

DIFFERENCES IN TOOTH SIZE RATIO BETWEEN MALE AND FEMALE PATIENTS REPORTING TO OPD OF ORTHODONTIC DEPARTMENT BHITAI DENTAL & MEDICAL COLLEGE MIRPURKHAS

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ABSTRACT

The aim of the present study was to assess differences in tooth size ratio between male and female patients reporting to Orthodontic Department at Bhitai Dental Hospital, Mirpurkhas, Sindh.

The study was carried out on 150 (75 males, 75 females) study casts. Criteria for selection of the study casts were pretreatment orthodontic casts with Angle Class I and fully erupted permanent teeth with no dental anomalies. The individual mesiodistal tooth size was measured with a Boley's gauge. The mean and standard deviation was calculated for the size of the teeth and the interarch tooth width ratios both anterior and overall.

The ratios for the tooth size were compared to the original Bolton ratio. The overall ratio was found to be 91.61 almost equivalent to the original Bolton ratio of 91.3, whereas the anterior ratio was found to be 79.70, higher than the 77.1 as calculated by Bolton. The mean values for the overall and anterior ratio for the male and female subjects determined which significant. Standard deviations for overall were not statistically & anterior ratio were larger than the Bolton's value.

There were no significant differences between the mean overall and anterior tooth width ratio of males and females. Even though the values were not significantly high, a careful analysis of interarch tooth size relationship (Bolton's ratio) should be added along with other diagnostic considerations before initiating orthodontic treatment for better finishing and stability.

Key Words: Tooth size discrepancy, Tooth size, Bolton ratios.

INTRODUCTION

The task of an orthodontist is to align the teeth and dental arches to improve the function and facial esthetics.¹ The proportional relationship between the mesio-distal crown dimensions of the upper and lower teeth are accepted as an important index by which an orthodontist can determine the possible esthetic and functional limits of treatment, especially with regard to the finishing phase of orthodontic therapy.^{2,3,4} The

tooth size discrepancy makes it difficult to align teeth in optimal position i.e. ideal overjet, overbite and a Class-I molar relationship.^{5,6}

Tooth size discrepancy means disproportion among the sizes of individual teeth, when this disproportionality is observed than the clinical manifestations may be crowding, spacing, overjet, overbite and improper occlusion.⁷ Therefore, it is mandatory to determine the proportionality of the maxillary and mandibular teeth in the same arch and between arches right at the start of treatment.⁸

Treatment planning especially in extraction cases without consideration of tooth size ratio can compromise the final results, the chosen extraction pattern leads to a clinically significant mandibulo- maxillary tooth size discrepancy. Many investigators measured the tooth sizes in relation to occlusion following Black's investigation in 1902 and Neff in 1949.⁹ Pioneer work on tooth sizes was conducted by Dr Wayne Bolton in

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1958, he believed that an optimal occlusion and the achievement of proper occlusal interdigitation in the finishing stages of orthodontic treatment are not possible without the correct maxillary and mandibular mesiodistal tooth size relationship. He provided the normative data on the mandibular to maxillary tooth size ratios which was widely accepted and it was then named after him as Bolton's ratio.¹⁰

As far as the factors responsible for the determination of the tooth size dimensions, several studies indicate that tooth size ratios show genetic, ethnic, racial and gender differences.^{14,15} A strong variation is found in the literature regarding relation of tooth size discrepancy and gender. A polygenic model of inheritance best explains the genetic basis for this variation.¹⁶

Several studies have been carried out to set the norms for the Bolton ratio on various ethnic groups.^{11,12,13} However, no such study has been carried out in local sindhi population to identify the normal values for tooth size ratio, that may provide a strong key for orthodontic diagnosis and improve the quality of orthodontic treatment. Purpose of this study was to identify and compare the tooth proportions in local population variation according to gender in relation to original Bolton's analysis.

METHODOLOGY

A Cross sectional study was conducted to calculate differences in tooth size ratio between male and female patients reporting Orthodontic Department, Bhitai Dental & Medical College Mirpurkhas Sindh. This study was conducted at the Dental OPD of Orthodontic Department, Bhitai Dental & Medical College Mirpurkhas Sindh.

One hundred and fifty casts of patients, seen at OPD of Orthodontic Department, Bhitai Dental & Medical College, Mirpurkhas Sindh for treatment, were analyzed. Patients with Class-1 molar relationship, having permanent dentitions and having fully erupted first Molar in both arches were included. Patients with mesiodistal discrepancy, tooth loss due to carries/trauma, prosthesis/crowned teeth, extensive tooth fillings and with apparent congenital craniofacial anomalies.

Sample of patients consisting of both male and female individuals having Class I occlusion belonging to different ethnic groups, living in Mirpurkhas were selected through a non-probability sampling technique. Good quality study models of 150 subjects were produced after satisfying the inclusion criteria. A sharpened mechanical Boley's gauge accurate at 0.1mm was used to measure the teeth. Measurements were taken at the highest contact points or at the widest mesiodistal widths of all permanent teeth from right to left first molars of the maxillary arch. The tip of the Boley's gauge was held perpendicular to the long axis of each tooth. The same procedure was done for the mandibular teeth. The measurements were repeated two times after the interval of week to avoid error. All the data was recorded in the proforma.

The mean, standard deviation for the mesiodistal tooth sizes and Bolton ratio was measured. The data was analyzed on SPSS version 16. The study proposal was reviewed and approved by ethical review committee of Bhitai Dental & Medical College, Mirpurkhas, Sindh and permission was granted by the Dean of the Faculty of Dentistry.

RESULTS

The results of the study reveal that the mean overall interarch tooth width ratio among males was slightly

TABLE 1: OVERALL AND ANTERIOR INTERARCH TOOTH WIDTH RATIOS OF THE MALE AND FEMALE INDIVIDUALS OF THE PRESENT STUDY SAMPLE

	Males		Females	
	Overall interarch tooth width ratio	Anterior interarch tooth width ratio	Overall interarch tooth width ratio	Anterior interarch tooth width ratio
N	75	75	75	75
Mean	91.61	79.70	91.12	79.75
S.D	3.39	3.36	2.60	3.78
Range	7.99	16.9	12.56	15.33
Minimum	86.45	71.73	84.03	73.04
Maximum	94.44	88.63	96.59	88.37

TABLE 2: COMPARISON OF THE MEANS OF OVERALL INTERARCH AND ANTERIOR TOOTH WIDTH RATIO OF MALES AND FEMALES OF THE STUDY SAMPLE

Comparison of means	t	df	Significance (2 tailed)	Mean Difference	95% Confidence interval of the difference	
					Lower	Upper
Overall ratio of females with males	-.264	49	.793	-.10463	-.9060	.6967
Anterior ratio of females with males	-.363	49	.718	-.19583	-1.2854	.8937

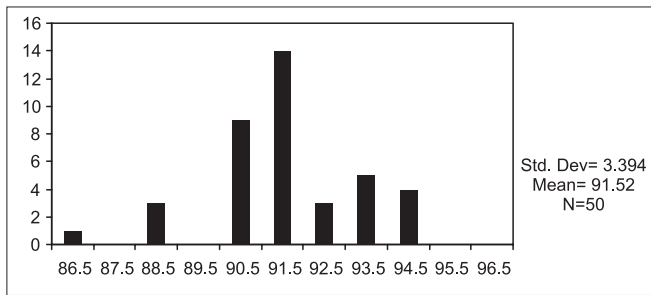


Fig 1: Overall tooth width ratios of males of the present study sample

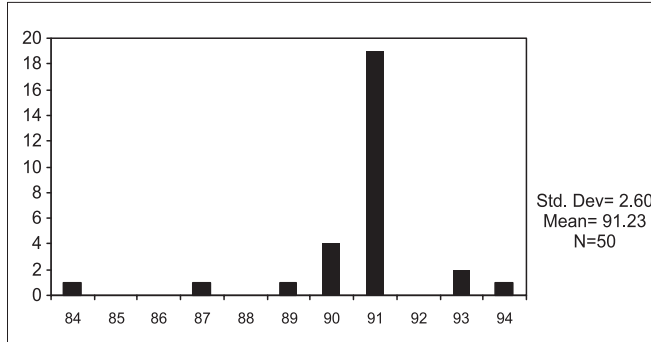


Fig 2: Overall tooth width ratios of females of the present study sample

higher (91.61 ± 3.39) than the females (91.12 ± 2.60). Mean overall anterior interarch tooth width ratio among males (79.70 ± 3.36) was also found to be slightly higher as compared with females (79.75 ± 3.78). (Table 1)

Statistical comparisons reveal that the mean difference of overall interarch tooth width ratio of males and females (-0.10463) and mean differences of anterior tooth width ratio of males and females (-0.19583) of the present study sample were not statistically significant. (Table 2)

DISCUSSION

When the overall and anterior teeth width ratios of the males were compared to females for the current study sample, female overall ratio 91.12 ± 2.6 , approximates the Bolton overall ratio of 91.3 ± 1.91 more closely than males. This finding strengthens the idea of Smith et al¹⁷ that the Bolton ratio is only applicable to white females as the Bolton sample was mainly consisted of white females. The overall width and anterior width ratio in males for the current study sample are found slightly greater than the females, but the differences are not statistically significant. These findings are in agreement with Nourallah et al¹⁸ when studying Syrian subjects and Moshabab¹⁹ when studying Saudi subjects. Further Toshiya et al¹² found insignificant results in Japanese population regarding gender differences. They speculated that gender differences in tooth size ratios may be population specific. However these findings are in contrast to Behnam M et al²⁰ and Santoro et al²¹ as they found high variability in male and female subjects.

In the present study, the mean values for the me-

siodistal width of teeth showing low variability this may be due to high accuracy with which the measurements were taken. Present study demonstrates that maxillary teeth have more variation in their mean mesiodistal width particularly maxillary central and lateral incisors as compared to the mandibular incisors except mandibular molars which found with pronounced variation. Mean smallest mesiodistal width of lower right central incisor (LRI) i.e. 5.33mm followed by lower left incisor (LLI) i.e. 5.37mm, while the largest mean mesiodistal width of lower left first molar (LL6) i.e. 10.931mm followed by lower right first molar i.e. 10.892mm. These findings are in agreement with Uysal T.²³ (2005), who found the same mesiodistal tooth size variations when studying Turkish population.

The mean values of overall and anterior ratio for the present study sample i.e. 91.546 ± 2.165 and 79.176 ± 3.08 . The mean overall ratio of the present study sample is found slightly different from Bolton mean overall ratio i.e. 91.3 ± 1.91 . The value of mean overall ratio of the current study sample is found very close to the study of Crosby & Alexander²², Freeman²⁴ and Santoro et. al.²¹ They all found it equivalent to the Bolton overall ratio of 91.3 ± 1.91 . This reveals that Bolton overall ratio can be applicable for the present study sample.

The value of mean anterior interarch tooth width ratio of the present study sample is 79.1 ± 3.0 . This value is significantly different from Bolton anterior interarch tooth width ratio i.e. 77.2 ± 1.65 . This finding is found in close approximation with the result of Jaiswal A et al¹³ who found the mean overall interarch tooth width ratio same as calculated by Bolton in their sample, while the mean anterior interarch tooth width ratio was significantly different from the mean anterior interarch tooth width ratio calculated by Bolton in his sample.

The value of anterior interarch tooth width ratio of the present study sample is also closely match with the result of Adeymi AT, Bankole OO and Denloye OO¹¹, on Nigerian population group which was 79. The reason of difference in anterior interarch tooth width ratio for the present study sample is found due to variation in the size of the maxillary front teeth. The basis of difference in anterior interarch tooth width ratio for the other studies were also found same.

The present study sample contained high values of standard deviation for the mean overall and anterior interarch tooth width ratio when compared with the Bolton study. The current study sample value of S.D for the overall interarch tooth width ratio is 2.4 and 3.0 for the anterior interarch ratio, where as the value calculated by Bolton for standard deviations were 1.91 and 1.65 for overall and anterior interarch tooth width ratio respectively. The S.D values for the current study sample are closely matched with the values of Freeman⁷⁹ and Crosby Alexandra.²² The difference in the S.D values for the current study sample might be due to the sample size. Bolton used a sample size of 55 ideal occlusion patient (11 untreated and 44 treated

orthodontically) where as the current study have a sample size of 100 Class I patient (all untreated orthodontically).

Mean overall ratio of current study sample is found close to the North American Caucasians and found different from African American sample. This finding is coincident with the results of v. parades et al²⁵ and Toshiya End et al.¹² They found the same mean overall ratio and different mean anterior ratio from North American Caucasians and African American sample.

T-test, comparison of the mean overall ratio of current study sample with Bolton overall ratio shows that the mean overall ratio of current study sample and Bolton ratio is statistically non significant. This finding reveals that the Bolton overall ratio is applicable for the current study sample.

The mean anterior ratio of the current study sample and Bolton mean anterior ratio is statistically significant. According to Santoro Ayuob et al²¹ study findings, larger values of mean anterior ratio require either removal of tooth structure in the mandibular arch (inter proximal reencountering) or the addition of tooth structure in the maxillary arch to achieve an ideal overjet and overbite. Most recently tooth width ratio discrepancy outside 2 S.D from Bolton mean ratio considered clinically significant. According to this statement an anterior ratio below 73.9 or above 80.5 and overall ratio below 87.5 or above 95.1 considered clinically significant, in this study both the mean overall ratio (91.3) and the mean anterior ratio (79.1) fall within the 2SD of the Bolton means. Therefore Bolton ratios are applicable for the current study sample. To set occlusion on these norms would give optimal occlusion.

CONCLUSION

Within the limitation of current study following conclusions can be drawn:-

There were no significant differences between the mean overall and anterior tooth width ratio of male and female for the current study sample. The current study finding suggest that even though the values were not significantly high, a careful analysis of interarch tooth size relationship (Bolton's ratio) should be added along with other diagnostic considerations before initiating orthodontic treatment for better finishing and stability.

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CONTRIBUTIONS BY AUTHORS

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| 1 Umer Khayyam: | Write of the article. |
| 2 Khalil: | Assistance in data collection. |
| 3 Atif Jawad: | Supervisor. |