Parameters for Assessment of Antero-Posterior Skeletal Discrepancy: A Review and Compilation

Harsha P Mahajan1, Ketan Vakil2, Jeegar Vakil3

1- Post Graduate Student, Department of Orthodontics and Dentofacial orthopaedics, SMBT Dental college, Sangamner, Maharashtra, India
2- Professor and H.O.D, Department of Orthodontics and Dentofacial orthopaedics, SMBT Dental College, Sangamner, Maharashtra, India
3- Senior Lecturer, SMBT Dental college, Sangamner, Maharashtra, India

ABSTRACT

Diagnosis and treatment planning is the most important and critical step in Orthodontics. Malocclusion is classified in all the three planes- sagittal, vertical and transverse. Various parameters for assessment of antero-posterior discrepancy have been mentioned in previous literature. However each parameter has its own characteristics, advantage and shortcomings. This review gives a compilation of the various parameters like ANB angle, WIT’s appraisal, Beta angle, YEN angle, W angle which can be useful to diagnose A-P problems precisely.

KEYWORDS: ANB angle, Beta angle, Sagittal jaw relationship, W angle, WIT’s appraisal, YEN angle.

INTRODUCTION

An accurate anteroposterior measurement of jaw relationships is critically important in orthodontic diagnosis & treatment planning. Numerous angular & linear measurements are used to assess the sagittal discrepancy between maxilla and mandible which is of prime importance in diagnosis & treatment planning. This article is a review and compilation of the various parameters and measurements used for assessment of anteroposterior (A-P) skeletal jaw discrepancy.

VARIOUS METHODS

1948, Down’s was first to evaluate the anterior posterior apical base relationship. Angle between A-B (point A and B) plane & N Pog (Nasion Pogionion facial angle) was used to assess the sagittal discrepancy (Figure No.1).1 Riedel measured SNA (Sella Nasion subspinale) & SNB (Sella nasion supramentale) used difference ANB (subspinale nasion supramentale) in order to assess sagittal relationship (Figure No.2).2

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Though widely used, the following factors have been reported to affect the ANB angle:\(^3\)
1. The patient's age. The ANB angle has a definite tendency to decrease with increasing age.
2. The change of the spatial position of the nasion either in the vertical or antero-posterior direction or both.
3. The upward or downward rotation of the Sella Nasion line
4. The upward or downward rotation of the jaws.
5. The change in the angle SN to the occlusal plane.
6. The degree of facial prognathism.

In order to overcome the shortcomings of ANB angle, Chang reported a linear measurement of the distance between points A and B projected onto the Frankfort horizontal plane (Figure No.3).\(^4\) Freeman in 1981 gave the A-X-B method for evaluation of A-P discrepancy by eliminating the shortcomings of nasion (Figure No.4).\(^5\)
measurement that was less affected by variations in craniofacial physiognomy (Figure No.5). The distance between the points of contact of the perpendiculars on the occlusal plane, AO and BO, served as an indicator of skeletal sagittal jaw relationship. It has come to be known as the Wits (Witwatersrand University, Johannesburg, South Africa) Appraisal.

Kim and Vietas gave the anteroposterior dysplasia indicator (APDI), which is a resultant reading obtained from the facial angle plus or minus the A-B plane angle and again plus or minus the palatal plane angle (Figure No.6).

The Beta angle is a new measurement for assessing the skeletal discrepancy between the maxilla and the mandible in the sagittal plane. It uses 3 skeletal landmarks—point A, point B, and the apparent axis of the condyle (C)—to measure an angle that indicates the severity and the type of skeletal dysplasia in the sagittal dimension. A perpendicular is drawn from point A to the line C-B and Beta angle is measured at A (Figure No.7).

Shortcomings of ANB, WIT’s appraisal and Beta angle are described in Table No.1.

<table>
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<tr>
<th>ANB</th>
<th>Wits Appraisal</th>
<th>Beta angle</th>
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<tr>
<td>Affected by patients age, growth rotation, vertical growth, &amp; the length of ant cranial base</td>
<td>Occlusal plane – dental parameter used for assessing skeletal relationship</td>
<td>Depends on points A &amp; B change their site substantially due to both growth &amp; treatment</td>
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<td>Point A cannot be identified in all cephalograms</td>
<td>Functional occlusal plane identification is difficult in mixed dentition, open bite cases, severe cant of occlusal plane, missing teeth</td>
<td>Difficulty in locating center of condyle</td>
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Table No.1
Neela et al gave a new parameter the YEN angle for assessment of A-P discrepancy. The following points are used:

- Centre of sellaturcica S
- Point M- Maxillary point M, representing the midpoint of the pre-maxilla in the mid-sagittal plane was located on the tracings according to the superior, anterior, and palatal outlines of the pre-maxilla, and the midpoint was identified with concentric circles.
- G-point was established using a specially designed transparent template containing a number of circles whose diameter increased in increments of 1 mm. All the centres of the circles in the template were identified by a pinhole. The centre of the best-fit circle tangent to the internal inferior, anterior, and posterior surfaces of the mandibular symphyseal area in each sagittal cephalogram was determined in the circle that best fit the pre-maxilla or the outline of the pre-maxilla.

The YEN angle is measured at M as shown in the Figure No.8. Bhadet al further modified this angle and gave the W angle. They constructed perpendicular from point M to line SG and then measured the angle at point M (Figure No.9).

The Geometry of angle W provides an added benefit that it will be relatively stable even when on the rotation or vertical growth of the jaws. Hence, measurement of W angle is of special importance as a sagittal parameter in clockwise or counter clockwise jaw rotation skeletal patterns and the transitional period of vertical facial growth.

Inadequacies of YEN angle and W angle:

- The accurate tracing and the locating the centre of the pre-maxilla requires experience.
- Determination of prognathic or retrognatic jaw is not possible.

<table>
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<th>Parameters</th>
<th>Normal Values</th>
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<tr>
<td>ANB angle</td>
<td>Skeletal Class I - 2°&lt;br&gt;Skeletal Class II &gt; 2°&lt;br&gt;Skeletal Class III &lt; 2°</td>
</tr>
<tr>
<td>WITS Appraisal</td>
<td>Skeletal Class I - Coincidence of AO &amp; BO or BO 1 mm ahead of AO in males.&lt;br&gt;Skeletal Class II - AO ahead of BO in females or AO coinciding with or ahead of BO in males.&lt;br&gt;Skeletal Class III - BO ahead of AO in females or BO ahead of AO by more than 1 mm in males</td>
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<tr>
<td>Beta Angle</td>
<td>Skeletal Class I - 27° and 35°&lt;br&gt;Skeletal Class II &lt; 117 degrees&lt;br&gt;Skeletal Class III &gt; 123 degrees</td>
</tr>
<tr>
<td>YEN Angle</td>
<td>Skeletal Class I - 117 to 123 degrees&lt;br&gt;Skeletal Class II &lt; 117 degrees&lt;br&gt;Skeletal Class III &gt; 123 degrees</td>
</tr>
<tr>
<td>W Angle</td>
<td>Skeletal Class I - 51 and 56°&lt;br&gt;Skeletal Class II &lt; 51°&lt;br&gt;Skeletal Class III &gt; 56°</td>
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</table>
Thus the various parameters discussed in this manuscript will help in accurate assessment of the A-P skeletal discrepancy. This review gives a compilation of the various parameters used for assessing the antero-posterior discrepancy. In order to overcome the shortcomings of each at least 2-3 parameters should be used.

REFERENCES