Original Article

Corelation of Mesiodistal Width of Upper Anterior Teeth with Inner Canthal Distance in Population of Hyderabad Region

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ABSTRACT

Objective: To determine the correlation of mesiodistal width of upper anterior teeth with inner canthal distance in population of Hyderabad region.

Study Design: Cross Sectional Study

Place and Duration of Study: This study was conducted at the Department of Prosthodontics, Liaquat University of Medical & Health Sciences (LUMHS) Jamshoro from June 2018 to January 2019.

Materials and Methods: Total 122 subjects were included with convenient sampling technique. The data was collected by measuring the inner-canthal distance (ICD), with Vernier caliper by placing against the forehead and lowered towards the eyes. The external arms of the Vernier caliper were adjusted so that they were in gentle contact with medial angles of the palpebral fissures of the eyes. The distance between these two anatomical landmarks were recorded as the ICD represented in millimeters.

Three readings of ICD were done to ensure precision and the mean value was recorded. The mesiodistal widths (MDW) of each maxillary central incisor, lateral incisor and canine were recorded intra-orally. The combined width of upper anterior (CWUA) teeth was calculated by summing up the widths of central incisors, lateral incisors and canine of both contralateral sides. Then the combined widths of maxillary anteriors were co-related with the ICD. The readings were recorded in proforma. The Data was analyzed by SPSS version 16.

Results: The mean age was 28.16±5.508. The males were 61% and female were 39%. Comparison of mean score of ICD in male was 29.38±2.44 and in female was 28.97±2.01 which is statistically not significant. Comparison of mean score of CWUA teeth in male was 32.68±2.69 and in female was 32.02±2.31; statistically not significant. Pearson correlation of ICD with CWUA was positive and statistically significant.

Conclusion: The results of the present study suggest that ICD may be a reliable predictor to determine the MDW of upper anterior teeth. The relationship between ICD and CWUA a ratio between ICD and CWUA was found. The overall mean ratio between ICD and CWUA was found to be 1.10. This indicates that the MDW of upper anterior teeth can be obtained by multiplying ICD with 1.10.

Key Words: Inner-canthal distance, Mesio-distal width, Correlation

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INTRODUCTION

Esthetics is one of the primary concerns of all individuals and it has importance in the field of dentistry.

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Esthetics plays a crucial role in complete denture prosthodontics. One of the important tasks in esthetic dentistry is the creation of harmonious smile. To achieve a harmonious smile, the Prosthodontist has to carefully blend the science and art with regards to selection and arrangement of teeth.[1]The size, form and color of the teeth must be in harmony with surrounding oral and facial structures. Selection of appropriately sized teeth requires both artistic skill and scientific knowledge.[2]

Most important step in denture esthetics is the selection of suitable size of maxillary anterior teeth.[1] The accurate size estimation of combined width of maxillary anterior teeth become very difficult in the absence of preoperative clinical records. Several anatomic measurements, including bi-zygomatic width (BZW), inter-pupillary distance (IPD), inter-alar width (IAW), ICD, and inter-commissural width have been suggested to aid in the estimation of a combined width

of the maxillary anterior teeth (inter-canine width).[3] Controversial studies have been reported regarding correlation between the width of the mouth and the MDW of the upper anterior teeth. Clapp and Tench published that the distal surfaces of the maxillary canines should be located at the commissural of the mouth, but Al Wazzan and colleagues, found no correlation between the width of the mouth and the MDW of upper anterior teeth. [4]

Scandrett et al evaluated BZW, IAW, ICW, sagittal cranial diameter, inter-buccal frenum distance, philtrum width, and age as predictors of the width of maxillary anterior teeth and central incisors.[5] Kumar and Gupta investigated facial measurements was the width of the nose. When measured in bone structure, the nasal width showed equal or nearly equal measurements to the width of the four maxillary incisors in 93% of the skulls analyzed.[1] However, when measured in soft tissue, the inter-alar width (IA) is not correlated to the width of the four maxillary incisors but rather to the width of the six maxillary incisors. On the other hand, Smith, in 1975, found that neither the nasal width nor the IA correlated to the width of the six upper anterior teeth.[6] Naeem et al found that IPD is different in males and females and is not correlated with the selection of artificial teeth.[7]. Another facial anthropometric measurement is the distance between the inner canthus of the eyes. The investigators concluded that no single predictor was accurate enough for clinical application. Therefore, it appears that more than one variable is needed to predict the width of maxillary anterior teeth and central incisors.

The ICD is stated as the distance between the medial angles of the palpebral fissures of both eyes.[8]. At 5 years of age, 93% of ICD growth has been achieved; maturity is reached between 8 and 11 years. The ICD is considered normal at a dimension of 28 35 mm.[3] Selecting anterior teeth in absence of any previous record is one of major problems faced by dentists. In the absence of previous records, ICD can be helpful so the purpose of this study is to determine the correlation of ICD with MDW of maxillary anterior teeth. The results of this study will be beneficial for Prosthodontists in selecting proper anterior teeth and for patients in their appearance.

MATERIALS AND METHODS

This study was conducted at Department of Prosthodontics, Institute of Dentistry; LUMHS Jamshoro, Sindh. Ethical clearance was sought from the Ethical Review Board of University. The written informed consent was acquired from the participants. The sample size was calculated using epitool online software by taking the standard deviation 2.81 (taken as reference the ICD from the association between the facial widths and width of upper anterior teeth [4]) at 95% confidence interval at 0.5 acceptable error. The total sample size calculated was 122. Inclusion criteria were fully dentate adults of age ranging from 20-40 years irrespective of gender. Exclusion criteria were patients with attritional teeth, restored teeth, orthodontic ally treated teeth, undergone crown and bridge work or Congenital and/or acquired oro-facial deformities.

The participants were seated on a dental chair to measure the ICD and their heads were held upright towards the horizon. The Vernier caliper was put against the forehead and lowered to the eyes. The Vernier caliper's internal arms were adapted so that the palpebral fissures of the eyes were in smooth contact with the medial edges. As the ICD depicted in millimeters, the distance amid these two anatomical landmarks was documented. Three readings of ICD were made to ensure precision and the mean value was recorded. The MDW were recorded intra-orally for each central incisor, lateral incisor and canine. Cheek retractors were used to facilitate access. The readings were found with the pointed claws of the digital caliper's inner jaws placed in labial embrasures at the largest mesio-distal aspect of each tooth and the digital caliper's long axis kept parallel to the incisal corners, and the caliper's inner and outer jaws were positioned perpendicular to the tooth's long axis. The combined size of maxillary anterior teeth was computed by summing the widths of both contralateral sides of central incisors, lateral incisors and canine. Then the maxillary anterior teeth paired length was correlated with the ICD. The measurements were recorded in proforma.

Data was entered and analyzed through SPSS version 17. Mean and standard deviation were calculated for quantitative variables like age, ICD, MDW of maxillary anterior teeth. Frequency and percentage were calculated for qualitative variable like gender. Independent t test was applied to check the statistical difference between gender and ICD, MDW of maxillary anterior teeth. Pearson correlation coefficient was determined between ICD and MDW of maxillary anterior teeth. P value < 0.05 was considered as significant at 95% confidence interval.

RESULTS

The male was 61% and female were 39%. The mean age was 28.16 ± 5.50. Mean MDW of right central incisor, lateral incisor and canine was 6.04±0.61, 4.84 ± 0.62 and 5.31 ± 0.74 respectively. Mean MDW of left central incisor, lateral incisor and canine was 6.03 ± 0.64, 4.874±0.665 and 5.281±0.703. The mean ICD was 29.22 ± 2.286 (Table-1)

Comparison of mean score of ICD in male was 29.38±2.44 and in female was 28.97±2.01 which is statistically not significant (Table-2).

Comparison of mean score of CWUA in male was 32.68±2.69 and in female was 32.02±2.31; statistically not significant (Table-3).

Pearson correlation of ICD with CWUA was positive and statistically significant (Table-4).

Table No.1: Descriptive statistics of Gender, Age, MDW and ICD of teeth

Gender	Frequency	Percent (%)
Male	75	61
Female	47	39
Age in years	**Mean**	**SD**
Age	28.16	5.50
Mesio-Distal width of teeth		
Right central incisor	6.04	0.61
Right lateral incisor	4.84	0.62
Right Canine	5.31	0.74
Left Central Incisor	6.03	0.64
Left Lateral Incisor	4.874	0.665
Left Canine	5.281	0.703
Inner-canthal distance (ICD)		
ICD	29.226	2.2867

Table No.2: Comparison of mean score of inner canthal distance in gender (Student T-Test)

	Gender	N	Mean	Std. Deviation	Std. Error Mean	P value
Inner Canthal Distance	Male	75	29.38	2.441	0.281	0.346
	Female	47	28.97	2.016	0.294	

Table No.3: Comparison of mean score of combined width of upper anterior teeth (CWUA) in gender (Student T-Test)

	Gender	N	Mean	Std. Deviation	Std. Error mean	P value
Mean of all	Male	75	32.68	2.694	0.311	0.164
	Female	47	32.021	2.310	0.336	

Table No.4: Correlation of inner canthal distance with mesiodistal width of maxillary anteriors

Correlations			
		Inner Canthal Distance	Mean of All
Inner Canthal Distance	Pearson Correlation	1	.599**
	Sig. (2-tailed)		.001
	N	122	122
CWUA	Pearson Correlation	.599**	1
	Sig. (2-tailed)	.000	
	N	122	122

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

Enhancement of facial beauty is one of the primary elective goals of patients seeking dental care. Loss of teeth especially anterior teeth is a traumatic experience that prompts people to seek dental care. Hence the planned prosthesis should fulfill esthetic harmony, functional efficiency and structural balance with the rest of the dento-facial structures. Achieving excellent esthetics when restoring or replacing the maxillary anterior teeth is one of the most challenging tasks in dentistry. Hardy IR had stated that, "To meet the esthetic needs of the denture patient, we should make the (denture) teeth look like (the patient's) natural teeth." [9] In complete denture construction, selection of anterior teeth is a vital step. When no pre-extraction records are available, selecting the proper size and shape of anterior teeth for edentulous patients can be difficult. The relative stability of the ICD aroused interest in various authors who have reported using ICD as the anatomic landmark in determination of MDW of central incisor and upper anterior teeth.[8,10,11] These studies were conducted for limited sample size and for a single ethnic group. This study has also same limitation of insufficient sample size but different ethnic groups like sindhi, siraiki and muhajir. The authors of these studies were of an opinion that, the ethnic related differences in ICD may exist and they proposed further research to validate the relationship between ICD and maxillary central incisors and maxillary anterior teeth. ICD was chosen for measurement in the present study for the following reasons: Studies have proved that the reference points (namely, medial angles of the palpebral fissures of the eyes) as a stable anthropometric parameter. These reference points can be easily located and measured with a simple instrument such as Vernier caliper.[1]

In this study Vernier caliper was one of the research gadgets. The limitations of using caliper as a measuring device was noticed during the study which includes, inability to insert the thinner beaks of the caliper in the broadest width of the tooth due to tight teeth contacts, some subjects did not co-operate to place the beaks of the caliper in the medial canthus to record ICD.

In our study it was observed that ICD was slightly more in men than in women. This is in agreement with the studies of Wazzan KAA, Sanin C& Savara BS[5,12] An analogous report in this regard was also been stated by Mavroskoufis et al. [13] In this study the CWUA teeth was almost equal in males and females which is not in agreement with the study conducted by Wazzan KAA and Lavelle CL who observed that all tooth dimensions and ICD were significantly larger in men than in women. [5,14]

CWUA teeth are the sum total width of each anterior tooth. Most of the values (95% confidence interval) of this parameter ranged between 32.68 and 32.02 with the

mean being 32.35 mm where as it was 48.68 mm and 49.02 mm with the mean being 48.85 mm in the study conducted by Kumar A et al.[1] In this study mean values of CWUA and sex showed statistically in-significant difference where as it showed statistically significant difference in the study of Kumar A et al.[1] The mean value of CWUA found in present study was less than the value reported by Scandrett et al.[15] (53.61 mm),Wazzan[5] (45.23 mm) and Shillingburg et al.[16] (45.80 mm). This variation in the measurements reported could be attributed to the difference in the ethnicity of the population evaluated.

The relationship between ICD and CWUA teeth a ratio between ICD and CWUA was found. The overall mean ratio between ICD and CWUA was found to be 1.10. The mean value showed no statistically significant difference between genders. This indicates that the MDW of upper anterior teeth can be obtained by multiplying ICD with 1.10. This ratio is less than the ratio quoted by Kumar AKV et al[1] (1.61) and Wazzan KAA[5] (1.426). This variation in the ratio may also due to difference in the ethnicity of the sample population tested.

In this study the subjects were relatively homogeneous which relate to the study conducted at Saudi Arabia where the homogenous samples were selected, the results of this study are more applicable to the population evaluated. Comparisons with data on Western populations may be undertaken, but ethnic differences should be considered.

The mean MDW of the central (Right and Left) incisors (6.03mm) and (8.48 mm) is not in agreement with the findings of Scandrett FR et al[15] (8.50 mm). The mean value of the combined width of the 6 maxillary anterior teeth (32.43) does not support the findings of Shillingburget HT[16] (45.80 mm) and Abdullah M[8] (43.00 mm). To some extent, the variations may be explained by differences in measuring techniques and in the ethnicities of the populations studied. In the present study the mean ICD was (29.22) less than values reported by Wazzan KAA[5] (31.92), Abdullah M[8] (32.00 mm) and Freihofer HP[17] (31.20 mm).

The Pearson correlation coefficients were positive and highly significant for various tooth widths. These findings indicate that the ICD could be used to select maxillary anterior teeth for edentulous patients.

CONCLUSION

The results of the present study suggest that ICD may be a reliable predictor to determine the MDW of upper anterior teeth. The relationship between ICD and CWUA a ratio between ICD and CWUA was found. The overall mean ratio between ICD and CWUA was found to be 1.10. The mean value showed no statistically significant difference between sexes. This indicates that the MDW of upper anterior teeth can be obtained by multiplying ICD with 1.10. Interpretation and extrapolation of the results must be tempered, however, by an acknowledgement of the study's limitations. Only single centered study was approached, and subjects were selected within a narrow age range. It was single operator based study. Further research is necessary to validate the outcomes of this investigation. Future research should investigate ethnic groups other than the one evaluated in the present study.

Author's Contribution:

Concept & Design of Study:	Sandeep Kumar
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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