ORIGINAL ARTICLE

Gender as a Variable Influencing the Mesiodistal width of Permanent Maxillary Anterior Teeth: An Analysis using AutoCAD Software

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OBJECTIVE: The objective of this study was to determine potential differences among male and female genders regarding the mesiodistal widths of permanent maxillary anterior teeth in adult dentate individuals.

METHODOLOGY: This was an analytical cross-sectional study which was conducted in Out Patient Department of Peshawar Dental College, Peshawar from February to April 2019.

The sample comprised of 180 individuals with a mean age of 15-25years selected from a population visiting Peshawar Dental College that fulfilled the inclusion criteria. JPEG file format of OPG images were graphically analyzed by Autodesk AutoCAD software 2017 version to calculate the mesiodistal widths of permanent maxillary anterior teeth. Independent t test was used to compare mesiodistal teeth dimensions between males and females.

RESULTS: Mesiodistal widths of permanent maxillary anterior teeth, in males, were greater than females but the difference in their mean values were statistically insignificant (P>0.05). The mesiodistal width of permanent maxillary right lateral incisor in males was larger (8.023± 1.083 mm) than females (7.853± 1.319 mm) but the difference was statistically insignificant (P>0.05).

CONCLUSION: It can be concluded that gender had statistically non-significant association with the mesiodistal widths of permanent maxillary anterior teeth.

KEYWORDS: Gender, Mesiodistal width, Permanent maxillary anterior teeth, Autodesk AutoCAD software

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INTRODUCTION

During the last few decades patients and dentists have taken greater interest in dental esthetics.[1] Dental esthetics is most dominant aspect of facial attractiveness and encompasses not only tooth colour, size and shape[2] but also other aspects like upper lip position[3] and gingival morphology.[4]

Maxillary anterior teeth are considered the most dominant element in dental and facial esthetics because of the amount of visible coronal structure.[5] Research has been carried out on determining the approximate width of maxillary anterior teeth by studying their relation with gender, race6 facial profile[7] facial measurements[8] and malocclusions.[9]

A study conducted in Chile observed that mesiodistal width of maxillary central incisors and canines had different statistically significant values between males and females. A flaw in the design of that study was the use of sample size of 303 subjects (177 females and 126 males), while for

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a comparative study, it is better to consider equal number of male and female subjects. In the present study we will be taking equal number of male and female subjects.[10]Another study conducted in Saudi Arabia stated that all maxillary anterior teeth had greater mean values for mesiodistal width in males as compared to the females with a mean of 49.4 mm in males and 48.2 mm in females.[11]

A study in India found that the mean mesio-distal width for central incisors was 8.9mm in males and 8.6mm in females, while for lateral incisors it was 6.89 mm in males and 6.79 mm in females and for canines it was 9.8 mm in males and 8.6 mm in females. It showed that mesiodistal width of maxillary central incisors and canines was significantly greater in males than in females with canines showing significantly greater values as compared to central incisors.[12]

According to a study conducted in India, maxillary right and left canines exhibit a mean width of 1.0cm in males and 0.9cm in females but this study examined only canines[13] due to the reason that canines are least frequently extracted teeth possibly because of relatively decreased incidence of caries and periodontal disease.[14]

In a study conducted in Lahore, Pakistan on 14-30 years old subjects with orthognathic profile having aligned and fully erupted set of permanent maxillary anterior teeth with no caries or attrition were studied and it was found that the ratio of the mean mesio-distal crown width of the maxillary lateral incisor to that of the maxillary central incisor was approximately 80.7% in males and 78.6% in females, maxillary canine to that of the maxillary central incisor was approximately 90.77% in males and 87.95% in females, maxillary lateral incisor to that of the maxillary canine was approximately 88.93% in males and 89.36% in females.[15]

In all the previously conducted studies, old methodologies were used for measuring mesiodistal width of permanent maxillary anterior teeth. Most of the studies used vernier calipers and took measurements either directly on the subjects teeth[12], orodental models.[10,11,13,15], Thread[11] and manual divider[12] have also been used for this purpose.

According to a recent study conducted based on evaluating an association of tooth form with the face shape, photographs of subjects face and teeth were analyzed by using AutoCAD software.[8] In present study however we will be taking standardized images obtained from OrthoPantomoGram (OPG). 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 considered as the best tool for this purpose.

Another limitation of previously conducted studies was improper identification of landmarks for measuring the mesiodistal width of permanent maxillary anterior teeth. In Pakistan and India, mesial and distal contact points were taken as reference.[10,11,13,15] In a study conducted in Saudi Arabia mesiodistal measurements were taken from a line drawn perpendicular to the long axis of teeth following their maximum contours11. In present study we will geometrically find mesiodistal width in AutoCAD software by drawing two vertical lines (tangent to mesial and distal contour) and two horizontal lines (one on upper intersection of distal tangent and one on lower intersection of mesial tangent). A horizontal line equidistance to previous two horizontal lines will represent the greatest mesiodistal width.[8]

The aim of this study was to determine that gender is an important variable for the mesiodistal width of permanent maxillary anterior teeth in adult dentate subjects of age 15-25 years, using AutoCAD software. This will help in providing data to dentists for fabricating denture teeth in teeth selection for edentulous patients[16], use in forensic odontology for criminal identification.[12,13,10] orthodontic treatment planning[17] and restorative treatment.[18]

METHODOLOGY

It was an analytical cross-sectional study which was conducted in Oral diagnosis department of Peshawar Dental College, Peshawar from February to April 2019. This study was ethically approved by instituitional review board (IRB) of Prime Foundation Pakistan. Data was collected in Out Patient Department (OPD) of Peshawar Dental College. Sample size of of 180 individuals was calculated by non-probability consecutive sampling. Both male and female gender were included, out of which 90 were males and 90 were females. 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 orthodontic treatment. Inclusion criteria was subjects having fully erupted, structurally and periodontally sound maxillary anterior teeth that are having satisfactory alignment.

Sexual dimorphism is defined as the effect of gender (i.e. male and female) on the mesiodistal widths of permanent maxillary anterior teeth.

Mesiodistal widths of permanent maxillary anterior teeth shall be the widest horizontal distance between the maximum convex points of mesial and distal margins from labial surface of maxillary anterior teeth. It was calculated from OPG images of subjects which were analyzed in Autodesk AutoCAD software 2017 version by drawing two vertical lines (tangent to mesial and distal contour) and two horizontal

lines (one on maxillary intersection of distal tangent and one on mandibular intersection of mesial tangent). A horizontal line equidistance to previous two horizontal lines shall represent the greatest mesiodistal width8.

STATISTICAL ANALYSIS

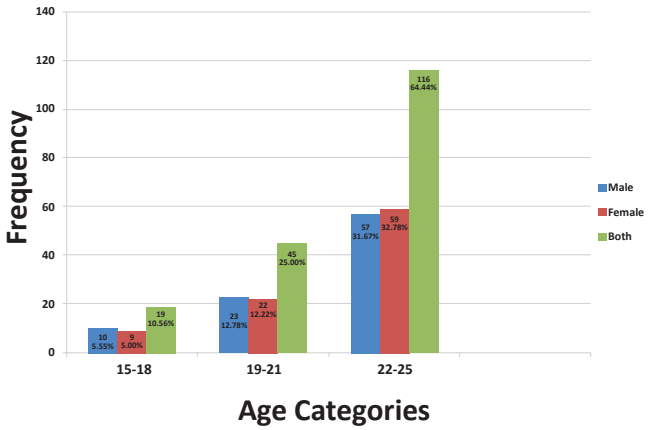
The data were entered & analyzed using computer program SPSS version 20.0. Frequencies and percentages were computed. Mean and standard deviations were calculated for all numerical variables like age and all maxillary anterior mesiodistal teeth widths. Independent t test was used to compare mesiodistal teeth dimensions between males and females. 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 9.826±1.038 mm, 7.94±1.206 mm, and 9.47±1.43 mm respectively. The mean

Figure 1: Age distribution of all subjects



mesiodistal width of left maxillary canine, lateral incisor and central incisor was 9.82±1.085 mm, 8.031±1.105 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 and figure 2.

Though the mesiodistal widths of teeth in males were

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±2.574		
Right maxillary canine (mm)	7-13.3, 9.826±1.038	9.86± 0.947	9.792± 1.126
Right maxillary lateral incisor (mm)	5-11.7, 7.94±1.206	8.023± 1.083	7.853± 1.319
Right maxillary central incisor (mm)	6.3-14, 9.47±1.43	9.659± 1.295	9.28± 1.536
Left maxillary central incisor (mm)	6.4-13.7, 9.57±1.37	9.783± 1.197	9.388± 1.503
Left maxillary lateral incisor (mm)	5-11.2, 8.031±1.105	8.141± 0.976	7.92±1.215
Left maxillary canine(mm)	7-12.8, 9.82±1.085	9.889±0.957	9.742± 1.199

Figure 2: Mean and SD values of mesiodistal wdiths of maxillary anterior teeth

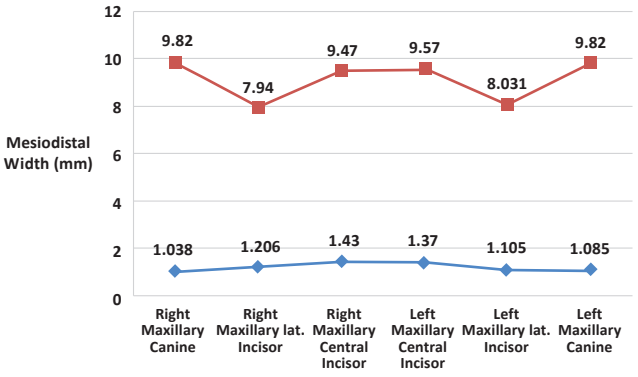


Table 2: Comparison of mesiodistal tooth width of maxillary anterior teeth between genders

Tooth	Gender	Mean ±SD	95%C I	P-value
right maxillary canine	Female	9.792± 1.126	-0.374 , 0.238	0.663
	Male	9.86± 0.947		
right maxillary lateral incisor	Female	7.853± 1.319	-0.525, 0.185	0.346
	Male	8.023± 1.083		
right maxillary central incisor	Female	9.28± 1.536	-0.797, 0.039	0.122
	Male	9.659± 1.295		
left maxillary central incisor	Female	9.388± 1.503	-0.795, 0.004	0.062
	Male	9.783± 1.197		
left maxillary lateral incisor	Female	7.92±1.215	-0.545, 0.103	0.180
	Male	8.141± 0.976		
left maxillary canine	Female	9.742± 1.199	-0.466, 0.173	0.366
	Male	9.889±0.957		

larger than those in the females but the difference for mean values were statistically insignificant (P>0.05). For right maxillary canine the mean width in females was 9.79± 1.12 mm while in males it was 9.86± 0.94 mm (95% CI= -0.37 , 0.23; P=0.66). Similarly, right maxillary lateral incisor in males was larger (8.023± 1.083 mm) than females (7.853± 1.319 mm) but the difference was statistically insignificant (95% CI= -0.52, 0.18; P=0.34). Similarly, the average value for the mesiodistal width of right maxillary central incisor in males was larger (9.65± 1.29 mm) than females (9.28± 1.53 mm) but again the difference was statistically insignificant (95% CI= -0.79, 0.03; P=0.12). Similarly, the difference in the mesiodistal widths values of teeth on the left and right maxillary arch were insignificant results. The detailed results are shown in table 2.

DISCUSSION

Sexual dimorphism is a term used for the variations in stature, size, and shape between males and females. This is applicable to dental identification too, as no two mouths are similar.[19] The sexual dimorphism existence in permanent dentition is an established phenomenon and reported in literature. Sexual dimorphism, therefore, has a vital significance in forensic odontology and medicine.[20] Teeth are useful to differentiate gender by calibrating their buccolingual and mesiodistal dimensions. Use of teeth to determine gender have an essential role in young people where the skeletal secondary sexual features like breast, hip broadening and moustaches have not yet developed.[21] Many reasons like genetic, environmental and ethnicity can be held responsible for non-concordance between our study and previous literature.

This study aims to determine if gender can be an important variable for assessing 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 6-12 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.

For all permanent maxillary anterior teeth, the mesiodistal widths were larger in males as compared to females. In this study mesiodistal width of central incisors was 9.7mm for males and 9.3mm for females, for lateral incisors it was 8.0mm for males and 7.8mm for females, while for canines it was 9.9mm for males and 9.7mm for females with P>0.05 (Table 2).

Our results showed that sexual dimorphism in mesiodistal widths of maxillary anterior teeth was present but was not statistically significant. So, in our population the sexual dimorphism cannot be used to determine gender in forensic cases.

Alqahtani et al recorded the mesiodistal width for central incisor was 8.8mm for men and 8.6mm for women, lateral incisor was 6.7mm for men and 6.4mm for women, and canines was 8.0mm for men and 7.6mm for women. He concluded that though the values for mesiodistal tooth width were larger for males as compared to females but no statistically significant difference was found. These results were in concordance with present study.[22]

Srivastava et al assessed and determined the role of permanent maxillary incisors and cuspids for sex determination of undergraduate dental students. They measured with the help of a digital vernier caliper as well as manual divider to measure the mesiodistal dimensions of the maxillary front teeth from canine to canine. They found that mean mesiodistal width of central incisors was 8.9mm in males & 8.6mm in females, for lateral incisors it was 6.8mm in males & 6.7mm in females and for canines it was 9.8mm in males & 8.6mm in females this shows that the mesiodistal dimensions and left maxillary canines and central incisors were significantly larger in males than females. They concluded that sexual dimorphism in maxillary canine and central incisors are helpful in gender determination.[12]

Neves et al[23] stated that among the mesiodistal widths of all maxillary and mandibular teeth, canines were more sexually dimorphic as compared to other teeth. Peckmann at al15 found that maxillary central incisors and canines showed significant sexual dimorphism (P<0.008) as compared to lateral incisors (P>0.008) while in this study none of the maxillary anterior teeth showed significant results (P>0.05). These results were in accordance with our study that showed that canines were more sexually dimorphic as compared to other teeth, although the difference was not statistically significant.

Rajat et al.[11] stated that all maxillary anterior teeth had a greater mean of 49.4mm in males and 48.2mm in females while in this study it was 55mm in males and 53.9mm in females.

Leung et al measured the mesiodistal widths of incisors, canines, premolars and first molars of mandibular and maxillary jaws from digital e-models with the help of 03DM digital model software and showed that females had significantly smaller teeth as compared to males. These results were not in accordance with present study which can be attributed to the fact that two different types of softwares were used for this purpose.[24]

Tehranchi et al.[25] conducted a comparative study to measure mesiodistal widths of casts and reported AutoCAD software provides more precise results while the manual method is only reliable when taken with extreme caution.

While the previously conducted studies used vernier caliper and manual measurement which are less accurate and time consuming. These authors reported that vernier caliper and manual measurement needs extreme caution during calibration, duplicate measurements and averaging and experience is an essential factor for accurate measurement.[10,11,12,13,15].

On the basis of this study, it has been observed that gender 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 centre, small sample and a hospital based study which may not represent the Peshawar population. Further large sample and community based studies are recommended which will explore this area in depth.

CONCLUSION

According to this study, it can be concluded that gender had a statistically non-significant association with the mesiodistal widths of permanent maxillary anterior teeth, so these findings cannot be used as an appropriate guide for determining gender in forensic cases.

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CONFLICT OF INTEREST

None declared

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