Bolton ratio in subjects with normal occlusion and Class-I malocclusion

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ABSTRACT

Methods: The materials comprised 120 pre-treatment study cast [60 male & 60 female aged 13-17 years] ,divided into two groups,first group were selected from the models of 60 students who had normal occlusion without crowding [equal male & female] and second group were selected from 60 patients who had Angle class-I crowding[equal male &famale], applied for orthodontic treatment based on the following criteria –permanent dentition from the 1st right molar to the 1st left molar and no interproximal caries or restorations.Bolton anterior & overallratios were performed for the study casts of the subjects using slide caliper.

Results: The results showed that there was no significants differences between two groups .Also no significant gender differences were found in Bolton anterior& overall ratios.

Keywords: **Malocclusion, Angle class-I crowding , Bolton anterior ratio, Bolton overall ratio.**

INTRODUCTION:

Bolton analysis is one of the most popular methods for determing tooth size abnormality .Bolton Analysis is a tooth analysis developed by Weyne A Bolton.Bolton ratio determinates the discrepancy between the size of maxillary and mandibular teeth.This analysis help to determine the optimum interarchrelationship.It is useful in aiding dignosis as well as treatment planning. This analysis measures the mesio-distal width of each teeth and is divided into analysis.1,2Wayne A Bolton presented this analysis in the year 1958. In 1962, he published another paper which talked about clinical applications of using Bolton analysis in orthodontics.

An overall analysis measures the sum of mesio-distal width of all 12 mandibular teeth and compares them to the 12 maxillary teeth.The overall ratio is known to be 91.3%.3The overall ratio is determined using the following formula

$$\text{Overall ratio} = \frac{\text{sum of mandibular 12}}{\text{Sum of maxillary 12}} \times 100$$

The anterior analysis measures the sum of mesio-distal width of front 6 mandibular teeth and compares them to maxillary teeth.The anterior ratio is known to be 77.2%.The anterior ratio is determined using the following formula.

$$\text{Anterior Ratio} = \frac{\text{sum of mandibular 6}}{\text{Sum of maxillary}} \times 100$$

The overall ratio of more than 91.3% means that the mandibular teeth are excess compare to normal. A ratio less than 91.3%would mean the mandibular teeth are less than normal. Anterior analysis follows the same principle. Having a different ratio than normal is referred to as Bolton discrepancy. A standard deviation of more than 2 yields a significant discrepancy.

If the discrepancy goes indetected initially, it may lead to

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delay in the completion of the treatment on to a compromised result, therefore the ability to analyze the proportionability of the maxillary and mandibular teeth is an important diagnostic tool that would best be used at the initial diagnostic stage.
One of the drawbacks of this analysis is that the sample that Bolton measured in his paper in 1958 ,consisted of only Caucasian populations. Therefore Boltons overall ratio and anterior ratio Mean and Standard Deviations are not representive of samples from other race and population.

MATERIALS AND METHODS:

In this study, 60 pairs ofpretreatmentstudy casts were selected from the students and patients of the Orthodontics Department of Dhaka Dental College & Hospital and were divided into groups.The first group were selected from the models of 30 students who had normal occlusion without crowding [equal male & female] and second group were selected from 30 patients who had Angle class-I crowding [equal male &famale], applied for orthodontic treatment based on the following criteria –The criteria for selection were as follows:

Study casts are of a good quality.

All the permanent teeth to be fully erupted except for the third molars.
No mesiodistal and occlusal tooth abrasion
No interproximal caries and restorations
 No supernumerary teeth or dental malformations.
The age range was 13-17 years. The following parameters were measured and used to compared the two groups.

DATA PROCESSING:

After collection of data, the obtained data was checked,verified& edited. These were entered in a personal compputer using the SPSS (Statistical Package for Social Sciences).Entered data were cleaned,edited and appropiatestastistical tests were done depending on the distribution of data.

DATA ANALYSIS :

Data were saved on an Excel spreadsheet and then transferred to SPSS software package for statistical analysis.All datas will be analyzed through statistical methods by using SPSS software. This study was a analytical & comparative study conducted among the 60 patients and students of Dhaka Dental College Hospital.The statistical tests to be used for analysis of data was T- test.In this analytical test the level of significance p value less than0.05 was considered occlusion.

RESULTS:

There were no statistically significant differences inBolton anterior and overall ratios among the two groups. Table 2 summarizes the means, standard deviations and statistical comparisons of Bolton anterior and overall ratios observed in each group.It showed that there were no statistically significant differences between the two groups for both anterior and overall ratios.Table 2 & 3 summarizes the means ,standard deviations and statistical comparisons of Bolton anterior and overall raios observed in each sex. It showed that there were no statistically significant differences between the two genders.

Table –1:   Age for each sex in normal occlusion and class-I malocclusion.

| | Male (30) | | Female (30) | |
	Normal (n=15)	Class-I (n=15)	Normal (n=15)	Class-I (n=15)
Age in years	Mean(±SD) 22.40(±1.40)	Mean(±SD) 15.40 (±1.72)	Mean(±SD) 22.73(±1.03)	Mean(±SD) 14.80(±2.11)

In normal occlusion group, mean age of male (n-15) was 22.40(±1.40) years and female (n-15) was 22.73(±1.03) years. In class-I malocclusion group, mean age of male (n-15) was 15.40(±1.72) years and female (n-15) was 14.80(±2.11) years (Table-01).

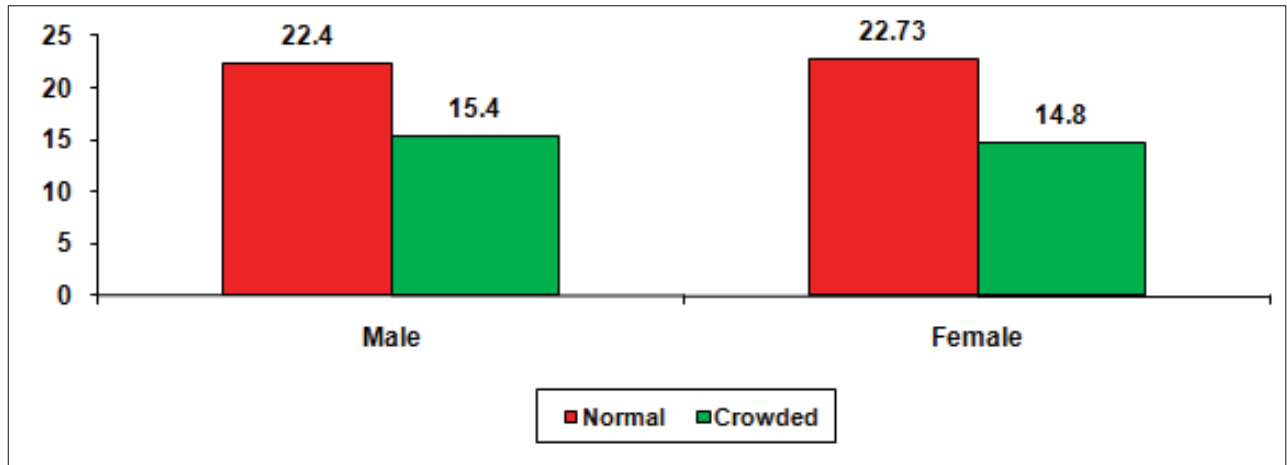Similar condition showing in the bar chart (fig-1)

Fig-1. Mean age of sex in normal occlusion andclass-I malocclusion(crowded) as shown in corresponding (Table-01)

Table-02:Anterior Bolton ratio for each sex in normal occlusion and class-I malocclusion.(%).

Region	Male (n=30)			Female (n=30)			Total (n=60)		
	Normal (n=15) Mean (±SD)	Class-I (n=15) Mean (±SD)	P value	Normal (n=15) Mean (±SD)	Class-I (n=15) Mean (±SD)	P value	Normal (n=30) Mean (±SD)	Class-I (n=30) Mean (±SD)	P value
Anterior Bolton Ratio	79.48 (±3.20)	77.70 (±2.43)	0.09NS	79.54 (±3.17)	77.36 (±3.12)	0.06NS	79.51 (±3.13)	77.53 (±2.75)	0.05 NS

NS= Not significant., */*** - Significant(p <0.05

In anterior Bolton ratio no significant difference was detected between the normal and the class-I groups. (Table-02)

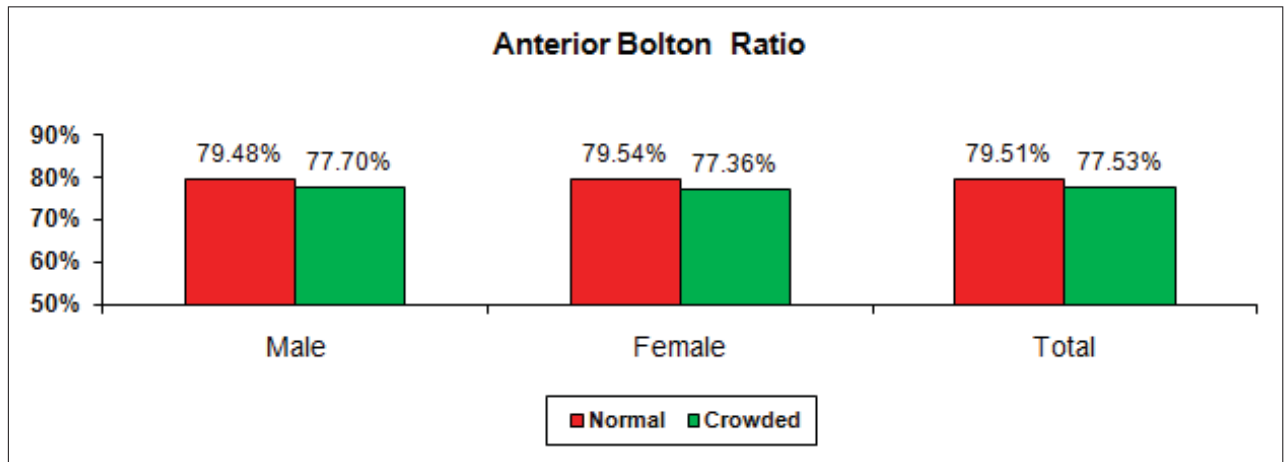Similar condition showing in the bar chart (fig-02).

Fig- 02. Anterior Bolton ratio for each sex in normal occlusion and class-I malocclusion(crowded) as shown in corresponding (Table-0

Table-03:Bolton Overall ratio for each sex in normal occlusion and class-I malocclusion (%).

Region	Male (n=30)			Female (n=30)			Total (n=60)		
	Normal (n=15) Mean (±SD)	Class-I (n=15) Mean (±SD)	P value	Normal (n=15) Mean (±SD)	Class-I (n=15) Mean (±SD)	P value	Normal (n=30) Mean (±SD)	Class-I (n=30) Mean (±SD)	P value
Overall Bolton ration	91.34 (±2.05)	91.02 (±1.99)	0.66NS	91.66 (±2.07)	91.00 (±2.89)	0.49NS	91.49 (±2.03)	91.01 (±2.44)	0.41NS

NS= Not significant., */*** - Significant(p <0.05)
Overall Bolton ratio did not show any significant difference between the two groups.(Table-03).

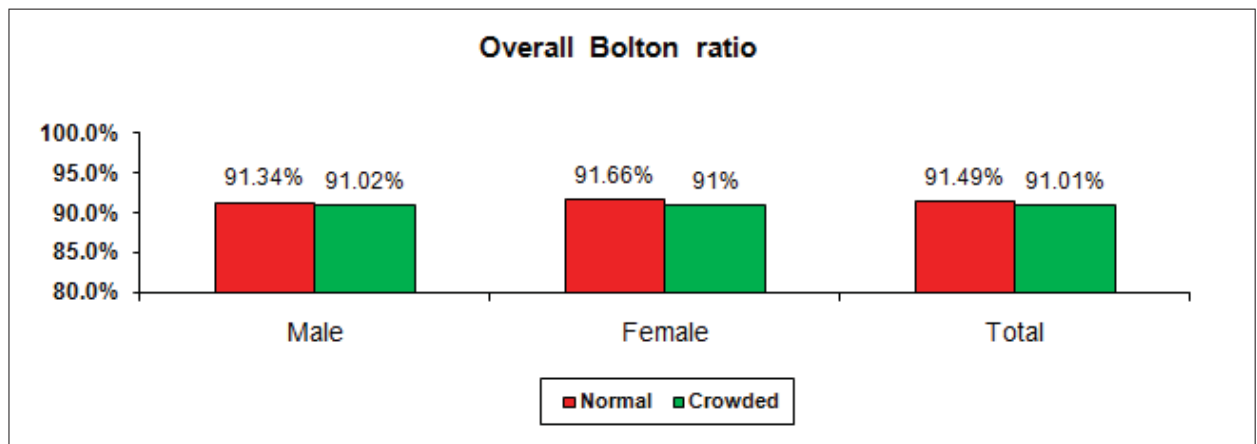Similar condition showing in the bar chart (fig-03).

Fig- 03: Overall Bolton ratio for each sex in normal occlusion and class-I malocclusion(crowded) as shown in corresponding (Table-03).

Dicussion:

Tooth size discrepancies in orthodontic diagnosis has been widely reported in the literature and accepted in the orthodontic field as the relationship between the upper and lower anterior and posterior dentitions is related to proper orthodontic finishing. In this study, Bolton anterior and overall ratio among two groups in Bangladeshi sample were studied.The sample size was relatively small because we restricted the selection upon a young age group to minimize the possibility of alternations in mesiodistal tooth dimensions due to attrition,proximal restoration or caries.
In this study the statistical analysis of Bolton anterior and overall ratios calculated in two classes of malocclusion studied showed no significant differences.Nie and Lin found that there were no significant differences between normal and other malocclusion groups.It could be suggested that Bolton discrepancies may be a cause of on a predisposing factor to malocclusion.If these discrepancies are diagnosed early the orthodontist will be able to plan proper solutions like composite build up or mesiodistal stripping when required and finishing orthodontics can be better predicted.Another solutionssuggested by Ramos at al4 is to make changes in inclination of anterior Bolton discrepancies and achieve an ideal relationship of incisors.In comparing the anterior and overall Bolton ratio in crowded and uncrowded groups for each sex no significant difference was found which is correlated to the study of Maryam Poosti.

Conclusion:

As Bolton's ratio is now considered the seven key of occlusion, it would seen prudent for clinicians to routinely include this analysis in their initial case, which would

prove beneficial in both treatment planning and final expectations of both the clinicians and the patients. This study concluded that there were no significant differences between ratio and ratio for the Bangladesh population.In this study two groups did not show any differences in the ratio while the malocclusion (crowded dentition) showed larger teeth in the mesio- distal dimension.There were no differences between males and females.

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