Study Of Mandibular Canine Teeth Dimorphism In Establishing Sex Identity In Gujarat Region

Dr. Dhara Parekh*, Dr. Ankur Zalawadia, Dr. Srushti Ruparelia**, Dr. Shailesh Patel***, Dr. S. P. Rathod****, Dr. S. V. Patel*****

*Tutor, **Assistant Professor, ***Associate Professor, ****Professor and Head, Department of Anatomy, Medical College, Bhavnagar; *****Dean, GMERS, Medical College, Gandhinagar

Abstract : Mandibular canines exhibit the greatest sexual dimorphism amongst all teeth. The present study was performed on 368 healthy MBBS students of Medical College, Bhavnagar (216 males, 152 females) of 18 – 24 years with the aim to investigate whether any correlation existed between odontometric measures including mandibular canine index, and sex determination in the year of 2006. Mean value of intercanine distance was higher in males than females and the difference was statistically highly significant (p value<0.01). Comparison of mean values of left and right mandibular canine widths exhibited lesser values in females. The variation in right and left mandibular canine width between males and females was highly significant (p value<0.01). The right and left mandibular canine index (MCI) among genders showed significant difference. Our study conclusively establishes the existence of a definite statistically significant sexual dimorphism in mandibular canines and MCI.

Key-words: Sexual Dimorphism, Intercanine Distance, Mandibular Canine Width, Mandibular Canine Index

Corresponding Author: Dr. Dhara Parekh,Tutor, Department of Anatomy, Government Medical College, Bhavnagar - 364001

INTRODUCTION: Teeth are an excellent material in living and non-living populations for anthropological, genetic, odontologic and forensic investigations. These exhibit the least turnover of natural structure and are readily accessible for examination. Being the hardest and chemically the most stable tissues in the body they are selectively preserved and fossilized, thereby providing by far the best record for evolutionary change. Their durability in the face of fire and bacterial decomposition makes them invaluable for identification[1].

According to Black[2], tooth size standards based on odontometric investigations can be used in age and sex determination. Whenever it is possible to predict the sex, identification is simplified because then only missing persons of one sex need to be considered. In this sense identification of sex takes precedence over age[3].

Studies on tooth morphology have in the past been conducted using either intra-oral measurements or measurements on casts. Barrett et al[4] have observed that intra-oral measurements are less reliable. Garn et al[5] and Nair et al[6] have found the mandibular canines to exhibit the greatest sexual dimorphism amongst all teeth. The mandibular canines have a mean age of eruption of 10.87 years and are 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 indicate that canines can be considered as the 'key teeth' for personal identification[7]. Anderson DL and Thompson GW[8] investigated the inter relationship and sex difference of dental and skeletal measurements and reported that the mandibular canines was the tooth likely to survive both dental disease and air crashes. Hence, canine width could be useful for sex determination.

The present study establishes the impact of the 'sex factor' on the morphometry of the mandibular canines. The results indicate that the dimorphism in canines can be of immense medico-legal use in identification. The study defines the morphometric criteria for mandibular canines in Gujarat population.

MATERIAL AND METHODS: The study of 368 healthy MBBS students of Medical College, Bhavnagar was conducted at Department of Anatomy, Bhavnagar in year 2006. Out of these 368 students, 152 students are female & 216 students are male. Both sexes belong to age group between 18 to 24 years. Cases with any doubt about age or oral pathology are excluded from the series.

The following intraoral measurements were taken by using a Vernier Caliper with resolution of 0.02 mm after getting consent of the subjects.

1. The mandibular canine width: was taken as the greatest width between the contact points of the teeth on either side of the lower jaw.

2. The inter-canine distance: was measured as the linear distance between the tips of right and left mandibular canine in the lower jaw.

3. Mandibular canine index (MCI): was calculated using the formula –

Mandibular canine width / Inter-canine distance

4. Sexual Dimorphism in right and left mandibular canines was calculated using formula given by Garn & Lewis[9] as follows: Sexual Dimorphism = (Xm / Xf - 1) × 100 (Xm = mean value of male canine width; Xf = mean value of female canine width).

All measurements were repeated twice by two independent observers to identify any intra and inter-observer variability of these techniques. Data collected was tabulated according to gender and sides and statistically analyzed.

RESULTS: Table one shows sex related differences amongst various parameters. When the mean value of intercanine distance of the 368 subjects (216 males and 152 females) were compared, males showed higher value than the females and the difference was statistically highly significant (p value<0.001). However, the variance value for the females was more than the males. The width of the mandibular canine was slightly higher for males than females. When the mean values for left and right mandibular canine widths were compared between males and females, the females showed lesser value. Furthermore, variation in width of the right and left mandibular canine was more in the males than in females. The observed difference in the variation of the right and left canine width between males and females was statistically highly significant (p value<0.001). The right and left mandibular canine index were almost bilaterally symmetrical in both the males and females with more variation in females as com-pared to males. There was statistical significance of these observed differences between the genders for right and left mandibular canine indices (p value<0.001).

Table-1 Sex related differences amongst various parameters

Parameters	Sex	Mean ± SD (mm)	'p' value
Inter-canine distance	Male	30.51±1.94	<0.001
	Female	28.60±1.52	
Right canine width	Male	6.66±0.59	<0.001
	Female	5.65±0.53	
Left Canine width	Male	6.92±0.61	<0.001
	Female	5.77±0.52	
Right MCI*	Male	0.213±0.0246	<0.001
	Female	0.199±0.0239	
Left MCI*	Male	0.219±0.0235	<0.001
	Female	0.203±0.0227	

MCI* = Mandibular canine index

Table-2 shows percentage of sex correctly predicted using right and left side MCIs. It was ob served that out of 216 males, sex was correctly predicted only in 109 males and out of 152 females only 84 females were correctly predicted by using right side MCIs. Thus overall correct sex prediction was noted in 193 individuals i.e. 52.4%. Similarly, correct sex prediction was noted in 187 individuals (106 males and 81 females) with overall 50.8% accuracy by using MCIs left side.

Table-2 Percentage of sex correctly predicted using MCI

Sex	MCI Right side		MCI left side	
	No.	%	No.	%
Male	109	50.5	106	49.0
Female	84	55.3	81	53.3
Total	193	52.4	198	50.8

DISCUSSION: Gender determination in damaged or mutilated dead bodies or from skeletal remains constitutes the foremost step for identification in medico-legal examination. Although DNA profile gives accurate results yet measurement of linear dimensions, such as inter-canine distance and width of canine teeth can be used for determination of sex in large population because it is simple, reliable, inexpensive and easy to perform.

In the present study the inter-canine distance both in males and females is found highly significant (p value <0.01). It is further observed that mean intercanine distance in males is 30.51**±**1.94 mm and the value in females is 28.60**±**1.52 mm, thus values in males being higher than those of females. Observations in males and females has been observed by Kaushal et al[10] (male: 25.873±1.253, female: 25.070±1.197), Reddy et al[11] (male: 26.860±1.48, female: 26.287±1.45), Kaushal et al[12] (male: 25.87±1.25, female: 25.07±1.19), Abdullah[13] (male: 26.9552±2.3129, female: 26.4575±2.7790), and Al- Rifaiy et al[14] (males: 27.0171±2.3168 and females: 26.4615±2.7761 mm). The results of present study are higher than previous studies in case of male as well as female.

In the present study there exists a statistically significant sexual dimorphism in the morphometry of the mandibular canines as far as mandibular canine widths are concerned. We have noted the mean value of right canine width in males and females to be 6.66**±**0.59 mm and 5.65**±**0.53 mm respectively and that of left canine width in males and females 6.92**±**0.61 mm and 5.77**±**0.52 mm respectively. These values are found to be highly significant (p <0.01). It is also observed that mean values of canine widths to be higher in males compared to females. Our findings in males and females are sup-ported by Kaushal et al[10] who have reported mean right canine width in males 7.229±0.280 mm and in females 6.690±0.256 mm, and left canine width in males 7.299±0.292 mm and in females 6.693±0.323 mm in their study on 60 subjects (males: 30 and females: 30) of 17 – 21 years age group. In the present study comparison of right canine width with left canine width in males have showed no difference and a similar observation is noted in females when right canine width is compared with left canine width. Thus, it can be clearly stated that the canine width of either side both in males and females depicts no significant differences. Our findings are well supported by other workers[10- 15].

Kaushal et al[12] in their study on 30 males and 30 females of the North Indian population in the age group of 17 - 21 years on right and left mandibular canine have observed that the probability of sex determination using right MCI for males and females is 70% and 80% respectively and that with left MCI for males and females has been 66.67% and 83.33% respectively. This is in contrast to our findings wherein we have noted still lower values for sex prediction i.e. 50.5% in males and 49% in females using MCI of right side and 52.4% males and 50.8% females using MCI of left side. Further, the probability of correct prediction of sex using MCI is higher for males in our study. We have noted an overall higher percentage of accuracy for sex prediction from right side MCI as compared to left side MCI.

In the present study it is observed that whenever canine width is greater than 7.3 mm, the probability of sex being male is 100%. This is in contrast to Kaushal et al[10] and Rai et al[16] who have reported corresponding values as 7.0 mm and 7.2 mm respectively. This finding could be of immense medico-legal importance in identification of Gujarati subjects as the determination of sex makes identification easier.

CONCLUSION: Our study conclusively establishes the existence of a definite statistically significant sexual dimorphism in mandibular canines and that MCI is of limited value and can only be used as an adjunct with other parameters for the determination of sex in cases of highly mutilated and damaged bodies where jaws are at hand. It is concluded that a canine width greater than 7.3 mm is 100% suggestive of males.

REFERENCES:

1. Williams's PL, Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE, Fergusson MWJ, 2000 Gray's Anatomy. In: The Teeth, Churchill Livinstone, London, 38th Edn, 169-170.
2. Black GV, 1902 Description of human teeth, S.S. White Mfg. Co., 4th Edn.
3. Camps FE, 1976 Gradwohl's Legal Medicine. In: Identification by the skeletal structures., John Wright and Sons., 3rd Edn, 110.
4. Barrett MJ, Brown T and Macdonald MR. 1963 Tooth size in Australian aborigines. Australian Dental Journal. 8(2): 150-5.
5. Garn, S.M. and Lewis, A.B., 1967 Bucco-Lingual size asymmetry and its developmental meaning. Angle Orthod. 37(1): 186-193.
6. Nair, P., Rao, B.B. and Annigeri, R.G., 1999 A study of tooth size, symmetry and sexual dimorphism. Journal of Forensic Medicine & Toxicology. 16(2): 10-13.
7. Dahberg A.A., 1963 Dental traits as identification tools. Dent Prog. 3(1): 155-160.
8. Anderson DL, Thompson GW., 1973 Interrelationship and sex differences of dental and skeletal measurements. J Dent Res. 52: 431.
9. Garn, S.M. and Lewis, A.B. Bucco-Lingual size asymmetry and its developmental meaning. Angle Orthod. 1967; 37(1): 186-193.
10. Kaushal S, Patnaik VVG, Agnihotri G. Mandibular Canines in sex determination. J Anat Soc India. 2003; 52 (2): 119-24.
11. Reddy MV, Saxena S, Bansal P. Mandibular canine index as a sex determinant: A study on the population of Western Uttar Pradesh. Journal of Oral and Maxillo facial Pathology. 2008; 12 (2): 56-59.
12. Kaushal S, Patnaik VVG, Sood V, Agnihotri G. Sex determination in North Indians using Mandibular canine index. JIAFM. 2004; 26(2): 45-49.
13. Abdullah MA. A cross sectional study of canine tooth dimorphism in establishing sex identity: A comparison of two different populations. Cairo Dental Journal. 1998; 14(2): 191-96.
14. Al-Rifaiy MQ, Abdullah MA, Ashraf I, Khan N. Dimorphism of mandibular and maxillary canine teeth in establishing sex identity. The Saudi Dental Journal. 1997; 9(1): 17-20.
15. Boaz K, Gupta C. Dimorphism in human maxillary and mandibular canines in establishment of gender. J Forensic Dent Sci. 2009; 1(1): 42-44.
16. Rai B, Dhattarwal SK, Anand SC, Bhardwaj DN. Mesio-distal diameter of Mandibular canine as a sex and intercanine distance as the age determinant. IIJFMT. 2008; 6(2).