

ORIGINAL RESEARCH

A Comparison of 3 New Cephalometric Angles with ANB and Wits Appraisal for Assessing Sagittal Jaw Relationship

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ABSTRACT

Introduction: Assessment of facial skeletal relationships is one of the critical diagnostic decisions on an orthodontist on a day today basis. To aid this assessment we have a plethora of cephalometric analyses at our disposal. It is an established fact that none of the analyses is perfect.

Aim: 1. To study the comparison of ANB and Wits appraisal with 3 new cephalometric angles. 2. To assess the accuracy and reproducibility between them.

Materials and Methods: Lateral cephalometric radiographs of 100 patients were 17 randomly selected from the archives of the Department of Orthodontics, C.S.M.S.S Dental College, Kanchanwadi, Aurangabad, Maharashtra, India.

Results: Student's t-test showed, in Class I samples, none of the angles was showing 100% correlation with ANB. The 38 closest angle was W angle when compared with ANB and wits appraisal.

Conclusion: ANB angle is the pioneer, and it's having a gold standard.

Keywords: Cephalometric angles, ANB, Wits appraisal, Sagittal jaw relationship

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INTRODUCTION

"Assessment of facial skeletal relationships" is one of the critical diagnostic decisions on an orthodontist on a day to day basis. To aid this assessment, we have a

plethora of cephalometric analyses at our disposal. It is an established fact that none of the analyses is perfect. Any vibrant science such as orthodontics needs to adopt perennial quest for better methods.

To meet this end, many newer approaches are published in the scientific journals, stating the drawbacks of the old analyses and highlighting the advantages of their new solution. Although these respectable journals have eminent reviewers to check the validity of such claims, sometimes, bad one slips through. A case in point is the surge of newer methods to assess the maxillomandibular relationships. The time-tested ANB angle and Witt's appraisal have been contested by some authors. Beta, Yen, and W angles have been published in journals of international repute as better alternatives.

This presentation does a reality check on these angles by comparing them to the universally used "gold standards" - ANB and Wits appraisal.

Aims

The aim of the present study is as follows:

1. To study the comparison of ANB and Wits appraisal with 3 new cephalometric angles.
2. To assess the accuracy and reproducibility between them.

MATERIALS AND METHODS

Lateral cephalometric radiographs of 100 patients were randomly selected from the archives of the Department of Orthodontics, C.S.M.S.S Dental College, Kanchanwadi, Aurangabad, Maharashtra, India. All were of good quality and had no artifacts that might interfere with the location of the anatomical points. No differentiation was made for gender.

The sampling technique was purposive sampling. Inclusion criteria were subjects exhibiting varying degrees of skeletal and/or dentoalveolar malocclusion, not undergone any orthodontic procedures before. Exclusion criteria were subjects with congenital anomalies/syndromes and marked asymmetries.

Initially, 100 lateral cephalometric radiographs were collected and later sorted out with Class I, II, and III skeletal patterns through angles classification of malocclusion and soft tissue profile analysis. Among them, 5

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subjects each of different malocclusion were selected for the study.

For a patient to be included in the Classes I, II, or III skeletal pattern group, criteria were ANB angle, Wits appraisal, soft tissue profile, and dental malocclusion. A skeletal Class I relationship was indicated by an ANB of 2–4°, wits appraisal coincidence of AO and BO in females or BO 1 mm ahead of AO in males, soft tissue profile straight, and dental malocclusion with angles Class I molar relation. Five lateral cephalograms were collected from the screened files to meet the above criteria to form skeletal Class I group.

A skeletal Class II relationship was indicated by an ANB of >4°, Wits appraisal with AO ahead of BO in females or AO coinciding with or ahead of BO in males, soft tissue profile convex and dental malocclusion with angles Class II molar relation. Five lateral cephalograms were collected from the screened files to meet the above criteria to form skeletal Class II group.

The skeletal Class III individuals were characterized by an ANB <2°, Wits appraisal with BO ahead of AO in females or BO ahead of AO by more than 1 mm in males, soft tissue profile concave and dental malocclusion with angles Class III molar relation. Five lateral cephalograms were collected from the screened files to meet the above criteria to form skeletal Class III group.

Detailed scrutiny of all the patients in this study was done; records of final 5 Class I, 5 Class II, and 5 Class III, aged between 14 and 30 years, fulfilling the above-mentioned criteria were selected for the study.

The pre-treatment cephalograms were traced manually onto a cellulose acetate sheet by the primary author using fluorescent tracing screens to provide illumination. All cephalographs were obtained in the standard manner with the same radiographic equipment.

Statistical analysis was done to check the reliability of beta, yen, and W angles with ANB and Wits appraisal using student's *t*-test.

Second method used was modified radiographic technique, in which one sample was selected with the same criteria as mention above for Class I samples. Only mandible was rotated downward and forward keeping other things constant for making it into Classes II and III skeletal pattern. The reliability of beta angle, Yen angle, and W angle with ANB and Wits appraisal was measured [Table 1].

Landmarks Included

1. N - Nasion. The most anterior point on the frontonasal suture in the midsagittal plane.
2. S-Sella - the geometric center of the pituitary fossa
3. Point A: Subspinale. The most posterior midline point

Table 1: Radiographic modification method

Sample	Angles to be evaluated	Inference
Class I	ANB	Class I
	Beta	Class I
	Yen	Class III
	W	Class III
	Wits	Class I
Class II	ANB	Class II
	Beta	Class I
	Yen	Class I
	W	Class III
	Wits	Class II
Class III	ANB	Class III
	Beta	Class I
	Yen	Class III
	W	Class III
	Wits	Class III

in the concavity between ANS and the prosthion.

4. Point B: Supramentale. The most posterior midline point in the concavity of the mandible between the most superior point on the alveolar bone overlying the mandibular incisors and pog.
5. OP: Occlusal plane. This is drawn through the region of maximum cuspal interdigitation.
6. Point M - Midpoint of premaxilla
7. Point G - Center of the largest circle that is tangent to the internal inferior, anterior, and posterior surfaces of the mandibular symphysis.
8. Point C - Center of condyle, found by tracing the head of condyle and approximating its center.

Parameters Included

1. ANB angle: Formed by planes from point A to nasion and from nasion to point B.^[1]
2. "Wits" appraisal: Perpendicular lines dropped from point A to point B onto occlusal plane. "Wits" reading is measured from AO to BO.^[2]
3. Beta angle: Formed by three skeletal landmarks: A point (subspinale), B point (supramentale) and center of condyle formed by tracing the head of the condyle and approximating its center (C). Line connecting C with B point (C-B line), line connecting A and B points and line from point A perpendicular to C-B line. Finally, measuring the beta angle, this is the angle between the last perpendicular line and the A-B line.^[3]
4. Yen angle: Formed by three reference points: S, midpoint of the sella turcica; maxillary point M,^[4] midpoint of premaxilla; and G,^[5] center of the largest circle that is tangent to the internal inferior, anterior, and posterior surfaces of the mandibular symphysis. When S, M, and G are connected, they form the YEN angle, which is measured at M.^[6]

5. W angle: Is formed between the perpendicular line from point M to S-G line and M-G line.^[7]

Table 2: Comparison of mean and S.D for beta angle, Yen angle and W angle with ANB angle in Class I samples

	ANB	Witt's	BETA	YEN	W
Mean±SD	1±0	1±0	0.2±0.4	0.4±0.4899	0.6±0.899

SD: Standard deviation

Table for T values

	Beta	Yen	W
ANB and Witt's	4.00	2.45	1.63

Table 3: Comparison of mean and S.D for beta angle, Yen angle and W angle with ANB angle in Class II samples

	ANB	Witt's	Beta	Yen	W
Mean±SD	1±0	1±0	0.6±0.4899	0±0	0±0

SD: Standard deviation

Table for T values

	Beta	Yen	W
ANB and Witt's	1.63	0	0

Table 4: Comparison of mean and SD for beta angle, Yen angle and W angle with ANB angle in Class III samples

	ANB	Witt's	Beta	Yen	W
Mean±SD	1±0	1±0	0.8±0.4	1±0	1±0

SD: Standard deviation

Table for T values

	Beta	Yen	W
ANB and Witt's	1.00	0	0

Table 5: Overall comparison of mean and SD for beta angle, Yen angle and W angle with ANB angle

	ANB	Witt's	Beta	Yen	W
Mean±SD	1±0	1±0	0.53±0.4989	0.47±0.4989	0.53±0.4989

SD: Standard deviation

Table for T values

	Beta	Yen	W
ANB and Witt's	3.52	3.93	3.52

RESULTS

Student's *t*-test showed, in Class I samples, none of the angles was showing 100% correlation with ANB. The closest angle was W angle when compared with ANB and wits appraisal [Table 2].

In Class II samples, beta angle was closest compared with ANB. Whereas yen and W angles showed considerable difference on comparison with ANB and wits appraisal [Table 3].

On comparison of beta, Yen, and W angles with ANB angle and Wits appraisal in Class III samples showed no significant difference [Table 4].

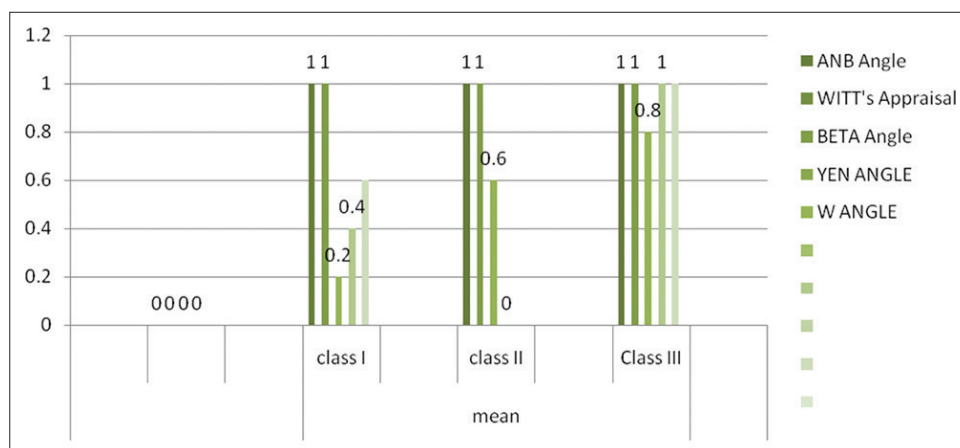
Statistical comparison of overall mean values of beta, yen, and W angles was 1, 0.53, 0.47, and 0.53, respectively, for Classes I, II, and III samples with ANB and Wits appraisal. Results showed a statistically significant difference [Table 5 and Graph 1].

In the modified radiographic technique also none of the angles was showing 100% correlation when compared with ANB and wits appraisal [Table 1].

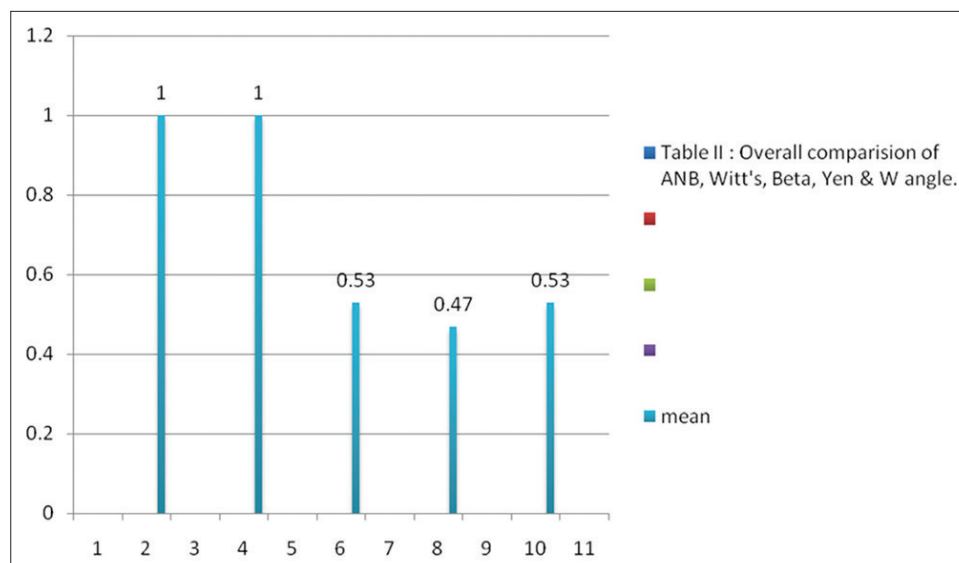
DISCUSSION

ANB angle being the pioneer in measuring the sagittal dysplasia has stood the test of time. Since then, many other angles were introduced. All other AP parameters introduced over the years are affected by at least one of the factors, namely patient's age, jaw rotations, poor reproducibility of landmarks, growth changes in reference planes, and changes due to orthodontic treatment (Ishikawa *et al.*, 2000). The most popular parameter still widely used for assessing the sagittal jaw relationship remains the ANB angle and Wits appraisal, even though affected by various factors as mentioned above (Jacobson, 1975).

Beta angle avoids the use of the functional plane and is not affected by jaw rotations (Baik and Ververidou, 2004). However, it uses point A and point B, which can



Graph 1: Comparison of means of all angles in Classes I-III samples



Graph 2: Overall comparison of ANB angle, wits appraisal, yen angle, W angle

be remodeled by orthodontic treatment and growth (Richardson, 1982; Frank, 1983; Rushton *et al.*, 1991). The reproducibility of the location of condylion on mouth-closed lateral head films is limited (Adenwalla *et al.*, 1988; Moore *et al.*, 1989; Ghafari *et al.*, 1998). Instead of condylion, center of condyle could be used, but an approximation of center of the condyle is difficult (Baik and Ververidou, 2004). Beta angle indicating a Class II or Class III skeletal pattern does not determine which jaw is prognathic or retrognathic.

Yen angle uses the following reference points S, Pt M and pt G. When these points are connected, YEN angle is formed measured at M. Studies have shown that continuous remodeling occurs during adolescence and beyond, in sella turcica. As a result, the position of its midpoint changes. Therefore, it is not a stable point and the above-listed parameters fail to be satisfied by Yen angle too (Melson 1974). Furthermore, constructions of M and G points are not accurate because precise tracing of the premaxilla and locating a center is not easy. It measures an angle between the SM and MG planes. Therefore, any jaw rotations due to growth or orthodontic treatment can mask true basal dysplasia.

As W angle uses same parameters of Yen angle, which are not stable, the concept of jaw rotation and SG line is not clear. Therefore, this also dissatisfies the above parameters.

When we think logically, for measuring any antero-posterior discrepancy between the jaws, the reference point should be in the vertical plane either above or below. ANB angle has taken point N as a reference point, which falls in the vertical plane. Therefore, it satisfies the criteria for a best view where others do not because their reference points are not in the vertical plane.

As results showed, there was no angle which was accurate and consistent as compared with ANB angle and Wits appraisal. Statistically, significant difference was found between Beta, Yen, and W angles compared with ANB and Wits appraisal [Graphs 1 and 2].

A similar study was done to compare cephalometric analyses for assessing sagittal jaw relationship which shows similar kind of result showing a weak correlation between ANB and beta angle.^[8]

As this new angle is not fully satisfying the above-mentioned parameters and also their reference points which have been taken for measuring the discrepancy between the jaws are not present in the vertical plane, so they do not satisfy the criteria for the perfect view. ANB despite of having drawbacks still remain the only angle to evaluate antero-posterior jaw discrepancy.

CONCLUSION

ANB angle is the pioneer, and it's having a gold standard.

Beta, Yen, and W angles are not accurate and consistent, showing varying results with Classes I-III compared with ANB. The new angles should add the value to the old angle and should not create confusion among the results.

REFERENCES

1. Reidel R. Analysis of dentofacial relationships. *Am J Orthod* 1957;43:103-19.
2. Jacobson A. Application of the "Wits" appraisal. *Am J Orthod* 1976;70:179-89.
3. Baik CY, Ververidou M. A new approach of assessing sagittal discrepancies: The beta angle. *Am J Orthod Dentofacial Orthop* 2004;126:100-5.
4. Kierl MJ, Nanda RS, Currier GF. A three year evaluation of

- skeletal stability of mandibular advancement with rigid fixation. *J Oral Maxillofac Surg* 1990;48:587-92.
5. Braun S, Kittleson R, Kim K. The G-axis: A growth vector for the mandible. *Angle Orthod* 2004;74:328-31.
 6. Braun S, Kittleson R, Kim K. The G-axis: A growth vector for the mandible. *Angle Orthod* 2004;74:328-31.
 7. Wasundhara AB, Nayak S, Umal D. A new approach of assessing sagittal dysplasia: W angle. *Eur J Orthod* 2011;125:1-5.
 8. Gul-e-Erum, Fida M. A comparison of cephalometric analyses for assessing sagittal jaw relationship. *J Coll Phys Surg Pak* 2008;18:679-83.