Tooth width Ratio in Crowding and Noncrowding dentition among patient attending BSMMU

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ABSTRACT

Crowding is a common presentation among the patients seeking orthodontic treatment. The cause of crowding could be various such as mesiodistal tooth width discrepancy, boney discrepancy among the jaw, early loss of deciduous molar, different patterns of malocclusion, ethnic group, nutritional and developmental factor.

Material and Methods: One hundred cases were selected among which 31 were male and 69 were female, 70 cases had crowded dentition and 30 cases had non crowded dentition. Boltons Overall ratio and Anterior ratio were calculated for every case and comparison was done among crowded and non crowded dentitions.

Result: Mean Overall ratio and mean anterior ratio were found to be 91.06% and 79.66%. Neither Overall ratio nor Anterior ratio was significant for crowding and non crowding cases. On comparing for male and female, only anterior ratio was found to be significant in female in crowding and non crowding cases.

Key words: Crowding, Noncrowding, Bolton's anterior ratio, Overall ratio

INTRODUCTION

Crowding is a common presentation among the patients seeking orthodontic treatment. Crowding can occur because of the mesiodistal tooth width ratio, other causes of crowding can be boney discrepancy among the jaw, often early loss of deciduous molar causes crowding in the premolar region.

The absence of Tooth size discrepancy is the seventh "key" for an ideal occlusion. Significant tooth size discrepancies prevent an ideal occlusion being produced at the end of orthodontic treatment.[1-2] In general men have bigger teeth size than women; this doesn't mean that they have larger tooth size ratios or an increase in the prevalence of Tooth size discrepancy.[3-5] Several methods have been developed to evaluate interarch tooth size relationship, Kesling's diagnostic setup,[6] Neff's anterior coefficient,[7-8] and Bolton's ratio for the six anterior teeth, and the overall ratio for the 12 teeth are few to name. Bolton's ratio has been used the most so far.[9-10]

Studies have shown differences between mesiodistal tooth width in crowding and non crowding dentitions.[11-12] Lundstrom didn't find differences with his proposed tooth width ratio and the amount of crowding.[13] Norderval et al showed that Bolton anterior ratio was significantly higher in dentition with lower incisal crowding.[14] Adams found significant differences in the total tooth width in upper and lower jaw in crowded and non crowded cases.[15] Eduardo Bernabe found that tooth with ratio was not statistically significant among crowding and non crowding cases or male and female.[16]

In a study in Bangladesh by Jahid, tooth widths were found to be more in crowded dentitions than non crowded dentitions and on comparing the anterior and overall ratios no significant difference was detected between crowding and non crowding dentitions.[17]

The aims of this study are to determine the mean mesiodistal tooth width, the anterior and overall Bolton's ratios, among crowded and non crowded patients attending the Outpatient department in Bangabandhu Sheikh Mujib Medical University.

MATERIALS AND METHODS

100 patients between the age of 13 and 30 were selected randomly in the outpatient department of Bangabandhu Sheikh Mujib Medical University. Case record files, which included history, clinical examination, orthopantomograms, study models, were the source of information used to diagnose cases as crowding or non crowding. The cases with fully erupted dentition were selected. Those with agenesis, extraction or proximal fillings were excluded. If an accurate diagnosis could not be made, the cases were excluded from the study.

Mesiodistal width of each tooth (except 2nd and 3rd molar) on each arch was measured in the largest area using sliding

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caliper with Vernier scale neared to 0.1 mm (Figure 1). Tooth width ratios were calculated using formulas proposed by Bolton which is as follows:

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

$$\text{Overall Ratio} = \frac{\text{Sum of mandibular 12 teeth}}{\text{Sum of maxillary 12 teeth}} \times 100$$

RESULT

Out of 100 cases, 70 had crowding and 30 had non crowding. Out of 31 males 22 had crowding and 9 had non crowding and out of 69 females 48 had crowding and 21 had non crowding. Neither the Overall ratio nor the Anterior ratios were significant for crowding and non crowding cases for the sample. Boltons overall ratio was neither significant for male nor for female in comparison for crowding and non crowding. Boltons anterior ratio was not significant for male but was significant for female.

Table I. Sum of Anterior and overall tooth width (in mm)

Tooth width	Minimum	Maximum	Mean	Std. Deviation
Overall				
Maxilla	88.00	114.50	101.66	6.43
Mandible	78.50	103.50	92.70	5.60
Anterior				
Maxilla	40.50	56.50	48.39	3.62
Mandible	32.50	48.00	38.56	2.84

Table II. Sum of tooth width in Male and Female (in mm)

Overall Tooth width	Maxilla		Mandible	
	Male	Female	Male	Female
Range	18.50	26.50	19.00	25.00
Minimum	95.50	88.00	84.50	78.50
Maximum	114.00	114.50	103.50	103.50
Mean	104.35	100.45	94.69	91.80
Std. Deviation	4.86	6.70	4.78	5.74
p	0.039		0.142	
Overall Tooth width				
Range	12.50	16.00	8.50	15.50
Minimum	44.00	40.50	35.50	32.50
Maximum	56.50	56.50	44.00	48.00
Mean	49.85	47.74	39.38	38.18
Std. Deviation	2.81	3.76	2.38	2.97
p	0.074		0.421	

p<.05 (significant)

Table III. Overall ratio and Anterior ratio in crowding and non crowding (in %)

	Min	Max	Mean	Std. Deviation	p
Overall Ratio					
Crowding	81.41	96.48	90.94	2.88	0.891
Non Crowding	80.70	98.10	91.36	3.08	
Anterior Ratio					
Crowding	72.82	86.81	79.34	3.66	0.064
Non Crowding	72.38	94.11	80.40	3.60	

Table IV. Overall ratio and Anterior ratio Comparison for male

	Min	Max	Mean	Std. Deviation	p
Overall Ratio					
Crowding	81.41	95.50	91.27	3.06	0.832
Non Crowding	87.20	93.30	90.30	2.44	
Anterior Ratio					
Crowding	73.79	82.00	78.76	2.67	0.806
Non Crowding	72.38	83.50	78.99	3.30	

Table V. Overall ratio and Anterior ratio Comparison for Female

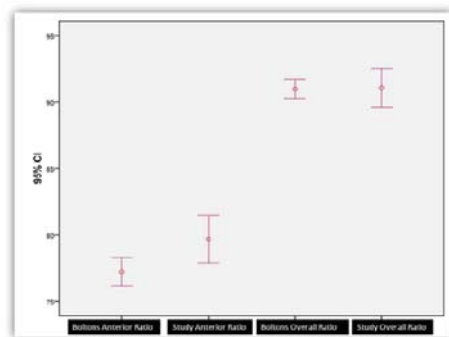|	Min	Max	Mean	Std. Deviation	p
Overall Ratio					
Crowding	83.90	96.48	90.78	2.81	0.927
Non Crowding	80.70	98.10	91.82	3.26	
Anterior Ratio					0.040
Crowding	72.82	86.81	79.60	3.99	
Non Crowding	75.24	94.11	80.99	3.62	

Figure 1. Ninety five percent confidence intervals of anterior and overall tooth width ratios with ±2 standard deviation illustrated as an error bar graph

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DISCUSSION

One of the goals in comprehensive orthodontic treatment is to obtain an optimal final occlusion, overbite, overjet. There are many factors that will influence the attainability of this goal. There has long been an understanding that a certain maxillary to mandibular tooth size ratio was important for proper occlusal relationship and better esthetic outcome of the case.

Overall and anterior ratios:
The tooth width ratios both overall and anterior were not significant in crowded and non crowded dentition thus null hypothesis proposed was accepted. Most of the authors who has done research on crowded and non crowded dentition have found tooth width ratios to be non liable for causing crowding.[18-19]

The overall ratio in this study was almost similar to Bolton's study but anterior ratio was slightly larger than Bolton's study. The probable reason for this could be the type of sample that constitutes this study (patients with orthodontic problems versus the Bolton individuals, who had optimal occlusions) The comparison is given in Figure 1. Similar results were obtained in previous studies.[20] The anterior ratio, from canine to canine, had a larger value (79.66%. compared with Bolton's 77.2%).

Comparison between male and female:
Susan N. Al-Khateeba; Elham S. J. Abu Alhaijab did not find any statistical significance between sexes whereas in this study anterior ratio was found to be significant between sexes (p value 0.040) With regard to gender and race, a systematic literature review[21] concluded that the small but statistically significant differences in Bolton ratios sometimes found between different racial groups and genders.

Tooth width:
As seen in Table II the total tooth width as well as anterior tooth width was larger in men than women. The sexual dimorphism in tooth dimensions was shown in other studies for different populations.[22-23] The total tooth width in maxillary arch was found to be significant (p value 0.039) between male and female, total tooth width in mandible and anterior tooth width were not significant. It specifies the samples to be statistically comparable

Tooth width excess:
Overall mandibular excess was found to be significant in this study, Overall maxillary excess, anterior maxillary excess and anterior mandibular excess were not significant in comparing crowding and non crowding cases. Our results showed that there was only a small significant difference in the distribution of subjects requiring mandibular corrections for overall tooth size discrepancy

LIMITATIONS OF THE PRESENT STUDY

This study was conducted in the cases seeking orthodontic treatment unlike the cases of Bolton's study which included the cases with Perfect Class I Occlusion.

CONCLUSION

The null hypothesis was accepted for the study. Thus concluding that the tooth width discrepancy is not directly associated with crowding, although tooth width, overall ratio and anterior ratio were higher in crowding cases than non crowding.

No difference between tooth width ratios according to sex or interaction between sex and crowding was found except for overall mandibular ratio in females.

Overall ratio found in this study was comparable with the Bolton's study but Anterior ratio found in this study was slightly higher in this study (79.66%).

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