

CO-RELATION BETWEEN BOLTON RATIO, ANTERIOR BOLTON RATIO AND DIFFERENT VERTICAL GROWTH PATTERNS

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ABSTRACT

Bolton's method of diagnosing tooth size discrepancies has been widely used in scientific studies since its publication. Aim of this study was to calculate Bolton Ratio & Anterior Bolton Ratio^{1,2,3} for Patients with different Vertical Growth Patterns and establishing correlation between Bolton's anterior and overall ratios and vertical growth pattern assessment parameters. Study models & lateral Cephalogram were taken for 60 subjects selected on the basis of selection criteria and Bolton Ratio, Anterior Bolton Ratio, SNM, MMA, SNP, Y-axis, SOPA, Jaraback ratio & Facial Ratio were calculated and analyzed using SPSS version 10. Results concluded that 1. Bolton Ratio and Anterior Bolton Ratio though slightly different in Normal Angle, High Angle & Low Angle Cases but the difference was statistically insignificant and 2. Statistically insignificant correlation occurs between Bolton Ratio, Anterior Bolton Ratio and vertical growth pattern assessment parameters

Keys words: Bolton Analyses, Anterior Bolton Analyses, Vertical Growth Patterns.

INTRODUCTION

This article is a continuation of our article published in Vol 28, No 1 issue of this journal where Bolton Ratio & Anterior Bolton Ratio were compared in different Sagittal problems and their correlation with dental parameters was assessed. We again stress on the assessment of Tooth Size Discrepancy at the initial diagnosis and treatment planning stage if excellence in orthodontic finishing has to be achieved.¹ Moreover, tooth size discrepancy is an often-overlooked problem in retention stage.²

Ballard reported that 90% of the casts of 500 patients he examined had tooth size discrepancies. Anterior tooth size discrepancies were more prevalent. When maxillary anterior teeth were too large in relation to mandibular anterior teeth, compensations included: 1) Deeper Overbite 2) greater overjet 3) Combinations of greater overjet and overbite 4) Crowded anterior segment, 5) Out of proper occlusion buccal segment and when mandibular anterior teeth were too large, compensations included: 1) an end-end incisor relationship 2) spacing in maxillary anterior teeth 3) crowding in mandibular incisor area and 4) improper occlusion.²⁻⁴

Tooth Size Discrepancy is a matter of both genetic and environmental factors. Various studies have investigated ethnic^{5,6} and sex^{7,8} differences in the intermaxillary tooth ratios. Different studies have compared the Bolton Ratio and Anterior Bolton Ratio in different Skeletal Problems.⁹⁻¹⁴ Different studies has also related Tooth size Discrepancies with Arch Length Discrepancy.

METHODOLOGY

The study was conducted on 60 subjects (36 females, 24 males) with age range of 12-30 years who reported at de, Montmorency College of Dentistry & University College of Dentistry, University of Lahore. Subjects having supernumerary or congenitally missing teeth, already undergoing with orthodontic treatment and Syndromes, were excluded from the study.

Sample was collected using the non-probability convenience sampling technique.

Study Casts were taken for each subject and Bolton Analysis was performed as

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$$\text{Bolton Ratio (X)} = \frac{\text{Sum of mesiodistal width of mandibular 12 teeth X 100}}{\text{Sum of mesiodistal width of maxillary 12 teeth}}$$

$$= X\%$$

$$\text{Anterior Bolton Ratio (Y)} = \frac{\text{Sum of mesiodistal width of mandibular 6 Anterior teeth X 100}}{\text{Sum of mesiodistal width of maxillary 6 teeth}}$$

$$= Y\%$$

Lateral Cephalogram was taken in natural head position for each subject. Lateral Cephalograms were then traced and analyzed. Parameters used to assess the vertical pattern of the patient were SN Plane to Mandibular Plane Angle) <SNM (32°±4), (Maxillo-Mandibular Plane Angle) <MMA (25°±4), (Sum of Posterior Angles) SOPA (396°±4), (SN Plane to Palatal Plane Angle) <SNP (6°±4), Y-axis (66°±4) Jaraback Ratio (65%±4) and Facial Ratio (54%±4). Patients having values within the norms were categorized as Normal Angle, values greater than the norms were categorized as High Angle and values lesser than norms were categorized as Low Angle case.

SPSS 10.0 was used for statistical evaluation.

1. Mean, Standard Deviation, Variance, Minimum & Maximum value and Range were calculated for each variable for each subject.
2. Correlation coefficients between Bolton Ratio, Anterior Bolton Ratio & Vertical Pattern were calculated using Pearson's correlation.

RESULTS

The study was conducted on 60 subjects (36 females and 24 males) with mean age 18.43±4.21. Descriptive Statistics were calculated for each variable for each subject as shown in table 1.

Correlation between Overall Bolton Ratio (X), Anterior Bolton ratio (Y) and Vertical assessment parameters was established. Statistically insignificant correlation existed between the Bolton ratio (X), Anterior Bolton Ratio (Y) and the Parameters used to assess the Vertical Pattern of the patients as shown in table 2.

Overall Bolton Ratio (X) for the sample was 92.25%±2.3, for Normal Angle Cases was 92.17%±2.46, for High Angle Cases was 92.34%±2.27 and for Low Angle Cases was 92.3%±2.19 respectively as shown in Table 3.

Overall Bolton Ratio (Y) for the sample was 78.6%±2.66, for Normal Angle Cases was 77.76%±2.4, for High Angle Cases was 79.56%±2.89 and for Low

TABLE 1: DESCRIPTIVE STATISTICS

	N	Range	Minimum	Maximum	Mean	Std. Deviation
PTAGE	60	18.00	12.00	30.00	18.4333	4.2080
X	60	11.42	88.00	99.42	92.2538	2.3099
XMM	60	4.20	.00	4.20	1.5092	1.0121
Y	60	12.23	73.10	85.33	78.6007	2.6685
YMM	60	4.33	.08	4.41	1.3015	.9698
SNM	60	35.00	19.00	54.00	33.8667	7.6534
SNP	60	16.00	1.00	17.00	8.2417	3.6424
MMA	60	28.00	13.00	41.00	25.6417	6.9368
YAXIS	60	25.00	56.00	81.00	67.8250	4.5704
SOPA	60	49.00	377.00	426.00	395.2750	9.1260
JR	60	22.37	54.83	77.20	85.2902	5.4683
FR	60	18.63	47.50	66.13	56.7247	3.5211
Valid N (listwise)	60					

N=60 (Entire Data)

TABLE 2: CORRELATION BETWEEN BOLTON RATIO (X), ANTERIOR BOLTON RATIO (Y) AND VERTICAL ASSESSMENT PARAMETERS

	X	Y	SNM	SNP	MMA	YAXIS	SOPA	JR	FR
X Pearson Correlation		.405**	.009	-.110	.081	-.153	-.031	-.092	.008
Sig. (2-tailed)		.001	.945	.401	.538	.044	.812	.483	.950
N			60	60	60	60	60	60	60
Y Pearson Correlation	**		.241	-.083	.285*	.187	.208	-.049	.237
Sig. (2-tailed)			.064	.528	.027	.151	.114	.710	.069
N			60	60	60	60	60	60	60

Correlation is significant at the 0.01 level (2-tailed).

Correlation is significant at the 0.05 level (2-tailed).

TABLE 3: BOLTON RATIO & ANTERIOR BOLTON RATIO FOR DIFFERENT VERTICAL GROWTH PATTERNS

	Normal Angle Case (N=28)		High Angle Case (N=21)		Low Angle Case (N=11)	
	Mean	SD	Mean	SD	Mean	SD
Age	18.46	3.82	18.52	4.56	18.18	4.18
Bolton Discrepancy (X)	92.17	2.46	92.34	2.27	92.23	2.19
Anterior Bolton Discrepancy (Y)	77.76	2.4	79.56	2.89	78.89	2.38
Vertical Parameters						
SNM	31.8	2.62	41.89	5.49	23.82	2.99
SNP	8.5	3.15	8.86	4.18	6.44	3.41
MMA	23.43	3.5	32.85	4.38	17.5	4.06
YAXIS	67.28	2.88	71.19	3.98	62.77	4.06
SOPA	393.14	4.3	403.81	7.52	384.41	5.72
Jaraback Ratio	66.49	4.21	61.66	3.56	69.16	7.41
Facial Ratio	56.2	3.03	58.26	3.57	55.12	3.78

Angle Cases was 78.89%±2.39 respectively as shown in table 3.

DISCUSSION

In this study, the Bolton Ratio & Anterior Bolton Ratio were compared in Normal Angle, High angle and Low angle cases in selected Pakistani Sample. Statistically insignificant relation exists between the Bolton Ratio (X), Anterior Bolton ratio (Y) and Vertical Parameters.

Previous studies have conformed that Tooth Size Discrepancy is a function of both genetic & environmental causes⁵⁻⁸

As in many other human attributes, teeth vary in size between males and females. There is lack of agreement regarding gender differences in relation to the tooth size proportion between upper and lower teeth.^{7,8}

Tooth size differences exist among various ethnic groups.^{5,6}

Different studies have compared the Bolton Ratio & Anterior Bolton Ratio in different Skeletal Problems. Sperry et al,¹¹ concluded that the frequency of mandibular tooth size excess (overall ratio) was greater in cases of mandibular prognathism than in Angle Class I and Class II cases. Lavelle,⁶ studied anterior tooth size stated that the teeth in the lower arch are larger in Class III cases than in Class I and II cases, with the inference that a Bolton discrepancy is greater in Class III cases than in the other malocclusion groups.

In our study we have compared the Bolton Ratio (X) and Anterior Bolton ratio (Y) with the parameters used to assess the vertical pattern of the patient. Overall Bolton Ratio (X) for the sample was 92.25%±2.3, for Normal Angle Cases was 92.17%±2.46, for High Angle Cases was 92.34%±2.27 and for Low Angle Cases was 92.3%±2.19. Statistically insignificant difference was found between patients having vertical pattern of growth.

Moreover Overall Bolton Ratio (Y) for the sample was $78.6\% \pm 2.66$, for Normal Angle Cases was $77.76\% \pm 2.4$, for High Angle Cases was $79.56\% \pm 2.89$ and for Low Angle Cases was $78.89\% \pm 2.39$. Though difference exist between the three groups but were statistically insignificant.

It was also found that no correlation exists between the Vertical growth pattern of the patient and Bolton Ratio and Anterior Bolton ratio.

CONCLUSIONS

Bolton Ratio and Anterior Bolton Ratio though slightly different in Normal Angle, High Angle & Low Angle Cases but the difference was statistically insignificant.

Statistically insignificant correlation occurs between Bolton Ratio, Anterior Bolton Ratio and vertical growth pattern assessment parameters

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