



Research

## Anterior Teeth Measurement among Subjects in the University of Port Harcourt as a Sex Indicator and Aid to Maxillofacial Reconstruction

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### Abstract

**Background:** The aim of this study is to determine sexual dimorphism using anterior teeth measurements and its use as an ancillary tool for sexual determination.

**Methods:** In this study, the measurements of the anterior teeth were carried out on one hundred and forty students (80M: 60F) of the University of Port-Harcourt ranging from 15-30 years. The mesiodistal diameter of the central and lateral incisors, right and left canines and their inter-canine distance were measured. These measurements were done with the aid of a digital Vernier caliper. Also, the percentages of sexual dimorphism were calculated. The values were subjected to statistical analysis.

**Results:** The mean mesiodistal central incisor (MDCI) value for males was  $9.78 \pm 0.47$ mm while that of the females was  $9.29 \pm 0.46$ mm. The mean mesiodistal lateral incisor (MDLI) value for males was  $7.80 \pm 0.54$  mm while that of the females was  $7.40 \pm 0.54$ mm. The mean mesiodistal right canine (MDRC) value for males was  $7.43 \pm 0.49$ mm while that of the females was  $7.04 \pm 0.40$ mm. The mean mesiodistal left canine (MDLI) value for males was  $7.39 \pm 0.51$ mm while that of the females was  $7.03 \pm 0.55$ mm. The mean mandibular inter-canine distance (MICD) value for males was  $33.73 \pm 1.15$ mm while that of the females was  $32.23 \pm 0.98$ mm. They were all statistically significant at  $p < 0.05$ .

**Conclusion:** It can be concluded that the incisors and the canines are useful tools in sex determination. The data obtained can be useful in maxillofacial reconstructive surgery

**Keywords:** Anthropology, Mesiodistal, Inter-canine, Sexual dimorphism, Maxillofacial reconstruction

### Introduction

Dental anthropology is a field of inquiry that utilizes information obtained from the teeth of either skeletal or modern human population to resolve anthropological problems. The teeth exhibit variables with a strong hereditary component that are useful in accessing population relationships and evolutionary dynamics.<sup>1</sup>

The face and notably the lips and cheeks are important structures not only of aesthetic value but also for expression, vibrancy, and vitality. As such both functional and aesthetic restoration in the lips and cheeks are restoration of appearance and reinstatement of function. For constructive and cosmetic surgery, realistic sizes and proportions are assessed using anthropometric techniques and used as guidelines to correct deformities and disproportions.<sup>2</sup>

Sexual dimorphism of the permanent teeth is a well-established attribute of primates. The size and distribution of this dimorphism are different in various species.<sup>3</sup> Tooth size standards based on odontometric investigations can be used in age and sex determination as human teeth exhibit sexual dimorphism.<sup>4</sup> Males have been found to possess larger tooth crowns than females in contemporary human populations.<sup>5</sup>

It has also been reported that alveolar and teeth dimensions and presence of dental diathesis and projections are linked with tension and relaxation of the lip thickness and height, which influence the two-dimensional measurements.<sup>6</sup>

This present study aims to determine the sex of an individual based on anterior teeth measurements and analyze if any sexual dimorphism exists between them.

Moreover, in maxillofacial reconstruction following clefts of the primary palate or reconstruction following trauma or ablative surgical procedure for dentoalveolar malignancies, this study can give a mean value for a population and gender and can be an indicator and guide for maxillofacial reconstructive surgery.

**Methods**

The study was carried out on 140 students at the University of Port-Harcourt, Choba, Nigeria in the age range of 15-30 years. These subjects were selected based on the following criteria: complete set of fully erupted and healthy teeth, no diastema between the teeth and must have not undergone any dental surgery of any kind or injury (fracture) of the dentoalveolar complex. With the aid of a digital Vernier caliper, the various anterior teeth measurements that were carried out on the subjects include:

1. **Mesiodistal diameter (MD):** this is defined as the greatest distance of the crown of the teeth from the mesial to the distal surface.
2. **Inter-canine distance (ICD):** this is defined as the distance between the canines on the mandible.

The calculated parameters of dental indices used during the study include incisor index and the mandibular canine index. Aitchison<sup>7</sup> derived the incisor index formula.

$$I_i = \frac{MDI_2}{MDI_1} \times 100$$

Where, MDI<sub>2</sub> is the maximum MD diameter of the upper lateral incisor and MDI<sub>1</sub> is the maximum MD diameter of the central incisor.

Rao et al.<sup>8</sup> derived the mandibular canine index (MCI), which is expressed as a ratio of the mesiodistal (MD) dimension of canines and the inter-canine arch width. Khangura et al.<sup>9</sup> defined the percentage of sexual dimorphism as the percentage by which the tooth size of males exceeds that of females. This is calculated using the formula.

$$\% \text{ Sexual Dimorphism} = \left[ \left( \frac{X_m}{X_f} \right) - 1 \right] \times 100$$

Where X<sub>m</sub> = mean male tooth dimension; and X<sub>f</sub> = mean female tooth dimension.

**RESULTS**

The percentage distribution of the subjects used in this study were 57.14% males while that of females 42.86%.

Table 1: Sample size of Male and Females Percentage Distribution

| Sex     | Number of Subjects | Percentage Distribution (%) |
|---------|--------------------|-----------------------------|
| Males   | 80                 | 57.14                       |
| Females | 60                 | 42.86                       |

From the table below, the mean mesio-distal central incisor (MDCI) value for males was 9.78mm while that of the females was 9.29mm. The mean mesio-distal lateral incisor (MDLI) value for males was 7.80mm while that of the females was 7.40mm. The mean mesio-distal right canine (MDRC) value for males was 7.43mm while that of the females was 7.04mm. The mean mesio-distal left canine (MDLC) value for males was 7.39mm while that of the females was 7.03mm. The mean mandibular inter-canine distance (MICD) value for males was 33.73mm while that of the females was 32.23mm. All results were statistically significant at p<0.0001.

Table 2: Inferential Statistics of Anterior Teeth Measurements in Male and Female subjects

| VARIABLE (mm) | Sex | Min   | Max   | Mean  | S. D | S. E | Z <sub>Obs</sub> | Z <sub>crit</sub> | p-value | Inference |
|---------------|-----|-------|-------|-------|------|------|------------------|-------------------|---------|-----------|
| MDCI          | M   | 8.73  | 10.65 | 9.78  | 0.47 | 0.05 | 6.28             | 1.96              | <0.0001 | SIG       |
|               | F   | 8.47  | 10.40 | 9.29  | 0.46 | 0.06 |                  |                   |         |           |
| MDLI          | M   | 6.83  | 9.15  | 7.80  | 0.54 | 0.06 | 4.58             | 1.96              | <0.0001 | SIG       |
|               | F   | 6.27  | 8.97  | 7.40  | 0.50 | 0.07 |                  |                   |         |           |
| MDRC          | M   | 6.15  | 8.57  | 7.43  | 0.49 | 0.06 | 4.23             | 1.96              | <0.0001 | SIG       |
|               | F   | 5.87  | 8.24  | 7.04  | 0.56 | 0.07 |                  |                   |         |           |
| MDLC          | M   | 5.99  | 8.59  | 7.39  | 0.51 | 0.06 | 3.97             | 1.96              | <0.0001 | SIG       |
|               | F   | 5.80  | 8.18  | 7.03  | 0.55 | 0.07 |                  |                   |         |           |
| MICD          | M   | 30.91 | 35.78 | 33.73 | 1.15 | 0.13 | 8.32             | 1.96              | <0.0001 | SIG       |
|               | F   | 30.19 | 34.40 | 32.23 | 0.98 | 0.13 |                  |                   |         |           |

**Table 3:** Descriptive Analysis on the Percentage of Sexual Dimorphism among Male and Female subjects (as postulated by Khangura et al., 2011)

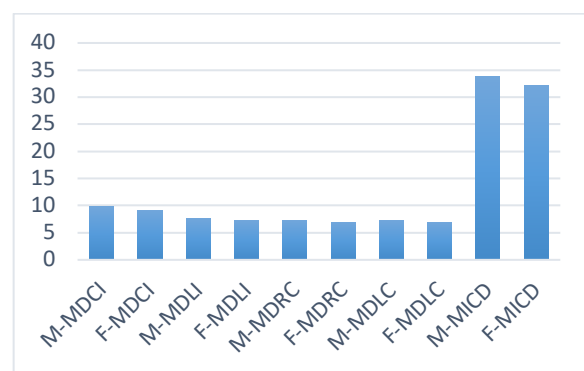
| Variable | Sex | Mean (mm) | Sexual Dimorphism (%) |
|----------|-----|-----------|-----------------------|
| MDCI     | M   | 9.78      | 5.27                  |
|          | F   | 9.29      |                       |
| MDLI     | M   | 7.80      | 5.41                  |
|          | F   | 7.40      |                       |
| MDRC     | M   | 7.43      | 5.54                  |
|          | F   | 7.04      |                       |
| MDLC     | M   | 7.39      | 5.12                  |
|          | F   | 7.03      |                       |
| MICD     | M   | 33.73     | 4.65                  |
|          | F   | 32.23     |                       |

**Table 4:** Incisor Index of Male and Female subjects (as postulated by Aitchison, 1964)

| Sex     | MDLI (mm) | MDCI (mm) | Incisor Index (I <sub>i</sub> ) In % |
|---------|-----------|-----------|--------------------------------------|
| Males   | 7.80      | 9.78      | 79.76                                |
| Females | 7.40      | 9.29      | 79.66                                |

**Table 5:** Mandibular Canine Index (MCI) of Male and Female Subjects (as postulated by Rao et al., 1989)

| VARIABLE | SEX | MEAN ± S.D    | RANGE (mm)  |
|----------|-----|---------------|-------------|
| RMCI     | M   | 0.220 ± 0.012 | 0.193-0.246 |
|          | F   | 0.219 ± 0.016 |             |
| LMCI     | M   | 0.219 ± 0.016 | 0.188-0.246 |
|          | F   | 0.218 ± 0.016 |             |



**Figure 1:** Bar Chart Showing the Mean of Different Teeth Measurements of all Subjects

## Discussion

In this study, the percentage of sexual dimorphism of the mesiodistal diameter of the right and left mandibular canines is 5.54% and 5.12% respectively. This agrees with studies done by Garn and Lewis<sup>10</sup> and Lysell and Myrberg<sup>11</sup> which had values of 6.4% and 5.7% respectively. Nair et al.<sup>12</sup> concluded in their study that

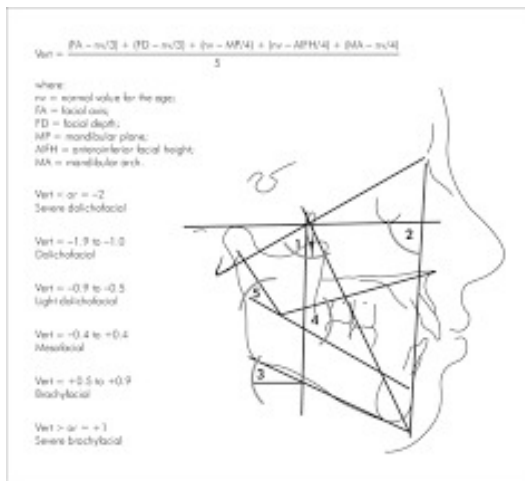
the maximum sexual dimorphism in left, and right mandibular canine was 7.7% and 6.2% respectively.

Ibeachu et al.<sup>13</sup> did a similar study among University of Port-Harcourt students. The mean mandibular intercanine distance was significantly higher in males (34.20mm) than in females (32.64mm). This is in line with the current study showing that males have a mean mandibular intercanine distance of 33.73mm and the females having a mean mandibular intercanine distance of 32.23mm.

Singh and Goyal<sup>14</sup> concluded in their study that in the maxillary arch, the mean width of the crowns of the central incisors (9.05mm in males and 8.62mm in females) was larger than the mean width of the crowns of the lateral incisors (7.07mm in males and 6.95mm in females). In this present study, the mean width of the crowns of the central incisors (9.78mm in males and 9.29mm in females) was larger than the mean width of the crowns of the lateral incisors (7.80mm in males and 7.40mm in females).

In this present study, the mean mandibular canine index for the right and left canine for the male subjects is 0.220 and 0.218 respectively while that of the females is 0.219 and 0.218 as well. Ibeachu et al.<sup>13</sup> found that the right and left canine for the male subjects were 0.228 and 0.230 respectively, while those of females were 0.208 and 0.207 respectively. They were all statistically significant. Clinical and model measurements have shown better ridge dimensions at experimental sites.<sup>15</sup> During Cleft lip repair, the actual position of the anterior teeth is important as this will contribute to the determination of the appropriate facial aesthetics of the individual as well as the relationship to its race. It has been reported by Segun et al.<sup>16</sup> that nostril sill joins the medial crural footplate some millimeters proximal to the base of the columella and has been found to vary in individual and races. The anterior teeth measurement, as determined in this study will provide easy and more accurate alignment or actual positioning of the lip to avoid undue tension or relaxation on the lip thickness and height as explained by Gbeneol.<sup>6</sup>

There are measurable dental planes and dimensions, as well as indices that are very useful in the reconstructive approach by surgeons for a successful dental surgery. Such facial growth pattern and classification, as described by Ricketts et al.<sup>17</sup> using Vert index as illustrated in the figure 1 below and Siriwat & Jara-bak<sup>18</sup> provides dependable data for utilization for correctional reconstructive surgery.



**Figure 1** - Five cephalometric measurements used in the Vertindex. 1: facial axis; 2: facial depth; 3: mandibular plane; 4: anteroinferior facial height; 5: mandibular arch<sup>19</sup>

The Siriwat & Jarabak analysis are performed by determining the Jarabak coefficient [(posterior facial height/anterior facial height) x 100] and classifies growth tendency into hyper-divergent (54 to 58%), neutral (59 to 63%) and hypo-divergent (64 to 80%)<sup>20</sup> (Figure 2).



**Figure 2:** Cephalometric Measurement used in the Jarabak Coefficient showing Posterior Facial Height (1) and Anterior Facial Height.<sup>19</sup>

It has been established that when vertical condylar growth exceeds dento-alveolar growth, anti-clockwise mandibular rotation occurs.<sup>21,22,23,24</sup> Among the three anti-clockwise rotational types, type I (rotational center on the condyle) and type III (rotational center on the premolars) produce compression of inferior incisors against superior incisors, giving rise to deepening of bite from these incisor teeth, hence their usefulness in the preparation for reconstructive surgery cannot be neglected for a near originality of facial outlook.<sup>25</sup>

**Conflict of Interest:** There is no conflict of interest among authors.

**Ethical Clearance:** Ethical clearance sort and approval obtained for the study. Subjects provided informed consent

### Conclusion

The study established sexual dimorphism in all parameters measured. This implies that the male and female mean  $\pm$  SD values obtained for the incisor and canine teeth dimensions are used independently of the other, with respect to gender. This study therefore has provided a useful baseline data as an aid for facial reconstructive surgery.

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