

# Proportional mesio-distal dimension of permanent maxillary teeth

Saad Asad<sup>a</sup>, Fareeha Bokhari<sup>b</sup>, Waleed Ahsan<sup>c</sup>

## Abstract

**Introduction:** The mesio-distal dimension of the maxillary anterior teeth is important in achieving pleasing dento-facial esthetics. However, little scientific data exists that evaluates sexual dimorphism and proportional dimensions of maxillary anterior teeth Purpose this study is thus to identify whether there is any sexual dimorphism observed between mesiodistal (M-D) dimension of permanent maxillary anterior teeth and to determine proportionate dimension of permanent maxillary anterior teeth.

**Material and Methods:** Gypsum casts of 80 fully dentate dental students (14-30 years) were included in the study based upon the selection criteria.

**Results:** Mesiodistal dimension of permanent maxillary anterior teeth and their proportionate relationship were established for establishment of norms for mesiodistal dimensions. Mesio-distal dimensions of male dentition for both right and left side teeth were greater than those of females (for the population in question), in accordance with previous studies. Ratio of mesiodistal crown dimensions of the maxillary lateral incisors to the maxillary central incisors was 78.06% in females and 80.73% in males. Ratio of the mesiodistal crown dimension of the maxillary lateral incisors to the maxillary canine was 87.96% in females and 90.77% in males and lastly, ratio of mesiodistal crown dimension of the maxillary canine to maxillary central Incisors was 89.36% in females and 88.94% in males.

**Conclusions:** Mesio-distal dimensions of six anterior maxillary teeth measured from contact point to contact point were found to be comparable with existing data in the literature. Sexual dimorphism was evident from results. Conclusively, such guidelines in addition to the absolute mesio-distal dimensions can help in establishing better anterior micro-esthetics and tooth-lip relationships.

**Keywords:** Anterior teeth dimensions, Tooth - lip ratios, Golden proportions

## Introduction

In Orthodontics, there is a shift of treatment and diagnosis paradigm. Orthodontists and patients are now more concerned in the management of their dento-facial esthetics rather than improvement only in their dental esthetics.<sup>1</sup> To achieve ideal dento-facial esthetics; macro-esthetics, mini-esthetics and micro-esthetics have to be taken into consideration during orthodontic diagnosis and treatment planning.<sup>2</sup> An orthodontist can thus achieve significant improvement in smile if he or she

understands the principles of dento-facial esthetics.<sup>3</sup> Dentofacial esthetics is not only important in orthodontics but has been pivotal in restorative dentistry,<sup>4</sup> prosthodontics and periodontics.<sup>5</sup> One of the components of micro-esthetics includes the mesio-distal dimension of anterior teeth and their proportionate relationship with each other. Moreover anterior teeth are good source of material for medico legal identification as sex determination is one of the important parameters in forensic identification. Sex determination using dental features is primarily based upon the comparison of tooth dimensions in males and females.<sup>6</sup> Even in Oral & Maxillofacial surgery, anterior teeth have been of prime concern. Thus dentists from all domains are concerned with the mesio-distal dimension of anterior teeth, though the implications may be different.

<sup>a</sup> Corresponding author: BDS, FCPS, Associate Professor Orthodontics, University College of Dentistry, The University of Lahore. E-mail: saad260@yahoo.com

<sup>b</sup> BDS, FCPS, Assistant Professor Orthodontics, University College of Dentistry, Te University of Lahore.

<sup>c</sup> BDS, Resident, Operative Dentistry

Orthodontist aims for achieving ideal maxillary anterior teeth positioning and inclination so that they could have a good impact on naso-labial angle, lip prominence and facial harmony, which can't be obtained until and unless maxillary anterior teeth dimensions are near to norms and in balance with lower teeth, otherwise either intra-oral problems like crowding, deep bite or abnormal incisor inclination occurs or extra-oral problems like nose-lip-chin harmony cannot be idealized.<sup>7</sup> In recent past, rather than knowing absolute values of mesio-distal dimensions of anterior teeth, the proportionate dimension became paramount for achieving ideal inter-arch, intra-arch relationships and nose-lip-chin harmony.<sup>8</sup> Little data is however available where proportionate rather than absolute dimensions are estimated.

Aim of this study was to firstly investigate whether there is any sexual dimorphism observed between mesiodistal (M-D) dimension of permanent maxillary incisors and canines. Secondly to determine proportionate dimension of permanent maxillary central incisors, lateral incisors and canines.

## Material and Methods

The study sample consisted of 70 adult dental students (35 males and 35 females) selected from University College of Dentistry, The University of Lahore. The patients within the age of 14 to 30 years, orthognathic profile, competent lips, complete set of erupted teeth, non-carious teeth without attrition, without maxillary lateral incisor microdontia, satisfactorily aligned maxillary teeth without spacing or crowding, no history of orthodontic treatment or trauma. After obtaining informed consent, the maximum mesio-distal dimension of each tooth was measured on the Gypsum casts of the maxillary arches of each subject from the anatomic contact points with the help of digital vernier calipers accurate to 0.01 mm, held parallel to the occlusal plane. Data was

analyzed using SPSS 17.0. Descriptive statistics were calculated and compared for male and female subjects. Sexual Dimorphism for each tooth was calculated as<sup>6</sup>

$$\text{Percentage of dimorphism} = \{(X_m/X_f)-1\} \times 100$$

where

$X_m$  = mean male tooth dimension

$X_f$  = mean female tooth dimension.

And proportionate relationship between permanent maxillary anterior teeth was calculated using<sup>7</sup>

$$\text{Ratio} = \frac{X_1}{X} \times 100$$

$X_1$  = Mesiodistal crown dimension of smaller tooth.

$X$  = Mesiodistal crown dimension of larger tooth.

## Results

Sample (70 dental students, 35 males and 35 females) ranged from 14 to 30 years (males mean age 24.03 years  $\pm$  7.75, females mean age 22.02 years  $\pm$  6.53). Mean and standard deviation for mesio-distal widths of each of the six anterior teeth measured from contact point to contact point was calculated.

Males showed greater mean mesiodistal dimensions for each tooth in comparison to females. Percentage of sexual dimorphism was calculated (Table I). The ratio of the mean mesio-distal crown dimension of the maxillary lateral incisor to that of the maxillary central incisor was approximately is 80.7% in males and 78.6% in females. The ratio of the mean mesio-distal crown dimension of the maxillary Canine to that of the maxillary central incisor was approximately is 90.77% in males and 87.95% in females. The ratio of the mean mesiodistal crown dimension of the maxillary lateral incisor to that of the maxillary Canine was approximately is 88.93% in males and 89.36% in females (Table II).

**Table I: Descriptive Statistics and percentage of sexual dimorphism**

	Mesio-distal Dimension of Permanent Maxillary Anterior Teeth (Male) n=35		Mesio-distal Dimension of Permanent Maxillary Anterior Teeth (Female) n=35		% of Sexual Dimorphism
	Mean	S.D	Mean	S.D	$\{(X_m/X_f)-1\} \times 100$
Tooth #8	8.848571	0.50	8.414286	0.46	5.161282
Tooth #9	8.897143	0.50	8.408571	0.47	5.810405
Tooth #6	8.082857	0.21	7.36	0.28	9.821427
Tooth #11	8.025714	0.42	7.437143	0.39	7.91394
Tooth #7	7.091429	0.58	6.668571	0.54	6.341059
Tooth # 10	7.234286	0.49	6.554286	0.66	10.37489

**Table II: Proportionate relationship between permanent maxillary anterior teeth**

Male (n=35)			Female (n=35)		
Mean Mesio-distal Dimension	%	Mean	Mean Mesio-distal Dimension	%	Mean
Tooth #7		80.726148	6.668571	79.253	78.6003215
Tooth #8	80.14208		8.414286		
Tooth #10			6.554286		
Tooth #9	81.31021		8.408571		
Tooth #6		90.775993	7.36	87.4703	87.9587275
Tooth #8	91.34647		8.414286		
Tooth # 11			7.437143		
Tooth #9	90.20552		8.408571		
Tooth #7		88.936517	6.668571	90.6056	89.367334
Tooth #6	87.73419		7.36		
Tooth #10			6.554286		
Tooth #11	90.13885		7.437143		

## Discussion

Orthodontists can correlate, evaluate and assess the maxillary anterior teeth dimension so that they can meet the individual micro-esthetic and functional needs.<sup>9</sup> Thus it is important to have clear cut information about the mesio-distal dimension of anterior teeth for their known esthetic implications. The mesio-distal dimension of permanent maxillary central incisors according to established standards is 8.5 mm, varying from 8.36 to 9.33 mm in different ethnicities.

Similarly, the mesio-distal dimension of permanent maxillary lateral incisors is 6.5 mm. Literature shows variation from 6.51 to 7.04 mm. The mesio-distal width of maxillary canine has been reported to be 7.5 mm and it varies from 7.53–8.32 mm.<sup>8-10</sup> Isa ZM et al, in their study on 60 fully dentate Malaysian adults found that the mesiodistal diameters of the maxillary central incisors, lateral incisors, and canines were  $8.54 \pm 0.50$ ,  $7.09 \pm 0.48$ , and  $7.94 \pm 0.40$  mm respectively,<sup>11</sup> while in our study mesiodistal width of maxillary central

incisors was  $8.85 \pm 0.50$  and  $8.89 \pm 0.50$  respectively for males and was  $8.41 \pm 0.46$  and  $8.41 \pm 0.47$  for females, mesiodistal width of maxillary lateral incisors was  $7.09 \pm 0.58$  and  $7.23 \pm 0.49$  for males and  $6.67 \pm 0.54$  and  $6.55 \pm 0.66$  for females respectively. The mesiodistal width of maxillary canines was  $8.08 \pm 0.21$  and  $8.02 \pm 0.42$  for males and  $7.36 \pm 0.28$  and  $7.44 \pm 0.39$  for females respectively showing that mesiodistal dimension of maxillary anterior teeth in our sample are comparable with that of other studies. This study showed that mesio-distal dimensions measured from anatomical contact point to contact point of male dentition for both right and left side teeth (Table I) are greater than those of females which is in accordance with the reported norms. Srivastava R in their study on 300 subjects, found that maxillary central incisors and canines exhibit statistically highly significant sexual dimorphism and could be used as an adjunct for the determination of gender in individuals.<sup>12</sup> Khan et al found that mesiodistal crown dimensions of males had significantly larger dimensions (than females) of maxillary central incisors and mandibular second premolars among the Bangladeshi population.<sup>13</sup> Singh et al in their study found that the mesiodistal crown dimensions of the teeth of males is greater than that of females.<sup>7</sup> Richardson *et al* also found that teeth of males are larger than those of females for each type of tooth in both the arches.<sup>14</sup> Fernandes TMF et al in their study also found sexual dimorphism.<sup>15</sup> Singh et al in their study found that the ratio of the mesiodistal crown dimension of the maxillary lateral incisors to the maxillary central incisors was 80% in females and 78% in males,<sup>7</sup> while in this study, ratio of mesio-distal crown dimension of maxillary lateral incisors to maxillary central incisors was 78.06% in females and 80.73% in males. Moreover, in the present study, ratio of mesiodistal crown dimensions of maxillary lateral incisors to maxillary canines was 87.96% in females and 90.77% in

males and ratio of the mesiodistal crown dimension of the maxillary canine to maxillary central incisors was 89.36% in females and 88.94% in males.

Proportional guidelines in addition to absolute mesio-distal dimension can definitely help in establishing better anterior micro-esthetics and tooth-lip transition.

## Conclusions

Mesio-distal dimensions of six anterior maxillary teeth measured from contact point to contact point were found to be comparable with existing data in the literature. Sexual dimorphism was evident from results. Conclusively, such guidelines in addition to the absolute mesio-distal dimensions can help in establishing better anterior micro-esthetics and tooth-lip relationships.

## Acknowledgment

Dedicated to Dr Ahsan Naveed (Late), Associate Professor Operative Dentistry, University College of Dentistry, The University of Lahore.

## References

1. Ackerman JL, Proffit WR, Sarver DM. The emerging soft tissue paradigm in orthodontic diagnosis and treatment planning. *Clin Orthod Res* 1999 May; 2(2):49-52.
2. Brandão RCB, Brandão LBC. Finishing procedures in orthodontics: dental dimensions and proportions (microesthetics). *Dental Press J Orthod* 2013 Jan;18(5):147-74.
3. Sarver DM. Enameloplasty and esthetic finishing in Orthodontics - Differential diagnosis of incisor proclination-The importance of appropriate visualization and records Part 2. *J Esthet Restor Dent* 2011 Oct 18;23(5):303-13.
4. Frese C, Staehle HJ, Wolff D. The assessment of dentofacial esthetics in restorative dentistry: a review of the literature. *J Am Dent Assoc* 2012 May;143(5):461-6.
5. Bitter RN. The periodontal factor in esthetic smile design - altering gingival display. *Gen Dent* 2007 Nov;55(7):616-22.
6. Khangura RK, Sircar K, Singh S and Rastogi V. Sex determination using mesiodistal dimension of

- permanent maxillary incisors and canines. *J Forensic Dent Sci* 2011 Jul-Dec;3(2):81-5.
7. Singh SP, Goyal A. Mesiodistal crown dimensions of the permanent dentition in North Indian children. *J Indian Soc Pedod Prev Dent* 2006 Dec;24(4):192-6.
  8. Pamecha S, Dayakara HR. Comparative measurement of mesiodistal width of six anterior maxillary and mandibular teeth in Rajasthan population. *J Indian Prosthodont Soc* 2012 Jun;12(2):81-6.
  9. Ash MM, Stanley JN. *Wheeler's dental anatomy, physiology and occlusion.* (2003), 8<sup>th</sup> edi; Saunders: Elsevier.
  - 10 Lennart L, Nils M. Mesiodistal tooth size in deciduous and permanent dentitions. *Euro J Orthod* 1982;4:113-22.
  11. Isa ZM, Tawfiq OF, Noor NM, Shamsudheen ML, Rijal OM. Regression methods to investigate the relationship between facial measurements and widths of the maxillary anterior teeth. *J Prosthet Dent* 2010 Mar;103(3):182-8.
  12. Srivastava R et al. Gender determination from the mesiodistal dimension of permanent maxillary incisors and canines: An odontometric study. *J Indian Acad Oral Med Radiol* 2014(11);26:287-92.
  13. Khan SH, Hassan GS, Rafique T, Hasan MN, Russell MS. Mesiodistal crown dimensions of permanent teeth in Bangladeshi population. *Bangabandhu Sheikh Mujib Med Uni J* 2011;4:81-7.
  14. Richardson ER, Malhotra SK. Mesiodistal crown dimension of the permanent dentition of American Negroes. *Am J Orthod.* 1975;68:157-64.
  15. Fernandes TMF et al. Comparison of mesiodistal tooth widths in Caucasians, African and Japanese individuals with Brazilian ancestry and normal occlusion. *Dental Press J Orthod* 2013 May-June;18(3):130-5.