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Sexual Dimorphism in Mandibular Canine Crown Dimensions in Early Adolescents: A Hospital based Study

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Abstract

Determination of sex is valuable in forensic investigations. Forensic odontology plays a major role due to the hardness and chemical stability of teeth. This study was done to find out the utility of mandibular canine crown dimensions as a tool for sex determination in North Indian population. Crown length and mesiodistal width of right and left mandibular canines were measured on the 60 casts and analyzed to assess sex difference using Students 't' test. The canine crown parameters as measured for males and females when compared were found to be statistically significant. However, when these parameters were compared between left and right sides for the same sex, they were found to be statistically insignificant.

Key words: *Sexual dimorphism, canine, crown dimensions.*

Introduction

"Sexual dimorphism" is variations in morphological features between males and females. Sex determination is important in the identification of unknown individuals especially when information relating to the person is unavailable. Sex determination can be done either by morphological or molecular analysis. Most anatomical methods for sex determination are based on pelvic and cranio-facial morphology.[1] However, these bones are sometimes recovered as fragments, rendering sex estimation difficult especially in juvenile or sub-adult remains since dimorphic traits become apparent only after puberty. Morphology of teeth is potentially useful in sex determination because both primary and permanent sets of teeth develop before puberty. Mandibular canines are considered as the 'key teeth' for personal identification because they are least affected from periodontal diseases and are the last to be extracted.[1,2] *Nair et al* (1999)[3] found that the mandibular canines exhibit greatest sexual dimorphism among all teeth. The aim of this study was to find out the utility of mandibular canine crown dimensions as a tool for sex determination in North Indian population and to compare the crown dimensions of right and left mandibular canines.

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Material and Method

A retrospective, hospital-based study was conducted in post graduate department of orthodontics and dentofacial orthopaedics, School of Dental Sciences, Sharda University, Greater Noida . Total 60 casts of completely erupted and caries free dentition of 12-15 yrs age group subjects (30 male and 30 female) were studied. Cast with partially erupted, restored, and attrited canine were excluded from the study. Type of malocclusion present was not taken into consideration. Sexual dimorphism was studied on the basis of comparison of mandibular canine crown length, mesiodistal width, and length:width ratio. The crown length and mesiodistal width of right and left mandibular canines were measured using a digital Vernier caliper. The measurements were recorded and statistical analysis using Students '*t*' test was done to assess sexual dimorphism.

- Following measurements were taken in all the casts on an anatomically sound basis using a digital Vernier Caliper with a measuring range of 0–150 mm/0–6 inch, resolution: 0.01mm/0.0005 inch, repeatability: 0.01mm/0.0005 inch, accuracy: + 0.02 mm/0.001 inch. (<100 mm), + 0.03 mm/0.001 inch. (>100 – 150 mm), maximum measurement speed: 1m/s.

o Crown length of the mandibular canines on each side was recorded as the greatest distance on labial surface from the incisal line to cervical line parallel to the occlusal plane.

o Width of the mandibular canines taken as the greatest mesiodistal width between the contact points of teeth on either side of jaw.

• Sexual Dimorphism in right and left mandibular canines was calculated using formula given by *Garn & Lens (1967) i.e.,* Sexual dimorphism = (xm/xf) x 100 (where xm is mean value of male and xf is mean value of female).

Results

• The readings obtained were subjected to statistical analysis to derive conclusions and the results have been depicted in the tables 1-6. From the findings, it can be interpreted that the left canine is found to exhibit greater sexual dimorphism. The sexual dimorphism as computed for measurements on casts has been observed as follows.

• Length

o Sexual dimorphism in Right canine = 1.016%

o Sexual dimorphism in Left canine = 1.022%

• Width

o Sexual dimorphism in Right canine = 1.059%

o Sexual dimorphism in Left canine = 1.077%

Table 1: Crown length of mandibular canines in male vs female

Group	Sex	Mean	S.D.	Coefficient of Variation	Standard Error	t' Stat	p Value
Right Canine Length	Male	8.233	0.28	3.87	0.169	0.523	0.007**
	Female	7.62	0.256	3.83	0.191		
Left Canine Length	Male	8.317	0.01	4	0.186	0.691	0.006**
	Female	7.711	0.01	4.83	0.189		

(*p>0.05: not significant, **p≤0.05: significant, ***p≤0.001: highly significant)

Table 2: Crown length of mandibular canines in Right vs Left

Group	Mean	S.D.	Coefficient of Variation	Standard Error	t' Stat	p Value
Male						
Right	8.233	0.926	0.111	0.169	-0.331	0.371*
Male Left	8.317	1.021	0.121	0.186		
Female Right	8.100	1.046	0.127	0.191	-0.124	0.451*
Female Left	8.133	1.033	0.125	0.189		

(*p>0.05: not significant, **p≤0.05: significant, ***p≤0.001: highly significant)

Table 3: Crown width of mandibular canines in male vs female

	Sex	Mean	S.D.	Coefficient of Variation	Standard Error	t' Stat	p Value
Right Canine Width	Male	6.99	0.44	3.89	0.19	7.869	0.001***
	Female	6.384	0.37	3.55	0.16		
Left Canine Width	Male	6.98	0.61	3.53	0.27	8.368	0.001***
	Female	6.374	0.32	4.82	0.14		

(*p>0.05: not significant, **p≤0.05: significant, ***p≤0.001: highly significant)

Table 4: Crown width of mandibular canines in Right vs Left

Group	Mean	S.D.	Coefficient of Variation	Standard Error	t' Stat	p Value
Male Right	6.99	0.43	0.062	0.196	0.029	0.488*
Male Left	6.98	0.61	0.088	0.276		
Female Right	6.6	0.374	0.056	0.167	0.569	0.292*
Female Left	6.47	0.323	0.049	0.144		

(*p>0.05: not significant, **p≤0.05: significant, ***p≤0.001: highly significant)

Table 5: Crown length : width ratio of mandibular canines male vs female

	Sex	Mean	S.D.	Coefficient of Variation	Standard Error	t' Stat	p Value
Right Canine Length: Width Ratio	Male	1.158	0.073	0.063	0.03	2.07	0.035**
	Female	1.326	0.165	0.124	0.07		
Left Canine Length: Width Ratio	Male	1.15	0.095	0.083	0.04	2.07	0.035**
	Female	1.332	0.171	0.128	0.07		

(*p>0.05: not significant, **p≤0.05: significant, ***p≤0.001: highly significant)

Table 6: Crown length : width ratio of mandibular canines Right vs left

Group	Mean	S.D.	Coefficient of Variation	Standard Error	t' Stat	p Value
Male						
Right	1.15	0.073	0.063	0.032	0.148	0.443*
Male Left	1.15	0.095	0.083	0.042		
Female						
Right	1.32	0.165	0.124	0.07	0.126	0.451*
Female Left	1.34	0.184	0.137	0.08		

(*p>0.05: not significant, **p≤0.05: significant, ***p≤0.001: highly significant)

Discussion

The present study establishes the existence of statistically significant sexual dimorphism in mandibular canines. The results are in consistence with a study on Saudi males and females of 13-20 year age group population by Hashim and Murshid (1993) who found that only the canines in both jaws exhibited a significant sexual difference.[4] Lew and Keng (1991) obtained similar results in their study on ethnic Chinese population with normal occlusions. Garn & Lewis (1967) and Lysell & Myrberg (1986) established that the mandibular canine with 6.4% and 5.7%, respectively demonstrates the greatest sexual dimorphism amongst all teeth. *Nair et al* (1999) in their study on South Indian subjects concluded that the left mandibular canine (7.7%) shows the maximum sexual dimorphism followed by the right mandibular canine (6.2%).[1] In the present study also, the left mandibular canine was found to exhibit greater sexual dimorphism.

In contrast, Mohd. Abdulla has reported a low degree of sexual dimorphism that is not statistically significant in Saudi population.[5] Similarly insignificant sexual dimorphism was reported by Al Rifaiy *et al*[6], in Saudi Arabian population. A study of human fossil excavated at Ra's Al- Hamra, Eastern Arabian Coast also showed statistically insignificant sexual dimorphism of mandibular canine teeth.[7] *Gabriel (1958) has* stated that any measurement of teeth unaccompanied by age, race and sex must be treated with great reserve. Apart from sex the other significant findings that can be obtained from teeth are age, race, customs and habits.[8]

This study concludes that human teeth are sexually dimorphic and although males and females exhibit overlapping dimensions, there are significant differences in mean values.[9,10] Sexual dimorphism has been observed in both deciduous and permanent dentition, with more dimorphism exhibited by the permanent teeth.[11,12] On an average, male teeth are slightly larger than female teeth, with canine showing the greatest difference.[13,14] Microtomographic scans of the internal dental tissues have also shown significantly greater quantities of dentine in male teeth than in female. Researchers have attempted to use statistical techniques such as discriminant functions or logistic regression equations based on these sex differences to estimate sex, but the usefulness of such formulae is unsure as sexual dimorphism in teeth might vary between populations.[15,16,17]

Since the present study has been conducted on both sexes in a definite age group in the North Indian population, it establishes the morphometric criteria of canine size for the North Indian population. The emerging field of forensic odontology in India relies a lot on inexpensive and easy means of identification of persons from fragmented jaws and dental remains. The present study measured by only linear dimensions because of its simplicity and low expenses. The practicing dentists and the dental students should be made aware of the available technologies and its use in forensic dentistry.

New researches have to be encouraged in the field of forensic dentistry which will pave way for incorporating newer technologies in establishing the human identity.

Conclusion

This study concludes that canine crown length, width, and length:width ratio as measured for males and females when compared were found to be statistically significant. However, these parameters for the same sex both in male and female, when compared between left and right, were found to be statistically insignificant. Further, the left canine is found to exhibit greater sexual dimorphism.

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