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The Correlation Between Overjet and Sagittal Skeletal Relationships

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ABSTRACT

Objectives: To determine the correlation between overjet and sagittal skeletal relationship.

Materials and Methods: This study investigated patients at Orthodontics Department of Karachi Medical and Dental College. This cross-sectional study lasted for six months from August 2019 to Feburary 2020, after due approval of the synopsis. After detailed history and clinical examination patients were included in the research. Measurements were made on pre-treatment dental models for malocclusion class and overjet, and lateral cephalometric x-rays for ANB angle and Wits analysis. All measurements were taken manually by the researcher and documented on a preformed Proforma.

Results: When the class of malocclusion was not considered, overjet had high correlation with ANB angle ($r = 0.789$) and Wits appraisal (0.825) which was statistically significant (p-value < 0.01).

Conclusion: The overjet can be used to predict sagittal malocclusion. When the malocclusion class was not considered, overjet had high correlation with the ANB angle and Wits appraisal and when the class of malocclusion was considered, Class III showed strong correlation between overjet and ANB angle.

Keywords: ANB Angle, Antero-Posterior Discrepancy, Overjet, Sagittal Plane Analysis, Wits Appraisal

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INTRODUCTION

Orthodontic diagnosis and treatment planning necessitates various records which includes dental models, radiographs, intra-oral and extra-oral pictures.[1] Cephalometric analysis is a crucial diagnostic tool in orthodontics. In order to identify and classify a malocclusion, the measured values of cephalometric analysis are compared to normal values in norms of that particular population in two planes; sagittal and vertical. Sagittal plane analyses are used to determine the discrepancies in anteroposterior dimension. There are several different cephalometric analyses consisting of angular and linear measurements to help the orthodontist diagnose.[2] The ANB angle is commonly used to determine discrepancy on the sagittal plane. It describes the extent of discrepancies skeletally, which may vary from 1 to 4 degrees.[3]

An important measurement to find out the skeletal and dental discrepancy between maxillary and mandibular arches is overjet. The variation in overjet can be found

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skeletally, dentally, or both.[4] Despite the fact that a connection exists between overjet and skeletal elements, the difficulty of giving a convincing treatment plan might be overcome by an intensive investigation of the association among dento-skeletal relationships.[4] If the overjet is in excess of 10 mm, treating the case surgically would be a more viable acceptability while choice is between surgical or orthodontic intervention. In any case, overjet is basically a degree of skeletal disharmony which can be represented, it manifests the advantage of being an objective measurement of skeletal problem.[5]

ANB angle has certain restrictions since its value can be altered by the incorrect location of the nasion,[6] an increase or decrease in vertical face height[7] or a change in the SN plane.[8] Wits appraisal, which was developed to address the issues with ANB angle, can be misinterpreted because of inconsistent occlusal planes.[9] The Wits appraisal cannot be considered an analysis rather, it is regarded as a tool for diagnosis to assess the degree of anteroposterior jaw discrepancy on a lateral cephalometric x-ray.[10]

The rationale for conducting this study is to find the correlation between overjet and sagittal skeletal values in Karachi residents, the extent to which overjet can be useful in determining skeletal relationships in anteroposterior dimension by using ANB and Wits Analysis, and to ascertain if the studies done before are applicable to our population.

MATERIALS AND METHODS

This cross-sectional study was done at Orthodontics Department, in KMDC. To determine the size of the sample, non-probability purposive sampling was used. The sample size came out as 78 which was calculated by the correlation sample size calculator, taking stats by Abdul Jabbar [1] for correlation between overjet and wits in class I as 0.317 with a confidence interval of 95 percent. Patients were grouped into class I, II and III malocclusion on the basis of Angle's classification. This research recruited participants of both genders aged 14 to 35 years old, having permanent teeth and no prior history of orthodontic treatment. Patients having orofacial syndromes, cleft lip and palate, prosthetic replacement, facial asymmetry and any incisor-related trauma were all excluded.

After receiving approval from the CPSP research cell (Ref No. CPSP/REU/DSG-2017-174-2127), data from lateral cephalometric x-rays and dental models of patients reported to the Karachi Medical and Dental College's Orthodontics OPD were collected. The researcher took impressions and made plaster casts. The patients' lateral cephalograms were used to calculate the ANB angle (Fig 1) and Wits analysis (Fig 2).

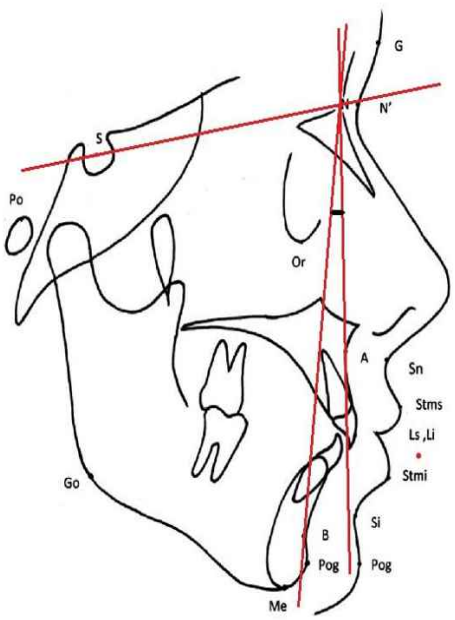

Figure 1: ANB Angle

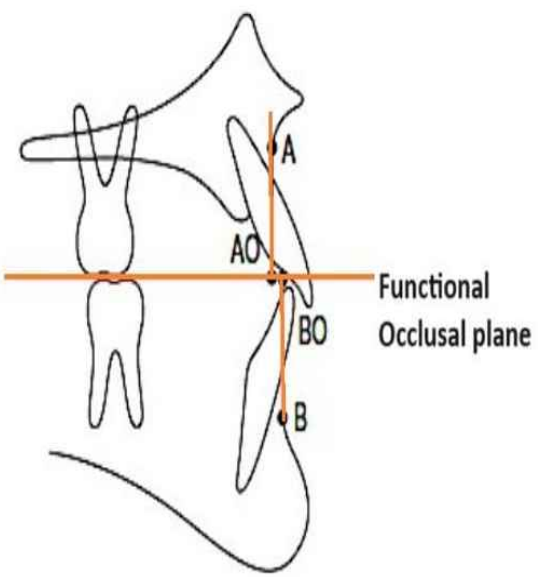

Figure 2: Wits Analysis

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Casts for teeth were used to determine overjet. To reduce inaccuracy, the researcher included and traced every cephalogram herself and lateral cephalometric x-rays were obtained from the same source.

The amount of horizontal (anterior-posterior) overlap between the maxillary and mandibular incisors is known as overjet. The skeletal relationship between two jaws is designated by ANB (A point, nasion, and B point), which was taken as: (a) Skeletal Class I: 2 ± 2 degrees of ANB, (b) Skeletal Class II: greater than 4 degrees of ANB, (c) Skeletal Class III: Negative relationship of ANB. The Wits appraisal evaluates how closely the mandible and maxilla are connected to one another in the sagittal (anteroposterior) plane. Data analysis was done using SPSS version 23. Frequencies and percentages were determined for gender and malocclusion classes. Mean and SD were performed for age and overjet. Using Pearson's correlation, the overjet and skeletal correlations were performed. Through post-stratification, effect modifiers like age and gender were taken into consideration. Statistically significant results were identified by a *p*-value less than or equal to 0.05.

RESULTS

Data were grouped by malocclusion which incorporates; 27 (34.6%) class I, 28 (35.9%) class II div 1 and 23 (29.5 %) class III cases. Patients with ages of 15 to 29 years with a mean of 20.84±4.01 were included. Class I patients had a mean age of 19.66±3.43 years (aged 15 to 26), Class II div I patients had a mean age of 21.57±3.79 years (aged 16 to 28), and Class III cases had a mean age of 21.34±4.70 years (aged 15 to 29). In total, data consisted of 30 males (38.5%) and 48 females (61.5%). With mean values of 3.57± 3.727 mm, it was discovered that the lowest recorded overjet was -4 mm and the highest was 12 mm. The mean value of overjet for the class I group was 3.018±1.631 mm, ranging from 0.00 to 8.00 mm; for the class II division I group was 7.321±3.795 mm, ranging from 1 to 12 mm; and the for the class III group mean value for overjet was -0.326±1.556 mm, ranging from -4 to 2 mm.

The ANB angle had a mean value of 3.60 degrees and a range of -5 degrees to 11 degrees. In class I, the mean ANB value was 4.15±2.214, ranging from -1 to 8 degrees; in class II, division 1, the mean was 6.86± 2.039, ranging from -5 to 2 degrees.

Wits analysis similarly displayed a distribution with a mean value of 2.217±3.960 mm and ranging from -8 mm to 10 mm. The class III group had the mean value of -2.521±3.083 mm ranging from -8 to 3 mm. Class II division 1 showed a mean of 5.446±2.024 mm ranging from 1 to 10 mm, while class I had a mean of 2.907± 1.599 mm ranging from -0.50 to 7 mm as shown in Table 1.

Table 1: Distribution of overjet (mm), ANB, and Wits Appraisal with respect to different malocclusion groups

Malocclusion Group	N	Overjet Mean and Sd	ANB Mean and Sd	Witts Appraisal Mean and Sd
Class I	27	3.018+1.63	4.15+2.214	2.907+1.59
Class II	28	7.321+3.79	6.86+2.49	5.446+2.02
Class III	23	-0.326+1.55	-1.00+2.039	-2.521+3.08

Pearson's correlation was applied which showed overjet exhibited a high correlation with ANB angle (r = 0.789) and Wits (0.808), which was statistically significant (*p*-value 0.01) when the malocclusion class was not taken into account as shown in Table 2.

In class I malocclusion, a very weak positive correlation between ANB and Overjet (r = 0.191, *p*-value > 0.05) was found, which is statistically insignificant. However, for class II groups, there was a weak correlation of overjet with ANB angle with "r" value of 0.399. (*p*-value 0.05), and only for class III malocclusions there is a significant strong correlation between ANB and overjet (r = 0.716, *p*-value 0.01) as shown in Table 2. The Pearson's correlation between overjet and Wits appraisal in class I is strong and significant, for class II and III was moderate and statistically significant having "r" value of 0.605, r = 0.495 and r = 0.484. (*p*-value < 0.01) as shown in Table 2.

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Table 2: Correlation between overjet with ANB angle and Wits appraisal in Class I, II and III

Correlation between overjet with ANB angle					
	Correlation	**Overall Sample**	**Class-I**	**Class-II**	**Class-III**
Overjet	**Pearson's Correlation**	0.789**	0.191	0.399*	0.716**
	Sig. (2-tailed)	0.000	0.340	0.035	0.000
	N	78	27	28	23
Correlation of overjet with Wits appraisal					
	Correlation	**Overall Sample**	**Class-I**	**Class-II**	**Class-III**
Overjet	**Pearson's Correlation**	0.808**	0.605**	0.495**	0.484*
	Sig. 2-tailed)	0.000	0.001	0.007	0.019
	N	78	27	28	23

DISCUSSION

One of the significant factors in the diagnosis and treatment planning process is the anteroposterior relationship among the two jaws.[11] The objective of our research was to determine whether there was a correlation between the overjet values and cephalometric analysis that evaluate the cranio-facial structures anteroposteriorly.

Given that they both indicate the anteroposterior relationship of the jaws, overjet and ANB were expected to be positively correlated. However, overjet is influenced by the incisor's inclination, while ANB is influenced by the nasion's position anteriorly and laterally, as well as by the orientation of the sella-nasion plane and maxilla. When measuring ANB, one has to consider deviations from nature.[11] Dentoskeletal overjet has been proposed by Al- Hammad et al. as a measurement of sagittal discrepancies.[12] In a research by Abdul Jabbar, they discovered a statistically significant but weak correlation between overjet and Wits assessment in class I and class II cases, as well as a significant correlation between overjet and Wits appraisal in class III cases,[3] however, the results of our study, which discovered a strong correlation between ANB and overjet only in class III cases, agrees with Abdul Jabbar's study's finding.

Similar results to ours were obtained in different research. If the malocclusion class was disregarded, overjet showed favorable relationship with ANB angle and Wits evaluation regardless of the reference planes employed to acquire it. Among all classes of malocclusion, only class III malocclusion exhibits a high correlation. Using linear regression analysis, overjet was also demonstrated to be a valid predictor of anteroposterior skeletal discrepancies.[2]

When compared to those of Zupanc, their research confirmed overjet is not a reliable method in interpreting anteroposterior skeletal relationships in Class I and III cases. Overjet was discovered to be a significant predictor in Class II division 1 cases, whereas our study showed class III cases have strong significant correlations and weak correlation with class I and II.[4]

Likewise, the findings found in Farah Naz's study, where it is shown that overjet can be used to determine anteroposterior relationships but was not found to be the determinant of vertical patterns.[11] Thayer's study produced conflicting findings by establishing a weaker correlation between overjet and Wits, however, we revealed a strong correlation between overjet and Wits values.[13]

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Ghulam Rasool obtained contradictory results by conducting a correlational analysis of overjet and ANB angle, which revealed a weak correlation in all malocclusion groups. Overjet cannot be used to better estimate sagittal jaw discrepancy because it is not a reliable determinant of anteroposterior skeletal relationship, according to their research. The conclusions drawn from their research showed there is a weak correlation between overjet and ANB. This could be caused by the influence of the incisor's inclination, but ANB is unaffected. However, ANB can also deviate due to the aberrant location of the nasion, SN plane, and inclination of maxilla and mandible.[6]

Hasan et al assessed relationships among dento-skeletal features including overjet and ANB in Class II cases. In contrast to our study, his study showed a positive correlation, whereas our findings suggested a weak correlation for class I and II malocclusions,[14] The findings of a research conducted by Luca Lombardo showed that overjet could be a reliable interpreter of ANB and the U1-bi-spinal plane. However, when skeletal class I and II were taken into account separately, different findings were achieved.[15]

CONCLUSION

We can draw multiple conclusions from our research without considering the malocclusion classes, there was a high correlation between overjet and ANB angle and Wits analysis. Class III cases showed a strong correlation, class II; a weak correlation, and class I; a very weak correlation between overjet and ANB angle. A statistically significant and strong positive correlation between overjet and Wits appraisal in Class I individuals and moderate correlations were found in Class II and III malocclusion.

In class III cases, overjet is highly correlated with ANB angle which represents skeletal discrepancy. However, because of the increased variability, dental measurements other than overjet should also be taken into account, and the sagittal relationship should also take into account jaw rotations. For this reason, further research is required.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

The ethical approval is provided Research Ethics Committee of the College of Physicians and Surgeons Pakistan (REU) granted ethical approval for this study (Ref No. CPSP/REU/DSG-2017-174-2127).

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AUTHORS CONTRIBUTION

Conception and design of the study: H. Siddiqui, S.S. Hussain

Acquisition of data: H. Siddiqui

Analysis and interpretation of data: H. Siddiqui

Drafting of the manuscript: H. Siddiqui

Critical review of the manuscript: S.S. Hussain

Approval of the final version of the manuscript to be published: H. Siddiqui, S.S. Hussain

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