Dimorphism in human maxillary and madibular canines in establishment of gender

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Abstract

Sexual dimorphism refers to the differences in size, shape, color, etc. between males and females and is a useful tool to distinguish them, especially in forensic investigations and anthropological assessments. The canines are favoured as ideal teeth to study these differences in view of their durability in the oral cavity. The present study was performed on 100 dental casts of a South Indian population in the age group of 14–20 years in an attempt to assess the dimorphism of human permanent maxillary and mandibular canines and to evaluate the possibility of dimorphism of the canines being used as a valid tool in the forensic and legal identification of an individual. The mesiodistal and buccolingual measurements were subjected to statistical analysis using the t test to determine whether significant differences exist between tooth sizes in males and females. The present study revealed that the mean values of the buccolingual and mesiodistal dimensions of the mandibular left canine (33) were greater in females than in males and the mean values of the mesiodistal dimensions of the mandibular right canine (43) in females were greater than that in males in the given sample. The finding could be attributable to evolution resulting in a reduction in sexual dimorphism, causing an overlap of tooth dimensions in modern males and females.

Key words: Mandibular canine, maxillary canine, sexual dimorphism

Introduction

Teeth are extremely durable even at high temperatures and may be identified even when the rest of the body has undergone decomposition. They are thus invaluable as an additional tool to determine sex on fragmentary adult skeletons. Of all the teeth in the human dentition, the canines are the least frequently extracted teeth (possibly because of the relatively decreased incidence of caries and periodontal disease). Also, canines are reported to withstand extreme conditions and have been recovered from human remains even in air disasters and hurricanes.[1]

The identification of sex is of significance in case of major disasters where bodies are often damaged beyond recognition. Sexual dimorphism refers to the systematic difference in form (either in shape, size, or color) between individuals of different sexes in the same species. Teeth of various species are known to exhibit sexual dimorphism. The dentition in males is larger than in females. 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 dentitions in males.[2]

This study was undertaken to assess the dimorphism of human permanent maxillary and mandibular canines in a South Indian population.

Materials and Methods

The study comprised the evaluation of dental casts of 100 South Indian patients (50 males and 50 females) in the age group of 14–20 years. The rationale for selection within the

said age group being the fact that all permanent canines are fully erupted and attrition is minimal in this age group.

The significant exclusion criteria employed for selection of the study sample were the presence of partially erupted/ectopically erupted teeth, patients with dental/occlusal abnormalities (such as rotation, crowding, occlusal disharmony, etc.), teeth showing physiologic or pathologic wear and tear (e.g., attrition, abrasion, abfraction, erosion), and patients with deleterious oral habits (like bruxism).

The greatest mesiodistal and buccolingual width of all four canines was measured with the help of a Vernier calliper (with 0.1 mm resolution) [Figures 1 and 2]. Measurements were recorded on an Excel spreadsheet and subjected to statistical analysis using 't' test. Multiple comparisons and group comparisons were also performed.

Results

It was observed that the mean values of the buccolingual and mesiodistal dimensions of the mandibular left canine (33) were greater in females than in males [Tables 1 and 2]. Also, the mean values of the mesiodistal dimensions of the mandibular right canine (43) in females were greater than that in males in the given sample [Table 1]. However, there was no statistical significance to these observed differences between the genders for the buccolingual as well as mesiodistal measurements of each of the canines.

Figure 1: Measurement of mesiodistal dimension of canine with Vernier callipers (0.1 mm resolution)

Figure 2: Measurement of buccolingual dimension of canine with Vernier callipers (0.1 mm resolution)

Discussion

Hashim HA and Murshid ZA in 1993 evaluated 720 teeth of pretreatment orthodontic casts in a Saudi population aged 13–20 years to determine the teeth in the human dentition with the highest likelihood of exhibiting dimorphism. Their study showed that the canines were the only teeth to exhibit dimorphism.[3] In a continuation of the same study, they also determined that there was no statistically significant difference between the left and right sides suggesting that measurement of teeth on one side could be truly representative when the corresponding measurement on the other side was unobtainable.[4]

A study by Kaushal et al., found a statistically significant dimorphism in the mandibular canines in 60 subjects in a North Indian population, where the mandibular left canine was seen to exhibit greater sexual dimorphism. They also concluded that if the width of the canine is greater than 7 mm, the probability of the sex of the person under consideration being male was 100%.[1]

In a Saudi Arabian sample of 503 school students, Al-Rifaiy et al., found the mean values for left and right maxillary and mandibular canine mesiodistal width was less for females than for males but were not statistically significant.[5]

Yuen, So, and Tang in a longitudinal study measured mesiodistal crown diameters in both primary and

Table 1: Mean values of mesiodistal dimensions of canines with application of t test

	Gender	N	MD Mean	Std. deviation	t
MD13	M	50	7.8120	.54796	1.10000
	F	50	7.6880	.57911	p=0.274 ns
MD23	M	50	7.7980	.57089	1.06400
	F	50	7.6780	.55707	p=0.290 ns
MD33	M	50	6.9880	.56230	.18000
	F	50	7.0080	.55138	p=0.858 ns
MD43	M	50	6.9880	.56773	.63700
	F	50	7.0520	.53117	p=0.526 ns

Table 2: Mean values of buccolingual dimensions of canines with application of test

	Gender	N	BL Mean	Std. deviation	t
BL13	M	50	8.2180	.67270	1.06200
	F	50	8.0840	.58671	p=0.291 ns
BL23	M	50	8.2060	.66713	.54700
	F	50	8.1400	.53184	p=0.586 ns
BL33	M	50	7.3880	.61864	.26800
	F	50	7.4220	.65131	p=0.791 ns
BL43	M	50	7.4440	.59356	.36200
	F	50	7.4000	.62073	p=0.718 ns

permanent teeth in a Chinese population and observed reverse dimorphism in the mandibular incisors. However, their findings were not statistically significant.[6]

Acharya and Mainali found reverse dimorphism (where females showed larger teeth than males) in the mesiodistal dimension of mandibular second premolars in a Nepalese population. The finding could be attributable to evolution resulting in a reduction in sexual dimorphism, causing an overlap of tooth dimensions in modern males and females.[7]

Conclusion

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. It is in such situations that the dentist can be called upon to render expertise in forensic science. A database may be established of dental morphometric measurements of nonattrited teeth with a view to determine variations among large populations that may be beneficial for anthropological, genetic, legal, and forensic applications.

The present study measured only linear dimensions because of the simplicity, reliability, and inexpensivity. More accuracy could have been obtained by the application of Moire's topography and Fourier's analysis that however require sophisticated equipments and the use of complex mathematical equations, respectively. The mandibular canine index may also be used as an adjunct to enhance accuracy.[8]

Dental dimorphism, particularly of the canines, has been extensively documented. However, the present study has revealed the lack of statistically significant dimorphism in canines. Also, the finding of reverse dimorphism (i.e., the females exhibiting larger canines than males) is quite unusual and needs to be validated using a larger sample size.

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