FACE WIDTH AS A VARIABLE INFLUENCING THE MESIODISTAL WIDTH OF PERMANENT MAXILLARY ANTERIOR TEETH: AN ANALYSIS USING AUTOCAD SOFTWARE

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ABSTRACT

Objective: The objective of this study was to determine face width as an important variable for the mesiodistal width of permanent maxillary anterior teeth in adult dentate subjects.

Material & Methods: It was an analytical cross-sectional study conducted in Oral diagnosis of Peshawar Dental College, Peshawar from February 2019 to April 2019.

A total of 180 subjects were included that fulfilled the inclusion criteria. Subject underwent the standard OPG procedure. JPEG file format of OPG images were analyzed by Autodesk AutoCAD software 2017 version to calculate the mesiodistal widths of permanent maxillary anterior teeth. Indirect mounting whipmix facebow model 9185 was used to measure face width by measuring the inter-condylar distance. The distance between two ear pieces of facebow was measured with the help of a digital caliper. One way ANOVA was run to see the effect in mesiodistal dimension of teeth widths among the three facial types.

Results: All the differences in mesiodistal widths of permanent maxillary anterior teeth among different facial widths were highly statistically significant ($P<0.05$). For all maxillary anterior teeth, the mesiodistal widths of teeth were larger in subjects with large facial width(148.05 ± 1.61mm). In medium facial width (134.8 ± 5.737mm) the teeth dimensions were smaller than large facial width but larger than in small facial width (118.75 ± 2.647mm)

Conclusion: It was concluded that facial width had statistically significant association with the mesiodistal widths of permanent maxillary anterior teeth.

Keywords: Face Width, Maxillary Anterior Teeth, Autodesk AutoCAD Software

NTRODUCTION

Dental esthetics is most dominant aspect of facial attractiveness and encompasses not only tooth colour, size and shape but also other aspects like upper lip position and gingival morphology.[1,2,3] Maxillary anterior teeth are considered the most dominant element in dental esthetics and facial esthetics because of amount of visible coronal structure.[4] Research has been carried out on de-termining the approximate width of maxillary anterior teeth by studying their relation with gender, race, facial profile, facial measurements and malocclusions. [5,6,7,8] This will help in providing data to dentists for, fabricating denture teeth in teeth selection for edentulous patients, ortho-dontic treatment planning ,restorative treatment.[9,10,11] In a study conducted in Lahore, Pakistan, a lower correlation between inter-condylar distance and maxillary inter-canine distance was found. There was a ratio of 3.7:1 between mean inter-condylar distance and mean inter canine distance of maxillary teeth.[12]

Another study in Iran studied the correlation between two facial widths (Bizygomatic width and inter-condylar width) and mesiodistal width of maxillary central incisors. It showed that there was a weak correlation between the inter-condylar width and right central incisor.[13]

In present study, the inter-condylar distance will

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be taken as a representative of facial width. Facial type or inter-condylar distance was measured with arbitrary face-bow in these studies while in present study it will be measured with the help of indirect mounting whipmix facebow model 9185 which is an ear type of facebow with condylar rods that helps to measure intercondylar distance. Also, in these studies the mesiodistal widths of teeth were measured with help of Vernier calipers either directly on subjects teeth[10]or on dental casts while in this study mesiodistal width of individual teeth will be measured from the OPG images, with the help of Autodesk AutoCAD 2017 version software which is the latest version in AutoCAD series and best tool for this purpose.[7]

The aim of this study was to determine that face width is an important variable for the mesiodistal width of permanent maxillary anterior teeth in adult dentate subjects of age 15-25 years, using whipmix facebow.

MATERIAL & METHOD

It was an analytical cross-sectional study which was approved from ethical committee IRB/2020-257. Data was collected in Out Patient Department (OPD) of Peshawar Dental College from February 2019 to April 2019. By non-probability consecutive sampling technique, total of 180 subjects of both male and female gender were included, out of which 90 were males and 90 were females. Equal number of cases in small, medium, large face-widths were taken i.e. 60 small, 60 medium and 60 large face width cases. The age range was from 15-25 years. Informed consent was taken from all subjects. Exclusion criteria was subjects with missing permanent maxillary anterior teeth, anterior prosthesis or restorations, developmental anomaly of permanent maxillary anterior teeth, proximal surfaces alteration, history of orofacial surgery or orthodontic treatment. Inclusion criteria was subjects having fully erupted, structurally and periodontally sound maxillary anterior teeth that are having satisfactory alignment and with healthy Temporo-Mandibular Joint (TMJ).

Face width was calculated according to inter-condylar distance which is defined as the distance between each condyle as measured on the face of subjects from front view. It shall be calculated by a single examiner, using an indirect mounting whipmixfacebow model 9185 having a U-shaped frame. On anterior end, in front of anterior thumb screw it has marks to denote S(small), M(medium), L(large). The Thumbscrew was loosened, bitefork was positioned according to the midline, earpiece positioned in external auditory meatus, nose piece centered on nasion. The distance between the two earpieces of facebow shall be measured by using digital Vernier caliper having least count of 0.01mm.

Small width: Earpieces of facebow are <125 mm apart. Medium width: Earpieces of facebow are 125-145 mm apart. Large width: Earpieces of facebow are >145 mm apart.

Mesiodistal widths of permanent maxillary anterior teeth were calculated from OPG images of subjects which were imported to the drawing board of Autodesk AutoCAD software 2017 version. After selecting "millimeter" as a unit , the cursor was dragged from the most mesial point of the tooth to the most distal point of tooth and the measurement in information window was noted.

The data were entered & analyzed using computer program SPSS version 20.0. Frequencies and percentages were computed. Mean and standard deviation were calculated for all numerical variables like age and all maxillary anterior mesiodistal teeth widths. One-way ANOVA was run to compare maxillary anterior mesiodistal teeth widths among the three facial types. Post hoc analysis was done using Tucky test for multiple comparisons among various facial widths for mesiodistal teeth widths. P<0.05 was considered to be significant level.

RESULTS

Total 180 subjects were equally distributed in both genders. Gender distribution was equal i.e. n=90(50%) males and n=90(50%) females. The mean age was 22.19±2.57 (SD) years with a range of 15-25 years. The most common age group of the participants was 22 to 25 years with 116(64.44%) subjects followed by those having age group of 19-21 years that had 45(25%) subjects. Subjects in the age group 15-18 years were 19(10.56%). These details are graphically depicted in figure 1.

The mean mesiodistal width of right maxillary canine, lateral incisor and central incisor was 9.82±1.03 mm, 7.94±1.20 mm, and 9.47±1.43 mm respectively. The mean mesiodistal width of left maxillary canine, lateral incisor and central incisor was 9.82±1.08 mm, 8.03±1.10 mm, and 9.57±1.37 mm respectively. The detailed mean and standard deviation of age and maxillary anterior teeth is shown in table 1.

The mean facial width in small, medium and large facial type was 118.75±2.647, 134.8±5.737, 148.05±1.61 mm respectively. Their ranges are given in table 2.

Of total 180 subjects, there were equal number of cases in small, medium and large face width i.e. 60 small, 60 medium and 60 large face width cases. Irrespective of the maxillary anterior tooth, mesiodistal width was directly proportional to the width of the subject face. In medium facial width the teeth dimensions were smaller than those having large facial width but larger than those having small facial width. Mean maxillary right canine width was 9.32±0.84 mm, 9.77±0.9 mm and 10.4±1.08 mm in small, medium, large facial types respectively. Mean maxillary right lateral incisor width was 7.25±0.95 mm, 7.92±0.94 mm, and 8.64±1.28mm in small, medium, large facial types respectively. Mean maxillary right

central incisor width was 8.58± 1.02 mm, 9.37± 1.1 mm, and 10.5± 1.46 in subjects with small, medium, large facial widths respectively. Similar pattern was for left sided maxillary anterior teeth. All the differences in mesiodistal width of teeth among different facial widths were highly statistically significant (P<0.001). The details are shown in table 3.

Table 1: Mean and standard deviation for age and mesiodistal width of maxillary anterior teeth.

Variable	Range and Mean ± SD of all subjects	Mean ± SD	
		Male	Female
Age (years)	15-25, 22.19±2.57		
Right maxillary canine (mm)	7-13.3, 9.83±1.04	9.86± 0.95	9.79± 1.13
Right maxillary lateral incisor (mm)	5-11.7, 7.94±1.21	8.02± 1.08	7.85± 1.32
Right maxillary central incisor (mm)	6.3-14, 9.47±1.43	9.66± 1.29	9.28± 1.54
Left maxillary central incisor (mm)	6.4-13.7, 9.57±1.37	9.78± 1.19	9.39± 1.50
Left maxillary lateral incisor (mm)	5-11.2, 8.03±1.10	8.14± 0.98	7.92±1.21
Left maxillary canine(mm)	7-12.8, 9.82±1.08	9.89±0.96	9.74± 1.19

Table 2: Mean and standard deviation of different facial widths.

Face dimension	Mean ± SD(mm)	Range
Small (n=60)	118.75±2.65	112-124
Medium(n=60)	134.8±5.737	125-143
Large(n=60)	148.05±1.61	146-152

Table 3: Comparison of mesiodistal tooth width of maxillary anterior teeth among facial widths

Tooth	Face type	Mesiodistal widths of teeth	%95 CI**	P-value*
		Mean± SD(mm)		
Right maxillary canine	Small	0.84±9.32	(9.54 ,9.1)	<0.001
	Medium	0.9±9.77	(10.01 ,9.54)	
	Large	1.08±10.4	(10.67 ,10.1)	
Right maxillary lateral incisor	Small	0.95±7.25	(7.49 ,7.01)	<0.001
	Medium	0.94±7.92	(8.167 ,7.68)	
	Large	1.28±8.64	(8.97 ,8.31)	
Right maxillary central incisor	Small	1.02 ±8.58	(8.84 ,8.31)	<0.001
	Medium	1.1 ±9.37	(9.656 ,9.09)	
	Large	1.46 ±10.5	(10.84 ,10.1)	
Left maxillary central incisor	Small	0.96 ±8.74	(8.98 ,8.49)	<0.001
	Medium	1.12 ±9.49	(9.78 ,9.2)	
	Large	1.36 ±10.5	(10.88 ,10.2)	
Left maxillary lateral incisor	Small	0.97 ±7.37	(7.619 ,7.12)	<0.001
	Medium	0.96 ±8.1	(8.349 ,7.85)	
	Large	1.02 ±8.62	(8.885 ,8.36)	
Left maxillary canine	Small	0.92 ±9.29	(9.53 ,9.05)	<0.001
	Medium	0.99 ±9.72	(9.98 ,9.47)	
	Large	1.03 ±10.4	(10.7 ,10.2)	

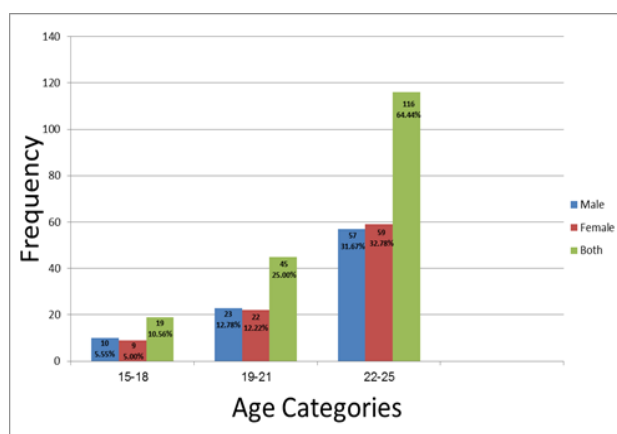*One-way ANOVA; significant level, P<0.05; **confidence interval

Fig 1: Age distribution of all subjects

DISCUSSION

This study determined if face width was an important variable for the mesiodistal widths of permanent maxillary anterior teeth in adult dentate subjects of age 15-25 years, visiting Out-patient Department of Peshawar Dental College in a 3 months' time interval, the measurements of teeth were done using soft images of subjects OPGs using Autodesk AutoCAD 2017 version software for measuring widths of teeth.

Tehranchi et al conducted a comparative study to measure mesiodistal widths of casts and reported AutoCAD software give a more precise result and manual method is only reliable when extreme caution is taken.[14] While previous studies used Vernier caliper and manual measurement which are less accurate and time consuming. These authors reported that Vernier caliper and manual measurement need extreme caution during calibration, duplicate measurements and averaging and also experience is a great factor for accurate measurement. [15-19] Thus, it implies that Autodesk AutoCAD software was considered as an appropriate tool for the measurement of mesiodistal widths of permanent maxillary anterior teeth.

For all maxillary anterior teeth, the mesiodistal widths of teeth were larger in subjects with large facial width(148.05±1.61mm). In medium facial width (134.8±5.737mm) the teeth dimensions were smaller than large facial width but larger than in small facial width (118.75±2.647mm) with P<0.05. (Table 3)

One of the most difficult aspects during the selection of maxillary anterior teeth for a removable prosthesis is the determining of appropriate mesiodistal width of six maxillary anterior teeth. Many attempts have been made to establish methods of estimating the combined width of these anterior teeth, and have to improve the esthetic outcome. The proportion of facial structures and relationship between facial measurements and natural teeth could be used as a guide in selecting denture teeth. There is a correlation between facial measurements and the mesiodistal width of the maxillary anterior teeth. According to Gomes

et al the inter-canthal distance (r=0.466), inter-pupillary span (r=0.258), and inter-commissural distance (r=0.522) had a significant correlation to the mesiodistal width of the teeth. These results showed that as facial widths parameters are increasing the mesiodistal teeth width is also increasing. So large faces have larger teeth.[20]

Isa et al determined the relationships between some facial dimensions (inter- pupillary distance and inter-alar width) and widths of the maxillary anterior teeth to potentially provide a guide for tooth selection on 60 participants in Malaysia using regression methods.[21] Tripathi et al did correlation of inter-pupillary distance, inter-canthal width, bizygomatic width, and inter-alar width with inter-canine distance in Indian patients to determine the mesiodistal width of maxillary anterior teeth in edentulous patients. They found a statistically significant correlation (P<0.005) between these landmarks and the mesiodistal width of the maxillary anterior teeth.[22] These findings of all previous studies are supported by our findings.

Smith reported that nasal width, which is also considered as a type of facial width, had no significant correlation with width of six maxillary anterior teeth. There was a weak correlation in males(0.11) and females(0.23) and both were non-significant (P>0.05).[23] These results were not in accordance with this study.

On the basis of this study, it was observed that face width can be used for the purpose of selection of maxillary anterior teeth but it is not recommended to use it as a sole method for selection of maxillary anterior teeth; rather it should be used as a supplemental method. This is a single center, small sample and a hospital based study which may not represent Peshawar population. Further large sample and community based studies are recommended which will explore this area in depth.

CONCLUSION

According to this study, it is concluded that facial width had a statistically significant association with the mesiodistal widths of permanent maxillary anterior teeth, so these findings can be used as an appropriate guide for determining mesiodistal width for prosthetic maxillary anterior teeth in edentulous patients.

REFERENCES

1. McGowan S. Characteristics of Teeth: A Review of Size, Shape, Composition, and Appearance of Maxillary Anterior Teeth. Compen Continu Educat Dent.2016;37(3):164-171.

2. Chou JC, Thompson GA, Aggarwal HA, BosioJA, Irelan JP. Effect of occlusal vertical dimension on lip positions at smile. J Prosthet Dent.2014; 112(3):533-539.

3. Venugopal R, Ahmed A, Nichani A. Clinical assessment of the gingival contours and proximal contact areas in the maxillary anterior dentition. Gen Dent. 2017;

65(2):e7-e11.

4. Dalaie K, Behnaz M, Mirmohamadsadeghi H, Dashti M. Maxillary Anterior Teeth Width Proportion a Literature Review. EC Dent Sci. 2017; 16:197-206.

5. Fernandes TMF, Sathler R, Natalício GL, Henriques JF, Pinzan A. Comparison of mesiodistal tooth widths in Caucasian, African and Japanese individuals with Brazilian ancestry and normal occlusion. Dent Press J Orthod. 2013; 18(3):130-135.

6. Raghavendra N, Kamath VV, Satelur KP, Rajkumar K. Prediction of Facial Profile Based on Morphometric Measurements and Profile Characteristics of Permanent Maxillary Central Incisor Teeth. J Forensic Sci Med.2015; 1(1):26-32.

7. Mehndiratta A, Bembalagi M, Patil R. Evaluating the Association of Tooth Form of Maxillary Central Incisors with Face Shape Using AutoCAD Software: A Descriptive Study. J Prosthod. 2019; 28(2):e469-e472.

8. Malkoç S, Başçiftçi FA, Nur M, Çatalbaş B. Maxillary and mandibular mesiodistal tooth sizes among different malocclusions in a sample of the Turkish population. Eur J Orthod. 2010; 33(5):592-596.

9. Park DJ, Yang JH, Lee JB, Kim SH, Han JS. Esthetic improvement in the patient with one missing maxillary central incisor restored with porcelain laminate veneers. J Advanc Prosthod. 2010; 2(3):77-80.

10. Brandão RCB, Brandão LBC. Finishing procedures in Orthodontics: dental dimensions and proportions (microesthetics). Dent Press J Orthod. 2013; 18(5):147-174.

11. Frese C, Staehle HJ, Wolff D. The assessment of dentofacial esthetics in restorative dentistry: A review of the literature. J Am Dent Assoc. 2012; 143(5):461-466.

12. Shaikh IA, Qamar K, Naeem S. Relationship of the intercondylar distance with maxillary inter canine distance. Pak Oral Dent J. 2011; 31(2):470-473.

13. Jafari HJ, Radmehr O, Kaviani R, Valaei N. The analysis of correlation between the facial width and mesio-distal width of the maxillary anterior teeth. J Res Dent Sci. 2014; 11:49-53.

14. Tehranchi A, Nouri M, Massudi R, Katchooi M. Diagnostic value of manual and computerized methods of dental casts analysis. J Dent(Tehran). 2009; 6(2):85-90.

15. Asad S, Bokhari F, Ahsan W. Proportional mesio-distal dimension of permanent maxillary teeth. Pak Orthod J. 2015; 7(1):30-34.

16. Peckmann TR, LogarC, Garrido-Varas CE, Meek S, Pinto XT. Sex determination using the mesio-distal dimension of permanent maxillary incisors and canines in a modern Chilean population. Sci Justic. 2016; 56(2):84-89.

17. Rajat RK, Rishav S, Romil S, Nauseen H. Comparative evaluation of mesiodistal width of six maxillary anterior teeth in J&K population. Int J Sci Study. 2017; 5(7):4-7.

18. Sravya T, Dumpala RK, Venkateswara Rao Guttikonda PKM, Narasimha VC. Mesiodistal odontometrics as a distinguishing trait: a comparative preliminary study. J Forensic Dent Sci. 2016; 8(2):99-102.

19. Srivastava R, Jyoti B, Jha P, Gupta M, Devi P, Jayaram R. Gender determination from the mesiodistal dimension of permanent maxillary incisors and canines: An odontometric study. J Ind Acad Oral Med Radiol. 2014; 26(3):287-292.

20. Gomes VL, Gonçalves LC, Do Prado CJ, Junior IL, De Lima Lucas B. Correlation between facial measurements and the mesiodistal width of the maxillary anterior teeth. J Esthet Restor Dent. 2006; 18(4):196-205.

21. Isa ZM, Tawfiq OF, Noor NM, Shamsudheen MI, Rijal OM. Regression methods to investigate the relationship between facial measurements and widths of the maxillary anterior teeth. J Prosthet Dent. 2010; 103(3):182-188.

22. Tripathi S, Singh RD, Chand P, Kumar L, Singh GK. A study to correlate various facial landmarks with intercanine distance. Ind J DentRes. 2018; 29(4):440-444.

23. Smith B.J. The value of the nose width as an esthetic guide in prosthodontics. J Prosthet Dent. 1975;34(5):562-573.

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Rashid M:	Principal investigator, Concept and data analysis
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Shah SA:	Proof reading and critical analysis
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Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.