

Prevalence of Middle Mesial Canal Based on Clinical and Radiological Evaluation in Permanent Mandibular First Molar: A Clinical and Cone-beam Computed Tomography Analysis

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Abstract

Background: The success of endodontic therapy depends on the complete debridement of the entire root canal system. Many studies have investigated the morphology of mandibular molar, but the prevalence of the middle mesial canal in the mesial root of the mandibular first molar is still the subject of controversy. Missed canal and consequently inadequate debridement of the root canal system can eventually lead to failure of therapy. Hence, it is imperative to meticulously look for extra canals to ensure successful treatment.

Materials and Methods: In this *in vivo* study, 100 patients who reported for root canal treatment were included in the study. Patients' age and sex were recorded. After access cavity preparation, a standardized technique is performed between the mesiobuccal canal and mesiolingual canal to search for a middle mesial canal using a 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 that 50 patients were male and 50 patients were female. Based on gender, the prevalence of middle mesial canal in tooth number 36 and 46 is 18% (9 patients) and 19% (10 patients); for females and males, it is 20% (10 patients) and 22% (11 patients). Based on age group, the prevalence of middle mesial canal in tooth number 36 and 46 between the age of 15 and 30 is 23% (13 patients) and 24% (15 patients), between the age of 31 and 60 is 20% (5 patients) and 22% (6 patients), and age above 60 is 14% (1 patient) and 16% (2 patients), respectively.

Conclusion: From this study, we concluded that the prevalence of the middle mesial canal in the permanent mandibular first molar can be as high as 24%, with the prevalence being higher in males than females and the age group between 15 and 30 years had the highest prevalence.

Key words: Cone-beam computed tomography, Extra canals, Mandibular molar, Middle mesial canal

INTRODUCTION

Many studies have investigated the morphology of mandibular first molar, but the prevalence of the middle mesial canal in the mesial root of the mandibular first

molar is still the subject of controversy. The success of endodontic therapy depends on the complete debridement of the entire root canal system. Improper cleaning may harbor microorganisms. A strong relationship exists between the existence of an untreated canal space and apical periodontitis.^[1] Mandibular first molars are the most frequent tooth to be endodontically treated.^[2] Conventionally, mandibular molars are described as two-rooted teeth with 2 canals in the mesial root and 1 or 2 canals in the distal root.^[3] Complex anatomy is often seen in the mesial root of the mandibular first molar.^[4-6] The presence of independent middle mesial canal was first reported by Vertucci and Williams^[4] and Barker *et al.*,^[5] in 1974. According to Pomeranz

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et al.,^[7] the middle mesial canal can be classified into three categories such as fin, confluent, and independent. Fin is when an instrument can pass freely between the mesiobuccal and mesiolingual canal. Confluent is when the middle mesial canal originates as a separate orifice but apically joins with the mesiobuccal or mesiolingual 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 the middle mesial canal in mandibular molar.^[6-10]

The complex anatomy of the mesial roots of mandibular molars, if not addressed, may harbor reservoirs of microorganisms.^[11] Effective management 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 to evaluate the prevalence of the middle mesial canal in mandibular first molar clinically and radiographically using cone-beam computed tomography (CBCT).

MATERIALS AND METHODS

This prospective study was conducted in dental clinics at Chennai for patients who reported for root canal treatment (RCT) procedure. Inclusion criteria include patients above the age of 15 years with permanent mandibular first molar indicated for RCT either for caries or fractures involving the pulp. Intentional RCT for prosthodontics reasons was also included in the study. Exclusion criteria include 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, mesiolingual, and distal 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 are visualized with dental operating microscope to check for the existence of middle mesial canal. CBCT was taken to confirm the presence of the middle mesial canal. The results were statistically analyzed and discussed.

RESULTS

In our study, out of 100 patients included that 50 patients were male and 50 patients were female [Table 1]. Based on gender, the prevalence of middle mesial canal in tooth number 36 and 46 is 18% (9 patients) and 19% (10 patients); for females and males, it is 20% (10 patients) and 22% (11 patients).

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

| Gender | Number of patients | Prevalence of middle mesial canal | |
|--------|--------------------|-----------------------------------|---------------------|
| | | Tooth number 36 (%) | Tooth number 46 (%) |
| Female | 50 | 18 | 19 |
| Male | 50 | 20 | 22 |

Table 2: Cross-tabulation between the age and prevalence of middle mesial canal

| Age (years) | Number of patients | Prevalence of middle mesial canal | |
|-------------|--------------------|-----------------------------------|---------------------|
| | | Tooth number 36 (%) | Tooth number 46 (%) |
| 15–30 | 62 | 23 | 24 |
| 31–60 | 27 | 20 | 22 |
| Above 60 | 11 | 14 | 16 |

In our study, out of 100 patients based on age group, the prevalence of middle mesial canal in tooth number 36 and 46 between the age of 15 and 30 is 23% (13 patients) and 24% (15 patients), between the age of 31 and 60 is 20% (5 patients) and 22% (6 patients), and age above 60 is 14 % (1 patient) and 16% (2 patients) [Table 2].

DISCUSSION

Variations in root canal anatomy are so common that many authors now consider it as a normal phenomenon.^[12] Earlier studies on root canal anatomy were performed using demineralizing and injecting a dye technique.^[6,13-15] However, this technique had the disadvantage of producing irreversible changes to the studied sample.^[16] Few studies have used radiographs as a methodology to evaluate root canal morphology.^[17-19] Conventional radiographs produce only two-dimensional image of a three-dimensional object and can lead to the superimposition of the root canals (i.e., they tend to lie one behind the other in the buccolingual plane and can easily go undetected).^[16] CBCT has the advantage over conventional radiographs in that it three-dimensionally evaluates the root canal morphology and hence was used in this study.

The prevalence of the middle mesial canal in mandibular molar ranges from approximately 0.95%–46.2%.^[20,21] Azim *et al.*^[21] and Karapinar-Kazandag *et al.*^[9] suggested that the use of a dental operating microscope can improve the recognition and negotiation of accessory canals.

In our study, out of 100 patients included that 50 patients were male and 50 patients were female. Based on gender, the prevalence of middle mesial canal in tooth number 36 and 46 is 18% (9 patients) and 19% (10 patients); for females

and males, it is 20% (10 patients) and 22% (11 patients). Thus, the prevalence of the middle mesial canal in the mandibular first molar was higher in males compared to females but statistically insignificant. Tahmasbi *et al.*^[22] concluded in their study that there was no statistically significant difference between gender and prevalence of middle mesial canal in a mandibular first molar. Thus, the results of our study correlate with Tahmasbi *et al.*

In our study, out of 100 patients based on age group, the prevalence of middle mesial canal in tooth number 36 and 46 between the age of 15 and 30 is 23% (13 patients) and 24% (15 patients), between the age of 31 and 60 is 20% (5 patients) and 22% (6 patients), and age above 60 is 14% (1 patient) and 16% (2 patients). Thus, the prevalence of the middle mesial canal in mandibular first molar is higher in the age group between 15 and 30 years and decreases as the age increases.

Likewise, Pomeranz *et al.*,^[7] 1981; Fabra-Campos,^[23] 1989; Azim *et al.*,^[21] 2015; Nosrat *et al.*,^[24] 2015; Kim *et al.*,^[25] 2013; and Goel *et al.*,^[26] 1991, supported the view that middle mesial canal can be easily located in patients of a younger age group, but progressively decreased 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 the middle mesial canal, thus minimizing the risk of the missed canal. With the use of both these aids in this study, we conclude that the prevalence of the middle mesial canal in mandibular first molar can be as high as 24%, with the highest incidence in patients aged 15–30 years and the incidence progressively decreases as the age advances.

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