Original Article

Correlation of intercanine distance with bizygomatic width and intercanthal distance in Nigerian population

Okeke C.M., Chukwuka, O.J., Enemuo, I.C.

ABSTRACT

Background and aim: Some facial parameters may be used to determine the width of maxillary anterior teeth when there is no pre extraction record. The aim of this study was to find out if intercanine distance (ICD) has any correlation with bizygomatic width (BZW), inner intercanthal distance (IICW) and outer intercanthal distance (OICW) in our environment.

Materials and Methods: The sample size was 348 (157 males and 191 females) and age range was from 18 to 28 years. The ICD, BZW, IICD and OICD were measured with a Venier caliper in millimeters. Means and standard deviations of parameters were obtained and comparison of means was done with t test. Correlation was done with Pearson correlation while p value was set at 0.05.

Results: The values of BZW (male - 112.4 ± 9.6mm, female - 109.0 ± 8.2mm), IICW (male - 35.3 ± 3.1mm, female - 34.4 ± 5.4mm) OICW (male - 102.2 ± 7.9mm, female - 99.9 ± 6.0mm) and ICD (male - 42.9 ± 2.5mm, female - 41.3 ± 2.4mm) were significantly higher in males than females. Among males BZW, IICW and OICW had mild significant correlation with ICD. In females, BZW, IICW and OICW did not have any correlation with ICD.

Conclusion: There was weak correlation between ICD and the studied facial parameters in males, but there was no correlation in females in our environment. Hence, the studied facial parameters may not be used as alternative for determining ICD.

INTRODUCTION

The aim of denture prosthodontics is to restore normal function, dentolabial alignment and to achieve facial harmony. This improves esthetics and mood (Gomes *et al.*, 2006; Asli *et al.*, 2017; Tripathi *et al.,* 2018). The aim of this research was to determine whether intercanine distance (ICD) has any correlation with bizygomatic width (BZW) and intercanthal width in our environment.

The ICD is important in the initial assessment for the determination of size and shape of dentures. Some other facial parameters may be used to determine ICD when pre-extraction record is not available (Varjão *et al.*, 2006). These include (BZW) and intercanthal width (Tripathi *et al.*, 2011; Shivhare *et al.*, 2015; Deogade *et al.*, 2015). There is paucity of local research data on this topic in our locality and this forms the motivation for this study.

MATERIAL AND METHODS

The study design was cross sectional observational design. It was conducted among undergraduate students of the Faculty of Basic Medical Sciences of our Institution. The sample size was 348 subjects (157 males and 191 females) and age range was from 18 to 28 years.

Ethical approval was obtained from the ethical committee of the Faculty of Basic Medical Sciences of the Institution. Informed consent was obtained from the study participants.

Inclusion criteria included:
- Subjects from Igbo ethnic group
- Subjects 18 years or above
- Subjects with apparently normal teeth

Exclusion criteria included:
- extraction, crowding or spacing of maxillary anterior teeth
- developmental anomalies of the maxillofacial region
- history of orofacial surgery
- gingival inflammation or hypertrophy.

Address for Correspondence:
Okeke C.M.
Department of Anatomy,
Nnamdi Azikiwe University,
Nnewi Campus, Nigeria.
cm.okeke@unizik.edu.ng

Department of Anatomy, Nnamdi Azikiwe University, Nnewi Campus, Nigeria

The parameters that were measured included the bizygomatic width (BZW), inner intercanthal width (IICW), outer intercanthal width (OICW) and maxillary intercanine distance (ICD). All measurements were done with a digital Vernier caliper (Metric & Sae Digital Display ISO9001: 2000, Jumlee Company, China), with precision of 0.01mm. Measurements were recorded in millimeter.

The IICW was obtained by measuring the distance between the medial angles the palpebral fissures (Figure 1), while the OICW was obtained by measuring the distance between the lateral angles of the palpebral fissures. The distance between the prominent parts of the zygoma was measured to get BZW (Figure 2). The ICD was measured by measuring the distance between the distal points of the maxillary canine teeth. The measurements were carried out by one observer to reduce interpersonal bias. Three readings were obtained for each measurement, and the mean was calculated.

Data analysis was done using the Statistical Package for Social Science (SPSS) Version 20. Means and standard deviations of measured parameters were obtained and comparison of means was done with t test. Correlation was done with Pearson correlation while p value was set at 0.05.

Results

The mean age for male subjects was 21.90 years ± 1.93, while the mean age for female subjects was 21.30 ± 1.83

The values obtained from the intercanine distance (ICD), bizygomatic width (BZW), inner intercanthal width (IICW) and outer intercanthal width (OICW), are shown in table 1. Males have significantly higher values in all the parameters than females. Table 2 shows the correlation between BZW, IICW and OICW with ICD in males. All the parameters showed significant correlation with ICD in males. However in females, neither of the measured parameters correlated with the ICD (table 3).

Table 4 shows regression equations for obtaining ICD from BZW, IICW and OICW.

Table 1: Values of bizygomatic width, inner intercanthal width, outer intercanthal width and intercanine distance

Parameter	Sex	Mean±SD	t-value	p-value
BZW (mm)	Male Female	112.4 ± 9.6 109.0 ± 8.2	3.840	<0.001
IICW (mm)	Male Female	35.3 ± 3.1 34.4 ± 5.4	2.001	0.046
OICW (mm)	Male Female	102.2 ± 7.9 99.9 ± 6.0	3.420	0.001
ICD (mm)	Male Female	42.9 ± 2.5 41.3 ± 2.4	6.607	<0.001

BZW - bizygomatic width, IICW - inner intercanthal width, OICW - outer intercanthal width, ICD - intercanine distance

Table 2: Correlation of intercanine distance with bizygomatic width, inner intercanthal width and outer intercanthal width in males

Parameter	Pearson Correlation	BZW	IICW	OICW	ICD
BZW	R p-value	1	0.273 0.000	0.344 0.000	0.159 **0.025**
IICW	R p-value	0.273 0.000	1	0.290 0.000	0.143 **0.043**
OICW	R p-value	0.344 0.000	0.290 0.000	1	0.163 **0.021**
ICD	R p-value	0.159 0.025	0.143 0.043	0.163 0.021	1

BZW - bizygomatic width, IICW - inner intercanthal width, OICW - outer intercanthal width, ICD - intercanine distance

Table 3: Correlation of intercanine distance with bizygomatic width, inner intercanthal width and outer intercanthal width in males

Parameter	Pearson Correlation	BZW	IICD	OICD	IC
BZW	R	1	-0.014	0.305	-0.057
	p-value		0.845	0.000	0.424
IICD	R	-0.014	1	0.227	0.071
	p-value	0.845		0.001	0.317
OICD	R	0.305	0.227	1	0.080
	p-value	0.000	0.001		0.261
IC	R	-0.057	0.071	0.080	1
	p-value	0.424	0.317	0.261	

BZW -   bizygomatic width,   IICW - inner intercanthal width,   OICW   - outer intercanthal width,   ICD - intercanine distance

Table 4: Regression equation for deriving intercanine distance from bizygomatice width, inner intercanthal width and outer intercanthal width in males

Equation	R	T	p-value
ICD = 38.262 + 0.041(BZW)	0.159	18.786	<0.001
ICD = 38.910 + 0.112(IICD)	0.143	19.950	<0.001
ICD = 37.304 + 0.054(OICD)	0.163	15.609	<0.001

BZW -   bizygomatic width,   IICW - inner intercanthal width,   OICW   - outer intercanthal width,   ICD - intercanine distance

DISCUSSION

The research work focused on the relationship that bizygomatic width (BZW), inner intercanthal width (IICW), and outer intercanthal width (OICW) have with intercanine distance ICD; with an aim to determine whether ICD can be derived indirectly from the other facial parameters. The ICD is necessary in determining the combined width of the maxillary anterior teeth; which is the first step in selection of appropriate dentures in denture prosthodontics. The goal of denture prosthdontics is to restore function and aesthetics; not only as regards normal dentolabial alignment, but also as regards the general harmony of dental and facial beauty (Tripathi *et* al., 2011; Asli *et al*., 2017).

The values of facial parameters obtained for male subjects in the present study were ICD: 42.9mm ± 2.5, BZW: 112.4mm ± 9.6, IICW: 35.3mm ± 3.1 and OICW: 102.2mm ± 7.9. For female subjects, the values were ICD: 41.3mm ± 2.4, BZW: 109.0mm ± 8.2, IICW: 34.4mm ± 5.4 and OICW: 99.9mm ± 6.0. Shivhare *et al.,* (2015) conducted a similar work among Indians and reported the following values: males ICD: 34.44mm ± 2.09, BZW: 142.19mm ± 4.20, IICW: 32.78mm ± 3.21 and OICW: 96.11mm ± 5.25 and females ICD: 31.14mm ± 0.74, BZW: 130.44mm ± 1.32, IICW: 30.17mm ± 0.83 and OICW: 89.78mm ± 2.04. From the figures above, the values of the parameters were comparable to ours but the value of BZW in their study was higher than that of our study both in males and females, while the values of the other parameters (ICD, IICW, OICW) were lower than ours. The reason for the difference may be due to racial difference.

The values reported by Deogade *et al.,* (2015) were ICD - 44.19±3.16, IICW – 28.04±3.44 (for males) and ICD – 43.54±3.47, IICW – 24.40±3.25 (for females). The ICD reported in our work were lower than theirs in both sexes, while the IICW obtained in

our work were higher than that reported in their work. The difference again is understood to be rooted in racial differences. It is important to note that one thing was common between the present work and the two previously mentioned works above; the values of the parameters in males were significantly higher than that of females. But this is different from the work of Asli *et al*., (2017) which reported no significant difference in the values of the facial parameters among males and females. Intercanine distance reported in their work (Asli *et al*., 2017) was 34.93 ± 1.87 (male) and 34.19 ± 2.16 (female), while IICW was 30.64 ± 1.73 (male) and 30.86 ± 2.55 (female). These values were lower than ours.

In the present work, the BZW, IICW and OICW had significant correlation with ICD in males, whereas in females, BZW, IICW and OICW did not have any correlation with ICD. This same pattern was reported by Asli *et al*., (2017) where they found out that IICW had significant correlation with ICD in males (p = 0.000) but not in females (p = 0.333).It is different from the findings of Tripathi *et al*., (2018) who found significant correlation of ICD with intercanthal width and BZW in both males and females. It is known that gender difference plays significant role in anthropometry and this can explain the findings above.

Chaudhary *et al*., (2018) did not find any significant correlation between IICW with ICD. Shivhare *et al.,* (2015) reported that ICD correlated with OICW but not with BZW and IICW in males within the age range of 18 to 23 years, while in females, ICD correlated with IICW but not with BZW and OICW within the same age range. Kini *et al*., (2013) reported that ICD has highly significant correlation with interpupillary distance and intercommissural distance but not with IICW. In the work of Jain *et al*., (2018), it was reported that the width of maxillary anterior teeth (ICD) correlated with interalar distance, interpupillary distance and

BZW in Indian population. They also reported that the ICD correlated with intercanthal distance among the Saudi population and intercommisural width among the Brazillians. These variations in the reported relationship between ICD and other facial parameters can be explained by the effect of ethnicity and racial differences in anthropometry. It is therefore important to conduct local research study on this subject if one is to use any of these facial landmarks as an alternative for determining combined maxillary anterior width.

Ideal reconstruction of the teeth becomes difficult in absence of pre extraction records like casts or photographs. Some methods have been proposed as possible alternatives in determining the combined maxillary anterior width, which will be used to determine the size and shape of artificial dentures. Among these methods are inter alar width, BZW, facial height and intra oral measurements like incisive papilla and ICD (Asli *et al.*, 2017). However, none of the methods has been universally accepted in determining the size of dentures (Chaudhary *et al.,* 2018). The result of our study shows that BZW, IICW and OICW correlated significantly with ICD only in males. However, the values of the correlation coefficients are too small to establish a true relationship. Table 4 gives the regression formulae through which ICD can be determined using the above facial parameters.

Conclusion: The search for alternative method as a guideline for selecting the appropriate size and shape of denture in denture prosthodontics is meaningfully justified; especially when there is no pre extraction record. This is because of the intense need for acceptable aesthetic outcome. The findings of our study did not give convincing evidence for using the studied facial parameters in determining ICD.

REFERENCES

Asli, H.N. and Khosravi, M.G. (2017) Evaluation of the relationship between upper intercanine and inner canthal distances in selected patients, *Bioscience Biotechnology Research Communications,* 10(2): 143-147.

Chaudhary, M.A.G., Khan, A.A., Qureshi, A. and Ahmad, S. (2018) Relationship between intercanthal distance to intercanine width of maxillary anterior teeth in Pakistani population, *Journal of Pakistan Dental Association*, 27(3):124-126.

Deogade, S.C., Mantri, S.S., Sumathi, K. and Rajoriya, S. (2015) The relationship between innercanthal dimension and interalar width to the intercanine width of maxillary anterior teeth in central Indian population, *Journal of Indian Prosthodontic Society,* 15(2): 91–97.

Gomes, V.L., Gonçalves, L.C., Prado, C.D., Junior, I.L. and Lucas, B.D.L. (2006) Correlation between facial measurements and the mesiodistal width of the maxillary anterior teeth, *Journal of Esthetics and Restorative Dentistry*, 18(4):196-205

Jain, A.R., Nallaswamy, D., Ariga, P. and Ganapathy, D.M. (2018) Determination of correlation of width of maxillary anterior teeth using extraoral and intraoral factors in Indian population: a systematic review. *World Journal of Dentistry*, 9(1):68-75

Kini, A.Y. and Angadi, G.S. (2013) Biometric ratio in estimating widths of maxillary anterior teeth derived after correlating anthropometric measurements with dental measurements. *Gerodontology*, 30(2):105-111.

Shivhare, P., Shankarnarayan, L., Basavaraju, S.M., Gupta, A., Vasan, V. and Jambunath, U. (2015) Inter canine width as a tool in two dimensional reconstruction of face: An aid in forensic dentistry, *Journal of Forensic Dental Science*, 7(1): 1–7.

Tripathi, S., Aeran, H., Yadav, S., Singh, S.P., Singh, R.D. and Chand, P. (2011) Canine tip marker: a simplified tool for measuring intercanine distance. *Journal of Prosthodontics*, 20(5):391-398

Tripathi, S., Singh, R.D., Chand, P., Kumar, L. and Singh, G.K. (2018) A study to correlate various facial landmarks with intercanine distance, *Indian Journal of Dental Research*, 29:440-444

Varjão, F.M. and Nogueira, S.S. (2006) Nasal width as a guide for the selection of maxillary complete denture anterior teeth in four racial groups, *Journal of Prosthodontics*, 15(6):353-358.