

## Role of maxillary and mandibular canine indices in sex determination: Perspective of a forensic odontologist

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### Abstract:

**Introduction:** Dental evidence is valuable in identification of individuals, especially following mass disasters. Canines are found to exhibit the greatest sexual dimorphism amongst all teeth.

**Objective:** To investigate the accuracy with which gender can be differentiated by using the maxillary and mandibular canine indices in an Indian population.

**Material and Methods:** The present study was performed on 200 subjects (100 males, 100 females) between the age group of 18-25 years, randomly sampled with informed consent (Through 3rd party).

**Results:** Males showed greater mean mesiodistal dimensions for each tooth in comparison to females in both maxillary and mandibular arches. When the level of accuracy for sex determination was measured using maxillary canine index it was found that 55% females and 60% males were classified correctly. The level of accuracy for sex determination using mandibular canine index found 67% females and 78% males were classified correctly.

**Conclusion:** canine indices are a quick and reliable method for sexual identification when a standard for the population is available. With these calculations, we could predict the sex correctly at 72.5% and 57.5 % in this study for mandibular and maxillary canine indices respectively. This method can be used as adjunct to other available tools for sex

**Key words:** Canine Width, Inter canine Distance. Forensic odontology

### Introduction

Teeth are an excellent material in living and non-living populations for anthropological, genetic, odontologic and forensic investigations. Teeth are the most indestructible part of the body and exhibit the least turnover of natural structure.<sup>1</sup> Hence, teeth can be identified even when the rest of the body has undergone decomposition; especially for identification on fragmentary adult skeleton.<sup>2</sup>

“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.<sup>3</sup>

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Teeth are readily accessible for examination and since no two teeth have similar morphology, they form an excellent forensic tool for sex determination. The identification of sex is of significance in case of major disasters where bodies are often damaged beyond recognition.<sup>2</sup>

Gender determination of skeletal remains is a 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 existing standard data must then be applied and may help individual basis however, gender differences are not always distinctive, when taken collectively they can give a good indication in the majority of cases.<sup>4</sup> Mesio-distal diameter of mandibular and maxillary canines provides evidence of sex determination due to dimorphism.<sup>5</sup> Mandibular canines especially are found to exhibit the greatest sexual dimorphism amongst all teeth.<sup>6</sup>

The canines are not only exposed to less plaque, abrasion from brushing, or heavy occlusal loading than other teeth, they are also less severely affected by periodontal disease and so, usually the last teeth to be extracted with respect to age. These findings indicate that mandibular canines can be considered as the “key teeth” for personal identification.<sup>7</sup>

The purpose of this study was to investigate the accuracy with which gender can be differentiated by using the Mandibular Canine Index.

## Materials and methods

The study comprised of 200 subjects, of which 100 were males and 100 females. The ages of the subjects ranged between 18-30 years. This age group was selected, as attrition is minimal in this age group.<sup>8</sup>

The subjects were informed of the nature of the study and a written record of their consent documented.

### Inclusion criteria

Our study included subjects with normal overjet and overbite (2-3 mm), caries free canine teeth, absence of spacing in the anterior teeth, molar and canine relationship, healthy state of gingiva & periodontium and no history or clinical evidence of crown restoration, orthodontic treatment, trauma.

### Exclusion criteria

Partially erupted and ectopically erupted teeth, patients with dental/ occlusal abnormalities (such as rotation, crowding, occlusal disharmony etc), teeth showing physiologic or pathologic wear and tear (e.g. attrition, abrasion, abfraction, erosion) and patients with deleterious oral habits (e.g. bruxism) were excluded from the study.

## Methodology

**Measurement of the Mesiodistal Width**– The procedure for measuring the mesiodistal tooth width was performed as described by Hunter and Priest.<sup>9</sup> The mesial and distal surfaces of the teeth were identified and the distance between the crest of curvature on the mesial surface and crest of curvature on the distal surface of canine was recorded by the divider points. The divider was then held against the Vernier caliper and read.

**Measurement of the Inter-canine Distance** – The inter-canine distance was measured between the tips of same arch canines. The divider points were applied to the tips of the mandibular canines. The divider was then held against the Vernier caliper and the reading was noted.

The mandibular canine index was calculated using the formula below<sup>4</sup>

$$\text{Mandibular canine index} = \frac{\text{Mesio-Distal Width of Mandibular Canine}}{\text{Mandibular canine arch width}}$$

The maxillary canine index was calculated using the formula below<sup>4</sup>

$$\text{Maxillary canine index} = \frac{\text{Mesio-Distal Width of Maxillary Canine}}{\text{Maxillary canine arch width}}$$

## Results

Males showed greater mean mesiodistal dimensions for each tooth in comparison to females in both maxillary and mandibular arches. The mean values of maxillary canine widths in males and females on the right and left sides were compared using t-test and were found to be statistically significant (P < 0.0001). The mean value was greater in males as compared to females. The findings were similar in case of mandibular canine index.

When the level of accuracy for sex determination was measured using maxillary canine index it was found that 55% females and 60% males were classified correctly.

The level of accuracy for sex determination using mandibular canine index found 67% females and 78% males were classified correctly.

**Table 1: Maxillary Canine Index among study population**

Sex	No of subjects	Right		Left	
		Mean	SD	Mean	SD
Male	100	7.012	0.588	7.135	0.472
Female	100	6.580	0.507	6.355	0.455

**Table 2: Mandibular Canine Index among study population**

Sex	No of subjects	Right		Left	
		Mean	SD	Mean	SD
Male	100	6.723	0.578	6.855	0.461
Female	100	6.299	0.497	6.103	0.432

**Table 3: Percentage of cases correctly predicted using maxillary canine index**

Sex	Total (in %)
Males	60/100(60)
Females	55/100(55)
Overall	115/200(57.5)

**Table 4: Percentage of cases correctly predicted using mandibular canine index**

Sex	Total (in %)
Males	78/100(78)
Females	67/100(67)
Overall	145/200(72.5)

Gender determination in damaged and mutilated dead bodies or from skeletal remains constitutes the foremost step for identification in medico-legal examination and bioarcheology. Whenever it is possible to predict the sex, identification is simplified because then missing persons of only that sex need to be considered.<sup>10</sup>

Various other factors have also been found to have some bearing on tooth size giving rise to morphometric differences between male and female teeth, namely environmental factors and eating habits.<sup>11,12,13</sup>

Garn et al in their large study at Fels Institute had correlated sexual dimorphism in canines with number of variables, namely stature, weight, subcutaneous fat thickness, bone age, menarche in girls and the time of epiphyseal union. These correlations suggested direct influence of steroidal hormones on tooth development and maturation. They found that tooth eruption is accelerated in early maturing girls; indicating that to some extent steroid hormones of gonadal and adrenal origin may be involved in the relationship between sexual maturation and dental development.<sup>14</sup>

The present study establishes the existence of a definite statistically significant sexual dimorphism in mandibular canines. This finding is consistent with that of work done by other authors.<sup>15,16</sup> It establishes the inter-canine distance and mandibular canine index as useful parameters in differentiating the sexes.

Garn et al, studied the magnitude of sexual dimorphism by measuring the mesiodistal width of the canine teeth and showed that “the mandibular canine showed a greater degree of sexual dimorphism than the maxillary canine.”<sup>17</sup>

However, Minzuno reported that maxillary canine showed a higher degree of sexual dimorphism compared to the mandibular canine in a Japanese population.<sup>18</sup>

The present study comprised of 200 subjects in the 18–30 year age group, of which 100 were males and 100 females. We were able to successfully predict sex to an extent as high as 72.5%. according to mandibular canine index and 57.5 % according to maxillary canine index. Very few studies have included both maxillary and

mandibular canine indices together for sex determination.

## Conclusion :

The standard Mandibular Canine Index is a quick and easy method for determining sex in identification and maxillary canine index can be an adjuvant for the same.

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