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Accuracy of beta angle in assessment of sagittal skeletal discrepancy in Chennai population – A cephalometric study

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1. Introduction

Diagnosis and treatment planning in orthodontics and dentofacial orthopaedics have heavily relied on technology. Imaging is one of the most ubiquitous tools used by an orthodontist to measure and record the size and form of the craniofacial structures. Though introduced by Broadbent, cephalometrics might best be ascribed to J.A.W. Van Loon of Holland who described a technique, which related the teeth to the rest of the face, which showed the true picture of the patient's malocclusion. Both angular and linear measurements have been incorporated into the various cephalometric analyses to measure the antero-posterior discrepancies and come to a treatment plan.[1]

The ANB angle though very popular to describe skeletal discrepancies between maxilla and mandible,[2] the displacement of the nasion and rotation of the jaws, as during growth, can change the reading.[3] Some authors have stated that point A and B are influenced by growth or orthodontic treatment.[4–6]

Jacobson's Wits appraisal overcame the ANB angle problem and related point A and B to the occlusal plane. But it may not be accurately reproducible in case of openbite.[7,8] Furthermore, any change in the occlusal plane during normal development or during orthodontic treatment can significantly change the readings.[9,10] Any change in angulation of the functional occlusal plane caused by growth, development of dentition can influence the Wits appraisal.[11,12]

To overcome the limitations and drawbacks of Wits appraisal Baik CY and Ververidou M introduced beta angle as new angular measurement for assessing the skeletal discrepancy between maxilla and mandible in the sagittal plane. This measurement was found to remain constant even with the changes in the position of cranial landmarks, jaw rotations or dental occlusion.[13]

The beta angle has three points and three lines.

The three points are:

(1) A point (subspinale) – the deepest midline point on the premaxilla between the ANS and prosthion (described by Downs).
(2) B point (supramentale) – the most posterior point in the concavity between infradentale and pogonion (described by Downs).
(3) C point – the centre of the condyle, found by tracing the head of the condyle and approximating its centre.

The three lines are:

(1) Line connecting the point C to point B.
(2) Line connecting the point B to point A.
(3) Line perpendicular from point A to line C–B (Fig. 1).

Finally the angle is measured between the perpendicular line and the AB line. Any angle between 27° and 35° has been found to have a Class I skeletal pattern and anything more acute or obtuse had a skeletal Class II or skeletal Class III pattern respectively.

Various authors have done study on beta angle in different populations. There was statistically significant difference found among the mean values of beta angle, as compared to the original study, in a study done in population of Nellore district.[14] There was little change in the mean values of beta angle in the different skeletal patterns in North Indian

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population as well.[15] The beta angle range for Garhwali population also varied from the normal range as proposed by the authors.[16] In a study done in Pakistani population found that the beta angle range was equally reliable and similar to the original study.[17]

There was no study found in the literature about the range of beta angle in population of Chennai district, hence the aim of our present study is to check the accuracy of beta angle in Chennai population.

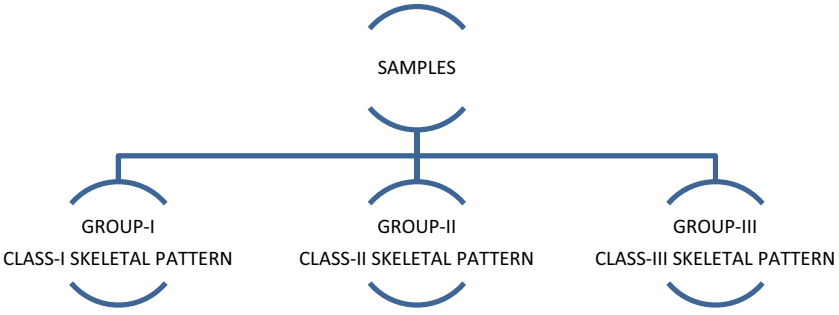
2. Materials and methods

Study was done using the available pre-treatment lateral cephalometric X-rays/cephalograms of patients with malocclusion requiring orthodontic treatment. Patients selected were between the age group of 9–25 years and had not undergone any orthodontic treatment before. 150 lateral cephalograms were evaluated for ANB angle and Wits appraisal. On the basis of the values obtained for ANB angle and Wits appraisal the samples were assigned to one of the three groups: Group I, Group II and Group III.

Group I included patients with Class I skeletal pattern with ANB angle of 1°–3° and Wits appraisal between −3 and 0 mm. Group I consisted of 30 patients (16 males, 14 females).

Group II included patients with Class II skeletal pattern with ANB angle equal to or greater than 4° and Wits appraisal greater than or equal to −1 mm. Group II consisted of 30 patients (13 males, 17 females).

Group III included patients with Class III skeletal pattern with ANB angle less than or equal to 1° and Wits appraisal less than or equal to −4 mm. Group III consisted of 30 patients (15 males, 15 females).



The beta angle was measured for each patient in all the three groups and the mean values were calculated (Fig. 2).

2.1. Statistical analysis

Data collected were summarized by finding means and standard deviations. ANOVA (analysis of variance) test was done to determine the statistically significant difference among the mean values of the three groups. A *P* value less than or equal to 0.05 was considered statistically significant.

3. Results

The values of ANB, Wits appraisal and beta angle for Group I, Group II and Group III patients were listed. The mean value for beta angle in class I patients was found to be 30.9° with a standard deviation of 3.2°. The mean value for beta angle in class II patients was found to be 26° with a standard deviation of 6.4°. The mean value for beta angle in class III patients was found to be 41.7° with standard deviation of 5.4° (Table 1). ANOVA showed that the *P* value is less than 0.05, which shows statistically significant difference between the groups (Table 2). The difference in the mean value of beta angle between males and females showed no statistically significant difference (Table 3) (Fig. 3).

4. Discussion

Accuracy of sagittal relationship plays a very crucial role in orthodontic treatment planning for which both linear and angular measurements have been consistently used. Changes in the facial height, jaw inclination and jaw prognathism can cause an error in the angular measurements whereas inclination of the reference line gives a faulty linear variable. Moyers et al. in his article has categorically stated about the shortcomings of such cephalometric analysis.[1]

The most popular parameter for assessing the sagittal jaw relationship, ANB angle, which is affected by various factors, has shown discrepancies between the interpretation and the actual difference in the apical bases.[4–6] These shortcomings were overcome by the WITS appraisal which though did not depend on the cranial landmarks but had issues with marking the correct occlusal planes especially when it came down to cases with mixed dentition or a case with an open-bite.[7,8]

Chong Yol Baik and Maria Verveidou from the Tufts University in Greece brought in a new concept of beta angle, which was independent of cranial landmarks and the functional occlusal plane. The usage of only Point A, Point B and the apparent axis of the condyle (Point C) made it sure that changes in these points reflected only changes of the jaws. It is also easier for the clinician to trace the head of the condyle. Very precise tracing of the contour of the condyle head is not needed when the centre of the head of the condyle is marked.

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