"Comparative Evaluation of the Relationship between the Intermedial Canthus Width on the Face and the Width of the Maxillary Central Incisor in Males and Females in The Local Population"

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ABSTRACT

Introduction: One of the most important phases in the fabrication of the complete denture is the selection of the maxillary central incisors because they are most visible when viewed frontally. Anthropometric measurements on the face can be used as a guide in selecting proper sized anterior teeth. The relationship between the intermedial canthus width (MCW) and the width of the two maxillary central incisors has been reported to be in the golden proportion given by Levin in 1978. The formula used was $CW = (MCW \times 0.618) / 2$ where CW is the width of the maxillary central incisor.

Materials and Method: In this study, the following anthropometric measurements were performed using a digital vernier caliper: CW which is the mesiodistal width of the maxillary central incisor and MCW which is the distance between the right and left medial canthus. The differences and variables were studied by sex and the differences in the expected mesiodistal width of the central incisor by $(MCW \times 0.618) / 2$ with the real value were evaluated. The values were evaluated using the one way ANOVA test with Post Hoc ANOVA test & unpaired t-test.

Results: There was a significant correlation between the width of the central incisor (CW) and the calculated width of the central incisor (CW2) in males in the local population where the P-value is 0.047. There was no significant correlation between the width of the central incisor (CW) and the calculated width of the central incisor (CW2) in females where the P-value is 0.062.

Conclusion: Within the limitations of this study, the following conclusions were drawn – There was a significant correlation found between intermedial canthal width with maxillary central incisor in males in the local population. Inter medial canthal width, when multiplied by a decreasing function value of geometric progression term 0.618 and divided by 2, was a reliable predictor of maxillary central incisor width in males in the local population.

Key Words: Anthropometric measurements, Central incisor width, Digital vernier calliper, Golden proportion, Intermedial canthus width, The medial palpebral fissure

INTRODUCTION

An aesthetically sound complete denture can be achieved by evaluating both facial soft and hard tissues.^{1, 2} 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.⁴

Hence anthropometric measurements such as the intermedial canthus width, inter-commissural width, internal width, bizygomatic width, sagittal cranial diameter, interpupillary width have been suggested to quantify the selection of maxillary anterior teeth for complete dentures.^{4, 5}

The intermedial canthal width (MCW) is the length measured between the angles of the medial palpebral fissures bilaterally.^{4, 6}

It was found that 78 per cent of the development of adult MCW was achieved by 1 year of age, after which the growth

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spurt in this region significantly reduced in comparison to that of the lateral orbital canthus.⁴⁻⁶

Laestadius et al(1969)reported that the MCW completely matured between the ages of 8 and 11 years in comparison with other eye structures and that it remained at a constant size of 28 to 35 mm for the rest of the adult life.⁶

Therefore, the MCW is considered as a dependable anatomic or anthropometric measurement that may give a valid approach for selecting the anterior tooth size.⁶

The relationship between the intermedial canthus width (MCW) and the width of the two maxillary central incisors has been suggested to be in the golden proportion given by Levin in 1978.⁷

Application of golden proportion to determine central incisor width is 1.618:1 and it is reciprocal 0.618 in geometry. The common ratios of the geometric progression are 0.618 and 1.618.⁷

Any reducing factor is multiplied by 0.618 and any increasing factor by 1.618 to get the next result. The intermedial canthal width was found to be higher than the combination of the widths of the maxillary central incisors. Hence, the MCW of each individual was multiplied by a reducing factor value of the geometric progression (0.618) to get the combined width of two maxillary central incisors. The result was then divided by 2 to obtain the width of a single maxillary central incisor.

The formula can be represented as:

Combined width of central incisors = $MCW \times 0.618$

Calculated central incisor width (CCIW) = $(MCW \times 0.618) / 2$ ⁷

In a country like India, we find individuals in various ethnic groups with diverse physical characteristics. Hence, the purpose of this study is to find a correlation in the relationship between the MCW and mesiodistal width of the upper central incisor in males and females among the local population.

MATERIALS

A total of 36 participants (Males-18, Females-18) in the age group of 18-25 years of Dr. D. Y. Patil Dental College and Hospital, Pimpri, Pune was selected which met the following presented criteria and informed written consent was obtained [DYPDCH/IEC/120/67/19]. The chosen participants had well aligned, completely erupted permanent maxillary teeth & completed musculoskeletal development of the face. There was no history of orthodontic treatment, gross facial asymmetry, restorations of the maxillary central incisors, prosthetic restoration of the maxillary central incisors, crowding or missing teeth, abnormal maxillary-mandibular relationship, diastema in the maxillary anterior teeth & any

physiologic condition causing developmental anomaly of the face and teeth. The materials used were a digital vernier calliper (Swabs Professional Instruments 6 inch digital vernier calliper), surface disinfectant (Raman and Weil bacilli spray 25) and cotton rolls.

METHODOLOGY

- The following anthropometric measurements were performed using a digital vernier calliper (Figure 1): CW which is the mesiodistal width of the maxillary central incisor and MCW which is the distance between the right and left medial canthus.
- The mesiodistal width of the maxillary central incisor was measured using the internal jaws of the vernier calliper. The beaks of the internal jaws of the vernier calliper were placed in the labial embrasures at the widest mesiodistal dimension of the tooth and the long axis of the vernier calliper was held parallel to the incisal edge and also the internal and external jaws of the digital calliper were positioned perpendicular to the long axis of the tooth (Figure 3). It was ensured that there was no movement while recording the width. The width is represented in millimetres.^{3,4}
- For measuring the intermedial canthus width, the participants were seated in a dental chair with their heads in an upright position so they look forward at the horizon. The digital calliper was placed against the forehead and lowered to the level of the eyes. The external jaws of the digital calliper were adjusted so that they were in slight and mild contact with the medial angles of the inner palpebral fissures of the eyes (Figure 2). The length between these two anatomic landmarks was measured and represented in millimetres.^{4,5}
- The differences and variables were studied by sex and the differences in the expected mesiodistal width of the central incisor by $(MCW \times 0.618) / 2$ with the real value were evaluated.
- The values were evaluated using the one way ANOVA test with Post Hoc ANOVA test & unpaired t-test.

Figure 1: Digital vernier caliper.

Figure 2: Measuring the intermedial canthal distance.

Figure 3: Measuring the width of the central incisor.

RESULTS

The mean, standard deviation and p-value (Pearson's value) for Intermedial canthal distance (MCW), Right central incisor width (CW) and the calculated width of the central incisor (CW2) were calculated in the tables below.

As per table 1, the mean value of the intermedial canthus width in males is 31.60 and in females is 28.81. There was a statistically significant Pearson's correlation between the intermedial canthus width in males and females in the local population (P-value < 0.005) where 1 denotes the male population and 2 denotes the female population.

There is a significant difference in the standard deviation values of the actual (0.581) and calculated width (0.903) of the central incisor as shown in table 2.

There was a significant correlation between the width of the central incisor (CW) and the calculated width of the central incisor (CW2) in males in a local population where the P-value is 0.047 as shown in table 3.

There was no significant correlation between the width of the central incisor (CW) and the calculated width of the central incisor (CW2) in females where the P-value is 0.062 as seen in table 4.

Table 1: Pearson's correlation between the width of the central incisor in males and females in the local population

	SEX	N	Mean	Std. Deviation	Mean diff	t	P value
MCW	1 (M)	18	31.602778	3.0241573	2.7888889	3.237	.003
	2 (F)	18	28.813889	2.0536772			
CW	1	18	8.416667	.5858127	.2316667	1.202	.238
	2	18	8.185000	.5707194			
CW ₂	1	18	9.670000	.9878914	.7661111	2.777	.009
	2	18	8.903889	.6276111			

Table 2: Mean and standard deviation between the actual and calculated values of the width of the central incisor

	Descriptive Statistics		
	Mean	Std. Deviation	N
CW	8.300833	.5819739	36
CW ₂	9.286944	.9034753	36

Table 3: Pearson's correlation between the actual and calculated width of the central incisor in males in the local population

		CI	CI(W ₂)
CI	Pearson Correlation	1	.047
	Sig. (2-tailed)		.853
	N	18	18
CW ₂	Pearson Correlation	-.047	1
	Sig. (2-tailed)	.853	
	N	18	18

Table 4: Pearson's correlation between the actual and calculated width of the central incisor in females in the local population

		CI	CI(W ₂)
CW	Pearson Correlation	1	.262
	Sig. (2-tailed)		.294
	N	18	18
CW ₂	Pearson Correlation	.262	1
	Sig. (2-tailed)	.294	
	N	18	18

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 tasks 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.

Various anatomic dimensions have been suggested, which includes the bizygomatic width, interpupillary distance, intercalar width and inter commissural width as a guide for the selection of maxillary anterior teeth. One of the measurements is the distance between the inner canthus of the eyes.

Canthus is originally a Greek word 'Kanthos' meaning the corner of the eye is an angle on each side of the eye, formed by the union of the upper and lower lids. The medial junction of the 2 eyelids is called the medial angle (medial canthus).

Laestadius and co-workers reported that 78 per cent of the adult MCW is attained by 1 year of age. The intercanthal width is said to reach full maturation at 8 years in females and 11 years in males. As compared with other skeletal structures, the orbital measurements showed more advanced early development and less subsequential growth. Considering all

these factors, the intermedial canthus width (MCW) is a reliable anatomic dimension that may give a valid method to anterior teeth selection.^[6]

The relationship between the intermedial canthus width (MCW) and the width of the two maxillary central incisors is said to be in the golden proportion given by Levin in 1978.^[7]

As per this study conducted, there was a statistically significant Pearson's correlation between the intermedial canthus width in males and females in the local population (P-value < 0.005) where 1 denotes the male population and 2 denotes the female population. There was a significant correlation between the width of the central incisor (CW) and the calculated width of the central incisor (CW₂) in males in the local population where the P-value is 0.047 as shown in table 2. There was no significant correlation between the width of the central incisor (CW) and the calculated width of the central incisor (CW₂) in females where the P-value is 0.062 as seen in table 4.

HaticeOzdemir et al (2018)reported that MCW in men had a significant effect on the CW according to multiple linear regression analysis.^[1]Neda AL-Kaisy et al(2015) concluded that the golden proportion of the inner canthal distance to the width of the central incisors could be used as a reliable measurement in Kurdish men.²

Lt Col K.V. Arun Kumar et al (2014) concluded that to obtain the combined mesiodistal width of maxillary anterior teeth, the ICD (inner canthal distance) of the participant should be multiplied by 1.61. This ratio was consistent with all the four ethnic groups (Rajputs, Marathas, Sikh and Tamilian) irrespective of the gender of the participant.⁴

The width of the central incisor is calculated by multiplying ICD by the coefficient of a geometric progression of the golden proportion (0.618), then dividing the obtained result by 2.⁷

This method as per our study is useful when calculating the width of central incisors in men P-value <0.005 but not with women because the calculated P-value gave a statistically insignificant correlation as seen in the results above.

This study has shown that this method cannot be applied as a gold standard in all cases however there is a significant correlation to use the Intermedial canthal width to obtain the approximate width of the maxillary right and left central incisor while selecting the size of maxillary anterior teeth for any removable prosthesis.^{3,6,7}

CONCLUSION

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

1. There was a significant correlation found between intermedial canthal width with the width of the maxillary central incisor in males in the local population. The values derived from the actual width taken and through the formula had significant statistical co-relation concluding that the intermedial canthus width is a reliable anthropometric measurement in determining the width of the central incisor.
2. No significant correlation was found in females in the local population.
3. Therefore, Intermedial canthal width, when multiplied by a decreasing function value of geometric progression term 0.618 and divided by 2, was a reliable predictor of maxillary central incisor width in males in the local population.

Conflict of Interest: Nil

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