

Original article

# Relationship between the Interpupillary Distance and the Width of Maxillary Anterior Teeth of Different Face Forms Among Bangladeshi Adult Population

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**Abstract** - The aim of this study was to determine if any relationship exists between the interpupillary distance and the width of anterior maxillary teeth in different face forms of anterior maxillary teeth. Direct interpupillary distance and inter canine distances were measured among 100 subjects with a square face, 100 with a tapering face and 100 with an ovoid face. The measurements were carried out by using an electronic digital vernier caliper which measures to the nearest of 0.01 mm. The statistical analyses were performed using Special Package for Social Sciences (SPSS-V.19) computer program, and the Pearson Product Moment Correlation Coefficient and Mann-Whitney U test were done. For all the relationships, the level of significance will be tested. The p-value less than 0.05 and 0.01 will be accepted as the significance level. The mean  $\pm$  SD of the width of anterior maxillary teeth in square face form, Tapered face form, and Ovoid face form was  $49.48 \pm 5$  mm,  $46.81 \pm 4.08$  mm, and  $49.11 \pm 4.97$  mm, respectively. There were no statistical differences in interpupillary distance and width of anterior maxillary teeth in square face form, Tapered face form, and Ovoid face form were not statistically significant. It can be concluded that there is a positive correlation between the interpupillary distance and width of anterior maxillary teeth in different face forms of the Bangladeshi population.

**Keywords** - Face form, Interpupillary distance, Inter canine distance, Relationship, Width of maxilla.

## 1. Introduction

In treating edentulous patients, the prosthodontist has to provide the patient with dentures that satisfy both functional and esthetic requirements. Many dentists believe that a successful prosthesis should represent the lost tissue in approximately the same amount and in the same position to achieve a natural look. Nature should be imitated by placing the artificial teeth in the same position that the natural teeth previously occupied.<sup>1</sup> Boucher (1960) stated, "the only correct position of a tooth is the one in which it was placed by nature" ".<sup>2</sup> Martone (1963) stated that teeth had to be placed in the positions which the natural teeth occupied to maintain the natural harmonies in functional performance.<sup>3</sup>

One of the major hurdles in clinical prosthodontics has been selecting and replacing anterior maxillary teeth in the absence of pre-extraction records. The maxillary teeth selection for prosthesis is made to achieve pleasing esthetics. However, issues associated with matching the anterior dental esthetics arise due to individual variations. If artificial teeth

are selected to resemble their predecessors, patient acceptance is greater, and an enhanced outcome is achieved. Maxillary central incisors are reported to be the most important teeth to satisfy the patient's esthetic requirements, with the width being considered more critical than length. Patient complaints primarily involve anterior esthetics, and the maxillary central incisor is usually at the center of the compliant. As a result, selecting artificial teeth requires understanding physical and biological factors directly related to individual patient features.<sup>4</sup>

The complete denture treatment is successful when it is functionally adapted and esthetically accepted by the patient. Restoring the esthetics of a completely edentulous patient successfully poses many challenges. In patients with complete dentures, the suitability of artificial teeth depends on the dentist's ability to provide adequate support to the upper lip by maintaining an undistorted philtrum and nasolabial grooves and ensuring proper contact of the upper and lower lip at the vermilion border.<sup>5</sup> The teeth give each



face a unique identity. There are limitations to setting denture teeth in the original position of the natural teeth. The anterior teeth must fulfill certain functional and esthetic requirements, and compromises must be made between the two needs.<sup>6</sup> When they are lost, many individuals undergo some degree of depression and loss of self-esteem.<sup>7</sup> Complete denture esthetics is achieved when artificial teeth are in harmony with the surrounding environment,<sup>5</sup> overall facial appearance, which entails restoring tissue in amounts and positions similar to those of the lost tissue.

Tooth selection is important for cosmetic and functional interests when constructing a complete denture. Selection of anterior maxillary teeth is one of the most sophisticated aspects of complete denture fabrication.<sup>7,8</sup> As the anterior teeth of the denture are a frequently visible part, if the teeth are not appropriate in size, shape and shade, these look artificial.<sup>9</sup>

Anthropometric measurements of the face have been used as a guide in selecting the proper size of the anterior teeth. Among the anthropometric measurements, only interpupillary distance probably remains constant irrespective of age changes. Other points are made based on points placed on movable tissues, hence not reliable. The anthropometric measurements, however, appear like mechanical entities but still give a definite guideline for selecting the size of the teeth.<sup>5</sup>

The selection of anterior maxillary teeth must be in proportion with face measurements to achieve good esthetics.<sup>10</sup> Various techniques have been employed for the selection of anterior teeth. These methods reveal a dependence on the physical characteristics of the dento-facial form. Facial landmarks such as bi-zygomatic width, head circumference, facial height, inter-canine distance and interalar width have been considered while arriving at the mesiodistal dimensions of upper anterior teeth.<sup>11</sup>

The interalar distance has served as a reference for selecting the width of anterior teeth. There is a relation between interalar width and the space available for anterior teeth width.<sup>11</sup> The distance between the outer surfaces of the alae of the nose is the same as that between the tips of canines.<sup>12</sup> The inter-inner canthal distance (IICD) is the distance between the medial angles of the palpebral fissures of the eyes. The inter-inner canthal distance had a significant relation to the width of the teeth and can be a reliable predictor for estimating the tooth width. IICD is a reliable guideline for selecting the width of anterior maxillary teeth.<sup>13-15</sup> The corner of the mouth represents the place where the distal limit of the upper canine should be performed.<sup>16</sup>

So, many attempts have been made to quantify the section of the anterior teeth for the complete denture, but no universally accepted method is currently been selected for

the selection of denture teeth. The methods based on the soft tissue references show age-related variation. However, the hard tissue reference is stable and reproducible.<sup>17</sup> The relationship of inter-canine distance to inter-canthal distance, interalar width, inter-zygomatic distance, and inter-commusural width could be maintained to select properly sized anterior maxillary teeth. This clinical study was conducted to evaluate the correlation between maxillary anterior teeth measurements and horizontal inter-papillary distance for predicting the proper width of maxillary anterior artificial denture teeth.

## 2. Materials and Methods

This descriptive type of observational study was performed at the Department of Prosthodontics of the Faculty of Dentistry, Bangabandhu Sheikh Mujib Medical University. The study sample was dentate subjects of the Bangladeshi population in different face forms that came in dept of prosthodontics of BSMMU for treatment. A total of 90 participants were selected according to the Purposive sampling technique. The inclusion criterion was as follows: Subjects without any diseases in anterior teeth, aged between 18 to 40 years, normal occlusion or Angle class-I, do not receive any orthodontic treatment or extraction of anterior teeth, and no artificial crown/restoration on anterior teeth. Study procedure

Each subject of this study was selected through medical and dental history and clinical examination as per the data collection sheet enclosed herewith. 90 subjects were selected under subject selection criteria and divided into three groups: A, B, and C correspond to square, tapered and ovoid, respectively. Group-A consisted of 30 subjects with square faces, Group-B has consisted of 30 subjects with tapering faces, and Group C consisted of 30 subjects with ovoid faces. For measuring the interpupillary distance, subjects were seated comfortably in an upright position with his/her teeth in centric occlusion, lips relaxed and with an unsupported head and asked to look straight forward. Distance between the two outer angles (A) and inner angles (B) of the palpebral fissures was measured with spreading calipers. It was assumed that in normal conditions, the two eyes are of equal size, and the pupils are centrally placed, So the interpupillary distance

$$\frac{A-B}{2} + B$$

A - B gives the width of two eyes. One-half of this gives the width of one eye or two halves of eyes. By adding the distance between the two median angles (B), Interpupillary distance was obtained.<sup>18</sup> For measurement of the width of anterior maxillary teeth, dental floss was placed at the greatest curvature of the maxillary arch, and one mark on each side was placed at the distal surface of the canines. Using a digital calliper, dental floss was made straight to measure the distance between the marks. Each parameter was

measured three times, and the average value was computed and recorded in a predesigned proforma in the data collection sheet.

Data were collected by clinical examination. All the subjects were selected by maintaining the inclusion and exclusion criteria. For data collection, all the selected subjects were positioned on the dental chair according to the rule, and an ideal data collection sheet was maintained to keep the record. The statistical analysis was performed using Statistical Package for Social Sciences (SPSS-V.21) computer program, and the Pearson Correlation Coefficient and Mann-Whitney U test were done. For all the relationships, the level of significance was tested. A *p-value* less than 0.01 were accepted as the level of significance.

### 3. Results

The participants ranged from 18 to 14 years old, where 61% were male, and 39 were female.

Table 1 shows the relationship between the interpupillary distance and the width of anterior maxillary teeth in square face form, Tapered face form, and Ovoid face form. It was found that the mean  $\pm$ SD of interpupillary distance in Square face form, Tapered face form, and ovoid face was  $67.30 \pm 4.22$  mm,  $64.28 \pm 2.63$  mm, and  $62.40 \pm 3.79$

mm, respectively. The mean  $\pm$  SD of the width of anterior maxillary teeth in square face form, Tapered face form, and Ovoid face form was  $49.48 \pm 5$  mm,  $46.81 \pm 4.08$  mm, and  $49.11 \pm 4.97$  mm, respectively. There were no statistical differences in interpupillary distance and width of anterior maxillary teeth in the square face form, Tapered face form, and Ovoid face form were not statistically significant.

Table 2 shows the differences in interpupillary distance and the width of anterior maxillary teeth among the gender. In square face form participants, the mean  $\pm$  SD of interpupillary distance in males was  $64.51 \pm 3.04$  mm, and in females was  $68.5 \pm 5.77$  mm. The width of anterior maxillary teeth in males was  $45.91 \pm 3.67$  mm and in females was  $49.61 \pm 4.59$  mm. In tapered face form participants, the mean  $\pm$  SD of interpupillary distance in males was  $61.09 \pm 4.17$  and in females was  $64.5 \pm 2.04$ ; the width of anterior maxillary teeth in males was  $45.59 \pm 2.9$  and in females was  $50.59 \pm 1.05$  mm. In ovoid face form participants, the mean  $\pm$  SD of interpupillary distance within males was  $61.2 \pm 3.31$  and in females was  $63.46 \pm 4.02$ ; the width of anterior maxillary teeth in males was  $50.34 \pm 3.8$  and in females was  $47.88 \pm 5.71$  mm. Table 3 shows the ratio between interpupillary distance and width of anterior maxillary teeth was 1: 0.73 in the square face, their Pearson Correlation Coefficient is 0.98, and the P value was 0.00001, which is statistical significance.

**Table 1. Relationship between the interpupillary distance and the width of anterior maxillary teeth in square face form, taper and ovoid face form.**

Variable	Square Mean $\pm$ SD(mm)	Taper Maximum(mm)	Ovoid Minimum(mm)
Interpupillary distance	$67.30 \pm 4.22$	$64.28 \pm 2.63$	$62.40 \pm 3.79$
Width of maxillary anterior teeth	$49.48 \pm 5$	$46.81 \pm 4.08$	$49.11 \pm 4.97$

**Table 2. Means interpupillary distance and width of anterior maxillary teeth in the square, taper and ovoid face form in male and female groups**

Variable	square	Taper	Ovoid
Interpupillary distance	M: $64.51 \pm 3.04$ F: $68.5 \pm 5.77$	M: $61.09 \pm 4.17$ F: $64.5 \pm 2.04$	M: $61.2 \pm 3.31$ F: $63.46 \pm 4.02$
Width of maxillary anterior teeth	M: $45.91 \pm 3.67$ F: $49.61 \pm 4.59$	M: $45.59 \pm 2.9$ F: $50.59 \pm 1.05$	M: $50.34 \pm 3.8$ F: $47.88 \pm 5.71$

**Table 3. Relationship between the interpupillary distance and the anterior maxillary teeth in different face forms (n=90)**

Face form	Ratio between interpupillary distance & intercanine distance		Pearson correlation coefficient (r)	P- value
	Interpupillary distance	Width of maxillary anterior teeth		
Square	1	0.73	0.98	0.00001
Taper	1	0.72	0.691	0.000012
Ovoid	1	0.79	0.700	0.00008

The ratio between interpupillary distance and width of anterior maxillary teeth was 1: 0.72 in the tapering face, their Pearson Correlation Coefficient is 0.691, and the P value was 0.000012, which is also statistical significance.

The ratio between interpupillary distance and width of anterior maxillary teeth was 1: 0.79 in the ovoid face, their Pearson Correlation Coefficient is 0.700, and the P value was 0.00008, which is statistically significant.

#### 4. Discussion

Every person likes to be presentable irrespective of age and sex, and when they become edentulous, they seek dental treatment to restore esthetics. Many attempts have been made to quantify the selection of anterior maxillary teeth for complete dentures. The present study was an attempt to find out the potential relationship between the width of anterior maxillary teeth and the interpupillary distance.

The study shows the interpupillary distance was  $67.30 \pm 4.22$ ,  $64.28 \pm 2.63$  and  $62.40 \pm 3.79$  in square, tapered and ovoid face form, respectively. The width of anterior maxillary teeth was  $49.78 \pm 5$ ,  $46.81 \pm 4.08$  and  $49.11 \pm 4.97$  in the square, tapered and ovoid, respectively. Waqar Hussain (2012) conducted a study where the interpupillary distance was  $65.26 \pm 5.41$ , and the intercanine distance was  $46.01 \pm 7.31$ .<sup>19</sup> The result of this study is similar to the result of the present study. Another study revealed the interpupillary distance's mean value ( $59.16\text{mm}$ ).<sup>20</sup> The variation of the mean interpupillary distance of the present study may be due to racial differences. Sheikh et al.<sup>21</sup> investigated a study and found mean interpupillary distance was  $64.14\text{mm}$  and the width of anterior maxillary teeth  $54.87\text{mm}$ , which agrees with the present study. NS et al.<sup>5</sup> found a mean interpupillary distance of  $3.860\text{ cm}$  with a standard deviation of  $0.60$ , and the mean width of anterior maxillary teeth was  $0.488 \pm 0.086\text{ cm}$ . among 100 people ( $r=0.4681$ ). In their study, the author used photographs of the subjects as study material to measure the distance, whereas we used an electronic vernier caliper and the result also differs. Similarly, Wazzan et al.<sup>22</sup> found the mean value of the width of anterior maxillary teeth ( $45.16 \pm 3.28\text{mm}$ ) is nearly the same as the present study.

This study found a positive correlation between the interpupillary distance and the width of anterior maxillary

teeth.  $r$  was  $0.98$ ,  $0.691$  and  $0.700$  in the square, tapered and ovoid face forms, respectively. Kassab<sup>23</sup>, in his study, showed mean interpupillary distance in males was  $64.9 \pm 2.1\text{mm}$  and in females was  $59.42 \pm 7.66\text{mm}$ . The width of maxillary teeth in males was  $51.35 \pm 2.6\text{mm}$ , and in females was  $48.59 \pm 4.97\text{mm}$  among 100 subjects of the Mousule university of Iraq, which are nearly related to the values of the present study. In this study, the P value was  $0.0041$  among male and  $0.000073$  among female subjects. Another study evaluated the interpupillary distance as a guide for selecting anterior teeth where  $P < 0.01$  among male subjects and  $P < 0.01$  among female subjects.<sup>24</sup> A total of 100 subjects were selected based on predominant selection. Facial photographs of all the subjects were taken using an SLR camera. The variation in the P value with the present study is due to material differences. In the present study, the vernier caliper was used to measure the width of anterior maxillary teeth.

The measurement of interpupillary distance was also recorded by using a vernier caliper as done by Abdullah et al.,<sup>13</sup> when he measured the intercanine distance, showed a mean value (of  $46.01 \pm 7.31\text{ mm}$ ). Similarly, Almas et al.<sup>25</sup> found the mean value of intercanine distance ( $45.16 \pm 3.28$ ). The result of this study is similar to the result of the present study. This study found a positive correlation between interpupillary distance and width of anterior maxillary teeth among the different types of face forms. When all the parameters are considered, only interpupillary distance maintains a constant proportional relationship with teeth that are not worn and hence can be used as a guide for selecting the proper size of a totally edentulous individual.

#### 5. Conclusion

Considering the study's limitations, there is a positive correlation between the interpupillary distance and width of anterior maxillary teeth in different face forms of the Bangladeshi population.

##### 5.1. Ethical clearance

This study was performed at Bangabandhu Sheikh Mujib Medical University after taking ethical clearance from the Institutional Review Board (IRB) of Bangabandhu Sheikh Mujib Medical University.

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