

Odontometric Analysis: An Aid for Sexual Dimorphism

Anuj Mishra*, Ruchika Prasad**, Abhishek Sinha***, Sunita Srivastava****, Debanti Giri*****

*,****Post graduate student **,****Sr. Lecturer ***Reader Dept of Oral Medicine and Radiology, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Raebareilly Road, Lucknow, Uttar Pradesh, India.

Abstract

Aims: The purpose of this study was to investigate whether sexual dimorphism can be established by odontometric study of permanent mandibular canine teeth as well as canine arch width. **Methods:** This study was carried out on 40 subjects of subjects selected from Sardar Patel dental and medical sciences, Lucknow. Out of these 40 subjects, 20 subjects were female and 20 subjects were male. Both sexes belong to age group between 17 to 25 years. The following measurements of the permanent mandibular canine teeth were taken: mesio-distal width of the crown and intercanine distance. From these measurements mandibular canine index was calculated. In addition, the percentage of sexual dimorphism was calculated. **Results:** There was sexual dimorphism in mesio-distal width, canine arch width and canine index of permanent mandibular canine teeth. Sexual dimorphism is more on right permanent mandibular canine teeth than left permanent mandibular canine teeth. **Conclusion:** According to the present study, sexual dimorphism in mesio-distal diameter is more in right mandibular canine is than left mandibular canine teeth. Sexual dimorphism in canine index is more in right mandibular canine (3.94%) is than left mandibular canine teeth (1.92%).

Keywords: Mandibular Canine; Sexual Dimorphism; Canine Width; Intercanine Distance.

Introduction

Identification of sex in damaged dead bodies (non-living population) is an essential step for medico legal purposes [1]. Human teeth are the hardest and chemically the most stable tissues in the body, and are extremely durable even at high temperatures. Teeth can be identified even when the rest of the body has undergone decomposition [2]. They are well preserved after death. Further, they show significant sexual dimorphism and are readily accessible for examination [3]. Thus; they provide excellent materials for forensic studies involving identification of sex [2]. 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 mandibular canines can be considered as the 'key teeth' for personal identification [3].

"Sexual Dimorphism" refers to those differences in size, stature and appearance between male and female that can be applied to dental identification because no two mouths are alike. Sex determination using dental features is mainly based upon the comparison of tooth dimensions in males and females [4].

Studies on tooth morphology have in the past been conducted using either intra-oral measurements or measurements on casts. Barrett et al (1963) have observed that intra-oral measurements are less reliable. Garn et al (1967) and Nair et al (1999) have found the mandibular canines to exhibit the greatest sexual dimorphism amongst all teeth [4].

Canines are also better likely to survive severe trauma such as air disasters, hurricanes or

Corresponding author: Anuj Mishra, Post graduate student, Dept of Oral Medicine and Radiology, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Raebareilly Road, Lucknow, Uttar Pradesh, India.

E-mail: annumishra13@gmail.com

conflagration. These findings indicate that mandibular canines can be considered as the 'key teeth' for personal identification. (Dahberg, 1963) [3].

The present study is to know the sexual variation in the morphology of permanent mandibular canines. It involved measurement of mesiodistal width, intercanine distance and canine index. To establish the effectiveness of mandibular canine index in predicting sex, take correct dental alignment into consideration. Mesiodistal width of left and right mandibular canines were measured in the present study in a comparable cohort of male and female subjects keeping other parameters which influence tooth size same for both the groups. The measurements were then subjected to statistical comparisons and values of significance were calculated to know the importance of parameters in determination of sex.

Material and Methods

Forty subjects, 20 males and 20 females in the age group of 17-25 years were selected for the study. This age group was selected, as attrition is minimal in this age group and there are good chances of healthy periodontium. Such cases were identified with Class-I molar relationship, absence of incisor spacing with normal overjet and overbite. (Vacher and Gupta, 1966). The study was conducted on the subjects selected from Sardar patel dental and medical sciences, Lucknow. Cases with any doubt about age or oral pathology are excluded from the series.

Inclusion Criteria

- Healthy state of gingiva and periodontium.
- Caries free teeth.
- Normal overjet and overbite.
- Absence of spacing in the anterior teeth.
- Normal molar and canine relationship.

Following parameters were determined in this study

- Mesiodistal width of right mandibular canine.

- Mesiodistal width of left mandibular canine.
- Intercanine distance.
- Right mandibular canine index.
- Left mandibular canine index.

Measurements

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

- The mandibular canine width (RMCW and LMCW): With the subject in a sitting position, RMCW and LMCW were measured with Vernier caliper as the greatest width between the contact points of the teeth on either side of the lower jaw.
- The inter-canine distance (ICD): was measured as the linear distance between the tips of right and left mandibular canine in the lower jaw.
- Mandibular canine index (RMCI and LMCI): was calculated based formula adapted from Rao et al. (1989) who derived Mandibular Canine Index (MCI) for establishing sex identity was calculated using the formula [5] – Mandibular canine width / Inter-canine distance.

All measurements were taken on an anatomically sound basis using a Vernier Caliper with a resolution of 0.02 micro-meters and a divider with a fixing device. The readings obtained were subjected to statistical analysis to derive conclusions and Sexual Dimorphism in RMCW and LMCW were calculated using formula given by Garn & Lens (1967) as follows:

$$\text{Sexual Dimorphism} = (X_m / X_f - 1) \times 100$$

(X_m = Mean value of male canine width;

X_f = Mean value of female canine width).

Observations and Results

Results of present study are depicted in Table 1 and 2.

Table 1: Parameters of mandibular canines of male and female and their statistical significance

S.No	Parameters	Sex	Mean	SD	Coefficient of Variation	P-value	Significance
1.	Right canine width	M	7.19	2.23	0.20	<0.05	Significant
		F	6.30	0.35	0.00		
2.	Left canine width	M	7.32	2.46	0.23	<0.05	Significant
		F	6.35	0.35	0.00		
3.	Inter-canine distance	M	29.2	3.31	0.113	<0.05	Significant
		F	26.9	3.12	0.116		
4.	Right mandibular canine index	M	0.26	1.88	0.15	<0.05	Significant
		F	0.25	0.35	0.00		
5.	Left mandibular canine index	M	0.26	2.13	0.18	<0.05	Significant
		F	0.25	0.35	0.00		

In Table-1 the parameters of mandibular canines of male and female and their statistical significance have been shown.

The mean mesiodistal width of right and left mandibular canines are significantly different in male and female.

Table 2: Mandibular canine indices

Parameters	Right Canine	Left Canine
Sexual Dimorphism	3.94%	1.92%

Sexual dimorphism was calculated and right mandibular canine was found to be more dimorphic than left mandibular canine.

Discussion

Sex identification with tooth (size) is dependent upon the difference in the tooth size between males and females; called '*Sexual Dimorphism*'. S.D refers to those differences in size, stature and appearance between males and females that can be applied to dental identification as just like that no two mouths are alike [6]. Amongst all teeth, canines have been shown to be the teeth with maximum sexual dimorphism. Thus in the present day humans, sexual dimorphism in mandibular canines is not merely a coincidence but can be expected to be based on functional activity [7]. The determination of sex makes identification easier and it is of immense forensic importance. In fact, it has been suggested that the first reported crime in the history of mankind was solved when the bite marks were discovered in the remains of forbidden fruits in the Garden of Eden and identified as those of Adam and Eve [8].

The difference in size between male and female teeth has been explained as part of the genetic expression of the male being larger than the female. It is the Y chromosome which intervenes most in the size of teeth by controlling the thickness of dentine, whereas the X chromosome responsible for the thickness of enamel. The sexual dimorphism in average tooth size is caused by a promoting effect of the Y chromosome on dentinal growth. Along with the MD width of mandibular canine, the inter-canine width has also been shown to be different in males and females [9].

Garn and Lewis and Lysell and Myrberg concluded that the mandibular canine exhibited the greatest sexual dimorphism amongst all teeth (6.47% and 5.7% respectively) [10]. Nair et al in their study on South Indian subjects reported that the left

Inter canine distance was also statistically analyzed. The difference of means of intercanine distance of male and female was not statistically significant.

Mandibular canine indices for right and left canines were also found to be significantly different in male and female.

mandibular canine exhibited a sexual dimorphism of 7.7% and the right mandibular canine 6.2% [11].

Kaushal et al in their study on 60 subjects in a North Indian population found a statistically significant dimorphism in mandibular canines. The mandibular left canine was seen to exhibit greater sexual dimorphism (8.8%) than the right mandibular canine (7.9%). They also concluded that if the width of the canine is greater than 7mm, the probability of the sex of the person under consideration being male was 100% [12].

The present study establishes the existence of a definite statistically significant in sexual dimorphism in mandibular canines. The present study establishes a statistically significant sexual dimorphism in mandibular canines. Determination of sex by mesiodistal measurement of mandibular canines is a relatively quick, easy and inexpensive method, and can aid in identifying persons from fragmented jaws and dental remains.

It must be noted, however, that the method of sex determination via canine measurement has its limitations; the sex of the subject to whom the fragment of the mandible belongs can be determined satisfactorily only when the fragment is found in the geographical area where the subject was born.

Conclusion

It is a known fact that teeth provide excellent models for the study of relationship between ontogeny and phylogeny. In the present day humans, sexual dimorphism in mandibular canines is not merely a coincidence but can be expected to be based on functional activity.

It is concluded that the mesiodistal widths of mandibular canines are significantly different in males and females, as are the mandibular canine indices. The mandibular inter-canine distance was not significantly different. The right mandibular

canine was found to be more dimorphic than left mandibular canine. The parameters measured in the present study will be of immense help in identification of sex in forensic investigations.

References

1. Dr. P. C. Srivastava. Correlation of Odontometric Measures in Sex Determination. *J Indian Acad Forensic Med*, 32(1).
2. Rishabh Kapila, K.S. Nagesh, Asha R. Iyengar, Sushma Mehkri. Sexual Dimorphism in Human Mandibular Canines: A Radiomorphometric Study in South Indian Population. *JODDD*, Spring 2011; 5(2).
3. Thoma AM et al. Anthropometric Evaluation of Mandibular Canine Width And Inter canine Distance in Sex Determination. *IJRD ISSUE 2*, 2013.
4. Prof. Dr. Irfan Ahmed Mughal Dr. Farida Manzur. Mandibular Canine Index (Mci)- Its Role In Determining Gender. *Professional Med J Sep* 2010; 17(3): 459-463.
5. Rao NG, Rao NN, Pai ML, Kotian MS. Mandibular canine index-A clue for establishing sex identity. *Forensic Sciences International* 1989; 42: 249-54.
6. Dr. Dhara H. Parekh ,Dr. S. V. Patel , Dr. A.Z. Zalawadia , Dr.S.M.Pate. Odontometric Study Of Maxillary Canine Teeth To Establish Sexual Dimorphism In Gujarat Population. *Int J Biol Med Res.* 2012; 3(3): 1935-1937
7. Eimerl, S. and De Vore, L. *The Primates Times Inc.* New York, 1965.
8. Lysell L, Myrberg N. Mesiodistal tooth size in deciduous and permanent dentitions. *Eur J Orthod* 1982; 4: 113-22.
10. Garn SM, Lewis AB, Swindler DR, Kerewsky RS. Genetic control of sexual dimorphism in tooth size. *J Dent Res* 1967; 46: 963-72.
11. Nair P, Rao BB, Annigeri RG. A study of tooth size, symmetry and sexual dimorphism. *J Forensic Med Toxicol* 1999; 16: 10-3.
12. Kaushal S, Patnaik VV, Agnihotri G, Mandibular canines in sex determination. *J Anat Soc India* 2003; 52: 119-24.