

Prevalence of Middle Mesial Canal in Permanent Mandibular Second Molar Based on Clinical and Radiological Evaluation

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ABSTRACT

Background: The success of any endodontic treatment depends upon several factors such as knowledge of internal and external anatomy of root canals, knowledge about the instrumentation, thorough cleaning, shaping, obturation and post endodontic restoration. Even though C-shaped canals are more common in mandibular second molar, cases of middle mesial canal in mandibular second molar have also been reported. **Methods:** In this in-vivo study 100 patients who reported for root canal treatment were included. Patient's age and sex were recorded. After access cavity preparation, a standardized technique is performed between mesiobuccal canal and mesio lingual canal to search for a middle mesial canal by using dental operating microscope and confirmed radiologically by taking Cone Beam Computed Tomographic image and results were analyzed. **Results:** In our study out of 100 patients included 50 patients were males and 50 patients were females. Based on gender, prevalence of middle mesial canal in tooth number 37 and 47 is 8 % (4 patients) and 8 % (4 patients) for females and for males it is 10 % (5 patients) and 9 % (5 patients). Based on age group, prevalence of middle mesial canal in tooth number 37 and 47 between age 18-30 is 15 % (11 patients) and 14 % (10 patients), between age 31- 60 is 10 % (2 patients) and 12 % (3 patients) and age above 60 is 0 % (0 patient) and 0 % (0 patients) respectively. **Conclusion:** From this study we concluded that prevalence of middle mesial canal in mandibular second molar can be as high as 10% and the age group between 15-30 years had the highest prevalence.

Keywords: Middle mesial canal, Mandibular second molar, CBCT, Dental operating microscope.

INTRODUCTION

The success of any endodontic treatment depends upon several factors such as knowledge of internal and external anatomy of root canals, knowledge about the instrumentation, thorough cleaning, shaping, obturation and post endodontic restoration. One of the causes of failure in endodontic treatment is that clinician is unable to remove all the pulp tissue and clean the root canal system completely.^[1]

A strong relationship exists between the existence of an untreated canal space and apical periodontitis.^[2] Even though C-shaped canals are more common in mandibular second molar, cases of middle mesial canal in mandibular second molar also had been reported. Traditionally, mandibular second molars are described as 2-rooted teeth with 2 canals in the mesial root and 1 or 2 canals in the distal root.^[3,4] However variation from these have been reported in various studies.^[3,4] The presence

of independent middle mesial canal was first reported by Vertucci and Williams^[5] and Barker et al in 1974.^[4] According to Pomeranzet al,^[6] middle mesial canal can be classified into 3 categories like fin, confluent, independent. Fin is when an instrument can pass freely between the mesiobuccal and mesio lingual canal. Confluent is when the middle mesial canal originates as a separate orifice but apically joins with mesiobuccal or mesio lingual canal. Independent is when the middle mesial canal originates as a separate orifice and terminates as a separate foramen. Few clinical studies have investigated the incidence of middle mesial canal in mandibular molar.^[6-10] However middle mesial canals are more common in mandibular first molars and have rarely been reported in mandibular second molars.^[6,10]

The difference in the prevalence of middle mesial canals between the studies might be due to the investigation methods and the studied population. Thus, the complex anatomy of the mesial roots of mandibular molars has to be properly addressed if not may lead to missed canal and harbor reservoirs of micro-organisms.^[11] Effective managements of a middle mesial canal requires a complete understanding of its complex anatomy and relationship with other root canal space configurations. Hence the purpose of this study is

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to evaluate the prevalence of middle mesial canal in mandibular second molar clinically and radiographically using CBCT.

MATERIALS AND METHODS

This prospective study was conducted in the dental clinics present at Chennai for patients who reported for root canal treatment procedure. Inclusion criteria includes patients above the age of 18 years with permanent mandibular second molar indicated for root canal treatment either for caries or fractures involving pulp. Intentional RCT for prosthodontics reasons were also included. Exclusion criteria includes teeth with open apices, resorption, endo-perio lesions, calcifications and developmental anomalies. The patients who met the inclusion criteria were given local anesthesia and rubber dam isolation was done. After achieving the subjective and objective symptoms of local anesthesia, access cavity was prepared. The main canals including mesiobuccal, mesio lingual and distal canal were located and pulp was extirpated using size #8, #10 K-file, broaches and biomechanical preparation was done with rotary instruments in sequence, complete irrigation was done with normal saline and then canals were visualized with dental operating microscope to check for the existence of middle mesial canal. CBCT was taken to confirm the presence of middle mesial canal. The results were statistically analyzed and discussed.

RESULTS

In our study out of 100 patients included 50 patients were males and 50 patients were females. Based on gender, prevalence of middle mesial canal in tooth number 37 and 47 is 8 % (4 patients) and 8 % (4 patients) for females and for males it is 10 % (5 patients) and 9 % (5 patients).

Table 1: Cross tabulation between the gender and prevalence of middle mesial canal.

| Gender | No of patients | Prevalence of middle mesial canal | |
|--------|----------------|-----------------------------------|---------------------|
| | | Tooth Number 37 (%) | Tooth Number 47 (%) |
| Female | 50 | 8 % | 8 % |
| Male | 50 | 10 % | 9 % |

Table 2: Cross Tabulation between the Age and Prevalance of Middle Mesial Canal.

| Age (Yerars) | No of patients | Prevalence of middle mesial canal | |
|--------------|----------------|-----------------------------------|---------------------|
| | | Tooth Number 37 (%) | Tooth Number 47 (%) |
| 18-30 | 70 | 15 % | 14 % |
| 31-60 | 22 | 10 % | 12% |
| Above 60 | 8 | 0 % | 0 % |

In our study out of 100 patients based on age group, prevalence of middle mesial canal in tooth number 37 and 47 between age 18-30 is 15 % (11

patients) and 14 % (10 patients), between age 31-60 is 10 % (2 patients) and 12 % (3 patients) and age above 60 is 0 % (0 patient) and 0 % (0 patient).

DISCUSSION

One of the most common reason for the failure of endodontic treatment is missed canals. For the mesial root system of mandibular second molars, besides mesiobuccal (MB) and mesio lingual (ML) canal, occasionally there is an accessory mesial canal. Studies have evaluated the distribution pattern of the third canals in mandibular molars - 45% located closer to mesio lingual canals, 30% located in the middle between the mesio lingual and mesiobuccal canals (mesial middle canals) and 25% located closer to the mesiobuccal canals.^[11,9] Recent research has shown that the prevalence of middle mesial canals was 8% in mandibular second molars.

Clinical methods to analyse the root canal morphology including radiographic interpretation and visual inspection (with magnification) are used during endodontic treatment. Studies have reported that 7.52% of the orifices were deeper than 2 mm so they could not be revealed via troughing.^[12] Separation, curvature and fusion are more likely to occur to this location, so as a clinician, we should not only memorize the common anatomical configurations, but also identify the unusual ones. The detection and biomechanical cleaning of this kind of area during root canal treatment are critical.^[13] Every attempt should be made to find all canals to ensure successful endodontic treatment. Hence, some auxiliary tools in procedures may be necessary. It was demonstrated that the root canal orifices were more accurately detected under a dental operating microscope (DOM) than that with naked eye and the surgical loupes^[10,14] and increased the detection rate to 93%, even if canal anatomy was complicated.^[14]

The prevalence of middle mesial canal in mandibular molar ranges from approximately 0.95% to 46.2% Azim et al and Karapinar-Kazandag et al suggested that the use of a dental operating microscope can improve the recognition and negotiation of accessory canals.^[9,15,16]

Two-dimensional image of conventional periapical radiograph has limitations such as distortion and the superimposition of dental structures,^[17] which could eventually lead to missed canal and consequently failure of treatment. Cone-beam computed tomography (CBCT) has a distinct advantage in that it is a clinical radiographic technique that provides three-dimensional information of the root canal morphology, thus minimizing the possibility of missed canal. Also, cone beam CT (CBCT) imaging has been shown to provide comparable images at reduced dose and costs to be considered as an alternative to multi

detector CT imaging in endodontics.^[18] Cotton et al,^[19] reported a number of useful applications of CBCT imaging in endodontics.

In our study out of 100 patients included 50 patients were males and 50 patients were females. Based on gender, prevalence of middle mesial canal in tooth number 37 and 47 is 8 % (4 patients) and 8 % (4 patients) for females and for males it is 10 % (5 patients) and 9 % (5 patients). Thus the prevalence of middle mesial canal in mandibular second molar was higher in males compared to females but statistically insignificant. Tahmasbi, M., et al., concluded in their study there were no statistical significant difference between gender and prevalence of middle mesial canal in mandibular molar. Thus the results of our study correlates with Tahmasbi, M et al.^[13]

In our study out of 100 patients based on age group, prevalence of middle mesial canal in tooth number 37 and 47 between age 18-30 is 15 % (11 patients) and 14 % (10 patients), between age 31-60 is 10 % (2 patients) and 12 % (3 patients) and age above 60 is 0 % (0 patient) and 0 % (0 patients). Thus the prevalence of middle mesial canal in mandibular second molar is higher in age group between 18-30 years and decreases as the age increases.

Likewise, Pomeranz et al,^[6] 1981, fabra-Campos,^[20] 1989, Azim et al,^[16] 2015, Nosrat et al,^[11] 2015, Kim et al,^[21] 2013, Goel et al,^[22] 1991 support the view that middle mesial canals can be easily located in patients of a younger age group, but progressively decrease its incidence with age.

CONCLUSION

The presence of an untreated middle mesial canal is a potentially important reason for endodontic treatment failure. The dental operating microscope and CBCT are highly effective in detecting the presence of additional canals. The use of both these aids together results in reliable detection of middle mesial canal, thus minimizing the risk of missed canal. With the use of both these aids in this study, we conclude that the prevalence of the middle mesial canal in mandibular second molar can be as high as 10%, with the highest incidence in 18 to 30 years age group and the incidence progressively decreases as the age advances.

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