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ASSESSMENT OF ROOT CANAL MORPHOLOGY IN UPPER SECOND PREMOLAR

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ABSTRACT

Objective was to evaluate the root canal morphology for maxillary second premolar using two periapical radiographs.

This cross sectional descriptive study was conducted on 80 teeth at Rawal dental college, Islamabad. The inclusion criteria were both genders, age range 20 to 60 years, having irreversible pulpitis, pulp necrosis, and periapical pathosis in upper second premolars. The cases allergic to local anesthesia, upper second premolars with prognosis, fracture and internal resorption were excluded from study. Two periapical radiographs were used to determine the number and configuration of canals. Chi-square test was applied for comparison of canal morphology among genders and age groups.

The males were 44(55%) and females were 36(45%). The mean age was 34.93±9.03 years. The most common type of canal configuration was type II (n=31, 38.75%) followed by type IV (n=27, 33.75%). In 44(55%) participants there was single canal, in 35(43.75%) were two canals and in 1(1.25%) were three canals. Type II canal was more in males (n=25, 56.82%) than females (n=6, 16.67%). Type I canal configuration was more in females (n=9, 25%) than males (n=4, 9.09%). These differences were statistically significant (P=0.003).

For maxillary second premolars in upto half cases in our population have two canals and common types of canal configuration are type II and IV.

Keywords: *Maxillary second premolar, root canal morphology, number of canal, canal configuration*

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INTRODUCTION

In order to carry out a successful root canal treatment the clear knowledge of root canal configurations is of paramount importance.[1] The existence of variability in morphology of the root canal is associated with difficulties to debride the all remnants from root canal systems and can lead to unfavorable results of endodontic treatment.[2] Radiological analysis has an important role in both diagnosis and treatment planning of root canal treatment.[3] The conventional X-rays like preapical can give limited information about detailed anatomy of root canal system due to its two dimensional nature. Three dimensional radiographs can depict real and detail anatomy of the root canal without distortion. However, 3-D radiographs are associated with high cost, increased radiation dose and need of high level of expertise.[4] Another alternative investigation tool which is less costly and with lesser radiation dose for determining root canal morphology is the use of two periapical X-rays through SLOB (same lingual opposite buccal) rule.

The contemporary studies have shown that root canal is not a single canal running from orifces to apices in the teeth, it is rather a complex system that undergoes splitting and joining along its course.[5, 6] Various configurations exist in root canal system and numerous classification systems have been reported. Vertucci's Classification is most versatile system for classifying the complex anatomy of root canal.[7]

Upper premolars especially second premolars are among the difficult teeth to treat endodontically with success. The complexity is due highly variable canal morphology, inability to image their entire root canal

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anatomy, presence of extra-roots and accessory canal.[8] A study conducted on western population reported that single canal is most common (75%) followed by two canals (24%) and least are three canals (1%).[9]A study conducted in Saudi Arabia on maxillary second premolar root canal morphology using CBCT reported that 83% had one root, 16% had two root and 1% had three roots. The most common configuration of root canal in upper second bicuspid was type I (60%) followed by type II (16%).[8]

Complete debridement and sealing of entire root canal need deep knowledge of anatomy. In literature there is large variation among studies on type of canal and number of roots for upper second premolars.[8, 10] There is scarcity of local literature in our local population. This study will provide local statistics which can be helpful clinician in order to perform successful endodontic treatment for maxillary second premolar.

The objective of this study was to evaluate the root canal morphology for maxillary second premolar using two periapical radiographs.

MATERIAL AND METHODS

This cross sectional descriptive study was conducted at department of operative dentistry, Rawal dental college, Islamabad. Ethical approval was obtained from hospital research committee. After in depth explanation about the study verbal informed was obtained from all participants. The recruitment of the participants was done by non-probability consecutive sampling technique. The sample size was 80 teeth calculated through WHO software at 95% confidence level and 5% of margin of errors using proportion of canal configuration of 5.5% for type V from previous study.[10] The inclusion criteria were both males and females, age ranging from 20 to 60 years, having irreversible pulpitis, pulp necrosis, and periapical pathosis in upper second premolars. The cases allergic to local anesthesia, upper second premolars with prognosis due to gross carious lesion, fracture and internal resorption were excluded from study.

After detailed clinical and radiographic examination of maxillary second premolars, a local anesthesia was administered to all participants. Teeth isolation was done with rubber dam and access cavity in bucco-lingual direction was prepared using round bur. After access cavity preparation canals were negotiated using number 15 k-file and two periapical radiographs were taken using horizontal SLOBE technique by about 45^0 angulation change between the two X-rays. Vertucci's Classification was applied for categorization for canal morphology from type I to VII as follows;

- Type I: One canal from pulp floor orifice to root apex
- Type II: Start 2 discrete canals at pulp floor and unite to form single canal just above apex.
- Type III: Start as a one single canal at pulp floor then bifurcate into 2 canal within the root and then rejoin to form single canal just superior to apex
- Type IV: Have 2 separate canals from start to the apex
- Type V: One canal goes from pulpal floor then divides to form 2 distinct canal and 2 separate foramina at the apex.
- Type VI: Start 2 discrete canals at pulp floor and unite to form single canal at the midpoint then divides to form 2 distinct canal and 2 separate foramina at the apex.
- Type VII: Single canal exits the pulp, bifurcates and reunites within the root, and lastly again bifurcates

All data analysis was performed in STATA 14. Mean and SD were calculated for continuous variables and frequencies and percentages for qualitative variables. Chi-square test was run to stratify canal configuration and number of canals among age group and genders to see effect modifiers. P≤0.05 was statistically significant level.

RESULTS

The males were 44(55%) and females were 36(45%). The mean age was 34.93±9.03 years with range from 20 to 56 years. The most common age group was 20 to 30 years (n=32, 40%) followed by 31 to 40 years (n=25, 31.25%) as shown in figure 1. The most common type of canal configuration was type II (n=31, 38.75%) followed by type IV (n=27, 33.75%). In 44(55%) participants there was single canal, in 35(43.75%) were two canals and in 1(1.25%) were three canals. (Table 1)

Type II canal was more in males (n=25, 56.82%)

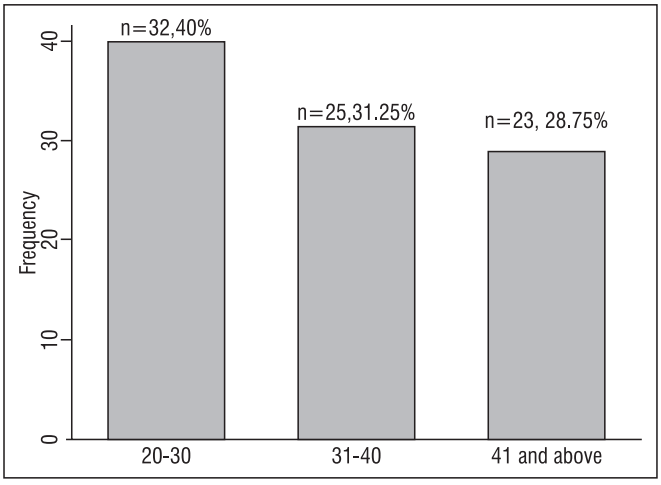

Fig 1: Age distribution of the study

TABLE 1: FREQUENCY OF CONFIGURATION AND NUMBER OF CANALS

Variable	Sub-category	Frequency	Percent
Configuration of canal	I	13	16.25
	II	31	38.75
	III	1	1.25
	IV	27	33.75
	V	8	10
No. of canal	1	44	55
	2	35	43.75
	3	1	1.25

TABLE 2: FREQUENCY OF CONFIGURATION AND NUMBER OF CANALS STRATIFIED BY STRATIFIED GENDER=

		Male	Female	P-Value*
		n (%)	n (%)	0.003
Configuration of canal	I	4(9.09)	9(25)	
	II	25(56.82)	6(16.67)	
	III	1(2.27)	0(0)	
	IV	10(22.73)	17(47.22)	
	V	4(9.09)	4(11.11)	
Number of canals	1	28(63.64)	16(44.44)	0.121
	2	15(34.09)	20(55.56)	
	3	1(2.27)	0(0)	

*Chi-square test

TABLE 3: FREQUENCY OF CONFIGURATION AND NUMBER OF CANALS STRATIFIED BY STRATIFIED AGE GROUP

Group	Sub group	20-30 years	31-40 years	40 & above years	P-Value*
No. of canal	1	21(65.63)	12(48)	11(47.83)	0.353
	2	11(34.38)	12(48)	12(52.17)	
	3	0(0)	1(4)	0(0)	
Configuration of canal	I	4(12.5)	6(24)	3(13.04)	0.496
	II	14(43.75)	6(24)	11(47.830	
	III	0(0)	0(0)	1(4.35)	
	IV	10(31.25)	10(40)	7(30.43)	
	V	4(12.5)	3(12)	1(4.35)	

*Chi-square test

than females (n=6, 16.67%). Type I canal configuration was more in females (n=9, 25%) than males (n=4, 9.09%). These differences were statistically significant (P=0.003). The number of canals among was not statistically significant (P=0.121). (Table 2)

Frequency of configuration (P=0.353) and number of canals (P=0.496) stratified by stratified age group were statistically significant. The details are given in Table 3.

DISCUSSION

The objective of this study was to evaluate the root canal morphology for maxillary second premolar using two periapical radiographs. Our results showed that the most common type of canal configuration was type II (38.75%) followed by type IV (33.75%). Most common number of canal was single followed by double and least

was triple. Sexual dimorphism was found for canal configuration.

Successful root canal therapy is total debridement and three dimensional sealing of the entire root canal system.[11] Maxillary premolars have variable anatomy with respect to number and configuration of canals. Canals divide and rejoin in various configurations to form complex anatomy.[12] Prior knowledge of root canal system is of prime importance for successful endodontic treatment.[13]

In this study we used two periapical radiographs in horizontal parallax technique to determine the number and configuration of canals. Although the gold standard for determining number and configuration of canals is cone beam computed tomography (CBCT) but it is expensive and not available in operative dentistry departments in our country. Previous studies also used two periapical radiographs for determining the number and configuration of canals.[10,14]

Our findings showed that in 44(55%) participants there was single canal, in 35(43.75%) were two canals and in 1(1.25%) were three canals. Previous studies showed variable number of canals in upper second premolars. A CBCT based study conducted at Karachi on 115 maxillary second premolars. Their results showed that 57(49.6%) cases had one canal and 56 (48.7%) had two canals and 2 (1.7%) had three canals.[14] These results are closure to our study. Another study conducted in Pakistan using conventional two radiographs in SLOBE technique reported that in maxillary second premolar, one canal was present in 25% and two canals was found in 75%.[10] Another study conducted on western population reported that single canal is most common (75%) followed by two canals (24%) and least are three canals (1%).[9] The variations in results can be due to genetic and ethnic variability.

Our results showed that the most common type of canal configuration was type II and type IV on basis of vertucci classification. Similar results were found in previous study.[10] Al-Zubaidi et al.[8] conducted a study in Saudi Arabia using CBCT and reported that the most common configuration of root canal in upper second bicuspid was type I (60%) followed by type II (16%). The variations in results can be due to genetic differences but use of difference tool of measurement can a factor as we used conventional radiographs while they used CBCT.

There are limitations of this study that it has small sample size, single centered and used conventional radiographs. Furthermore large sample, multi-centered and CBCT based studies are indicated on this subject.

CONCLUSION

Within the limits of this investigation it can be concluded that for maxillary second premolars upto half cases in our population have two canals and common type of canal configuration are type II and IV.

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4 Shamsul Alam:	Interpretation of results and literature search
5 Rizwan Qureshi:	Research supervision and critical reviewing
6 Farooq Kamran:	critical review