Gender Based Comparison of the Relationships of Maxillary Anterior Teeth and Facial Measurements

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Abstract

The main purpose of this study was to compare the facial and teeth measurements and their relationships in male and female. A total of 200 medical and dental students (68 males and 132 females) participated in this study from March 2016 to July 2016. The studied facial measurements were bizygomatic width (BZW), inter-pupillary distance (IPD), mouth width (MW), nose width (NW), inner-canthi distance (ICD) and eye width (EW). Teeth measurements were measured from the study model made from each participant. Then, teeth measurements studied were central incisor width (CIW) and inter-canine distance (ICaD). Statistical analyses were done using SPSS 20.0 with the level of significance (α) = 0.05. Independent-Sample T test was used to compare the facial and teeth measurements between males and females. Independent-Samples T test revealed that there was significant difference in all the facial measurements (BZW, IPD, MW, NW, ICD and EW) and teeth measurements (ICaD and CIW) in males and females (p <0.05). Pearson Correlations show that significant correlation of the CIW with IPD, MW and EW. The study reveals that males have broader face, wide mouth, nose and eyes in comparison to females. It showed that all the measured facial measurements (BZW, IPD, MW, NW, ICD and EW) and teeth measurements (ICaD and CIW) were significantly greater in males than females (p <0.05). The ratios of ICaD/CIW in males and females were 4.46 and 4.45, respectively. These findings of this study help in the teeth selection and esthetic rehabilitation of maxillary anterior teeth in male and females.

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Introduction

Facial beauty has always been the most valued aspect of human beauty. Beauty and esthetics have been praised from time immemorial. Jefferson has given concepts establishing the existence of a universal standard for facial beauty based on the divine proportion and its biologic significance where the face is divided into vertical fifths.[1] Dental esthetics is a primary consideration for patients seeking a restorative treatment. The proportion of the anterior teeth especially maxillary anterior teeth plays an important role not only to dental esthetics but to the facial esthetics.[2] In addition, the optimal size of the maxillary anterior teeth results in harmony with the overall facial appearance in male and female. In addition, selection and positioning of artificial teeth depend on many factors. Various theories have been postulated throughout the decades for the selection of the artificial teeth from facial landmarks, i.e. bizygomatic width, nose width, inter-pupillary distance, etc.[3-5] According to Pound's Concept (1954), states that the proportions of the upper central incisor is 1/16th of the width of the face or bizygomatic width.[6]

In addition, the position of the canine is important in smile design and denture teeth arrangement because it provides tissue support at the corner of the mouth and its position is in the turning point of the dental arch. Therefore, the position of the canines is the principle factor to be considered in complete denture esthetics. In addition, the correct position of the canines

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can provide valuable information for selecting the size of upper anterior teeth. Several suggestions are offered as guidance when marking the canine line on the upper occlusion rim. The corner of the mouth represents the distal surface of the upper canines and indicated by marks made on the upper occlusion rim, vertical parallel lines from the lateral surface of the alae of the nose, indicates the estimation of the position of the tip of the upper canine,[6] lines drawn from the he inner canthus of the eye to the alae of the nose passes through the upper canine tooth.[7] Picard (1958) reported that the nose width could be used to establish the width of the maxillary anterior teeth.[8] Smith (1957), however, reported a low relationship between radiographic measurement of the nose width of the nose and the distance between the maxillary canine tips.[9]

Face and teeth dimensions varies between male and female. Frush and Fisher (1955) also mentioned gender differences of teeth in Dentogenic concept.[10] One main factor influencing dentogenic restorations were sex (male or female) apart from personality (vigorous, moderate, or delicate), and age (young, middle-aged, or elderly). Each factor influenced and was inseparable from the others and combined to enhance personal character and appearance.

In addition, Ibrahimagić-Šeper et al.[11] found that dimensions of the face and teeth vary in male and female.[11] Face length differences between male and female were ±6%, whereas, face widths differences were ±4%. Length of the maxillary central incisors between male and female were ±5%. The difference for the cervical width of the incisor between the genders was ±1.5%, for contact point width ±3% and for incisor's width at the incisal edge ±4%. Owens et al. also found that narrower central incisor's dimensions in female than in men.[12] This study will compare the facial and teeth measurements and their relationships in male and female.

Materials and Methods

The main objective of this cross-sectional study was to study and compare the facial and teeth measurements and their relationships in male and female. A total of 200 medical and dental students (68 males and 132 females) participated in this study from March 2016 to July 2016. After obtaining ethical approval from the Institutional Review Committee (IRC), all selected participants who met the criteria were requested to sign the informed consent prior to the research explaining the detail of the research. The age of the participants was between 18 to 45 years old with no facial deformity.

Facial measurements and were measured direct from each participant at the rest position using a digital caliper (Model CD-6", Mitutoyo, Japan) by one investigator. The studied facial measurements were bizygomatic width (BZW), inter-pupillary distance (IPD), mouth width (MW), nose width (NW), inner-canthi distance (ICD) and average eye width (EW). For measuring facial measurements, at first, the landmarks were identified on face and then, the measurements were measured.

Teeth measurements were measured from the study model made from each participant. At first, impression of the maxillary arch was made using irreversible hydrocolloid (Jeltrate, Dentsply, PA, USA) and study model was made with dental stone type IV (Vel-Mix stone, Kerr Co., CA, USA) according to the manufacturer instructions. Then, teeth measurements studied were central incisor width (CIW) and inter-canine distance (ICaD). ICaD was measured as the maximum distance between the distal surface of the canines in each study model. For measuring CIW, the maximum mesio-distal widths of the both central incisors were measured using the digital calliper in each study model and the mean width of the both central incisors define as the CIW.

Each measurement was measured 3 times and the average was noted. Statistical analyses were done using SPSS Statistics Software (version 24) with the level of significance (α) = 0.05 and the degree of confidence (d) = 0.95. Independent-Sample T test was used to compare the facial and teeth measurements between males and females. Pearson Correlation was done to see the correlation of various facial measurements with ICaD and CIW.

Results

The result shows that the predominance were females (68 males and 132) (Table 1). Regarding facial measurements, the mean BZW, IPD, WM, WN, ICD and WE in males were 127.90±5.83, 62.67±3.89, 47.55±3.63, 35.42 ±2.83, 31.49 ±1.56 and 28.37±1.65, respectively,

whereas, in female were 123.03±5.86, 59.46 ±3.03, 44.24±3.07, 32.20±2.34, 31.00±1.63 and 26.97±1.64, respectively (Table 2). Regarding teeth measurements, the mean ICaD and WCI in males were 37.17±1.90 and 8.32±0.49, respectively, where in females were 36.13±1.91 and 8.12±0.49, respectively (Table 2). Independent-Samples T test revealed that there was significant difference in all the facial measurements (BZW, IPD, MW, NW, ICD and EW) and teeth measurements (ICaD and CIW) in males and females (p <0.05). This reveal that males have broader face, and wide mouth, nose and eye in comparison to females.

Gender	Frequency (n)	Percentage (%)
Male	68	34
Female	132	66
Total	200	100

Table 1. Distribution of students.

Measurements	Total (mm) Mean (±SD)	Male (mm) Mean (±SD)	Female (mm) Mean (±SD)	*P* value
Bizygomatic width (BZW)	124.69 ±6.28	127.90 ±5.83	123.03 ±5.86	<0.001*
Inter-pupillary distance (IPD)	60.55 ±3.67	62.67 ±3.89	59.46 ±3.03	<0.001*
Mouth width (MW)	45.36 ±3.63	47.55 ±3.63	44.24 ±3.07	<0.001*
Inter-canine distance (ICaD)	36.48 ±1.97	37.17 ±1.90	36.13 ±1.91	<0.001*
Nose width (NW)	33.29 ±2.94	35.42 ±2.83	32.20 ±2.34	<0.001*
Inner-canthi distance (ICD)	31.17 ±1.62	31.49 ±1.56	31.00 ±1.63	0.048*
Eye width (EW)	27.44 ±1.76	28.37 ±1.65	26.97 ±1.64	<0.001*
Width of central incisor (CIW)	8.19 ±0.50	8.32 ±0.49	8.12 ±0.49	0.007*

Table 2. Comparisons of facial measurements between male and female. *Significant at p <0.05 from Independent-Samples T test.

In total studied population mean BZW, IPD, MW, NW, ICD and EW were 124.69 ±6.28, 60.55 ±3.67, 45.36 ±3.63, 33.29 ±2.94, 31.17 ±1.62 and 27.44 ±1.76, respectively, whereas, the mean ICaD and CIW were 36.48 ±1.97 and 8.19 ±0.50, respectively (Table 2).

Pearson Correlations show that significant correlation of the CIW with IPD (0.177), MW (0.155) and EW (0.145) (Table 3). The ratios of facial measurements and ICaD; BZW/ICaD, IPD/ICaD, MW/ICaD, ICaD/EW, ICaD/ICD and ICaD/NW in males were 3.44, 1.68, 1.27, 1.31, 1.18 and 1.05, respectively, whereas, in females were 3.40, 1.64, 1.22, 1.33, 1.65 and 1.22, respectively (Table 4). In addition, the ratios of facial measurements and CIW; BZW/CIW, IPD/CIW, MW/CIW, WN/CIW and EW/CIW in males were 15.37, 7.53, 5.71, 4.46 and 3.41, respectively, whereas, in females were 15.15, 7.32, 5.44, 3.96 and 3.32. The ratios of ICaD/CIW in males and females were 4.46 and 4.45, respectively (Table 4).

Ratios	ICaD	CIW
BZW	0.413 (p<0.001)	0.189 (p = 0.007)
IPD	0.251 (p <0.001)	0.177* (p =0.012)
MW	0.397 (p =0.001)	0.155* (p =0.029)
EW	1.35 (p =0.56)	0.145* (p <0.001)
ICD	0.212 (p =0.003)	0.137 (p =0.054)
NW	0.231 (p =0.001)	0.050 (p =0.481)
ICaD	1	0.475 (p<0.001)
CIW	0.474 (p<0.001)	1

Table 3. Correlations of various facial measurements with inter-canine distance and central incisor width. *Significant correlation at P <0.05 from Pearson's Correlation Test. *ICaD - inter-canine distance CIW - width of central incisor; BZW - bizygomatic width; IPD - inter-pupillary distance; MW - mouth width; NW - nose width; ICD - inner-canthi distance; EW - eye width;*

Ratios	Total	Male	Female
BZW/ICaD	3.42	3.44	3.40
IPD/ICaD	1.66	1.68	1.64
MW/ICaD	1.24	1.27	1.22
ICaD/EW	1.33	1.31	1.33
ICaD/ICD	1.17	1.18	1.65
ICaD/NW	1.09	1.05	1.22
ICaD/CIW	4.45	4.46	4.45
BZW/CIW	15.23	15.37	15.15
IPD/CIW	7.39	7.53	7.32
MW/CIW	5.53	5.71	5.44
ICaD/CIW	4.45	4.46	4.44
NW/CIW	4.06	4.46	3.96
EW/CIW	3.35	3.41	3.32

Table 4. Ratios of facial measurements with inter-canine distance and central incisor width. *BZW - bizygomatic width; IPD - inter-pupillary distance; MW - mouth width; NW - nose width; ICD - inner-canthi distance; EW - eye width; CIW - width of central incisor, ICaD - inter-canine distance.*

In total studied population, the ratios of facial measurements and ICaD; BZW/ICaD, IPD/ICaD, MW/ICaD, ICaD/EW, ICaD/ICD and ICaD/NW were 3.42, 1.66, 1.24, 1.33, 1.17, 1.09, respectively, and, the ratios of facial measurements and CIW; ICaD/CIW, BZW/CIW, IPD/CIW, MW/CIW, ICaD/CIW, NW/CIW and EW/CIW were 15.23, 7.39, 5.53, 4.45, 4.06, 3.35. The ratio of ICaD/CIW was 4.45 (Table 4).

Discussion

Different views have been reported on the significance of various facial measurements in the selection of anterior teeth. Proffit and White[13] stated that the nose width should be approximately the same as the distance between the inner-canthi distance, whereas the mouth width should be approximately the inter-pupillary distance. But, in this study, the nose width was greater than the inner-canthi distance in both males and females (showing greater nose width in males). In addition, inter-pupillary distance was much greater than mouth width in both males and females. In addition, Sforza et al.[14] did a 3D electromagnetic study of facial proportion in Italian adolescent boys and girls, and found that attractive adolescents had wider and shorter faces with smaller noses. In this study, it revealed that there was significant difference in all the facial measurements (BZW, IPD, MW, NW, ICD and EW) and teeth measurements (ICaD and WCI) in males and females (P <0.05). In addition, males have broader face, and wide mouth, nose and eye in comparison to females. These may be from the geographic distribution of the origin of the participants. Similarly, the teeth measurements ICaD and CIW were greater in male than female which is similar to study done by Owens et al[12] where they found narrower incisor's dimensions in female.

Ibrahimagi et al.[5] studied the relationship of width of upper incisors (WUI), width between distal surfaces of upper canines (WDaC) with the width of the alae of the nose (WAN) and width of the corners of the mouth (WCM). They found statistically significant difference between males and females existed for all the measured variables and males had bigger dimensions which is similar results found in our study. In addition, they found that WAN/WUI = 1.206:1 which is different from our study (NW/CIW = 4.06), WCM:WDaC = 1.228:1 which is similar to our study (MW/ICaD = 1.24) and WDaC:WAN = 1.158:1 which is nearly similar to our study (ICaD/NW = 1.09).

A study done by Varjao et al.[15] found that poor correlation between the corners of the mouth for the selection of artificial teeth. Sinavarat et al.[16] evaluate canine positions, intercanine tip width (ICTW) and width of distal surface of canine (WDC), related to facial landmarks including interalar width, intercommissural width (ICoW) and distance between left and right projection lines drawn from inner canthus of eyes to alae of the nose (DPICa). They concluded that ICTW and WDC had relationship with ICoW and DPICa. DPICa showed stronger correlation with the position of maxillary canine than that of ICoW. The above study is similar to our study where, we found that significant correlation of mouth width (MW) with central incisor width (CIW). MW was 5.71 times than the CIW in males and 5.44 times than the CIW in females. In addition, we also found the significant correlation of inter-pupillary distance (IPD) and eye width (EW) with central incisor width (CIW). So, these measurements may be used as a guide for the selection of teeth for esthetic rehabilitation of maxillary anterior teeth.

Another study by Hasanreisoglu et al.[17] in 100 students where they studied the correlation of inter-canine distance and CIW with BZW and NW, and they found positive correlation between inter-canine distance with NW and, CIW with BZW. Similarly, al-el-Sheikh & al-Athel[18] did study in 163 subjects to study correlations among IPD, NW, and width of 6 anterior teeth, where they found significant correlations. These results are alternate to our study, where we found no correlation of inter-canine distance with NW and IPD, and CIW with BZW.

In this study, minor errors may have occurred during measurements of the facial landmarks as the measurements are made on the soft tissue. For example, the inner canthus of the eye and the alae of the nose are soft tissue, and they are mobile in nature. Still, special considerations like not pressing the facial soft tissues during measurements to minimize errors during taking these measurements. Moreover, the patient's head position and stability may also influence these measurements. Time duration also limit the sample size of this study.

Conclusions

The study reveals that males have broader face and wide mouth, nose and eye in comparison to females. It showed that all the measured facial measurements (BZW, IPD, MW, NW, ICD and EW) and teeth measurements (ICaD and CIW) were significantly greater in males than females. In addition, there was significant correlation of IPD and EW with central CIW. So, these measurements may be used as a

guide for the selection of teeth for esthetic rehabilitation of maxillary anterior teeth.

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