative and endodontics, KMCT dental college, Kozhikode, within the span of 2 years ranging from June 2017 to June 2019. Total of 227 teeth were evaluated from 220 patients. All the teeth evaluated were mature mandibular permanent first molars referred for endodontic therapy to the department.

Purpose: The presence of middle mesial (MM) canals is quite high in North Kerala population. Missing these canal space would potentially lead to failure of root canal treatment.

Methods: All the mature mandibular first molars treated between June 2017 and June 2019 were considered for the study. Mesial developmental groove was inspected and explored in every case to detect accessory canal. If cases were that having MM canal was found, it was cleaned, shaped, and recorded. Results were analyzed using Chi-square test.

Results: A total of 227 first molars from 220 patients were treated during the specified period, of which 78 teeth (34.36%) had negotiable MM canals. Statistical analysis revealed no significant relationship between different age groups with incidence of MM canals but gender had slight influence, wherein female patients had more.

Conclusion: The presence of MM canals is quite high in North Kerala population.

Key words: Accessory canal, Mandibular molar, Middle mesial canal, Root canals

INTRODUCTION

A successful endodontic treatment depends on complete debridement of pulp space and creating a fluid tight seal. Favorable environment for healing should be created, which is free of microbes and necrotic tissue. However, this is not always possible in teeth with unusual canal morphologies. They are probably more prone to treatment failures due to insufficient knowledge of canal anatomy and aberrations associated with it.

Mandibular first molars normally have two roots and three to four canals (two mesial and one-two distal).^[1] The incidence of variation is quite high, including seven to eight canals, C-shaped canals, isthmus, and an additional third canal in the mesial root.^[2,3]

The middle mesial (MM) canal used to be an occasional entity, which lies in the developmental groove between the mesiobuccal (MB) and mesiolingual (ML) canals. Since its first reporting by Vertucci and Williams as well as Barker *et al.* in 1974, the MM canal has been extensively studied. Its incidence has been reported to be 0–46%.^[4]

Pomeranz *et al.* classified MM canals into three categories – (1) Fin: The file passes freely between the main mesial canal (ML or MB) and the MM canal (transverse anastomosis), (2) confluent: The MM canal merges with the main mesial canals in the apical third, and (3) independent: The MM

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canal originates as a separate orifice and ends with a separate apical foramen.^[5]

Radiographic examination using conventional intraoral periapical views is important for the evaluation of the canal configuration. However, it has its inherent limitation to assess the root canal system completely. Advanced technology like cone beam computed tomography (CBCT) and magnification with the aid of ultrasonic troughing would be of great help in finding extra canals. Dentists worldwide often do not have access to these tools like CBCT^[6] and unfortunately majority of practitioners in North Kerala would not be an exception. Hence, our aim was to estimate the incidence of MM canals in conventional practice without advanced tools and also to show the importance of knowledge about extra canals and tactile sense in locating orifices.

Ours is the first *in vivo* study from North Kerala that was aimed primarily to record the incidence of MM canals in patients who underwent endodontic treatment at a Dental School in North Kerala. The secondary aim was to evaluate the relationship of age, gender, location of orifice, and type of canal with the detection rate of MM canals in mandibular first molars.

MATERIALS AND METHODS

This study was undertaken in department of conservative and endodontics, KMCT dental college, Kozhikode, within the span of 2 years ranging from June 2017 to June 2019. Total of 227 teeth were evaluated from 220 patients. All the teeth evaluated were mature mandibular permanent first molars referred for endodontic therapy to the department. Mean age of the patients was 28 years. Proposal of the study was submitted to ethical committee and approval was obtained. A written consent was taken from patients before starting the treatment.

After administering anesthesia teeth were isolated with rubber dam and access cavities were prepared. Access cavities inspected and explored using endodontic probe.

Mesial and distal canals were located. Initial glide path was created using stainless K file #10 (mani, inc, Japan). Canals were prepared using rotary nickel-titanium instruments (Edge Endo, Albuquerque, New Mexico). In retreatment cases, previous root canal filling were removed using protaper retreatment files (Dentsply Maillefer, Ballaigues, Switzerland) and Endosolv E (Septodont, Delaware, USA).

The pulp chamber floor was then carefully examined, during visual inspection looked for additional bleeding points between orifices, difference in color, and pulp tissue strangled at isthmus. DG 16 endodontic explorer was carefully moved over these suspected areas to see for a catch, [Figure 1] exploration, and negotiation of that point was done with #10 K files. Working length was established with woodpex gold III – electronic apex locator (Guillin Woodpecker medical instrument co ltd. China)

Root canals were prepared in crown down fashion. Irrigants used were saline, 5.25% sodium hypochlorite/2% chlorhexidine (retreatment cases) throughout the procedure. Canals were dried using paper points and master cone periapical radiograph was taken using distal angulation. Obturation was done using gutta-percha and zical sealer using cold lateral compaction. Final radiographs were taken after access cavities were restored.

The incidence of MM canals, their course, and location with respect to main mesial canals was recorded and categorized using the Pomeranz classification. [Figure 2] The distributions of MM canals with respect to age and gender were also noted. The data were analyzed using Chi-square test. Statistical analysis was performed using SPSS (Version 20; IBM Corp., Armonk, NY) and $P < 0.05$ was considered as statistically significant.

RESULTS

Out of 227 molars treated, 78 (34.36%) had negotiable MM canals. Mean age of the treated patients, male – 28.97 with standard deviation 12.27 and female – 28.45 with standard



Figure 1: (a-c) Exploring mesial groove in search of middle mesial canal

deviation 11.75. There was no significant difference in the incidence of MM canals with an increase in age.

The distribution of MM canals based on gender was found to be statistically non-significant ($P > 0.05$). However, MM canals slightly more common among female patients (41% male and out of 78 MM canals).

Most common type of MM canals found was type II 64.1% (50/78), where canals were confluent with either of the mesial canals [Figure 2b] following Type I, where it was a fin rather than actual canal 32% (25/78) [Figure 2a] and the least found type was Type III a separate canal with a separate portal of exit 3.8% (3/78) [Figure 2c].

Most common location of MM canal orifice was in the center between the main mesial canals 60.2% (47/78) of the cases [Figure 3a], following toward the MB canal in 25.6% (20/78) of the cases [Figure 3b] and least was closer to or in close proximity to ML canal in 14.1% (11/78) of the cases [Figure 3c].

Association between location of orifice and canal type was found to be statistically significant ($< 0.001\%$).

Type I canals had orifice location most commonly in proximity to MB orifice (60%) following in center (28%) and least toward ML canal(12%).

Type II canals had orifice location most commonly in the center (80%) following in proximity to MB orifice (16%) and least toward ML orifice (4%).

About Type III canals, it was interesting to find that orifice location was 100% only in the center between MB and ML canal orifice.

DISCUSSION

A successful endodontic treatment can be attributed to removal of bacterial biofilms in root canal ramifications such as fins, deltas, loops, accessory canals, and isthmuses^[7]

The isthmuses of mandibular first molars are classified into five types

Type I is two separate canals,

Type II is two separate canals connected by an isthmus,

Type III is three canals connected by an isthmus,

Type IV is two elongated canals that join in the center, and

Type V is a single, very broad, and elongated canal.^[8]

The MM canal or accessory mesial canal lies in the subpulpal groove or the isthmus connecting the main mesial canals. Since its first mention in the literature in 1974, the incidence of MM canal has been reported by various authors in both *in vivo* and *in vitro* studies.^[9,10,11] These studies can be further classified into those done with and without magnification.

Detection of accessory canals can be increased evidently using advanced tools like microscope/loupes and ultrasonics. A recent *in vivo* study reported the highest ever occurrence of MM canals (46.2%).^[9] In our study, advanced tools were not used as stated that aim of the study was to check incidence rate in conventional treatment without



Figure 2: Types, a) Type 1, b) Type 2, and c) Type 3

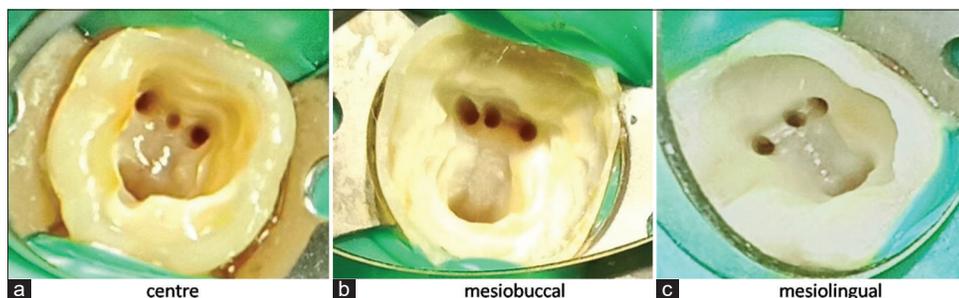


Figure 3: (a-c) Recording location middle mesial orifice in relation to mesial canal orifice

advanced aids. We aimed at dental practice which is done in majority of the place. Dentists worldwide often do not have access to these tools like CBCT.^[6]

Few authors argue that third mesial canal is not an accessory canal but sequelae of instrumenting isthmus between MB and ML canals. However, these accessory canals when negotiated and cleaned will definitely increase the chance of cleaning the otherwise inaccessible isthmus. There by increase the success rate of non-surgical root canal therapy.^[10]

Troughing the mesial pulpal groove in a mesioapical direction away from the furcation is a significant factor in detection and negotiation of MM canals. Troughing the groove up to 2 mm has resulted in increased detection rates and subsequent negotiation of MM canals. A recent *in vivo* study has demonstrated that 39.6% more MM canals were detected and explored after controlled troughing to within 2 mm depth using a 1 mm diameter round bur head as a depth guide. However, it requires clear visibility, specialized instruments, and care to avoid perforation and its potential complications.^[9]

One of the clinically significant factors in detecting orifice was age of the patient in previous studies.^[5,9,12,13] The incidence rate decreased with an increase in age. However, in contrast, our study did not find any significant influence with age of the patient in finding the orifice. However, definitely younger patients had larger MM canals which were easier to negotiate.

We also noted the location of orifice in relation MB and ML canal orifice. It MM canal orifice was most commonly located in the middle of the MB and ML orifices (60.2%) followed by orifice located closer to the MB canal (25.6), while remaining 14.1% had orifices toward ML canals. These findings are not in consistent with those of previous studies which reported that the MM canal was located closer to the ML canal in majority of the cases followed by the MM orifice located in the middle of MB and ML canals, while the least number of cases showed the orifice closer to the MB canal^[9] Our results are partly in agreement with another study, they found that MM orifice is most commonly located in the middle followed by closer to ML canal and least near MB canal.^[13,14]

Most common type of canal configuration found in our study was confluent type (TYPE 2) – 64.1% followed by Fin (TYPE 1) – 32% and rarely found – only 3 cases were separate canal (TYPE 3) – 3.8%. These findings are in consistent with those of previous studies.^[9,13,14]

CONCLUSION

Within limitations of study, we found that the presence of MM canals is quite high in North Kerala population. Missing these canal space would potentially lead to failure of root canal treatment.

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