Sex Determination in Deltans using Mandibular Canine

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ABSTRACT

Teeth are an excellent material for genetic, odontologic, anthropological and forensic investigations. Amongst all teeth, mandibular canines are found to exhibit the greatest sexual dimorphism. In this study, sex determination in Deltans was evaluated using the mandibular canine index. The results were subjected to statistical analysis and were found to be highly significant.

A total of two hundred (200) individuals (Deltans), a hundred (100) males and a hundred females in the age group seventeen to twenty-one years were selected for this study because minimal attrition occurs in this group. The 200 subjects were students of School of Basic Medical Sciences, Abraka, whose parents are of Delta State origin. The range of right canine width (mm) and left canine width (mm) were 7.3-8.3, 7.5-8.4 for males and 6.8-7.8, 6.85-7.65 for females respectively. Sexual dimorphism was higher in the right canine with a value of 8.580%. The probability of sex determination for males was 50.94% and females was 49.06%. The overall probability of sex determination was 50%. However, the probability that the sex was male when either canine was greater than 7.8mm was as high as 100%. This study establishes the existence of a structurally significant sexual dimorphism in the morphology of mandibular canines in Deltan population.

Key words: Mandibular canine index, sex determination, Deltans.

INTRODUCTION

All the structures in the human body in their functional morphology and histology continuously maintain the bodies physiological equilibrium. The human body is made up of skeletal framework of bones, soft tissue and circulatory fluid.

The teeth being the hardest tissue in the body , are selectively preserved and fossilfied thereby providing by far the best documented record from evolutionary study. Their durability in the face of fire and bacterial decomposition makes them invaluable for identification (William et al 2000). Teeth are resistant to heat, chemicals and microbial attack and there is possibility of doing restoration for lost structure due to failure to regenerate when destroyed and have been described as the fourth most hardest structure on earth. All these factors are helpful in personal identification and sex determination (Kavitha 2005). Sex determination could be done successfully in using chromosomal studies as the male has XY chromosomes and female has XX chromosome.this is only possible in the laboratory and takes a longer time and this facility is hardly available in all places. Hence , sex determination with the help of the teeth is necessary for an interpretation in law and justice.

Tooth size standards based on odntometric investigation can be used in age and sex determination (Black 1902).

The mandibular canine, have a mean age of eruption of 10.98 years and is less affected than other teeth by periodontal diseases. These are the last teeth to be extracted with respect to age. Canines are also better likely to survive severe trauma such as air disasters, hurricanes or conflagration. These findings all suggest that

mandibular canines can be considered as the "key teeth" for personal identification (Dahberg 1963).

This research establishes the impact of "sex factor" on the morphometry of mandibular canines. It defines the morphometric criteria for mandibular canine index (MCI) in indigenes of Delta state of Nigeria and this is of definite significance as tooth morphology often influenced by environment, cultural and racial factors (Halim, 2001).

The aim of this study is to help in providing a method for forensic scientist in determining the sex elements in Deltans by using the canine tooth.

Gram et al (1967) stated the magnitude of sexual dimorphism in tooth size as well as percentage dimorphism in 243 subjects from south west ohio. The largest sexual dimorphism in meso-distal tooth size was exhibited by the mandibular, first and second molars D=0.52 and 0.45mm respectively with the maxillary and mandibular canines next in order of difference (D=0.44) and (0.42mm). On percentage basis, dimorphism was greatest for canines and least for mandibular incisors. But canine dimorphism was specific to mesio-distal diameter. Mesio-distally the lower canines showed the greatest difference between the sexes. Rao et al (1989) derived MCI for establishing sex identity, the index was derived as ratio between two parameters in permanent mandibular canines. Namely the maximum crown width and the canine arch width (mm) and was calculated as follows:

MCI= mesiodistal crown width of mandibular canine
          Mandibular canine arch width

Accuracy of sex determination was found to be 84.3% in males and 87.5% in females.

MATERIAL AND METHODS

The instrument used for this study were a divider with a fixing device and a meter rule graduated in millimeters (resolution 0.50mm)

The width of the mandibular canines were taken as the greatest mesio-distal width between contact points of the teeth on either side of the jaw, the intercanine distance was measured between tips of both canines in the lower jaw. Intra oral measurements was taken in 200 subjects (100 males and 100 females) in the age group of 17-21 years. All measurements were taken on an anatomically sound basis using a meter rule with a resolution of 0.50mm and a divider with a fixing device.

The readings obtained were subjected to statistical analysis to derive a conclusion. Sexual dimorphism in right and left mandibular canines was calculated using formular given by Garm et al (1967) as follows.

$$\text{Sexual dimorphism} = \frac{Xm}{XF}$$

Xm = mean value for males
Xf = mean value for females
Further mandibular canine index was calculated based on the formular by Rao et al (1989)
MANDIBULAR CANINE INDEX(MCI)

Standard mandibular canine index

The standard mandibular canine index of the population studied was obtained from the measurement taken in the sample by applying the following formular

$$MCI = \frac{\text{mesiodistal crown width of mandibular canine}}{\text{Mandibular canine arch width or inter-canine}}$$

$$\text{Std MC} = \frac{(\text{mean male MCI} + SD) + (\text{mean female MCI} + SD)}{2}$$

According to Rao et al (1989) if the calculatedmandibular canine index for the individual was higher than the standard mandibular canine index the individual was considered to be a male. If it was the other way round the subjects was taken as a female.

Prediction of sex was done using the same method for the selected Deltan subjects with lower anterior dental alignment. The findings were represented graphically.

Table 1: Showing statistical significance of different parameters

Parameter	sex	mean	±S.D	Coefficient of variation	t' state 'p'value	Significance
inter-canine distance	M	28.29	1.75	5.04	2.638<0.006	Highly significant
	F	26.7	1.49	5		
RT Canine width	M	7.84	0.52	4.12	7.872<7.4 *10	Highly significant
	F	7.2	0.49	4.1		
LT Canine width	M	7.75	0.51	4.85	7.730 < 2.31	Highly significant
	F	7.2	0.54	5.03		
RT MCI	M	0.27	0.08	4	9.821 < 7.70	Highly significant
	F	0.26	0.08	4.21		
LT MCI	M	0.27	0.08	5.02	4.178 < 7.02	Highly significant
	F	0.26	0.49	5.87		

Table 2: Showing Sexual Dimorphism in Mandibular Canine

Canine Tooth	Sexual Dimorphism
RT Canine	8.58%
LT Canine	8.54%

Table 3: Showing percentage of cases correctly predicted RMCI (RT= 0.273)

SEX	Number	Percentage
M	100	50.94%
F	100	49.06%

Table 4; Showing percentage of cases correctly predicted using LMCI (Standard MCI (LT) = 0.272.)

Sex	Number	Percentage
M	100	50.94%
F	100	49.06%

Table 5: Showing range of Canine width, male versus female

sex	RT Canine Width (mm)	LT Canine Width(mm)
M	7.3-8.	7.5-8.4
F	6. 8-7.8	6.85-7.65

RESULTS

The following parameters were determined in males and females
1.   Inter-canine Distance
2.   Right mandibular canine width
3.   Left mandibular canine width
4.   Right mandibular canine index
5.   Left mandibular canine index

The result in tables 3 and 4 shows the probability of sex determination to be as high as 100%, when the width of either canine is greater than 7.8 the sex is a male.Using the mandibular canine index sex was accurately predicted as high as 50.94% and 49.06% for males and females respectively.

DISCUSSION

This study confirms the fact that there is statistically significant sexual dimorphism in mandibular canines . it is consistent with kausal et al 2004 who conducted a study on sixty North Indians (30 female , 30 males) and found that the mandibular canines exhibited statistical significance. Hashim and murshid 1993 who conducted a study on Saudi males and females

also found that only the canines of both jaw exhibited significant sexual difference while other teeth did not. , this was also confirmed in study on Chinese (Lew and keng1991).Among the significant findings that can be obtained from the teeth are race, age sex habits and customs(Molnar 1971) ,so any measurement of teeth unaccompanied by age sex or race of the individual must be treated with reserve.(Gabriel 1958). Since this study was conducted in both sexes in a definite age group in the Deltan population . it establishes a morphometric criteria of canine size for the Deltan population. This study indicates the probability of male sex determination to an extent as high as 100% when the width of either canine is greater than 7.8mm, this finding is of definite significance as the determination of sex makes identification easier and it is of immense forensic importance, Kaushal et al 2003. In this study sex determination was successfully predicted as high 50.94% and 49.06% for males and females respectively. Similar success to a higher percentage has been

recorded .In the literature, 75 % kaushal et al (2004), 85.5% Rao et al. but such method of sex determination has limitations as sex of the subjects to whom the fragment of the mandible belongs can be determined at best if the fragment is found in the geographical area where the subject was born, . This implies that it is necessary to make up a random sample of the population from this geographical area to calculate the corresponding standard mandibular canine index.

CONCLUSION

The standard MCI is a fast and easy method for determining sex in identification, but one must be prudent in interpreting the results which must be confirmed by other methods since accuracy has never exceeded 84-87% in any previous study. We recommend that further studies be carried out on various ethnic populations of Nigeria for comparison and robust data

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