

# Mesio-distal crown width in permanent dentition amongst adolescent population of Province II of Nepal

Alok Kumar Jaiswal<sup>1\*</sup>, Umesh Parajuli<sup>2</sup>, Manish Bajracharya<sup>3</sup>, Binita Singh<sup>1</sup>

Department of Orthodontics and Dentofacial Orthopaedics, <sup>1</sup>M B Kedia Dental College and teaching hospital, Birgunj, Nepal,

<sup>2</sup>Gandaki Medical College, Pokhara <sup>3</sup>National Academy of Medical Sciences, Bir Hospital, Kathmandu

## ABSTRACT

**Background:** The purpose of this study was to gather normative data on the mesio-distal crown dimensions amongst adolescent population of Province II, Nepal, to make an accurate diagnosis and treatment planning in orthodontics. It will also be useful in various clinical disciplines of dentistry including basic dental and anthropological research. **Materials and Methods:** Samples were selected Full form OPD of M B Kedia Dental College, Birgunj, Nepal. Total numbers of participants were 120, out of which 60 males and 60 females were selected after initial examination aged between 11 to 23 years. Subjects with all permanent teeth erupted (except second and third molar) without any history of previous orthodontic treatment and with no dental anomalies were included in this study. The alginate impressions were made by the well trained dental surgeon. Digital vernier calliper providing measurements to  $\pm 0.01$  millimeter (mm) was used to measure the mesio-distal dimension of all teeth. **Results:** The mean, range and standard deviation were calculated for the size of the teeth. Independent t-test was used to compare between male and female population. The significance level was set at p value  $\leq 0.05$ . The population of Province II, Nepal shows greater sexual dimorphism in mesio-distal crown dimension which was exhibited by the maxillary molars (0.88 mm) followed by mandibular molars (0.38 mm). Similarly in anterior tooth segment the maxillary canines (0.29 mm) followed by the mandibular canines (0.27 mm). **Conclusion:** The mean mesio-distal crown dimensions of the permanent dentition of males were larger than that of females for each type of tooth except maxillary central and lateral incisor.

**Keywords:** adolescent, mesio-distal width, sexual dimorphism

## \*Corresponding Author

Dr Alok Kumar Jaiswal  
Associate Professor, Department of Orthodontics and Dentofacial Orthopaedics, <sup>1</sup>M B Kedia Dental College and teaching hospital, Birgunj, Nepal,  
Email: dralokjaiswal@gmail.com

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## INTRODUCTION

Variation of tooth size is influenced by genetic and environmental factors. Many studies reported that variation of tooth size exists within the race and in subjects with different racial origin.<sup>1</sup> According to Proffit and Fields<sup>2</sup>, tooth space analysis should be done accurately before any Orthodontic treatment. Tooth size discrepancy is defined as a disproportion among the sizes of individual teeth and amongst the jaws.<sup>2</sup> In order to achieve optimal occlusion maxillary to mandibular tooth width ratios must be proportionate in size.

Many authors have evaluated factors associated with differences in the tooth width. The relationship between malocclusion type and tooth size proportions has also been reported.<sup>1, 3-7</sup> Since differences in tooth size have been reported with ethnic groups,<sup>3, 8-11</sup> most of the practitioners now disagree to apply the tooth size reported from the other ethnic groups. Bishara et al.<sup>11</sup> conducted a study which includes the population of Egypt, Mexico, and the United States. They

noticed that there was a difference in the mesio-distal dimensions of teeth among the three populations. There was sexual dimorphism where males had larger teeth than females in all three groups of population. There were no statistical significant differences between the right and left sides for all the three study groups.

Till date, few studies on the mesio-distal dimensions of teeth of the Nepalese population are found in the literature. No such studies have been reported in the population of province II. This study was carried out to gather data from province II on the mesio-distal widths of the permanent teeth and to see the gender differences in tooth width. This will help Orthodontist to diagnose the case properly and finish the case with precise occlusion.

## MATERIALS AND METHODS

This was a hospital based cross-sectional study conducted at M B Kedia Dental College, Birgunj, Nepal, within the duration of August 2018 to November 2018. The study was conducted after getting ethical clearance from institutional review board, M B Kedia Dental College Birgunj, Nepal. Sample size calculation was based on 80% power and significance level of 5%<sup>12</sup> and considering 0.70 as maximum tolerable error rate and based on standard deviation of 2.5.  $N = [Z + (1 - \beta)]^2 \times SD^2 / L^2$ , where, Z=Confidence interval (95%, CI=1.96),  $\beta$ =probability of type II error= 0.16, Standard Deviation= 2.5, L= tolerable error= 0.70 and N=Sample size. The sample size came to be 100. We included 120 samples in our study. Informed consent was obtained from parents or patients before recording data as applicable. The patients were examined in a clinical set up of dental OPD with illuminated light using mouth mirror, probe and tweezers. The inclusion criteria were 1) Participants must be a resident of province II 2) 11-23 years of age 3) All set of permanent teeth erupted (except second and third molars). The exclusion criteria were subjects with 1) Proximal or occlusal wear, interproximal caries or restorations 2) Crowding, spacing, cross bite, over retained deciduous tooth, missing permanent tooth, any dental anomalies 3) Cleft lip and palate or any other syndromes 4) Past history of orthodontic treatment. After obtaining the consent from patients meeting the inclusion criteria, alginate impressions of both maxillary and mandibular teeth were made by a trained dental surgeon. The impressions were poured with dental stone, Type 3 gypsum product. Total numbers of participants were 120; 60 males and 60 females. Digital vernier calliper [0-150 mm, 799A-6/150, Starrett tools (Suzhou) Co. Ltd., China] providing measurements to  $\pm 0.01$ mm was used to measure the mesio-distal dimension of all teeth. The

teeth measured included the mandibular and maxillary permanent incisors, permanent canines, first premolars, second premolars and first molars. All measurements were made by a single investigator. Maximum 10 pairs of casts measured per day to avoid eye fatigue. All measurements were done directly on study models. Maximum mesio-distal width of each tooth was measured and recorded to 0.1mm. All measurements were taken perpendicular to the long axis of the tooth with the calliper beak entering the inter-proximal area from the buccal or occlusal side.<sup>13</sup> Repeated measurements were performed to minimize the possible errors. Intra-examiner reliability was predetermined at 0.2mm as mentioned by Bishara et al.<sup>11</sup> Bishara<sup>11, 14</sup> recommended that measurements that varied by 0.2mm or less to be averaged and re-measurement was done for measurements that varied more than 0.2 mm and the three measurements were averaged.

Statistical analysis was performed with IBM SPSS Statistics Version 16 for Windows. Data were presented as mean, standard deviation (SD), frequency and percentage where appropriate. Independent t-test was used to compare between males and females. The significance level was set at p value  $\leq 0.05$ .

## RESULTS

The data on mesio-distal crown dimensions of the permanent maxillary and mandibular teeth of the Nepalese population studied are summarized in table 1 and 2 respectively. The mean mesio-distal crown dimensions of the permanent dentition of males were larger than that of females for each type of tooth except maxillary central and lateral incisor. Comparison was done between the mean mesio-distal dimensions of right and left side of both maxillary and mandibular arches amongst females and males as shown in table 5 and 6. The differences between the mean mesio-distal dimension of individual tooth on the right and left sides were comparable.

Table 1: Mesio-distal width of individual tooth in females

Tooth	Min width (mm)	Max width (mm)	Mean+SD (mm)
Mandibular right first molar	10.00	10.99	10.57 $\pm$ 0.24
Mandibular right second premolar	5.76	7.87	6.82 $\pm$ 0.51
Mandibular right first premolar	5.31	7.71	6.91 $\pm$ 0.48
Mandibular right canine	5.44	7.93	6.65 $\pm$ 0.45
Mandibular right lateral incisor	4.63	6.82	5.87 $\pm$ 0.42
Mandibular right central incisor	4.13	6.33	5.35 $\pm$ 0.44
Mandibular left central incisor	4.12	6.44	5.33 $\pm$ 0.42

Mandibular left lateral incisor	4.82	6.90	5.87±0.41
Mandibular left canine	5.50	7.96	6.62±0.47
Mandibular left first premolar	5.31	7.70	6.89±0.48
Mandibular left second premolar	5.73	8.03	6.86±0.52
Mandibular left first molar	10.11	11.12	10.59±0.24
Maxillary right first molar	9.15	9.97	9.59±0.22
Maxillary right second premolar	5.36	7.52	6.45±0.47
Maxillary right first premolar	5.22	7.77	6.84±0.48
Maxillary right canine	6.48	8.43	7.57±0.42
Maxillary right lateral incisor	6.08	7.23	6.62±0.27
Maxillary right central incisor	8.09	8.97	8.51±0.23
Maxillary left central incisor	8.13	9.09	8.53±0.25
Maxillary left lateral incisor	6.12	7.30	6.64±0.27
Maxillary left canine	6.65	8.40	7.59±0.40
Maxillary left first premolar	5.21	7.77	6.83±0.48
Maxillary left second premolar	5.45	7.52	6.44±0.45
Maxillary left first molar	9.17	10.23	9.64±0.26

Table 2: Mesio-distal width of individual tooth in males

Tooth	Min width (mm)	Max width (mm)	Mean±SD (mm)
Mandibular right first molar	9.60	12.15	10.94±0.61
Mandibular right second premolar	5.79	8.15	6.92±0.48
Mandibular right first premolar	5.89	8.31	7.03±0.46
Mandibular right canine	6.20	7.76	6.89±0.35
Mandibular right lateral incisor	4.97	6.70	6.04±0.36
Mandibular right central incisor	4.67	6.26	5.36±0.33
Mandibular left central incisor	4.66	6.26	5.37±0.33
Mandibular left lateral incisor	4.97	6.80	6.03±0.36
Mandibular left canine	6.20	7.77	6.92±0.33
Mandibular left first premolar	5.92	8.30	7.05±0.46
Mandibular left second premolar	5.79	8.05	6.88±0.46
Mandibular left first molar	9.79	12.03	10.97±0.60
Maxillary right first molar	9.92	11.14	10.49±0.31
Maxillary right second premolar	5.49	7.32	6.49±0.39
Maxillary right first premolar	5.82	7.85	6.98±0.38
Maxillary right canine	7.15	8.82	7.88±0.37
Maxillary right lateral incisor	5.91	7.14	6.52±0.33
Maxillary right central incisor	7.80	9.13	8.38±0.38
Maxillary left central incisor	7.50	9.16	8.37±0.38
Maxillary left lateral incisor	5.88	7.10	6.53±0.32
Maxillary left canine	7.16	8.82	7.86±0.35
Maxillary left first premolar	6.07	7.85	6.97±0.38
Maxillary left second premolar	5.29	7.89	6.48±0.43
Maxillary left first molar	9.97	11.09	10.49±0.29

Table 3: Comparison of tooth width of mandibular arch between female and male

Tooth	Gender	Mean±SD (mm)	S.E. Mean	P Value
Mandibular right first molar	F	10.57±0.24	0.031	P<0.000*
	M	10.94±0.61	0.079	
Mandibular right second premolar	F	6.82±0.51	0.066	P =0.281
	M	6.92±0.48	0.061	
Mandibular right first premolar	F	6.91±0.48	0.061	P =0.156
	M	7.03±0.46	0.060	
Mandibular right canine	F	6.65±0.45	0.058	P =0.002*
	M	6.89±0.35	0.044	
Mandibular right lateral incisor	F	5.87±0.42	0.054	P =0.017*
	M	6.04±0.35	0.045	
Mandibular right central incisor	F	5.35±0.44	0.056	P =0.894
	M	5.36±0.34	0.043	
Mandibular left central incisor	F	5.33±0.42	0.054	P =0.556
	M	5.37±0.33	0.042	
Mandibular left lateral incisor	F	5.87±0.41	0.052	P =0.032*
	M	6.03±0.36	0.047	
Mandibular left canine	F	6.62±0.47	0.060	P<0.000*
	M	6.92±0.33	0.042	
Mandibular left first premolar	F	6.89±0.48	0.062	P =0.084
	M	7.05±0.46	0.058	
Mandibular left second premolar	F	6.87±0.52	0.066	P =0.788
	M	6.88±0.46	0.059	
Mandibular left first molar	F	10.59±0.24	0.031	P<0.000*
	M	10.97±0.60	0.077	

F=female, M= male, \*p <0.05 significant

Table 4: Comparison of tooth width of maxillary arch between male and female

Tooth	Gender	Mean±SD (mm)	S.E. Mean	P Value
Maxillary right first molar	F	9.59±0.22	0.028	P<0.001
	M	10.49±0.31	0.039	
Maxillary right second premolar	F	6.45±0.47	0.061	P =0.660
	M	6.49±0.39	0.051	
Maxillary right first premolar	F	6.84±0.48	0.061	P =0.087
	M	6.98±0.38	0.048	
Maxillary right canine	F	7.57±0.42	0.054	P<0.000*
	M	7.88±0.37	0.048	
Maxillary right lateral incisor	F	6.62±0.27	0.035	P =0.071
	M	6.52±0.33	0.042	
Maxillary right central incisor	F	8.51±0.23	0.029	P =0.020*
	M	8.38±0.38	0.048	
Maxillary left central incisor	F	8.53±0.25	0.032	P =0.005*
	M	8.37±0.38	0.049	
Maxillary left lateral incisor	F	6.64±0.27	0.035	P=0.032*
	M	6.53±0.32	0.041	
Maxillary left canine	F	7.59±0.40	0.052	P <0.001*
	M	7.86±0.35	0.045	

Maxillary left first premolar	F	6.84±0.48	0.062	P =0.098
	M	6.97±0.38	0.049	
Maxillary left second premolar	F	6.44±0.45	0.057	P =0.624
	M	6.48±0.43	0.055	
Maxillary left first molar	F	9.64±0.26	0.033	P <0.001*
	M	10.49±0.29	0.038	

F=female, M= male, \*p <0.05 significant

Table 5: Comparison of tooth width between right and left side of both arches in females

Arch	Tooth notation	Right (mm) Mean±SD (n=60)	Left(mm) Mean±SD (n=60)	p-value
Maxillary	First Molar	9.64±0.26	9.59±0.23	0.315
	Second Premolar	6.44±0.45	6.45±0.47	0.924
	First Premolar	6.84±0.48	6.84±0.48	0.937
	Canine	7.59±0.40	7.57±0.42	0.783
	Lateral Incisor	6.64±0.27	6.62±0.27	0.670
	Central Incisor	8.53±0.25	8.51±0.23	0.577
	First Molar	10.59±0.24	10.57±0.24	0.634
	Second Premolar	6.86±0.52	6.82±0.51	0.698
Mandibular	First Premolar	6.89±0.82	6.91±0.48	0.909
	Canine	6.62±0.0.47	6.65±0.45	0.720
	Lateral Incisor	5.87±0.41	5.87±0.42	0.942
	Central Incisor	5.33±0.43	5.35±0.44	0.769

\*p <0.05 significant

Table 6: Comparison of tooth width between right and left side of both arches in males

Arch	Tooth notation	Right(mm) Mean±SD (n=60)	Left(mm) Mean±SD (n=60)	p-value
Maxillary	First Molar	10.49±0.29	10.49±0.31	0.990
	Second Premolar	6.48±0.43	6.49±0.39	0.960
	First Premolar	6.97±0.38	6.98±0.38	0.880
	Canine	7.86±0.35	7.88±0.37	0.837
	Lateral Incisor	6.53±0.32	6.52±0.33	0.953
	Central Incisor	8.37±0.38	8.38±0.38	0.897
	First Molar	10.97±0.60	10.94±0.61	0.813
	Second Premolar	6.88±0.46	6.92±0.48	0.663
	First Premolar	7.05±0.46	7.03±0.46	0.842
	Canine	6.91±0.33	6.89±0.35	0.674
Mandibular	Lateral Incisor	6.03±0.36	6.04±0.36	0.843
	Central Incisor	5.37±0.33	5.36±0.34	0.891

\*p <0.05 significant

The largest sexual dimorphism in mesio-distal crown dimension was exhibited by the maxillary molars (0.88mm) followed by mandibular molars (0.38 mm), similarly in anterior tooth segment the maxillary canines (0.29 mm) followed by the mandibular canines (0.27 mm).

In both genders the maxillary first premolars exhibits greater width than the maxillary second premolars,

averaging 0.42 mm. In the mandibular arch, the lateral incisors were wider than the central incisors, by an average dimension of 0.67 mm in males and 0.53 mm in females. In the mandibular arch, the mean mesio-distal crown dimension of the central incisors was less than that of the lateral incisors for both the genders. In mandibular arch, the mean mesio-distal crown dimension of the first premolars was greater than that of the second premolars for males but almost same for females. In both males and females, the SD of tooth size measurement showed that variability differed between individual teeth.

### DISCUSSION

In the present study, the mean mesio-distal width of the individual tooth showed larger tooth size in males as compared to females except for maxillary central and lateral incisor. This is similar to the study done in Nepalese population by Shrestha R,<sup>15</sup> in Bangladeshi population by Khan et al.<sup>16</sup> The study showed that teeth in males, with the exception of the mandibular 2<sup>nd</sup> premolar, mandibular 1<sup>st</sup> premolar, mandibular central incisors, maxillary 2<sup>nd</sup> premolar, maxillary 1<sup>st</sup> premolar, maxillary right lateral incisors, had significantly greater mesio-distal crown width than those in females p value <= 0.05 table 3 and 4, which is similar as reported by Kundi<sup>17</sup> in his study.

There were no significant differences in the mesio-distal dimensions as compared to the right and left side in both females and males as shown in table 5 and 6. This was similar to the studies done by Khan et al<sup>16</sup> in Bangladeshi population. This result is in contrary to the study done by Shrestha R<sup>15</sup> in Nepalese population, which showed significant differences in the size of maxillary first molars, maxillary second molars, mandibular central incisors and mandibular lateral incisors, which were larger in right side. These differences could be due to the variation in distribution of different ethnic groups in samples collected. Mahmoud NM<sup>4</sup>, Lavelle et al.<sup>1</sup> and Lundstoum<sup>18</sup> also found definite differences between right and left side teeth measurements.

The results obtained in this study will provide useful clinical information to diagnose and frame treatment planning for orthodontic patients of province II of Nepal. This will help orthodontist to achieve good treatment results. As Nepal is a country with ethnic diversity this study can be extended to other provinces with larger sample size.

### CONCLUSIONS

From the findings, it could be concluded that, the differences between the mean mesio-distal dimension

of individual tooth on the right and left sides were comparable. The mean mesio-distal crown dimensions of the permanent dentition of males were larger than that of females for each type of tooth except maxillary central and lateral incisor.

### CONFLICT OF INTEREST

None declared

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