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A NEW CEPHALOMETRIC TOOL W-ANGLE FOR THE EVALUATION OF ANTEROPOSTERIOR SKELETAL DISCREPANCY IN ORTHODONTIC PATIENTS

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ABSTRACT:

Introduction: Correct diagnosis and treatment planning is the backbone of successful orthodontic treatment. In order to achieve this goal, a new cephalometric method was introduced known as W angle which has overcome shortcomings previously faced by the other cephalometric tools.

Methods: A sample size of 140 patients (94 females and 46 males) was selected. The mean and standard deviations were calculated for W angle. Pearson correlation was applied to evaluate linear relationship between ANB and W angle of various skeletal malocclusions (skeletal class I, II, or III).

Results: The mean value of W angle for Class I skeletal pattern was (53.7°) ±1.80 SD, while mean value for class II patients was (47.5°) ±2.08 SD. W angle for skeletal class III cases was (60.0°) ±2.91 SD. There was statistically significant correlation between ANB and W angle while comparison of all skeletal classes also show significant difference between groups (p=0.00).

Conclusion: W angle can be an alternate analysis to diagnose sagittal skeletal discrepancies with equal accuracy.

Key words: Malocclusion, W angle, Anteroposterior skeletal discrepancy.

INTRODUCTION:

Accurate diagnosis and treatment planning is the main hallmark of orthodontic treatment. Inaccuracies in diagnosis result in unaccepted results which will frustrate not only the orthodontist but most importantly the patients. To overcome such problems, a new cephalometric tool has been devised which can give not only accurate but reproducible results. Previously the methods available to analyze discrepancy in sagittal direction were ANB, wits appraisal and Beta angle. These methods involve landmarks that are unreliable and can affect the interpretation and hence diagnosis of orthodontic case.

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Taylor [1] in his study highlighted the limitation of ANB angle. According to him, in ANB angle, the nasion point is the head of the angle and any deviation in its position would directly and principally affect the ANB reading .This angle is also affected by factors like degree of facial prognathism, jaw rotations, patients' age, vertical and horizontal position of nasion and facial height. [2]

To overcome the problems faced by ANB angle, Jacobson [3, 4] introduced a new linear method to assess sagittal discrepancy. This new method was Witt's appraisal. Witts analysis is the linear distance between A and B point perpendicular to the functional occlusal plane.[3] Position of nasion and mandibular jaw rotation were not a problem with Witt's but it has its own drawbacks. First of all, identification of occlusal plane is not accurately reproducible and secondly inclination of occlusal plane affects the readings of Witt's apraisal. [5,6,7] The angulation of functional occlusal plane is also greatly influenced by eruption of teeth, alveolar bone development and facial growth direction.

Beta angle which was developed by Baik and Ververiduo [8] uses point A and condylion. Both structures are not reproducible. The A point is influenced by alveolar bone remodeling caused by orthodontic treatment.[9] The other problem is reproducibility of the location of condylion which is affected by jaw rotations. [10]

The drawbacks of ANB, Wits and Beta angle stress the need of developing a new and reliable method which can accurately measures skeletal discrepancies. This lead to the introduction of W angle. The purpose of this article is to perform W angle in a sample from Pakistani population and compare its reliability with angle ANB.

MATERIAL AND METHODS:

This cephalometric based cross sectional study consisted of 140 patients. A sample size of 140 patients was selected to provide more than 90% power. A p-value of 0.05 or less was considered statistically significant. Sample comprised of 94 females and 46 male patients, ages ranged between 15 and 28 years Data was collected from patients coming to Orthodontics Department at Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, DUHS for orthodontic treatment. Patients were categorized into skeletal class I, II, or III depending on the values of ANB (i.e. Class I if ANB=2-4°, Class II if ANB >4° and Class III if ANB < 2°).

W angle.

W angle was measured on all the cephalometric tracings in the following manner:

Following landmarks were used to measure the W angle: (Figure 1)

Point S — midpoint of the sella turcica;

Point M — midpoint of the premaxilla;

Point G — centre of the largest circle that is tangent to the internal inferior,

anterior, and posterior surfaces of the mandibular symphysis.

After identifying these points, four lines were drawn connecting S and M points, M and G points S and G points. A perpendicular is drawn from point M on S – G line. W angle is measured which is the angle between the perpendicular line from point M to S – G line and the M – G line

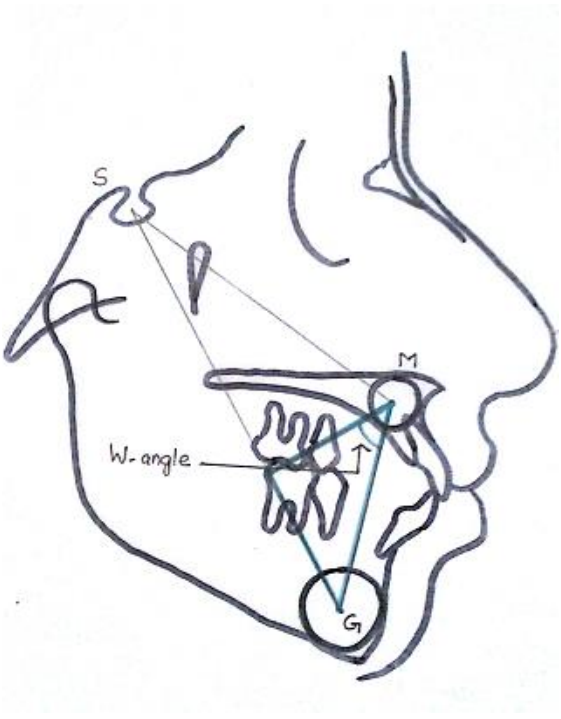

Figure No. 1 Landmarks for the measurement of W Angle

Statistical analysis:

Statistical analyses were done using the Statistical package for the social sciences (SPSS for windows version 16). The mean and standard deviations were calculated for W angle. Pearson correlation was applied to evaluate the linear relationship between ANB and W angle of skeletal I, II and III malocclusions.

RESULTS:

In this study, the mean value for W angle in Class I skeletal pattern was 53.7° with a standard deviation of ±1.80°. The mean value for W angle in Class II skeletal pattern was 47.5° with a standard deviation of ±2.08° while the mean value for W angle in class III skeletal pattern was 60.0° with a standard deviation of ± 2.91° (Table 1).

Table 2 highlights the Pearson's correlation between angles ANB and W angle. The results of bivariate correlation show statistically significant relationship between ANB and W angle values

Table 1: Mean values of W angle in various skeletal malocclusion

Classes	ANB angle	W angle	P value
I	2±2	53.7 ±1.80	0.000
II	>4	47.5 ±2.08	0.000
III	< 0	60.0 ±2.91	0.000

ŧCorrelation is significant p<0.05

Table 2: Pearson correlation table between ANB and W angle in various skeletal malocclusions

	W angle (class I)	ANB angle (class I)
W angle (class I)	r = 1	r = 0.956** p = 0.000
ANB angle (class I)	r = 0.956** p= 0.000	r = 1

	W angle (class II)	ANB angle (class II)
W angle (class II)	r =1	r = 0.375** p = 0.009
ANB angle (class II)	r = 0.375** p = 0.009	r = 1

	W angle (class III)	ANB angle (class III)
W angle (class III)	r =1	r = -0.854** p = 0.000
ANB angle (classIII)	r = - 0.854** p = 0.000	r =1

**Correlation is significant p<0.05

DISCUSSION:

The significance of accurate diagnosis in the anteroposterior dimension is of utmost importance in orthodontics. Treatment planning is based on correct diagnosis. If diagnosis is not accurate planning will also be incorrect leading to undesirable outcomes. Previously, methods used to analyze the anteroposterior skeletal dimension were influenced by the factors such as age of patient, jaw rotations, inclination of S-N plane etc. The aim of our study was to come up with such a tool that will be free from all the influences mentioned above.

ANB has limitations because of its dependency on structures like patient's age, growth rotation of the jaws, vertical growth, and the length of the anterior cranial base (AP position of N) which according to Jacobson makes cephalometric interpretation more complex and confusing.[3,4] Witt's appraisal does not include cranial base structures like nasion but it depends on functional occlusal plane which is affected by factors like dental euptions, development of alveolar bone etc.[6] Beta angle uses structures that are accurate and reproducible and not affected by rotations of jaw but as it is influenced by point A and point B which are not reliable as they are remodeled by orthodontic treatment.[8]

The sample size of 140 patients was selected having different skeletal malocclusions. Results showed the mean values of skeletal class I, II and III. The mean value and standard deviations of W angle of the three skeletal relations had been shown in (Table 1) and the results isare similar to Wasundhara.etal. [11]

The study done by Wasundhara. etal showed that a W angle between 51 and 56 degrees can be considered to have a Class I skeletal pattern. With an angle less than 51 degrees, patients are considered to have a skeletal Class II relationship and with an angle greater than 56 degrees, patients have a skeletal Class III.[11]

Pearson correlation test showed significant relation between ANB and Witt's appraisal which is consistent with the findings of Sara M.[12] However in contrast to her study, which shows negative significant correlation between ANB and W angle in all three skeletal malocclusion classes (I,II and III) , our study showed negative significant relation between ANB and W angle of skeletal class III malocclusion.

As W angle is independent of cranial base length (position of Nasion) it can also be used to assess the changes that take place over the course of orthodontic treatment as landmarks used are stable and reproducible. Furthermore, W angle does not indicate that which jaw is at fault. It simply shows the relationship between maxilla and mandible.

CONCLUSION:

1 W angle is a very helpful diagnostic tool to date to examine sagittal jaw relation both accurately and consistently.

2 The mean value for the W angle in Pakistani adults with a Class I, II, and III skeletal relations were 53.7°, 47.5° and 60.0° respectively.

3 The W angle had a significant relation with ANB in all three classes (skeletal I, II and III)

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