ORIGINAL RESEARCH PAPER

Dental Science

A COMARISIONAL STUDY OF TWO NON RADIOGRAPHIC METHODS OF MIXED DENTITION ANALYSIS IN RURAL BILASPUR POPULATION

Dr. Hemalata Rajmani*	Assistant professor Department of Dentistry,CIMS,Bilaspur,CG -495001.*Corresponding Author
Dr.Sandeep Prakash	Professor and head ,Department of Dentistry,CIMS,Bilaspur,CG-495001.
Dr.Sonal Patel	Senior resident, Department of Dentistry,CIMS,Bilaspur,CG-495001.

ABSTRACT

Back ground and Objectives: Mixed dentition space analysis forms a critical aspect of early orthodontic treatment. The two most widely used non-radiographic tooth size prediction methods, Tanaka & Johnston's prediction equations and Moyers prediction tables were derived from population of Northern European ancestry. However, the applicability of these methods in other ethnic groups has been varied and questionable. The aim of this study is to compare and evaluate the applicability of Tanaka & Johnston and Moyers (75th percentile) mixed dentition prediction methods in rural Bilaspur sample.

Method: In this study, dental casts of 150 rural Bilaspur subjects (75 males & 75 females) were used. Subject's age ranged from 12 - 16 years. Teeth measured included mandibular permanent incisors, maxillary and mandibular permanent canines, first and second premolars. Digital caliper calibrated to 0.01mm was used to record mesiodistal dimensions. The actual teeth measurements were then statistically compared with the predicted values derived from the Tanaka & Johnston's equations and Moyers probability tables at the 75th percentile.

Results: Tanaka & Johnston prediction equations overestimated the mesiodistal widths of permanent canines and premolars in both the arches. Moyers 75th percentile also overestimated the actual measurements except for the maxillary arch. The percentage of overestimation was more for Tanaka & Johnston prediction method than that of Moyers (75th percentile).

Conclusion: The data from present study illustrates the limitation of Tanaka & Johnston regression equations and Moyers (75th percentile) chart when applied to rural Bilaspur population.

INTRODUCTION

Esthetics has been an important consideration in the field of Orthodontics. The basic objectives of orthodontic treatment are functional efficiency, structural balance and esthetic harmony. Among the patients seeking orthodontic treatment children constitute a vast majority. Malocclusion is one of the major problems faced during dentofacial development. Mixed dentition analysis using Moyers tables and Tanaka Johnston's prediction equation have several advantages. No radiographs are required. Tables can be used for both the maxillary and mandibular arch estimations and there is fairly good accuracy despite a tendency to overestimate the size of unerupted teeth. The development of these two methods however was based on data derived from a population of Northern European descent. Malocclusion varies between different populations, ethnicities and age groups, especially in respect to both crowding and the saggital dental arch relationship. Therefore, the accuracy of these prediction methods may be questionable when applied to a population of different ethnic origin. In addition, there is some evidence of secular trends of changing dimension of teeth, which may require progressive modification of mixed dentition analysis for different population. Thus the purpose of this study is to test the reliability of Tanaka Johnston equations and Moyers charts in rural Bilaspur population which would be beneficial for orthodontists in planning the treatment in this part of the country.

MATERIAL & METHOD

The sample comprised of the dental study models of 150 subjects (75 males & 75 females) who belongs to the Chhattisgarhi community were collected from school children. The school were randomly selected from Bilaspur district. The measurements were carried out using a digital calliper Libral co. with an accuracy of 0.01 mm. The mesiodistal dimension of the teeth were measured. All measurements were taken directly from the study models. The measurements were between two anatomical contact points of each tooth, parallel to the occlusal and vestibular surfaces.

The teeth measured included the mandibular permanent central and lateral incisors, the maxillary and mandibular permanent canines, first and second premolars. Teeth were measured manually, and independent measurement by a second investigator was also done to compare interexaminer reliability. Interexaminer reliability was 0.2mm. The 2 sets of measurements were compared. When they varied by 0.2mm or less, the measurements were averaged. In instances where the measurements varied by more than 0.2mm, the teeth were remeasured and the nearest three measurements were averaged; however, this remeasurement seldom proved necessary.

AIM & OBJECTIVE:-

The aim of this study is to compare and evaluate the applicability of Tanaka & Johnston and Moyers (75th percentile) mixed dentition prediction methods in rural Bilaspur sample.

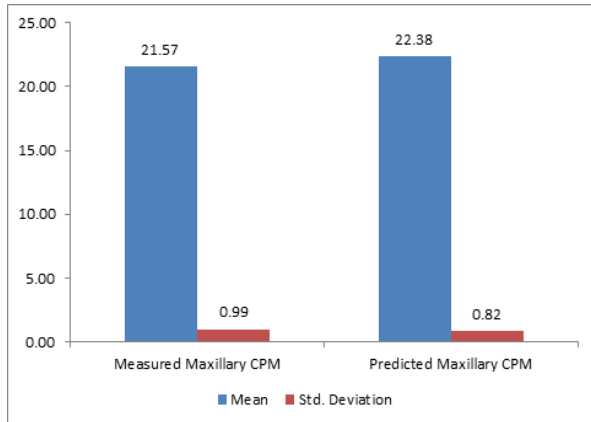## RESULTS:- TANAKA & JHONSTON METHOD

a Maxillary arch :

The results of the paired t-test (table 1 and graph 1) shows highly significant difference values were observed between measured and predicted value of canine and premolar segment in the maxillary arch (p=0.00). Predicted value overestimated the measured values by 0.81mm ranging from 3.45 to -2.43mm.

b Mandibular arch: The results of paired t-test (table 1 and graph 2) shows highly significant differences were observed between the measured value and the predicted values of canine and premolar segment in the mandibular arch (p=0.000). Predicted value overestimated the measured values by 1.07 mm ranging from 4.45 to -1.5mm.
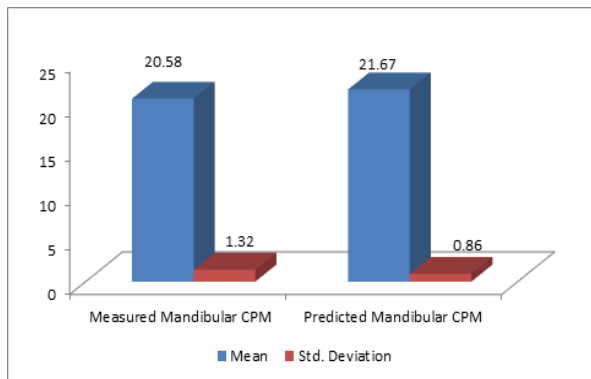
Table 1 Comparison of measured and predicted canine and premolars segment values by Tanaka & Jhonston equation method in both arches.

S.NO.	ARCH	MEAN DIFF	SD	SEE	P-VALUE
1	Maxillary	-.80	0.88	0.07	0.00
2	Mandibular	-1.04	1.07	0.08	0.00

Mean diff=absolute mean, P value =P<0.05; significant difference , SD=standard deviation, SEE=standard error of mean, **Graph1** Comparison of measured and predicted canine and premolars segment values by Tanaka & Jhonston equation method in maxillary arch.

CPM= canine and premolar segment, Mean=absolute mean, Std.deviation= standard deviation

Graph2 Comparison of measured and predicted canine and premolars segment values by Tanaka & Jhonston equation method in mandibular arch.

CPM= canine and premolar segment, Mean=absolute mean, Std.deviation= standard deviation

2 MOYERS METHOD
a Maxillary arch :
The results of the paired t-test (table 2 and graph 3) shows no significant difference were observed between measured value and predicted value in the maxillary arch at 75% probability chart.

Table 2 Comparison of measured and predicted value of canine and premolar segment in maxillary arch by Moyers probability table at 5 to 95 percentile.

MOYERS CHART PERCENTILE	MEAN DIFFE	SD	SEE	P-VALUE
5	2.21	1.03	0.08	.000
15	1.64	0.99	0.08	.000
25	1.29	0.97	0.07	.000
35	1.02	0.96	0.07	.000
50	0.65	0.94	0.07	.000
65	0.29	0.92	0.07	.000
75	0.01	0.91	0.07	.824
85	-0.31	0.90	0.07	.000
95	-0.97	0.93	0.07	.000

Mean diff =mean difference, P value =P>0.05; no significant difference , SD=standard deviation, SEE=standard error of estimate.
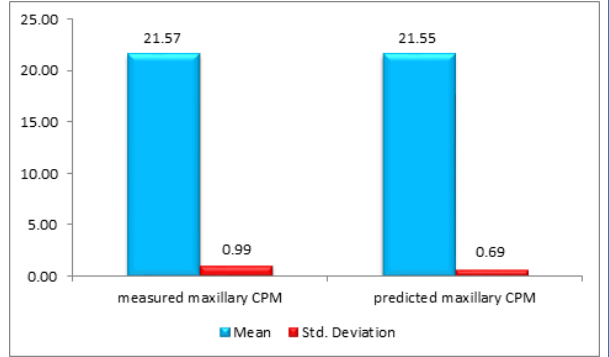
Graph 3 Comparison of measured and predicted value of canine and premolar segment in maxillary arch by Moyers probability table at 75th percentile.

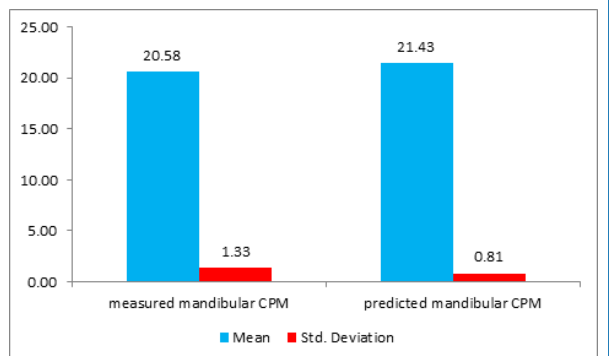CPM= canine and premolar segment, Mean=absolute mean, Std.deviation= standard deviation

bMandibular arch:
The result of paired t-test (table 3 & graph 4), shows highly significant differences between the measured value and the predicted values of mesiodistal width of canine and premolar segment value (p=0.00) in the mandibular arch at 75% probability chart. Predicted value overestimated the measured values by 0.84mm and ranging from 4.28 to -1.67mm, where as 50% probability level is compatible with measured value and shows no significant difference.

Table 3 Comparison of measured and predicted value of canine and premolar segment in mandibular arch by Moyers probability table at 5to 95 percentile.

MOYER CHART PERCENTILE	MEAN DIFFE	SD	SEE	P-VALUE
5	1.91	1.064	.086	.000
15	1.19	1.065	.086	.000
25	0.76	1.068	.087	.000
35	0.40	1.072	.087	.000
50	-0.04	1.067	.087	.638
65	-0.50	1.073	.087	.000
75	-0.84	1.073	.087	.000
85	-1.27	1.077	.087	.000
95	-2.00	1.082	.088	.000

Mean diff=mean difference, P value =P>0.05; no significant difference , SD=standard deviation, SEE=standard error of estimate,

Graph 4 Comparison of measured and predicted value of canine and premolar segment in mandibular arch by Moyers probability table at 75th percentile.

CPM= canine and premolar segment, Mean=absolute mean, Std.deviation= standard deviation

DISCUSSION-
Arch length deficiency is the prime cause for developing

malocclusion, therefore predicting the sizes of unerupted cuspids and bicuspids is important in evaluating the amount of space available in the arch for the succeeding permanent teeth and thereby making necessary occlusal adjustments .The radiographic method to find out the sizes of unerupted cuspids and premolars has certain disadvantages like underexposure / overexposure / distortions etc of x-rays. Moyers, Tanaka & Johnston, Ballard and Wylie have formulated methods for predicting the sizes of unerupted canines and premolars using the mesiodistal widths of erupted mandibular permanent incisors. The Moyers analysis used the sum of the widths of mandibular incisors to predict the sum of both mandibular and maxillary canines and premolars at various probability levels (5% to 95%), initially as combined tables for both sexes and later as separate tables for either sex. However, he recommended its use at 75% which clinically is thought to give protection on the crowded side. Tanaka & Johnston produced simplified regression equations for predicting the sizes of unerupted canines and premolars. They established that the mesiodistal widths at the 75th percentile can be predicted by taking the half width of mandibular incisors and adding 10.5mm for the mandibular teeth and 11.0mm for the maxillary teeth. Of the common methods today, this is perhaps one of the quickest and easiest. Most odontometric studies have found mesiodistal tooth widths to be generally larger in black populations than in Caucasian ones.[1,2,3,4] Comparisons of mean mesiodistal tooth widths in the present study and in other black population[1,3] groups to those in Caucasian populationshave confirmed that the black subjects have generally larger teeth for all tooth types for both sexes. When mesiodistal widths of tooth groups were compared with North India[5] and south India[6] the tooth size is smaller. When compared with other ethnic groups Yuen et al   Hongkong(Chinese)[7], Jaroontham & Goodrey (Thai)[8], Diagnese et al (Senegalese)[9] the present population shows smallest mesiodistal tooth size.(Because of the distinct ethnicity and uniqueness of the rural Bilaspur population and until date, no study of this type has been conducted on this population the present study was considered to evaluate the applicability of these prediction methods and their relevance to this population. The sample comprised of the dental study models of 150 subjects (75 males & 75 females) who belong to the Chhattisgarhi community were collected from school children.

CONCLUSION—

The result obtained by two methods were compared it was found that Tanaka and Jhonston method in both the arches shows significant difference between predicted and measured value, where as in Moyers only the statistically difference between predicted and measured values are seen in mandibular arch. When compared the overestimation values between both methods, Tanaka & Jhonston shows higher value than Moyers. Since in the Moyers probability chart 50% is reliable for mandibular arch and 75% for maxillary arch. Thus Moyers method at this percentile can be applicable to rural Bilaspur population.

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