Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/vg1a0d16

DETAILED MORPHOLOGY OF MAXILLARY FIRST PREMOLARS FOLLOWING ORTHODONTIC EXTRACTION

Dr. Momena Rashid[1], Dr. Hurraia Zahid[2], Dr. Aiman Hassan[3], Dr. Umer Ullah[4], Dr. Arbab Zia Ur Rehman[5*], Dr. Muhammad Ahmad Tayyab[6], Dr. Arbab Shahkar Hamid[7]

[1]Assistant Professor, Oral Biology, Rehman College of Dentistry, Peshawar, Pakistan
[2]Assistant Professor, Oral Biology, Sardar Begum Dental College, Gandhara University, Peshawar, Pakistan
[3]PG, Department of Oral Biology, Khyber Medical University Peshawar, Pakistan
[4]Assistant Professor, Oral and Maxillofacial Surgery, Rehman College of Dentistry, Peshawar, Pakistan
[5*]Associate Professor, Oral Biology, HBS Dental College and Hospital, Islamabad, Pakistan
[6]House Officer, Rehman College of Dentistry, Peshawar, KPK, Pakistan
[7]Abbottabad International Dental College, Abbottabad, Pakistan

***Corresponding author:** Dr. Arbab Zia Ur Rehman
*Email: arbabzia6@gmail.com

ABSTRACT

Background: The objective of this study was to evaluate the morphological variations in orthodonticaly extracted maxillary first premolars.

Method: A descriptive cross-sectional study was conducted in the 'Department of Oral Biology at Rehman College of Dentistry, Peshawar, from June 15, 2022, to December 15, 2022'. Following ethical approval, a total of 207 maxillary first premolars from individuals of both genders aged 18 and above were examined. The teeth were categorized into four groups based on root morphology. Data analysis was performed using SPSS (version 21).

Results: Among the 207 patients, 104 were female, and 103 were male, with an average age of 32.02 years (ranging from 18 to 55 years) and a standard deviation of 13.45 years. Bifurcated teeth were the most common, accounting for 42.05% of cases, followed by laminated teeth at 30.43% and single-rooted teeth at 23.18%. Only 4.34% of the patients had teeth with three roots.

Conclusion: Bifurcated andlaminated roots in maxillary first premolars are more common in our population. Morphology of maxillary first premolar shows great variation in their root configuration in different ethnicities.

Keywords: Morphology, maxilla, orthodontics, premolar, bicuspid, root.

INTRODUCTION

The internal and external anatomical studies of maxillary first premolars have revealed that variations in anatomy can happen in all sets of teeth and can be extremely complex.[1] The tooth has two cusps, with the buccal cusp being lengthier than the palatal cusp. Another important feature of this tooth is the mesial developmental groove which is present on the mesial surface.[2] Although different studies have reported the structure of the root, along with its canal configuration, can differ considerably among various populations.[3] The root of the Maxillary 1st premolar has 3 forms of

root ranging from a single root to multiple root forms.[4]with the two roots or bifurcated root to be the common type.[5] The tooth typically has two roots but it can also have a single root. [6] Pedersen mentioned a high incidence of one-root maxillary first premolars in the East Greenland Eskimo dentitions.[7] Vertucci et al. proposed the system which is the most commonly used system for roots of maxillary first premolars.[8]Premolars might exhibit multi-roots and complex canal configurations, representing a challenge to the clinicians**.**There is variation in number and configuration of roots of maxillary first premolars. Anatomical variations seen in the root and canal studies documented; so far have multifactorial contributions. These include age, gender, ethnicity, and study design.[9] Significant racial variation of root and canal morphology of maxillary first premolars have been investigated and reported in previously published studies**.** Maxillary 1st premolars are commonly extracted for orthodontic treatment because of their position and varying shape with most types of discrepancies in cases that require the retraction of anterior teeth. 'Maxillary first premolars are unique due to their diverse root anatomy, which is a well-documented aspect of root morphology and a subject of interest in dental research. Studies have examined these variations across different populations, including South Asians (Nepalese), Southeast Asians (Singaporeans), East Asians (Chinese), West Asians (Jordanian and Saudi Arabian), as well as European and African groups'

Justification of this study is that premolars are crucial dental structures which play significant role in chewing and maintaining over all dental health. Understanding different types of root is vital for a dental practioners as it can aid in diagnosis, planning and execution of dental procedures which can help prevent complications and improve treatment out comes. It will also shed light on environmental and genetic factors which influence dental development.

The objective of this study was to evaluate the morphological variations in orthodonticaly extracted maxillary first premolars.

METHODOLOGY

This research was conducted in the 'Oral Biology Department at Rehman College of Dentistry, Peshawar, from June 15, 2022, to December 15, 2022' using a descriptive cross-sectional study design.

After obtaining informed consent, 207 maxillary first premolars from individuals over 18 years of age with fully developed roots and closed apices were analyzed. Teeth exhibiting pathologies, restorations, caries, or developmental anomalies were excluded.

The sample size was determined using 'G* Power software (version 3.1.9.4) with a significance level of 0.05, medium effect size (0.3), and a confidence level of 95.1%. A convenience sampling method was employed'.

Following extraction, the teeth were immediately cleaned and stored in labeled containers containing a 10% formalin solution. The root morphology of these teeth was assessed and categorized into four groups. The prevalence of different root types was analyzed using frequencies and percentages.Statistical analysis was done with SPSS (version 21). Frequencies and percentages were calculated for different types of root types.

RESULTS

The findings revealed that the study included 104 females (50.25%) and 103 males (49.75%), with an average age of 32.02 years, ranging from 18 to 55 years, and a standard deviation of 13.45 years (Table I).

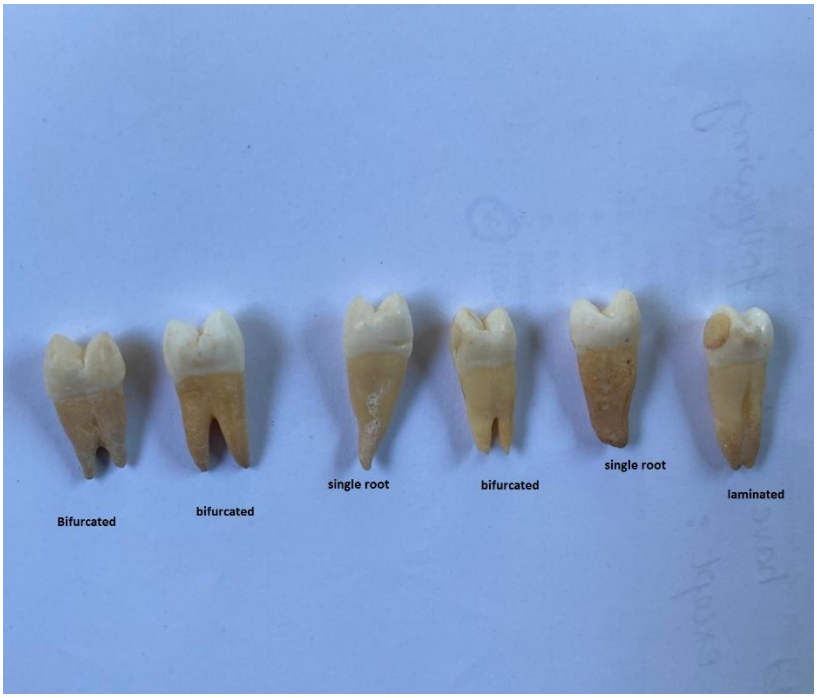
Among the examined teeth, bifurcated roots were the most prevalent (n=87, 42.05%), followed by laminated roots (n=63, 30.43%) and single-rooted teeth (n=48, 23.18%). Only 9 patients (4.34%) had teeth with three roots (Table II).

Table 1: Distribution of Age and Gender Among Patients (n=207)

Age	Gender
'Range':18-55 years	'Male' :103(49.75%)
'Mean': 32.02 years (± 13.45)	'Female' :104(50.25%)

Table 2: Distribution of Root Morphology(n=207)

Root types	Male	Female	Total
Single Root	22(45.84%)	26(54.16%)	48(23.18%)
Bifurcated	44(50.57%)	43(49.43%)	87(42.05%)
Laminated	30(47.61%)	33(52.39%)	63(30.43%)
3 Roots	7(77.78%)	2(22.22)	9(4.34%)
Total	103(49.75%)	104(50.25%)	207(100%)



DISCUSSION

Maxillary first premolars show a lot of variation in their morphology. This is in sharp contrast to maxillary 2nd premolars which have a consistent morphology.[10] These teeth have characteristics of both canine and molars as they occupy space between the two. Canines are mostly used for aesthetics and cutting whereas molars are used for chewing, thus maxillary first premolars exhibit qualities of both.[11]The maxillary first premolar typically has two roots. However, there can be variations in root anatomy that lead to different types of root configurations. These variations are important for dental professionals to understand in order to effectively diagnose and treat dental issues.[12]

Our study revealed that the bifurcated root form is more common as compared to the other types of roots. These results are similar to a study done in Uganda where 'two root form in maxillary 1st premolar tooth was more prevalent with only 16.9% of people having single root' [13] Population of Poland, Saudi Arabia, Kosovo and Turkey also have prevalence of two root form.[14] However in Jordan a study revealed 63.2% of the population had a single root.[15]Several studies done in China revealed the single root form to be as high as 72.2%.[16] These results show considerable variation from other Asian population. Our study also showed single root form to be 23.18% which is in accordance with studies done in other Asian countries.[17] Al though the exact reason for variation in root configuration is not exactly known but it can be due to a combination of factors including genetics, evolutionary adaptation, and functional demands. These factors can result in differences in root number, length, shape, and overall morphology.[18]

Our study revealed laminated root form to be 30.43%. The exact reason why roots fuse is not fully understood but it can occur when two separate tooth germs merge during development, creating a tooth with a larger and more complex root structure.[19] The roots may appear fused or partially fused, leading to a "laminated" appearance. Our results are in accordance with other

studies done in asia which showSingaporean population has prevalence of laminated roots as high as 32.1 %.[20]

The presence of three roots in a maxillary first premolar is considered an anatomical variation or anomaly. Our study showed 4.34% of patients to have 3 roots in their maxillary first premolars. Normally, maxillary first premolars have two roots: a mesial root and a distal root. However, in some individuals, a third root may be present, typically located between the mesial and distal roots. This third root is often referred to as a "middle" or "buccal" root[21]. The development of tooth roots is a complex process involving interactions between various tissues. Sometimes, these interactions can lead to the formation of an extra root, resulting in a maxillary first premolar with three roots. Environmental factors, genetics, evolution and developmental disturbances also might have a role in forming 3 roots which is considered an anamoloy.[22] Diagnostic tools likeX-rays, cone beam computed tomography are essential to identify the number of roots in teeth, including premolars. Proper identification of the root configuration is important for dental procedures like root canal treatments, extractions, and restorative work.

Limitation

Root configuration anomalies, including the presence of additional roots, can vary among different ethnic groups and populations. If a study is conducted on a specific ethnic group or geographic region, the results might not be applicable to other populations.

CONCLUSION

Bifurcated andlaminated roots in maxillary first premolars are more common in our population. Morphology of maxillary first premolar shows great variation in their root configuration in different ethnicities. Dental surgeons need to be vigiliant while treating maxillary first premolars because of its diverse and complex root morphology to give proper treatment to their patients.

REFERENCES

1. Senan EM, Madfa AA, Alhadainy HA. Root and canal configuration of mandibular first molar in a Yemeni population: A cone-beam computed tomography. Eur Endod J. 2020; 5(1):10-17.
2. Kapila S, Kaur T, Bhullar RS, Sandhu A, Dhawan A, Kaur A. Use of physics forceps in atraumatic orthodontic extractions of bilateral premolars: A randomized control clinical study. J Maxillofac Oral Surg. 2020.; 19(3):347-354.
3. Araujo MT, Caldas DL. Tooth extractions in orthodontics: First or second premolars? Dental Press J. orthod. 2019; 24(3):88-98.
4. Tian YY, Guo B, Zhang R, et al. Root and canal morphology of maxillary first premolars in a Chinese subpopulation evaluated using cone-beam computedvtomography. Int endodont j. 2012; 45(11):996- 1003.
5. Al-Shehri S, Al-Nazhan S, Shoukry S, Al-Shwaimi E, Al-Shemmery B. Root and canal configuration of the maxillary first molar in a Saudi subpopulation: A cone-beam computed tomography study Saudi Endod J. 2017;7:69–76.
6. Khan M, Khan RM, Javed MQ, Ahmed A. Root canal configuration of the mesio-buccal root of maxillary first permanent molars in local population JIIMC. 2018;13:210–14
7. Ahmad IA, Alenezi MA. Root and root canal morphology of maxillary first premolars: A literature review and clinical considerations J Endod. 2016;42:861–72
8. Vertucci FJ. Root canal morphology and its relationship to endodontic procedures Endod Top. 2005;10:3–29.
9. Nazeer MR, Khan FR, Ghafoor R. Evaluation of root morphology and canal configuration of maxillary premolars in a sample of Pakistani population by using cone beam computed tomography J Pak Med Assoc. 2018;68:423–7.
10. Alqedairi A, Alfawaz H, Al-Dahman Y, Alnassar F, Al-Jebaly A, Alsubait S. Cone-beam computed tomographic evaluation of root canal morphology of maxillary premolars in a saudi population Biomed Res Int. 2018;2018:8170620.

11. Hanif F, Ahmed A, Javed MQ, Khan ZJ, Ulfat H. Frequency of root canal configurations of maxillary premolars as assessed by cone-beam computerized tomography scans in the Pakistani subpopulation. *Saudi Endod J.* 2022;12(1):100-105.
12. Allawi S, Madarati AA, Al-Tayyan M. Evaluation of roots and root canals' morphology of maxillary premolars in a Syrian subpopulation using cone-beam computed tomography. *Saudi Endod J*. 2023;13(2):168-76.
13. Faraj BM, Abdulrahman MS, Faris TM. Visual inspection of root patterns and radiographic estimation of its canal configurations by confirmation using sectioning method. An ex vivo study on maxillary first premolar teeth. BMC Ora HeaL. 2022;22(1):166-8.
14. Gündüz H, Özlek E. Evaluation of Root Morphology and Root Canal Configuration of Mandibular and Maxillary Premolar Teeth In Turkish Subpopulation By Using Cone Beam Computed Tomography. East J Med. 2022;27(3)64-9.
15. Alsaket YM, El-Ma'aita AM, Aqrabawi J, Alhadidi A. Prevalence and Configuration of the Second Mesiobuccal Canal in the Permanent Maxillary First Molar in Jordanian Population Sample. Iran Endod J. 2020;15(4):217-21.
16. Wu D, Hu DQ, Xin BC, Sun DG, Ge ZP, Su JY. Root canal morphology of maxillary and mandibular first premolars analyzed using cone-beam computed tomography in a Shandong Chinese population. Med. 2020;99(20):111-6.
17. Liu X, Gao M, Bai Q, Ruan J, Lu Q. Evaluation of palatal furcation groove and root canal anatomy of maxillary first premolar: A CBCT and micro-CT study. BioMed Res Int. 2021;2021-5.
18. Liu X, Gao M, Ruan J, Lu Q. Root canal anatomy of maxillary first premolar by microscopic computed tomography in a Chinese adolescent subpopulation. BioMed Res Int.2019;201-9.
19. Pan JY, 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 ora heal. 2019;19(1):1-5.
20. AlRahabi MK, Ghabbani HM. Endodontic management of a three-rooted maxillary premolar: A case report. JTUMS. 2019;14(3):312-6.
21. Mahore D, Alam S, Mishra SK, Kumar A. Endodontic management of three rooted maxillary first premolar and presence of an associated three rooted second premolar. UJDS. 2020;6(1):64-6.
22. Buchanan GD, Gamieldien MY, Tredoux S, Vally ZI. Root and canal configurations of maxillary premolars in a South African subpopulation using cone beam computed tomography and two classification systems. J Ora Sci. 2020;62(1):93-7.