

THE CORRELATION BETWEEN WITS AND ANB CEPHALOMETRIC LANDMARKS IN ORTHODONTIC PATIENTS

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ABSTRACT

Objective: To correlate cephalometric values of ANB angle and Wits appraisal in patients reporting to AFID.

Study Design: Cross sectional, comparative study.

Place and Duration of Study: The study was carried out in the Department of Orthodontics at AFID Rawalpindi. ANB and Wits values from Lateral cephalograms of patients, from Dec 2014 till May 2015 were recorded.

Material and Methods: On the basis of inclusion criteria; out of a total of 200 lateral cephalograms, 161 Lateral Cephalograms were selected. Their ANB values and wits values were recorded. Correlation was found by Pearson correlation test. Bivariate analysis was done. A *p*-value of ≤ 0.05 was considered to be statistically significant. SPSS 22 was used for statistical analysis.

Results: Our results showed that 34.8% of the patients were males and 65.2% were females. Regarding class of malocclusion (I, II and III); 41% were class I, 44.1 were Class II and 14.9% were class III. The age range was from 9 to 33 years with a mean of 14.46 years.

Regarding the correlation, bivariate analysis showed that the ANB and Wits were significantly correlated with an "r" value of 0.469 and a *p*-value of 0.00 which was statistically significant.

Conclusion: ANB and Wits are significantly correlated.

Keywords: ANB, Correlation, Pakistani population, Wits.

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INTRODUCTION

The subject of facial aesthetics is pre-eminently important to Orthodontists. The study of aesthetics by profile analysis dates back to Egyptian and the Greek era¹. For malocclusions cephalograms are beneficial in quantifying skeletal and dental features². Primarily malocclusions are classified on dental and skeletal characteristics. Skeletal discrepancies can be further classified whether the discrepancy is sagittal, transverse or vertical³. An accurate antero-posterior measurement of the jaw relationship is critically important in orthodontic diagnosis and treatment planning of these skeletal discrepancies.

For assessing the sagittal discrepancy, assessment by ANB angle was proposed⁴. The ANB angle is formed with the vertex at point N

(nasion, the most anterior aspect of the frontonasal suture, located by visual inspection on the tracing) and two sides respectively extending to A point (the deepest point on the contour of the premaxilla) as well as B point (the deepest point on the contour of the mandible)⁵.

Wits appraisal was supposed to overcome the weaknesses of ANB, however, various studies have questioned the reliability of both the angle ANB and Wits appraisal. ANB angle has been found to be affected by rotation of the Sella-Nasion (S-N) plane, the relative length of the Sella-Nasion plane and the rotation of the jaws during growth and treatment⁶. As an alternative, it was suggested that perpendiculars be drawn from points A to B on the occlusal plane (Wits appraisal), but misinterpretation of Wits value was encountered due to variability in the occlusal plane, which was seen to be easily affected by tooth eruption and orthodontic treatment⁷.

Because both the measurements calculate the sagittal discrepancy, it seems reasonable that

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there should be a correlation between the two cephalometric values. This study was undertaken to know about the correlation of ANB and Wits value in a sample of Pakistani population reporting to Armed Forces Institute of Dentistry Rawalpindi, Pakistan.

MATERIAL AND METHODS

This study was conducted in the department of Orthodontics at AFID Rawalpindi. Patients reporting to AFID were considered for sampling. Ethical and administrative approval was sought from the concerned authorities before the commencement of this study. The study was conducted on patients reporting from Dec 2014 till May 2015.

Table-I: Descriptive statistics of the patients.

Variable	Min	Max	Mean	SD
Age	9	33	14.46	4.50
ANB	-8	10	3.57	3.66
WITS	-11	16	1.22	3.77

Table-II: Frequency and percentage for gender and class of malocclusion among patients.

Variable	Frequency	Percentage
N	161	100
Male	56	34.8
Female	105	65.2
Class I occlusion	66	41
Class II occlusion	71	44.1
Class III occlusion	24	14.9

This was a comparative cross sectional, retrospective study, with convenient sampling. 200 patients were selected and pre-treatment lateral cephalograms were recorded. Out of a total of 200 lateral cephalograms 161 lateral cephalograms were chosen for the study.

The inclusion criteria included patients who had not undergone orthodontic treatment. In case of presence of primary teeth only deciduous molars were to be presented. All the three classes of occlusion (Class I, Class II and Class III) of skeletal and dental malocclusion were also included in the sample.

The exclusion criteria was based on omitting supernumerary teeth, impacted teeth, extracted teeth, missing teeth, heavily restored teeth,

malformed teeth and patients with repaired or unrepaired cleft lip and palate.

This study was based on tracing good quality pre-treatment lateral cephalograms of patients (with clearly visible anatomical landmarks, free from distortion and artefacts). The radiographs were taken with the lips relaxed and the head in natural head position. Tracing was done on a 0.003 matt acetate tracing sheet. The ANB angle was traced by connecting the bony point N with the deepest point on anterior maxilla and the anterior most border of chin. Wits analysis was done by first drawing the functional occlusal plane and then taking perpendicular from bony point A and the bony

point B to the occlusal plane.

Frequencies and percentages were determined for gender and class of occlusion. Minimum value, mean value and maximum value was determined for age, ANB angle and Wits appraisal. Standard deviation was determined for angle ANB and the Wits value. Pearson correlation coefficient (r) was applied to know the correlation between the two variables. A Bivariate correlation analysis was done between Wits and ANB angle. A p -value of <0.05 was considered as statistically significant. SPSS 22 was used for statistical analysis.

RESULTS

Regarding age, ANB and Wits; our results for minimum, maximum, mean value and

standard deviation are summarized in table-I. For gender and class of malocclusion the frequency and percentage are given in table-II.

Pearson correlation coefficient along with bivariate analysis was done and it showed that the ANB and Wits were significantly correlated with each other with an r value of 0.469 and a p -value of 0.00 which was statistically significant.

DISCUSSION

Despite its shortcomings, the ANB angle (the difference between SNA and SNB angle)⁸ is the most commonly used measurement in appraising the antero posterior jaw discrepancy. The ANB angle; however, does not take into consideration the relative relationship of the denture bases to cranial reference planes. Due to these limitation the ANB angle was criticized and it was suggested that "Wits" appraisal overcomes this shortcoming⁹. Many different analyses beside ANB and Wits have been proposed for assessing the sagittal discrepancy between maxilla and mandible¹⁰⁻¹². AF-BF¹³ and Beta angle¹⁰ have been used effectively for the evaluation of antero-posterior discrepancies affecting the apical bases of the jaws¹⁴. Jacobson thought that ANB was not a good indicator of anteroposterior jaw disharmony⁹. According to him the ANB angle may give erroneous results due to rotation of the jaws or the spatial position of point N may affect the ANB reading¹⁵. Along with clockwise or anti clockwise rotational change in the jaw position and sagittal position of point N, the ANB may be affected by vertical position of point N, the upward or downward rotation of the Sella-Nasion plane, the age of the patient, the relation of Sella-Nasion plane to the occlusal plane, the degree of prognathism of jaws and the recording errors¹⁶.

Some attempts have been made in the past to find a correlation between Sella-Nasion and the ANB angle. This lead to the prediction of the Wits appraisal from the ANB angle. Godfrey K and Chandra PK, found that the relationship between angle ANB and Wits appraisal was significant. They were also able to predict angle ANB from

Wits appraisal and Wits value from ANB angle¹⁷. Our study showed that ANB and Wits were correlated. Although the r value of 0.469 was not statistically significant but the correlation was significant at 95% confidence level with a p -value of 0.00. This means that clinical use of either ANB or Wits shall be useful and the proposed disadvantages of ANB are not clinically relevant. Our study however did not take into consideration the effects of palatal plane, occlusal plane, mandibular plane and the over jet. The concept that ANB value can be misleading was not evident in our study. It may be concluded that either ANB and/or Wits can be used and they can give accurate diagnosis.

Regarding Pakistani studies, a study was done to establish correlation between ANB, Wits value & palatal plane angle. It was found that statistically significant correlations were found between ANB angle & Wits appraisal, while statistically insignificant correlation was found between palatal plane angle, ANB & Wits value suggesting that rotational change in the palatal plane with reference to Sella-Nasion plane had no impact on the sagittal assessment parameters. Moreover a statistically significant correlation was found between mandibular plane and palatal plane¹⁸.

In another Pakistani study, a correlation between ANB angle and Wits appraisal was done. This study concluded that over jet is a good predictor for sagittal skeletal relationship only in class III malocclusion¹⁹. A study was done to evaluate the validity of newly introduced cephalometric analysis using W angle and YEN angle in Pakistani and Bangladeshi samples and to compare both populations with commonly used sagittal measurements. Bangladeshi and Pakistani sample lateral cephalograms were traced for ANB, Wits appraisal, Beta angle, W angle and YEN angle. These results suggested that all the performed analyses are valid and can be used to diagnose skeletal discrepancies and diagnosis based on single analysis is insufficient²⁰.

A study was performed to check the prediction and reliability of Yen angle along with other sagittal discrepancy parameters and to discuss the correlation existing between them. It was suggested that instead of relying on one single parameter, others should also be viewed and should be correlated with clinical findings²¹. Although ANB is widely used for assessment of Sagittal discrepancy, several authors, including Jacobson¹⁵, showed that the anteroposterior position of point N relative to points A and B influences angle ANB, as does rotational growth of the upper and lower jaws^{22,23}.

A study was done to evaluate if palatal plane could be used as a skeletal plane of reference in lateral cephalometric radiographs to evaluate sagittal maxillomandibular relationship. According to this study the palatal plane is a better indicator than Wits and ANB²⁴.

In one study²⁵ correlation coefficients showed that the ANB angle and the Wits appraisal are significantly correlated but the *r* values are relatively low. These findings explain the discrepancies that are present in some cases between the measured values of the ANB angle and the clinical judgment of the orthodontist. The conclusions derived from this investigation are as follows: (1) No significant differences were observed in the changes between male and female subjects for either the angle ANB or Wits between age of 5 years and adulthood. (2) The ANB angle changes significantly with age, while the Wits appraisal indicates that the relationship between points A and B does not change significantly with age. (3) Correlation coefficients showed that the ANB angle and the Wits appraisal were significantly correlated but the *r*-values are relatively low. Our study also confirm to the same findings with a low *r*-value and statistically significant *p*-value. These findings explain the discrepancies that are inherent in some cases between the measured values of the ANB angle and the clinical judgment of the orthodontist. For a more accurate diagnosis of the anteroposterior apical base relationship, both the ANB angle and Wits appraisal should be used.

In another study the results indicated that approximately 93% of the variation of the Wits appraisal could be explained by the variation of the ANB, Sella-Nasion line and SNA angles. The study also showed that the ANB angle and the Wits appraisal, cannot be directly compared. One study concluded that ANB and Wits must be included in 3D cephalometric analyses as both are necessary to undertake a more accurate diagnosis of the maxillo-mandibular relationship of the patients²⁶. To obtain comparable interpretations, one should correct the results of both measurements in relation to the variations in their reference systems. Our study finds a significant relation between Wits and ANB, but variation of Sella-Nasion and SNA was not considered in our study.

CONCLUSION

Our study shows that Wits and ANB are significantly correlated; ANB can be used instead of Wits and vice versa. This study however, did not take into consideration the effect of different planes on the outcome of the correlation of the two variables. It is suggested that the effects of occlusal, palatal, mandibular plane and overjet on ANB or Wits can be determined in other studies.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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