

Determination of prevalence of middle mesial canals in mandibular molars using cone beam computed tomography- A cross sectional study

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Abstract:

Background: The goal of this study was to use cone beam computed tomography (CBCT) to investigate the prevalence of middle mesial canals (MMC) in mandibular molars in the Kozhikode population (Kerala, India).

Materials and Methods: CBCT images of 103 patients were chosen from the department of oral medicine and radiology at the government dental college in Kozhikode, Kerala, India, as well as one private centre. The number of roots, canals, and presence and shape of MMC were assessed in mandibular first and second molars with no indication of previous root canal treatment, full coverage restorations, or root resorption. The patients' age and gender were also noted. Analysis of the data was done using SPSS software and the significance level was set to 5% ($p < 0.05$). **Results:** Out of 324 teeth evaluated middle mesial canals found in 29 teeth with an overall prevalence of 9 percent with significantly higher prevalence in first molar than second molar. There was no statistical correlation between the existence of MMCs and age, gender, or tooth side. **Conclusion:** In our community, the total prevalence of MMC was 9%, which is at the lower end of the range reported in the literature (0.26 percent to 53.8 percent)

Key Word: cone beam computed tomography, middle mesial canal, mandibular molar, root canal treatment

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I. Introduction

The most prevalent teeth in dental practise that require endodontic treatment are mandibular permanent molars.^[1, 2] They are crucial for proper chewing because they play a significant function in mastication. Two canals in mesial root and one distal canal are characteristic of mandibular first and second molars.^[3] A second distal canal, a third canal in the mesial root (MMC), a third canal in the distal root (MDC), a third root found distolingually known as radix entomolaris (RE), a buccally located additional root known as radix paramolaris (RP), a c-shaped canal, and a total of up to eight canals have all been reported in the literature.^[4-6] A detailed understanding of both internal and external morphology, which can vary widely within the norm, is required for successful root canal therapy.^[7]

For successful root canal therapy, a thorough debridement of the whole root canal system is required. One of the most common root canal therapy failures is missed canals. Vertucci and William, as well as Barker et al, were the first to discover the MMC in mandibular molars in 1974.^[3,8] Failure to detect the presence of an MMC during endodontic treatment of mandibular molar teeth could result in bacterial biofilms remaining in the canal, causing periapical inflammation to worsen and treatment failure.^[9]

Root canal morphology has been researched using a variety of approaches, each with its own set of advantages and disadvantages. Plastic casts,^[10] staining and cleaning,^[11] micro-computed tomographic imaging,^[12-14] and an operational microscope were all used in in vitro experiments.^[15] CBCT has the benefit over other procedures in that it displays healthy teeth in real time.

It's crucial to understand the prevalence and distribution of middle mesial canal (MMC) in mandibular molar teeth in various groups, which can range from 26 percent^[16] to 53.8 percent.^[17] A number of studies have found that racial and ethnic characteristics may play a role in molar tooth root canal shape and morphology, leading these anatomical abnormalities to occur at various rates in people all over the world.^[18] Previous studies have looked at the incidence of MMC in certain communities, but the situation in the Kozhikode area has not been studied to our knowledge. The purpose of this study is to assess the occurrence and distribution of middle mesial canals in mandibular molars in the Kozhikode area, a city in north part of Kerala state, in India.

II. Material and Methods

The project protocol was reviewed and approved by institutional research committee and institutional ethical committee government dental college Kozhikode (IEC no: 189/2020/DCC). CBCT images of 103 patients were selected from the data base of oral medicine and radiology department of the same institution and from a private centre near to the institution taken, as part of a dental examination for diagnosis and treatment planning purposes

Planmeca Promax 3D classic(Helsinki, Finland) was the CBCT unit used in this study with voxel size in the range of 150-200 μm and field of view 08x5.0cm(401x401x251).Exposure parameters were 90kvp, 8.0mA, 12.000s

The Planmeca Romexis Viewer programme was used to view the CBCT images. Image processing software was used to adjust the brightness and contrast of the images. All observations are done by an oral and maxillofacial radiologist and an endodontist based on criteria and variants that planned before during project protocol. All images analyzed simultaneously to obtain a consensus between two examiners

Sample size calculation was done using previous study^[19] with precision 5%.First and second lower molars with no previous history of root canal treatment, full coverage restoration were included in the study. The study eliminated teeth with open apices, root resorption, or calcification. All images were analysed in three planes (sagittal, axial and coronal). The number of roots and canals in each root were counted during the examination. Age and sex of the patients were also recorded and patients were classified in to four age groups :< 20, 21-40, 41-60, >60. When a radiolucency with a clearly round cross section was observed between the MB and ML canals in the axial view, independent of the presence or absence of an isthmus, the MM canal was reported.

After data collection data entered in excel work sheet and data analysis was performed with the help of statistical packages for social sciences (SPSS) The presence and prevalence of MMC, as well as their relationship with age, gender, and mandible side, were compared using the Chi-squared test. The significance level was chosen at 5% ($P < 0.05$).

III. Results

CBCT of 103 patients were analysed (51% males and 49% females, mean age =26years). A total of three hundred and twenty four teeth were analysed out of which one hundred and fifty six were first molars and one hundred and sixty eight were second molars. MMCs were found in twenty nine teeth (9%). In first molars the prevalence of MMC was 6.5 %. While in second molars it was 2.5 % (Figure1) $P < .05$. There were no significant associations between MMC prevalence and age, gender, or mandible side.(Table 1) In addition, among all the first and second mandibular molars, 13 second molars with C-shaped canals (4%),(Figure2) 13 first molars with radix entomolaris(4%) and two second molars with radix paramolaris(0.6%) were found

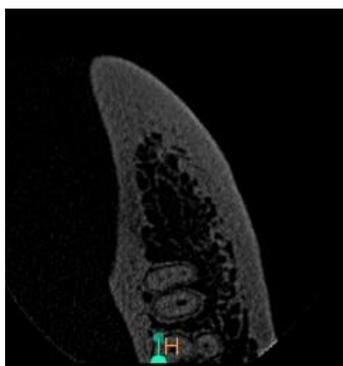


Figure 1: MMC in mandibular second molar



Figure 2: C-shaped canal in mandibular second molar

Table 1: Relation of MMC to Demographic Factors

Molar type	First molar	Second molar	Total	P value	
		21(6.5%)	8(2.5%)	29(9.0%)	<.05
side	Right	left		P value	
		14(4.3%)	15(4.6%)	29(9.0%)	>.05
Gender	Male	Female		P value	
		19(5.9%)	10(3.1%)	29(9.0%)	>.05
Age	Up to 20 years	21-40 years	>40 years	P value	
		10(3.1%)	11(3.4%)	8(2.5%)	>.05

Table 2: Relation of MMC to second distal canal

The Frequency Distribution (%) of MMC Based on Two Distal Canal		
	Two distal canal, n (%)	
	With	without
With MMC	14	15
Without MMC	26	269
Total	40	284

IV. Discussion

The morphology and internal anatomy of many types of teeth differs depending on ethnicity and race. This explains why different types of middle mesial canal architecture and prevalence occur at varying rates in different groups.^[18]

In this research, the incidence of MM canals was at the lower end (9%), compared to the reported range in the international literature (0.26% to 53.8%). Tahmasbi et al^[19] conducted a CBCT study to find the prevalence of MMC in 122 teeth using the voxel size of 76µm they found a prevalence of 16.4% which is comparatively more compared to present study may be due to different in size of voxel in addition to difference in ethnicity and race. The present study found significant number of MMC in first molars than second molars that is consistent with previous study.^[19] There was no difference in MMC distribution between first and second molars in a few trials.^[18,20] Other investigations revealed a higher frequency in second molar, although the findings were not statistically significant.^[17,21] The current study found no significant differences based on age, which is consistent with previous research.^[22] In other studies, MMC was found to be more common in younger patients than in older people. In several research, sex, in addition to molar type and age, appears to be a significant determinant.

Inaty et al^[20] found out that there is a significant difference between women (11.2%) and men (18.4%) (P value<0.05). Kuzekanani et al^[23] found that more prevalence in females than males. The present study shows no significant difference in males and females that is consistent with most of the previous studies.^[18,19] Side of the mandible does not appear to be significant factor in the present study. Kuzekanani^[23] et al found that more prevalence of MMC on the right side (12.2%) than left side (3.4%). Prevalence of MMC was more in teeth having second distal canal in the present study (Table 2)

Detection difficulties due to small orifice diameter and orifice hidden by developmental groove, as well as complications due to the canal root to main canal, are challenges faced by clinicians during the management of teeth with MMC. Access modification, ultrasonic troughing, magnification, troughing under magnification, and CBCT are all used in the clinical detection of these canals. Various studies report varying rates of detection with various methods, and the use of CBCT should be limited due to the radiation risk. It is concluded that

troughing under magnification improves detection rate, and more research in this area is required. [21,24,25] The current study's limitations were that it was a single-center study with low-resolution images

V. Conclusions

Prevalence of the middle mesial canals was lower (9%) and is at the lower end of the reported range in the international literature, which ranges from 0.26 percent to 53.8 percent. There is no statistically significant difference in age groups, gender, or mandibular side. MMC was more common in first molars than second molars, and teeth with a second distal canal were more common than teeth with a single canal. Careful exploration of the region between canal orifices is necessary in order to prevent missing the MMC and consequences

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