ORIGINAL RESEARCH PAPER

Dental Science

APPLICABILITY OF BOLTON'S ANTERIOR AND OVERALL RATIO ON JAIPUR POPULATION.

KEY WORDS: : esthetics, Bolton, anterior ratio, overall ratio.

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ABSTRACT

Aim: Applicability of Bolton's analysis on Jaipur population.
Material and Methods: The 270 subjects were the students, patients and their attendants who visited the Jaipur dental college and hospital. The width of teeth was measured on the dental stone casts using a digital caliper. The data were analyzed using Student's t-test with level of significance p 0.05. Statistical analysis was done using SPSS for windows software (version 21).
Results: No significant difference was found in the overall ratio between Jaipur subjects and Bolton's ratio (p 0.05), whereas statistically significant differences were observed in anterior ratio (p 0.05).
Conclusion: Bolton's ratio did not serve as an adequate guideline for Jaipur population. Specific population and or ethnic characteristics should be considered to establish objectively quantifiable Bolton's ratio.

Introduction

Orthodontic treatment should result in appropriate points of contact between neighboring teeth. Appropriate proportions in tooth sizes are needed to achieve this. However, some discrepancies between tooth sizes are not apparent until the final stages of orthodontic treatment .[1, 2] Any discrepancy in the tooth size ratio guides the treatment plan between extraction and nonextraction or only reproximation. The relationship between upper and lower teeth for good occlusion was proposed by Bolton.[3]

Bolton established the following ratios between maxillary and mandibular teeth for good occlusal relationship.

Overall ratio = 91.3% the standard deviation (SD) was 1.91 % Anterior ratio = 77.2% the SD was 1.65%. [1]

In a subsequent paper, Bolton expanded on the clinical application of his tooth size analysis. Bolton's SD of his original sample (> 1SD) has been used to determine the need for reduction of tooth tissue by interdental stripping or the addition of tooth tissue by restorative techniques.[2]

Bolton developed his overall and anterior ratios based on 55 patients with excellent class I occlusions.[4] Although Bolton's analysis has proven extremely useful in the clinical setting to guide the orthodontist in cases with extreme tooth size discrepancies, it is not without limitations. Firstly, as Bolton's study included only cases with excellent occlusion, its feasibility in different malocclusions is questionable.

Secondly, and perhaps more important, since gender composition of Bolton's sample was not specified, it implies potential selection bias.[5] Also, most of the cases taken up in his study were orthodontically treated (nonextraction) but the methods of gaining space have not beenpecified.[4]

Many studies were conducted to evaluate the applicability of Bolton's ratio for different population and most of the studies concluded that there is a need for ethnic or population specific intermaxillary tooth size ratio. Hence there is a need to individualise each population with their own ratios whilst others claim that it is indeed valid for other populations.[5-17]

Therefore, the aims of the present study were to determine anterior and overall tooth-width (Bolton's) ratios in Jaipur population and compare them with the Bolton standards.

Materials and Methods

The sample for this study consisted of study models of 270 subjects. The subjects were the students, patients and their attendants who visited the Jaipur dental college and hospital. The inclusion criteria were:

1. Jaipur individuals.
2. Fully erupted all maxillary and mandibular teeth (except third molars).
3. Absence of spacing, intrusion, extrusion, rotation and crowding.
4. No periodontal disease.
5. No history of orthodontic treatment.
6. No dental prosthesis
7. Absence of tooth anomalies.

Following are the exclusion criteria:
1. Gross restorations that affect tooth's mesiodistal diameter.
2. Any gingival alteration or dental irregularities.
3. Loss of tooth structure due to attrition, fracture or caries.

Perforated metal stock trays, rubber bowls, curved metal spatula, straight metal spatula, alginate impression material, dental stone, dental plaster, base formers, sand paper were used for making the impressions and preparing the casts.

A digital caliper (Figure 1) with precision reading to the nearest 0.01 mm was used to measure the size of teeth. The mesiodistal width was obtained by measuring the maximum distance between the mesial and distal contact points of the tooth.

A single investigator will measured each arch twice, from right first molar to left first molar. If the second measurement differed by more than 0.2 mm from the first measurement, the tooth was measured again and only the new measure was registered. Anterior ratio = Sum of mandibular 6 / Sum of maxillary 6 X 100

Following formula was used to calculate anterior ratio and overall ratio.

According to Bolton: Anterior ratio = 77.2% the SD was 1.65% .The data are classified as normal for Bolton's ratio within ± 1 SD (77.2 ± 1).

Anterior mandibular discrepancy (excess) if ratio is > 1 SD i.e., more than 78.2%.

Anterior maxillary discrepancy (excess) if ratio is < 1 SD i.e., <76.2%.

The data are classified as normal for Bolton's ratio within ± 1 SD (77.2 ± 1)Overall ratio = Sum of mandibular 12 / Sum of maxillary 12 X 100

The overall ratio will be calculated using the following formula.

According to Bolton: Overall ratio = 91.3% the SD was 1.91%. The data are classified as normal for Bolton's ratio within ± 1 SD (91.3 ± 1).

Overall mandibular discrepancy (excess) if the ratio is >1 SD, i.e., more than 92.3%.

Overall maxillary discrepancy (excess) if the ratio is <1 SD i.e., < 90.3%.3, 4

The data obtained were tabulated and subjected to statistical analysis using Student's t-test with level of significance p 0.05. Statistical analysis was done using SPSS for windows software (version 21).

Figure 1: Digital caliper

Results
The mesiodistal dimension's mean and standard deviation (SD) of teeth and comparison of contralateral teeth in upper and lower arch are shown in. In our study the results depicts that there was wee non-significant differences in between the right and left sides of the dental arch and symmetry in size exists (Table 1). Table 2, Graph 1 shows no statistically significant difference in overall ratio and statistically significant ration in anterior ratio between our study and Bolton's ratio.

Table 1. The comparison between mesiodistal tooth measurements of right and left teeth.

Upper arch	Right		Left		p value
	Mean	SD	Mean	SD	
Central incisor	8.88	0.52	8.89	0.52	0.98
Lateral incisor	6.96	0.45	6.97	0.45	0.88
Canine	7.70	0.50	7.70	0.50	0.93
First premolar	6.92	0.42	6.92	0.42	1.00
Second premolar	6.50	0.35	6.50	0.35	0.99
First molar	10.48	0.43	10.48	0.43	0.98
Lower arch	Right	Left	P value		
	Mean	SD	Mean	SD	
Central incisor	5.33	0.36	5.33	0.36	0.99
Lateral incisor	5.90	0.34	5.90	0.34	0.98
Canine	6.98	0.41	6.98	0.41	0.99
First premolar	7.14	0.39	7.13	0.40	0.88
Second premolar	7.01	0.40	7.01	0.40	0.91
First molar	11.00	0.47	10.99	0.46	0.99

Table 2: Anterior and overall tooth width ratios of our study as compared with Bolton's ratios.

Ratio	Study		Bolton		p value
	Mean	SD	Mean	SD	
Anterior	77.32	0.73	77.20	2.44	0.01
Overall	91.36	1.09	91.30	1.71	0.37

Graph 1: Comparison of anterior and overall tooth width ratios of our study to the Bolton's ratios
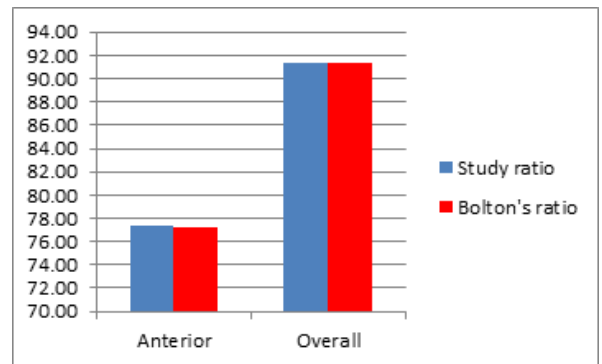
Discussion
Esthetics is the combination of qualities, such as shape, proportion, color of human face or form, or in other objects that delights the sight. Artificial denture esthetic is generally considered to be naturalness in the appearance of the orofacial regions, in the function of the mandible and lips, and the using esthetically appropriate tooth forms and alignments with composition and colors. The relative dimensions of teeth seem to be among the most objective dental criteria within the esthetic requirement.18-19

In our study found non-significant left-right side difference in mesiodistal tooth width was found in both upper and lower arches (Table 1). This shows that both upper and lower dental arches has symmetry in size of respective teeth. Our results are in disagreement with the previous studies20 in which right to left side tooth size was no significant. This difference may be due to the fact that in our study we selected subjects with all fully erupted teeth without any malocclusion. In upper arch central incisor whereas in lower arch first molar shows maximum variability in mesiodistal dimensions. Our results are similar for lower arch but dissimilar for upper arch from.

Intermaxillary tooth-size discrepancies can be evaluated using a diagnostic set up or by prediction using a mathematical formula (Bolton analysis). If the discrepancy was not detected initially, it may lead to embarrassing delays in the completion of the treatment at the finishing stage, or to a compromised and unstable result. Hence, Bolton analysis is an important diagnostic tool and one that should be the best used at the initial diagnostic stage in orthodontic therapy3-4.

The original Bolton norms were calculated using 55 models with excellent occlusion, of which 44 were orthodontically treated. Bolton's estimates of variation were underestimated because his sample was derived from perfect Class I occlusions3-4. In our study we examined 270 subjects and found no statistical significant difference between the present study and Bolton's study for overall ratio (p 0.05) whereas a statistically significant difference was observed in anterior ratio (p 0.05) (Table2, Graph 1). Hence Bolton's overall ratio is applicable for Jaipur population but anterior ratio is not applicable. The Bolton's ratio is affected by type of population and or ethnic group. Our results are in agreement with the results of Nie Q and Line J 6, Othman and Harradine21 and Mohammad Khursheed Alam 22 but in disagreement with the results of Basaran 23.

Conclusion
1. There were no significant differences between the present study and Bolton's study for overall ratio whereas a significant difference was observed in anterior ratio.

2. Ethnic differences should be taken into consideration to establish objectively quantifiable golden proportion, golden percentage and golden standard and Bolton ratio.

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