Research Article

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Comparison and Evaluation of Various AP Skeletal Analysis: A Cephalometric Study

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ABSTRACT

Background: Antero-posterior jaw relationship is important in orthodontic diagnosis and treatment planning. The objective of this study was to investigate comparison and correlation between the ANB angle, W angle, Beta angle and HBN angle in the assessment of sagittal jaw discrepancy.

Material and Method: A sample of 92 cases categorized into male and female were taken. The ANB angle, W angle, Beta angle, and HBN angle were measured for each patient on lateral cephalogram. Correlation coefficient analysis and ANOVA analysis was done.

Result: The coefficient of variance is least for ANB angle (8.3) followed by W angle (17.4) and Beta angle (24.6). The results were found highly significant for W and Beta angle in both males and females. Pearson's correlation test revealed that HBN angle and W angle and HBN angle and Beta angle were highly correlated.

Conclusion: HBN angle had a significant correlation with ANB angle, Beta angle, and W angle. The HBN angle can be used along with W and Beta angle to provide a more accurate assessment of sagittal jaw relationship.

Keywords: HBN angle, Beta angle, W angle.

INTRODUCTION

Sagittal relation of the maxilla to mandible is one of the most important diagnostic criteria in orthodontics. Since the introduction of Wylie's[1] method for assessing anteroposterior discrepancies, there have been various angular and linear measurements proposed in sagittal jaw relationship which could help the orthodontist to establish the most suitable and appropriate treatment plan for the patient.

Down's[2] in 1948 introduced the A-B plane angle. Riedel[3] in 1952 introduced the ANB angle using the difference of SNA and SNB angle. Since then, ANB angle has been widely used as a principle method for evaluating sagittal jaw relationship. However, both Down's and Reidel's method are subject to error due to the variation in the position of Nasion point which is affected by growth and its displacement can directly affect the A-B plane angle and ANB angle. Wits appraisal introduced by Jacobson[4] in 1975 is a linear AO-BO distance between points A and B projected perpendicular on the functional occlusal plane. It is also a second widely used method after ANB angle. Wit's appraisal also has limitations as it uses a functional occlusal plane which is not easy and accurately reproducible, particularly in mixed dentition patient. Also, the change in angulation of the

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functional occlusal plane due to the eruption of permanent teeth and development [5-7] also influences Wit's appraisal reading

In 2004, Baik and Ververidou[8] introduced the Beta angle which uses the point A, point B and the apparent axis of condyle (point C) skeletal landmarks as a reference point to measure an angle that indicates the severity and type of skeletal dysplasia in anteroposterior dimension. Since Beta angle also has some drawback as it uses point A which is also affected by orthodontic treatment. The quest for the ideal angle for diagnosing anteroposterior jaw discrepancy is still on. This lead to the introduction of W angle by Bhad[9] et al in 2003 using three skeletal landmarks – point M, point G, and point S as a reference point. The W angle is the angle between the perpendicular line from point M on the SG line and MG line. The angle thus has avoided the use of Nasion and point A which were said to be altered due to growth or orthodontic treatment.

Another angle independent of the cranial reference plane and the occlusal plane is the HBN angle proposed by Harsh Bhagvatiprasad Neeta[10.] in 2015. Three skeletal landmarks were used point C(apparent axis of the condyle), point M, point G and the angle between the perpendicular line from point M to CG line and MG line is HBN angle.

The validity of these angles and their comparison with each other has yet not been undertaken. This study was designed to assess the level of correlation of HBN angle with commonly used sagittal indicators, such as ANB angle, W angle, and Beta angle in class I malocclusion subjects.

MATERIAL AND METHOD

The present study was conducted in individuals who reported to the out patients department of orthodontics and dentofacial orthopaedics, CSMSS Dental College and Hospital, Aurangabad. Complete clinical examination and case history of 236 individuals who attended the OPD was taken.

Inclusion Criteria for selecting the cases:

- Cases with skeletal class I jaw bases with the age group of 18 & above, and who had never undergone orthodontic treatment were selected.
- Permanent dentition with no missing teeth(except 3rd molars)
- The absence of TMJ disorder and pain.
- The absence of craniofacial malformation and facial asymmetry.

Method of collection of data:

Total 92 cases fulfilling the above inclusion criteria were selected, which were further divided into a male and female group. The lateral cephalograms were taken with the teeth in centric occlusion, lips in a relaxed posture and head in natural head position. This cephalometrics were traced for ANB angle, Beta angle, W angle, and HBN angle was measured in the following manner.

1. ANB angle – To construct the ANB angle, points A, B, and N (Nasion) were located. Two lines N-A and N-B were drawn. ANB angle is between the N-A line and N-B line at point N (Figure no 1).

2. Beta angle – To construct Beta angle point A, B, and C (apparent axis of the condyle) were identified. Three lines C-B, A-B and line from point A perpendicular to C-B line were drawn. Beta angle is the angle between the perpendicular and A-B line (figure no.2).

3. W angle - To construct W angle, point S, G and M were identified. Four line S-G, S-M, M-G and a perpendicular line from point M to S-G line were drawn. W angle is the angle between the perpendicular line from point M to S-G line and M-G line (figure no. 3).

4. HBN angle - HBN angle was formed by, first locating three points:

Point C- apparent axis of the condyle, Point M- the midpoint of the premaxilla, Point G- the centre of the largest circle that is tangent to internal inferior, anterior and posterior surface of mandibular symphysis. Next defining four lines: first line: A line connecting point C to G; second line: a line connecting from M to G; the Third line from point C to M; Fourth line: a perpendicular line drawn from M to C-G line.

Finally, HBN angle is measured, which is the angle between the perpendicular line from point M to C-G line and the M-G line (figure no.4). All the angles were correlated with each other within the groups.

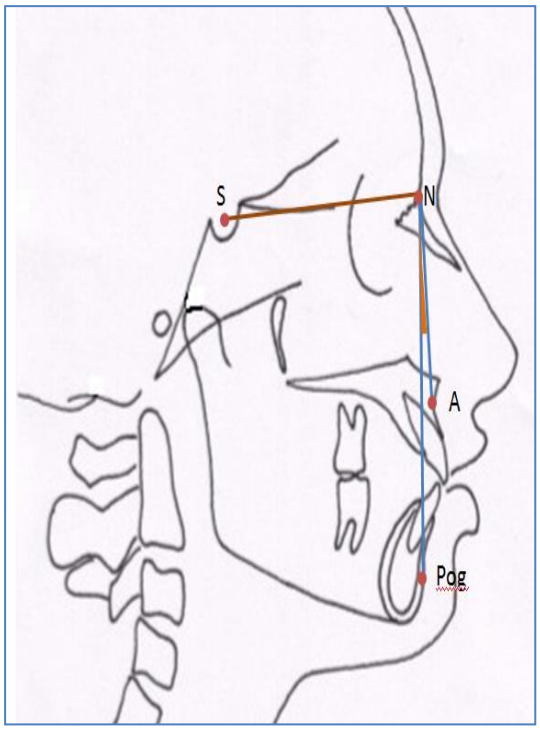


Fig1: ANB angle

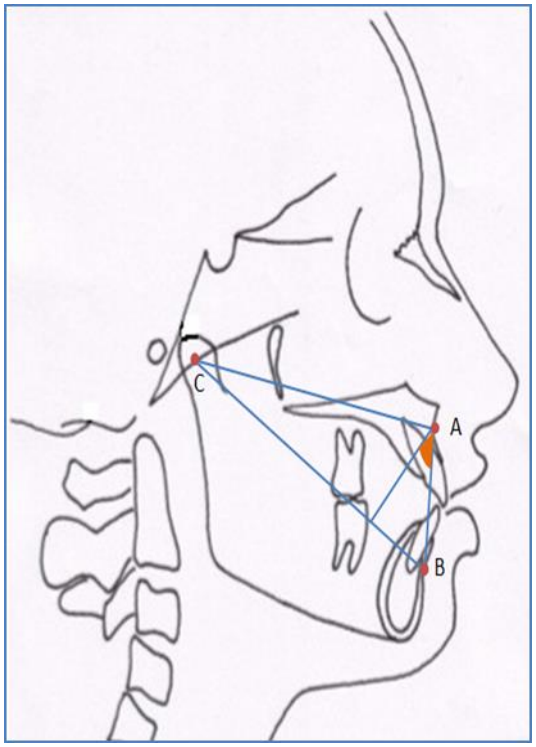


Fig 2: Beta angle

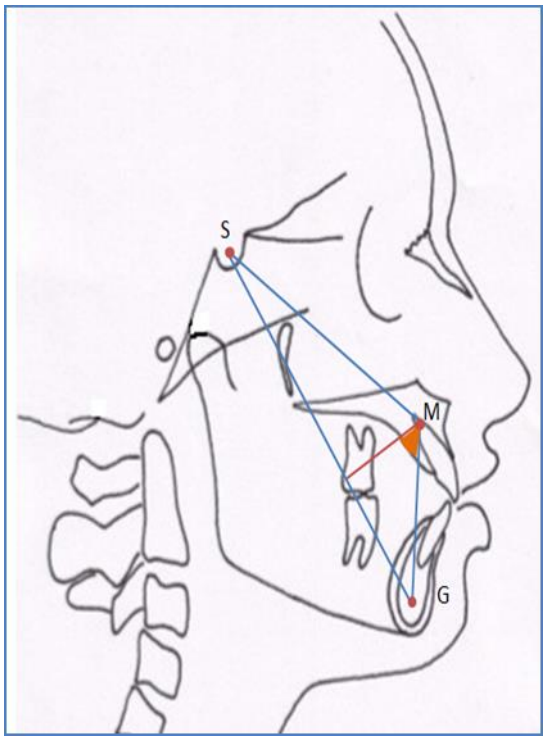


Fig 3: W angle.

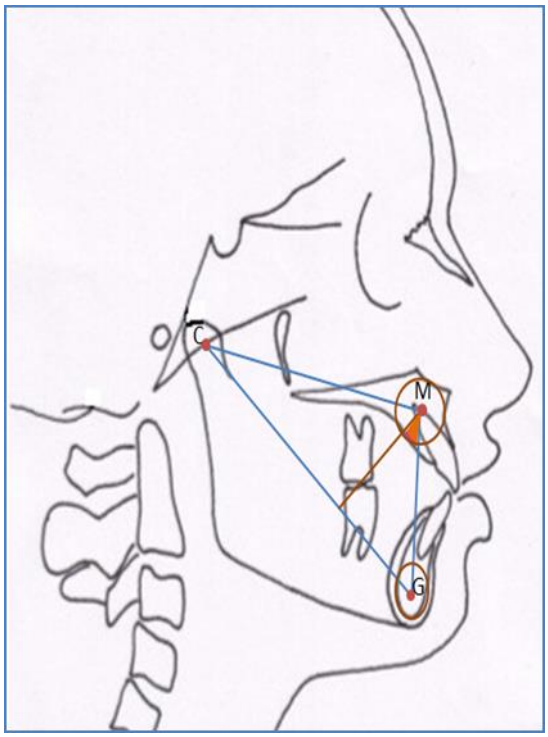


Fig 4: HBN angle.

Statistical Analysis:

The data were collected, tabulated and statistical analysis was performed as follows:

- Mean and Standard Deviation was calculated for each parameter (table no. 1 & 2) .
- One way analysis of variance (ANOVA) was performed to determine whether there was a statistically significant difference between the mean values of ANB angle, Beta Angle, W angle and HBN angle.
- Correlation coefficients between the various parameters were calculated using Pearson's correlation coefficient (table no. 3 & 4).

Table 1: Mean and Standard Deviation for males.

Descriptive Statistics			
	Mean	Std. Deviation	N
HBN	37.89189	5.521593	37
ANB	5.162162	2.141047	37
W ANGLE	52.16216	3.840671	37
B ANGLE	25.62162	7.013286	37

Table no. 2: Mean and Standard Deviation for females.

Descriptive Statistics			
	Mean	Std. Deviation	N
HBN	38.27	4.938	55
ANB	4.49	3.108	55
W ANGLE	51.98	4.236	55
B ANGLE	27.40	6.256	55

Table 3: Correlation coefficient among all the four parameters for males; *Correlation is significant at the 0.05 level (2 tailed).

Correlations		
		HBN
HBN	Pearson Correlation	1
	N	37
ANB	Pearson Correlation	-.367
	Sig. (2-tailed)	.025
	N	37
W ANGLE	Pearson Correlation	.768
	Sig. (2-tailed)	.000
	N	37

B ANGLE	Pearson Correlation	.760
	Sig. (2-tailed)	.000
	N	37

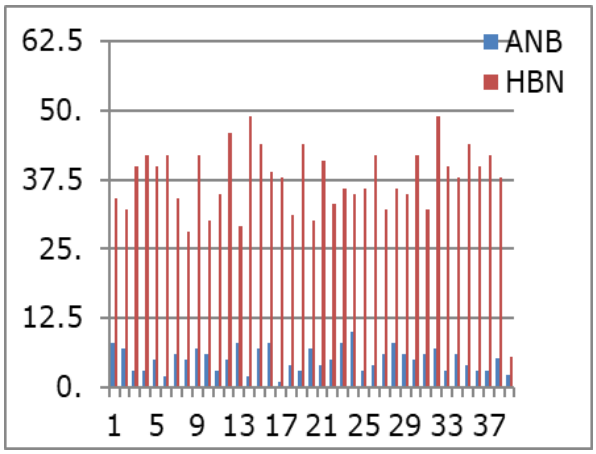
Table 4: Correlation coefficient among all the four parameters for females; *Correlation is significant at the 0.05 level (2 tailed).

Correlations		
		HBN
HBN	Pearson Correlation	1
	Sum of Squares and Cross-products	1316.909
	Covariance	24.387
	N	55
ANB	Pearson Correlation	-.547
	Sig. (2-tailed)	.000
	N	55
W ANGLE	Pearson Correlation	.833
	Sig. (2-tailed)	.000
	N	55
B ANGLE	Pearson Correlation	.799
	Sig. (2-tailed)	.000
	N	55

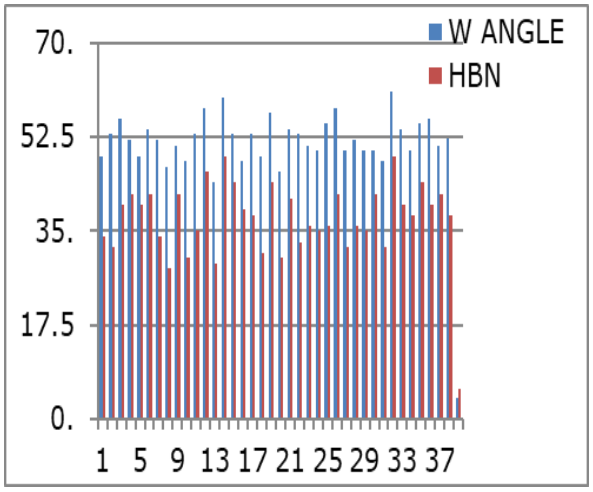
RESULTS

This study was undertaken to check the validity of the HBN angle and its comparison with ANB angle, Beta angle, and W angle. Results from this study show that there is the statistically significant difference between HBN angle, ANB angle, Beta and W angle. Table no. 3 shows that there is a strong positive linear relation between HBN angle and W angle (r value = 0.768, p value = 0.000) and HBN angle and Beta angle (r value = 0.760, p value = 0.000). A negative linear relationship was found between HNB angle and ANB angle (r value = -0.367, p value = 0.000) for males.

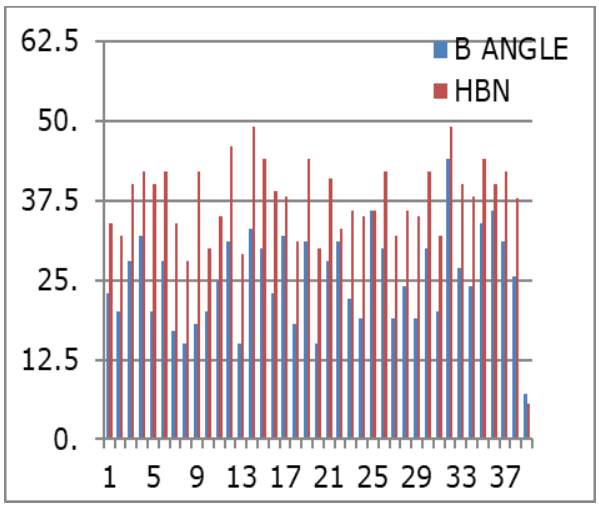
Table no. 4 shows the positive linear relation between HBN angle and W angle (r value = 0.833, p value = 0.000) and between HBN and Beta angle (r value = 0.799, p value = 0.000). Similarly, a negative linear relation was seen between HNB angle and ANB angle (r value = -0.547, p value = 0.000). The coefficient of variance is least for ANB angle (8.3) followed by W angle (17.4) and Beta angle (24.6). The results were found highly significant for W and Beta angle in both males and females.



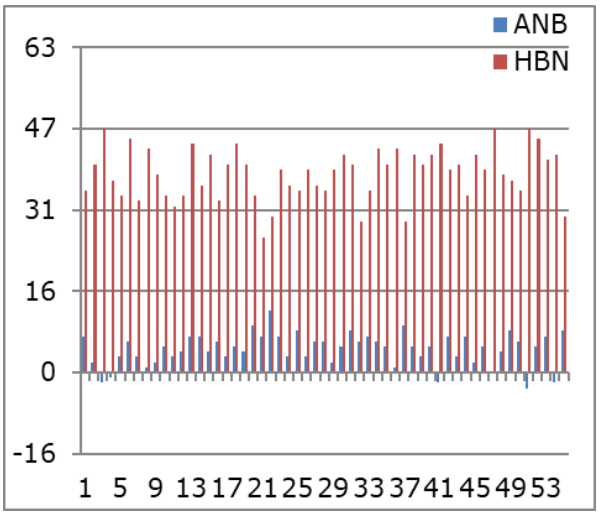
Graph 1: Histogram showing a correlation between ANB and HBN angle in males.



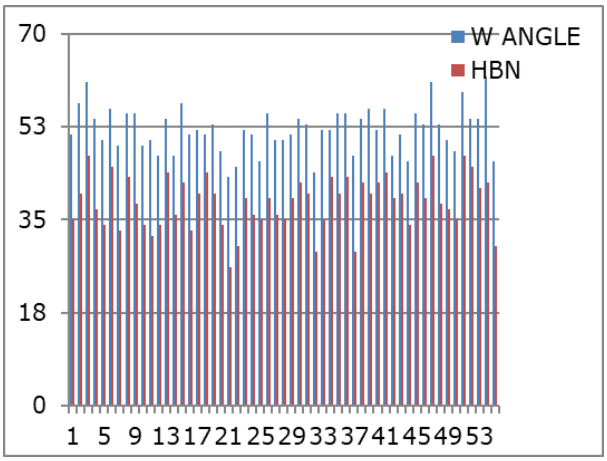
Graph 2: Histogram showing a correlation between W angle and HBN angle in males.



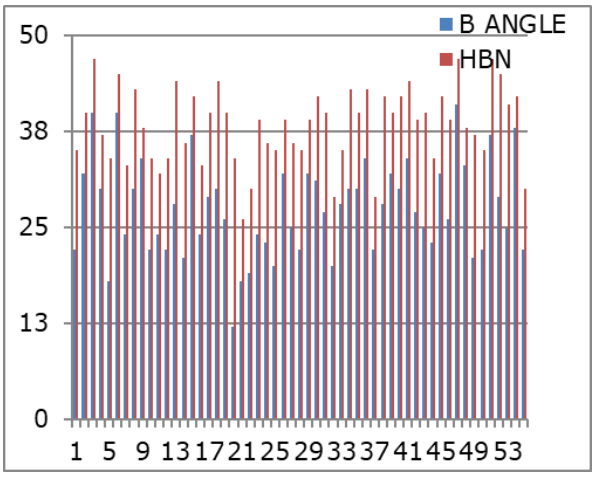
Graph 3: Histogram showing a correlation between Beta angle and HBN angle in males.



Graph 4: Histogram showing a correlation between ANB angle and HBN angle in females.



Graph 5: Histogram showing a correlation between W angle and HBN angle in females.



Graph 6: Histogram showing a correlation between Beta angle and HBN angle in females.

DISCUSSION

Till date, many linear and angular measurements have been introduced to determine anteroposterior jaw relation and jaw position. Wylie was the first to introduce the method to assess sagittal jaw relation. After that many variables have come in to use for assessing the jaw relation in the anteroposterior direction. ANB angle introduced by the Riedel is subjected to error as it uses point N in the measurement which is affected by the growth. Also, rotation of jaw due to growth changes ANB angle[11,12,13,14]. After the introduction of ANB, various angles and linear measurements were introduced, such as Wit's appraisal, Antero-posterior Dysplasia Indicator [15], Freeman's AXB angle [16], AF-BF distance[17] etc, but none of the parameter is universally reliable because of their limitations. A different analysis may provide a different reading for the same skeletal jaw relation due to change in the reference planes. Angular measurements are influenced by the changes in facial height, jaw rotation whereas linear variables can be influenced by the inclination of the reference plane.

Recently introduced angles which are dependent on stable landmarks like Beta angle, W angle and HBN angle are used for determining sagittal jaw relationship. In this study, an attempt was made to find a correlation between the widely used variables and recently proposed cephalometric measurement which was used to indicate sagittal jaw relationship.

From the present study, it was found that the value of HBN angle is significantly (p value < 0.005) different in both male and female group. The mean values recorded in the present study was 37.8 ± 5.5 in males and 38.2 ± 4.9 in females. The mean value for HBN angle in skeletal class I subject was 42.88 ± 2.23 as stated by Harsh Bhagvatiprasad Nita. Thus, the result of this study was in accordance with the above study. The result of this study showed that the value of the ANB angle in 5.1 ± 2.1 in males and 4.4 ± 3.1 in females. The value of the ANB angle was significantly (p value < 0.005) different in both male and female group.

From the present study, it was found that the value of W angle was significantly (p value < 0.005) different in both male and female group. The mean values recorded in the present study was 52.4 ± 3.8 in males and 51.9 ± 4.2 in females. The mean value for W angle in skeletal class I subject was 53 ± 2 as stated by Bhad et al. Thus the result of this study was at par with the result of the pevious study.

The result of this study showed that the value of the Beta angle was significantly (0.005) different in both male and female group. The mean values recorded in the present study was 25.6 ± 7.0 in males and 27.4 ± 6.2 in females. The mean value for a Beta angle in skeletal class I subject was 31.1 ± 2 as stated by Baik and Ververidou. Thus the result of this study was in accordance with the result of the above study.

The result of Pearson's Coefficient Correlation i.e r value shows the negative linear relationship between the HBN and ANB angle (r value – 0.367 in males and -0.547 in females). The reason for this is the N point in ANB angle is not fixed during growth and is affected by various factors such as patient growth, rotation of the jaws, vertical growth and length of the anterior cranial base. Both W and Beta angle shows a positive correlation with the HBN angle (r value 0.768 in males and 0.833 in females and 0.760 in males and 0.799 in females respectively) as all these three parameters do not use N rather uses more stable landmarks for a sagittal relationship.

CONCLUSION

The following conclusion can be drawn from the study:

1. HBN angle had a significant correlation with ANB angle, Beta angle, and W angle.

2. HBN angle was highly correlated to Beta and W angle.

3. HBN angle, Beta and W angle are the significant angles to assess sagittal jaw relationship between maxilla and mandible.

4. The HBN angle can be used along with W and Beta angle to provide a more accurate assessment of sagittal jaw relationship.

CONFLICT OF INTEREST

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

REFERENCES

1. Wylie WL. The assessment of anteroposterior dysplasia. Angle Orthod 1947 ;17:97-107.

2. Downs WB. Variation in a facial relationship; their significance in treatment and prognosis. Am J Orthod 1948; 34(10); 812-840.

3. Riedel R. The relation of maxillary structures to the cranium in malocclusion and in normal occlusion. Angle Orthod 1952;22: 142-45.

4. Jacobson A. The 'Wits' appraisal of jaw disharmony. Am J Orthod 1975; 67:125-38.

5. Richardson M. Measurement of dental base relationship. European Journal of Orthodontics 1982; 4: 251 – 256.

6. Frank S The occlusal plane: reliability of its cephalometric location and its changes with growth [thesis] . University of Oklahoma, Oklahoma City 1983.

7. Sherman S L , Woods M , Nanda RS 1988 The longitudinal effects of growth on the ' Wits ' appraisal . American Journal of Orthodontics and Dentofacial Orthopedics 93 : 429 – 436.

8. Baik C Y, Ververidou M. A new approach to assessing sagittal discrepancies: the Beta angle. Am J Orthod Dentofac Orthop. 2004;126: 100–105.

9. Bhad W, Nayak S, Doshi U. A new approach to assessing sagittal dysplasia: the W angle. Eur J Orthod. 2011;1-5.

10. Harsh Bhagvatiprasad Dave, Vikas GllI, Divyaroop Rai, Y N N Reddy. The HBN Angle, Journal of Indian Orthodontic Society. 2015;49(2):79-84.

11. Freeman RS. Adjusting the A-N-B angle to reflect the effect of maxillary position. Angle Orthod 1981; 51(2): 162-171.

12. Moore A W 1959 Observations on facial growth and its clinical significance . American Journal of Orthodontics 1959;45 : 399 – 423.

13. Enlow D H 1966 A morphogenetic analysis of facial growth. American Journal of Orthodontics 52: 283 – 299.

14. Nanda R S 1955 The rates of growth of several facial components measured from serial cephalometric roentgenograms . American Journal of Orthodontics 41: 658 – 673.

15. Kim YH, Vietas JJ Antero-posterior dysplasia indicator: an adjunct to cephalometric differential diagnosis. Am J Orthod 1978; 73(6); 619-633.

16. Freeman RS. Adjusting the A-N-B angle to reflect the effect of maxllIary position. Angle Orthod 1981; 51(2): 162-171.

17. Chang HP. Assessment of antero-posterior jaw relationship. Am J Orthod Dentofacial Orthop 1987; 92(2):117-122.