

ORIGINAL ARTICLE

PREVALENCE OF SECOND MESIOBUCCAL CANAL IN MAXILLARY SECOND MOLARS ON THE BASIS OF CLINICAL AND RADIOGRAPHIC PARAMETERS

Iftikhar Akbar¹, Junaid Islam², Abdul Majeed¹, Rizwan Qureshi³

¹Department of Operative Dentistry and Endodontics, Peshawar Dental College, Riphah International University, Islamabad-Pakistan

²Department of Operative Dentistry and Endodontics, Abbottabad International Dental College, Abbottabad-Pakistan

³Department of Operative Dentistry and Endodontics, Rawal Institute of Health Sciences, Islamabad-Pakistan

Background: The objective of this study was to determine the prevalence of the second mesiobuccal canal in permanent maxillary second molar in patients presenting to Peshawar Dental College and Hospital. **Methods:** One hundred and twenty patients advised for root canal treatment in the maxillary second molars participated in the study. Two detection procedures, clinical and radiographical examination were used. Two pre-operative radiographs with different angulations and one post-operative radiograph were taken to examine roots and root canals. Access cavities were prepared and the second mesiobuccal canal was explored using magnifying dental loupes (3.5 x), endodontic explorer (DG16) and size 10 K-file. Descriptive statistics were recorded as percentages, frequencies and mean. The chi-square test was used for gender, age-wise comparison and right and left side of the maxillary jaw. **Results:** One hundred and twenty patients were recruited in the study. There were 65 (54.2%) males and 55 (45.8%) females. The second mesiobuccal canal was more common in males compared to females (p -value=0.434). The second mesiobuccal canal was most commonly found in 3rd decade with mean age, of 40.5 ± 12.31 , (p -value =0.51). The frequencies and percentages of the second mesiobuccal canal in maxillary second molars on the right and left side of the jaw were 70 (58.3%) and 50 (41.7%) respectively (p -value =0.310). **Conclusion:** The second mesiobuccal canal was found in less than half of the second molars. The most successful method of detection in this study was both clinical and radiographic.

Keywords: Endodontic treatment; Maxillary Molar; Root canal anatomy

Citation: Akbar I, Islam J, Majeed A, Qureshi R. Prevalence of the second mesiobuccal canal in maxillary second molars on the basis of clinical and radiographic parameters. J Ayub Med Coll Abbottabad 2023; 35(4):579–82.

DOI: 10.55519/JAMC-04-11877

INTRODUCTION

Endodontic therapy is frequently executed for the management of pulpal and periapical pathosis to preserve the teeth.¹ Proper endodontic treatment can be explained as biomechanically cleaning and shaping of the root canals, and consequently obturation of the cleaned and shaped root canals.² A rewarding root canal treatment depends upon a comprehensive awareness of the tooth's specifics and shape of the root canals because of the ample mutability in this regard even within the natural extent. The outer structure and inner shape of the teeth are uncertain regarding the quantity and form of roots and root canals.³

Unluckily, because of the intricacy of root canal anatomy, it could be demanding to see on 2-dimensional periapical radiographs. Therefore, the orifices of canals or surprisingly the whole canal are most likely to be missed in the procedure of root canal treatment.⁴ Maxillary molars have a large number of roots, along with unique shaping & configurations, as a result of which their interior canal anatomy is so fluctuated.⁵ The canals of maxillary molar teeth are specifically hard to handle, being the

most accepted exemplar of numerous roots and multi-root canals.⁶

Among the molars, the maxillary 2nd molars possess the most complicated root canal morphology.⁵ Besides the innermost position of the maxillary 2nd molars in the maxillary arch, the difficulty of instrumentation and the large diversity of its root canal structure are the main causes of adversities of endodontic care.⁷ Kulild *et al.* revealed that the existence of a second mesiobuccal canal (MB2) in the maxillary 1st and 2nd molars is reasonably frequent.⁸ The global pervasiveness of the 2nd Mesiobuccal canal utilizing CBCT was established to be 73.8%, with a span of 48–97.6%.⁴ This broad discrepancy revealed in the occurrence of the 2nd Mesiobuccal canal may be produced by variations in ancestry, age group, and gender of the people and techniques between the researchers.⁹ While various researchers have focused on the occurrence of the 2nd mesiobuccal canal in maxillary molars, more studies regarding the existence of the 2nd mesiobuccal canal is yet required.¹⁰

In laboratory research, several techniques seemed to be acquired to illustrate canal

form and shape, which include root canal clearing techniques, transverse cross-sectioning, radiographic examination, and dentine troughing under operating microscope, ultrasonic, scanning electron microscope and micro-computed tomography.¹¹ Unquestionably, operating microscopes accompanied by ultrasonic instruments are regarded as standard tools to detect additional canals. Furthermore, understanding of the clinician, besides the time utilized in the exploration of 2nd Mesio Buccal canal, in combination with certain appliances, is useful in providing the positive results of root canal location.¹²⁻¹⁵

The prevalence of second mesiobuccal canal in maxillary second molars using CBCT was 69% and 65% for maxillary right and left second molars respectively.¹ The other studies using CBCT showed the prevalence of second mesiobuccal canal in maxillary second molars 30% and 17%.⁹ There has been a lack of research in our domain about frequency of 2nd mesiobuccal canal in permanent maxillary second molar. The aim of this research was to investigate clinically and radio graphically the prevalence of second mesiobuccal canal present in permanent maxillary 2nd molars in local residents. So that the knowledge of differences in root canal morphology of permanent maxillary 2nd molars will improve the endodontic practice of general dental practitioner by successfully treating the maxillary second molars.

Although microscope in combination of ultrasonic are the most successful tools in finding MB2 canal, this study will show us whether to rely on only radiograph or clinical parameters or to use both in finding the number of canals. More over this study will also help us to know the frequent variation of quantity of root canals in maxillary 2nd molar in our population. The knowledge of frequency of root canals will prevent unnecessary cutting of tooth structure and will facilitate better cleaning, shaping and obturation. This will also reduce the possibility of missing a root canal during the procedure and hence will result in successful endodontic treatment and better prognosis.

MATERIAL AND METHODS

This descriptive cross-sectional study was carried out in the department of Operative Dentistry and Endodontics at Peshawar Dental College and Hospital from January 2021 to November 2022. The approval of this study was taken from the Institutional Ethical Review Committee of Prime Foundation (Prime/ IRB/ 2021-338). One hundred and twenty subjects advised with root canal treatment of maxillary second molars from outpatient department participated in the study. The inclusion criteria were patients' age from 11 to 70 years, second maxillary molars with no previous endodontic treatment and patients requiring elective endodontics. Teeth with

internal root resorption and not restorable were excluded from the study. The patients were informed/explained regarding the purpose, procedure, risk and benefits of the study. Verbal and written informed consent were taken from every participant. The sampling technique was non probability consecutive sampling. Sample size was assessed using WHO sample size calculator stating the statistics for Root 1 (i.e., single rooted Max 2nd molar) as 4.7%, margin of error 3.8% and 95% confidence level. The estimated sample was 120.

Two detection procedures, clinical and radiographical examination were used in patients scheduled for endodontic treatment in permanent maxillary second molar. Two pre-operative radiographs were taken; one with 90° angulations to the tooth and a second with mesial shift of 20° to find out the third dimension and were used to examine root canals. Access cavities were prepared following the administration of local anaesthesia and rubber dam isolation. After clear visualization and using magnifying dental loupes (3.5x), the floors of the pulp chambers were explored, and canals were first detected with Endodontic explorer (DG16). Root canals were then scouted with size 10 K-file. A third periapical image was taken with the files placed in the negotiated root canals to confirm their presence. After cleaning and shaping the root canals were then obturated in the second visit.

The data were recorded for age, gender, and tooth type. The collected data were analyzed using appropriate statistical methods. Descriptive statistics were used to summarize the demographic characteristics of the study participants. Frequencies and percentages were calculated for categorical variables, such as gender and tooth type. Mean and standard deviation were calculated for continuous variables, such as age. Chi-square test was used to determine the association between the presence of a second mesiobuccal canal and demographic characteristics such as age, gender, and tooth type. A *p*-value of less than 0.05 was considered statistically significant. The statistical analysis was performed using SPSS version 25.0 software.

RESULTS

Over all 120 patients were recruited in the study. The frequency of the second mesiobuccal canal was 9 (7.5% with SD±0.264). Table 1 and 2 shows frequency of patients' age wise. Second mesiobuccal canal was most commonly found in 3rd decade with mean age, 40.5±12.31, (*p*-value =0.51). There were 65 (54.2%) males and 55 (45.8%) females. Second mesiobuccal canal was more common in males compared to females (*p*-value =0.434). Table-3. The frequencies and percentages of second mesiobuccal canal in maxillary second molars on the right and left side of the jaw was 70 (58.3%) and 50 (41.7%) respectively. (*p*-value =0.310) Table-4

Table-1: Age-wise distribution of patients

Age group	Frequency {N}	Percent {%
11-20	7	5.8
21-30	20	16.7
31-40	37	30.8
41-50	26	21.7
51-60	23	19.2
61-70	7	5.8
Total	120	100

Table-2: Patients' distribution by age and presence of second mesiobuccal canal

Presence of second mesiobuccal canal	Age group (years)						Total	p-value
	11-20	21-30	31-40	41-50	51-60	61-70		
Yes	0 (0%)	5 (56%)	2 (22%)	1 (11%)	1 (11%)	0 (0%)	9 (100%)	0.51
No	7 (6%)	15 (13.5%)	35 (31.5%)	25 (22%)	22 (20%)	7 (60%)	111 (100%)	
Total	7 (6%)	20 (16%)	37 (31%)	26 (22%)	23 (19%)	7 (6%)	120 (100%)	

Table-3: Presence of second mesiobuccal canal according to gender

Gender of the patient	Presence of second mesiobuccal canal			p-value
	Male	Female	Total	
Yes	6 (67%)	3 (33%)	9 (100%)	0.434
No	59 (53%)	52 (47%)	111 (100%)	
Total	65 (54%)	55 (46%)	120 (100%)	

Table-4: Frequency of MB2 on the right and left side of maxillary jaw

Side	Frequency {N}	Percent {%	p-value
Right side	70	58.3	0.310
Left side	50	41.7	
Total	120	100	

DISCUSSION

A large number of methods have been worked and reported both in vitro and in vivo for the confirmation of MB2 existence. These procedures have been devised the main reference standards in knowing the existence or absence of MB2 canals. Outcomes of these researches have shown the occurrence of MB2 between 90% (MCT) and 93.5% (tooth clearing technique). The technique of choice for detecting MB2 canals is considered CBCT because it is universally accessible, inexpensive and gives high quality images with least health hazards of ionizing radiations as compared to MDCT.¹⁶⁻²⁰

This research assessed the prevalence of root canals in permanent maxillary 2nd molars in a selected population of the province Khyber Pakhtunkhwa, Pakistan. The study used clinic-radiographical technique for the assessment of root canals which is the least productive method as compared to CBCT. Our study demonstrated the frequency of MB2 canal 7.5% in permanent maxillary 2nd molar. Abbasali Khademi *et al.*² conducted a study on Iranian population. Their retrospective study consisted of 295 CBCT images from 295 subjects (165 female and 130 male patients) out of 470 CBCT images. This produced three hundreds and eighty-nine images of maxillary 1st (197 and 192 on the right and left side respectively) and four hundred and sixty maxillary 2nd (235 and 255 on the right & left side respectively) molars. Maxillary first and second molars showed the prevalence of MB2 canals 70.2% and 43.4%

respectively. This difference can be due to different ethnic sub groups and differences in the method of detection used.

Our study showed that the frequency of MB2 root canal in second molar was more in men compared to women, which is in agreement with the study by Abbasali Khademi *et al.*² Although more researches with greater sample sizes are needed to explore if the gender has any consequences on the prevalence of MB2.

Khalid Alfouzan *et al.*⁴ conducted a study on Saudi population on maxillary 1st molars. Their study demonstrated that twenty-eight teeth (80%) had two MB canals and six teeth (17%) had three MB canals. In the maxillary 2nd molars, twenty-four (80%) had two MB canals while four (13%) teeth had three MB canals, which is in contradiction to the results of this study (7.5% MB2 in maxillary 2nd molars). The discrepancy in reported MB2 presence can be ascribed to varying methods of inspection utilized for their identification and the non-identical races and ages assessed.

Nelson Alexander Fernandes¹ conducted a study in which they included scans of 200 patients containing 100 males & 100 females. Overall, eight hundred teeth were analyzed, and teeth containing extra canals in their mesiobuccal roots (MB2) were specified. The prevalence of MB2 was higher in 1st maxillary molar teeth, i.e., 92% & 87%, for teeth 16 & 26, respectively. While a lower prevalence of MB2 was shown by 2nd maxillary molar teeth, i.e., 69% & 65%, for the 17 & 27,

subsequently. In terms of side involved our study has comparable results to this study that is more cases of MB2 were found in tooth 17 as compared to tooth 27.

Similarly, the presence of MB2 is reduced with increasing age in this study as also found by Nelson Alexander ¹ with the second and third decade most prominent. The strengths of the study were that it was performed in a minimum time period of 1 year with magnifying loupes (3.5x) The limitations were that the sample size was small, and the resources were limited and also not using the standard method of CBCT

CONCLUSION

This study concluded that 3rd decade most commonly had MB2 canal with no significant difference between males and females. In this selected group of population, the second mesiobuccal canal (MB2) was present in less than half of second molars. In most cases the MB2 canal was found both clinically and radio graphically. There was no significant difference between the genders of the patients. MB2 canal was found more in younger patients as compared to older patients due to calcifications in the latter group. Further large-scale, multicenter studies and utilizing CBCT are required to explore the root canal morphology of mesial root more accurately.

Conflict of interest: None

AUTHORS' CONTRIBUTION

IA: Conception and design of the study, drafting, write-up. JI, AM: Data collection and analysis. RQ: Data interpretation.

REFERENCES

1. Fernandes NA, Herbst D, Postma TC, Bunn BK. The prevalence of second canals in the mesiobuccal root of maxillary molars: A cone beam computed tomography study. *Aust Endod J* 2019;45(1):46–50.
2. Khademi A, Naser AZ, Bahreinian Z, Mehdizadeh M, Najarian M, Khazaei S. Root Morphology and Canal Configuration of First and Second Maxillary Molars in a Selected Iranian Population: A Cone-Beam Computed Tomography Evaluation. *Iran Endod J* 2017;12(3):288–92.
3. Naseri M, Ali Mozayeni M, Safi Y, Heidarnia M, Akbarzadeh Baghban A, Norouzi N. Root Canal Morphology of Maxillary Second Molars according to Age and Gender in a Selected Iranian Population: A Cone-Beam Computed Tomography Evaluation. *Iran Endod J* 2018;13(3):373–80.
4. Alfouzan K, Alfadley A, Alkadi L, Alhezam A, Jamleh A. Detecting the Second Mesiobuccal Canal in Maxillary Molars in a Saudi Arabian Population: A Micro-CT Study. *Scanning* 2019;2019:9568307.
5. Betancourt P, Navarro P, Cantín M, Fuentes R. Cone-beam computed tomography study of prevalence and location of MB2

- canal in the mesiobuccal root of the maxillary second molar. *Int J Clin Exp Med* 2015;8(6):9128–34.
6. Olczak K, Pawlicka H. The morphology of maxillary first and second molars analyzed by cone-beam computed tomography in a polish population. *BMC Med Imaging* 2017;17(1):68.
7. Zeng C, Shen Y, Guan X, Wang X, Fan M, Li Y. Rare Root Canal Configuration of Bilateral Maxillary Second Molar Using Cone-beam Computed Tomographic Scanning. *J Endod* 2016;42(4):673–7.
8. Natanasabapathy V, Randhya R, Sundar S, Kowsky D, Arul B. Unusual Location of a Second Mesiobuccal Canal in the Maxillary First Molar managed with the Aid of Cone-beam Computed Tomography. *J Ope Dent Endod* 2016;1:35–8.
9. Ratanajirasut R, Panichuttra A, Panmekiate S. A Cone-beam Computed Tomographic Study of Root and Canal Morphology of Maxillary First and Second Permanent Molars in a Thai Population. *J Endod* 2018;44(1):56–61.
10. Lee SJ, Lee EH, Park SH, Cho KM, Kim JW. A cone-beam computed tomography study of the prevalence and location of the second mesiobuccal root canal in maxillary molars. *Restor Dent Endod* 2020;45(4):46.
11. Zhang R, Yang H, Yu X, Wang H, Hu T, Dummer PM. Use of CBCT to identify the morphology of maxillary permanent molar teeth in a Chinese subpopulation. *Int Endod J* 2011;44(2):162–9.
12. Coelho MS, Lacerda MFLS, Chagas Silva MH, Rios MA. Locating the second mesiobuccal canal in maxillary molars: challenges and solutions. *Clin Cosmet Investig Dent* 2018;10:195–202.
13. Mashyakhly M, Jabali A, Albar N, AbuMelha A, Alkahtany M, Bajawi H, *et.al.* Root and canal configurations of maxillary molars in a Saudi subpopulation (Southern region): In vivo cone-beam computed tomography study. *Saudi Endod J* 2022;12(2):180–5.
14. Anirudhan S, Suneelkumar C, Uppalapati H, Anumula L, Kirubakaran R. Detection of second mesiobuccal canals in maxillary first molars of the Indian population—a systematic review and meta-analysis. *Evid Based Dent* 2022;4:1.
15. Verma P, Love RM. A Micro CT study of the mesiobuccal root canal morphology of the maxillary first molar tooth. *Int Endod J* 2011;44(3):210–7.
16. Yasser F, bin Shehzad H, Chaudry A. Frequency of Second mesiobuccal canal in maxillary first molar detected through cone beam computed tomography. *Pak Oral Dent J* 2022;42(1):36–8.
17. Alnowailaty Y, Alghamdi F. The Prevalence and Location of the Second Mesiobuccal Canals in Maxillary First and Second Molars Assessed by Cone-Beam Computed Tomography. *Cureus* 2022;14(5):e24900.
18. Magalhães J, Velozo C, Albuquerque D, Soares C, Oliveira H, Pontual ML, *et al.* Morphological Study of Root Canals of Maxillary Molars by Cone-Beam Computed Tomography. *Sci World J* 2022;2022:4766305.
19. Blattner TC, George N, Lee CC, Kumar V, Yelton CD. Efficacy of cone-beam computed tomography as a modality to accurately identify the presence of second mesiobuccal canals in maxillary first and second molars: a pilot study. *J Endod* 2010;36(5):867–70.
20. Martins JN, Marques D, Silva EJ, Caramês J, Mata A, Versiani MA. Second mesiobuccal root canal in maxillary molars—a systematic review and meta-analysis of prevalence studies using cone beam computed tomography. *Arch Oral Biol* 2020;113:104589.

Submitted: March 8, 2023

Revised: September 4, 2023

Accepted: September 9, 2023

Address for Correspondence:

Prof. Dr. Iftikhar Akbar, Peshawar Dental College, Riphah International University, Islamabad-Pakistan

Email: driftikhar156@hotmail.com