Original

Canine index in establishing Sex Identity – A Study among the Chennai Population

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Abstract

Human teeth being the hardest, durable and most stable form an exemplary material for anthropological, odontological and forensic investigations. Teeth are well preserved even after death. A major outbreak in the forensics of humans is the identification of sex/gender of the individual. This can be determined anthropometric evaluation. Teeth are readily accessible and do not need special dissection and hence form valuable elements in forensic investigations. There exists sexual dimorphism in the canine width and intercanine distance of mandibular canines. These teeth also exhibit greatest difference in the age of eruption than other teeth. Identification of sex precedes age as this would eliminate the missing/ involved persons of one sex.

Key Words: Canine, Index, Sex determination.

Introduction

Teeth are excellent materials in living and non-living persons and have least turnover rate. Their ability to survive fire and bacterial decomposition makes them an invaluable tool of forensic odontologists.[1,2] Sexual dimorphisms refer to the distinctive differences in size or appearance between the sexes of an animal in addition to the sexual organs themselves. Identification /determination of sex using odontometric investi-gations is simple and the specimens can be obtained without much difficulty.[3] Mandibular canines having a mean age of eruption of 10.87 years, have

- Relatively low incidence of caries
- Least exposed to plaque/ calculus
- Less subjected to heavy occlusal loads
- Least affected by periodontal disease
- Last teeth to be extracted
- Survive calamities like air disasters and hurricanes[4,5]

These factors made the mandibular canines considered as the "key teeth for personal identification" by forensic odontologists.[5,6] Studies performed on the lower canines using the ratio between the maximum crown width & inter-canine width, resulting in a mandibular canine index (MCI), have shown an ability to determine gender with an accuracy of 84.3% in males & 87.5% in females & 83.3% in males & 81% in females by comparing the observed MCI with a standard MCI value respectively.[7,8] The purpose of this study is to investigate the accuracy with which gender can be differentiated by using the mandibular canine index.

Materials and Methods

Study Type: Cross Sectional Study

Selection Criteria:
120 adult healthy human volunteers will be participating in this Cross-sectional study.

120 subjects, 60 males and 60 females in the age group of 17 – 23 years who are willing to participate will be selected. This age group was selected, as attrition is minimal in this age group.

Inclusion Criteria
Subjects with the following status of tooth will be included in the study (adopted from Aggarwal et al)

- Healthy state of Gingiva and Periodontium
- Caries free tooth
- Normal over jet and over bite
- Absence of spacing in the anterior teeth
- Normal molar and canine relationship.

Measurements:
All measurements will be made in a clean and well illuminated room taking all the aseptic precautions. All measurements will be made by two examiners and the mean values will be taken for further analysis.

The following measurements will be taken for each subject

- Mesio distal width of right maxillary canine
- Mesio distal width of left maxillary canine
- Intercanine distance

From the measured values, the following values will be calculated for each subject

- Right mandibular canine index
- Left mandibular canine index
- Sexual dimorphism

Measurement of mesio-distal width
The procedure was performed as suggested by Hunter and Priest[9]. The mesial and distal surfaces of the teeth will be identified and the distance between the crest of curvature on the mesial surface and crest of curvature on the distal surface will recorded by the divider points. The divider will then be held against the Vernier caliper and read.

Measurement of the Inter-canine Distance
The inter-canine distance will be measured between the tips of the mandibular canines. The divider points will be applied to the tips of the mandibular canines. The divider will then be held against the Vernier caliper and the reading will be noted.

Mandibular Canine Index
It will be calculated by dividing the mesiodistal width of the canine by the intercanine distance. All measurements will be recorded in a tabulated manner and statistically analyzed. Standard deviation, variance and z values will be calculated for each parameter.

Sexual dimorphism
Sexual dimorphism will be calculated according to the formula given by Garn et al (10) as follows:
Sexual Dimorphism in mesiodistal width = [{Xm/Xf } - 1] x 100; where Xm is mean mesiodistal width in males and Xf is mean mesiodistal width in females.

Statistical analysis
The data was analyzed using an **independent sample "t" test** and the results were tabulated.

Variables	Males		Females		p value	Significance
	Mean	SD (+/-)	Mean	SD (+/-)		
Right Canine Index	0.28	0.010	0.25	0.25	0.006	Highly significant
Left Canine Index	0.28	0.008	0.25	0.008	0.009	Highly significant

Results
The following parameters were determined in males and females:
- Right mandibular canine width
- Left mandibular canine width
- Intercanine distance
- Right mandibular canine index
- Left mandibular canine index

From the above table it is evident that there is statistically significant difference between the right mandibular canine index and left mandibular canine index in males and females. There was no difference in the canine index amongst males and females separately but the was highly significant difference when the both were compared.

This method is found to be useful in predicting the sex in a South Indian population to an extent of % when compared with the standard findings of Rao et al[7] and Muller et al[11].

Discussion
Mandibular canine index was employed in many studies on large populations as it is simple, significant & reliable, inexpensive and easy to perform. This is significant as tooth morphology is influenced by cultural, environmental and social factors.[12]

Hashim & Murshid (1993) conducted a study on Saudi males and females in the age group of 13-20 years and found that only canines in both the jaws exhibited significant sexual difference amongst all the other teeth.[13]

Kaushal et al found a statistically significant dimorphism in mandibular canines. In their study on 60 subjects where the mandibular left canine exhibited greater dimorphism than those on the right.[3]

According to the results of Gran & Lewis and Lysell & Myrberg of 6.4% and 5.7% respectively, mandibular canines exhibit greatest sexual dimorphism. Gabriel stated that any measurement of teeth accompanied by age, race & sex should be treated with great reserve. [14,15]

The current study similar to the above studies establishes a statistically significant sexual dimorphism in the mandibular canines and elicits that the mandibular canine index is a useful parameter in the determination of sexes.

The appreciable difference between canines in determining the sex is due to the influence of Y chromosome which is responsible for the thickness of dentine but the effect of which is not uniform on all the teeth. Whereas the X chromosome is considered responsible for the thickness of enamel and its influence was uniform on all the teeth.[16,17] both X and Y chromosomal involvement was found by various workers. [18,19,20]

Teeth form excellent materials to study the relationship between ontogeny and phylogeny.[21] As stated by Eimerl & De Vore (1965), in the evolution of primates, the caninces are not functionally masticatory but are coincidental with the threat of aggression and actual aggression. The transfer of this aggressive function from the teeth to the fingers occurred in humans and until this transfer, survival was primarily dependent on canines, especially in males.[3,21]

Other factors which have been found to have some bearing on tooth size resulting in morphometric differences between males and females are environmental factors and eating habits. [12,22,23,24]

The present study establishes a statistically significant sexual dimorphism in mandibular canines. Determination of gender based on the mandibular canine width is an inexpensive, relatively quick and easy method and could be assessed in cases of fragmented jaws and dental remains.

There might be differences in measurements of certain subjects which might be due to variations in geographical area where the subject was born.

Conclusion

In forensic medicine, dental evidence is valuable in identification of individuals, especially after mass disasters.

The standard mandibular canine index is a quick and easy method. Since the accuracy of prediction has never exceeded 84-87%, conformation can be done by using more reliable methods like DNA analysis. The standard canine index can be employed to arrive at a primitive distinction between the sexes which could be substantiated or confirmed with other time consuming methods.

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