PREDICTION OF SIZE OF UNERUPTED PERMANENT CANINES & PREMOLARS IN SUBJECTS OF MADHYA PRADESH.

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The aim of the study was to derive prediction equations and probability tables for combined mesiodistal crown diameters of canines & premolars on one side of dental arch from that of four lower permanent incisors for Malwa males & females using simple linear regression. The study was performed using 200 dental models of Malwa subjects which were randomly selected out of 900 students of two local high schools, 100 males & 100 females with age range 13-19 yrs. Prediction table to estimate the combined mesiodistal width of unerupted permanent canines and first and second premolars is suggested.

Mixed dentition analysis is an important part of early orthodontic treatment. In mixed dentition patients clinician needs to know how much space will be required for unerupted canines & premolars and how much lee way is available.

Two main approaches have been used to estimate mesiodistal width of unerupted permanent canines & first and second premolars.

1. Measurement on radiographs.
2. Use of regression equation that relates the width of erupted teeth to width of unerupted teeth.

The radiographic method requires accuracy in technique to avoid miscalculation & if crowns are rotated in their crypts then measurement are impossible.

The simple & more accurate estimate can be obtained by using regression schemes.

The permanent mandibular incisors have been found to be most reliable indices of size of remaining permanent teeth of both arches

The reliability of prediction tables based on regression schemes i.e. Moyer's tables[1] & Johnston and Tanaka[2] equation are fairly good for population of Northern European Group from which their data was obtained but their accuracy could be in questions when applied to population of different ethnic background.

This study is undertaken to find the correlation between combined mesiodistal width of permanent canines & premolars (maxillary & mandibular) and mandibular incisors in a cosmopolitan sample of Indore Malwa region of Madhya Pradesh and to derive new prediction equation and tables for local population.

MATERIAL & METHODS

900 students of two high schools of Indore were examined, out of which two hundred were selected randomly for the study (100 male & 100 female), upper and lower impression of all 200 students were taken and study models were prepared, the criteria for selection were as follow .-

1. Subject had to be of Malwa background for at least one prior generation.
2. The teeth measured had to be free of restoration, fracture, proximal caries, anomaly.
3. A maximum of 19 years of age was used to preclude any discrepancies caused by proximal wear.

The mesiodistal width of mandibular permanent incisor, maxillary and mandibular permanent canines and premolars on each side of dental arch were measured.

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A good quality spring loaded needle pointed divider was held parallel to occlusal surface if tooth appeared to be in normal alignment otherwise its mesiodistal width was measured through the proximal points where the contact with adjacent tooth would normally occur. The dimensions to near one quarter millimeter were taken & recorded.

The data were used to generate regression equations specifically least square regression equations of the form Y = A + B (X) were calculated for each sex.

Y1 = combined mesiodistal width of mandibular canines & premolars in one quadrant.

Y2 = combined mesiodistal width of maxillary canines & premolars in one quadrant.

X = measured mesiodistal width of four mandibular permanent incisors.

A & B = constants which were derived (A is the coefficient for Y intercept & B is coefficient for slope of regression line)

These equations were derived from coefficient of linear correlation (r).

RESULTS

Descriptive Statistics standard error of estimate, absolute mean error, regression equation, sexual

Table - 1

Combined Mesiodistal Crown Diameters (mm) For Unilateral Permanent Canine-Premolars And Four Mandibular Permanent Incisors.

Tooth Group	Sex	N	Mean in mm	SD in mm	Range	Sex diff. (M F)	% Dimorphism
X	M F	100 100	22.8475 22.6025	1.0901 1.1743	20.00-26.25 20.50-25.50	0.245	1.08
Y2	M F	100 100	21.21875 20.72875	1.169184 0.968577	18.00 23.75 18.50 24.25	0.49*	2.36
Y1	M F	100 100	20.5085 19.923	0.8040 0.9639	18.00-22.25 17.25-21.87	0.5847**	2.94

** Statistically significant sex difference at P < 0.01

Table -2

Simple Linear Regression Analysis Of Combined Mesiodistal Crown Diameters Of Unilateral Permanent Canine - Premolars On Combined Mesiodistal Crown Diameters Of Mandibular Permanent Incisors.

Variables	*Sex*	*N*	*Regression coefficient*			*r*	*R2*	Standard Error of Estimate
			A	B	P(B)			
Y2 : X	M	100	8.3976	0.5612	<0.01	0.69633	0.49	0.85
Y2 : X	F	100	13.8494	0.3044	<0.01	0.3689	0.13	0.91
Y1 - X	M	100	7.8461	0.5542	<0.01	0.7376	0.54	0.74
Y1 - X	F	100	9.7453	0.4503	<0.01	0.5486	0.30	0.81

*P- value associated with the slope of the regression line.

Table - 3 (iii): Differences (mm) Between True And Predicted Values And Absolute Mean Errors (mm) of the Dependent Variables At 50th Percentile Level.

Dependent Variable	Sex Difference (mm)	SD for Mean error (mm)	Absolute	% of observation with absolute error (mm)		
				< 0.500	0.501-1. 00	> 1. 000
Yl	Male	0.8335	0.6696	41	35	24
Yl	Female	0.9163	0.72265	42	34	24
Y2	Male	0.7501	0.6066	45	34	21
Y2	Female	0.8086	0.6542	46	33	21

Table - 7: Person's product-moment correlation coefficient for different ethnic groups

Study	Ethnic Group	X			YJ : X		
		M	M+F,	F	M	4f-F	F
Ballard, Wylie	Caucasian					0.64	
Hixon, Oldfatlier	Caucasian					0.69	
Bolton	Caucasian					0.65	
Moorrees, Reed	Caucasian		0.51			0.38	
I'maka, Jolmsoii	Caucasian		0.625			0.648	
Smith, King, et al	Caucasian					0.66	
Ferguson, et al	American		0.630			0.706	
Frankel, Benz	American	0.72		0.61	0.79		0.66
Zilberman et al	Israeli		0.64			0.66	
Yuen et al	Hong Kong	0.79		0.64	0.77		0.69
Present Study	Malwa	0.69		0.36	0.73		0.54

dimorphism and correlation coefficient is shown in Table-1, 2, 3 (iii), 7, 8 & 9.

DISCUSSION

It is known that tooth size varies among different races and ethnic groups and prediction using tables/equations based on data derived from different ethnic groups may not suffice for other races/ethnic groups.

It is obvious that a prediction method which gives over prediction of 2-3 mm can lead orthodontist to go for extraction therapy in border line mixed dentitions cases, thus it is necessary to rely on prediction methods which based on data derived from populations for whom prediction are to be made. Sexual dimorphism has also been confirmed in several studies[3,4].

The correlation coefficient between combined width of canines & premolars and mandibular permanent incisors for Malwa children were found to be 0.696 (Y2 with X) and 0.737 (Y1 width X) for males & 0.368 & 0.548 respectively for females.

Table – 8: Proposed prediction table for combined mesiodistal width of unerupted permanent maxillary and mandibular 3,4,5 in one quadrant (at 50th percentile level)

Sum of ↓ incisor	Male		Female	
	Y1	Y2	Y1	Y2
20	18.93	19.62	18.75	19.94
20.5	19.21	19.90	18.98	20.01
21	19.48	20.18	19.20	20.20
21.5	19.76	20.46	19.43	20.39
22	20.04	20.74	19.65	20.55
22.5	20.32	21.02	19.88	20.70
23	20.59	21.30	20.10	20.85
23.5	20.87	21.59	20.33	21.00
24	21.18	21.87	20.55	21.15
24.5	21.42	22.15	20.78	21.31
25	21.70	22.43	21.00	21.46
25.5	21.98	22.71	21.23	21.61
26	22.26	22.99	21.45	21.76
26.5	22.53	23.27	21.68	21.92

* Measurement in mm

These figures except for female maxillary arch were comparable to other published data (Table-7).

Moorey & Reid[5] reported figures of 0.51 (Y2 with X) and (Y1 with X), other studies of caucasians[5,6,7,8] reported higher values for both arches (r = 0.63 to 0.69), while Israeli children[9] were found to have comparable coefficient. Table-7 Shows the correlation coefficient for different ethnic group as reported earlier in literature. Using the values of coefficient A & B listed in Table-2 for equation for prediction of upper and lower, canines and premolars in each sex were derived as follows :-

Male : $Y2 = 8.397 + 0.5612\,X$

Male : $Y1 = 7.8461 + 0.5542\,X$,

Female : $Y2 = 13.8494 + 0.3044\,X$

Female : $Y1 = 9.7453 + 0.4503\,X$

When applied these equations to local subjects about 68% of the subjects will have a true sum of canines and premolars value in the range of 1 SEE below to 1 SEE above the mean predicted size.

The standard error of estimate (SEE) for Malwa children was found to range from 0.74 mm to 0.91 mm comparable to errors reported earlier in literature[10,1,11,7]. The study showed absolute mean error ranged from 0.6 to 0.72 mm which was equal to error reported by Yoen KKW et al[12] for Hongkong Chinese.

The standard error of estimate and absolute mean error in this study point to the fact that prediction models for females were less precise than males, similar findings have been reported by Frankel HH et al[10] and Staley RN et al[11].

It was observed (Table-3(iii)) that absolute mean error provided by prediction table at 50th percentile level was least as compared with absolute mean error at 75th, 65th & 35th percentile level, that is why we proposed 50th percentile level of our prediction table for different sexes in Malwa region almost 80-86% of cases would lie within 1 mm of error. It was observed that Tanaka & Johnston[2] prediction table over predicts even at 25th percentile level in Malwa Sample.

Reliability of suggested prediction table can further be authenticated by a study taken on mixed dentition subjects with standardized radiographic studies.

CONCLUSIONS

The correlation coefficient between combined mesiodistal width of four mandibular permanent incisors and that of maxillary and mandibular canines and premolars ranged from 0.69 to 0.73 in males and 0.36 to 0.54 in females.

1. Standard error of estimate for each sex was computed which ranged from 0.74 to 0.85 mm in males & 0.81 to 0.91 in female.
2. Prediction table has been derived similar to those of Moyer's[1] for prediction of combined mesiodistal width of canines and premolars (upper & lower) from that of four mandibular permanent incisors at various percentile levels for males & females. It was found that prediction tables serves best at 50th percentile level.
3. Tanaka & Johnston[2] prediction equations was applied to local sample and it was found that it over predicts even at 25th percentile level, our new tables serve better.

The prediction table have been found quite reliable for clinical application in diagnosis and treatment planning for mixed dentition orthodontic patients having tooth material-space discrepancy problems.

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