

# Gender Determination by Diagonal Distances Of Teeth

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## Abstract

Teeth form an excellent material for anthropological, genetic, odontologic and forensic investigations. Gender determination of skeletal remains is part of the archaeological, anthropology 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. The purpose of this study was to investigate the accuracy with which gender can be differentiated by odontometric analyses in a North Indian population. The material consisted of 445 dental casts (233M:212F) in the age group of 17-57 years. Measurements were made on the mesio buccal, distolingual and distobuccal mesiolingual diameters by digital vernier caliper. Mandibular canine ( $p < 0.001$ ) had significant mean differences in all measurements. It also showed high significant dimorphic values for some of the other variables investigated for future study.

## INTRODUCTION

Odontometry has been performed on various tooth groups with the objective of establishing measurements that can act as standards, and this may also facilitate some procedures of the dental surgeon, as well as in forensic odontology. The diameters of the deciduous teeth are significantly greater in males than in females, both in the mesiodistal and vestibule to palatal directions<sup>1</sup>. Sexual dimorphism of teeth has been extensively studied by means of odontometric analyses, and most studies have shown statistically significant differences with t-test as well as with discriminant analysis based on data of the mesio-distal and bucco-lingual crown diameters in the permanent dentition<sup>2,3</sup>. In general male teeth have been found to be larger than those of the female and an excellent review on the subject has been published by Kieser<sup>4</sup>.

Tooth size standards based on odontometric investigations can be used in age and sex determination<sup>5</sup>. Garn et al and Nair et al have found the mandibular canines to exhibit the greatest sexual dimorphism amongst all teeth<sup>6,7</sup>. Studies performed on the lower canines using the ratio between the maximum crown width and Canine arc width, resulting in a mandibular canines index, have shown an ability to determine gender with an accuracy of 84.3% in males and 87.5% in females by comparing the observed MCI with a standard MCI value<sup>7</sup>. The purpose of this study was to investigate further the accuracy with which gender can be differentiated by using odontometric measurements of the

permanent dentition in a north Indian population, and to verify existing measurements and find new parameters to differentiate male from female teeth i.e. in forensic odontology or anthropology standard table for identification.

## MATERIAL AND METHODS

### SUBJECTS

The study was conducted on 445 patients (233M: 212F) in the age group of 10-40 years selected from the Out Patient Department of the Government Dental College associated with Pt. Bhagawat Dayal Sharma Post Graduate Institute of Medical Science, Rohtak (India). Teeth with marked wear or heavily restored were excluded from the research. An impression of both arch was taken with alignate and poured with type IV dental stone. Care was taken to pour the impression immediately to minimize the dimensional changes.

### INSTRUMENT

A digital vernier calliper (Mechanical Pvt. Ltd., India), giving two decimal points was used for the measurements.

### MEASUREMENT METHODS

Each tooth was measured in four different dimension distolingual-mesiobuccal (DL-MB) and distobuccal-mesiolingual (DB-ML).

### DISTOBUCCAL-MESIO Lingual CROWN

**DIAMETER**

The greatest distance between the disto-buccal and mesio-lingual surfaces of the crown, creating a diagonal in relation to the tooth and with the vernier calliper held parallel to the occlusal surface of the crown.

**DISTOLINGUAL-MESIOBUCCAL CROWN DIAMETER**

The greatest distance between the mesiobuccal and distolingual surfaces of the crown, creating a diagonal in relation to the tooth and with the vernier calliper held parallel to the occlusal surface of the crown.

**STATISTICAL METHOD**

The entire data collected was subjected to statistical analysis by using computer software package SPSS/PC version 11.0.

**RESULTS**

The mean values and standard deviation of all recorded dimensions were larger in males than in females (table I).

The mandibular canines showed significant mean differences in all investigated variables.

There were no statistically significant differences between any of the measures of the left and right sides of either maxilla, or the mandible .

Of the investigated variables, the mesiobuccal distolingual dimension showed the highest percentage of statistically significant mean differences where as the mandibular central incisor, maxillary first and second premolar, and lower first premolar had no significant dimorphic mean values.

While the distolingual to mesiobuccal diameter of maxillary canine and mesio distal diameter of mandibular canines can be showed the highest percentage of statistically significant mean differences (p<0.001).

**Figure 1**

Table 1: Mean values and standard deviation (mean ± S.D.) in mm of tooth diameters(DB-ML and DL-MB) between male and female diameters. (FDI system followed for tooth designated)

Tooth	DB-ML (Mean ± S.D.)		DL-MB (Mean ± S.D.)	
	Males	Females	Male	Females
11	7.55 ± 0.89	7.42 ± 0.82	8.47 ± 0.69*	7.95 ± 0.62*
12	6.62 ± 0.62	6.32 ± 0.82	6.97 ± 0.72*	6.30 ± 0.73*
13	7.67 ± 0.56*	7.20 ± 0.52*	8.37 ± 0.59***	7.21 ± 0.52***
14	8.50 ± 0.89	8.22 ± 0.93	8.31 ± 0.52	8.30 ± 0.57
15	8.62 ± 0.57*	8.30 ± 0.53*	9.17 ± 0.73	9.00 ± 0.53
16	11.57 ± 0.84	11.52 ± 0.94	12.78 ± 0.54*	12.22 ± 0.59*
17	11.14 ± 0.52*	9.52 ± 0.54*	11.83 ± 0.39**	10.90 ± 0.62**
41	5.75 ± 0.87	5.70 ± 0.62	5.81 ± 0.42	5.77 ± 0.53
42	6.12 ± 0.73	6.02 ± 0.82	6.32 ± 0.57	6.22 ± 0.54
43	6.80 ± 0.59*	6.44 ± 0.53*	7.62 ± 0.66*	7.13 ± 0.53*
44	7.10 ± 0.87	7.00 ± 0.63	7.87 ± 0.52*	7.21 ± 0.57*
45	8.17 ± 0.82	7.90 ± 0.82	8.50 ± 0.62**	7.51 ± 0.63**
46	11.52 ± 0.42*	11.12 ± 0.47*	11.71 ± 0.57*	11.31 ± 0.52*
47	11.31 ± 0.53*	10.80 ± 0.57*	11.69 ± 0.62	11.57 ± 0.62

\*P<0.05

\*\*P<0.01

\*\*\*P<0.001

**DISCUSSION**

Teeth are an excellent material in living and non-living populations for anthropological, genetic, odontologic and forensic investigations. Their durability in the face of fire and bacterial decomposition makes them invaluable for identification. Combinations of root lengths and crown diameters have also shown a high discriminatory capability<sub>10</sub>. The present study establishes the existence of a definite statistically significant sexual dimorphism in distolingual-mesiobuccal diameter of maxillary canine (p<0.001) and distolingual-mesiobuccal diameter of second molar (p<0.01) compared distolingual mesiobuccal diameter of maxillary (p<0.05) incisors, maxillary first molar (p<0.01), mandibular canine (p<0.05), mandibular first and

second premolar ( $p < 0.05$ ) and mandibular first molar distolingual mesiobuccal diameter ( $p < 0.05$ ) of tooth showed highest sexual dimorphism as compared to other diameter's the mandibular canines are considered to demonstrate the greatest percentage of sexual dimorphism amongst all teeth in their mesio-distal width<sup>7,11</sup> as finding in this study.

Although most studies have resulted in a high degree of accuracy of gender determination, a more recent study was focused on the complexity and unreliability of accurate determination based on odontometric data. In spite of high levels of confidence and high percentage of correct classification by gender, these high levels were not matched in the allocatory procedures; only 30.4% of male and 18.2% of female caucasians could be allocated correctly<sup>12</sup>.

The present study thus supports the usefulness of the canine crown diameters in gender determination by odontometric analysis, and introduces some new diagonal variables, which may be useful as complements.

### CONCLUSION

The usefulness of the mandibular canines as an aid in gender determination by odontometric analysis in, for example, forensic dentistry or anthropology is supported by their high level of survival in the dentition. Of the investigated variables, the mesio buccal distolingual dimension showed the highest percentage of statistically significant mean differences as compared to other dimensions.

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