

Gender determination using maxillary central incisor and maxillary canine**Anjali S, Prashanth Shenai¹, Laxmikanth Chatra², Veena KM¹, Prasanna Kumar Rao¹, Tashika Kushraj³**

Post Graduate Student, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India; ¹Professor, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India; ²Senior professor and Head, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India; ³Reader, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

Address for Correspondence:

Dr. Anjali S, Postgraduate Student, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

ABSTRACT:

Background: Teeth are a valuable tool in forensic investigation as it provides resistance to damage in terms of bacterial decomposition and fire. Aim of this study is to investigate whether there is any sexual dimorphism observed in mesiodistal (M-D) dimension of permanent maxillary central incisors, and permanent maxillary canines.

Method: 30 pre-treatment maxillary casts of subjects were selected for the study. The Mesio-distal width of maxillary central incisors (right and left) and maxillary canines (right and left) were measured using Vernier Caliper.

Result: Mesiodistal dimensions of left maxillary central incisors were significantly different in males compared to those in females.

Conclusion: Left maxillary central incisors can be used for sex determination with more accuracy in the case of females than males

Keywords: Gender determination, maxillary central incisors, maxillary canine, mesio-distal

INTRODUCTION

Teeth are good sources of material for civil and medicolegal identification.¹ Teeth are resistant to damage in terms of bacterial decomposition and fire making it a valuable tool in forensic investigation.² Enamel is the hardest substance in the body. Teeth are made up of this and hence can withstand any trauma than any other tissues in the body. Teeth of various species is known to exhibit sexual dimorphism.³ It can be applied to dental identification because no two teeth are alike.⁴ Males usually have a larger dentition than females in human populations. Tooth morphology and crown size are characteristic features in males and females.⁵

The anterior teeth are important in dental and facial esthetics. It is readily seen during eating, speech, mastication and facial gesticulation. The maxillary central incisors occupy a

strategic anatomical position, in the centre of upper arch.⁶ Canines are least frequently extracted teeth being less affected by periodontal diseases.⁷ The variations in tooth form are the common occurrence in permanent dentition and these variation have an ethnic, forensic and anthropological significance.⁸ The Mesio-distal and Bucco-lingual diameter of the permanent tooth crown are the two most commonly used and researched features used in determination of sex on the basis of dental measurements.⁹

The aim of the present study was to investigate whether there is any sexual dimorphism observed in the mesiodistal (M-D) dimension of permanent maxillary central incisors, and permanent maxillary canines. It was also aimed to investigate the accuracy with which these could be employed for the gender determination in a population.

MATERIALS AND METHODOLOGY

The present study was conducted on pretreatment records taken from the dental department. 30 pre-treatment maxillary casts of subjects, 15 males and 15 females were selected for the study. Maxillary casts of subjects between the age of 17 and 25 were included with fully erupted maxillary central incisors/maxillary canine having intact contact area, normal overjet and overbite. Any attrited, abraded, malpositioned, restored, carious or fractured teeth were excluded from the study. The maximum mesiodistal dimension of each tooth [maxillary right & left central incisors (Figure 1) and maxillary right and left canines (Figure 2)] was measured with the help of a vernier caliper.



Figure 1: maximum mesiodistal dimension of maxillary right central incisors using vernier calipers



Figure 2: maximum mesiodistal dimension of maxillary right canine using vernier calipers.

To eliminate any inter-observer error, all the measurements were done by a single

examiner. All the reading was taken three times and the average of three values was calculated to lessen the intra-observer error. The data thus obtained were subjected to statistical analysis by using two-sample t-test to test for statistical difference between means.

RESULTS

In this study males had a greater mean mesiodistal dimensions for each tooth, when compared with females. Left maxillary central incisors showed statistically significant difference in mesiodistal dimension while comparing males and females. (Table 1)

The percentage of dimorphism for each tooth was calculated using the following formula:

$$\text{Percentage of dimorphism} = \{(X_m/X_f) - 1\} \times 100$$

where X_m = mean male tooth dimension; X_f = mean female tooth dimension.¹

The dimorphism of right central incisor, left central incisor, right canine, and left canine were 5.5%, 6.3%, 2.3% and 2.08% respectively. (Table 2)

There are several stepwise discriminant function statistics to develop formulas for determining gender. To determine the gender, the tooth dimensions are multiplied with the respective unstandardized coefficients and added to the constant. The individual was considered a male if the values thus obtained were greater than the sectioning point and was considered female if the value was less than the sectioning point. (table 3) Left maxillary central incisors can be used for gender determination with 66.7% of accuracy in case of females and 60.0% accuracy in case of males. (Table 4)

Table 1: Detailed description of mean, standard deviation and P value of each tooth for males and females

TEETH	SEX	N	MEAN	Std. DEVIATION	t
INCRT	male	15	9.567	.563	1.982 p=.057 ns
	female	15	9.067	.799	
INCLT	male	15	9.500	.500	2.329 p=.027 sig
	female	15	8.933	.799	
CANRT	male	15	8.200	.414	1.217 p=.234 ns
	female	15	8.013	.426	
CANLT	male	15	8.167	.556	.892 p=.38 ns
	female	15	8.000	.463	

(INCRT- right central incisor, INCLT-left central incisor, CANRT-Right canine, CANLT-Left canine)

Table 2: Percentage of dimorphism observed for right and left maxillary central incisors and maxillary canines.

TEETH	% DIMORPHISM
Right Central incisor	5.5145
Left Central incisor	6.3472
Right Canine	2.33
Left Canine	2.0875

Table 3: Average discriminant scores for each sex

Model	Unstandardized coefficients		Standardized coefficients	t	sig
	B	Std. Error	Beta		
1 Constant	3.839	1.794		2.140	.042
CANRT	-.028	.396	-.023	-.071	.944
CANLT	.075	.303	.076	.249	.805
INCRT	.120	.343	.171	.350	.729
INCLT	-.417	.359	-.586	-1.160	.257

a. Dependent variable: SEX

Table 4: Predictability of maxillary left central incisors (actual vs predicted)

		SEX		TOTAL
		MALE	FEMALE	
Gender predicted	Male Count	9	5	14
	%	60.0%	33.3%	46.7%
	Female Count	6	10	16
	%	40.0%	66.7%	53.3%
Total	Count	15	15	30
	%	100.0%	100.0%	100.0%

DISCUSSION

Gender determination in damaged dead bodies or from skeletal remains constitute an important step for identification in medico-legal examination. Forensic odontology plays an important role in identification in man-made and natural disaster. It relies a lot on inexpensive and easy means of identification of persons from fragmented jaws and dental remains. Hence odontometric parameters can be used for determination of gender in a large population because of its simplicity, reliability, and low cost.¹

Doris et al. have reported that the early permanent dentitions provide the best sample for tooth size measurements because it has less damage and less attrition in most individuals.

So the effect of these factors on the actual mesiodistal tooth width would be minimum.¹⁰ Thus only subjects in the 17-25 years' age group were included in the study sample.

This study was evaluated in the South Indian population which showed that the mean male tooth dimensions are greater than females in both maxillary central incisors and canine which is in accordance with previous studies. In Thailand population 80% of the entire dentition exhibited statistically larger male tooth dimension.¹¹ In another study conducted in South Indian population showed that the mean mesiodistal width of maxillary canines was greater among men (right: 7.80+0.45 mm; left: 7.85+0.45 mm) than women (right: 7.55+0.45 mm; left: 7.60+0.44 mm).¹²

The Y-chromosome control the thickness of dentine, whereas the X-chromosome is concerned with the thickness of enamel.¹³ Stroud et al 1994 indicated that males have larger mesiodistal diameter of a single tooth, which may be due to thicker dentine. A study conducted in North Indian population revealed that canines were found to be statistically significant for sexual dimorphism.¹⁴ Mandibular canines are known to exhibit greatest sexual dimorphism.¹⁵

In this study only left central incisors were found to be statistically significant for sexual dimorphism. The sexual dimorphism obtained were 6.34% for maxillary left central incisor.

Another study in South Indians the sexual dimorphism for the right maxillary central incisor has been found to be 1.67% while for the left maxillary central incisor the sexual dimorphism was 1.90%.¹⁶

Cultural, environmental and racial factors are known to influence tooth morphology¹⁷ Variation in food resources has been explained as one such environmental cause. The interaction between environmental and genetic factors could be responsible for the variation in the magnitude of dimorphism.²

CONCLUSION

The study assessed the use of mesiodistal dimension of permanent maxillary central incisors and canines because of its easiness and accuracy. The study showed that left maxillary central incisors can be used for gender determination with 66.7% of accuracy in the case of females and 60% accuracy in the case of males. Thus this study indicates that left maxillary central incisors can be used as an adjunct along with other accepted procedures for gender determination when only fragmentary remains are encountered in mass disasters.

REFERENCES

1. Khangura RK, Sircar K, Singh S, Rastogi V. Sex determination using mesiodistal dimension of permanent maxillary incisors and

canines. *Journal of Forensic Dental Sciences* 2011;3(2):81-5.

2. Rao NG, Rao NN, Pai ML, Kotian MS. Mandibular canine index - a clue for establishing sex identity. *Forensic Sci Int* 1989;42(3):249-54.

3. Dahberg AA. Dental traits as identification tools. *Dent Prog* 1963;3:155-60.

4. Kiesu JA. Human adult odontometrics. In: *The study of variation in adult tooth size*. Cambridge University Press.1990.

5. Dayal PK, Srinivasan SV, Paravatty RP. Determination of sex using tooth. In: *Textbook of Forensic Odontology (1st ed.)*. Hyderabad: Paras Medical Publisher 1998: 40.

6. Kaushal S, Patnaik VVG, Agnihotri G, Jain RL. Maxillary Central incisor morphometry in North Indians-A dimorphic Study. *JPAFMAT* 2005;5:13-7.

7. Parekh DH, Patel SV, Zalawadia AZ, Patel SM. Odontometric Study Of Maxillary Canine Teeth to Establish Sexual Dimorphism in Gujarat Population. *Int J Biol Med Res* 2012; 3(3):1935-7.

8. Williams PL, Bannister LH, Berry MM, Collins P, Dursek, Fergusson MWJ. *Grays anatomy; the teeth*. 38th Ed. Churchill Livingstone, New York. 2000: p.1704

9. Iscan MY, Kedici PS. Sexual variation in bucco-lingual dimensions in Turkish dentition. *Forensic Sci Int* 2003;137:160-4.

10. Doris JM, Bernard BW, Kuftinec MM, Stom D. A biometric study of tooth size and dental crowding. *Am J Orthod* 1981;79:326-36.

11. Ruengdit S, Riengrojpitak S, Tiensuwan M, Santiwong P. The 6th CIFS Academic Day. 2011; 14-15.

12. Bakkannavar SM, Monteiro FNP, Arun M, Kumar GP. Mesiodistal width of canines: a tool for sex determination. *Med Sci Law* 2012; 52:22-6.

13. Garn SM, Lewis AB, Swindler DR, Kerewsky RS. Genetic control of sexual dimorphism in tooth size. *J Dent Res* 1967; 46:963-72.

14. Richardson ER, Malhotra SK. Mesiodistal crown dimension of the permanent dentition of

American Negroes. Am J Orthod 1975; 68:157-64.

15. Vishwakarma N, Guha R. A study of sexual dimorphism in permanent mandibular canines and its implications in forensic investigations. Nepal Med Coll J 2011;13(2): 96-9.

16. Nair P, Rao BB, Annigeri RG. A study of tooth size, symmetry and sexual dimorphism. Forensic Med Toxicol 1999;16(2):10-3.

17. Halim A. Regional and clinical anatomy for dental students. In: general principles of anthropology. 1st Ed, modern publishers. 2001;p.362.

How to cite this article: Anjali S, Shenai P, Chatra L, Veena KM, Rao PK, Kushraj T. Gender determination using maxillary central incisor and maxillary canine. Arch of Dent and Med Res 2016;2(1):1-5.