

## Sexual Dimorphism and Odontomeric-Analysis of Permanent Maxillary and Mandibular Anterior Teeth in the Population Of Karachi, Pakistan

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### Abstract

#### **Background:**

Sex identification of skeletal remains is one of the prime factors employed in the identification of an individual. Very little data has been extracted in Pakistan which supports forensic dentistry in the identification of sex. Therefore, to determine gender dimorphism we use dental casts, as teeth are the most reliable, hard and stable human tissue which serves as a valuable material for forensic anthropology.

**Objectives:** To determine mesio-distal and Labio-lingual diameters of anterior teeth and evaluate the potential of gender dimorphism among measured parameters in the population of Karachi, Pakistan.

#### **Materials and methods:**

Dental measurements were taken from the dental cast of maxillary and mandibular anterior teeth by using a digital vernier-calliper.

**Results:** The result shows that there is no significant difference between labio-lingual and mesio-distal surfaces of anterior teeth among gender except mesio-distal measurement of mandibular canine.

#### **Index-terms:**

sex estimation, sex characteristic, dimorphism, gender, Dichromatism, Sexual, Age determination, Anthropometry, Dentition.

### **I. Introduction**

Recognition of an individual is of principal significance in mass catastrophes like tremors, and hurricanes, in criminal investigations, in

wrongdoing examinations, and in distinguishing proof of disfigured and deteriorated bodies like casualties of suffocated people, and fire mishaps. (1,2) In such situations, the finding of sex is a huge advance in reconstructive autopsy outline of medico-legitimate individual recognition(1) Usually a forensic scientist wants to know about the gender, age, ethnicity of an unidentified individual in which, gender determination has been the focus of numerous forensic investigations and is of significant importance in mass casualty situations where bodies are harmed to the point of being indistinguishable (3,4) Nevertheless, sex assurance with the assistance of skeletal remaining parts turns into a mystery for scientific specialists particularly when the skeletal remaining parts are broken or fragmented. In such instances the usage of dental remaining parts, for example, teeth is an astounding piece of proof that can be utilized to decide sexual orientation(5,6). Even though pelvic and cranial bones can be more exact and faultless in recognizing gender, they are seldom in ideal condition, but in outrageous cases, for example, natural calamities or catastrophes might forestall precise assessment through them. Thus teeth are considered very valuable in these situations as they are frequently recuperated undamaged (6-8). Teeth are investigated to be novel organs made the most acceptable and durable mineralized tissues in the human body. Because of this, the utilization of dental

morphology to decide on sexual dimorphism is a system set up in anthropological and natural investigations (9,10). The most widely used dimensions in sex estimation studies have been maximum in mesio-distal and bucco-lingual crown measurements (11-12). These measurements are less affected by wear and accordingly can permit a bigger dataset to be acquired, with a more extensive scope of ages addressed (7). There are insufficient studies that have been conducted for assessment of the presence of gender dimorphism among the population of Karachi. The rationale of the study is to assess gender dimorphism and emphasize its importance in forensic dentistry. The domain of forensic odontology is yet to be explored at large when it comes to Pakistan. There is no such institute that has a specific course that has been designed to train dental surgeons with the proper professional handling, examination, interpretation and presentation of dental evidence in both criminal and civil legal procedures.

This study aimed to determine mesiodistal and buccolingual diameters of anterior teeth and evaluate the gender dimorphism among measured parameters in the population of Karachi, Pakistan.

## II. Materials & Methods:

### *Study Setting and Duration*

This study was conducted in the Department of Oral Biology Of Liaquat college of medicine and Dentistry, Karachi Pakistan from January 2022- June 2022. The dental casts were obtained from the outpatient department of orthodontics which went under orthodontic treatment from the year 2020-2022. The ethical approval was obtained from the Institutional Review Board from the institution Liaquat College of Medicine & Dentistry with the reference number IRB/D-000032/22. The sample size for this study was estimated using an open Epi sample size calculator version 3.01, after inserting the mean value of cervical-incisal (CI) width of lower canine for females  $5.71 \pm 2.12$  and males  $6.43 \pm 2.21$  (8) with a 5% margin error and 95% confidence interval and using the ratio of sample size 0.85 we get the sample size of  $n= 295$ , 159 for female and 136 for male. Hence the

frequency of orthodontic treatment is more in female patients as compared to male patients, we get a sample of  $n=300$ , 78 in males and 222 in females. Non-probability convenience sampling technique was used for this survey. To avoid the possibility of incorrect measurements, samples with carious decay were excluded. Three hundred samples ( $n = 300$ ) were taken (of which 78 males and 222 females study casts) with an age range of 17- 30 years. A measurement of the pretreatment dental cast was taken from the outpatient department of Orthodontics at Liaquat College of Medicine & Dentistry, Karachi. The cast has been poured in an impression taken with irreversible hydrocolloid (alginate) and poured with a type IV dental stone. Care was taken to pour the impression immediately to minimize the dimensional changes. Mesio-distal (MD) and labio-lingual (LL) measurements in millimetres of maxillary and mandibular anterior teeth (central incisor, lateral incisor, canine) of both sides were taken with the help of a digital Vernier calliper with the resolution of 0.01mm (calibration) on the cast model. To check the intra-examiner reliability 10% ( $n = 30$ ) of randomly selected samples dimensions were re-measured by the same investigator at 3 days interval and found good agreement ( $r=0.98$ ). The data were subjected to analysis by SPSS V 22 using descriptive statistics; mean and standard deviation were calculated. Comparing the mean values among male and female tests for normality shows that the data is not normally distributed and hence we proceed to apply the Man-Whitney U-test, Level of significance was considered at  $p < 0.05$ .

## III. Results:

In this study around 73% of female study cast and 27% of male study cast were taken. A measurement of mesiodistal and labiolingual taken from the right quadarant was 51% and from the left quadrant was 49%. The Sexual dimorphism of anterior teeth shows no significant difference between mesiodistal and labiolingual surface of anterior teeth among gender except mesio-distal surface of mandibular canine as shown in table 1. Cohen's D was

applied to calculate the effect size of mandibular canine after inserting the values we get

$$\text{Cohen's } d = (6.8 - 7.13) / 0.079057 = 4.174207$$

which shows the difference between the two means is larger than one standard deviation.

The table 2: Shows insignificant difference of mesiodistal and labiolingual measurement of anterior tooth in males and females with reference to tooth quadrants.

Tooth	Mean $\pm$ SD (Labiolingual surface ) Male	Mean $\pm$ SD (Labiolingual surface) Female	P-Value	Mesiodistal surface Mean $\pm$ SD Male	Mesiodistal surface Mean $\pm$ SD Female	P- value
Maxillary Central incisor	6.34 $\pm$ 0.12	6.33 $\pm$ 0.74	0.60	9.10 $\pm$ 0.99	8.95 $\pm$ 0.62	0.10
Maxillary lateral incisor	5.60 $\pm$ 0.11	5.62 $\pm$ 0.62	0.94	7.26 $\pm$ 0.98	7.16 $\pm$ 0.63	0.43
Maxillary Canine	6.93 $\pm$ 0.13	6.91 $\pm$ 0.67	0.81	7.89 $\pm$ 0.10	7.75 $\pm$ 0.66	0.32
Mandibular Central incisor	5.24 $\pm$ 0.09	5.20 $\pm$ 0.05	0.48	5.73 $\pm$ 0.07	5.69 $\pm$ 0.05	0.67
Mandibular Lateral incisor	5.27 $\pm$ 0.11	5.42 $\pm$ 0.061	0.54	6.11 $\pm$ 0.081	6.20 $\pm$ 0.20	0.45
Mandibular Canine	6.35 $\pm$ 0.12	6.29 $\pm$ 0.58	0.53	7.13 $\pm$ 0.10	6.80 $\pm$ 0.05	0.008*
*Significant level < 0.05						

Table 1: Relationship/comparison of sexual dimorphism in relation to tooth surface.

**Discussion:** Forensic odontology deals with the careful handling and identification of a victim through proper analysis of dental evidence,(9,10) excavations recovered for forensic and archeological purposes. Teeth appear to be the most stable tissue of the body(11) and can withstand various insults well and this characteristic makes them the focus of interest in several forensic investigations and studies. (2,12,13).Gender assessment of an individual is a crucial step in making identification in forensic perspective, and tooth presented to be a promising candidate reported by several investigators (14). This study intends to determine the existence of gender dimorphism in permanent maxillary and mandibular anterior teeth. In our study, the

labio-lingual and mesio-distal dimensions of permanent maxillary and mandibular anterior teeth (Central incisor, Lateral incisor, Canine) were measured using a digital Vernier calliper. The presented study found no significant difference between males and

females concerning labiol-ingular and mesio-distal measurement of maxillary central and lateral incisors and mandibular central and lateral incisors. However, in the present study, the mesio-distal dimension of the mandibular canine was found significant. In contrast, Lakhanpal M et al (2) found a significant difference in maxillary lateral incisor and maxillary canine. Soundarya N et al(8) also revealed a significant difference in mesiodistal dimension of maxillary canine and Neves JA et al (15) and Capitaneanu C

Tooth	Male p-value	Female p-value
Maxillary Central incisor (MD)	0.78	0.874
Maxillary Central incisor (LL)	0.081	0.727
Maxillary lateral incisor (MD)	0.264	0.754
Maxillary lateral incisor (LL)	0.161	0.797
Maxillary Canine(MD)	0.348	0.477
Maxillary Canine(LL)	0.730	0.436
Mandibular Central incisor(MD)	0.228	0.321
Mandibular Central incisor(LL)	0.141	0.791
Mandibular Lateral incisor(MD)	0.316	0.873
Mandibular Lateral incisor(LL)	0.191	0.326
Mandibular Canine(MD)	0.201	0.234
Mandibular Canine(LL)	0.641	0.195
*Significant level at or below 0.05		

(16) observed a significant difference in maxillary and mandibular canine but found no significant difference in incisors following our findings. Boaz K al(17) reported a significant difference in the measured dimension of mandibular canine in the south Indian population and revealed a larger dimension in females as compared to males. Astete JC et al(18) (10) found no significant difference in maxillary incisors this finding is in accordance with the

**Table2: Comparison of difference of mesio-distal and labio-lingual measurement of anterior tooth with preference to tooth quadrants.**

presented study and noted larger Kazzazi SM et al (7). Since the variance are present in odontometric features in respective population, even within the same population in the evolutionary and historical context, becomes essential to define population-specific values to make identification possible based on dental dimension (19).measurement of canines in males. However our finding revealed no significant difference between right and left quadrant in both genders these are in accordance with

**Conclusion:** Hence several studies have been conducted to evaluate the existence of sexual dimorphism taking different parameters to reveal the need for population-specific data. The presented study will provide valuable information to forensic and anthropological investigators and share normative morphometric data of the studied population.

**Limitation:** In the present study dental cast has been used instead of measuring in vivo to avoid any discomfort to patients encountered while taking measurements. Further research is needed for the evaluation of sexual dimorphism including posterior permanent teeth

**Conflict of Interest:** None to declare.

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