

ORIGINAL ARTICLE

Evaluation of sexual dimorphism in human premolars using longitudinal ground sections- An Institutional study

Dr. Mohammed Hussain¹, Dr. Rubeena Anjum², Dr. Mandeep Kaur³, Dr. Nidhi Khajuria⁴, Dr. Nitish Bhat⁵, Dr. Ashanka Bhardwaj⁵

1. Post Graduate Student, Department of Oral & Maxillofacial Pathology & Oral Microbiology, IGGDC, Jammu
2. Professor & Head, Department of Oral & Maxillofacial Pathology & Oral Microbiology, IGGDC, Jammu
3. Assistant Professor, Department of Oral & Maxillofacial Pathology & Oral Microbiology, IGGDC, Jammu
4. Lecturer, Department of Oral & Maxillofacial Pathology & Oral Microbiology, IGGDC, Jammu
5. Tutor, Department of Oral & Maxillofacial Pathology & Oral Microbiology, IGGDC, Jammu

How to cite: Hussain M, Anjum R, Kaur M, Khajuria N, Bhat N, Bhardwaj A, Evaluation of sexual dimorphism in human premolars using longitudinal ground sections- An Institutional study, *Int J Forensic Odontology*.2023.8;1:1-6
DOI: <https://doi.org/10.56501/intjforensicodontol.v8i1.574>

Received on: 25-12-2022 **Accepted on:** 28-02-2022 **Web Published on:** 13-03-2023

ABSTRACT

Introduction: Sex determination plays an important role in forensics. On average, males possess larger tooth crowns than females in contemporary human populations, although the degree of dimorphism varies within different populations. Ground sectioning of teeth can provide an accurate measurement of enamel and dentinal thickness and can be used for gender determination in forensic analysis.

Aim: The main aim of this study is to evaluate sexual dimorphism in human premolars using longitudinal ground sections.

Materials & Method: In this study extracted premolar teeth of males and females were taken. Longitudinal ground sectioning of these teeth was made and later examined under light microscope under customized grids.

Results: Data was statistically analyzed and results were tabulated. It was found that enamel area and average enamel thickness was higher in females than males and coronal dentinal areas were more in males.

Conclusion: Results of this study suggest that the differences in crown morphology among males and females can be used as a potential tool in forensic analysis.

Keywords: Sexual dimorphism, average enamel thickness, forensic analysis, ground sectioning.

Address for Correspondence:

Dr. Mohd Hussain

Post Graduate Student,

Department of Oral & Maxillofacial Pathology & Oral Microbiology, IGGDC, Jammu.

Email Id: hussynmazhar01@gmail.com

INTRODUCTION

Teeth are the hardest structures in the human body. During a disaster even after the other tissues are destroyed, teeth have been found to survive.¹ As the dental tissues are resistant to environmental assaults such as incineration, immersion, trauma, mutilation and decomposition they are therefore invaluable for identification on fragmentary adult skeleton.^{2,3} Teeth are readily accessible for examination and since no two teeth have similar morphology, they form an excellent forensic tool for sex determination.³ Various features of the teeth, such as morphology, crown size, and root lengths, are characteristic for male and female sexes. There are also differences in the skull patterns. These will help a forensic odontologist to identify the sex.⁴ In most contemporary human populations, males possess larger permanent molar crowns than females. Historically, this dimorphism has been viewed as being primarily due to larger amounts of either enamel or dentine. Some authors suggested that it is enamel while others found significant differences in the amounts of dentine.⁵ Canines, amongst all the teeth, have been shown to exhibit the maximum sexual dimorphism. Teeth adjacent to canines share with it a tendency for greater dimorphism; the greater the canine dimorphism, the greater the sexual dimorphism of adjacent teeth.⁶ The aim of this study was to evaluate sexual dimorphism in human premolars using longitudinal ground sections.

METHODOLOGY WITH STATISTICAL ANALYSIS

Extracted teeth were taken from the Oral & Maxillofacial Surgery Department of IGGDC Jammu after gaining an approval by Institutional Ethical Committee of IGGDC Jammu. 10 extracted premolar teeth of males and 10 extracted premolar teeth of females were taken. Only those teeth which were extracted for orthodontic reasons were included in this study. Extracted teeth were collected & washed thoroughly and then stored in 10 % formalin. These extracted teeth were mounted in dental stone for the purpose of holding the root during ground sectioning (Fig. 1A). A line was marked on each tooth buccolingually from the occlusal surface down to the cervical line in the centre of each tooth. With the help of carborundum disc attached to micromotor longitudinal sections were made and final fine grinding of these sections ($50\mu m$) were made with the help of Arkansas stone. Final finishing, clearing & mounting of tooth sections were done before viewing under microscope (Fig.

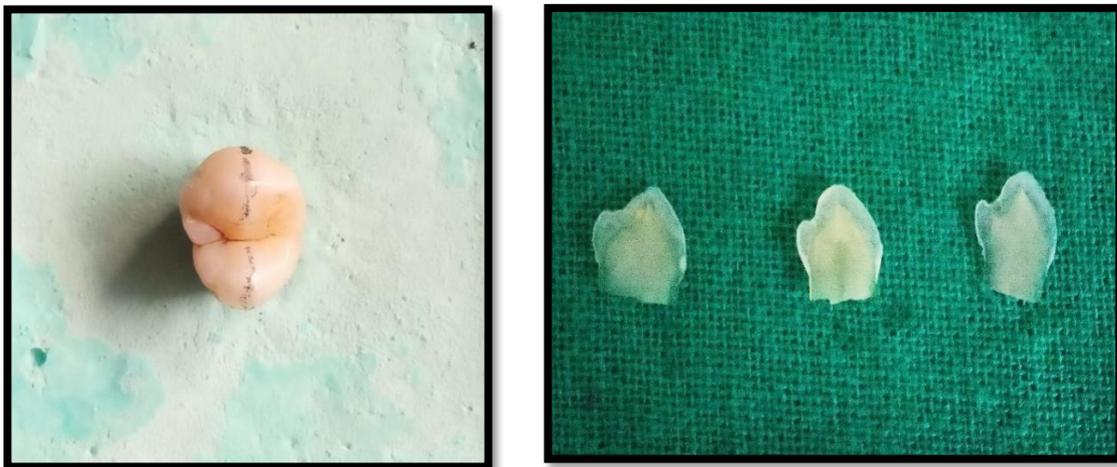


FIG. 1 (A): MOUNTING OF EXTRACTED TEETH IN DENTAL STONE FOR HOLDING THE ROOT DURING SECTIONING. (B): FINAL GROUND SECTIONS OF TEETH AFTER FINISHING.

METHODS OF MEASUREMENT

The mounted slide was placed under the microscope over which the customized grid was placed. At least 4 rectangular grids were included starting from one end of the crown to another end in such a way so as to include the whole crown. Parameters measured were Enamel area (EA), Coronal dentinal area (CDA), Bicervical diameter (BCD), Length of DEJ & Average enamel thickness (AET) (Fig. 2). Four boxes were included in each section in the enamel region which were added up to obtain the total enamel area. All the rectangular grids which fall in dentinal area were counted and added up to obtain the coronal dentinal area. For measuring bicervical diameter rectangular grids from one cervical end to another end were measured and length measured along the DEJ and added up to obtain the total length for measuring DEJ length. For measuring average enamel thickness the total enamel area was divided by length of DEJ.

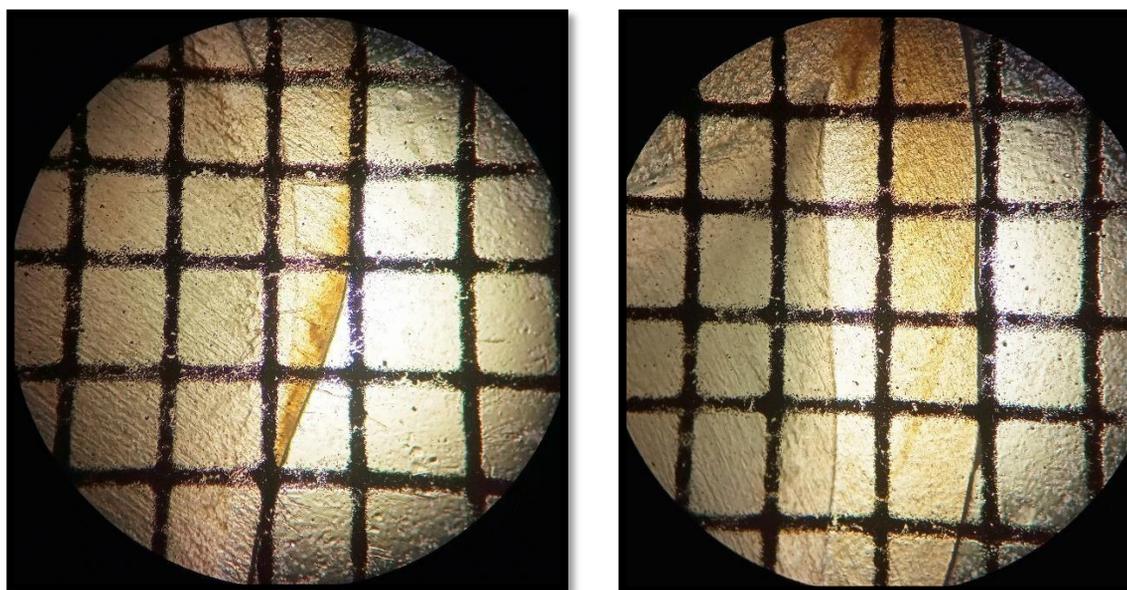
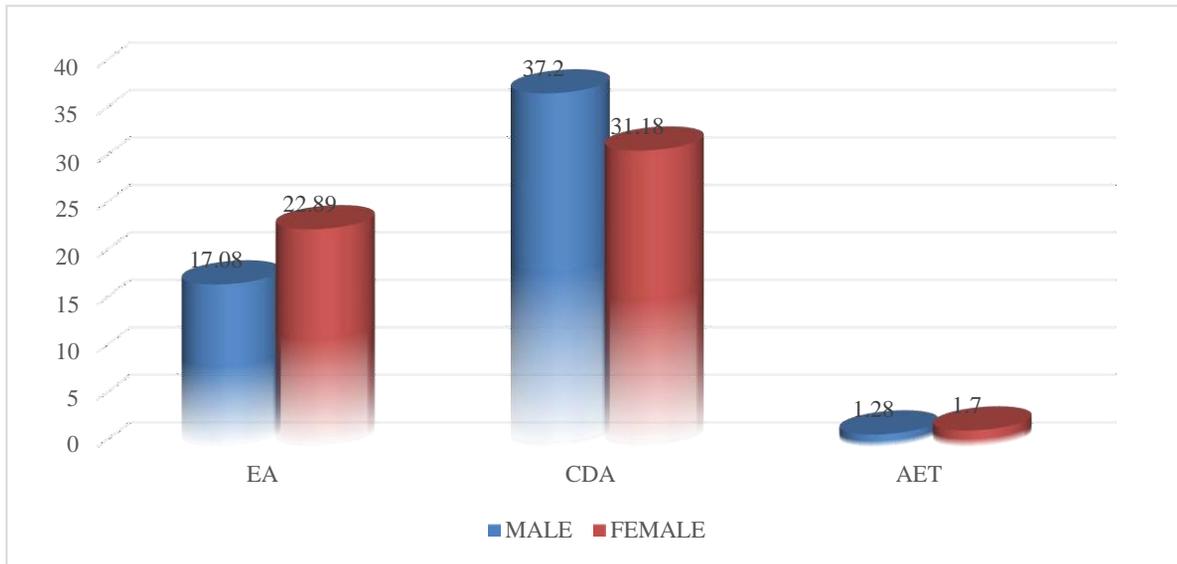


FIG. 2: GROUND SECTIONS OF PREMOLARS AS VIEWED UNDER MICROSCOPE OVER WHICH CUSTOMISED GRID IS PLACED.

RESULTS

Enamel area, Coronal dentin area, Average enamel thickness, Bicervical diameter were measured for premolar teeth from both males and females. Values obtained were tabulated and subjected to statistical analysis using independent sample t-test to compare between male and female. There was statistically significant difference in EA, CDA and AET between male and female [Table 1]. It was found that enamel area (EA) and average enamel thickness (AET) was higher in females than males and coronal dentinal areas (CDA) were more in males whereas there was no significant difference in bicervical diameter (BCD) and length of DEJ of premolar teeth among males and females. [Graph 1]



GRAPH 1: GRAPH SHOWING EA, CDA, AET IN PERMANENT PREMOLARS BETWEEN MALES AND FEMALES.

Table 1: Comparison of mean values of EA, CDA, BCD, DEJ Length and AET in males and females.

SL. NO	VARIABLE		MEAN (SD)	P VALUE
1.	EA	MALE	17.08 ± 1.50	0.00*
		FEMALE	22.89 ± 0.96	
2.	CDA	MALE	37.2 ± 1.54	0.00*
		FEMALE	31.18 ± 1.29	
3.	BCD	MALE	7.19 ± 0.78	0.80
		FEMALE	7.11 ± 0.61	
4.	DEJ Length	MALE	13.1 ± 0.65	0.62
		FEMALE	13.25 ± 0.67	
5.	AET	MALE	1.28 ± 0.11	0.00*
		FEMALE	1.7 ± 0.11	

*p< 0.05; Significant

DISCUSSION

Sexual dimorphism represents a group of morphologic characteristics that discriminate gender of an individual. Among these dimorphic traits, literature indicates that tooth has been assessed in different populations for its applicability in investigations pertaining to identification.⁷ Teeth are one of the strongest human tissues and are known to resist a variety of antemortem and postmortem insults.⁸ Tooth size standards based on odontometric investigations can be used in age and sex determination as human teeth exhibit sexual dimorphism. Males possess larger tooth crowns than females in contemporary human populations.³ There is evidence of the effect of genes on both osseous and dental structures. The Y chromosome is largely responsible for size of teeth by controlling the thickness of dentine, whereas the X chromosome only controls the thickness of enamel.⁹ The use of permanent first premolar teeth highlights the importance of situations when only posterior teeth are

available for examination as anterior teeth are usually prone to be lost due to trauma and developmental anomaly. Bharti A et al also pointed out that since canine showed a highest degree of sexual dimorphism, the teeth neighboring to canine, that is, lateral incisor and first premolar showed greater sexual dimorphism compared with the remaining teeth.⁶ A study done by Dinakaran J et al found that upper first premolar exhibited higher degree of sexual dimorphisms.¹⁰ In the present study, we used permanent first premolar teeth because it is frequently extracted due to orthodontic reason and such teeth showed least loss of enamel due to attrition or abrasion. It was believed by many researchers that males possess a greater crown and dentin size than females due to a longer bell stage of tooth development when the dentin was deposited before the onset of amelogenesis. A study done by R.N.M. Feeney et al significant differences in the components of enamel thickness were found in the maxillary canine and first premolar, with males having significantly greater values for dentine area and DEJ length.¹¹ In our study males possess greater coronal dentin area than females although there were no significant differences in DEJ length in males & females. In the present study females possess greater enamel area (EA) and average enamel thickness (AET) than males which were also in consistent with the study done by Monalisa, et al.¹² Although there was no significant difference between the Bicervical diameter (BCD) & length of DEJ between males and females in the present study and the results were in consistent with the study done by Monalisa, et al.¹² As the results of the present study showed the correlation between the crown morphology of males and females and the males possess greater CDA than females and the females possess greater EA & AET than females. These differences can be used as a diagnostic aid in forensic analysis when there is need to determine the sex of unknown individuals.

CONCLUSION

Forensic Odontologists play a vital role in the process of identification. In instances when only fragments of the body are recovered, the tooth is the chief tool that can be used to determine sex of an individual. Dentition allows simple and easy methods for sex determination as well as the more advanced and sophisticated techniques. It is therefore very important that a Forensic Odontologist is acquainted and familiar with most, if not all of the methods for sex determination by dentition.

Financial support and sponsorship - Nil

Conflicts of interest - There are no conflicts of interest

REFERENCES

1. Ibrahim AN, Bhat V, Shenoy SM, Shetty VA. Quantitative evaluation of DNA from the tooth pulp exposed to varying temperatures. *NUJHS*. 2016;6(3):6-9.
2. Anjum R, Kaur M, Hussain M, Shafi S. DNA in forensic odontology: An overview. *Indian J Forensic Community Med*. 2022;9(1):25-28.
3. Kapila R, Nagesh K, Iyengar A, Mehkri S. Sexual Dimorphism in Human Mandibular Canines: A Radiomorphometric Study in South Indian Population. *J Dent Res Dent Clin Dent Prospects*. 2011; 5(2):51-54.
4. Nagare SP, Chaudhari RS, Birangane RS, Parkarwar PC. Sex determination in forensic identification, a review. *J Forensic Dent Sci*. 2018; 10(2):61-6.
5. Schwartz GT, Dean MC. Sexual Dimorphism in Modern Human Permanent Teeth. *American Journal of Physical Anthropology*. 2005; 128(2):312–317.

6. Bharti A, Angadi PV, Kale A D, Hallikerimath SR. Efficacy of “dimodent” sex predictive equation assessed in an indian population. J Forensic Odontostomatol. 2011;29(1): 51 – 56
7. Kalistu SN, Doggalli N. Gender Determination by Forensic Odontologist: A Review of various methods. Journal of Dental and Medical Sciences. 2016;15(11): 78-85
8. Soundarya N, Jain VK, Shetty S, Akshatha BK. Sexual dimorphism using permanent maxillary and mandibular incisors, canines and molars: An odontometric analysis. J Oral Maxillofac Pathol. 2021; 25:183-8.
9. Manica S, Liversidge H, Hector M. Can human maxillary premolar crown dimensions discriminate between males and females? Bull Int Assoc Paleodont. 2018;12(2):41-6.
10. Dinakaran J, Dineshkumar T, Nandhini G, Priyadharshini N, Rajkumar K. Gender determination using dentition. SRM J Res Dent Sci. 2015; 6:29-34
11. Feeney RNM, Zermeno JP, Reid DJ, Nakashima S, Sano H, Bahar A, et al. Enamel thickness in Asian human canines and premolars. Anthropological Sci. 2010; 118(3):191–198.
12. Monalisa W, Kokila G, Sharma HD, Gopinathan PA, Singh OM, Mayur S. Sexual dimorphism of enamel area, coronal dentin area, bicervical diameter and dentinoenamel junction scallop area in longitudinal ground section. J Oral Maxillofac Pathol 2018; 22:423-9



Published by MM Publishers
<https://www.mmpubl.com/ijfo>

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.
To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

Copyright ©2023 Mohammed Hussain, Rubeena Anjum, Mandeep Kaur, Nidhi Khajuria, Nitish Bhat, Ashanka Bhardwaj