

Correlation between Bolton Ratio and Incisal Inclination

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ABSTRACT

Aim: To investigate whether the bolton's ratio are correlated to the inclination of anterior teeth.

Setting: Orthodontic department-de'Montmorency College of Dentistry, Pakistan.

Methods: The cross-sectional study was conducted at Orthodontic department-de'Montmorency College of Dentistry, Pakistan. In the present study 100 lateral cephalograms and plaster casts of untreated Class I malocclusion patients (18 boys, mean age:17.3±1.3 years; 12 girls, mean age: 17.0±1.7 years) were included..

Results: Statistically significant correlation existed between the Bolton ratios and incisal inclinations.

Conclusion: Bolton's ratios and inclinations of incisors are correlated.

Keywords: Bolton ratio; Inclination; UI-PP; UI-SI; IMPA.

INTRODUCTION

There are six keys of normal occlusion, provided by Andrews in his study in 1972 on 120 plaster models of dental patients. These six keys focused on correction of molar relation, correction of tip and tipping of crowns, derotation of teeth, closure of residual spaces and correct occlusal plan. Correction of tooth size mass was the 7th key of normal occlusion and it was suggested by Bennett and McLaughlin².

Tooth size discrepancy is basically mismatch in mesiodistal dimensions of individual teeth.³ The harmony in tooth mass ratio must be maintained, otherwise it will result in failure to achieve optimal normal functional occlusion^{4,5}.

The mesio-distal widths of teeth were initially described by G.V. Black⁶, following this, number of authors did study on norms of mesiodistal dimensions of individual teeth⁷⁻¹⁰. Bolton's analysis is recognized method of calculating tooth size discrepancies.¹¹ According to Bolton's analysis, norms for overall tooth mass are 91.3% while norms for anterior incisal teeth are 77.2%^{12,13}.

There are multiple factors that can affect bolton proportions, which are already investigated in the previous studies¹⁴⁻¹⁹ but studies on correlation between bolton ratios and anterior incisal inclinations are very few. Therefore the objective of the present study was to find out the correlation of bolton teeth ratios and inclination of anterior teeth..

MATERIALS AND METHODS

The cross-sectional study was conducted at Orthodontic department-de'Montmorency College of Dentistry, Pakistan. The study involved 100 lateral cephalograms and models of untreated patients. Duration of this research was from 15.8.2016 to 15.6.2017. Selection criteria were: skeletal class one patients, having acceptable quality of orthodontic treatment records, got no history of previous orthodontic or dental restorative treatment, medically fit patients and no any dental pathos.

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Upper incisor to palatal plane (UI-PP) & lower incisor to mandibular plane angle (IMPA) were measured. Bolton analysis was done on plaster cast models of patients²⁰. Linear regression analysis was done to find out the Pearson's correlation coefficient for finding out the relationship between these two variables.

RESULTS

Age distribution is presented in Table I. The descriptive stats for Bolton analysis and incisal inclinations are shown in Table II. The correlation analysis showed that anterior teeth inclinations are significantly correlation to the bolton's ratio (Table III).

Table I: Descriptive stats for age (n=100)

Age (years)	
N	100
Mean	17.11
SD	4.13
Minimum	13
Maximum	23

Table II: Descriptive stats for Bolton ratio and incisal inclinations (N=100)

Variable	Min.	Max.	Mean	SD
Overall Bolton	88.87	95.76	92.32	2.6707
Anterior Bolton	75.34	81.23	78.01	1.8572
UI-PP	105	129	116.090	4.1260
IMPA	84	103	96.456	3.8790

Table III: Correlation between bolton ratio and incisal inclinations

	BR	ABR	IMPA	UIPP
Bolton ratio (BR)				
Pearson Correlation	1.000	.0639**	0.471	0.169
Sig. (2-tailed)		.001	.111	0.490
Anterior Bolton				
Pearson Correlation	.0639**	1.000	0.301	0.299
(ABR)				
Sig. (2 tailed)	.001		0.281	0.230
IMPA				
Pearson Correlation	0.471	0.301	1.000	0.499*
Sig. (2 tailed)	0.111	0.281		.039
UIPP				
Pearson Correlation	0.169	0.299	0.499*	1.000
Sig. (2-tailed)	0.490	0.230	0.39	

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

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

DISCUSSION

Calculation of bolton ratios is must before starting any orthodontic case. The aim of this study was to find out the correlation of bolton teeth ratios and inclination of anterior teeth. It will help in finishing of orthodontic cases to optimum. The harmony in tooth mass ratio must be maintained otherwise it will result in failure to achieve optimal normal functional occlusion^{4,5}.

There are multiple methods reported in literature to find out the bolton teeth ratios. These methods include eye analysis, digital techniques of 3-dimensional nature, and vernier calipers. In the present study we calculated bolton ratios using vernier calipers which is accurate and reproducible as per reported evidence²¹.

Results of the current present research are in accordance with results of previously conducted studies on the bolton teeth ratios^{17,20,22} who showed that anterior teeth inclinations are significantly correlation to the bolton's ratio. Different x-ray techniques have been used in literature to calculate inclinations of upper and lower incisors²³ In the present study UI-PP and IMPA was used to calculate the inclinations of upper incisors and lower incisors, respectively²⁴.

There are multiple factors that can affect bolton proportions, which are already investigated in the previous studies^{14-19,25,26}. but studies on correlation between bolton ratios and anterior incisal inclinations are very few. The limitations of current study are small sample size and based on subjects of single centre, however within the limitations, the findings of this study showed that anterior teeth inclinations are significantly correlation to the bolton's ratio.

CONCLUSION

Bolton's ratios and inclinations of incisors are correlated.

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Conflict of Interest: We have no conflict of interest that I should disclose.

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