ORIGINAL ARTICLE POJ 2011:3(1) 16-20

Application of Moyer's prediction table in a sample of Karachi population

Irfan Qamaruddin Adnani[a], Fazal Shahid[b], Sana Zaman[c], Fahad Ahmed[d], Misbah Saleem[e]

Abstract

Introduction: Estimation of the mesio distal (MD) widths of unerupted teeth is essential in accurate diagnosis of mixed dentition orthodontic cases. Hence the purpose of this study was to evaluate the applicability of the Moyer's method of prediction and to develop a new prediction method for Karachi based population.

Material and Methods: A study was conducted on a sample of 200 patients of Karachi population, age range being 13-25 years with complete permanent teeth except third molars. MD dimensions of permanent mandibular incisors, maxillary/mandibular canines and premolars were measured using digital calipers with a calibration accuracy of 0.01mm. Paired sample T- test was carried out to compare the measured tooth sizes with Moyer's prediction table. Linear regression analysis was performed to correlate the relationship of lower incisors, maxillary and mandibular posterior segments with the established norms.

Results: Significant difference ($p < 0.05$) was found between the measured MD dimension of the buccal segment in maxillary arch in both males and females when compared with predicted width by Moyer's at the 75th percentile level. New linear regression equations were derived for both genders to allow accurate tooth size prediction for Karachi's population. Correlation coefficients between the total MD widths of mandibular permanent incisors and that of maxillary/mandibular canines and premolars were found to be 0.712 and 0.539 in males and 0.880 and 0.875 in females.

Conclusions: Moyer's prediction table is not an accurate method to estimate tooth dimensions in a Karachi based sample.

Keywords: Mixed dentition analysis, linear regression, mesio-distal widths

Introduction

Malocclusion is a very common problem in all populations, the frequency of which is well-known in modern countries. Most of the cases of malocclusion begin during mixed dentition stage.[1] In mixed dentition cases, the main aim is to maintain arch integrity for the eruption of permanent teeth. Spacing or crowding usually occurs when there is a discrepancy between the size of developing dentition and amount of space in the arch.[2]

The prediction of the size of unerupted canines and premolars in mixed dentition cases help in diagnosis as well as treatment. Accurate estimation of the sizes of unerupted canines and premolars offer a diagnostic value for tooth size to arch length discrepancies.

The determination of the size of canines and premolars prior to their eruption can be done with mixed dentition space analysis. Thus mixed dentition space analysis is an important part of an orthodontic evaluation. These analyses not only assess the amount of space required for the alignment of unerupted permanent teeth in the dental arch but also help to find whether the treatment plan would involve eruption guidance, serial extractions, space regaining, space maintenance, or periodic observation.[2-6]

There are different methods used to estimate the size of unerupted canines and premolars. These include, radiographic method in which mesio-distal width of un erupted permanent

[a] BDS, FCPS, Associate Professor, Department of Orthodontics, Baqai Dental College, Karachi

[b] Corresponding author; BDS, Lecturer, Department of Orthodontics, Baqai Dental College, Karachi.
E-mail: fzl_shahid@yahoo.com

[c,d,e] House officers, Baqai Dental College, Karachi.

dentition is directly measured from peri-apical radiogram and panorex.[7-9] The non radiographic methods include estimation through prediction equation, comparison with proportionality tables[10-12] or a combination of the above.

Out of these methods, Moyers prediction table is the most commonly used.[13-15] as no radiographs are required. Despite its advantages, this prediction table is based on the data derived from North American white children; therefore its applicability to other ethnic groups is questionable.[13-16]

The purpose of this study was to test the applicability of Moyer's prediction table and develop a prediction equation for Karachi based population.

Material and Methods

The sample of this study was collected randomly from the Department of Orthodontics, Baqai Medical University, Karachi. The records comprised of casts of two hundred patients (100 males and 100 females), their age ranging from 13-25 years. The criteria of selection were that all permanent teeth be present (excluding third molars) in both arches and no history of previous orthodontic treatment. Patients with carious teeth, missing/supernumerary teeth, micro/macrodontia, tooth attrition and any other craniofacial malformations were excluded from the study.

Mesio-distal widths of both maxillary and mandibular permanent incisors, canines, first and second premolars were measured using digital calipers (Mitutoyo digital caliper) with an accuracy calibration of 0.01mm. The measurements were taken by two investigators separately.

Data entry and analysis was carried out using the SPSS version 17. Descriptive statistics presented as mean, standard deviation (SD), range and standard error of the mean were calculated in both arches (Table I).

Linear regression was used to derive equations for prediction of the sum of mesio-distal widths of maxillary/mandibular canines and premolars. Combined width of mandibular incisors was considered as independent variable while mandibular and maxillary buccal segment widths were taken as dependent variables. The coefficient of correlation (r) predicted the relationship between sum of canines and premolars in both arches with the sum of mandibular incisors. Coefficient of determination (r^2) showed the accuracy of regression (Table II).

Table I. Descriptive statistics for the sum of the measured MD width of mandibular incisors and maxillary/mandibular buccal segment

Gender	Tooth Group	Mean (mm)	SD (mm)	Range (mm)	Standard Error of Mean
Male N=100	Sum of lower incisors	22.715	1.2191	19.5 - 25.5	0.1219**
	Sum of lower 345	21.997	0.9864	18.5 - 25.5	0.0986**
	Sum of upper 345	22.021	0.8201	19.0 - 23.9	0.0820**
Female N=100	Sum of lower incisors	23.115	1.5273	19.5 - 25.5	0.1527**
	Sum of lower 345	21.654	1.1332	19.0 - 23.6	0.1133**
	Sum of upper 345	22.019	0.8857	20.0 - 23.5	0.0886**

Table II. Regression parameters for prediction of summations of MD widths of the maxillary and mandibular buccal segments

Gender	Sum of 3,4,5, Segment	(r)	A	B	(r^2)
Males	Maxilla	0.712	11.137	0.479	0.507
	Mandible	0.539	12.091	0.436	0.290
Female	Maxilla	0.880	10.224	0.510	0.774
	Mandible	0.875	6.652	0.649	0.765

Correlation Coefficient (r), Coefficient of Determination (r^2)

The regression equation was expressed as Y = a +b (x) where Y represented the predicted combined MD width of the buccal segments (dependent variables) and X represented the measured MD width of the mandible incisors (independent variable). Values A and B were constants and SEE was the standard error of estimation (Table III).

Table III. Standard Error of Estimation

Gender	**Sum of 3,4,5, Segment**	**(SEE)**	**95% CI**
Male	Maxilla	0.5786	0.385--0.574
	Mandible	0.8351	0.299--0.573
Female	Maxilla	0.4229	0.455--0.565
	Mandible	0.5519	0.577--0.721

SEE (Standard error of estimation), CI (Confidence Interval)
The paired sample t-test was conducted to compare the mean of MD width of buccal segments from this study and those predicted by Moyer's in both males and female (Table IV).

Results

There was a significant difference ($p<0.05$) between the measured MD dimension of buccal segment in maxillary arch in both genders when compared with predicted width by Moyer's at 75th percentile level. Significant difference was also seen between the measured MD width of maxillary and mandibular buccal segment and their predicted width from Moyer's at 50th percentile level except MD width of mandibular buccal segment in males and females when compared with Moyer's 75th percentile level.

New regression equation was derived separately for both male and female patients to estimate the sum of mesio distal width of permanent canines and premolars with the help of lower four permanent incisors. The predictive equations were as follows:

Male Maxilla Y = 11.137 + 0.479 (x)
Male Mandible: Y = 12.091+0.436 (x)
Female Maxilla Y = 10.224 + 0.510(x)
Female Mandible Y = 6.652 + 0.649 (x)

Discussion

The tooth sizes and facial characteristics differ among the populations. Racial or ethnic specific mixed dentition space analyses require preview or validation at least after every generation. [17-20]

Table IV. Comparison with Moyer's predicted values at 50th and 75th percentile level

Percentile Probability of Male & Female	Paired Differences					t	Sig.(2-tailed)
				95% Confidence Interval of the Difference			
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper		
Female Mandible at 50%	-1.0000	.5401	.1498	-1.3264	-.6736	-6.676	.000**
Female Mandible at 75%	-.3000	.5033	.1396	-.6042	.0042	-2.149	.050**
Female Maxilla at 50%	-1.2308	.5588	.1550	-1.5685	-.8931	-7.941	.000**
Female Maxilla at 75%	-.5846	.4741	.1315	-.8711	-.2981	-4.446	.001**
Male Mandible at 50%	-.8154	.1625	.0451	-.9136	-.7172	-18.090	.000**
Male Mandible at 75%	-.3462	.6253	.1734	-.7240	.0317	-1.996	.069
Male Maxilla at 50%	-.8000	.5228	.1450	-1.1159	-.4841	-5.517	.000**
Male Maxilla at 75%	-.4538	.6240	.1731	-.8309	-.0768	-2.622	.022**

Significant ** $P < 0.05$

Mixed dentition space analysis is the most commonly used method to predict the size of unerupted teeth (canine and premolar).[2-6] This method helps in correct diagnosis as well as treatment planning. Neither over estimation nor underestimation provides a correct treatment plan. The prediction table which is widely used for mixed dentition analysis is derived from a Caucasian population, so its use in other ethnic groups lacks accuracy.[13-16] Hence every ethnic group should have their specific prediction table.

As there is a linear relationship between the sum of lower incisors and upper and lower posterior segments so many population have made linear regression equation for their specific population.[12-13]

New regression equation was derived separately for both genders to estimate the sum of mesio-distal width of permanent canines and premolars with the help of lower four permanent incisors. The regression equation was expressed as Y=a +b(x) where (Y) represented the predicted combined MD width of the buccal segment (dependent variables) and (x) represented the measured MD width of the mandibular incisors (independent variable). Values (a) and (b) were constants (Table II).

Regression equation is a simple method for estimating the mesio distal width of the teeth, however due to ethnic differences this proposed method must be tested in other samples to confirm its applicability.

Conclusions

Prediction of unerupted mesio-distal width of permanent canines and premolars is an important practice for proper diagnosis and treatment planning. Prediction table formulated by Moyer's does not coincide with our population therefore this newly

established equation can be used for an accurate estimation.

References

1. Hixson E H, Old father RE. Estimation of the sizes of unerupted cuspid and bicuspid teeth. Angle Orthod.1958; 28(4):236-40.
2. Hunter WS. Application of analysis of crowding and spacing of the teeth. Dental Clinics of North America. 1978; 22:563-77.
3. Huckaba GW. Arch size analysis and tooth size perdition. Dental Clinics of North America. 1964; 8:431-40.
4. Smith HP, King DL, Valencia R. A comparison of three methods of mixed dentition analyses. The Journal of Pedodontics. 1979; 3(4): 291-302.
5. Staley RN, O'Gorman TW, Hoag JF, Shelly TH. Prediction of the widths of un-erupted canines and premolars. JADA. 1984; 108(2):185-90.
6. Bishara SE, Staley RN. Mixed dentition mandibular arch length analysis: A step by step approach using Hixon-Oldfather prediction method. Am J Orthod. 1984;86(2):130-5.
7. de Paula S, de Oliveira Almeida MA, Lee PCF. Unerupted lower canines and premolars using 45° cephalometric radiography. Am J Orthod Dentofacial Orthop.1995; 107:309-14.
8. Lima EMS, Monnerat ME. Comparação das predições do somatório dos diâmetros mésio-distais de pré-molares e caninos permanentes inferiores com seus valores reais. Rio de Janeiro, Brazil: Universidade Federal do Rio de Janeiro; 1992.
9. Lima MF, Monnerat ME, Rocha R, Suza TM. Prediction of lower permanent canine and premolars width by correlation methods. Angle Orthod.2005; 75(5):805-8.
10. Van der Merwe SW, Rossouw P, Van Wyk Kotze TJ, Trutero H, Moyers RE. Handbook of Orthodontics. 4th ed. Chicago, Illinois.1988: 235-39.
11. Bernab'e E, Flores-Mir C. Are the lower incisors the best predictors for the unerupted canine and premolars sums? An analysis of a Peruvian sample. Angle Orthod.2005;75 (2):202-7.
12. Tanaka MM, Johnston LE. The prediction of the size of unerupted canines and premolars in a contemporary orthodontic population. JADA. 1974.88: 798–801.
13. Ferguson FS, Marco DJ, Sonnenburg EM, Shakun ML. The use of regression constants in estimating tooth size in the Negro population. Am J of Orthod. 1978; 73(1):68-72.
14. Al-Khadra BH. Prediction of the size of un-erupted canines and premolars in a Saudi Arab population. Am J of Orthod Dentofacial Orthop. 1993; 104(4):369-72.
15. Yuen KK, Tang EL, So LL. Mixed dentition analysis for Hong Kong Chinese. Angle Orthod. 1998; 68 (1):21-8.
16. Van-der-Merwe SW, Rossouw P, Van-Wyk-Kotze TJ, Trutero H. An adaptation of the mixed dentition space analysis for a Western Cape Caucasian population. J Dent Ass S fr.1991; 46(9) :475-9.
17. Warren JJ, Bishara SE. Comparison of dental arch measurements in the primary dentition between contemporary and historic samples. Am J Orthod Dentofacial Orthop.2000;119 :211-5.
18. Bishara SE, Khadivi P, Jakobsen JR. Changes in tooth size-arch length relationships from the deciduous to the permanent dentition: A longitudinal study. Am J Orthod Dentofacial Orthop.1995;108: 607-13.
19. Howe RP, McNamara JA Jr, O'Connor KA. An examination of dental crowding and its relationship to tooth size and arch dimension. Am J Orthod. 1983;83:363-73.
20. Doris JM, Bernard BW, Kuftinec MM, Stom D. A biometric study of tooth size and dental crowding. Am J Orthod Dentofacial Orthop. 1981;79:326-36.