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Research paper

Comparative analysis of clinical and experimental methods for determination of sexual dimorphism of mandibular canines

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ABSTRACT

The identification of gender is of significance in case of major disasters where bodies are often damaged beyond recognition Teeth are the hardest and chemically the most stable structure in the body. Moreover teeth show signs of least amount of changes in morphology and are easily accessible for examination. Therefore teeth are a first-rate material for genetic and forensic investigations. Out of all the teeth mandibular canines are considered as the "key teeth" for personal identification. Many studies have not been conducted simultaneously intra-orally and on the dental casts to establish the sexual dimorphism in the mandibular canines. The present study was undertaken in north Indian population to check the significance of intraoral measurements - mesio distal width and inter-canine distance as compared with the measurements on the dental casts. The study revealed that both the methods were equally reliable in gender determination.

1. Introduction

Gender determination is one of the important parameters in forensic identification. Teeth, being the central component of the masticatory apparatus of the skull, are good sources of material for civil and medicolegal identification.[1] The dentition in males is larger than in females in contemporary human populations. Teeth of various species are known to exhibit sexual dimorphism.[2] Mesiodistal and buccolingual diameters of the permanent tooth crown are the two most commonly used and researched features used in determining sex on the basis of dental measurements.[3] The mesiodistal width of mandibular canines and the intercanine distance are a simple inexpensive method that could be useful in forensic odontology establishing sex identity, and is of particular interest in adults aged 18–25 years.[4–8]In the present investigation, the odontometric measurements (mesio-distal width and inter-canine distance) were taken on both-the dental casts and intra-orally. The intraoral readings were compared with the readings of the dental casts and it was found that there was no statistical significance between the two. This indicates that the intraoral readings for the purpose of gender determination are as reliable as the readings taken on the dental casts.

2. Material and methods

2.1. Selection criteria

Sixty subjects, 30 males and 30 females in the age group of 17–21 years were selected for this study. This age group was selected as attrition is minimal in this age group.[9] The study was conducted on the students of Government Medical College, Patiala.

2.2. Inclusion criteria

Subjects with the following status of teeth were included in the study:

1 Healthy state of gingiva and periodontium.
2 Caries free teeth.
3 Normal overjet and overbite.
4 Absence of spacing in the anterior teeth.
5 Normal molar and canine relationship.

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2.3. Instrument

The measurements of mandibular canines were taken on an anatomically sound basis. All measurements were taken using vernier calipers, taking into account the error if any, in the instrument. The calipers used had a resolution of 0.02 mm. A divider with a fixing devise was also used for taking the measurements.

2.4. Measurement procedure

This method was adopted from the method used by Rao et al.[1] The various parameters of the teeth were measured using dividers with a fixing devise and vernier calipers with a resolution of 0.02 mm.

1 A written consent was taken from the subjects after explaining the details of the procedure. All aseptic precautions were taken while making the dental casts and taking the intra-oral measurements.
2 Making of study casts- Impressions of mandibular arches were taken with alginate impression material (irreversible hydrocolloid) and study casts were prepared with stone plaster.
3 The mesiodistal width of the right and left mandibular canines was measured as the greatest mesiodistal width between the contact points of teeth on either side of jaw. These measurements were taken intra-orally and on casts (Figs. 1 and 2).
4 The intercanine distance was measured between the tips of both canines in lower jaw. This was also taken intra-orally and on casts (Fig. 3).

Fig. 1. Mesiodistal width of right canine.

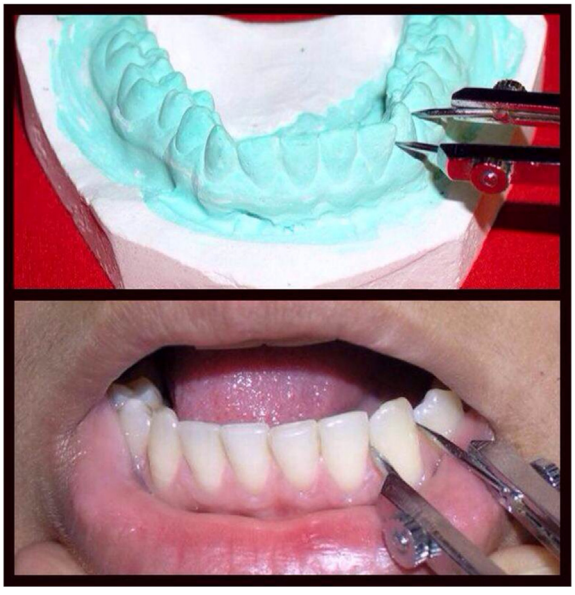

Fig. 2. Mesiodistal width of left canine.

Fig. 3. Intercanine distance.

Table 1
Right canine width- males vs. females.

Group	Sex	Mean (mm)	±S.D.	't'stat	'p'value	Significance
Casts	Males	7.231	0.376	7.34	<0.001	Highly significant
	Females	6.585	0.300			
Intraoral	Males	7.235	0.380	7.52	<0.001	Highly significant
	Females	6.59	0.275			

Table 2
Left canine width- males vs. females.

Group	Sex	Mean (mm)	± S.D.	't'stat	'p'value	Significance
Casts	Males	7.387	0.322	10.48	<0.001	Highly significant
	Females	6.6	0.254			
Intraoral	Males	7.384	0.318	10.47	<0.001	Highly significant
	Females	6.595	0.262			

Table 3
Inter canine distance-males vs. females.

Group	Sex	Mean (mm)	±S.D.	't'stat	'p'value	Significance
Casts	Males	26.003	0.499	3.51	<0.001	Highly significant
	Females	25.001	1.481			
Intraoral	Males	26.073	0.512	3.93	<0.001	Highly significant
	Females	24.954	1.471			

Table 4
Comparison of different parameters in males-Casts vs. Intraoral.

Parameters	Group	Mean (mm)	± S.D.	't'stat	'p'value	Significance
Right Canine Width	Casts	7.231	0.376	0.04	>0.05	Not significant
	Intraoral	7.235	0.380			
Left Canine Width	Casts	7.387	0.322	0.02	>0.05	Not significant
	Intraoral	7.384	0.318			
Inter Canine Distance	Casts	26.003	0.499	0.53	>0.05	Not significant
	Intraoral	26.073	0.512			

Table 5
-Comparison of different parameters in females-Casts vs. Intraoral.

Parameters	Group	Mean (mm)	± S.D.	't'stat	'p'value	Significance
Right Canine Width	Casts	6.585	0.300	0.067	>0.05	Not significant
	Intraoral	6.590	0.275			
Left Canine Width	Casts	6.600	0.254	0.069	>0.05	Not significant
	Intraoral	6.595	0.262			
Inter Canine Distance	Casts	25.001	1.481	0.122	>0.05	Not significant
	Intraoral	24.954	1.471			

5 To minimize errors, all the readings were taken by the same observer. Each reading was taken thrice and their mean was considered as the final reading.
6 Calculation of sexual dimorphism- Sexual dimorphism was calculated by the following formula:

$$\text{Sexual dimorphism} = \frac{\text{Xm}}{\text{Xf}} - 1 \times 100$$

where Xm = Mean of mesiodistal width of males.Xf = Mean of mesiodistal width of females.

2.5. Observations

It is evident from Tables 1 and 2 that the right and left canine width is larger in the males. The difference in males & females is statistically significant. This is true for measurements taken intraorally and from casts.

It is evident from Table 3 that the intercanine distance is larger in the males and the difference in males & females is statistically significant. This is true for measurements taken intraorally and from casts (see Table 4).

From Tables 5 and 6, it is evident that when the same measurements taken intraorally and on the casts are compared, the difference was statistically insignificant. This strongly indicates that in finding the sexual dimorphism of canines, the intraoral parameters are as reliable as the parameters taken on the dental casts.

From the findings, it can be interpreted that in both (Intraoral and cast readings) the left canine is found to exhibit greater sexual dimorphism than the right.

3. Discussion

Mandibular canines are believed to demonstrate the greatest percentage of sexual dimorphism in their mesiodistal width amongst all the teeth.[10–13]The intercanine distances of the mandibular canines also show significant sexual dimorphism.[14–17]

Table 6
Sexual dimorphism in mandibular canines.

Groups	Right canine	Left canine
Casts	9.81%	11.92%
Intra oral	9.78%	11.96%

Many investigators from different countries have studied the sexual dimorphism in canines. Schield[18] observed sexual difference in tooth size among American black, European and Mongoloid populations. The degree of sexual dimorphism of mandibular canine width was more in Ohio Caucasians and Australian aborigines than in Pima Indians and Tristanite population.[19] A study conducted in Saudi Arabia on males and females aged between 13 and 20 years indicated that among all teeth, only the canines in both jaws revealed a significant sexual difference.[20] Similar findings were reported in a study on ethnic Chinese population with normal occlusions.[21] In spite of tooth size variability factors, the canines were consistently larger in the males than the females in all the populations.

Many studies have been conducted on the mandibular canines to establish the sexual dimorphism. Some studies were conducted only on dental casts.[22,23] Some investigators took only intraoral measurements[24,25] while some took both intraoral as well as readings on dental casts.[26,27] In the present study, both intraoral and measurements on casts were taken. The intraoral findings were compared with the findings on the casts. It was found that there was no statistical significance between intraoral and cast measurements. Some authors[28] have suggested that intraoral measurements are less reliable than the cast measurements. But our study suggests that intraoral measurements are equally reliable and can prove to be an effective tool in gender determination.

3.1. Limitations of the study

Inclusion criteria were considered as without them, the standards determined for the population would lose value. Thus, the limitation of the study is that the identification will be restricted to cases with ideal dentition coming under the inclusion criterion.

Conflict of interest

There is no conflict of interest.

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