Comparison of Bolton's Ratios in a Sample of Iraqi and Egyptian Populations

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ABSTRACT

Background: The objective of this study was to investigate the possibility of standardizing the Bolton ratio analysis as a diagnostic measure for both Iraqi and Egyptian orthodontic populations within three Angle' classification groups.

Materials and methods: Two hundred forty pretreatment study casts (one hundred twenty of each population) were included in this study and divided into three Angle' classification groups. The mesiodistal crown diameters of all teeth were measured for computing the anterior and total Bolton ratios. Analysis of variance was performed to compare the mean ratios of Bolton analysis as a function of the Angle classification.HSD test was used to specify the classes of malocclusion that have significant differences.

Results: No statistically significant differences were determined in the mean values of the anterior ratio among the angle classification groups in both Iraqi and Egyptian populations. No statistically significant differences were determined in the mean values of the overall ratio among the angle classification groups in Iraqi population. While there were statistically significant differences in the mean values of overall ratio among the angle classification groups in Egyptian population. This difference is specified with in class II malocclusion of Egyptian population.

Conclusion: Anterior Bolton ratio can be standardized for both Iraqi and Egyptian orthodontic populations. While the overall ratio can be standardized only in class I and III malocclusions of both populations.

Key words: Bolton's ratio, Iraqi, Egyptian, Orthodontic Population. **(J Bagh Coll Dentistry 2016; 28(4):172-175)**

INTRODUCTION

Tooth-size discrepancies are seen more frequently in subjects with malocclusions [1]. Bolton investigated the relationship between the mesiodistal crown diameters of the upper and lower teeth and developed an analysis. For evaluation of the two sets of 12 opposing teeth, the term 'overall ratio' is used and for the two sets of six anterior teeth, the term 'anterior ratio'. Bolton stated that for a good interdigitation and occlusion, overall ratio should be 91.3 ± 1.91 and anterior ratio 77.2 ± 1.65 [2].

Many patients presenting for orthodontic treatment have a Bolton tooth-size discrepancy [3] that may highly influence proper interdigitation, overbite, overjet and alignment of the teeth [4]. Identifying such discrepancies before final tooth alignment should prove beneficial in defining the final expectations of both the clinician and the patient [5]. Therefore it would seem prudent for clinicians to routinely include Bolton analysis in their treatment planning. Although such an analysis may be time-consuming, the benefits of interproximal stripping to correct any discrepancies would seem to outweigh the minor inconvenience of performing the analysis, which should allow more efficient diagnosis of problems, more specificity in treatment planning and a higher success rate in achieving optimal

functional, stable and esthetically pleasing occlusions [3]. The reduction of tooth structure either by extraction or interdental reduction, or the addition to tooth structure by restorative technique is determined by the amount and location of Bolton tooth-size discrepancy [4].

Bolton's analysis has been investigated in different racial groups and populations. A limited number of studies in malocclusion groups have been undertaken, but their results were contradictory [6]. Size and shape of the dental arch can vary among different racial groups [7,8]. Different ethnic groups may have a different Bolton ratio [9]. These differences may complicate the orthodontic treatment. Hence the professionals must be prepared to attend individuals from different ethnicities and be capable to anticipate these differences, establishing a more personalized treatment [8]. On the other hand a significant difference was found for intermaxillary tooth size ratios among different malocclusion groups [10]. Therefore the present study aimed to calculate Bolton's overall and anterior ratios in Iraqi and Egyptian orthodontic populations within three angle's classes of malocclusion.

MATERIALS AND METHODS

The sample for this study consisted of two hundred forty pretreatment study casts (one hundred twenty of each population) selected from the archive of the Orthodontics Department of both college of dentistry- Baghdad University and faculty of dental medicine- Al-Azhar University.

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The sample has been fulfilled the following criteria:

- Study casts of orthodontic patients aged between 13 and 25 years.
- All permanent teeth erupted and present except for third molars.
- Study casts of good quality, with absence of fractured, deformed and large restored tooth.

The sample was divided into three groups:

- Group 1 with angle class I malocclusion (n=70) for each population
- Group 2 with angle class II malocclusion (n=40) for each population
- Group 3 with angle class III malocclusion (n=10) for each population.

The mesiodistal crown diameters of all teeth were measured with electronic digital caliper (China) accurate to 0.01mm.Each measurement was recorded at the 0.01mm, with the anterior 3-3 and total 6-6 sums recorded at the 0.1mm level. The measurements were done by two well-trained orthodontists according to the method described by Moorrees et al. [11], i.e. from the mesial contact point to the distal contact point at the greatest interproximal distance. Bolton's anterior (canine to the canine) and overall (first molar to first molar) ratios were calculated for each model with the following formulas:

(sum mandibular 12/sum maxillary 12) × 100 = overall ratio (%)

(sum mandibular 6/sum maxillary 6) × 100 = anterior ratio (%)

The measurements were then used to compute the anterior and total Bolton ratios. Data was analyzed using SPSS program. Mean and standard deviation values were calculated for anterior and total Bolton ratios for three Angle classifications in both Iraqi and Egyptian population. ANOVA was used to compare the anterior and total Bolton ratios for each population with Bolton's standards with in each malocclusion group. Tukey's honestly significant difference (HSD) test was used to specify the classes of malocclusion that have significant differences.

RESULTS

The means and standard deviation values of both ratios in each Angle classification are summarized in Table 1 for both Iraqi and Egyptian populations.

Comparison among the classes and between the population are presented in tables 2-5.

Table 1: Descriptive statistics for each ratio and class in Iraqi and Egyptian populations

Occlusion	Ratio	Population	Mean	S.D
Class I	Anterior	Iraqi	78.72	4.53
		Egyptian	78.85	2.79
	Over all	Iraqi	91.23	2.2
		Egyptian	91.63	2.58
Class II	Anterior	Iraqi	79.05	2.64
		Egyptian	78.46	3.97
	Over all	Iraqi	91.54	2.66
		Egyptian	89.14	5.13
Class III	Anterior	Iraqi	78.8	2.15
		Egyptian	78.65	4.2
	Over all	Iraqi	91.82	2.24
		Egyptian	90.65	3.71

Table 2: Population difference for anterior ratio with in each class

Occlusion	Population	t-test	d.f.	p-value
Class I	Iraqi	-0.193	123	0.848 (NS)
	Egyptian			
Class II	Iraqi	0.739	71	0.462 (NS)
	Egyptian			
Class III	Iraqi	0.093	17	0.927 (NS)
	Egyptian			

Table 3: Population difference for overall ratio with in each class

Occlusion	Population	t-test	d.f.	p-value
Class I	Iraqi	-0.940	123	0.349 (NS)
	Egyptian			
Class II	Iraqi	2.425	71	0.018 (S)
	Egyptian			
Class III	Iraqi	0.791	17	0.440 (NS)
	Egyptian			

Table 4: Classes' difference for each ratio and population

Population	Ratio	Occlusion	Classes difference F-test	Classes difference p-value
Iraqi	Anterior	I	0.080	0.923 (NS)
		II		
		III		
	Over all	I	0.343	0.711 (NS)
		II		
		III		
Egyptian	Anterior	I	0.159	0.853 (NS)
		II		
		III		
	Over all	I	4.999	0.008 (HS)
		II		
		III		

Table 5: Differences between the Angle classes of Egyptian population for overall ratio and their levels of significance determined by Tukey's honestly significant difference analysis.

Population	Ratio	Occlusion		Mean Difference	p-value
Egyptian	Over all	I	II	2.49	0.006 (HS)
			III	0.988	0.713 (NS)
		II	III	-1.50	0.482 (NS)

DISCUSSION

Bolton's analysis of overall and anterior teeth is the most frequently used analysis in both clinical orthodontics and scientific studies when evaluating the correspondence between maxillary and mandibular mesiodistal width of teeth. This analysis influenced examination of orthodontic patient and planning of orthodontic treatment, and is still used to this day [12]. Therefore it is necessary to calculate Bolton's ratios in orthodontic patients [13].

According to Ta et al. [14]; Uysal and Sari [15] and Endo et al. [16], it is necessary to determine specific standards, for different populations as well as for different malocclusions [13]. Therefore in the present study Bolton overall and anterior ratios were measured for Angle Class I, Class II, and Class III malocclusions in both Iraqi and Egyptian orthodontic populations.

Different results have been proposed in literature concerning the relationship between the malocclusion classes and the tooth size ratios. However no study was compare this relationship between Iraqi and Egyptian populations.

According to the present study, there were no significant differences in both anterior and overall ratios among the Angle classification groups of Iraqi population. This in consistent with Sulaimani andAfify [17] who concluded that there is no significant difference in Bolton anterior and overall ratios between Class I, Class II, and Class III malocclusions in Saudi Arabian sample. This accordingly comes in agreement with the results of O'Mahony et al. [18] which concluded that, there were no statistically significant differences in the prevalence of mean overall tooth size discrepancies with regard to malocclusion. Moreover the current results were in accordance with Basarana et al. [19] and Al-Khateeba and Elham [20] who found no statistically significant difference between the relationship of the first permanent molars according to Angle's classification and the value of the Bolton ratio.

Regarding Egyptian population there were no significant differences in the anterior ratio among the Angle classification groups while there were statistically significant differences in the mean values of overall ratio among the Angle classification groups. This is in consistent with the result of Richardson and Malhotra [21] who reported that there is a higher overall ratio on African population. Also this may be explained by the result of Fernandes et al. [22] who found that there is a tendency for African to present greater mesiodistal distance of teeth.

The significant difference in overall ratio in Egyptian population is specified within class II malocclusion group. This may be due to high frequency of tooth size discrepancy among patients with class II malocclusion according to the result of Naseh et al. [23]

The possible reason for these different results in the overall Bolton ratio in class II malocclusion between the two populations may be ethnic or racial because according to Lavelle[24] tooth sizes show considerable variation in different racial categories.

In conclusion;

✓ In Iraqi orthodontic sample, the comparison of overall and anterior Bolton ratio revealed no statistically significant difference within Angle Class I, II, and III malocclusions.

✓ In Egyptian orthodontic sample, there were no statistically significant differences in the anterior ratio within Angle Class I, II, and III malocclusions while there were statistically significant differences in the overall ratio among the three malocclusion classes. The difference was within Angle class II malocclusion group.

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