

# Prevalence Of Middle Mesial Canal In Mandibular First Molars Using Cone Beam Computed Tomography (CBCT) Analysis.- A Short Study

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## ABSTRACT:

**Aim:** The purpose of this study is to evaluate the prevalence of middle mesial canal in mandibular first molars using cone beam computed tomography (CBCT) analysis.

**Methodology:** The study population consisted of CBCT images of mandibular first molars of the patients referred to radiology centers of the Jaipur city. The inclusion criteria comprised of the images of mandibular first molars and images with a small field of view (FOV)(60 × 60), and voxel size I(V1) as well as images with high quality and resolution. Moreover, images with poor quality and resolution, root canal treated teeth, teeth with immature roots and large FOV were excluded from the study. The sample size was calculated to be minimum 50 samples by simple random sampling at 95% confidence level and 0.05 error rates. The comparison was considered statistically significant at  $P < 0.05$ .

**Results:** Amongst the females none of the subjects were having middle mesial canals, whereas in the males 1.7 percent and 1.4 percent were having middle mesial canal, as reported by observer 1 and 2 respectively. The overall prevalence of middle mesial canal was found to be 0.99 % and 0.80% respectively.

**Conclusion:** The prevalence of MMCs was revealed by the current CBCT study, which examined the root canal configurations of mandibular first molars in the Jaipur population. In molars with an undetected middle mesial canal, an untreated canal can be a significant factor in endodontic failure. Both the dental operating microscope and CBCT imaging work well for spotting accessory canals. This means that middle mesial canals can be found using one, the other, or both types of technology. Without having any preconceived notions about the number of canals in any tooth, a clinician must always look for the presence of accessory canals. This would guarantee better and more effective care.

**Clinical Significance:** The purpose of the current study, which was conducted using the CBCT technique, was to fill a significant gap in the available literature regarding the prevalence of middle mesial canals in mandibular first molars in Rajasthan

**Key Word:** middle mesial canals, root canal morphology, root anatomy

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## I. INTRODUCTION

The primary goal of root canal therapy is the thorough chemico-mechanical disinfection of the entire pulp space, which is followed by the three-dimensional obturation of the canal with an inert filling material.(1) Any variations in the canal morphology of a tooth could make it difficult to achieve ideal therapeutic objectives.(1)

Among these variations, the mandibular first molar's middle mesial canal, which Vertucci and Williams first identified, presents significant challenges for visualisation, identifying the true canal anatomy, and instrument access.(2) Therefore, before and during the root canal treatment of such teeth, aberrant anatomy must be identified. The evaluation of the canal configuration requires radiographic examination using traditional intraoral periapical views. It cannot, however, fully evaluate the root canal system due to its inherent limitations. Therefore, the importance of CBCT imaging for accurate diagnosis and treatment of the unusual canal morphology cannot be overstated.(2)

Any peculiar morphology may impair the effectiveness of endodontic treatment. Furthermore, studies on the mandibular molars' canal morphology have been done, with a particular emphasis on the middle mesial canal or an extra distal canal as determined by CBCT(3). The purpose of the current study, which was conducted using the CBCT technique, was to fill a significant gap in the available literature regarding the prevalence of middle mesial canals in mandibular first molars in Rajasthan.

## II. MATERIAL AND METHODS

The study population consisted of CBCT images of mandibular first molars of the patients obtained from various radiology centers of the Jaipur city. from November 2021 to April 2023.. A total 503 samples were utilised in this study.

**Study Design:** Prospective open label observational study

**Study Location:** Department of Conservative Dentistry and Endodontics, Mahatma Gandhi Dental College and Hospital ,Jaipur ,Rajasthan, India

**Study Duration:** November 2021 to April 2023.

**Sample size:** 503

**Sample size calculation:** The sample size was estimated on the basis of a single proportion design. The target population from which we randomly selected our sample was considered 20,000. We assumed that the confidence interval of 10% and confidence level of 95%. The sample size actually obtained for this study was 96 patients for each group. We planned to include 300 patients (Group I- Control, Group II- Cases of 100 patients for each group) with 4% drop out rate.

**Subjects & selection method:** The study population consisted of CBCT images of mandibular first molars of the

patients obtained from various radiology centers of the Jaipur city. The inclusion criteria comprised of the images of mandibular first molars and images with a small field of view (FOV)(60 × 60), and voxel size1(V1) as well as images with high quality and resolution. Moreover, images with poor quality and resolution, root canal treated teeth, teeth with immature roots and large FOV were excluded from the study. The sample size was calculated to be minimum 50 samples by simple random sampling at 95% confidence level and 0.05 error rates.

### Inclusion criteria:

Images of mandibular first molars and images with a small field of view (FOV)(60 × 60), and voxel size1(V1) as well as images with high quality and resolution from Jaipur CBCT Centres.

### Exclusion criteria:

1. Images with poor quality and resolution, root canal treated teeth, teeth with immature roots and large FOV.
2. CBCT scans from cities except Jaipur

### Procedure methodology

A total of 503 samples were studied and evaluated by two observers. A double- blinded study was conducted. The comparison was considered statistically significant at  $P < 0.05$ .

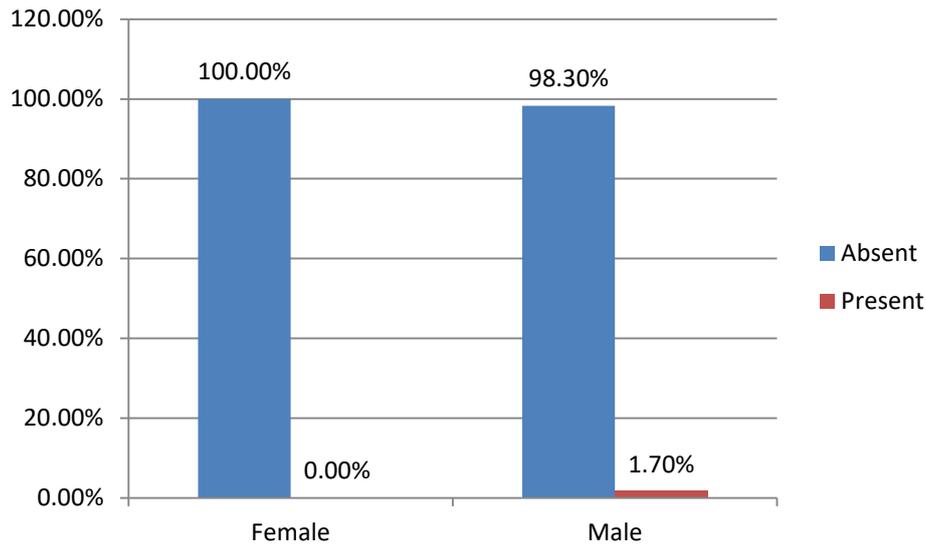
### Statistical analysis

Data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). The sample size was calculated to be minimum 50 samples by simple random sampling at 95% confidence level and 0.05 error rates. A total of 503 samples were studied and evaluated .Chi-square test was performed to test for differences in proportions of categorical variables between two or more groups. The comparison was considered statistically significant at  $P < 0.05$

## III. RESULT

	Absent	Present	Chi sq value	P value
Female	206	0	3.515	0.082 (Non-sig)
	100.0%	.0%		
Male	291	5		
	98.3%	1.7%		

**Table 1:** Association between gender and prevalence of middle mesial canals (observer -1)

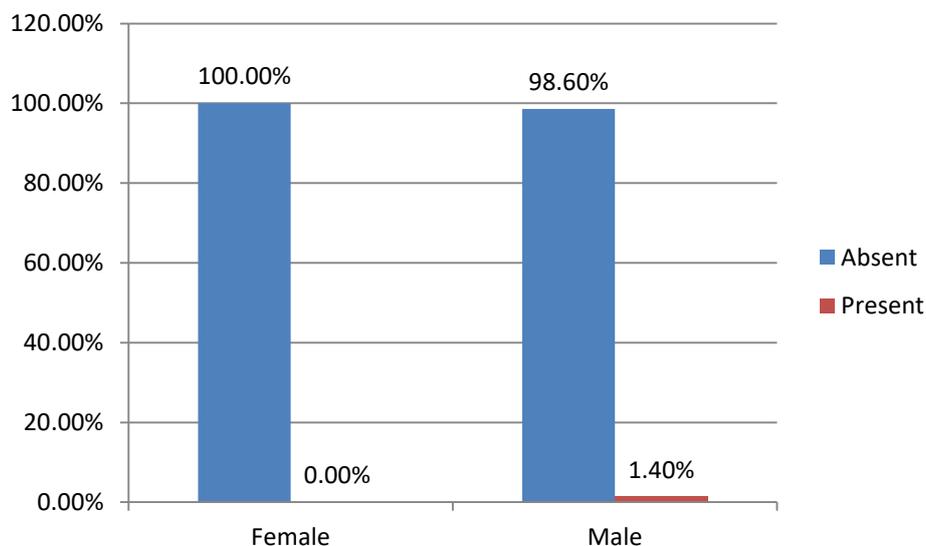


**Figure1: Prevalence Of Mesial Canals (Observer -1)**

Among the females, none of the subjects were having middle mesial canals whereas in the males, 1.7 percent were having middle mesial canal and 98.3% were not having middle mesial canal. The intergroup comparison between males and females was statistically non-significant ( $p=0.082$ ). Thus, the overall prevalence of middle mesial canal was 0.99 % as reported by Observer -1.

**Table 2: ASSOCIATION BETWEEN GENDER AND PREVALENCE OF MIDDLE MESIAL CANALS (OBSERVER - 2)**

	Absent	Present	Chi sq value	P value
Female	206	0	2.380	0.120 (Non-sig)
	100.0%	.0%		
Male	292	4		
	98.6%	1.4%		



**Figure 2: Prevalence Of Mesial Canals (Observer -2)**

Among the females none of the subjects were having middle mesial canals whereas in the males 1.4 percent were having middle mesial canal and 98.6% were not having middle mesial canal. The intergroup comparison between males and females was statistically non-significant ( $p=0.120$ ). Thus, the overall prevalence of middle mesial canal was 0.80 % as reported by Observer -2

**Table 3:** Interobserver agreement for location of middle mesial canals

		Observer -II		Inter-observer Agreement Coefficient	P value
		0	1		
Observer_1	Absent	497	0	0.894	0.001 (Sig)
		100.0%	.0%		
	Present	1	4		
		20.0%	80.0%		

The interobserver agreement between Observer –I and Observer II for the location of middle mesial canal was 89.40% (p=0.001)

#### IV. Discussion

The primary purpose of endodontic therapy is disinfection of the root canals. A thorough understanding of the anatomy and morphology of the tooth and its roots is necessary to achieve complete disinfection of the canals.(4)

While there are a set number of roots and canals in each tooth. Each root may differ in its canal number. The origin and continued existence of these canals are unknown. In actuality, the nerve or vessel's path serves as an additional passage.(1)

Between the mesiolingual and mesiobuccal canals in the mesial root of Mandibular First Molar, a third canal was found in 1974 by De Pablo OV.(5) The canal was then classified by Pomeranz et al. into three categories: independent, confluent, and fin. The terms "middle mesial canal" and "accessory mesial canal" were later used to describe this type of root canal.(2)

There are different methods to gauge the anatomical aberrations of various root canals, including cross-section preparation, clearing, clinical evaluation and imaging. (1)Sectioning and clearing are In vivo techniques that make it possible to assess the root canal anatomy. However, the clearing technique is preferred over other methods. Nevertheless, these methods are not utilized in clinics, so radiographs are the only methods used. As clinicians, we tend to presume the number of root canals in a specific root(3). However, according to the available literature, exceptions are the only rule. Moreover, the prevalence of two canals have been reported in the mesial root in most of the studies. Vertucci and Williams reported the first case of three independent mesial

canals with distinct orifice and foramen (9). Azim et al. (2015) reported the prevalence of the middle mesial canal in mandibular molars, by guided troughing under high magnification, to be 37.5%. (6)Versiani et al., in their study, reported the prevalence of middle mesial canal to be 18.6%, (7) implying a higher rate than the findings of our study. This difference seems to be due to the racial differences among various populations as well as the method used to evaluate the additional canals.(1)

In addition, Baugh et al. (2004) reported a prevalence rate of 1%–15% for this canal,(8) which is in line with the results of the current study. Furthermore, Gulabivala et al.(10) performed a study in 2001 and evaluated 139 first molars by root canal staining and clearing technique and showed types II and IV canals to be the most prevalent.(1)

In another study by Chourasia et al. in 2012 ,on an Indian population, 115 mandibular first molars were analyzed by a stereomicroscope at ×7.5 magnification and categorized according to Vertucci classification. The most prevalent canals were reported to be Type IV (54%) and Type I (3.65%).

Therefore, the prevalence of the middle mesial canal is different among various populations,(1) and it can be concluded that the middle mesial canal with a prevalence of 3.13%, if not detected, can deteriorate the quality of endodontic treatment.

On the other hand, the results of our study showed no significant difference between genders 1.4% and 1.7% in terms of the prevalence of the middle mesial canal, so accuracy in the detection of additional canals is necessary in both genders.

The presence of such canal aberrations can be assessed by the usage of a noninvasive, radiographic device, Cone Beam Computed Tomography (CBCT) as it is ideal for evaluation of an extra canal ,its orientation and position along with its configuration.

Periapical radiographs, although an important adjunct in endodontic therapy, are insufficient in analyzing the presence of middle mesial canals due to its 2–D imaging.(2)

It poses a great challenge for the clinician to detect middle mesial canal in the patients undergoing root canal treatment of mandibular first molars, due to the absence of CBCT machine in all dental centers as well as questionable role of periapical radiography in the accurate diagnosis of additional canals.

Thus, an initiative to make CBCT machines available in all dental centers should be made. Further, cases with unsuccessful treatment are recommended to be referred to the specialized centers with more diagnostic facilities.(1)

## V. Conclusion

The prevalence of MMCs was revealed by the current CBCT study, which examined the root canal configurations of mandibular first molars in the Jaipur population.

In molars with an undetected middle mesial canal, an untreated canal can be a significant factor in endodontic failure. Both the dental operating microscope and CBCT imaging work well for spotting accessory canals. This means that middle mesial canals can be found using one, the other, or both types of technology. Without having any preconceived notions about the number of canals in any tooth, a clinician must always look for the presence of accessory canals. This would guarantee better and more effective care.

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