

Original Research Article

Gender Predictability of Permanent Maxillary First Molar – A South Indian Study

Anjana Mohan Kumar¹, Veena KM², Laxmikanth Chatra³, Prashanth Shenai², Prasanna Kumar Rao⁴

¹Post graduate student, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India

²Professor, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India

³Senior professor and Head, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India

⁴Professor and acting HOD, AJ Institute of Dental Science, Mangalore, Karnataka, India

***Corresponding author**

Dr. Anjana Mohan Kumar

Email: anjanamohan99@gmail.com

Abstract: The study investigates the gender predictability of permanent maxillary first molar teeth. Mesio distal width of 30 permanent maxillary first molar teeth from casts of 15 male and 15 female patients between the age group of 17- 25 were measured. Results showed that permanent maxillary first molar tooth exhibited sexual dimorphism but accuracy of gender predictability was only moderate.

Keywords: sexual dimorphism, maxillary first molar, gender determination, gender dimorphism, human identification, mesio distal width

INTRODUCTION

Human identification is the recognition of an individual based on physical characteristics unique to that individual. Identification of human remains during mass disasters is often hindered by the state of the soft tissue. Hence several methods have been devised for identification from skeletal remains [1].

The four main attributes of biological identity that the forensic anthropologists wish to determine are the gender, age, stature, and ethnic or racial background of the individual, of which gender determination is often the first step.^[1] This is because it halves the number of possible matches and also subsequent methods for age and stature estimation are often gender dependent. Among the various skeletal parts, pelvis and skull are traditional indicators of gender and the accuracy rate of determining the correct sex is as much as 100% [1].

The major advantage of dentition is that it is often preserved, even when the bony structures of the body are destroyed, because of its physical characteristics and the protection it acquires from the jaw bones. It has the ability to resist the destructive action of the medium in which they are found better than any other skeletal structures. For this reason, the use of dental morphology to determine sexual

dimorphism is a procedure established in anthropological and biological studies [2].

The existence of sexual dimorphism in permanent teeth is also a known phenomenon, as observed in several investigations [2]. Though not as accurate as the skeleton, tooth crown dimensions are reasonably accurate predictors of sex and are useful adjuncts in sex assessment especially in young individuals where skeletal secondary characters have not yet developed.

The present study aims to determine gender of an individual based on the mesiodistal dimensions of permanent maxillary first molar teeth on casts and analyse sexual dimorphism exhibited by the tooth.

MATERIALS AND METHODS

The present study is conducted on pre-treatment records taken from the medical records department of our dental college, Mangalore. 30 pre-treatment maxillary casts of patients of known sex (15 males and 15 females) and aged between 17 to 25 years were selected. The models were selected based on an inclusion and exclusion criteria.

Inclusion criteria

- Fully formed permanent maxillary right and left first molar
- Caries, attrition & abrasion free
- Intact contact area

Exclusion criteria

- Missing first molar
- Any pathology or anomaly
- Any restorations
- Mal aligned teeth

Mesio distal width of maxillary right and left first molars was measured using verniercallipers. Mesio-distal width (MDW) is measured as the maximum distance (in mm) between the contact points with the second premolar and second molar teeth; (Figure 1)

Gender dimorphism was calculated using the formula-
 Gender dimorphism = [(mean male tooth dimension/ mean female tooth dimension) – 1] × 100 [3].

In order to obtain a reference point to differentiate males from females, this study adapted the procedure used by Rao, Rao, Pai et al., [4]. If the linear values of the Mesio-distal dimensions are higher than their respective reference points the individual is considered to be a male otherwise the individual is a female.

$$\text{Reference point} = [(\text{mean male dimension} - \text{SD}) + (\text{mean female dimension} + \text{SD})] / 2.$$

In order to assess the reliability of the measurements, intra-observer error was tested. The same measurements were obtained from 15 randomly

selected casts from the original sample at a different time by one person. Another observer measured the same randomly selected teeth. Their measurements were analyzed using student t test kappa. There was no statistically significant difference between the findings of the two observers.

The data obtained were subjected to statistical analysis with the Microsoft Excel; descriptive statistics, t-tests and regression analysis were used to compare the dimensions measured for males and females. P-value ≤ 0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

Table 1 shows the descriptive statistics for the mesio distal width of permanent maxillary first molar of both sides in both genders. These values were observed to be higher in males compared with females.

Table 2 shows the test of significant difference between the genders for maxillary crown dimension. The right maxillary mesio-distal width (RMMDW) was significant (p < 0.05), but left maxillary mesio-distal width (LMMDW) was not (p > 0.05).

Table 3 and 4 shows application of regression analysis which again showed that the right maxillary mesio-distal width (RMMDW) was significant (p < 0.05), but left maxillary mesio-distal width (LMMDW) was not (p > 0.05).

Table 5 demonstrates that the percentage of sexual dimorphism exhibited by the right and left permanent maxillary first molar was 3% on both sides.

Table 6 shows accuracy of sexual dimorphism using mesio-distal width of maxillary first molar of both sides.

Table 1: Descriptive statistics for the mesio distal width of permanent maxillary first molar of both sides in both genders.

Parameters	Gender	Side	Mean	SD
Mesio-distal	Male	R	10.483	.412
		L	10.403	.455
Mesio- distal	Female	R	10.133	.467
		L	10.090	.418

Table 2: Test of significant difference between the genders for maxillary crown dimension

Parameter	Gender	Mean	t-stat	P = value	Significance
LMMDW	M	10.483	1.9620	0.06	Not significant
	F	10.090			
RMMDW	M	10.403	2.17700	0.038	Significant
	F	10.133			

Table 3: Application of regression analysis for right maxillary mesio-distal width

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
1 (Constant)	5.764	1.961		2.940	.007
RIGHT	-.414	.190	-.381	-2.177	.038

Dependent Variabe : SEX

Table 4: Application of regression analysis for left maxillary mesio-distal width

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta		
1 (Constant)	5.454	2.017		2.704	.012
LEFT	-.386	.197	-.348	-1.962	.060

Dependent Variabe : SEX

Table 5: Sexual dimorphism of first permanent maxillary molar

Parameter	Right maxillary first molar	Left maxillary first molar
Mesio distal width	3%	3%

Table 6: Accuracy of gender predictability

Side	Male	Female
Right	53.3%	73.3%
Left	40.0%	73.3%



Fig. 1: Showing the measurement of mesiodistal width of maxillary first molar on cast using vernier calliper

DISCUSSION

Gender determination is one of the important factors used to assist in the identification of an individual. Various methods used for gender determination like DNA analysis, bone ossification test etc. can give very precise and accurate results, but are time consuming and expensive; hence odontometry is still considered an important adjunct in gender determination as it is simple, reliable, less time consuming and inexpensive. It can also be used easily in identification of sex in a large population.

In the present study descriptive statistics for mesio-distal widths of maxillary first molar of both

sides in both genders show that the values are higher in males compared with females.

These findings corroborate other studies which reported that males have larger teeth than females [5]. The sexual dimorphism of the male teeth are attributed to the shape of the first molar tooth, which is controlled by the genetic constitution of the individual. The Y chromosome is now known to contribute most in the size of teeth by controlling the thickness of dentine, whereas the X chromosome seems to be responsible for modulating thickness of the enamel [6].

But it was also noted that the mean values were lower than an Indian study, which reported the

mean mesio-distal width for males (11.33 mm right), 11.39 mm (left) and females (10.88 mm right), 10.87 mm (left) [7]. The variations among the different populations can be attributed to genetic, environmental, geographical and nutrition or dietary factors as they are known to affect tooth size [8, 9].

The tests of significant difference between the genders for maxillary crown dimension showed that the right maxillary mesio-distal width was significant than the left maxillary mesio-distal width. This finding is consistent with previous studies conducted by Macaluso Jr [1] and Agnihotri and Sikri [7].

Sexual dimorphism was 3.0% in both the parameters. These values when compared with previous studies are lower. Agnihotri and Sikri reported mesio-distal width of 4.14% (right), 4.78% (left). Macaluso Junior reported mesio-distal width of 4.33%. This difference can be attributed to genetic, environmental and geographic factors. It has been reported that teeth have behaved in many ways in the course of evolution, ranging from reduction of the entire dentition to reduction in a group of teeth in relation to another [10].

The reference point calculated in this study for the right side is 10.34mm i.e. if right mesio-distal width is greater than 10.34 mm the individual is likely to be a male and if it is less than 10.34mm then the individual is likely to be female. Similarly the reference point for the left side was calculated to be 10.23mm. The percentage of cases correctly predicted using right mesio-distal width was 53% for male and 73% for females; while it was 40% for males and 73% for females in the case of left mesio-distal width.

In a similar study conducted by EbohDeo 2012 the percentage of cases correctly predicted using right mesio-distal width was 68% for male and 62% for females; while it was 50% for males and 59% for females in the case of left mesio-distal width [5].

A study conducted on the odontometric sex assessment in Indians showed that the magnitude of sexual dimorphism in Indians is reduced when compared to other populations but similar to South Asian groups [11, 12]. The study showed that there is low univariate sexual dimorphism in Indians—only 37.5% of the entire dentition exhibited statistically larger male tooth dimensions, which is in agreement with results derived from other South Asian populations.

However, the study concluded that the sex identification accuracy is relatively moderate (75%), still relegating the dentition to being an adjunct rather than the sole criteria for sex assessment.

CONCLUSION

The mesiodistal width of permanent maxillary first molar tooth shows sexual dimorphism but the accuracy of gender prediction of the maxillary first molar tooth is only moderate. It also shows that the tooth size standards based on odontometric investigations are population specific and have shown varying degree of sexual dimorphism and it is not uniform in all humans, but can be used as an adjunct for sex assessment especially in mass disasters. But this study is a pilot study and further research has to be done with larger sample size to arrive at a proper conclusion.

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