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Role of Maxillary Canines in Sex Determination in Northern Central Region of India

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ABSTRACT

Introduction:- *Gender determination is one of the important parameters in the forensic science. The forensic odontologist is to identify the sex from whatever human dental remains are presented as a specimen.no two teeth have similar morphology and the purpose of this study was to investigate whether sexual dimorphism can be established by odontometric study of permanent maxillary canines' teeth as well as canine arch width. Morphology of individual teeth is unique and is determined by genetic factor.*

Aim and objective:-

- *To identify role of maxillary canines in sex determination.*
- *To find out maxillary canines index & sexual dimorphism methods for sex determination.*
- *To review the findings in light of available literature.*

Material & Methods:-*The study was carried out on 100 objects 50 males and 50 females selected from NIMS medical college Jaipur (raj) belong to northern central region of India for role of maxillary canine in sex determination. The mesiodistal dimension of permanent maxillary canines was measured with the help of verniercalliper.*

Results:-*The mesiodistal dimensions of the right and left maxillary canines were significantly different in male greater then female.*

Permanent maxillary canine exhibited larger mean values of mesiodistal dimension in males compared to females in northern central region of India.

Conclusion- *The results of the present study showed that maxillary canines exhibiting significant sexual dimorphism and can be used for sex determination in individual as well as in group such as in mass disasters like earthquakes, floods.*

Keywords:-*sexual dimorphism, sex determination, mesiodistal dimensions.*

INTRODUCTION

The identification of a dead body may be required in cases of sudden and unexpected death, fires, explosions railway or aircraft accidents, hidden decomposed bodies, and often needs great medico legal purposes.

The law enforcement community expects and requires that the forensic scientist report the identification of partial or complete remains of an individual to the best of his or her ability.

Various methods are used to establish the identity of unknown remains, the reliability of each method varies. The only methods that can give a totally accurate result is the DNA technique, but in many cases and several reasons it cannot be used.

The growth and developmental trends of teeth and jaws are known to be influenced by racial, social and geographic factors among others, therefore, standards developed for a population cannot hold good for other population. India being a vast country with diverse climates, religious and food habits.

Sex determination is one of the important parameters in forensic identification and using dental features is based upon the comparison. Of tooth dimensions in male and females. Sexual dimorphism refers to this systemic difference in the shape and size between individuals of difference sexes in the same species.

The jaw bones, immovable maxilla and movable mandible are very much concerned in the profession of the dentistry, as these bones bear the teeth. Though bones are hard, teeth are the hardest structures in the body and enamel of tooth is the hardest structure in the body, and is the fourth hardest structure in the universe because of its content of calcium apatite crystals, a homogenous mass.

Every tooth either deciduous or permanent has similar structure like enamel, dentin and pulp, but different morphological appearance. No two teeth have similar morphology and morphology of individual tooth is unique and is determined by genetic factor. The different morphology of different teeth helps for different function like incisors to bite, canine to tear, premolar to crush and molar to grind. As human tooth is hard, it gives resistance to fine chemicals and toxins; hence damage to tooth is not as easy and immediate process.

Many authors have done the measurement of crown in teeth between males and females and found certain variations. Though the morphology of the structure is similar to male and female, there is no need that, the size of the structure should remain same, as the size of structure is determined by various factors like exercise, nutrition, metabolic activities etc.

Few studies have established that the mesio-distal diameter of upper canine is less in females than males and they have established variations, only in permanent canines alone.

Hence, the present study has been aimed to measure the mesio-distal diameter, of maxillary canines provides evidence of sex determination due to dimorphism.Further this study includes to measure the inter-canine arch distance of maxilla in both males and females and to correlate the

maxillary canines' index of upper canine for sex determination.

Thus the aim of present study would help in providing a methodology for dentist and scientist in forensic dentistry for determining the sex determination in northern central region of Indiawith the help of crown measurements of canine.

MATERIAL AND METHODS

1.Selection criteria:-The study sample consisted 100 subjects,50 male and 50 females in the age group of 17-25years selected from students of NIMS Medical college Jaipur (Rajasthan) belonging to northern central region of India .who were selected based on the following criteria-

Inclusion Criteria

1. Healthy state of gingival and periodontium.
2. Caries free teeth.
3. Normal overject and overbite.
4. Absence of spacing in the anterior teeth.
5. Normal molar and canine relationship.

Exclusion Criteria

1. Caries teeth ,
2. congenital missing teeth
3. Fracture or prosthesis.
4. Spacing between teeth.
5. Age below 17 years and age above 25 years.

2. Methodology:-The subjects divided in to2 groups. Group A as male & group B as female. The measurements of these two group used to evaluate:-Maxillary Canines index&Sexual dimorphism

3. Material:-

1. Stainless steel Vernier caliper-for measurement of mesiodistal crown width of maxillary canine tooth.
2. .Divider with a fixing device. For measurement of maxillary canine arch width.
3. Stainless steel flexible tape

Material for formation of cast:-

1. Alginate powder
2. Dental Stone
3. Perforated Tray
4. Rubber Bowel
5. Spatula

Methods

Measurement of distance between two flange of venire caliper is recorded in millimeter .vernier caliper with resolution of 0.02 mm is used for measurement of mesiodistal crown width of four maxillary canines. Measurement of inter-canine distance done by divider, tip of one end of divider is kept over the center of tip of one side canine tooth & another end is kept over the center of opposite side canine tooth.all the measurements were done by a single examiner. The data thus collected were subjected to statistical analysis. For determination of the size of teeth, the mean range and slandered deviation were calculated.

$$\text{MCI} = \frac{\text{Mesiodistal crown width of maxillary canine}}{\text{Maxillary canine arch width.}}$$

Sexual Dimorphism

Sexual dimorphism was calculated based on mesiodistal width of maxillary canines. The reading obtained was subjected to statistical analysis to desire Conclusions and sexual

dimorphism in right & left Maxillary canines was calculated using formula given by Gran & lens as follows:

Sexual dimorphism= $\frac{X_m}{X_f} \times 100$

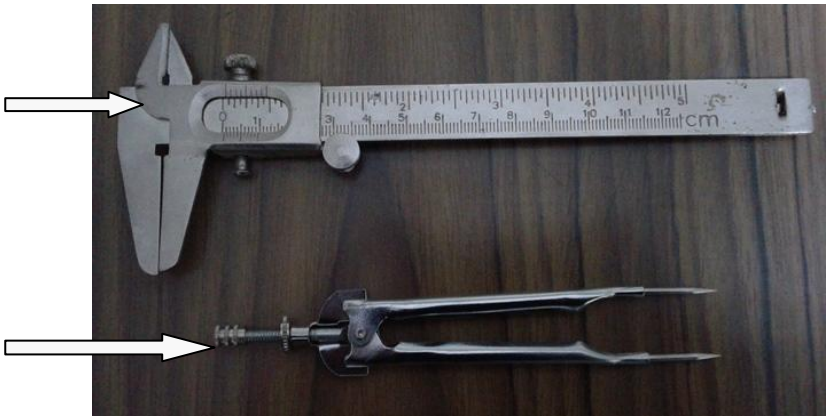
X_m= *mean value of males*

X_f= *mean value of females*

Observed maxillary canine index = $\frac{\text{Mesidistal crown width of maxillary canine}}{\text{Maxillary canines arch width or inter canine distance}}$

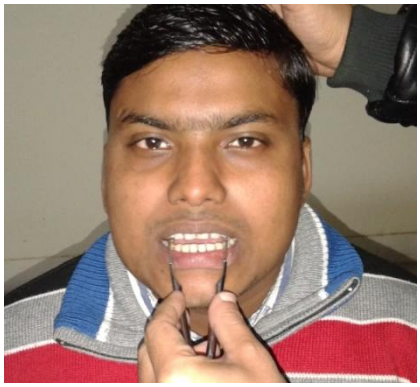
A

B



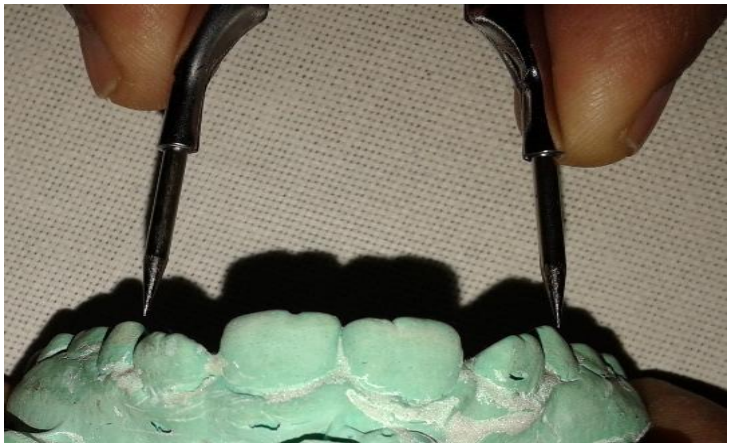
Verniercaliper B-Divider

Measurement of canine width by Vernier Caliper (orally)



Measurement of inter-canine distance by Divider (Orally)

Measurement of canine width by Divider (on cast)



Measurement ofinter-canine distance by divider (on cast)

RESULT

The present study was conducted in the department of Anatomy NIMS Medical College Jaipur.

The purpose of the study was to role of Maxillary canine in sex determination to compare the mesio-distal crown width of permanent maxillary canines between males and females to compare the mesio-distal crown width of right and left permanent maxillary canines .to compare the inter-canine arch width of maxilla between male and females, to derived the mean value of maxillary canines index and assess their reliability in predicting sex identity by deriving percentage accuracy.

The study was carried out on 100(50 male 50 females) Jaipur (Rajasthan) subjects with age ranging 17-25years. Subjects were selected based upon the inclusion and exclusion criteria set forth in the beginning of the study and informed consent was obtained. Full arch maxillary impression were made and poured with dental stone.

Maxillary right and left canine width and inter-canine arch width were recorded for each subject, thus, 100 maxillary canines were considered for the measurements. All the parameter recorded were tabulated and subjected to statistical analysis using statistical mean and slandered deviation .The result obtained and observation are as follows:- table 1 shows maxillary canine mesio-distal width intra-oral both male as well as female .table 2-Showing maxillary canine mesio-distal width on cast of both male as well as female. Table 3-shows Mean ± Sd of Inter canine distance of cast & intra oral according to sex . Table 4-shows Mean ± Sd of Right & Left maxillary canine index of cast & intra oral in male. table 5-Mean ± Sd of Right & Left maxillary canine index of cast & intra oral in female.

Table 1-Showing maxillary canine mesio-distal width intra-oral

Sex	Mean ± Sd	
	Right canine width	**Left canine width**
Male	**7.22422±0.15905**	**7.219±0.13643**
Female	**6.4882±0.8161699**	**6.588±0.11414**

Table 2 Showing maxillary canine mesio-distal width on cast according to sex

Sex	Mean ± Sd	
	Right canine width	**Left canine width**
Male	**7.2258±0.1663959**	**7.2202±0.12918**
Female	**6.6144±013377**	**7.2202±0.11368**

Sd- Standard deviance

Table -3 Showing Mean ± Sd of Inter canine distance of cast & intra oral according to sex

PARAMETER	Mean ± Sd	
	MALE	**FEMALE**
INTRA-ORAL	**25.31542±0.124696**	**23.81413±0.74969**
ON CAST	**25.31676±1.20938**	**23.84366±0.70911**

Sd- Standard deviance

TABLE No. 4 Mean ± Sd of Right & Left maxillary canine index of cast & intra oral in male

Parameters	Mean ± Sd		Significance
	RMC index	**LMC index**	
Intra oral	**0.28192±0.01203**	**0.2794±0.0087**	**HS**
Cast	**0.2826±0.0116**	**5.91352±39.84135**	**HS**

a-RMC-Right maxillary canine b-, Left maxillary canine

TABLE -5 Mean ± Sd of Right & Left maxillary canine index of cast & intra oral in female

Parameters	Mean ± Sd		Significance
	RMC INDEX	LMC INDEX	
Intra oral	0.7702±0.0101047	0.2794±0.0087	HS
Cast	0.27694±0.01095	0.27678±0.01084	HS

a-Right maxillary canine index b- Left maxillary canine index

CONCLUSION

After a detailed study and comparison of my work with other workers. the mesio-distal width of maxillary canine teeth is greater in males then females in age group17-25 years which is statistically significant maxillary canine arch width is also greater in male then females which is statistically significant .the diagnostic efficacy of maxillary canine Index & sexual Dimorphism method given by Garn & Lens very important for sexual dimorphism by these methods we can easily determined the role of maxillary canines in sexual dimorphism the relevant values always higher in males as compare in females.

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DISCUSSION

Dental anthropology is an important aspect of physical anthropology. Teeth are a very stable substance within the body, and are often the best-preserved portion of the body in archaeological and forensic cases.

In many cases, teeth are the only evidence that can be used for analysis. Especially in forensic cases, teeth can be the deciding factor in identification of individuals. In archaeological cases, dental anthropology can reveal much important information about individuals and populations.

Arya B.S. et al (1974) further quoted Mooreses C.F.A (1959) that the teeth in males were invariably bigger than females and the largest sex differences were appreciated with canines in both dentitions. The canines were significantly difference only in the permanent dentition observation is similar in my thesis.

Arya B.S. et al (1974) quoted found less pronounced sex differences in the deciduous dentition, than in the permanent dentition with maximum for permanent canines. The canines were larger in males as compared to females. The canines were significantly different only in the permanent dentition. He also found that, in females the continued enamel deposition occurring is less than in males observation is similar in my thesis.

Howe R.P NicNamara J.A. and O'Connor (1983) examined dental crowding and its tooth size and

arch distance / dimension and also different with males having slightly larger mesio-distal dimensions. These differences were more for maxillary incisors and canines. They also added the sexual dimorphism in mesio-distal tooth size may be due to different in dentin thickness and enamel deposition observation is similar in my thesis.

Tescher - Nicola M (1986) quoted sexual dimorphism of tooth crown diameters by measuring (mesio-distal and bucco-lingual diameters of upper canine) was 80% successful stating the average of both the deciduous and permanent teeth of female tooth possess altogether teeth of smaller dimensions. In males there was a small statistically increased in arch width from 12 to 15 years of age observation is similar in my thesis.

Staley R.N and Hoag J.F (1988) studied the widths of the male canines were significantly larger than females. They reported that the all measurements taken from African Primates and revealed that permanent canines contributing most to the discrimination of sex. Hence, the canine width could be useful for sex discrimination in forensic dentistry..

Rao N.K.G. et al (1989) derived Maxillary Canine Index (MCI) for establishing sex identity. The index was derived as ratio between two parameters in permanent maxillary canines. Namely the maximum crown width and canine arch width (mm) and was calculated.

$$\text{MCI} = \frac{\text{Mesiodistal crown width of maxillary canine}}{\text{Maxillary canine arch width.}}$$

Accuracy of sex determination was found to be 84.3% in the males and 87.5% in females observation is similar in my thesis in my thesis there is comparison between observed and standard maxillary canine index and value is almost similar.

Hashuri HA. Murrhid ZA (1993) investigated whether sex differences is these in measuring the mesio-distal tooth width between Saudi males and females. His reports confirm that canines in both jaws exhibited a significant sex difference. They reported the width of male canines were significantly larger than females ($p<0.001$).

These results showed the existence of a relative dental dimorphism (male > female mesio-distal diameter) with humans for sex determination observation is similar in my thesis.

1. The present study was carried out to established sex determination using the mesio-distal distance, intercanine distance for males and females in northern central region in India.
2. The study was conducted for width and length measurements of canine with the help of 100individuals of which 50 males and 50 females..
3. Mesio-distal width of canines was measured using divider with one portion of divider in contact point of mesial side and another portion of divider in contact point of distal side. The distance was recorded in millimeter.
4. The mean value and mean ± S.D value was calculated for measurements in male and female individual teeth .The mean value of

measurements was compared between male and female with statistical analysis.

5. The maxillary canine index was calculated by dividing the mean value of mesio-distal width of upper canine with that of mean value of inter-canine arch distance in upper canine. The mean value of male and female was compared statistically and results were recorded.
6. The mean value mesio-distal distance of all canines was increased in males ranging 7.2 to 7.8mm, than females ranging 6.7 to 7.6mm.
7. Mesio-distal distance of canine of males reveal that mesio-distal distance was more in males than females and reduction of mesio-distal width in female canine with range (male 7.5 to 8.3, female 7.5 to 7.9) is established with statistical significant $p<0.0001$.
8. The incisio-cervical distance of all canine teeth is more in males than females in individuals and range (male 11 to 11.4, female 10.5 to 10.6). This reduction in incisio-cervical length in females is established the significant $p<0.0001$
9. The sex determination can be done with help of distance of canine tooth in forensic dentistry to help of law and justice.
10. Rao N.K.G et al have demonstrated that in inter-canine distance and canine index are useful parameter as measured in differentiating the sexes.
11. Gabrial(1958)has also found that mesio-distal diameter was significantly greatly greater in males then females.
12. Mohmmad et al in his study on Saudi Arbiyan population observed the mean mesio distal width of maxillary canines having values 7.54±0.68mm (right)and 7.54± 0.67mm(left)in males. While in females it was 6.8±0.925mm (right) and 6.8±0.934mm (left) but the differences in males and females were not statistically significant.
13. The present study shows these value as right & left canine width of intra oral and cast in male it was RCW 7.22422±0.15905 mm in oral & slightly differ on cast it was 7.2258±0.16639mm and LCW 7.219±0.13643mm intra oral and 7.2202±0.12918on cast and RCW 6.4882 ± 0.81699 mm in oral & slightly differ on cast it was 6.6144 ±0.13377 mm and LCW 6.588 ±0.11414 mm intra oral and 6.5954 ±0.11368 on cast.

Compare of inter canine distance of cast & intra oral in males & females indicates that values higher in males as compare to females.

It was 25.31676±1.20938 on cast for male & 23.84366±0.70911 on cast for females23.81413±0.74969 for female on oral &25.31542±1.24696 for male.

REFERENCES

1. Garn S.M., Lewis AB. Swindler DR Kerewsky BS. Genetic Control of sexual

dimorphism in tooth size. Journal. 1967; 46(5): 963-972.

2. Gupta D.S., Chawla TN and Kapoor DN. Inheritance of tooth size and sexual dimorphism in case of malocclusion. JIDA. 1974; 95-102.
3. Harris E.F. A longitudinal study of arch size and form in untreated adults. Abstract.
4. Haschuls HA and Musshid ZA. Mesio-distal tooth width - A comparison between Saudi males and females. Egyptian Dental Journal. 1993; 39(1): 343-346.
5. Hattab F.N al Khateeb S., Sultan J. Mesio-distal crown diameters of permanent teeth in Jordanians. Archie's oral Biology. 1996; 41(7): 641-645.
6. Mehrothra R.G. Odontocranial characteristics as determinants of age, sex and race. Journal of Indian Dental Association. 1980; 52: 339-340.
7. Nair P. Rao BB and Annigeri R.G. A study of tooth size; symmetry and sexual dimorphism. J. of Forensic Medicine and Toxicology. 1999; 16(2): 10-13.
8. Sherfudhen H. Abdullah MA Khan N. A cross sectional study of canine dimorphism in establishing sex identity. Comparison of two statistical methods. 1996; 23: 627-631.
9. Slavkin H.C. Sex enamel forensic dentistry. A search for identity. JADA. 1997; 128: 1021-1025.
10. Strond J.L Buschang P.H and Goaz P.W. mesiodistal dentin and enamel thickness. Sexual dimorphism in Dento-maxillofacial Radiology. 1993; 23: 169-171.
11. Strond J.L Buschang P.H and Goaz P.W. mesiodistal dentin and enamel thickness. Sexual dimorphism in Dento-maxillofacial Radiology. 1994; 11: 60-67
12. Rao NG, Rao NN, Pai ML, Kotian MS. Mandibular canine index-A clue for establishing sex identity. Forensic SciInt 1989;42:249-54
13. Boaz K, Gupta C. Dimorphism in human maxillary and madibular canines in establishment of gender. J Forensic Dent Sci 2009;1:42-4.
14. Ýþcan MY. Forensic anthropology of sex and body size. Forensic SciInt 2005;147:107-12.
15. Kapila R, Nagesh KS, R Iyengar A, Mehkri S. Sexual dimorphism in human mandibular canines: A radiomorphometric study in South Indian population. J Dent Res Dent Clin Dent Prospects2011;5:51-4.
16. Yuen KK, So LL, Tang EL. Mesiodistal crown diameters of the primary and permanent teeth in southern Chinese - A longitudinal study.Eur J Orthod 1997;19:721-31.
17. Al-Rifaiy MQ, Abdullah MA, Ashraf I, Khan N. Dimorphism of mandibular and maxillary canine teeth in establishing sex identity. Saudi Dent J 1997;9:17-20.
18. Muller M, Lupi-Pegurier L, Quatrehomme G, Bolla M. Odontometrical method useful in determining gender and dental

alignment. Forensic SciInt 2001;121:194-7.

19. Kaushal S, Patnaik VV, Agnihotri G. Mandibular canines in sex determination. J Anat Soc India 2003;52:119-24.
20. Sognnaes RF. Forensic stomatology (first of three parts). N Engl J Med 1977;296:79-85.
21. Anderson DL, Thompson GW. Interrelationships and sex differences of dental and skeletal measurements. J Dent Res 1973;52:431-8.
22. Krogman W, Iºcan MY. The Human Skeleton in Forensic Medicine. Springfield, IL: Charles C. Thomas; 1986.
23. Alexander AG. A study of the distribution of supra and subgingival calculus, bacterial plaque and gingival inflammation in the mouths of 400 individuals. J Periodontol 1971;42:21-8
24. Hashim HA, Murshid ZA. Mesiodistal tooth width. A comparison between Saudi males and females.Part 1. Egypt Dent J 1993;39:343-6.
25. Hashim HA, Murshid ZA. Mesiodistal tooth width in a Saudi population sample comparing right and left sides. Part 2. Egypt Dent J 1993;39:347-50.
26. Bossert WA, Marks HH. Prevalence and characteristics of periodontal disease in 12,800 persons under periodic dental observation. J Am Dent Assoc 1956;52:42942.
27. Acharya AB, Mainali S. Univariate sex dimorphism in the Nepalese dentition and the use of discriminant functions in gender assessment. Forensic SciInt 2007;173:47-56.
28. Acharya AB, Mainali S. Limitations of the mandibular canine index in sex assessment. J Forensic Leg Med 2009;16:67-9.
29. Sundick RI. Age and sex determination of subadult skeletons. J Forensic Sci 1977;22:141-4.
30. Reddy VM, Saxena S, Bansal P. Mandibular canine index as a sex determinant: A study on the population of western Uttar Pradesh. J Oral Maxillofac Pathol 2008;12:56-9.
31. Krogh HW. Permanent tooth mortality: A clinical study of causes of loss. J Am Dent Assoc 1958;57:670-5.
32. Rao N.K.G et al have demonstrated that in intercanine distance and canine index are useful parameter as measured in differentiating the sexes.