Review Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2017;6:1s:245-249.

Assessment of Sagittal Discrepancies Through a New Approach of 'Beta Angle' in North Indian Population

Ankit Sikri[1*] Annupriya Khanna[2] Anil Kumar Mehrotra[3] Sujit Panda[4]

[1]Associate Professor, Department of Orthodontics & Dentofacial Orthopedics, Bhojia Dental College, Baddi, H.P, India.
[2]Assistant Professor, Department of Pedodontics & Preventive Dentistry, National Dental College, Dera Bassi, Mohali, India.
[3]Ex Professor and Head, Department of Orthodontics & Dentofacial Orthopedics, Rama Dental College, Kanpur, U.P, India.
[4]Professor, Department of Orthodontics & Dentofacial Orthopedics, Rama Dental College, Kanpur, U.P, India.

ABSTRACT

Introduction: Orthodontic diagnosis is the most critical step in providing comprehensive treatment to patient, which involves evaluation of cranial and dento-facial structures in all three planes, i.e. vertical, sagittal and transverse. The apical base relationship cephalometrically was made by orthodontists like W.B. Down, Reidel, Steiner. Baik and Ververidou (2004) came out with a different angle called as Beta Angle to relate the apical bases. They developed an angle between a perpendicular line drawn from point A to C – B line (centre of condyle to supramentale) and the A – B line. Through this study,attempt is made to develop norms of Beta Angle and to assess it in different skeletal patterns of North Indian population.

Material and Methods: 405 individuals between age group of 16-20 years were selected and the study was conducted in the Department of Orthodontics & Dentofacial Orthopedics, Rama Dental College, Kanpur. Based on ANB angle and profile, selected sample was divided into three skeletal pattern groups: Class I, Class II and Class III and Beta angle was measured for each subject in all the three groups. Correlation and regression analysis analyzed relation between Beta & ANB angle.

Results: Beta angle used in our study was consistent and homogenous in each group, and Beta angle does not vary significantly among ethnic groups.

Conclusion: Beta angle would be valuable whenever previously established cephalometric measurements, such as ANB angle, cannot be accurately used because of their dependence on varying factors.

Keywords: Beta Angle, ANB Angle, Skeletal Pattern.

INTRODUCTION

Orthodontic diagnosis is the most critical step in providing comprehensive treatment to a patient, which involves evaluation of cranial and dento-facial structures in all three planes, i.e. vertical, sagittal and transverse. Assessment of antero-posterior jaw relationship is of great clinical importance in diagnosis and treatment planning. The skeletal pattern plays an important role in occlusal development and also imposes limitation to the antero-posterior movement of incisors during treatment.

The first efforts in evaluating antero-posterior apical base relationship cephalometrically was made by **W.B. Down** by locating points A and B on the lateral cephalogram. **Reidel** measured the SNA and SNB angle and used their difference or **ANB angle** as an expression of dental apical base relationship. **Steiner** proposed the appraisal of

Received: Jan. 17, 2017: **Accepted**: Feb. 21, 2017
***Correspondence Dr. Ankit Sikri.**
Department of Orthodontics & Dentofacial Orthopedics, Bhojia Dental College, Baddi, H.P, India.
Email: sikriankit@gmail.com

pISSN 2278-0076
eISSN 2321-9270

various parts of the skull separately, namely the skeletal, dental and soft tissues.

This analysis related upper and lower jaws to the skull. Steiner was one of the first authors to elect the use of anterior cranial base (Sella to Nasion) as the line of reference to which jaws have been related.

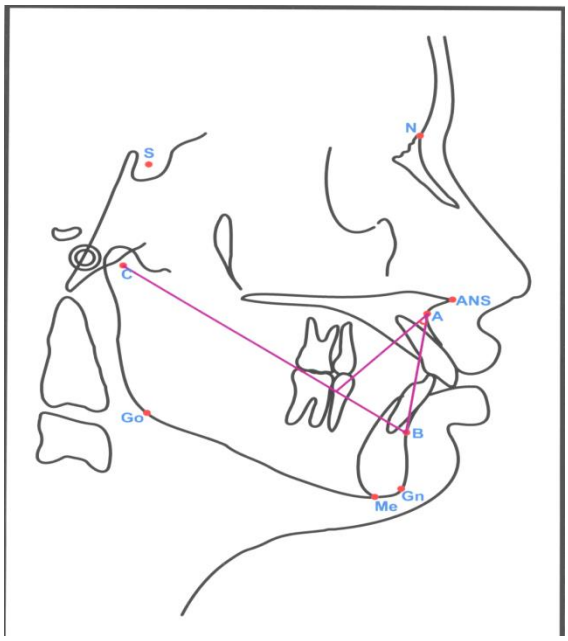


Fig 1: Tracing Representing Beta Angle.

Baik and Ververidou (2004) came out with a different angle called as **Beta Angle** to relate the apical bases. They developed an angle between a perpendicular line drawn from point A to C – B line (centre of condyle to supramentale) and the A – B line. The angle does not depend on any cranial landmark or dental occlusion. They developed norms for the American population. Since, there is always a racial variation, so it becomes necessary to determine the norms for Beta Angle which can be applicable on North Indian individual groups and can be of a great help in effective orthodontic diagnosis and treatment planning.

MATERIALS AND METHOD

Sixty five individuals between age group of 16-20 years were selected and the study was conducted in the Department of Orthodontics & Dentofacial Orthopedics, Rama Dental College, Kanpur. Family lineage was studied in each subject to note the nativity of North India. A standardized lateral cephalogram of the chosen sample was traced on acetate sheets by a single operator. The data was recorded in a pre-structured performa by the operator. Based on ANB angle and profile, selected sample was divided into three skeletal pattern groups: Class I, Class II and Class III. Beta angle was measured for each subject in all the three groups. Mean, standard deviation and range were calculated for each group and thus, norms for Beta angle were developed. Correlation and regression analysis analyzed the relation between Beta angle & ANB angle.

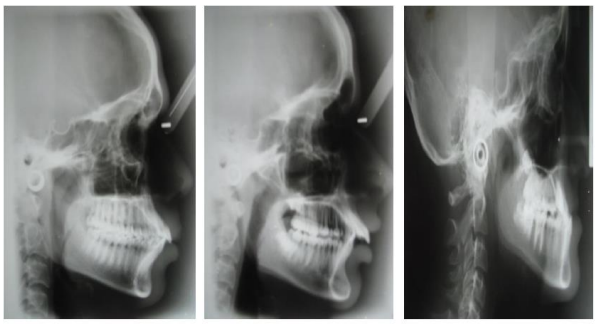


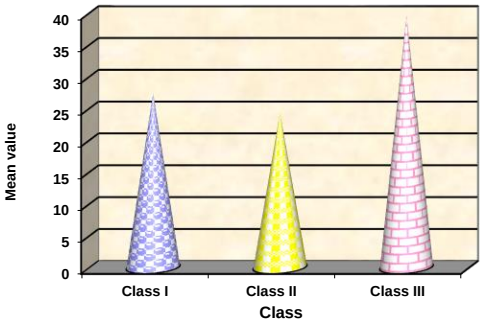
Fig – 2: CLASS – 1 PATTERN Fig – 3: CLASS – II PATTERN Fig – 4: CLASS – III PATTERN

RESULTS

The mean value of Beta angle in Class I skeletal group was found to be 27.4°, with a standard deviation of 3.1 and range of 23.5°- 38°. The mean value of Beta angle in Class II skeletal group was found to be 24.3°, with a standard deviation of 2.1 and range of 21.1°- 29°. The mean value of Beta angle in Class III skeletal group was found to be 39.6°, with a standard deviation of 2.3 and range of 33°- 42° **(TABLE – 1, GRAPH - 1)**.

Table 1: Pattern of Beta Angle In Class I, Class II And Class III Groups.

CLASS	N	RANGE (Degree)	MEAN ± SD	C.V.(%)
CLASS I	25	23.5-38	27.4 ±3.1	11.2
CLASS II	25	21.1-29	24.3 ± 2.1	8.6
CLASS III	15	33-42	39.6 ±2.3	6



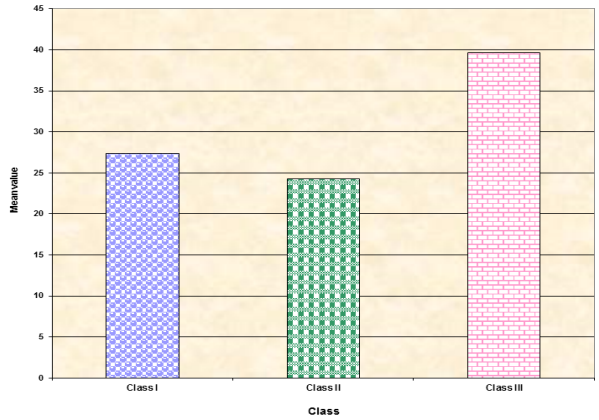
Graph 1: Pattern of βeta angle in class I, class II and class III skeletal groups.

The norms of Beta angle showed that in Class I group, the mean value for Beta angle was 27.4°± 3.1 and range of 23.5°-38°. In Class II group, the mean value for Beta angle was 24.3°± 2.1 and range of 21.1°-29°; while in Class III group, the mean value for Beta angle was 39.6°± 2.3 and range of 33°-42° **(TABLE – 2, GRAPH - 2)**.

Table 2: Norms for beta angle for north indian population.

CLASS	MEAN (Degree)	SD	95% CI (Mean ± 2 SD)
I	27.4	3.1	26 – 28
II	24.3	2.1	23 – 25
III	39.6	2.3	38 – 40

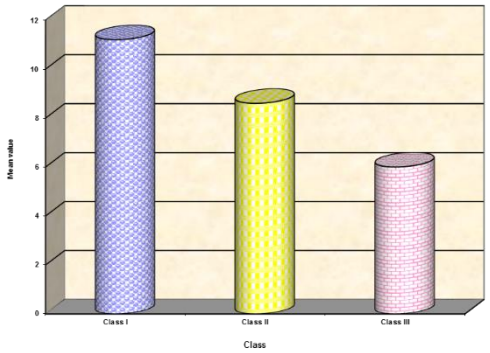
Graph 2: Norms for βeta angle for north Indian population.



The coefficient of variation of Beta angle was found to be 11.2% for Class I group, 8.6% for Class II and 6% for Class III groups. The coefficient of variation of ANB angle was found to be 23.2% for Class I group, 22.3% for Class II and 46% for Class III groups. These values support that Beta angle is a more consistent measurement to assess sagittal relationships than ANB. Correlation and Regression analysis performed for total sample assessed that of all the factors which may influence Beta angle & ANB angle account for 67% of variability **(TABLE – 3, GRAPH – 3).**

Table 3: Comparison of coefficient of variation of beta angle and anb angle in the three groups.

CLASS	BETA ANGLE (%)	ANB ANGLE(%)
CLASS I	11.2	23.2
CLASS II	8.6	22.3
CLASS III	6	46



Graph 3: Comparison of coefficient of variation of beta angle in three groups.

DISCUSSION

An accurate diagnostic evaluation of each individual involves a comparison of his/her cephalometric findings with the norms of his/her ethnic group. This is because cephalometric standards vary widely between different ethnic groups. Recently there has been a paradigm shift in the area of diagnosis and treatment planning towards "individualized treatment goals". This stems back to the time of research done by **Steiner**.

He had realized that malocclusions occur in a wide range of cranio- facial morphologies, some of which do not lend themselves to "ideal treatment outcome" nor can they all be corrected to a mean central tendency value norm with conventional orthodontics. Studies have been conducted to establish the cephalometric norms for different ethnic groups. They have investigated numerical values for the dental and skeletal variables, most importantly on the antero-posterior jaw discrepancies. In Class I group, the mean value for Beta angle is 27.4°, with standard deviation of 3.1 and range is 23.5°-38° which is similar to the study by **Baik and Ververidou**[9], who found the mean value for Beta angle as 31.1°, with a standard deviation of 2.0.

In Class II group, the mean value of Beta angle is 24.3°, with a standard deviation of 2.1 and range is 21.1°- 29°, which is in accordance with the findings of **Baik and Ververidou**, who assessed the mean value of Beta angle for this group as 24.5°, with a standard deviation of 3.0. In Class III group, the mean value for Beta angle is 39.6°, with a standard deviation of 2.3 and range in this group is 33°- 42°, which is in par with the results of **Baik and Ververidou**[9] with Beta angle being 40° with standard deviation of 4.2.

We found no significant relation between ANB angle and Beta angle in the Class I group. In Class II group, the relation between ANB angle and Beta angle is significant (p Value < 0.05) which varies from the findings of Jarvinen for this group. The relation between ANB angle and Beta angle is significant in Class III group. In our study, we found highest coefficient of determination for the Class I group (R^2 – 0.285), lowest for the Class II group (R^2 - 0.185) and significant relation between ANB angle and Beta angle in the Class I group. In Class II group, the relation between ANB angle and Beta angle is significant (p Value < 0.05). The relation between ANB angle and Beta angle is also significant in Class III group.

The coefficient of determination values for Class I, Class II and Class III group differ from other studies thus interpreting higher confidence interval values and reliability of Beta angle is confirmed over ANB angle. Of all the factors which may influence Beta angle, ANB angle account for 67% of variability. The variance analyses of our study support that Beta angle is more reliable than ANB angle.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCE

1. Millet D, Gravely JF. The assessment of Antero-posterior Dental Base relationships. Br J Orthod 1991; 18: 285-97.
2. Broadbent BH. A new x-ray technique and its application to orthodontia. Angle Orthod 1931; 1:45-66.
3. Hofrath H. Impact of Cephalometrics on orthodontic concepts. Angle Orthod 1950; 20:67-73.
4. Downs WB. Variations in facial relationships: Their significance in treatment and prognosis. Am J Orthod 1948; 34:812-40.
5. Riedel RA. The relation of maxillary structures to cranium in malocclusion and in normal occlusion. Angle Orthod 1952; 22:140-5.
6. Steiner CC. Cephalometrics for you and me. Am J Orthod 1953; 39:729-55.
7. Rotberg S. Fried N, Kane J, Shapiro E. Predicting the "Wits" appraisal from the ANB angle. Am J Orthod 1980; 77: 636-42.
8. Jacobson A. The "Wits" appraisal of jaw disharmony. Am J Orthod 1975; 67:125-38.
9. Baik CY, Ververidou M. A new approach of assessing sagittal discrepancies: the Beta angle. Am J Orthod Dentofacial Orthop. 2004; 126:100-5.
10. Nanda RS, Merrill RM. Cephalometric assessment of sagittal relationship between maxilla and mandible. Am J Orthod Dentofacial Orthop 1994; 105:328-44.
11. Beatty EJ. A modified technique for evaluating apical base relationships. Am J Orthod 1975; 68: 303-15.

12. Rakosi T, Jonas I, Graber TM. Color atlas of dental medicine. 1 st ed. New York: Thieme Medical Publishers; 1993.p.3.

13. Jacobson A. Radiographic Cephalometry. Illinios Quintessence Publishing Co; 1995.p.53-65.

14. Walker GF, Kowalski CJ. The Distribution of the ANB Angle in "Normal" Individuals. Angle Orthod 1971; 41: 332-5.

15. Hussels W, Nanda RS. Analysis of factors affecting angle ANB. Am J Orthod 1984; 85: 411-23.

16. Nanda RS. The rates of growth of several facial components measured from serial cephalometric roentgenograms. Am J Orthod. 1955; 41: 658-73.

17. Chang H. Assessment of anteroposterior jaw relationship. Am J Orthod Dentofacial Orthop 1987; 92:117-22.

18. Taylor CM. Changes in the relationship of nasion, point A, and point B, and the effects upon. Am J Orthod 1969; 42:176-93.

19. Mills JRE. The application and importance of cephalometry in orthodontic treatment. Am J Orthod 1970; 2: 32-47.

20. Ferrazzini G. Critical evaluation of the ANB angle. Am J Orthod. 1976 ; 69: 620-6.

21. Järvinen S. An analysis of the variation of the ANB angle: A statistical appraisal. Am J Orthod 1985; 87: 144-6.

22. Jarvinen S. Floating norms for the ANB angle as guidance for clinical considerations. Am J Orthod 1986; 90:383-7.

23. Jarvinen S. The JYD angle: a modified method of establishing sagittal apical base relationship. Eur J Orthod 1982; 4: 243-9.

24. Stoner, Morris M, Lindquist JT, Vorhies JM, Hanes, Rolenzo A. A cephalometric evaluation of 57 cases treated by Dr. Charles H Tweed. Angle Orthod. 1956; 26: 68-70.

25. Jacobson A. Update on the 'Wits' appraisal. Angle Orthod. 1988; 57: 205-19.

26. Haynes S, Chau MNY. The reproducibility and repeatability of the Wits analysis. Am J Orthod. Dentofacial Orthop 1995; 107:640-7.

27. Sherman SL, Woods M, Nanda RS, Currier GF. The longitudinal effects of growth on the Wits appraisal. Am J Orthod Dentofacial Orthop. 1988; 93: 429-36.