Estimation of Sexual Dimorphism by Mesiodistal Dimension of Permanent Maxillary Incisors and Canines

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Abstract

Introduction. Sexual dimorphism is the condition where whether the specific body part or the whole body of two sexes of the same species exhibit different characteristics except for the differences in primary sexual organs. Teeth are helpful in determining the sex, stature, race, age etc. same as bony tissues when identification is not possible from rest of the body. Most of the studies conducted earlier are on mandibular dental tissue and literature is sparse on evaluation of maxillary area. We decided to conduct the study on maxillary teeth.

Aims and Objectives. To find the correlation between mesiodistal dimension of permanent maxillary incisors and canines with the gender.

Methods. The study was conducted in Forensic Medicine and Toxicology department, Himalayan Institute of Medical Sciences, SRHU. The objective of the study was For the study sample of 100 individuals were taken out of which 50 were male and 50 female, all in the age group of 17-25 years of age. For measuring the dimension of teeth there comes mesiodistal, Buccolingual, labiolingual, crown heights, diagonal length etc. dimensions, but for our study we selected mesiodistal dimension. Subjects were taken according to the inclusion and exclusion criteria. The results were statistically analysed and compared with other studies.

Results. The study revealed about the definite association between mesiodistal dimensions of anterior maxillary permanent teeth and gender.

Conclusions: The results showed a positive correlation between the width and sexual dimorphism in maxillary canines, incisors and other teeth. Male teeth were greater in width as compared to female teeth in Indian population. More studies with larger number of subjects would be required to establish a proper correlation between maxillary dentition and gender.

Keywords: *Maxilla; sex determination; Teeth; Mesiodistal; permanent.*

Introduction

Sexual dimorphism is the condition where the specific body part or the whole body of two sexes of the same species exhibit different characteristics except for the differences in primary sexual organs. It is a pivotal component of individual identification in forensic medicine.[1] Krogman, conducted several studies regarding accuracy in determination of sex by skeletal remains and concluded that using entire skeleton, sex can be determined with 100% accuracy whereas long bones show 80% accuracy.[2] The cases where only dental tissues were recovered instead of whole skeleton like in cases of mass disaster like flood, earthquakes,

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hurricanes, fire etc. or mutilated body parts, bacterial decomposition, abrasion, high temperature etc., dental tissues may be found intact because of its high resistance against physical and chemical threats among other skeletal tissues. Tooth can be used for purpose of identification and helping the law.[3] Like the other bones of the body, teeth are helpful in determining the sex, stature, race and age when identification is not possible from rest of the body.[4] Garn et al[5] (1967), studied sexual dimorphism using dental tissues, and gave a formula for the determination of degree of sexual dimorphism between males and females as:

$$Sexual\ dimorphism = [\{Male\ mean - Female\ mean\}/\ Female\ mean] \times 100$$

Most of the studies were conducted on mandibular dental tissues earlier. In our study, we chose maxillary dental tissues over mandibular dental tissues for identification purpose due to sparse literature and data available.

The purpose of this study was to look for the correlation between mesiodistal dimension and sexual dimorphism in anterior maxillary teeth in adults and estimation of the percentage of sexual dimorphism in anterior maxillary teeth.

Material and Method:

It is an observational cross sectional study conducted in the Department of Forensic medicine and toxicology, Himalayan Institute of Medical Sciences, SRHU, Dehradun. Ethical clearance was obtained from the Institute's ethical committee prior to conduction of the study. A written informed consent was taken from the subjects after explaining them the procedure, risk and complications. In this study, the mesiodistal dimension of anterior permanent maxillary teeth was measured for determining of sex. 100 subjects (50 male and 50 females). were selected on the basis of the following inclusion and exclusion criteria.

Inclusion criteria-

1. Age of the subjects - above 18years
2. The canines of the subjects should be healthy and fully erupted.
3. There should be no gap in the teeth and no crowding should be present.

Exclusion criteria-

1. Ectopic location of tooth
2. Unhealthy gingiva or any infection
3. Incompletely erupted teeth
4. Various teeth
5. Restoration of canines and incisors
6. Endocrine abnormality affecting the eruption of teeth.

Materials used – Digital Vernier caliper, isopropyl alcohol, cotton.

Procedure- The vernier caliper was set on zero reading and was also checked for no or minimum instrumental error. Then the edges of the vernier caliper with which readings were to be taken were sterilized by using isopropyl alcohol. Procedure along with risks and benefits was described to the subject and the subject was told to widely open his/ her mouth so that all of his/her anterior maxillary dentition was clearly visible to examiner. The edges of the vernier caliper were opened and fixed approximating the edges of the teeth of which the dimensions were to be taken. The readings were noted down up to two decimal digits. The measurements were taken by single observer so as to minimize interobserver error. Readings were taken twice and an average was calculated for each tooth so as to reduce inter-observer error.

Mesiodistal dimension means the width of the tooth between the contact points with other teeth from medial to lateral side.[6]

Table-1 shows that the groups are similar comparing the mean values, standard deviation and standard mean error between the two sexes. The mean values for each tooth was taken under observation for both sexes are as follows

The recorded data was put in Excel sheet for statistical analysis by the software SPSS.

Results

Table-1: Group statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Right Canine	M	50	7.5230	0.74836	0.10583
	F	50	6.9698	0.67353	0.09525
Right lateral Incisor	M	50	6.9400	0.85090	0.12033
	F	50	6.2266	0.75144	0.10627
Right central incisor	M	50	8.4510	0.75956	0.10742
	F	50	7.9198	0.56642	0.08010
Left central incisor	M	50	8.4728	0.68031	0.09621
	F	50	7.9604	0.63025	0.08913
Left lateral incisor	M	50	6.9088	0.79678	0.11268
	F	50	6.2284	0.72174	0.10207
Left canine	M	50	7.4874	0.71300	0.10083
	F	50	6.7718	0.74148	0.10486

For males the mean values for Right canine was 7.5230+_0.74836, Right lateral incisor - 6.9400+_0.85090, Right central incisor - 8.4510+_0.75956, Left central incisor - 8.4728+_0.68031, Left lateral incisor- 6.9088+_0.79678, Left canine- 7.4874+_0.71300 and for Females the mean values for Right canine - 6.9698+_0.67353, Right lateral incisor - 6.2266+_0.75144, Right central incisor- 7.9198+_0. 56642, Left central incisor- 7.9604+_0.63025, Left lateral incisor- 6.2284+_0.72174, Left canine- 6.7718+_0.74148.

On comparing these mean values for both males and females, the mean values of all teeth taken under consideration for males were greater in comparison to those of females. By using these mean values and putting them in the formula given by Garn et Al., we can estimate the percentage of sexual Dimorphism in the teeth taken under observation. After putting the data in the formula, the percentage of sexual dimorphism exhibited by each teeth were as follow:

Right canine – 7.93%, Right lateral incisor- - 11.45%, Right central incisor – 6.70%, Left central incisor – 6.4%, Left lateral incisor – 10.92%, Left canine – 10.56%. Among all teeth taken under observation, all teeth show significant amount of sexual dimorphism and the maximum values were of right lateral incisor followed by left lateral incisor then left canine and right canine then right central incisor then left central incisor.

Table 2 shows that when independent t-test was done, the sig (2-tailed) value came out to be 0.000 (i.e. $p<0.05$). Due to this result we can say that there is statistically significant difference in mean mesiodistal dimension of tooth in males and female

Table-2: Significance of data by t-test and Levene's test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Right Canine	Equal variances assumed	2.447	.121	3.885	98	.000	.55320	.14239	.27064	.83576
	Equal variances not assumed			3.885	96.932	.000	.55320	.14239	.27060	.83580
Right lateral Incisor	Equal variances assumed	.381	.538	4.444	98	.000	.71340	.16054	.39481	1.03199
	Equal variances not assumed			4.444	96.524	.000	.71340	.16054	.39475	1.03205
Right central incisor	Equal variances assumed	7.306	.008	3.964	98	.000	.53120	.13400	.26529	.79711
	Equal variances not assumed			3.964	90.625	.000	.53120	.13400	.26502	.79738

Cont... **Table-2: Significance of data by t-test and Levene's test**

Left central incisor	Equal variances assumed	.407	.525	3.907	98	.000	.51240	.13115	.25213	.77267
	Equal variances not assumed			3.907	97.433	.000	.51240	.13115	.25212	.77268
Left lateral incisor	Equal variances assumed	.964	.329	4.475	98	.000	.68040	.15204	.37869	.98211
	Equal variances not assumed			4.475	97.057	.000	.68040	.15204	.37865	.98215
Left canine	Equal variances assumed	.094	.760	4.919	98	.000	.71560	.14548	.42691	1.00429
	Equal variances not assumed			4.919	97.850	.000	.71560	.14548	.42690	1.00430

Table-3: Paired sample statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Right central incisor	8.1854	100	0.71806	0.07181
	Left central incisor	8.2166	100	0.70141	0.07014
Pair 2	Right lateral Incisor	6.5833	100	0.87542	0.08754
	Left lateral incisor	6.5686	100	0.83003	0.08300
Pair 3	Right Canine	7.2464	100	0.76092	0.07609
	Left canine	7.1296	100	0.80811	0.08081

Table-4: Paired sample tests

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Right central incisor - Left central incisor	-.03120	.55905	.05591	-.14213	.07973	-.558	99	.578
Pair 2	Right lateral Incisor - Left lateral incisor	.01470	.81920	.08192	-.14785	.17725	.179	99	.858
Pair 3	Right Canine - Left canine	.11680	.69669	.06967	-.02144	.25504	1.677	99	.097

Table 3 According to our hypothesis, there should be no difference in mean mesiodistal dimension of a pair of teeth in same person.

Table 4 On applying paired t-test, the sig (2- tailed) value were found much higher than 0.05. This shows that there is a significant difference between the dimensions of both teeth of a pair.

Discussion

The exact values of sexual dimorphism are calculated by the formula given by Garn et al. Other studies were also completed by using the same formula.

Rajbir Kaur khangura et al. in their study found that males show a greater mesiodistal dimension as compared to females. The canines in study of Zeinab Davoudmanesh et al showed a greater mean width in case of males as compared to females. Contradictory to this, the maxillary right canine in the study of Sharlene Sara Babu showed a greater mean width for females as compared to males.

In our study, all the teeth under observation showed a greater mean mesiodistal width for males and significant values of percentage of sexual dimorphism as for Right canine- 7.93%, right lateral incisor- 11.45%, right central incisor- 6.70%, left central incisor- 6.4%, left lateral incisor- 10.92%, left canine- 10.56%. Right lateral incisor leading the values followed by the left lateral incisor then the left canine. The canines in study of Gloria Staka also showed greater value of mean mesiodistal width with the percentage of sexual dimorphism of 3.71%.

Here, in our study the maximum sexual dimorphism is shown by the right lateral incisor but in the study done by Neelakshi Pandey and Mang Shin Ma maximum sexual dimorphism is exhibited by right maxillary canine. In our study, the mean value of right canine in males is greater than that of females and can be supported by the evidence that the mean values of mesiodistal dimensions of male maxillary incisors is greater than that of females as seen in the study conducted by Madhavi Yuwanati in 2012.

Conclusion

The results show a positive correlation between the width and sexual dimorphism in maxillary teeth, and not only canines and incisors, other teeth also exhibit sexual dimorphism. Male teeth are greater in width as compared to female teeth in Indian population. More studies are required to be done on dentition, not only incisors and canines' of maxilla only, but other teeth also are required to be studied. Mesiodistal dimension is not the only one parameter for sexual dimorphism, but other parameters are also there that are needed to be touched.

Ethical Clearance: All ethical clearances were obtained from Institutional review board and ethics committee.

Source of Funding: Self

Conflict of Interest: Nil

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