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MOYER'S MIXED DENTITION PREDICTABLE VALUES CORRELATION AMONG HINDU CHILDREN OF BHOPAL CITY.

[1]Nikita Agrawal [1]Senior Lecturer
[2] Shashikiran N D [2]Professor and Head
[3] Shilpy Singla [3]Reader
[4] Vinaya Kumar Kulkarni [4]Professor
[5] Ravi K S [5]Assistant Professor

[1-3] *Department of Pedodontics and Preventive Dentistry, People's college of Dental science and Research center, Bhopal, Madhya Pradesh, India.*
[4] *Department of Pedodontics and Preventive Dentistry, Modern Dental college Indore, Madhya Pradesh, India.*
[5] *Division of Pedodontics, Department of Preventive Dental Sciences, College Of Dentistry (Gregor Campus), King Khalid University Abha- 61471 (Assir Province), Kingdom Of Saudi Arabia*

ABSTRACT:. **Context:** Prediction values based on a particular race cannot be considered as universal. It requires revision according to developing malocclusion and relative size of the tooth. **Aim:** To evaluate the applicability of Moyer's mixed dentition analysis with derivation of regression equation for Hindu children of Bhopal city; **Materials and methods:** The mesio-distal width of permanent mandibular incisors, maxillary and mandibular canine and premolars were measured for 200 children of 12-16 years of age using digital vernier caliper; **Statistical analysis:** Student's 't' test was applied to compare the actual and predicted values and linear regression equations were derived for prediction of tooth size. The correlation between the sums of the canine, premolars in both arches and mandibular incisors was done by using coefficient of correlation (r). The Student's unpaired t test was applied to compare the tooth dimensions between male and female;**Results:** Moyer's prediction values was not an accurate method to estimate tooth dimensions in the present study sample. The mesio-distal crown dimensions in both the arches were larger in males compared to the females ;**Conclusion:** Statistically significant difference was present between predicted values of Moyer's table and the values obtained in present study sample. So uses of newly devised regression equations are recommended for prediction of the combined mesiodistal width of canines and premolars in Hindu populations of Bhopal city.

KEYWORDS: **Correlation, Mixed dentition, Moyers prediction table, Regression equation**

INTRODUCTION

Teeth are reliable sources of information for expressing relationship of a person to a particular racial group [1] with dento-anthropologic structures including size and dimensional proportions.[2] The goal of dental health care providers for children and adolescents constitute proper assessment and management of developing malocclusion. [3] Predicting the size of unerupted teeth in the mixed dentition period is a key factor in management of the developing malocclusion [4] and establishing a valid treatment plan. [5] Mixed dentition space analysis forms an essential part of developing malocclusion assessment [6] and various methods of predicting the mesiodistal widths of unerupted canines and premolars are cited in literature [7] including the arch length deficiency problems.[8] The 75th percentile level of Moyers prediction tables is the universal method used to estimate the mesiodistal crown width of unerupted teeth.[9] It is derived from an unspecified number of North American white children (Caucasian). So its accuracy is questionable when applied to a different ethnic group population. [10]

The purpose of the present study is to test the correlation of Moyers mixed dentition analysis prediction tables among Hindu children of Bhopal city. The objectives were:

1. To compare actual and predicted values and to derive regression equations for space analysis in the present population.
2. To determine the correlation between sums of canine premolar (CPM) width in both the arches with mandibular incisors

3. To compare tooth dimensions of male and female subjects.

Materials and Method:

Stratified random sampling was done where 200 adolescent children (aged 12-16 years) of Bhopal city were selected out of 1569 children examined from 4 public schools and 2 dental camps organized by Department of Pedodontics, People's College Of Dental Sciences andRC, Bhopal . The inclusion criteria for the subjects were as follows: All fully erupted permanent teeth (except second and third molars) present in the maxillary and the mandibular arches, congenital craniofacial anomalies should be absent, no previous history of orthodontic treatment and dentition should be without caries, restorations, or age-related attrition. Subjects should belong to Hindu community rendering localization of samples. The informed consent was obtained from each individual. Dental impressions were made with irreversible hydrocolloid alginate impression material (Marieflex, Septdont Healthcare India) and immediately poured with dental stone (Unident, Australia) to avoid any dimensional changes. The measurement of mesio-distal width of mandibular permanent central and lateral incisors, maxillary and mandibular permanent canines, and first and second premolars were made using digital vernier caliper (Mitutoyo, Kawasaki) with least count of 0.01mm. Values of right and left side were averaged to obtain a single value. The measurements were between two anatomical contact points of each tooth, parallel to the occlusal and vestibular surfaces as described by Moorrees et al. [11] The teeth under study were measured manually and independently by a single investigator.

Statistical Analysis:

Descriptive statistics includes mean and standard deviation (**Table 1**). A student's t test was applied to compare the actual and predicted values. The actual measurements were compared with the predicted values of Moyers probability tables at the 35th, 50th and 75th percentile confidence levels **(Table 2).** The correlation between the sums of the canine, premolars in both arches and mandibular incisors was calculated by coefficient of correlation **(Table 3).** The Student's unpaired t test was applied to compare the male and female tooth dimension (Table 4). The regression equations used were as follows:

$$y = a + bx$$

(a and b are regression coefficients; x = summed width of mandibular incisors; y = summed width of canine and premolars).

Results

Moyers prediction values at 35th, 50th and 75th percentile confidence levels were not an accurate values to estimate tooth dimension of permanent canine and premolars in present sample. Variation was present in the mesiodistal tooth dimensions between males and females. Mesiodistal dimensions in the buccal segments of maxillary and mandibular arches were larger in males than in females with P values 0.0478 and 0.0001 respectively. From this data a new regression equations were derived for male and female subjects separately for predicting tooth dimension in the Hindu community children of Bhopal population.

Male:	**Maxilla -**	**Y = 17.272 + 0.183X**
	Mandible -	**Y= 13.914 + 0.297X**
Female:	**Maxilla -**	**Y= 17.151 + 0.173X**
	Mandible -	**Y=12.452 + 0.349X**

Discussion

According to Butler's field concept of tooth morphology "The teeth are repeated organs that occupy different positions in a continuous morphogenetic field".[12] This signifies the correlation between size of the teeth to genetics and environment.[10] Racial and gender-based mixed dentition space analyses needs revision once in every generation (approximately 30 years) due to changing trends in malocclusion and tooth size.[13] This accounts for various important factor affecting the alignment of teeth in the bony arches and the development of occlusion during transition of the dentition. [14] The reliability of study based on pooled data is characteristics of sample chosen like uniform ethnicity (Hindu community) and sample size. [15]

Tooth dimension studies on other population revealed variability as reported by Schirmer et al in North Europeans, [16] Alhaija et al in Jordanian subjects, [17] and Kuswandari et al in Indonesian Javanese children, [18] where Moyers prediction tables underestimated the actual mesiodistal widths of upper canine premolar segments in both the sexes. In the present study, Moyers prediction tables at 75th percentile value overestimated the tooth dimensions, except for the upper canine premolar segment of females. However, at 50th and 35th percentile values, they underestimated the actual mesiodistal widths of upper and lower canine premolar segments in both the sexes. This was in accordance with the study done by Durgekar et al. in south Indian school children. [10] This signifies that the racial and ethnic differences are evident with respect to tooth size. The reasons not been clearly elucidated, though genetic factors play a major role, and nutrition and environmental exposure during tooth development might have secondary roles. [15] Moyers probability tables are therefore neither accurate nor

Table I: Mean and SD for various tooth groups in different groups of subjects

T group	Gender	Total no:	Mean (mm)	S.D (mm)
LI*	M	78	22.08	1.897
UCPM**	M	78	21.33	1.335
LCPM***	M	78	20.97	1.497
LI	F	122	21.96	1.831
UCPM	F	122	20.96	1.252
LCPM	F	122	20.13	1.464

*Lower Incisors Width, **Upper Canine Premolar Width, ***Lower Canine Premolar Width, **M-**Male, **F**-Female.

Table II: Student t test for comparison of actual and predicted values

Gender	Arch	75^{th} percentile		50^{th} percentile		35^{th} percentile	
		"t" values	(P)	"t" values	(P)	"t" values	(P)
M	Max*	2.7985	0.0100	4.9287	0.0001	6.1365	0.0001
M	Mand**	2.8942	0.0080	4.220	0.0003	5.0068	0.0001
F	Max*	4.1917	0.0003	6.2080	0.0001	7.2958	0.00001
F	Mand**	5.9515	0.0001	7.7768	0.0001	8.7789	0.00001

M-Male, **F**-Female, *Maxillary, ** Mandibular

Table III. Coefficient of correlation (r), Regression constants (a, b), Coefficient of determination (r^2) for various tooth groups in different groups of subjects

T group	Gender	r	a	b	r^2
UCPM*	M	0.3714	17.272	0.183	0.1379
LCPM**	M	0.4779	13.914	0.297	0.2283
UCPM*	F	0.3709	17.151	0.173	0.1375
LCPM**	F	0.5467	12.452	0.349	0.2988

*Upper Canine Premolar, **Lower Canine Premolar,**M-**Male, **F**-Female.

Table IV: Comparison of mesiodistal width of group of teeth between male and female subjects.

Sum of teeth	Sex	Mean (mm)	SD (mm)	SE difference (mm)	p value
LI*	M	22.08	±1.897	0.544	0.0147^{+}
	F	21.96	±1.831		
UCPM**	M	21.33	±1.335	0.186	0.0478^{+}
	F	20.96	±1.252		
LCPM***	M	20.97	±1.497	0.214	0.0001$^{€}$
	F	20.13	±1.464		

*Lower Incisors Width, **Upper Canine Premolar Width, ***Lower Canine Premolar Width, M-Male, F-Female.
$^{+}$significant, $^{€}$highly significant

applicable when tested on a population of different ethnic origin. [7]

In tooth dimensions apart from racial differences, the descriptive statistics **(Table 2)** showed a statistically significant difference between the actual and predicted values at the 75th, 50th and 35th percentile for males and females, (where p<0.01 was highly significant) in both the arches. The researches support that racial differences are likely to be important variables in tooth size prediction equations. [7]

The coefficients obtained in this study (Table 3) were highest in case of female mandibular segment; the Coefficient of correlation (r) and Coefficient of determination (r^2) were 0.54 and 0.29 respectively. This was slightly higher than the study done by Godfrey et al in northeastern Thailand population. [19] The correlation coefficient signifies the polygenes that determine tooth size shared between the mandibular incisors and the canines and premolars thus justify its estimation prior to the eruption. Coefficient of determination indicated accuracy of regression equation showing more precise equation which can be attributed to the ethnic diversity and sample size. [15]

The value of standard errors (signifies degree of accuracy) for the new equations ranges from 0.186 mm to 0.544 mm **(Table 4)** which was lower as compared to the study done by Chandna et al which ranged from 0.63 mm to 0.83 mm. [7] Statistically significant sexual dimorphism was present in tooth size, as the mesiodistal dimensions of teeth were larger in males compared to the female subjects in both upper and lower canine premolar segments (P=0.0478 and P=0.0001 respectively) and in the mandibular incisal segment (P=0.0147). Similar results were seen in the studies, where mandibular segment demonstrate greater mesiodistal width amongst all the teeth. [20,21] Gran et al hypothesized the tooth dimension expression through X- linked inheritance where 2X chromosomes in females provide a measure of control.[22,23]

The results indicate that the Moyers probability levels would not be as accurate for the present study samples. Therefore for accurate predictions, new linear regression equations were formulated based on the data derived from the present sample.

Multiple regression analysis is the best non radiographic predictor using the mandibular permanent incisors as a predictor variable. The use mandibular permanent incisors dimensions had several advantages like they erupt early in the mixed dentition, can be easily measured, show little variability in size, and is directly in between of most space-management problems. [15] Radiographic measurements are meticulous due to errors like elongation, poor quality intra-oral films or rotated tooth. The use of digital caliper is more accurate method of measuring tooth dimensions and reduces random errors while measuring.[10]

Thus regression equation is simple and relatively accurate method for predicting mesio-distal width of teeth. [7] Racial and ethnic differences require proposed method to be tested in other subjects to confirm its applicability and consistency with large group populations.[10]

CONCLUSION

1. Present population demonstrated statistically significant sexual dimorphism in tooth size where mesio-distal crown dimensions were larger in males.
2. Moyers prediction tables were not an accurate method to estimate actual widths of unerupted canine premolar in both arches, in Hindu children of Bhopal City.
3. The linear regression equations are easy, non radiographic and precise methods for predicting the dimensions of unerupted teeth. However, the accuracy of the proposed prediction aids should be further tested in other ethnic groups of India.[15]

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Corresponding Author

Dr Nikita Agrawal
People's College of Dental Sciences and Research centre,
People's Campus, Bhanpur, Bhopal
Phone No.: 9826531777
E-mail : dr.nikita.agrawal@gmail.com