ROOT CANAL MORPHOLOGY IN MAXILLARY 2ND PREMOLAR USING CONE BEAM COMPUTED TOMOGRAPHY (CBCT) IN PATIENTS BELONGS TO PESHAWAR KHYBER PAKHUNKHWA

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ABSTRACT

Objectives: *The objective of this study was to investigate the root canal morphology in maxillary second premolar in a sample of Peshawar population.*

Methods and materials: *This cross sectional study was conducted on 200 CBCT images in Khyber College of Dentistry, Peshawar. The inclusion criteria were both genders, Pakistani nationals and age range from 20 to 50 years. CBCT images of maxillary second bicuspid which were unclear, distorted, have been endodotically treated, having post or other pathologies were excluded. Age and gender were recorded from data base available with CBCT. The assessment of root canal system of upper second premolar was done on basis of Vertucci classification. Stratification of canal morphology among age groups and gender was performed by running Chi-square/Fisher exact test.*

Results: *The mean age of the participants was 33.84±8.53 years. The males were 118 (59%) and females were 82 (41%). More than half of the participants had single canal (n=107, 54%) and 91(46%) had two canals. Most common morphology of canals according to Vetucci's classification was types II having 77 (38%) and type IV having 67 (34%). In young ages (20-30 years) the frequency of single canal was 56 (62%) while in old ages (41-50 years) it was 21(38%). These differences were statistically significant (p=0.009). However, the configuration among various age groups was not statistically significant (p=0.208).*

Conclusion: *Prevalence of two canals are very common in maxillary second premolar. The common root canal configurations are type II and IV in this tooth.*

Key words: *Maxillary second premolar, root canal system, number of canal, CBCT*

INTRODUCTION

Many dental procedures like crown preparation and endodontic therapy need comprehensive knowledge of dental anatomy[1]. Root canal therapy is biomechanical preparation of root canal system and their subsequent three dimensional sealing with long sustainable material[2]. The treatment success depends on how the root canal system was debrided and prepared to receive a well defined sealing[3]. Many factors play role in the success of endodontic treatment including proper case selection, accurate diagnosis, adequate clinical skill and profound knowledge of root canal system[4].

Maxillary second premolar is among the challenging tooth from endodontic treatment point of view. This is because of variation in number, morphology of canals, and presence of extra root among as well as within the population[5]. The morphology of canal in upper second premolar is not simple running

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of single canal from pulp floor to tooth apex but is very complex involving divisions and unions along its pathway[6,7]. The gold standard classification system for describing the complex root anatomy is the Vertucci's classification[8].

For diagnosing root canal system the role of radiograph is of paramount importance. The periapical radiograph by using parallax technique can elucidate the root canal system. However, periapical radiograph is two dimensional and is not well suited for these complex morphologies[9]. Cone beam computed tomography (CBCT) is the recent advancement in dental science which can create three dimensional anatomy, has less radiation dose and expose less area to radiations[10].

An investigation carried out on western population found that single canal is present in 75%, two canals are in 24% and three canals are in 1% in upper second premolars[11]. A Saudi study on root canal morphology of maxillary second premolar using CBCT found in 83% cases there is one root, two roots in 16% and three roots in 1%. On basis of Vertucci's classification most numerous type in upper second bicuspid was type I (60%) followed by type II (16%)[5].

To our knowledge there is lack of research on root canal morphology of upper second premolar using CBCT in our population. So the aim of this study was to investigate the root canal morphology in maxillary second premolar in a sample of Peshawar population.

MATERIALS AND METHODS

This cross sectional study was conducted on 200 CBCT images available at radiology department, Khyber College of Dentistry, Peshawar from 2019 to 2021. Ethical approval was sorted from hospital ethical committee. No ethical approval was deemed necessary from patients as these data do not affect confidentiality of the participants.

The inclusion criteria were both genders, Pakistani nationals and age range from 20 to 50 years. CBCT images of maxillary second bicuspid which were unclear, distorted, endodontically treated, having post or other pathologies were excluded. Age and gender were recorded from data base available with CBCT.

The assessment of root canal morphology of maxillary second premolar was done on the basis of Vertucci classification as below;

• 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

Data were entered in Microsoft Excel sheet 2016 and imported to SPSS 22. Continuous variables like age were computed as mean and standard deviation and categorical like gender and root canal morphology as frequencies and percentages. Stratification of canal morphology among age groups and gender was performed by running Chi-square/Fisher exact test. The level of significance was kept at $P \leq 0.05$.

RESULT

The mean age of the participants was 33.84±8.53 years with range from 20 to 50 years. The males were 118 (59%) and females were 82 (41%). Most common age groups were 20-30 years with 91 (46%) participants and 41-50 years having 55 (28%) subjects. (Table I)

Most common morphology of the root canals according to Vetucci's classification was types II having 77 (38%) and type IV having 67 (34%). More than half of the participants had single canal (n=107, 54%) and 91(46%) had two canals. (Table II)

Single canals were more in males (n=74, 63%) than females (n=33, 40%) while two canals were more prevalent in females (n=49, 60%) than males

(n=42, 36%). (Table III) . In young ages (20-30 years) the frequency of single canal was 56 (62%) while in old ages (41-50 years) it was 21(38%). These differences were statistically significant (p=0.009). However, the configuration among various age groups was not statistically significant (p=0.208). (Table IV)

DISCUSSION

This study was aimed to investigate the root canal morphology in maxillary second premolar in a sample of Peshawar population. Our findings showed that more than half of the participants had single canal and 46% had two canals. The common type of canal morphology according to Vetucci's classification was types II (38%) and type IV (34%).

The success of endodontic care depend on complete debridement of root canal system and subsequently their three dimensional complete sealing[12]. Literature shows that maxillary second bicuspid have variable anatomy and complex configuration[3,13].

Parallax technique using two periapical radiographs can be used for studying root canal morphology in upper second premolars but have many demerits[14,15]. We used CBCT to determine the exact morphology of root canal system in upper second premolar. Literature shows variable results regarding the prevalence of number of canal in upper second premolar. A Pakistani study on Karachi population by Siddiqui et al. on one hundred and fifteen cases found that single canal was present in 49.6% , two canal in 48.7% and three canals in 1.7%[15]. The results of Siddiqui et al are closure to our study. However, another Pakistani study using parallax technique reported that 25% have one canal and 75% have two canals in upper second bicuspids[14]. Another study on western population reported the prevalence of single canal was 75% , two canals were 24% and three canals were 1%[11].

Our results showed that the common type of canal morphology according to Vetucci's classification was types II (38%) and type IV (34%). A previous conducted study also reported that types II and type IV were commonest root canal morphology in upper second premolars[14] Al-Zubaidi et al.[5] 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 among

Table I: Frequency of gender and age group

Parameter	Characteristic	N = 200 n(%)
Gender	Male	118 (59)
	Female	82 (41)
Age group (years)	20-30	91 (46)
	31-40	54 (27)
	41-50	55 (28)

Table II: Frequency of configuration and number of canals

Variable	Characteristics	n (%)
Configuration of canal	I	34 (17)
	II	77 (38)
	III	3 (1.5)
	IV	67 (34)
	V	19 (9.5)
No. of canal	Single	107 (54)
	Two	91 (46)
	Three	2 (1.0)

Table III: Number and configuration of canal in upper second premolar in both genders

	Characteristic	Male, N = 118	Female, N = 82	P-Value*
No of canals	Single	74 (63)	33 (40)	0.002
	Two	42 (36)	49 (60)	
	Three	2 (1.7)	0 (0)	
Configuration	I	10 (8.5)	24 (29)	<0.001
	II	65 (55)	12 (15)	
	III	3 (2.5)	0 (0)	
	IV	29 (25)	38 (46)	
	V	11 (9.3)	8 (9.8)	

*Fischer exact test

Table IV: Number and configuration of canal in upper second premolar in various age groups

	Characteristic	20-30 years n(%)	31-40 years n(%)	41-50 years n(%)	P-Value*
No of canals	Single	56 (62)	30 (56)	21 (38)	0.009
	Two	35 (38)	22 (41)	34 (62)	
	Three	0 (0)	2 (3.7)	0 (0)	
Configuration	I	13 (14)	13 (24)	8 (15)	0.208
	II	35 (38)	16 (30)	26 (47)	
	III	3 (3.3)	0 (0)	0 (0)	
	IV	30 (33)	18 (33)	19 (35)	
	V	10 (11)	7 (13)	2 (3.6)	

*Fischer exact test

various populations can be due to genetic and ethnic factors.

CONCLUSION

Within the limits of this study it can be concluded that upto half individuals have two canals in maxillary second premolars. The common root canal configurations in maxillary second premolars are type II and IV.

REFERENCES

1. Pan JYY, Parolia A, Chuah SR, Bhatia S, Mutalik S, Pau A. Root canal morphology of permanent teeth in a Malaysian subpopulation using cone-beam computed tomography. BMC Oral Health. 2019;19(1):1-15.
2. Jakovljevic A, Nikolic N, Jacimovic J, Pavlovic O, Milicic B, Beljic-Ivanovic K, et al. Prevalence of apical periodontitis and conventional nonsurgical root canal treatment in general adult population: an updated systematic review and meta-analysis of cross-sectional studies published between 2012 and 2020. J Endod. 2020;46(10):1371-86. e8.
3. Dahlström L, Lindwall O, Rystedt H, Reit C. 'Working in the dark': Swedish general dental practitioners on the complexity of root canal treatment. Int Endo J. 2017;50(7):636-45.
4. Chubb DWR. A review of the prognostic value of irrigation on root canal treatment success. Aust Endod J. 2019;45(1):5-11.
5. Al-Zubaidi SM, Almansour MI, Al Mansour NN, Alshammari AS, Alshammari AF, Altamimi YS, et al. Assessment of Root Morphology and Canal Configuration of Maxillary Premolars in a Saudi Subpopulation: A Cone-Beam Computed Tomographic Study. BMC Oral Health. 2021;21(1):1-11.
6. Tahmasbi M, Jalali P, Nair MK, Barghan S, Nair UP. Prevalence of middle mesial canals and isthmi in the mesial root of mandibular molars: an in vivo cone-beam computed tomographic study. J Endod. 2017;43(7):1080-3.
7. Filpo-Perez C, Bramante CM, Villas-Boas MH, Duarte MAH, Versiani MA, Ordinola-Zapata R. Micro–computed tomographic analysis of the root canal morphology of the distal root of mandibular first molar. J Endod. 2015;41(2):231-6.
8. Ballullaya SV, Vemuri S, Kumar PR. Variable permanent mandibular first molar: Review of literature. J Conserv Dent. 2013;16(2):99.
9. Patel S, Durack C, Abella F, Shemesh H, Roig M, Lemberg K. Cone beam computed tomography in e ndodontics–a review. Int Endod J. 2015;48(1):3-15.
10. McGuigan MB, Theodorakou C, Duncan HF, Davies J, Sengupta A, Horner K. An investigation into dose optimisation for imaging root canal anatomy using cone beam CT. Dentomaxillofac Radiol. 2020;49(7):20200072-78.
11. James L, Gutmann, Fan B. Tooth morphology, isolation and access. In: Hargreaves KM, Berman LH. Cohen′s Pathways of the pulp. Mosby Elsevier, St. LuisMissouri 2015; 130-208.
12. Krell KV, Caplan DJ. 12-month success of cracked teeth treated with orthograde root canal treatment. J Endod. 2018;44(4):543-8.
13. Estrela C, Holland R, Estrela CRdA, Alencar AHG, Sousa-Neto MD, Pécora JD. Characterization of successful root canal treatment. Braz Dent J. 2014;25:3-11.
14. Hussain SM, Khan HH, Bhangar F, Alam M, Yousaf A, Ibrahim A. Evaluation of root canal configuration of maxillary second premolar in armed forces institute of dentistry Rawalpindi. Pak Arm Force Med J. 2020;70(2):605-09.
15. Siddiqui TM, Wali A, Qamar N. Frequency of two canals in maxillary premolars at a dental teaching institution. J Pak Dent Assoc. 2012;21:173-6.