# **"EFFICACY OF MANDIBULAR CANINE INDEX IN SEXUAL DIMORPHISM" - AN AID IN PERSONAL IDENTIFICATION**

# M. Chandrasekhar, Prof&amp,HOD,

## Department of Oral medicine and radiology, Government Dental college.

#### ABSTRACT

**INTRODUCTION:** Forensic odontology is basically the science dealing with establishing identity by teeth and has played an important, often crucial role in the identification of victims of mass disasters. Among all teeth, the mandibular canines are found to exhibit greatest sexual dimorphism. Mandibular canine index (MCI) is a simple odontometric method which uses the mandibular canine as the key to sex estimation. This index is defined as the ratio between the canine mesiodistal dimension and the mandibular canine arch width.

AIM: To evaluate the effectiveness of mandibular canine index (MCI) in the determination of sex.

**MATERIALS AND METHODS:** The study was conducted on 70 subjects (35 males, 35 females) of age group 16-25 years. Mandibular impressions were taken and study casts are fabricated. Mesiodistal and buccolingual dimensions of mandibular canines was measured with the help of digital Vernier calipers. Intercanine distance was measured with the help of a divider. The standard MCI value is used as a cut off point to differentiate males from females. Statistical analysis was done using t-test.

**RESULTS:** The mandibular canine index of right canine in percentage accuracy for males is 62.86% and females is 54.29 and MCI of left canine is 68.57% for males and 57.14 for females. The sexual dimorphism for right canine is 5.18% and for left canine is 8.44%, which shows significant results.

KEYWORDS: Mandibular canine index, mesiodistal dimension, intercanine distance, sexual dimorphism,

## **INTRODUCTION**

Forensic odontology is an evolving science and has a greater scope of development. Various methods have been developed to determine age, sex, and ethnicity of the person, using dental tissues. Sex determination is very important subdivision of forensic odontology, which plays a major role in identification of the unknown individuals in natural disasters; chemical and nuclear bomb explosion scenarios. It can be done by various

methods such as Craniofacial morphology and dimension; tooth dimension; tooth morphology, and DNA analysis<sup>1</sup>. Sexual dimorphism refers to the differences in size, stature, and appearance between male and female. Gender determination is the first and foremost task in any kind of forensic investigation of unidentified bodies and skeletal remains. Skeleton remains have been used for determining the gender of an individual and has proven to give accurate results when the skeletal bones are complete. It becomes a puzzle for forensic experts especially when the skeletal remains are fractured or incomplete. In such cases, the use of dental remains such as teeth is an excellent piece of evidence that can be used to determine gender. This is applied to dental identification because no two mouths are alike<sup>2</sup>. Gender determination plays a pivotal role in solving medico-legal cases as well as in anthropological studies.<sup>3</sup> At high temperature teeth are durable and may be identified even when the rest of the body has undergone decomposition. Mandibular canines are found to exhibit the greatest sexual dimorphism amongst all teeth because they are strongest teeth that less effected by diseases and the last teeth to be extracted with respect to age<sup>4</sup>. It was for these reasons that Rao *et al.* proposed the exclusive use of mandibular canines in sex identification. The authors developed an index, which they named mandibular canine index (MCI).

#### AIM OF THE STUDY:

- To measure the mesiodistal diameter of right and left mandibular canines so as to establish canine measurement variations in sex determination of kadapa population.
- To evaluate the effectiveness of mandibular canine index (MCI) in gender identification.

## **MATERIALS:**

- Alginate impression material
- Dental stone
- Digital vernier calipers

#### SAMPLE SELECTION

This study was carried out on 70 individuals patients who were visiting Rims dental hospital, kadapa for availing some kind of dental treatment or for a routine dental checkup and students of Rims dental college, kadapa. Of these 35 were males and 35 were females. Both sexes belong to age group between 16 and 25 years. The inclusion criteria were patients having healthy periodontium, caries-free and non-attrited canine

teeth and teeth having Class I canine relationship, fully erupted teeth with no spacings and no evidence of trauma. The exclusion criteria were patients having carious or missing mandibular anterior teeth, ectopically erupted teeth, the presence of abrasion, attrition, spacing, and crowding in mandibular anterior teeth and hard tissue diseases affecting the mandibular anterior teeth.

#### **METHOD**

Impressions were made by alginate and study models were prepared in dental stone. Mandibular study models were used for the analysis. On the study model, the following measurements were taken for all the subjects using a digital vernier's calipers. Mandibular canine width was measured as the greatest mesiodistal dimension between the contact points of mandibular canine on either side of the jaw using a vernier caliper, and the average of this was taken (Figure 1). The intercanine distance was measured as the linear distance between the cusp tips of right and left mandibular canine (Figure 2). Each reading was taken 3 times, and the average of three values was obtained to minimize the intra-observer error. The readings obtained from measurement of left and right mandibular canine width and intercanine distance were subjected to statistical analysis to assess the mandibular canine indices of the sample.

Rao et al. proposed the exclusive use of mandibular canines in sex identification. The authors developed an index, which they named Mandibular Canine Index (MCI), and was derived as follows:

MCI =<u>Mesiodistal crown width of mandibular canine</u> Mandibular inter-canine arch width The mean and standard deviation (S.D.) of the MCI was derived separately for males and females and a cutoff point-termed the 'Standard MCI'-to distinguish the sexes calculated as follows:

Standard MCI (MCIs) = (mean male MCI - SD) + (mean female MCI + SD)/2

- If the MCI value </= to the Standard MCI  $\rightarrow$  Female;
- If the MCI value > to that of Standard MCI  $\rightarrow$  Male

Sexual dimorphism in the right and left mandibular canines was calculated using the formula given by Garn and Lens (1967):<sup>3</sup>

Sexual dimorphism in mesiodistal width =  $(Xm/Xf) - 1 \times 100$ 

Xm = Mean value of canine width in males

Xf = Mean value of canine width in females.

#### RESULTS

The present study shows significant difference of mesiodistal width between males and females of right mandibular canine of pvalue (0.002) and very high significance of pvalue(<0.0001) seen in left mandibular canine. The intercanine distance was measured from the cusp tips of right and left mandibular canine using standardized criteria. The results showed that the mean value of the intercanine distance in males was 27.6000 and of females was 27.0429 in turn showing non significance of pvalue0.130. The MCI was calculated using a standardized formula. In males, the mean MCI on the right side was found to be 0.2520mm whereas on the left side it was found to be 0.2537mm . In females, the MCI on the right side was found to be 0.2447 mm whereas on the left side it was found to be 0.2537 mm . MCI of right canine is not significant where as highly significant for right canine(Table1).Based on the standard MCI calculated for right mandibular canine (0.25) and for left mandibular canine (0.246) the total probability of sex determination for right mandibular canine is 58.57% and for left canine is 61.24%, suggesting that mandibular left canine is more significant for right and left canine respectively, and females show 54.29% and 57.14% for right and left canine respectively. Table 2&3). The sexual dimorphism calculated through the formula shows in percentage for right canine 5.18 and for left canine 8.44.

Overall, the values obtained for the right canine width, left canine width, right MCI, and left MCI was found to be significantly higher in males than females showing sexual dimorphism. And width of left mandibular canine is higher than right mandibular canine predicting the reliability.

#### DISCUSSION

In the current study, there was a significant difference observed between the right canine width and left the canine width of males and females. Similar results were obtained in the previous study Reddy et al<sup>6</sup>. The difference in width of canine 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 dentin, whereas the X chromosome responsible for the thickness of enamel. The sexual dimorphism in mandibular canines can be expected to be based on functional activity due to evolution and socialization.<sup>7</sup> The present study establishes the existence of a definite statistically significant sexual dimorphism in mandibular canines. It is similar with studies conducted by Hashim and Murshid (1993) on Saudi males and females in the age group of 13-20 years and found that only the canines in both jaws exhibited a significant sexual difference while the other teeth did not<sup>8</sup>. Similar findings were given by Lew and Keng (1991) in their study on ethnic Chinese population<sup>9</sup>. Kumar et al (1989) have demonstrated that intercanine distance and mandibular canine index are useful parameters in differentiating the sexes. In the present study both these parameters as measured in males and females were compared and the difference was found to be statistically significant. Garn & Lewis (1967) and Lysell & Myrberg (1986) concluded that the mandibular canine with 6.4% and 5.7%, respectively demonstrates the greatest sexual dimorphism amongst all teeth<sup>10,11</sup>. Nair et al (1999) in their study on South Indian subjects concluded that the left mandibular canine with 7.7% followed by the right mandibular canine with 6.2% shows the maximum sexual dimorphism<sup>12</sup>. In the present study also, the left mandibular canine was found to exhibit greater sexual dimorphism (8.44%). In the present study, there was no significant difference between the intercanine distance of males and females. The study findings also revealed that there was a significant difference between the right and left MCI among males and females. The contribution of various tissues in sexual dimorphism of tooth size was reported by Harris et al. They found that males typically have significantly larger dentine and pulp dimensions than females; while marginal enamel thickness is similar in both sexes. Moss and Moss-Salentijn suggested that dimorphism was related to an absolutely longer period of amelogenesis for both deciduous and permanent dentitions.13

#### CONCLUSION

The significant results obtained on comparison of right and left mandibular canine indices in males and females justify its usage as a tool for the determination of sex of an individual.MCI is a quick and reliable method for sex identification when a standard for the population is available. It is inexpensive. Dimorphism in mandibular canines can be of significance in medico-legal cases in gender and personal identification. As the dental patterns are unique for every individual tooth dimensions are useful. Further studies and larger sample is required to approach the primary level of diagnosis in forensic dentistry.

#### REFERENCES

- Divakar KP. Forensic Odontology: The New Dimension in Dental Analysis. Int J Biomed Sci. 2017;13(1):1-5.
- Bashir T, Kandakurti S, Gupta J, Sachdeva AS, Ahmad N, Krishnan V. Use of mandibular canine index as a tool in gender dimorphism: A phenotypic study. J Indian Acad Oral Med Radiol 2016;28:386-90.
- Garn SM, Lewis AB, Kerewsky RS. Buccolingual size asymmetry and its developmental meaning. Angle Orthod 1967;37:186-93.
- Mughal IA, Saqib AS, Manzur F. Mandibular canine index (mci); its role in determining gender. Professional Med J 2010;17:459-63.
- Acharya AB, Mainali S. Limitations of the mandibular canine index in sex assessment. J Forensic Leg Med 2009;16:67-9.
- 6) Reddy VM, Saxena S, Bansal P. Mandibular canine index as a sex determinant: A study on the population of western Uttar Pradesh. JOMFP 2008;12:56-9.
- 7) Narang RS, Manchanda AS, Malhotra R, Bhatia HS. Sex determination by mandibular canine index and molar odontometrics: A comparative study. Indian J Oral Sci 2014;5:16-20.
- Hashim, H.A. and Murshid, Z.A. (1993) : Mesio-distal tooth width A comparison between Saudi males and females. Egyptian Dental. Journal 39(1): 343-6.
- Lew, K.K. and Keng, S.B. (1991): Anterir crown dimensions and relationship in an ethnic Chinese population with normal occlusions. Australian Orthodontic Journal. 12(2): 105-9.

- 10) Garn, S.M. and Lewis, A.B. (1967): Bucco-Lingual size asymmetry and its developmental meaning. Angle Orthod. 37(1): 186-193.
- 11) Lysell, L. and Myrberg, N. (1982) ; Mesiodistal tooth size in deciduous and permanent dentitions.European Journal of Orthodontics 61(1): 113-122.
- 12) 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.
- 13) Singh SK, Gupta A, Padmavathi B, Kumar S, Roy S, Kumar A. Mandibular canine index: A reliable predictor for gender identification using study cast in Indian population. Indian J Dent Res 2015;26:396-9.





Fig 2: Measurement of intercanine distance



PARAMETER	GENDER	NUMBER OF	MEAN	STANDARD	P VALUE
		SAMPLE		DEVIATION	
Age	Male	35	20.51	1.502	0.453
	Female	35	20.86	2.225	NOT SIG
MDW of Right	Male	35	6.9543	0.47424	0.002
Canine	Female	35	6.5943	0.47026	SIG
MDW of Left	Male	35	6.9857	0.45642	<0.0001
Canine	Female	35	6.4000	0.43589	VHS
Inter canine	Male	35	27.6000	1.37627	0.130
distance	Female	35	27.0429	1.65552	NOT SIG
MCI of Right	Male	35	0.2520	0.01729	0.122
Canine	Female	35	0.2447	0.02174	NOT SIG
MCI of Left Canine	Male	35	0.2537	0.01767	<0.0001
	Female	35	0.2373	0.01876	VHS

#### Table 1: Mesiodistal width, Intercanine distance and MCI of mandibular canines

## Table 2: Probability of sex determination (MCI – Right canine)

Gender	Number of cases studied	Number of cases with correct gender prediction by using standard MCI	Percentage accuracy
Males	35	22	62.86
Females	35	19	54.29
TOTAL	70	41	58.57

## STANDARD MCI VALUE - 0.25

Gender	Number of cases studied	Number of cases with correct gender prediction by using standard MCI	Percentage accuracy
Males	35	24	68.57
Females	35	20	57.14
TOTAL	70	44	61.24

### Table 3: Probability of sex determination (MCI –Left canine)

#### STANDARD MCI VALUE - 0.246

#### Table 4: Sexual dimorphism in Mandibular canine

MANDIBULAR CANINE	PERCENTAGE(%)
Right canine	5.18
Left canine	8.44