

Original Research Article

# Sexual dimorphism using mandibular canine in establishing sex identity among Kashmiri population - A clinical study

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## Abstract

Gender determination in forensic investigation is of immense medico legal importance especially in mass disaster. Teeth are excellent tools for identification as they are resistant to physical and chemical agents. The aim of the present study was to investigate gender dimorphism by measuring the linear dimensions of mandibular canine width and inter canine width among Kashmiri population. The study consists of 125 subjects selected from outpatient clinic of oral medicine and radiology, 64 were males and 61 were females. The age groups selected were in range from 18-24 years. There was statistically significant difference in canine width on right and left sides and inter canine distance between males and females (p value less than 0.05). These parameters can be helpful in determining the gender of the unknown deceased person in forensic investigations among Kashmiri population.

## Key words

Sexual dimorphism, Mandibular canine, Sex identity, Kashmiri population.

## Introduction

Morphological characteristics of teeth are subjected to numerous investigations by anthropologist, orthodontist, biologists, and

forensic experts [1]. Human teeth are the hardest and chemically the most stable tissues in the body, and are extremely durable even at high temperatures. Teeth can be identified even when

the rest of the body has undergone decomposition. They are therefore invaluable tools for identification of fragmentary adult skeleton. Teeth are readily accessible for examination and since no two teeth have similar morphology, they form an excellent forensic tool for sex determination. The identification of sex is of significance in case of major disasters where bodies are often damaged beyond recognition [2]. Teeth may be used for differentiating sex by measuring their mesio-distal and buccolingual dimensions [3]. This is of special importance in young individuals where skeletal secondary sexual characters have not yet developed. Amongst teeth, mandibular canines show greatest dimensional difference with larger teeth in males than in females [3, 4]. Sexual dimorphism is defined as an intra specific difference between males and females in some aspect of their non-reproductive anatomy (e.g., body size, tooth size) and, to some degree, is related to sexual selection. Sex determination is one of the important parameters in forensic identification [5]. Teeth being the central component of the masticatory apparatus of the skull are good sources of material for civil and medico legal identification. Teeth are resistant to damage in terms of bacterial decomposition and fire when rest of body is damaged beyond recognition which makes them valuable tool in forensic investigation.

Studies in the past have established that the mesiodistal width of the canine is less in females than males and have well established variation [6, 7]. The main aim of the present study was to evaluate the mandibular canine width as tool for sex determination among Kashmiri population and to find the average width of canines in males and females.

## **Materials and methods**

The study consisted of 125 subjects selected from outpatient clinic of oral medicine and radiology, 64 were males and 61 were females and were selected randomly.

The age groups selected were in range from 18-24 years. The inclusion criteria were: Age between 18 to 24 years, Presence of mandibular canine, Absence of attrition, abrasion, abfraction or fracture of the said tooth, healthy periodontal status, no past history or clinical evidence of orthodontic treatment, normal molar and canine relationship. The exclusion criteria were presence of abnormalities of tooth morphology, presence of crowding/spacing of anterior teeth, presence of carious lesion or filing in the interproximal area of canine, malaligned and malrotated, patients with endocrine disorders.

Mandibular dental impression were taken using alginate impression material and poured immediately to prevent distortion of the impression material. Measurement were repeated in case of casts doesn't represent accurate dimensions. One operator took all the measurements at a time to eliminate the inter observer variability using digital vernier caliper having accuracy of 0.02 mm in a well illuminated room. At least three measurements were taken and the mean value of the three observations was obtained to avoid errors. The project was reviewed and approved by institutional ethical committee and after undertaking the consent from each patient. The following measurements were recorded. The mesiodistal canine width was recorded as greatest distance between the proximal surfaces of mandibular canine. Both right and left sides recorded separately as shown in **Figure - 1**. Inter canine distance was measured as the distance between the tips of the canines as shown in **Figure - 2**. Sexual dimorphism between right and left canines, were calculated according to the formula by Garn, et al. [6] as follows

*Sexual dimorphism in percentage (%) =  $Ym - 1/Yf \times 100$  where  $Ym$  is the mean value for males and  $Yf$  is the mean value for females.*

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 18.0 (SPSS Inc., Chicago, Illinois, USA). Data was reported as

mean and standard deviation (SD). Student's Independent t-test was employed to explore the difference in the inter canine distance and mesiodistal canine width between males and females. Graphically the data was presented by bar diagrams. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

**Figure – 1:** Measurement of mesiodistal width of mandibular canine.



**Figure – 2:** Measurement of inter canine width.

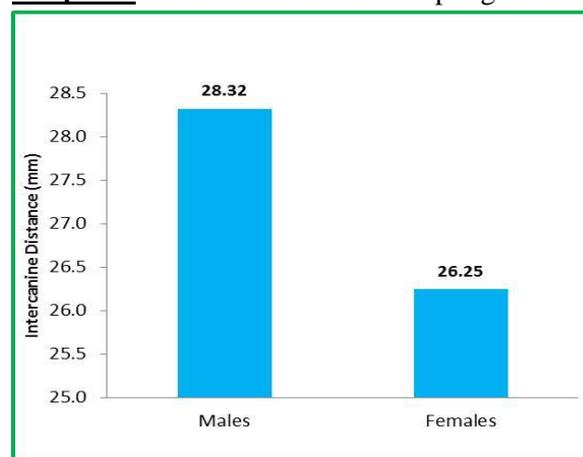


## Results

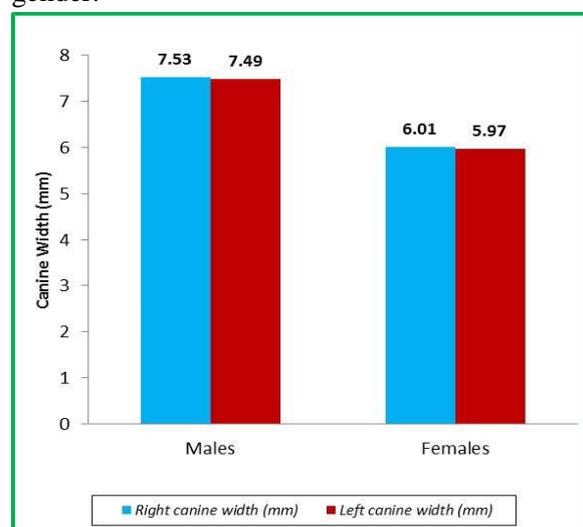
From the results of the present study it is evident that the mean mesiodistal width of the mandibular canine on right and left side was found to be greater in case of males than females which were statistically significant when compared with the student's t test as shown in **Table - 1**. The mean inter canine distance in case of males was  $(28.32 \pm 1.413)$  greater when compared to females  $(26.25 \pm 1.742)$  and this was

found to be statistically significant when subjected to statistical analysis. Also the mean mesiodistal mandibular canine width was more on the right side than on left side which indicates right canine is more appropriate for sexual dimorphism than the left canine however the difference between the two was not statistically significant in both males and females as shown in **Table - 1** and **Table - 2**. In the present study it was found that the chances of mandibular canine to show sexual dimorphism were 95% when the mesiodistal width was greater than 7.852 mm and 7.765 for right and left canine respectively in males as shown in **Table - 3**. Inter canine distance as per gender is shown in **Graph - 1** and right and left canine width is shown in **Graph - 2**.

**Graph - 1:** Inter canine distance as per gender.



**Graph - 2:** Right and left canine width as per gender.



**Table - 1:** Comparison of inter canine distance and canine width between males and females.

Variable	Males (n=64)		Females (n=61)		P-value
	Mean	SD	Mean	SD	
Inter canine distance (mm)	28.32	1.413	26.25	1.742	<0.001*
Right canine width (mm)	7.53	0.435	6.01	0.318	<0.001*
Left canine width (mm)	7.49	0.544	5.97	0.407	<0.001*

\*Statistically Significant Difference (P-value<0.05)

**Table - 2:** Comparison between right canine and left canine widths (mm) within each gender.

Variable	Left canine width (mm)		Right canine width (mm)		P-value
	Mean	SD	Mean	SD	
Males (n=64)	7.53	0.435	7.49	0.544	0.647
Females (n=61)	6.01	0.318	5.97	0.407	0.546

**Table - 3:** 95% Confidence interval of canine width and inter canine distance for males and females.

Variable	Left canine width (mm)		Right canine width (mm)		Inter canine distance (mm)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Males (n=64)	7.384	7.852	7.335	7.765	27.974	28.785
Females (n=61)	5.876	6.286	5.779	6.197	25.889	26.584

## Discussion

Determination of the sex in human has got immense importance in the forensic sciences. The most commonly and most precisely method is DNA analysis, however it has got disadvantages in terms of cost, availability of equipment etc. The study of teeth is useful in identification of age and can be used in sex determination [8]. Mandibular canines are considered as the “key teeth” for personal identification since they are the last teeth to be extracted with respect to age, they are less affected than other teeth by oral diseases, and are better likely to survive severe trauma such as air disaster, hurricane, or fire [9].

One of the main aims of our study was to evaluate the sexual dimorphism using the mesiodistal diameter of mandibular canine. It was found to be useful method in sexual dimorphism as the results were statistically significant in differentiating between males and

females (p <0.001). It was in consistent with the studies of the Ayoub, et al. [8], Reddy, et al. [10], Hashim and Murshid [11]. Hashim and Murshid conducted a study on 720 teeth on pretreatment orthodontic casts’ among Saudi population with age range of 13-20 years. They concluded that the canines were the only teeth to show sexual dimorphism also they determined that there was no statistically significant difference between right and left canines, so measurement on one side can represent the dimensions on the other side when the other side measurements are not obtainable [12].

In general, the difference in size between male and female teeth has been explained as part of the genetic expression of the male being larger than the female. The reason for the high level of dimorphic differences between male and female canines is uncertain, and consequently a large number of theories have been proposed. The age range chosen for our study provides best sample

for tooth size because there is less chances of attrition, abrasion and cervical abfraction. Furthermore the teeth for the purpose of the study are fully erupted.

Hunter and Priest [13] stated that measurement performed on the casts is more accurate, easy than performed on the patients. So we performed the measurement on the casts which is more advantageous as compared to the measurements performed on the patients. Furthermore measurement can be repeated at any time if there is miscalculation in data.

### Conclusion

From the present study it can be concluded that mesiodistal width of right and left canine as well as their inter canine distance was significantly greater in case of males than in females. The present study demonstrates that mesiodistal width of the right and left canines as well as the inter canine distance was significantly greater in males. The study also indicates that the probability of male sex determination is as high as 95% when width of either canine is greater than 7.852. Hence it can be concluded from the study that the measurement of mandibular canine width is quick and easy and valuable method for sex determination and identification of unknown individual among Kashmiri population

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