

Validation of Moyer's Mixed Dentition Space Analysis In A Group of Saudi Population

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Abstract: Aim: The aim of this study was conducted to evaluate the validation of Moyers dental arch analysis on a group of Saudi population. **Study population and methodology:** The present study included a sample of 50 dental models of Saudi subjects (30 male and 20 female). The mesio-distal width of the four mandibular permanent incisors, maxillary and mandibular canines and premolar teeth were measured. The measured values were compared with the predicted values of maxillary and mandibular canine and premolars obtained from the prediction table of Moyer at the level of 75%. **Results:** The results revealed the mean values of the sum of maxillary and mandibular canines and premolars obtained from Moyers charts were greater than those obtained from the study casts. Descriptive statistics shows a highly statistical significant difference for all subjects. In regard to the gender, no statistical significant difference between values from Moyer's method and the study casts for males and females. **Conclusion:** The sample of Saudi population have smaller teeth than the sample population of Northern American descent when compared to Moyers prediction table. The currently popular prediction methods would not be as accurate when used in a Saudi population. Further studies with larger samples size are indicated to confirm these findings.

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1. Introduction:

Mixed dentition is a transition period of occlusion in which both deciduous and permanent teeth are present, which lasts from the age of 6 to 12 years. Mixed dentition space analysis is an important aspect in orthodontic diagnosis and treatment planning, however this critical period helps to determine the amount of space available in the maxillary and mandibular arches^[1].

A correct diagnosis is the first step towards a successful orthodontic treatment, and mixed dentition analysis is considered a fundamental step to make a good diagnosis^[2-4].

For a proper occlusion, teeth must be proportional in size. A harmony between the tooth size and the space available is required within a dental arch to provide a proper alignment^[5].

Tooth size exhibits a continuous range of variation among individuals and between populations. Accumulated evidence indicates that tooth size reflects a complex interaction between a variety of genetic and environmental factors^[6]. The size and form of the dental arches can have considerable implications in orthodontic diagnosis and treatment planning, affecting the space available, dental esthetics, and stability of the dentition. In case of the available space is larger than the space required, spaces between teeth would be expected. On the other hand if the required space is larger than the available space, a crowded teeth would be expected^[7-9].

The first researcher who predicts the width of the permanent canines and premolars by using the sum of the lower permanent incisors by using prediction tables was Moyers^[1].

The Moyer's mixed dentition space analysis method is currently the most widely used.^[4,10-12] It established a probability table to predict the mesiodistal diameter of unerupted canines and premolars, in both arches^[13].

This table uses the sum of mesiodistal diameters of the four mandibular incisors and, for each value obtained in the sum of the four mandibular incisors, there is a corresponding value for unerupted canines and premolars of each quadrant^[14].

Moyer's method of space analysis was developed for North American children. It is reasonable to question its use in other populations because tooth size varies among ethnicities.

Several studies were conducted to predict the mesiodistal widths of permanent canines and premolars in the Saudi population and showed different results^[15-18].

Periodical evaluation of mixed dentition space analyses is required in each generation due to discrepancies in sizes of tooth and facial characteristics (Warren and Bishara, 2001). Hence the current study was directed to evaluate the validation of Moyers dental arch analysis on a group of Saudi population in Holy Makkah^[19].

Aim of Study:

The present study was conducted to evaluate the reliability/validation of Moyers dental arch analysis in a group of Saudi population.

2. Study Population and Methodology:

The present study was included a sample of 50 dental models of Saudi subjects (30 male and 20 female); their ages were ranged from 14–35 years with complete permanent dentition.

For the reliability and consistency in tooth width measurements, one investigator did all the measurements on the dental casts using a vernier gauge caliper to the nearest 0.1 mm. The mesio-distal widths of the teeth will be obtained by measuring the greatest distance between the contact points on proximal tooth surfaces [20]. The mesio-distal width of the four mandibular permanent incisors, maxillary and mandibular canines and premolar teeth were measured. The measured values will be corrected to the nearest 0.01 mm and recorded onto a datasheet with their corresponding identification numbers.

All subjects have taken an impression using Alginate with stock try of an appropriate size. Then, the impression had been poured in production lab at the same time of impression taking.

After measuring the distance of lower incisors, predicted values of maxillary and mandibular canine and premolars had been obtained from the prediction table of Moyer at the level of 75%.

Inclusion criteria:

- a. All casts are native Saudi subjects.
- b. All permanent teeth erupted (except molars).
- c. No inter-proximal caries or restorations.
- d. No missing or supernumerary teeth.
- e. No abnormally sized or shaped teeth.
- f. No or mild malocclusion.
- g. Minimal or no tooth wear, and
- h. No history of previous orthodontic treatment.

Data analysis:

The data will be entered into a computer and analyzed using Statistical Package for Social Sciences Inc. (SPSS version 20.0 for Windows, Illinois, USA). Descriptive statistics, including means, standard deviations, and minimum and maximum values were calculated for the actual tooth size and the predicted tooth size using the Moyers method. Student’s t-tests were carried out to determine whether significant difference existed: (I) between the sums of the mesiodistal diameter of permanent: (a) incisors, (b) canine and first and second premolars in male and female subjects, and (II) between the regression values using Moyers tables with the actual canine and premolars width measurements.

Ethical Considerations:

- ★ Ethical approval has been obtained from Hospitals/clinics to use the casts of their patients.
- ★ All participant record will be kept confidential.

3. Results:

Table-1: The sum of mesio-distal widths of maxillary and mandibular canines and premolars of the study subjects (n=50).

Variables	Type	N	Mean	Maximum	Minimum	Std. Deviation	t-Test	Std. Error	p-value
Maxillary canine and premolars	Moyer's value	50	21.166	23.3	20.3	0.579	3.695	0.082	0.000
	Study cast	50	20.462	22.7	17.7	1.216		0.172	
Mandibular canine and premolars	Moyer's value	50	20.986	23	19.6	0.659	3.600	0.093	0.001
	Study cast	50	20.258	22.7	17.2	1.268		0.179	

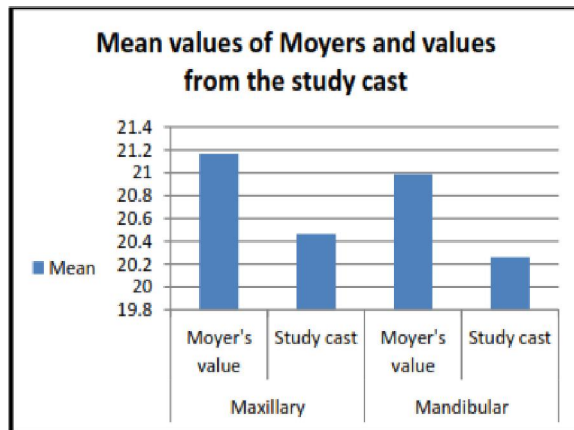
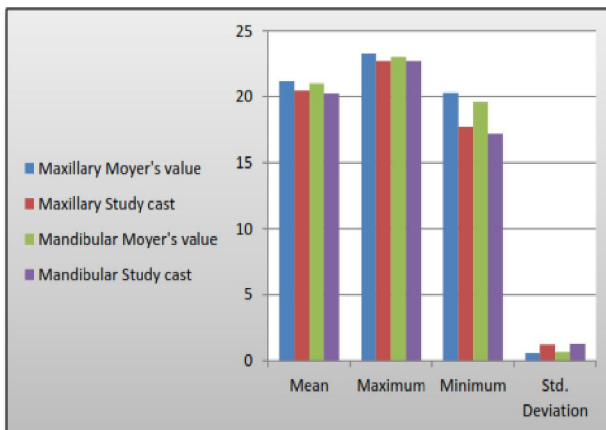


Fig. 1 comparison between Moyers' values and values obtained form the study cast

Table 2: Comparison of predicted values of mesio-distal widths of maxillary and mandibular canine and premolars from Moyers's method for males and females.

Variables	Gender	N	Mean	Std. Deviation	t-Test	p-value
Mesiodistal width of mandibular Incisors	Male	28	21.475	1.4884	- 0.511	0.612
	Female	22	21.682	1.3305		0.607
Maxillary canine and premolars	Male	28	21.329	0.6814	2.4	0.024
	Female	22	20.959	0.3276		0.016
Mandibular canine and premolars	Male	28	21.221	0.5977	3.086	0.003
	Female	22	20.686	0.6221		0.004

Table 3: Comparison of predicted values of mesio-distal widths of maxillary and mandibular canine and premolars from the study cast for males and females.

Variables	Gender	N	Mean	Std. Deviation	t-Test	p-value
Maxillary canine and premolars	Male	28	20.711	1.0706	1.661	0.103
	Female	22	20.145	1.3376		0.114
Mandibular canine and premolars	Male	28	20.486	1.0466	1.448	0.154
	Female	22	19.968	1.4802		0.173

The results of the present study revealed that the mean values of the sum of maxillary and mandibular canines and premolars obtained from Moyers charts were greater than those obtained from the study casts. Descriptive statistics shows a highly statistical significant difference for all subjects (table 1).

In regard to the gender, there was no statistical significant difference between values of mesio-distal widths of maxillary and mandibular canine and premolars from Moyers's method (table 2) and the study casts (table 3) for males and females.

4. Discussion:

Space analysis during mixed dentition is an important aspect in orthodontic diagnosis and treatment planning [21]. The mandibular permanent incisor teeth have been found to be the most reliable indices for the size of the remaining permanent teeth [22].

Measurement reliability, one of the most important aspects of odontometric studies, refers to the ability to obtain the same measurement consistently over sequential measures [23].

In an attempt to improve the reliability of the measurements of the present study, the following measures were employed:

1. Use of high-quality dental casts made of dental stone.
2. Use of calipers with digital displays to greatly reduce eye fatigue and the possibility of reading error [24].

In the current study, there were no statistically significant differences between the left and right sides. These findings indicate that the right or the left side measurements could be used to represent the mesiodistal tooth widths for this sample.

Several studies have confirmed that different races and ethnic groups present with different teeth sizes [25-27]. Furthermore, Comparing teeth sizes of Saudi population to other populations revealed that Saudis have smaller teeth than Malay, Turkish and Egyptian populations [28-30].

Through the results, our study showed that a Saudi population has smaller teeth in compared with Northern Europeans. This finding was in agreement with Al-Dlaigan et al., 2015 [31].

From our results, the mean values of the sum of maxillary and mandibular canines and premolars obtained from Moyers charts were greater than those obtained from the study casts. Descriptive statistics revealed a highly statistical significant difference for all subjects. These findings are in accordance with those reported from an earlier study on the Saudi population found that the recommended 75% confidence level of the Moyers probability tables overestimated the sizes of canines and premolars [32].

The results of independent t-tests showed that there were no statistically significant differences in the tooth widths between the male and female subjects. These results disagreed with the results reported by Burhan and Nawaya, 2014, as there were statistically significant differences in the tooth widths between the male and female Syrian subjects [33].

The results of this study indicated that methods relevant to American races might not be applicable to other races. Accordingly, it is difficult to draw a firm conclusion with this small sample size included in the present study. Further studies with a large samples size from different parts of Saudi Arabia are in need to establish a prediction table for Saudi population.

Conclusion and Recommendation:

Within the limitation of the current study we could concluded that the sample population of Saudi Arabs have smaller teeth than a sample population of Northern American descent when compared to Moyers prediction table. The currently popular prediction methods would not be as accurate when used in a Saudi population. Further studies with larger samples size are indicated to confirm these findings.

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