RESEARCH PAPER | Medical Science | Volume : 6 | Issue : 4 | April 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

Prediction of Widths of Unerupted Canine And Premolars Using Erupted Incisors And Molars for Population of Rural Area.

KEYWORDS: Mixed dentition analysis, prediction, regression equation, unerupted canine and premolars.

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ABSTRACT *Introduction: Space management in mixed dentition stage is of prime importance. Predicting the size of unerupted teeth during the mixed dentition period is a critical factor in managing the developing occlusion of a growing child. In present study, we aimed to determine linear regression equation for predicting the width of maxillary and mandibular permanent canines and premolars, based on the widths of mandibular permanent incisors and lower first permanent molars. Methods: Sample consisted of 300 dental casts, taken from population of rural area(150 males and 150 females). Mesiodistal widths of tooth were measured with an electronic digital caliper. Results: showed difference between the actual sum of width of mandibular canine and premolars (SCMP) and values of Tanaka and Johnston analysis.*

INTRODUCTION:

Orthodontic treatment planning and diagnosis is based on analysis of mixed and permanent dentition. Mixed dentition analysis is of critical step, it is that stage where both the deciduous and permanent teeth are present simultaneously. Treatment planning started from the mixed dentition leads to better results as early interception of the problems and the measures to prevent from developing established malocclusion is taken care off. Space management in this stage is of prime importance and if well managed and thoroughly planned, impending problems such as crowding, impacted teeth can be prevented. In managing the developing occlusion of a growing child is very critical by predicting the size of unerupted teeth during mixed dentition. The ability to predict the size of unerupted posterior teeth in mixed dentition is necessary if good treatment plan is to be established.[1,2]

The methods that are commonly used predicting the sizes of unerupted teeth are radiographic methods based on periapical[2,3] and 45°cephalometric radiographs,[4] non radiographic methods using prediction tables like Moyer's mixed dentition analysis, [5] Tanaka-Johnston analysis,[6]combination of both methods. [7-9]The radiographic methods tend to be inaccurate because of magnification errors. The prediction tables frequently lead to erroneous results because these methods have derived based on research on people of different ethnic origin. To avoid these complicating factors, statistical correlation methods such as regression equations have been proposed and most often applied.[10, 11] Several linear regression equations have been proposed and published for populations of different ethnic origins. Further, sexual dimorphism and racial variation has been confirmed in several studies as tooth size is greater in males than females.[10-14]

Also, different combinations of erupted teeth have been used previously to predict the width of unerupted canine and premolars. Amongst these the combination of the sum of permanent mandibular four incisors and first molars of both sides gave the highest correlation with the actual width.[11]

However, for this population of rural area no such study had been done in the past , hence our aim was to formulate a regression equation for this population and to compare the predicted values obtained from the values obtained by Tanaka and Jonston, so to check the applicability of various mixed dentition analysis for population of rural area.

MATERIALS AND METHOD:

Formulation of Regression Equation:

Sample:

The sample included were 300 study models (150 males and 150 females) of patents who had reported to the out –patient Department of Orthodontics, Sharad Pawar Dental College & Hospital, (DMIMS D U), Sawangi, Wardha.

Inclusion criteria:

1. Subjects were natives to rural area in wardha District.

2. Angles class I and II molar relationship with age range between 14 to 22years.

3. No history of orthodontic treatment till completion of growth.

4. All permanent teeth (except third molars) present with no attrition, restoration, missing teeth, abrasion, caries, fractures, congenital defects.

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Data collection method:
This study had been conducted at Sharad Pawar dental college & Hospital, Wardha, Maharashtra.

Individuals for the study assessed clinically. Alginate impression of the dentition were made and study models poured with high quality dental stone(type 3). To reduce eye fatigue, an electronic digital caliper (Digimatic) was used, which record to the nearest 0.01 mm. To gain access to the interdental spaces; the measurement tips of the digital caliper were narrowed. The caliper was adjusted to the greatest mesiodistal diameter of the tooth, parallel to occlusal surface and perpendicular to the long axis of the tooth and mesiodistal width of teeth were tabulated. This was performed to get sum of incisors and first molars of both sides, sum of incisors and sum of canine and premolars of right and left side.

With the help of stastician, a new regression equation to determine the sum of the mesiodistal widths of the maxillary and mandibular permanent canines and premolars was formulated.[10-15]

The results are based on both sides of the mandibular arch. A new regression equation to determine the sum of mesiodistal widths of the mandibular widths of the mandibular permanent canines and premolars (SCPM) was proposed. The mesiodistal widths of both mandibular first permanent molars plus the mesiodistal widths of the 4 mandibular permanent incisors (SMI) were used as predictors. [10,11,12,14,15]

Results :
Statistical significance was calculated(Table 1) .The result showed a significant statistical difference between the mesiodistal tooth widths of males and females(widths were generally larger in males than in females).

TABLE 1: Mean value of SI,SIM and actual SMCP(maxilla and mandible) of both groups:

Data		mean±SD(mm)	mean±SD(mm)
	N	MALES	FEMALES
SI	150	23±1.35	23±1.42
SIM	150	45.71±2.04	45.00±2.05
SMxCP(MAXILLA)	150	42.76±2.16	42.11±2.18
SMnCP(MANDIBLE)	150	43.44±5.12	41.08±2.36

A linear regression equation was determined to predict the sum of mandibular and maxillary permanent canines and premolars with the mandibular first molars plus the four mandibular incisors as predictors. The equation thus determined was calculated as; y=a+bx where "y" is the dependent variable, i.e. sum of mandibular and maxillary permanent canines and premolars, "x" is the independent variable, i.e. sum of mandibular first molars plus the four mandibular incisors, "a" is the y intercept, and "b" is the slope of the regression. The calculated values of constants "a" and "b" are: Since the goodness of fit of linear models as indicated by R^2 was poor for maxillary arch, outlier analysis was performed using Cook's distance method. The resulting linear expressions after removing the outliers are given in Table 2. A marginal improvement in the goodness of fit of the models was observed after removing the outliers.

TABLE 2: Regression equation of maxillary and mandibular arch for both males and females:

	Maxillary	Mandibular
Male	14.166+0.626x	9.432 + 0.709x
Female	20.777+0.470x	2.836 + 0.849x

Tanaka and Johnston,[6] prediction method is used for prediction of widths of canines and premolars in both arches. The results were formulated and compared with actual values of sum of canines and premolars in both the arches for males and females respectively. The difference between the predicted widths of both arches with Tanaka and Johnston equation and actual widths of canines and premolars were highly significant. Tanaka and Johnston over estimated the actual sizes of canines and premolars in both arches (Table3).

TABLE 3: Comparison of SMCP of values obtained by Tanaka Jonston and actual values (mean±SD):

Data	ACTUAL		TANAKA AND JOHNSTON	
	MALES	FEMALES	MALES	FEMALES
SMxCP	42.76±2.16	42.11±2.18	45.49±1.35	45.15±1.42
SMnCP	43.44±5.12	41.08±2.36	44.49±1.35	44.15±1.42

DISCUSSION:
The concept of preventive and interceptive orthodontics in the field of orthodontics had led to the importance of mixed dentition for proper occlusion and formation of occlusion in permanent dentition. Size of unerupted teeth during mixed dentition and their prediction is of utmost importance in growing child. There are many mixed dentition analysis present and reported in literature, one of which is measurement based on regression equation, which is used broadly and convenient. Correct estimation of size of unerupted teeth such as canines and premolars allow the orthodontist to accurately plan and diagnose the problem.[6]

Due to racial dimorphism the methods routinely available are many times not applicable for another population. This led to the formation of proper and new equation for the population of this area. Various methods to form regression equation are there and out of that the one using the combination of sum of incisors and molars frequently followed.[10,11]

Several authors found differences between tooth widths of males and females in various studies. Males have generally more tooth widths than females. Males and females data were analyzed separately.[11]

Findings from the present study showed that Tanaka and Johnston method of prediction overestimates the mesiodistal widths of both maxillary and mandibular teeth for males and females than the actual width of SCMP.

These regression equations formulated for Rural Population may be easy to use with no requirements of specific software for mixed dentition analysis. An correct estimation of space in posterior segment is sufficient or not to allow for eruption of permanent teeth to erupt. Further the present equation should be used in large samples to finds its accuracy and will be helpful to orthodontics to form proper

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diagnosis and treatment planning in mixed dentition stage.

Conclusion:
The proposed regression equation is as follows:

Maxillary :Y=14.166+0.626x(males) and Y=20.777+0.470x(females)

Mandibular: Y=9.432 + 0.709x(males) and Y=2.836 + 0.849x(females)

There was a significant difference was observed between the actual SCMP and values of Tanaka and Johnston for the present population.

Validating studies (based on similar samples) must be conducted to confirm the applicability and precision of the new regression proposed.

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