

Relating HBN and W angle with Sagittal Skeletal Parameters in Chennai population

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Introduction

The assessment of anteroposterior discrepancy is an indispensable step in the diagnosis and treatment planning in the field of orthodontics. There are various cephalometric parameters which have been proposed of which ANB angle (Riedel, 1952), Wits appraisal (Jacobson, 1975) and Beta angle (Baik, 2004) are the commonly used parameters.¹ The ANB angle was widely adopted when it was introduced in the year 1952. Later when Jacobson introduced the Wits appraisal in the year 1975, (A point and B point drawn perpendicular to the Occlusal plane and the distance between them is measured) it was used in conjunction with the ANB angle. The wits appraisal takes the occlusal plane as the reference since the occlusal plane can be easily affected by tooth eruption and dental development as well as by orthodontic treatment and also identification of the occlusal plane may be difficult, if the occlusal plane is canted it may also mask the original discrepancy.

The constancy of the Nasion point was questioned because the nasion point changes with growth and also due to displacements while taking the cephalogram due to

change in head position which can directly affect the A-B plane and hence the cephalometric reading.

In 2004, Baik introduced the Beta angle which utilises the point A, point B and apparent axis of the condyle C as the reference point (Fig-1). It is an angular measurement and it uses the point A which is said be a variable point, it is affected by the alveolar remodelling and upper incisor retraction during orthodontic tooth movement.

To overcome the existing problems, newer angular measurements were introduced – W angle and HBN angle. W angle was given by Wasundhara Bhad et al in the year 2011. W angle is measured between a perpendicular line from point M to the S – G line and M – G line, which does not depend on the unstable landmarks or the dental occlusion (Fig – 2)

The HBN angle given by Dave et al in the year 2015. It has three landmarks such as the apparent axis of the condyle, M midpoint of the premaxilla, and G center of the largest circle that is tangent to the internal inferior, anterior, and posterior surfaces of the mandibular symphysis and it does not depend on any cranial reference planes or occlusal plane (Fig – 3). Both these angles are

above all better to assess sagittal discrepancy occurring in both jaws.

The purpose of the study is to find the co-relation between the most commonly used parameters for finding the sagittal discrepancy (ANB angle, WITS appraisal and BETA angle) and newly introduced parameters (W angle and HBN angle) in Chennai population.

Materials and Method

The sample consisted of 39 lateral cephalograms of patients randomly selected from the patients who reported to the department of orthodontics and dentofacial orthopaedics.

These patients were divided into three groups – Class I, Class II and Class III

Criteria for skeletal Class I group

- ANB angle between 1° and 3°
- Wits appraisal between 0 and -1 mm
- Beta angle between 27° and 35°

Criteria for skeletal Class II group

- ANB angle more than or equal to 3°
- Wits appraisal greater than 0 mm
- Beta angle less than or equal to 27°

Criteria for skeletal Class III group

- ANB angle less than or equal to 1°
- Wits appraisal less than -1 mm
- Beta angle more than or equal to 35°

To construct the W angle, points S, M, and G were located. To locate points M and G, a template with concentric circles whose diameters increased in 1 mm increments was used. To construct HBN angle three skeletal landmarks were used: "C" (the apparent axis of the condyle), "M" (midpoint of the premaxilla), and "G" (center of the largest circle that is tangent to the internal inferior, anterior, and posterior surfaces of the mandibular symphysis).

All the angles were measured and then tabulated for statistical analysis to find out accuracy and reliability of W angle & HBN angle (Table 1, 2 and 3).

Statistical Analysis

1. To compare W angle with the existing standard parameters ANB angle, Wits appraisal and Beta angle (Table – 1)
2. To compare HBN angle with the existing standard parameters ANB angle, Wits appraisal and Beta angle. (Table – 2)

Results

In class I group, W angle has no significant association with the standard parameters ANB angle, Wits appraisal and beta angle (Table – 1) whereas HBN angle has negative correlation with ANB angle(-0.77) and Wits appraisal(-0.58) with significant p value of 0.00 and 0.04 respectively (Table- 2). Therefore, HBN angle is better in identifying class I cases.

In class II group, both W angle has negative correlation with ANB angle and Wits appraisal positive correlation with beta angle with correlation coefficient of 0.63 and significant p value of 0.01 (Table -1) and HBN angle has negative correlation with ANB angle and a positive correlation with Wits appraisal and strong correlation with Beta angle with correlation coefficient of 0.55 and a significant p value of 0.03 (Table – 2) respectively. Results have showed that W angle has strong correlation with beta angle when compared to HBN angle. Therefore, W angle is better in identifying class II cases.

In class III group, W angle has a negative correlation with ANB angle -0.78 and significant p value of 0.00 (Table -1) and HBN angle has negative correlation with wits appraisal -0.65 and significant p value of 0.03 (Table -2).

Discussion

In the orthodontic diagnosis, the cephalometric assessment of sagittal relationship is a necessary step. The reliability

of the angular and linear measurements has been questioned by various authors. The mostly used parameter for assessing the sagittal discrepancy is the ANB angle, but it has various drawbacks. The ANB angle changes with patient's age, growth rotation of the jaws, vertical growth, and the length of the anterior cranial base (AP position of N) should be considered, which makes the interpretation of this angle much more complex (Jacobson, 1975). Later Wits appraisal was introduced which was a linear measurement and it also had various shortcomings like the changes in the functional occlusal plane, which can sometimes be impossible to identify a proper occlusal plane, especially in mixed dentition and even the treatment may change the occlusal plane angulation. (Moore *et al.*, 1989; Ishikawa *et al.*, 2000). Beta angle does not depend on the cranial landmarks or the functional occlusal plane. But it uses point A and point B, which can be remodelled by orthodontic treatment and growth (Richardson, 1982; Frank, 1983; Rushton *et al.*, 1991). To overcome these existing problems, W angle and HBN angle was introduced which did not depend on the cranial landmarks, functional occlusal plane or A point and B point.

On gathering the required data from 39 cephalograms of patients from Chennai population with Class I, Class II and Class III and performing the cephalometric analysis, it has been found that in Class I cases, W angle has no significant association with the standard parameters ANB angle, Wits appraisal and Beta angle whereas HBN angle has a significant correlation with ANB angle and Wits appraisal with this it can be concluded that HBN angle is better at identifying Class I cases. In Class II cases both W angle and HBN angle has a strong correlation with beta angle and also W angle showed strong correlation with beta angle compared to HBN angle, therefore W angle is better at identifying the Class II cases. In Class III cases

W angle has significant correlation with ANB angle and HBN angle has a strong correlation with Wits appraisal.

Conclusion

This study was done to compare W angle and HBN angle with the existing standard parameters ANB angle, Wits appraisal and Beta angle. HBN angle is better in identifying class I cases. W angle is better in identifying class II cases. Old measurements for assessing the sagittal jaw relationship may be unreliable. Therefore it is recommended that one should not always rely on one method completely instead a combination of a few methods depending on the situation should be chosen to achieve enhanced results.

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Table legends

Table – 1- Pearson’s correlation for w angle with the skeletal sagittal discrepancy parameters for Class I, II and III cases

Skeletal class I		
W angle	Correlation coefficient	P value
ANB angle	-0.45	0.13
Wits appraisal	0.00	1.00
Beta angle	-0.27	0.39
Skeletal class II		
ANB angle	-0.42	0.11
Wits appraisal	-0.102	0.71
Beta angle	0.63	0.01
Skeletal class III		
ANB angle	-0.78	0.00
Wits appraisal	-0.63	0.05
Beta angle	0.44	0.20

Table – 2 - Pearson’s correlation for HBN angle with the skeletal sagittal discrepancy parameters for Class I cases

Skeletal class I		
HBN angle	Correlation coefficient	P value
ANB angle	-0.77	0.00
Wits appraisal	-0.58	0.04
Beta angle	0.37	0.23
Skeletal class II		
ANB angle	-0.39	0.14
Wits appraisal	0.13	0.62
Beta angle	0.55	0.03
Skeletal class III		
ANB angle	-0.53	0.11
Wits appraisal	-0.65	0.03
Beta angle	0.47	0.16