A CORRELATIVE CASE STUDY TO DETERMINE PROPORTIONALITY BETWEEN INNERCANTHAL DISTANCE AND MESIODISTAL WIDTH OF MAXILLARY CENTRAL INCISORS IN FOUR DIFFERENT ETHNIC GROUPS

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ABSTRACT

Background: Selection of appropriate sized anterior teeth is an essential step in denture esthetics. Failure to select and properly arrange the artificial teeth in the complete denture, may lead to the rejection of prosthesis by the patient, which is otherwise made well. Various methods for selection of maxillary anterior teeth have been proposed in the past. Inner canthal distance (ICD) is the one of the anatomic landmark which attains adult size early in the adulthood and remains constant throughout the life. This paper presents a case study which was conducted to determine the ratio between ICD and combined mesio-distal width of maxillary central incisors (CWCI) in four ethnic group.

Methodology: 800 patients of four ethnic groups of each sex were selected to determine the ratio existing between ICD and CWCI using digital caliper.

Results: Ratio between ICD and CWCI was found to be 0.60 consistent with all four ethnic groups irrespective of sex.

Conclusion: ICD is the most constant anatomic landmark in the face, which can be utilized in the selection of appropriate sized maxillary central incisor for completely edentulous patients who don't possess any of the pre-extraction records for artificial teeth selection.

Introduction

Dentists are scientists as well as artists of the dentition. Each dentist should try for best of his capability to create uniform harmony in each patient's dentition in relationship to their unique total persona. The integrated complex of sex, personality and age has a significant role in the perception of each patient's identity. Understanding this, a dental surgeon can begin to contemplate selecting and arranging artificial teeth in such a manner as to complement and enhance the individual character and facial form of their patients.

To look attractive, maxillary anterior teeth must be in proportion to facial structures. Therefore various anthropometric measurements like, interpupillary width, bizygomatic width, intercommissural, interalar width and sagittal cranial diameter have been proposed in an attempt to quantify the selection of anterior teeth for complete dentures. However these anthropometric measurement have shown little consensus over the period to be an effective method in anterior teeth selection. A study conducted on Saudi Arabian population revealed that ICD can be utilized to determine maxillary central incisors width[1]. Researchers have also concluded that ICD may be a reliable predictor of the CWCI and further research is necessary to validate the outcome with different races[2]. India is diverse with different ethnicity. The correlative relationship of ICD and CWCI existed in one ethnic group may or may not be same to other ethnic groups. Hence a study was designed to determine the proportionality between ICD and CWCI in four ethnic groups.

MATERIALS AND METHOD

This study was conducted on eight hundred dentate Indian subjects of four different ethnic groups; Rajputs, Marathas, Sikhs and Tamilians of 100 males and 100 females from each ethnic group totaling upto 800 subjects under the age group of 18-30 years, after obtaining their consent, were randomly selected to form the subjects of the study.

Inclusion and exclusion criteria were used to select subjects for the study are as follows;

Inclusion Criteria

1. No crowding, missing, spacing and between maxillary anterior teeth.
2. Absence dental caries or restorations in the maxillary anterior teeth
3. Patients with facial asymmetry.
4. No history of orthodontic treatment.

Exclusion Criteria

1. Patients with loss of tooth structures due to attrition, abrasion and erosion
2. Evidence of Microdontia/macradontia or malformed teeth
3. Any surgical corrections of the facial skeleton altering the existing natural proportions of the face.

Selected patients were seated in a dental chair with their heads supported in an upright position so that they looked forward at the horizon. The digital caliper (Nakamura Corp; Code 500-142) was placed against the forehead and lowered towards the eyes. The external arms of the digital caliper were adjusted so that they were in gentle contact with medial angles of the palpebral fissures of the eyes and the slide of the digital caliper

Fig 1: Measuring Inner canthal Distance using Digital caliper

Fig 2: Measuring Mesio-Distal width of Central Incisor

was locked(Fig 1). The distance between these two anatomical landmarks was recorded as the ICD represented in millimeters. Three reading of ICD were made and the values were averaged. The mesio-distal widths of each maxillary central incisors were measured using internal jaws of the digital caliper (Fig 2). The beaks of the internal jaws of the digital caliper were thinned to facilitate proper fit in the labial embrasures. Cheek retractors were used for ease of accessing. The measurements were made with the pointed beaks of the internal jaws of the digital caliper placed in labial embrasures at the widest mesiodistal dimension of each tooth and the long axis of the digital caliper held parallel to the incisal edges and also the internal and external jaws of digital caliper were positioned perpendicular to the long axis of the tooth The locking screw was tightened making sure that beaks of the digital caliper did not move apart during recording the width of the teeth. Three measurements per tooth were made and the combined width of maxillary central incisors (CWCI) was tabulated for each sample. The ratio between CWCI and ICD was calculated. Data obtained was subjected to statistical analysis.

RESULTS

Values and co-relation of ICD and CWCI obtained for each ethnic groups of both sex is depicted in the table 1.

The average mean ICD values for males and females were found to be 30.79 mm and 26.67 respectively. Sikh group had highest mean ICD distance of 31.34 mm for male and 29.95 mm for female subjects. Statistically significant difference in ICD measurements was found in all ethnic groups. There was negligible difference in the mean values of CWCI was found between male and female subjects of different ethnic groups. The 'P' values of CWCI have shown statistically significant differences between all ethnic group.

	INNER CANTHAL DISTANCE (ICD)			COMBINED WIDTH OF MAXILLARY CENTRAL INCISORS (CWCI)			RATIO BETWEEN ICD AND CWCI		
	Mean	SD	'P' Value	Mean	SD	'P' Value			
All subjects	30.23	1.51	<0.01	18.09	0.83	<0.01	0.599	0.02	<0.01
Males	30.79	1.35	<0.01	18.27	0.80	<0.01	0.594	0.02	<0.01
Females	29.67	1.45	0.069	17.92	0.83	0.062	0.604	0.01	
Ethnic groups									
Rajputs	30.43	1.22	<0.01	18.30	0.77	<0.01	0.60	0.02	<0.01
Sikhs	31.34	1.35		18.62	0.80		0.59	0.03	
Tamilians	30.71	1.43		18.12	0.77		0.59	0.01	
Marathas	30.68	1.25		18.06	0.74		0.59	0.02	
Ethnic groups									
Rajputs	29.75	1.39	0.069	17.74	0.86	0.062	0.59	0.01	0.19
Sikhs	29.95	1.48		18.05	0.81		0.60	0.01	
Tamilians	29.52	1.38		17.96	0.77		0.61	0.01	
Marathas	29.47	1.52		17.93	0.86		0.60	0.01	

TABLE: 1 DEPICTING MEAN, SD AND 'P' VALUES OF INNER CANTAL DISTANCE (ICD), COMBINED WIDTH OF MAXILLARY CENTRAL INCISORS (CWCI) AND RATIO BETWEEN ICD AND CWCI

The ratio between ICD and CWCI for all subjects was 0.599. The mean values among different ethnic group of both sexes ranged from 0.59 to 0.61 averaging to 0.60. The values so obtained were statistically significant.

DISCUSSION

Selecting appropriate size of maxillary anterior teeth when no pre-extraction records are available becomes difficult. In these situations anatomical landmarks can be utilized for determining suitable size of upper anterior teeth. The ICD is considered more reliable anatomic landmark in the facial structure, therefore this study was aimed to determine the relationship between ICD and CWCI

Owens EG and co-workers[3] reported a significant racial and gender differences in the width of the maxillary central incisor. They suggested that the size of maxillary anteriors should be evaluated carefully while replacing. Hence knowledge of racial forms may help to specify certain esthetic and functional modifications to treatment plans to accommodate the multiple racial groups with in modern societies. Errors at this stage can often result in patient rejection of otherwise well constructed, comfortable and efficient dentures purely on the basis of esthetics. Hence the goal is to have maxillary anterior teeth which restore optimal dentolabial relation in close harmony with overall sfacial appearance and natural teeth. ICD is the distance between the medial angles of the palpebral fissures. ICD attains almost the size of adulthood by adolescence[4] and remains stable thereafter. Since ICD remains constant though out the life and ease of recording it has been considered as reliable anatomical landmark in the facial skeleton. As reported by Freihofer HP[5] ICD ranges between 28mm to 35 mm irrespective of race and sex. In our study ICD ranged between 27mm to 36 mm, mean being 30.2 mm which is similar to the value reported by Laestadius et al[6] (30 mm) and smaller than the values reported by Abdullah[1] (32.00 mm) and Freihofer[5] (31.20mm).

The mean widths of right and central incisors in the present study was 9.03 mm and 9.06mm respectively which was higher than the values reported by by Cesario et al[7] (8.80mm) and Abdullaah[1] (8.77mm). Garn et al[8], who had found no significant difference in the mesiodistal diameters of left and right maxillary central incisors and thus justified the common practice of combining these tooth measurements.

As early as 1905, Berry[9] has stated that the maxillary central incisors has a definite ratio to the size of the face and termed it as Berry's Biometric Ratio. He advocated that width of maxillary central incisor is being one sixteenth of the width of the face.

In the present study ICD was correlated to CWCI. Determination of width of Maxillary central incisors is the first step in the selection of maxillary anterior teeth because they are the most prominent teeth in the arch when viewed from the frontal aspect[1]. Shillingburg et al[10] reported that the combined maxillary central incisors width is 37% of the circumferential arch distance between the distal surface of the maxillary canines. The combined lateral & canine widths accounted for 31% and 32% of the distance, respectively.

It was observed in this study that the overall mean ratio between the ICD and the CWCI was 0.599 mm (approx 0.60). This ratio was consistent between the ethnic groups and sex. When compared between the sexes the mean ratio in women was 0.01 more than that of men; this difference is statistically insignificant ('P' value 0.960). Hence it is apparent from the results that the combined mesiodistal width of maxillary central incisors can be obtained by multiplying the ICD with 0.60. This ratio is slightly more than the ratio stated by Khalid A Al Wazzan[2] (0.53) [35]. This slight variation may be due to difference in the ethnicity of the sample population tested.

CONCLUSION

Within the limitations of this study, the following conclusions were drawn:

1. The ratio between ICD and CWCI was 0.60 and were consistent with all four ethnic groups studied. This ratio can be utilised to select the width maxillary central incisors.

2. We can utilize the formula put forward by Sillingburg et al[10] to determine the combined width of the remaining maxillary anterior teeth using the width of maxillary central incisors for Indian population.

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