

# A Study On The Population Of Patna, Bihar To Determine Sex Using Mandibular Canine Index

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### Abstract:

**Objective:** To establish the effectiveness of mandibular canine index in predicting sex in people from Patna, Bihar.

**Materials and Methods:** 100 subjects belonging to Patna, Bihar (50 males; 50 females) in the age group of 17-25 yrs were included. Impressions were made with alginate and study models prepared with dental stone. Maximum mesiodistal diameter of mandibular canines and the linear distance between tips of mandibular canines were measured using a Vernier caliper. Observed mandibular canine index ( $MCI_0$ ) was calculated as the ratio between the maximum mesiodistal width of mandibular canine and canine arc width.

**Results:** Left canine exhibited greater sexual dimorphism i.e. 9.05% as compared with right canine i.e. 8.782%. Sex could be predicted correctly in approximately 70% of subjects examined.

**Conclusion:** With the standard MCI it was possible to detect sex in the population of Western Uttar Pradesh to an extent of about 72%. Hence it is considered as a quick, easy and reproducible method for determining the sex of an individual.

**Keywords:** Canine, mesio-distal dimension, Northern India, sexual dimorphism.

## I. INTRODUCTION

Gender determination of skeletal remains is part of archaeological and many medico-legal examinations. The methods vary and depend on the available bones and their condition. The only method that can give a totally accurate result is the DNA technique, but in many cases for several

reasons it cannot be used. Anthropological measurements of the skeleton and the comparison with existing standard data must then be applied and may help to differentiate between male and female remains. On an individual basis however, gender differences are not always distinctive, but taken collectively they can give a good indication in the majority of cases. When jaws are at hand, teeth may be used for gender

determination with the aid of odontometric analysis. Mandibular canines are found to exhibit the greatest sexual dimorphism amongst all teeth.[1,2] The mandibular canines are not only exposed to less plaque, calculus, abrasion from brushing, or heavy occlusal loading than other teeth, they are also less severely affected by periodontal disease and so, usually are the last teeth to be extracted with respect to age.[3] These findings indicate that mandibular canines can be considered as the .key teeth. for personal identification.[4] Studies performed on the lower canines using the ratio between the maximum crown width and inter-canine width, resulting in a mandibular canine index (MCI), have shown an ability to determine gender with an accuracy of 84.3% in males and 87.5% in females and 83.3% in males and 81% in females by comparing the observed MCI with a standard MCI value[5,6] respectively. Mandibular canine index was employed in numerous studies on large populations as it is simple, reliable, inexpensive and easy to perform.

The purpose of this study was to investigate the accuracy with which gender can be differentiated by using the mandibular canine index on the people from Patna, Bihar, and to correlate with other studies.

## II. MATERIALS AND METHODS

The study group consisted of 50 males and 50 females from Patna, Bihar, between the age group of 17-30 years.

The inclusion criteria for the study are as follows:

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

Maxillary and mandibular impressions of all the samples were taken with alginate and study models were prepared using dental stone. Mandibular study models were used for the analysis. Mandibular canine width was measured as the greatest mesiodistal dimension of mandibular canine on either side of the jaw using a Vernier caliper. The inter canine distance was measured as the linear distance between the cusp tips of right and left mandibular canine.

The observed mandibular canine width and intercanine width were subjected to statistical analysis to assess sex difference using unpaired t-test. Intraobserver error was assessed using paired student t-test on 25 randomly selected casts.

The observed MCI was then compared with the standard MCI value obtained in this study and correlated with previous studies like Rao *et al.* and Muller *et al.*[5,7]

## III. RESULTS

From Table 1 it is evident that the various parameters (inter-canine distance, mandibular canine width, (MCI) measured for males and females when compared are statistically different table 2. There is no statistically significant difference between the right and left mandibular canines amongst males or females so the maximum crown

width was considered, but when comparing between males and females there is highly statistically significant difference. The intra-observer error was assessed at  $p < 0.05$  level and showed no statistically significant differences. The calculated standard MCI for both males and females were found to be 0.256. With these calculations, we could predict sex correctly at 72.5% in this study. On comparing the  $MCI_0$  values of this study to the standard  $MCI_s$  values of Rao *et al.*(5), (0.274) and Muller *et al.*(7), (0.269) the percentage of sex prediction was low at average of 35 and 52% respectively.

Parameters	Mean $\pm$ S.D	P-value	Significance
<b>Right canine width Male</b>	7.017 $\pm$ 0.43	$p < 0.01$	Highly significant
<b>Right canine width female</b>	6.428 $\pm$ 0.35	$p < 0.01$	Highly significant
<b>Left canine width Male</b>	7.030 $\pm$ 0.44	$p < 0.01$	Highly significant
<b>Left canine width female</b>	6.446 $\pm$ 0.34	$p < 0.01$	Highly significant
<b>Inter-canine distance Male</b>	26.860 $\pm$ 1.48	$p < 0.01$	Highly significant
<b>Inter-canine distance female</b>	26.287 $\pm$ 1.45	$p < 0.01$	Highly significant

Table 1: Difference between the various parameters in males and females

Sex	Total (Percentage)
<b>Males</b>	39/50 (78)
<b>Females</b>	33/50 (66)
<b>Overall</b>	72/100 (72)

Table 2: Percentage of cases correctly predicted using mandibular canine index

## IV. DISCUSSION

Canines differ from other teeth with respect to survival and gender. These differences are probably related to their function, which is different on an evolutionary basis from other teeth. In present day humans, it is not coincidence that the mandibular canines are the teeth that show the greatest sex difference in size and in prominence and eruption age. Although canine sex differences and enhanced canine survival probably are not related to each other, both are probably related to the need for successful use of canines as weapons for total body survival. Canine separation is influenced by the width of the incisors and canines, and significant correlations were found in both sexes between canine separation and canine widths.[3]

The present study establishes the existence of a definite statistically significant sexual dimorphism in mandibular canines. It is consistent with the findings of Hashim and Murshid[8] who conducted a study 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.[8] Similar findings were given by Lew and Keng[9] in their study on an ethnic Chinese population with normal occlusions.[9]

In general, 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. The reason for the high level of dimorphic differences between male and female canines is uncertain, and consequently a large number of theories have been proposed. A popular theory has been to ascribe this to their function, which on evolutionary basis differs from other teeth. Eimerl and Devore postulated that in the evolution of primates there was a transfer of aggressive function from canines in apes to the fingers in man and that until this transfer was complete, survival was dependent on the canines, especially those of the males. The usefulness of the canines as an aid in gender determination by odontometric analyses, in forensic dentistry for example, is supported by their high level of survival in the dentition. The notable difference between canine in determining sex was noted to be due to the influence of the Y chromosome which was not uniform in all teeth. On the other hand the X-linked genetic influence on tooth width was rather uniform for all teeth.

Studies performed on the lower canines using the ratio between the maximum crown width and canine arc width, resulting in a mandibular canine index (MCI), have shown an ability to determine gender when performed on 384 females and 382 males of the South Indian population in the age group of 15-21 years with an accuracy of 84.3% in males and 87.5% in females by comparing the observed MCI with a standard MCI value.[10] In a similar study by Muller *et al.*[7] the population involved the students enrolled in the University of Nice-Sophia Antipolis. Two hundred and ten girls and 214 boys were randomly sampled (1/20). The results were found to be statistically significant. In the present study both these parameters as measured in males and females were compared and the difference was found to be statistically significant. It is the Y chromosome which intervenes most in the size of teeth by controlling the thickness of dentine, whereas the X chromosome, for a long time considered to be the chromosome responsible, only comes into play concerning the thickness of enamel.[2] The percentage dimorphism (the percent to which the tooth size of males exceeded that of females) expressed as the male/female ratio minus 1.00 was also calculated and according to the present study the left mandibular canine was found to exhibit greater dimorphism (9.058%). Garn and Lewis[2] and Lysell and Myrberg[11] concluded that the mandibular canine exhibited the greatest sexual dimorphism amongst all teeth (6.47% and 5.7% respectively). Nair *et al.*,[10] in their study on South Indian subjects reported that the left mandibular canine exhibited a sexual dimorphism of 7.7% and the right mandibular canine 6.2%. Any measurement of teeth unaccompanied by information about age, race and sex must be treated with great caution. In the present study, sex could be predicted to an extent of about 70%. But such a method of sex determination has its limitations due to variations of this parameter with

geographic distribution. This implies that it is necessary to make up a random sample of the population from this geographical area to calculate the corresponding standard MCI.

## V. CONCLUSION

MCI is a quick and reliable method for sexual identification when a standard for the population is available. Sex determination using the pelvis and skull bones shows accuracy of 95% and above. As the accuracy of MCI in identification of sex have never exceeded 87.5%, it can only be used as a supplement tool where as further more studies with greater sample size is needed to get more significant results.

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