ORIGINAL ARTICLE

Mesiodistal odontometrics as a distinguishing trait: A comparative preliminary study

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Abstract

Introduction: Sex determination is a vital step in reconstructing an individual profile from unidentified skeletal remnants. Variations in tooth size are influenced by genetic and environmental factors. Tooth size variations have been reported among different populations. **Aim:** To identify the sex by determining the mesiodistal (MD) dimensions of maxillary canines. **Objectives:** (1) To compare the MD diameter of all maxillary canines — (a) in the entire urban and tribal population, (b) in urban male and urban female populations, (c) in tribal male and tribal female populations, and (d) in the entire male and female populations and (2) To estimate the percentage of sexual dimorphism individually in urban and tribal populations. **Materials and Methods:** Fifty subjects each from urban and tribal populations in equal gender ratio were selected in Khammam district, Telangana, for the purpose of this study. After obtaining informed consent, maxillary study models of the selected subjects were made. MD diameters of left and right maxillary canines were measured on casts using vernier calipers. The obtained data were subjected to statistical analysis. **Results:** (1) The total tribal population showed a greater MD diameter of maxillary canines than the total urban population, (2) Urban males showed a greater MD diameter of maxillary canines than urban females, (3) Tribal males showed a greater MD diameter of maxillary canines than tribal females, (4) The entire male population showed a greater MD diameter of maxillary canines than the entire female population, and (5) The percentage of dimorphism between males and females in individual groups was found to be significant. **Conclusion:** The study showed maxillary canines exhibiting significant sexual dimorphism and can be used as a distinguishing trait for sex determination along with other procedures.

Key words: Maxillary canines, mesiodistal, odontometrics, sexual dimorphism

Introduction

Forensic dentistry is an interdisciplinary branch of science that applies to exclusive knowledge of dental science.[1] It plays an important role in determining the sex of the victims whose bodies are mutilated beyond recognition due to a major mass disaster.[2] It constitutes the foremost step

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for gender identification in medicolegal examination and bioarchaeology.[3] Sex can be determined based on the data from morphology of skull and mandible, metric features, and by DNA analysis of teeth.[2]

The science of forensic dentistry considers the relationship between teeth and jaws as evidence to law and justice, and one of the principal objectives in this field is personal identification and sex determination.[1] Teeth are the most indestructible part and chemically the most stable tissues in the body and exhibit the least turnover of natural structure.[4] Hence, teeth can provide excellent material in both living and nonliving populations for anthropological, genetic, odontological, and forensic investigations.

Sex determination using dental features is primarily based upon the comparison of tooth dimensions in males and females or upon the comparison of frequencies of nonmetric dental traits such as Carabelli's trait of upper molars, deflecting wrinkle of lower first molars, a distal accessory ridge of the upper and lower canines, or shoveling of the upper central incisors.[5]

Males possess larger tooth crowns than females in contemporary human populations. This may be due to a longer period of amelogenesis for both deciduous and permanent dentition in males.[6] The mesiodistal (MD) crown diameter of teeth is an important factor that affects the alignment of teeth in the bony arches and the development of occlusion during transition of dentition.[7]

Of all the teeth in the human dentition, canines are the least frequently extracted teeth possibly because of the relatively decreased incidence of caries and periodontal disease, and canines are reported to withstand extreme conditions and have been recovered from human remains even in air disasters and hurricanes.[6]

The present study establishes the impact of the "sex factor" on the morphometry of the maxillary canines and also a comparison between urban and tribal populations.

Materials and Methods

Fifty subjects each from urban and tribal populations in equal gender ratio were recruited from Khammam district, Telangana, for the purpose of this study.

Subjects with the following dental criteria were included in the study:

- Healthy state of gingiva and periodontium
- Caries free teeth
- Normal overjet and overbite
- Absence of space in the anterior teeth
- Normal molar and canine relationship.

After obtaining informed consent maxillary study models of the selected subjects, impressions were taken with alginate impression material, and later study casts were prepared with stone plaster [Figure 1].

The measurements of teeth were taken on an anatomically sound basis. The MD parameters of the maxillary canine teeth were measured using vernier calipers with a resolution of 0.02 mm. The greatest MD width between the contact points of the teeth was taken on the study casts. The data obtained were computed, tabulated, and statistically analyzed for the purpose of establishing sexual dimorphism.

Sexual dimorphism in right and left maxillary canines was calculated using the formula given by Garn and Lens (1967) as follows:

Sexual dimorphism = $(Xm/Xf) - 1 \times 100$

where Xm = mean value of males, Xf = mean value of females

Results

The mean values of the MD width of left and right maxillary canines in males and females of both urban and tribal populations were obtained by measurement on plaster models and analyzed. Collected data were entered in an Excel sheet and were used for statistical analysis. The mean value of the maxillary canine width in males and females on the right and left sides were compared using *t*-test.

Table 1 shows a comparison of total urban and tribal populations with respect to the width of individual teeth (total).

Table 2 shows the level of accuracy in determining sex by comparing right and left maxillary canines separately in urban males and females .

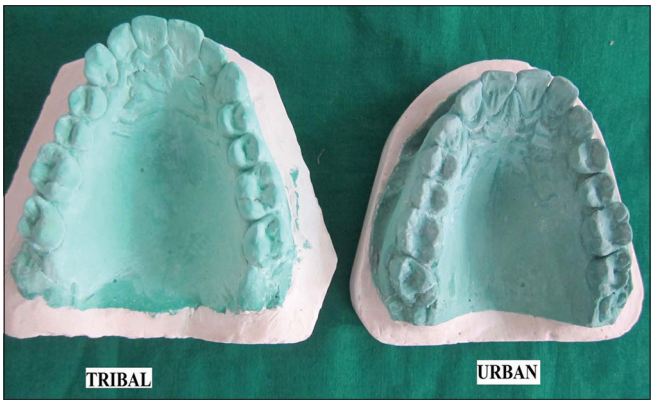

Figure 1: This figure shows maxillary cast model of urban and tribal populations

Table 3 shows the level of accuracy in determining sex by comparing right and left maxillary canines separately in tribal males and females.

Table 4 shows a comparison of entire urban and tribal male and female populations with respect to width of individual teeth.

Figure 2 shows the range of the measured MD dimension of right and left maxillary canines (which shows sexual dimorphism) for both males and females.

From the results of the present study, it is evident that the MD width of maxillary canines was statistically significant ($p < 0.05$). The mean value was greater in males as compared to females.

Discussion

The study of teeth has been a subject of interest to anthropologists, biologists, paleontologists, and orthodontists. This is because teeth are generally preserved even when the bone structures have been destroyed.[8] Although the DNA profile gives accurate results yet measurement of linear dimensions, such as anthropometric and odontometric parameters, can be used for determination of sex in large population because they are simple, reliable, inexpensive, and easy to measure.[3]

The size of the teeth is of great importance not only to indicate the different activities related to the occlusion or to determine the frequency of dental–tooth anomalies applied to the orthodontic treatment, but also to establish sexual dimorphism.[9] This, therefore, will have great significance in forensic odontology. Because of this, the knowledge of coronary dimensions for the identification of sex when skeletons are found becomes relevant, especially when anatomical parameters are not reliable for identifying a particular subject.

Lund and Mornstad studied 58 dental casts of Swedish subjects and found the canines to be the most dimorphic tooth[4]; this finding was consistent with our result. Various theories have been given to explain canine dimorphism as follows:[3]

- According to Moss, it is because of the greater thickness of enamel in males compared to females, which resulted from the long period of amelogenesis
- Y chromosomes produces slower male maturation.

Garn and Lewis (1967) and Lysell and Myrberg (1986) concluded that mandibular canine with accuracy levels of 6.4% and 5.7%, respectively, demonstrates the greatest sexual dimorphism among all teeth.[10]

Mohammed *et al*. (1997) in his study on Saudi Arabian population observed that the mean MD width of the maxillary canines having values of 7.54 ± 0.68 mm (right) and 7.54 ± 0.67 mm (left) in males, while 6.8 ± 0.925 mm (right) and 6.83 ± 0.934 mm (left) in females, but the differences in males and females were not statistically significant.[11]

Khagura *et al*. (2011) in his study showed that right and left maxillary canines can be used for sex determination with 64% accuracy in the case of females and 58% accuracy in the case of females.[3] The present study establishes the

Table 1: Comparison of urban and tribal populations with respect to width of individual teeth (total)

Tooth	Urban total ($n=50$)		Tribal total ($n=50$)		F	P
	Mean	SD	Mean	SD		
13	0.9733	0.0607	1.0110	0.0646	−2.3271	0.0235*
23	0.9787	0.0618	1.0213	0.0604	−2.7035	0.0090*

*$P<0.05$ SD: Standard deviation

Table 2: Comparison of urban male and urban female populations with respect to width of individual teeth by unpaired *t*-test

Tooth	Male ($n=25$)		Female ($n=25$)		t	P
	Mean	SD	Mean	SD		
13	1.0253	0.0389	0.9213	0.0181	9.3925	0.0000*
23	1.0320	0.0355	0.9253	0.0236	9.6963	0.0000*

*$P<0.05$ SD: Standard deviation

Table 3: Comparison of tribal male and tribal female populations with respect to width of individual teeth by unpaired *t*-test

Tooth	Male ($n=25$)		Female ($n=25$)		t	P
	Mean	SD	Mean	SD		
13	1.0673	0.0351	0.9547	0.0247	10.1516	0.0000*
23	1.0700	0.0217	0.9727	0.0450	7.5509	0.0000*

*$P<0.05$ SD: Standard deviation

Table 4: Comparison of male and female with respect to width of individual teeth in total population (urban + tribal)

Tooth	Male ($n=50$)		Female ($n=50$)		F	P
	Mean	SD	Mean	SD		
13	1.0463	0.0422	0.9380	0.0272	11.8123	0.0000*
23	1.0510	0.0348	0.9490	0.0427	10.1453	0.0000*

*$P<0.05$ SD: Standard deviation

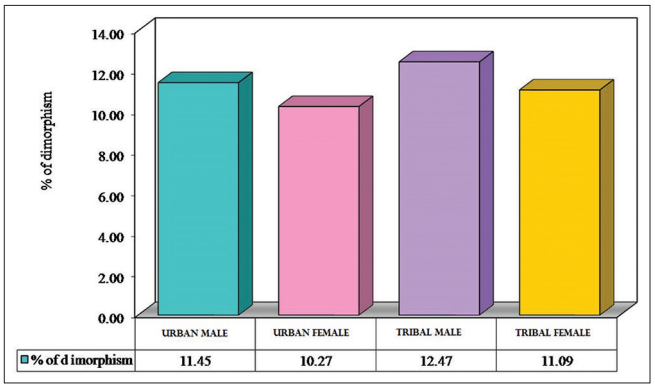

Figure 2: The range of the measured mesiodistal dimension of right and left maxillary canines (which shows sexual dimorphism) for both males and females

existence of a definite statistically significant difference in MD dimension of maxillary canines in the age group 18–40 years and found that only the canines in both the jaws exhibited sexual difference.

Conclusion

The study was carried out to evaluate the use of MD dimension of permanent maxillary canines because of its simplicity and reliability. The study showed that right and left maxillary canines can be used for sex determination both in tribal and urban populations, and also maxillary canines of tribal population have greater MD width than the urban population. The result indicates that the dimorphism in maxillary canines can be immensely used in gender identification in medicolegal examination, and this can be used as an adjunct along with other accepted procedures for sex determination. However, studies involving larger samples are required for more definitive and conclusive results.

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Conflicts of interest
There are no conflicts of interest.

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