Original Research Article

Comparative evaluation of the relationship between different anthropometric measurements on the face with the mesiodistal width of the maxillary central incisor in males and females in local population in Pune, India

ABSTRACT

Aims: To compare the width of the central incisor obtained by the given formulae with the actual width of the central incisor in males and females and assess whether the interpupillary , interalar ,intercommisural and interlateral canthus widths are reliable anthropometric measurements to give an accurate value of the width of the central incisor in local population.

Study design: Original Research.

Place and Duration of Study: Department Of Prosthodontics and Crown and Bridge, Dr. D. Y. Patil Dental College and Hospital, Pimpri ,Pune. Dr. D. Y. Patil Vidyapeeth, Pune – 411018, between June 2009 and July 2010.

Methodology: A total of 160 participants [Males=80; Females=80] were selected in the age group of 18-25 yrs which fulfilled the selection criteria. Informed consent was obtained from each student before participation. The following anthropometric measurements were performed: CW which is the mesiodistal width of the maxillary central incisor, interpupillary width (IPW) and the interalar width (IAW), intercommisural width (ICW) and interlateral canthus width (LCW) which were calculated using a digital vernier calliper. The differences and variables were studied by sex and the differences in the expected mesiodistal width of the central incisor by IPW/CW=6.6 and CW=IAW/4 with the real value was evaluated. The values were evaluated and the differences helped in determining whether these anthropometric measurements can be used as a guide for selection of artificial teeth in males and females in local population.

Results: As per this study conducted, in males & females there was statistically significant correlation between the width of the central incisors (CI) and the interalar width IAW (P value =0.043) and the interpupillary width IPW (P value =0.003) when calculated by formula CI=IAW/4 and CI=IPW/6.6. There was no statistically significant correlation between the width of the central incisor and the interlateral canthus width (LCW) and the intercommisural width (ICW).

Conclusion: There was significant correlation between the interalar width and interpupillary width and the width of the central incisor. Thus, interalar width, when divided by 4, and the interpupillary width when divided by 6.6 was a reliable predictor of the selection of the maxillary central incisor width in females and males in local population.

Keywords: anthropometric measurements , interalar width, intercommisural width , interlateral canthus width ,interpupillary width, central incisor ,facial measurements , original research

1. INTRODUCTION

Aesthetic tooth selection and its physiologic arrangement is a critical step to successfully restore the lost structural and functional harmony in a removable dental prosthesis.

One of the most important phases in the fabrication of any removable dental prosthesis is the selection of the maxillary central incisors because they are most visible when a person talks and smiles. [1]

The maxillary anterior teeth are the key elements contributing to the aesthetic importance of what we call dentofacial beauty.
It is our duty as a dentist to preserve and maintain the natural nobility of advancing age when fabricating any prosthesis, with apt selection and arrangement of anterior teeth.

In the early 19th century, most procedures involved “hunt and peck” or “trial and error” until the patient and the dentist were pleased with a specific size of a tooth. However, a more scientific method is required for the selection of teeth for edentulous patients. [1, 2]

Hence anthropometric measurements such as the intermedial canthus width, inter-commissural width, interalar width, bizygomatic width, sagittal cranial diameter, interpupillary width have been suggested in an effort to quantify the selection of maxillary anterior teeth for complete dentures. [1,2]

The average width of a single maxillary central incisor (CW) has been reported to be approximately 1/16 of the interzygomatic width (IZW).
However, subsequent studies have reported that this IZW/CW correlation is not a reliable predictor of CW. [2]

According to the embryogenic philosophy, the nose has been considered as an essential guide to determine the mesiodistal width of the maxillary central incisor. Furthermore, the interalar width is a facial landmark that is at the closest distance from the teeth. This distance also varies by sex and ethnicity. The IAW is estimated to average 4 times the width of the maxillary central incisor (CW = IAW/4).[2,3]

The Intercommissural width (ICW) is another anthropological measurement that can be evaluated in the selection of the maxillary central incisor size. Tooth size should be in harmony with the oral tissues. When the teeth are viewed frontally, they primarily draw attention with respect to their harmony with the surrounding soft tissues and the corners of the mouth. Therefore, this distance also has an effect on the design of an esthetically successful denture.[2]

The Interlateral canthus width(LCW) should be in harmony with the width of the maxillary central teeth, and it is thought that this distance, similar to the CW, does not change with age and may thus be an effective factor in selecting tooth size.[2]

The Interpupillary width (IPW) also remains constant and does not modify after the age of 14. Therefore, the ratio between the interpupillary width and the mesiodistal width of the upper central incisor is also expected to remain stable.
It has been suggested that the IPW/CW proportion of 6.6 can be used to predict the maxillary central incisor width which varies with sex and ethnicity(IPW/CW=6.6).[2, 4]

Thus, the study hypothesis will help us in finding a relationship between these anthropometric measurements on the face and the width of a maxillary central incisor in males and females in local population.

2. MATERIAL AND METHODS

A total of 160 participants [Males=80; Females=80] were selected in the age group of 18-25 yrs which fulfilled the selection criteria. Informed consent was obtained from each student before participation.

The following anthropometric measurements were performed: CW which is the mesiodistal width of the maxillary central incisor, interpupillary width (IPW) and the interalar width (IAW), intercommisural width (ICW) and interlateral canthus width (LCW).

The mesiodistal widths of the maxillary central incisor were measured using the internal jaws of the digital vernier caliper(Figure 1 &2). The beaks of the internal jaws of the digital caliper were placed in the labial embrasures at the widest mesio-distal dimension of the tooth and the long axis of the vernier caliper was held parallel to the incisal edges and also the internal and external jaws of the digital caliper were positioned perpendicular to the long axis of the tooth. The locking screw was tightened to ensure no movement while recording the width(as seen in Figure 3). The width was represented in millimeters.[3,4]

For measuring the interpupillary distance the participants were seated comfortably in an upright position and asked to look straight. The measurements were made from the mid pupil of one eye to mid pupil of other eye by placing the digital vernier caliper on the forehead and lowering it to the eyes(as seen in Figure 4). The width was represented in millimetres.[4]

For measuring the interalar width the participant were seated in upright position, with head firmly positioned. The participants were asked to inhale and exhale rapidly and deeply several times and then to hold their breath and not to expand the alae of the nose and the interalar width was determined by measuring the external width of the alae of the nose at the widest point(as seen in Figure 5). The width was represented in millimetres.[5]

For the measurement of the intercommisural width, the participants were required to widely open and close their mouth several times. This helped the fatigued musculature around the lips to relax during the measurement. During measurement, the mandible was in the rest position and the lips un-stretched. Then the lip vermilion was measured between left and right commisure of mouth using the digital caliper(as seen in Figure 6). The width was represented in millimetres.[9]

For measuring the interlateral canthus width, the participants were seated in a dental chair with their head in an upright position so they look forward at the horizon. The digital caliper was placed against the forehead and lowered to the eyes. The external jaws of the digital caliper were adjusted so that they will be in gentle contact with lateral canthus

of the eyes and were locked(as seen in Figure 7). The distance between these two anatomical landmarks was measured and represented in millimetres.

The differences and variables were studied by sex and the differences in the expected mesiodistal width of the central incisor by IPW/CW=6.6 and CW=IAW/4 with the real value was evaluated.

The values were evaluated and the differences helped in determining whether the interpupillary, interalar, intercommisural and interlateral commissural widths are reliable anthropometric measurements as a guide for selection of artificial teeth in males and females in local population.

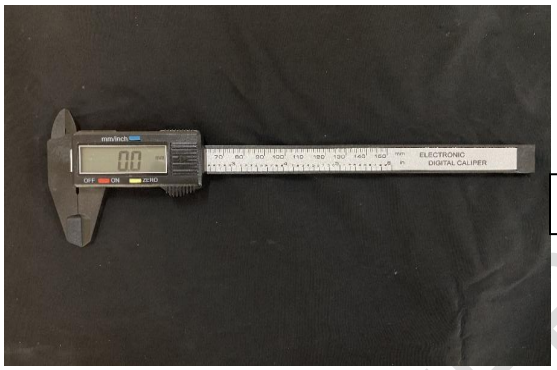

Figure 1: Digital Vernier Caliper

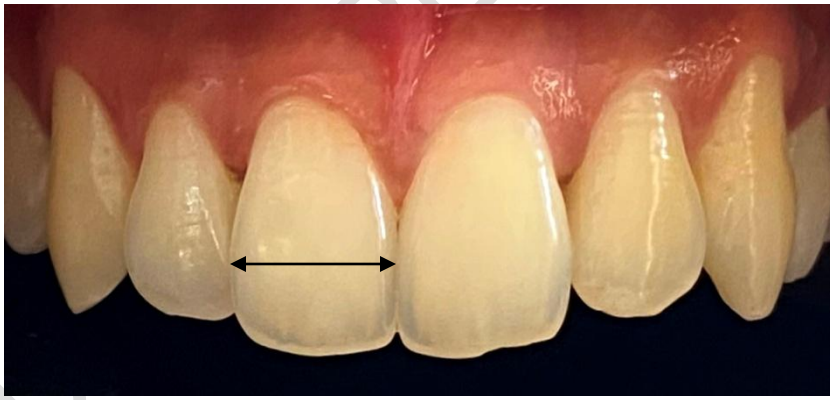

Figure 2: mesiodistal width of the maxillary central incisor

Figure 3 : Measuring the width of the central incisor

Figure 4 : Measuring the interpupillary width

Figure 5 : Measuring the interalar width

Figure 6 : Measuring the intercommissural width

Figure 7 : Measuring the interlateral canthus width

3. RESULTS AND DISCUSSION

Method of statistical analysis – Data obtained was entered and sorted in Microsoft Excel (v.2013). Statistical analysis was performed using Statistical package for social sciences (SPSS) software (v.21.0). Descriptive and frequency statistics was performed for the demographic details and study parameters of the participants (females and males). Pearson's correlation coefficient was used to determine the significant correlation amongst different parameters in males and females. Inter-group comparison was performed using Unpaired t-test/Independent t-test to assess significant differences between females and males. All statistical tests were performed at 95% confidence intervals; keeping p value of less than 0.05 as statistically significant.

Table 1 – Descriptive statistics: Mean (SD) of the parameters of the total study participants

Parameter	N	Minimum	Maximum	Mean	Std. Deviation
Age		19.00	25.00	24.41	4.69
CI	160	6.67	9.30	8.28	.46
IAW	160	30.84	45.10	34.35	2.67
CI=IAW/4	160	7.71	11.27	8.58	.66
IPW	160	49.25	66.71	58.00	3.84
CI=IPW/6.6	160	7.46	10.10	8.78	.58
LCW	160	86.20	105.20	93.76	5.31
ICW	160	44.60	56.41	49.03	2.28

Table 2 – Correlation between different parameters of the total study participants

Correlations						
		CI	**CI=IAW/4**	**CI=IPW/6.6**	**LCW**	**ICW**
CI	**Pearson Correlation**	1	.310**	.139	1.06	1.013
	p value	-	.000*	.101	.941	.879
	N	160	160	160	160	160
CI=IAW/4	**Pearson Correlation**	.310**	1	.252**	.450**	.067
	p value	.000*	-	.003*	.000*	.429
	N	160	160	160	160	160
CI=IPW/6.6	**Pearson Correlation**	.139	.252**	1	.586**	.269**
	p value	.101	.003*	-	.000*	.001*
	N	160	160	160	160	160
LCW	**Pearson Correlation**	1.06	.450**	.586**	1	.348**
	p value	.941	.000*	.000*	-	.000*
	N	160	160	160	160	160
ICW	**Pearson Correlation**	1.013	.067	.269**	.348**	1
	p value	.879	.429	.001*	.000*	-
	N	160	160	160	160	160

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

*p value <0.05 statistically significant

Interpretation – In our study, correlation between different parameters of the total study participants was assessed using Pearson's correlation coefficient test. A statistically

significant positive correlation was CI and CI=IAW/4; and CI=IPW/6.6; but not with LCW and ICW. (p value <0.05)

Table 3 – Correlation between different parameters amongst the female study participants

Correlations						
		CI	**CI=IAW/4**	**CI=IPW/6.6**	**LCW**	**ICW**
CI	**Pearson Correlation**	1	.262*	.378**	.054	.063
	p value	-	.043*	.003*	.680	.631
	N	80	80	80	80	80
CI=IAW/4	**Pearson Correlation**	.262*	1	.197	.440**	.112
	p value	.043*	-	.131	.000*	.396
	N	80	80	80	80	80
CI=IPW/6.6	**Pearson Correlation**	.378**	.197	1	.455**	.156
	p value	.003*	.131	-	.000*	.234
	N	80	80	80	80	80
LCW	**Pearson Correlation**	1.05	.440**	.455**	1	.463**
	p value	.680	.000*	.000*	-	.000*
	N	80	80	80	80	80
ICW	**Pearson Correlation**	1.63	.112	.156	.463**	1
	p value	.631	.396	.234	.000*	-
	N	80	80	80	80	80

*p value <0.05 statistically significant

Interpretation – Our study assessed the correlation between different parameters among Females using Pearson's correlation coefficient test. A statistically significant correlation was CI and CI=IAW/4; CI and CI=IPW/6.6; but not with LCW and ICW.

Table 4 – Correlation between different parameters amongst the male study participants

Correlations						
		CI	**CI=IAW/4**	**CI=IPW/6.6**	**LCW**	**ICW**
CI	**Pearson Correlation**	1	.374**	-.158	-.038	-.029
	p value	-	.001*	.158	.739	.796
	N	80	80	80	80	80
CI=IAW/4	**Pearson Correlation**	.374**	1	.323**	.506**	.059
	p value	.001*	-	.003*	.000*	.599
	N	80	80	80	80	80
CI=IPW/6.6	**Pearson Correlation**	-.158	.323**	1	.724**	.415**
	p value	.015	.003*	-	.000*	.000*
	N	80	80	80	80	80
LCW	**Pearson Correlation**	1.038	.506**	.724**	1	.195
	p value	.739	.000*	.000*	-	.081
	N	80	80	80	80	80
ICW	**Pearson Correlation**	1.029	.059	.415**	.195	1
	p value	.796	.599	.000*	.081	-

	N	80	80	80	80	80

*p value <0.05 statistically significant

Interpretation – Our study assessed the correlation between different parameters among Males using Pearson's correlation coefficient test. A statistically significant correlation was CI and CI=IAW/4; CI=IPW/6.6 but not with LCW and ICW. (p value <0.05)

DISCUSSION :

The selection of the correct size of maxillary anterior teeth for edentulous patients is an extremely important procedure, especially in the absence of pre-extraction records. [2]

As of today there is no universal accepted accurate method of determining the size of anterior teeth. [1, 2]

Achieving maximum aesthetics when replacing the maxillary anterior teeth is one of the most challenging and difficult task for a dentist. As in the words of Hardy IR, "To meet the aesthetic needs of the denture patient, we should make the denture teeth look like the patient's natural teeth".

In the past, patients and dentists thought that the dental aesthetics could only be ensured with modifications on teeth. Together with the latest developments in the smile analysis and aesthetic design, researchers have identified the aesthetics based on facial, oral-facial, dentogingival, and dental components.

Various anatomic dimensions have been suggested, which includes the bizygomatic width, interpupillary distance, interalar width and intercommissural width as a guide for selection of maxillary anterior teeth.

Neda AL-Kaisy et al (2015) concluded that the interalar distance (IAD) to the straight line width of the 6 anterior teeth could be used as a dependent parameter in Kurdish men. [1]

Hatice Ozdemir *et al* (2019) performed a study which concluded that all facial measurements, except the intercommisural width (ICW) and interpupillary width (IPW) in women and intermedial canthus width (MCW) in men, had significant effect on the CW according to multiple linear regression analysis. [2]

George Attokaran et al(2018) performed a study which showed a high significant co-relation between interalar distance and the mesiodistal width of the six maxillary anterior teeth in both males and females. [3]

Jogeshwar Barman et al (2018) concluded that the interpupillary distance can be used as a guide in determining suitable mesiodistal dimension of the maxillary central incisors. [4]

As per this study conducted, in females there was statistically significant correlation between the width of the central incisors (CI) and the interalar width IAW (P value =0.043) and the interpupillary width IPW (P value =0.003) when calculated by formula CI=IAW/4 and

CI=IPW/6.6.[As seen in table 3]. Similar results were observed in the study conducted by Neda AL-Kaisy and his co-workers in 2015.
There was no statistically significant correlation between the width of the central incisor and the interlateral canthus width (LCW) and the intercommisural width (ICW).

In males, there was statistically significant correlation between the width of the central incisors (CI) and the interalar width IAW (P value =0.001) and the interpupillary width IPW (P value =0.015) when calculated by formula CI=IAW/4 and CI=IPW/6.6.[As seen in table 4] whereas no statistically significant correlation was found between the width of the central incisor and the interlateral canthus width (LCW) and the intercommisural width (ICW). Similar results were observed in the study conducted by Hatice Ozdemir and his co-workers in 2019.

This study has shown that this method cannot be applied as a gold standard in all cases however there is significant correlation to use the Interalar width and the interpupillary width to obtain the approximate width of maxillary right and left central incisor while selecting the size of maxillary anterior teeth for any removable prosthesis.

4. CONCLUSION

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

1. There was significant correlation found between interalar width with the width of the maxillary central incisor in females & males in local population. The values derived from the actual width taken and through the formula had significant statistical co-relation concluding that the interalar width is a reliable anthropometric measurement in determining the width of the central incisor.

2. There was significant correlation found between interpupillary width with the width of the maxillary central incisor in females & males in local population. The values derived from the actual width taken and through the formula had significant statistical co-relation concluding that the interpupillary width is a reliable anthropometric measurement in determining the width of the central incisor.

3. No significant correlation was found in the width of the central incisor and the interlateral canthus width and the intercommisural width in females and males in the local population.

4. Therefore, Interalar width, when divided by 4, and the interpupillary width when divided by 6.6 was a reliable predictor of the maxillary central incisor width in females and males in local population.

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