



## Occurrence of Number of Canals in Maxillary Second Molar in South Indian Population - A Retrospective Study

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### ABSTRACT

Maxillary molars contain various anatomical variations with diverse shapes and forms. The variations in root canal anatomy may be due to developmental patterns or may have a genetic influence. The root morphological studies have led to a better understanding of canal morphology that contributes to successful cleaning and shaping of the root canal system. This study was done to assess the prevalence of the number of canals in Maxillary second molars and to determine its association with age and gender in a South Indian Population by evaluating post-operative periapical radiographs. A total of 384 case sheets of root canal treated maxillary second molars were reviewed and analyzed. The patients undergoing root canal treatment for maxillary second molars were screened, and cases selected for the study were in the age group of 18- 65 years. Data was analyzed using SPSS software. Out of 384 teeth, 211 were male and 173 were female patients. Number of canals had no significant correlation with age but had significant association with gender ( $p=0.085$ ). There were 3 canals in most of the cases. Within the limitations of the study, the maxillary second molars consisted mostly of 3 canals in both male and female patients. There was significant association between gender and number of canals.

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### INTRODUCTION

The success of endodontic treatment depends on optimal cleaning and shaping of the root canal sys-

tem (Ramamoorthi *et al.*, 2015). The root canal system has complex anatomical variations such as fins, isthmuses, C- shaped canals, lateral and accessory canals (Tomaszewska *et al.*, 2018). The knowledge of the intrinsic root canal morphology helps in locating the canals better (Betancourt *et al.*, 2016). Various irrigants and their interaction have been widely studied to achieve disinfection without leaving any residues, that would interfere with proper sealing of the root canal system (Siddique *et al.*, 2019; Noor, 2016). In cases of deep class V lesions, entrance filling along with RMGIC sealing of the lesion helps in adequate sealing of the tooth surface (Nasim *et al.*, 2018). Post endodontic restoration could be a veneer, partial or full coverage restoration with the aim of retaining maximum tooth structure (Ravinthar and Jayalakshmi, 2018). With the

advent of CBCT, the probability of missing canals has greatly reduced (Khosravifard *et al.*, 2018). CBCT is an effective tool for identifying extra canals in case of persistent radicular infections (Verma and Love, 2011; Scarfe and C, 2018; Patel *et al.*, 2019).

Maxillary molars contain various anatomical variations with diverse shapes and formations (Al-Fouzan *et al.*, 2013; Nikoloudaki *et al.*, 2015). Morphological variations in root canal anatomy have been influenced by developmental disturbances, ethnicity and genetics. Although CBCT is highly efficient in complex anatomical situations, the periapical radiographs are mandatory, cost-effective, lesser radiation exposure and are sufficient for routine dental cases, the judicious use of CBCT following ALARA principle should be followed (Patel *et al.*, 2019).

The aim of this study was to evaluate the occurrence of number of canals in maxillary second molars in South Indian Population and to correlate with age and gender to determine its association.

## MATERIALS AND METHODS

This retrospective study was conducted as Saveetha Dental college in 2020. Case sheets were analyzed from June 2019 to April 2020. A total of 384 case sheets of root canal treated maxillary second molars were reviewed and analyzed. The case sheets were cross-verified by another examiner to avoid missing any data. The age, gender of patients was checked by both data and photographic evaluation.

Patients included in the study were in the age group of 18- 65 years of age who underwent root canal treatment for maxillary molars. Patients with developmental anomalies and calcific disturbances in teeth were excluded from the study. Teeth with calcified canals were also excluded from the study (Timmerman and Parashos, 2018).

Sampling bias was minimized by verifying the photograph and radiographs by another reviewer. After verification of dental hospital management system records of all patients, the data such as number of canals in maxillary second molars, age and gender of patients were tabulated. Incomplete data or radiographs which were not of adequate diagnostic value, were excluded from the study to achieve better accuracy of the results.

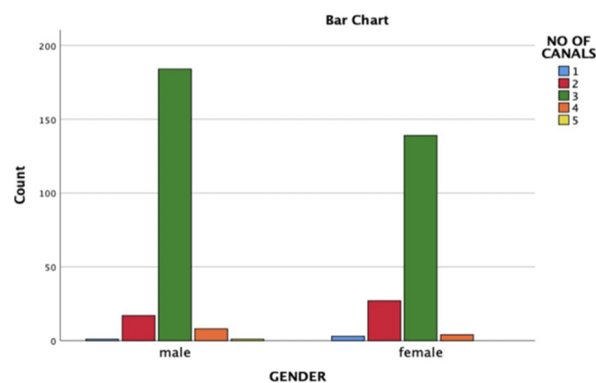
The cases were analyzed with intra oral periapical radiographs. In case of predilection of extracanals, CBCT was included in patient data which was also verified. Cases without CBCT will also be included in the study except in cases of doubt of aberrant anatomy or extra canals.

## Statistical Analysis

The analysis was done using SPSS Software. The association between age and gender was calculated using Descriptive statistics. The periapical radiographs were chosen using convenience sampling. The independent variables were assigned as age and gender and the dependent variables were the root canal treated maxillary second molars. The data were analyzed using the Chi-square test. The type of analysis performed was associative and descriptive using SPSS software (SPSS version 21.0, SPSS, Chicago IL, USA). The p-value less than 0.05 was considered to be statistically significant.

## RESULTS AND DISCUSSION

A total of 384 maxillary second molars were evaluated, out of which 211 (60.6%) belonged to male and 173 (49.7%) belonged to female patients (Table 1). There were 3 canals more commonly observed in male and female patients followed by two canals (Figure 1). There was significant association between gender and number of canals (p-value < 0.05 - significant) according to Chi-square test (Table 2). There was no significant association between age and number of canals in maxillary right and left second molars.



**Figure 1: Bar chart representing the association between gender and number of canals in the maxillary second molar.**

Identifying and assessing the root canal configuration and its varied anatomy is fundamental to achieve success in cleaning and shaping the root canal system (Olczak and Pawlicka, 2017). Proper cleaning and shaping of the root canal system is the predictive factor for the success of endodontic treatment (Govindaraju *et al.*, 2017). An ideal irrigant should dissolve pulp and necrotic tissue, remove the smear layer, reduce endotoxin levels and act as a lubricant. (Teja and Ramesh, 2019). Studies have shown increased MMP levels in inflammatory con-

**Table 1: Distribution of number of canals amongst gender in Maxillary second molar**

No. of canals		1	2	3	4	5	Total
Gender	Male	1	17	184	8	1	211
	Female	3	27	139	4	0	173
Total		4	44	323	12	1	384

**Table 2: Chi-square test - Association between gender and the canal variations (p<0.05) according to Chi-square test**

	Value	df	Asymptomatic Significance ( 2- sided)
Pearson Chi-square	8.195	4	.085
Likelihood ratio	8.608	4	.072
Linear- by- linear Association	7.872	1	.005
No of valid cases	384		

ditions (Teja and Ramesh, 2020). Disease of pulp may be inflammatory or infectious. The vitality of the pulp should be checked using reliable vitality tests before starting the root canal treatment (Janani et al., 2020). The entire inflamed pulp tissue should be eliminated in all the canals to achieve success in endodontic therapy (Ramesh et al., 2018). *E. faecalis* is one of the common persistent endodontic pathogens, usually obtained in cultures from re-treatment cases, in which one of the prime reasons of failure would have been missed canals. In cases of persistent infections or refractory cases, the use of intracanal medication is mandatory to effectively disinfect the canal (Manohar and Sharma, 2018). In cases of trauma, the prognosis of replanted teeth after avulsion depends on storage medium, temperature, time duration and several other factors (Rajakeerthi and Nivedhitha, 2019). In case of class II Ellis fracture, careful distinguishment should be done between sensitivity and pain. Pulp vitality test should be repeated at regular recall appointments, before deciding the treatment (Jose et al., 2020).

Studies on internal and external anatomy of teeth have shown that complex anatomical variation can occur in all teeth. (Shafqat et al., 2018) The factors that play a role in these variations include ethnicity, age, gender and study design (Ratanajirasut et al., 2018).

Naseri et al studied the root morphology of maxillary second molars in Iranian population and concluded that all maxillary molars had more than one root and there was significant correlation between gender and number of canals (Naseri et al., 2018). Studies by Neelakantan et al, showed that the root number, morphology and canal morphology of Indian maxillary molars showed features that were

different from Caucasian and Mongoloid traits (Neelakantan et al., 2010). This was the first kind of study done in the South Indian population to derive an association between the number of canals in maxillary second molars and age and gender of the patient.

Wu et al, studied that the morphology of maxillary second molars using CBCT and concluded that the root fusion of maxillary second molars increased with age, while the root canal morphology was more complex in individuals of intermediate ages (Wu et al., 2017). This was the reason for the decreased number of canals as patient's age increases. The reason behind reduction in canals may be due to increased secondary dentin deposition and sclerosis occurring in aged individuals (Purushotham and Sahoo, 2020).

Also, the presence of MB2 (mesiobuccal second canal) is always closely associated with MB1, but may have a single path of exit (Magat and Hakbilen, 2019). The knowledge of the complexity of root canal curvatures and the number of root canals help in achieving success in Endodontic therapy (Martins et al., 2020).

The limitations of the study include a very small sample size and population studied. Also, CBCT would always be a better assessment tool than peri-apical radiography for root anatomical configuration studies (Kumar et al., 2016). CBCT has also been used in vitro studies for measuring remaining dentin thickness after different rotary instrumentation techniques (Ramanathan and Solete, 2015).

Enamel is subjected to repeated cycles of demineralization and remineralization, which controls the nature of caries progression. Earlier detection of caries and proper treatment would help avoid inva-

sive treatment procedures (Rajendran et al., 2019). Remineralising agents can help greatly in avoiding caries or its progression (Nasim and Nandakumar, 2018).

## CONCLUSION

Within the limitations of the study, the maxillary second molars mostly consisted of 3 canals in both male and female patients. There was no significant difference between age and number of canals. But a significant difference between gender and number of canals were observed. The studies of root canal configuration in different populations helps the clinician to have the basic understanding of the number of canals in various teeth. This avoids missing any canal during root canal treatment. The canal intricacies such fins, isthmuses, lateral canals are more commonly found in permanent molars due to increased mesiodistal dimensions of roots. Hence irrigant activation must be done to achieve optimal disinfection of the root canal system.

## Conflict of interest

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