Intercanthal distance of a Sudanese population sample as a reference for selection of maxillary anterior teeth size

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Abstract
Background: The choice of the size of artificial teeth takes an important place in the removable prosthodontic treatment. However, the standards or proportions commonly used as a guide have been developed mainly on Caucasian populations.
Objectives: to investigate the relationship between intercanthal distance and the anterior maxillary teeth size in Sudanese population.
Methods: This is a descriptive cross sectional study conducted in 114 subjects, (45 males - 69 females), from Khartoum and Juba Universities. The age range was from 18-46 years. The intercanthal distance (I.C.D) was the measurement taken between the median angles of the palpabar fissure. Maxillary intercanine distance was obtained by measuring a line from the tip of the canine on one side, to the canine on the other side. An electronic digital caliper (Narex – Czechoslovakia) was used for all measurements. Data were analyzed using Person chi–square test.
Results: a significant correlation is found between intercanthal distance and maxillary intercanine distance in all subjects (P-value 0.015), and in females who had a (P-value of 0.006). Maxillary intercanine distance may be estimated by dividing I.C.D by factor 0.9.
Conclusion: These results could be used as a helpful guide for selection of anterior teeth width in the Sudanese population.

Keywords: prosthodontic, palabar fissure, denture.
forms of natural teeth were determined to improve the selection of anterior artificial teeth. The width of the tooth is considered by some to be more critical than the length. Several authors have attempted to identify normal tooth dimensions. Photographs, radiographs and computer imaging have also been used to help in tooth selections. In this country none of the above methods have been used and applied, to determine any variation in these anatomic measurements related to ethnic and race variables, therefore a study was suggested to investigate this subject and look for a scientific correlation. The current study investigated the I.C.D. which is defined as a distance between the median angles of the palpalbral fissure.

**Methods**

This is a descriptive cross sectional study conducted in a sample of Sudanese population. One hundred and fourteen Sudanese students from Khartoum and Juba Universities were selected for the study. Sample size was calculated according to the formula:

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N = \frac{z^2 pq}{d^2}
\]

- N = Sample size
- \( z = 1.96 \)
- p = Prevalence
- q = Probability (100-p)
- d = Desired margin of error.

The subjects were 69 females and 45 males, with ages ranging from 18-46 years. Participants were selected following certain criteria: all maxillary teeth present; no distemas, Angles Class I Relationship, Skeletal Class I Jaw Relation, regular intact anterior teeth, teeth free from filling, no history of orthodontic treatment; severe attrition and caries cases were excluded. Subjects with a history of congenital anomaly, orbital disease, trauma or facial surgery were also excluded. Participants were informed about the study by the investigator and encouraged to participate in the study.

Dental casts were prepared by first taking impressions, with irreversible hydrocolloid impression material (Alginate Cavex Holland), using suitable perforated trays. Following inspection these impressions were washed under running water to remove the saliva. Then impressions were casted immediately using stone (ZETA Muffle Italy).

**Cast production:** Irreversible hydrocolloid was used to obtain maxillary impressions that were poured immediately with dental stone. Each cast was then mounted on a plaster base formed by placing the cast on a thin mixture of plaster of Paris being placed on a flat rubber base. Each cast was then oriented in a consistent position using the occlusal plane as the plane of reference to facilitate subsequent measurements to prevent dimensional changes. The study models were numbered to help in identification.

**Measurements:** Different measurements relevant to this study were taken. All measurements were made and recorded by one operator. The mean of three readings of these measurements, for each specimen was recorded. All measurements were carried out using an electronic digital caliper (Narex – Czechoslovakia), to the nearest tenth of a millimeter. The I.C.D, together with the width of the six maxillary teeth was measured for each subject.

**Intercanthal distance:** The patient was requested to sit in a dental chair in an upright position with the head straight. The patient was asked to close the eyes, and relax before the I.C.D measurement was taken. (Photo 1)

![Photo (1) Measuring intercanthal distance with electronic digital caliper](image-url)

The intercanine distance was measured in a straight line between the canine’s cusp tip of the right side and left side. (Photo 2)
Data from the measurements were subjected to statistical analysis by using Person chi-square test, to assess quantitatively whether a set of frequencies follow a particular distribution. A P-value of <0.05 was considered significant.

Results
The results of examination of 114 subjects (45 males, 69 females) and 114 maxillary casts are summarized in tables 1, 2 and 3.

Table 1: Relationship between the I.C.D; age and gender

| I.C.D     | Age    | Gender | 18-25 yrs | 26-33 yrs | 34-41 yrs | 42-49 yrs | Total |
|-----------|--------|--------|-----------|-----------|-----------|-----------|-------|
| 25.01-    | Male   | 4      | 2         | 1         | 1         | 8         |
| 30.00 mm  | Female | 7      | 2         | 2         | 0         | 11        |
| 30.01-    | Male   | 12     | 11        | 0         | 1         | 24        |
| 35.00 mm  | Female | 26     | 15        | 6         | 0         | 47        |
| 35.01-    | Male   | 4      | 5         | 1         | 0         | 10        |
| 40.00 mm  | Female | 5      | 6         | 0         | 0         | 11        |
| 40.01-    | Male   | 1      | 1         | 1         | 0         | 3         |
| 45.00 mm  | Female | 0      | 0         | 0         | 0         | 0         |
| Total of males | 21  | 19 | 3  | 2  | 45 |
| Total of females | 38 | 23 | 8  | 0  | 69 |
| Total     | 59     | 42     | 11        | 2         | 114       |

All subjects: P.value: 0.103
Male: P: 0.772.
Female: P: 0.458.

Table 2: The mean widths of I.C.D in relation to gender (mm)

| Sample | No. of sample | Mean | Variance | S.D   | S.E   | Range | Min  | Max  | CV |
|--------|---------------|------|----------|-------|-------|-------|------|------|----|
| Male   | 45            | 33.4 | 14.4     | ±3.8  | 0.07  | 15.4  | 28.4 | 43.7 | 11%|
| Female | 69            | 32.4 | 6.8      | ±2.6  | 0.31  | 11.6  | 26.7 | 38.3 | 8% |
| Mixed  | 114           | 32.8 | 9.9      | ±3.02 | 0.30  | 17.1  | 26.7 | 43.7 | 9% |

S.D: Standard deviation
S.E: Standard error
CV: Coefficient of variation
Table 3: Relationship between the I.C.D; the intercanine distance and gender (mm)

| I.C.D | 25.01- | 30.01- | 35.01- | 40.01- | 45.00- | Total |
|-------|--------|--------|--------|--------|--------|-------|
|       | 25.01  | 30.01  | 35.01  | 40.01  | 45.00  |       |
| Male  | 0      | 2      | 5      | 1      | 8      |       |
| Female| 0      | 7      | 4      | 0      | 11     |       |
|       | 1      | 3      | 19     | 1      | 24     |       |
| Female| 1      | 22     | 24     | 0      | 47     |       |
| Male  | 0      | 0      | 8      | 2      | 10     |       |
| Female| 0      | 3      | 5      | 3      | 11     |       |
| Male  | 0      | 0      | 3      | 0      | 3      |       |
| Female| 0      | 0      | 0      | 0      | 0      |       |
| Total | 2      | 37     | 68     | 7      | 114    |       |

All subjects: P-value 0.015
Male: P-value 0.682
Female: P-value 0.006

Discussion
In the last century there has been great work in order to determine the anterior teeth size. It has proved a difficult task finding a relationship between anterior teeth size and facial land marks. Several studies have found the mean range of I.C.D to range between 20-36 mm. I.C.D was also compared with age, gender and race.

In the present study, measurements of I.C.D and intercanine distance were all found greater in males than in females (table 1 and 3). This is in consistent with pervious reports.

The mean width of I.C.D (32.8 mm) was greater in this study when compared with the findings of Alwazzan, Abdulla, Freihofer, Gupta et al. However it was smaller than those reported by Murphy et al (33.90 mm).

In the present study, the relation between I.C.D and intercanine distance was significant in all subjects (P = 0.015). Females also showed a significant (P= 0.006), in contrast to males where the P was 0.682 (Table 3).

Conclusion
The intercanthal distance had overall a significant relation to the width of the teeth and can be a reliable predictor for estimation of the tooth width. Maxillary intercanine distance may be estimated by dividing intercanthal distance by factor 0.9 in the Sudanese population.

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