



COMPARISON OF BETA ANGLE AND YEN ANGLE IN ASSESSING SAGITTAL DISCREPANCIES IN NORTH GUJARAT POPULATION- AN ORIGINAL STUDY

Dental Science

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ABSTRACT

Aim: The analysis of skeletal relationships of jaws in the sagittal plane is critical for orthodontic diagnosis for which numerous lateral cephalometric analyses have been proposed. The aim of the present study is to compare ANB, Wits appraisal, Beta angle and Yen angle for their validity and reliability in diagnosis of skeletal classes.

Methods: Pretreatment cephalograph of 40 orthodontic patients were taken from orthodontic department of Narsinhbhai Patel dental college, Gujarat. Radiographs were traced for ANB, Wits appraisal, Beta angle and Yen angle measurements. Patients were divided into three skeletal classes i.e. class I, II and III based on measurements and incisor classification and profile recorded from their files. ANOVA was applied to check the validity of performed analyses and Pearson Correlation test was performed to find out the correlation between analyses and skeletal classes.

Results: YEN angle was highly reliable and most homogeneously distributed angular parameter to assess antero-posterior sagittal discrepancy. Wits appraisal, ANB and β angle also exhibit homogenous distribution and less variability in comparison to other parameters. As all the parameters used in this study share statistically significant correlation amongst themselves, so instead of relying on one single parameter, others should be checked and correlated with clinical finding.

Conclusion: YEN angle was highly reliable parameter to assess the antero-posterior sagittal discrepancy and can be used to correlate the findings in case other parameters like ANB angle and wits appraisal have questioned reliability.

KEYWORDS

Skeletal class, Sagittal Analysis, Reliability, Validity

INTRODUCTION

Various cephalometric analyses have been proposed for the evaluation of the sagittal skeletal discrepancies. Downs described the AB plane angle and Downs angle of convexity to assess the anteroposterior jaw dysplasia.⁽¹⁾ In 1953, Riedel introduced the ANB angle, which was later

popularized by Steiner.⁽²⁾ Studies have indicated that these angular measurements are sensitive to small changes in the position of nasion and sellarurica, length of the anterior cranial base and the vertical growth pattern.⁽³⁾ To overcome this limitation, Jacobson proposed the Wits appraisal, which employed the occlusal plane as the reference.^(4,5) Few researchers have questioned the reproducibility and reliability of Wits appraisal due to the variations in inclination and difficulties in identification of the functional occlusal plane.⁽⁶⁾ Hence, several other parameters have been and are still being introduced to overcome the shortcomings of the existing cephalometric analyses for an accurate diagnosis of sagittal discrepancies. Recently, the Beta angle and W angle have been proposed to evaluate the anteroposterior jaw dysplasia, but their diagnostic performance and validity have not yet been investigated.⁽⁷⁾ In the same sequence Yen angle has also been proposed as a better parameter for evaluating the sagittal discrepancies.⁽⁸⁾ This article aims to evaluate the reliability of the Yen Angle and beta angle in determining the sagittal discrepancies in three different malocclusion groups.

MATERIALS AND METHODS

The study was carried out using lateral cephalogram of 40 Indian patients with the age range of 10-25 years, obtained from outpatient department of Orthodontics and Dentofacial Orthopaedics, Narsinhbhai Patel Dental College and Hospital, Visnagar. Forty patients categorized into class I, Class II & class III malocclusion by

ANB and Wits appraisal cephalometric measurement were selected for the study. An informed consent was obtained. A lateral cephalogram was taken for each subject. The patient full filling the following criteria were included in the study:

CLASS I

1. ANB angle of 2°
2. Wits appraisal 2mm

CLASS II

1. ANB angle of 3° to 8°
2. Wits appraisal angle was greater 3 to 10mm

CLASS III

1. ANB angle of 1 or less
2. Wits appraisal was greater than or equal -1 mm

METHODOLOGY

Four patients who did not meet the above set criteria were not included in the study. The final sample consist of class I (15 patient) class II (15 patient) and Class III (10 patient) malocclusion group. The lateral cephalometric radiograph was taken in natural head posture in the standard manner. Tracings were made by hand using a sharp 3H pencil on acetate tracing paper in a dark room using X-ray viewer. For the measurement of the linear distances, scale was used to the nearest of 0.5 mm and angles were measured to the nearest of 0.5 degree. The true vertical line was then established. The important hard and soft tissue structures were then marked on the cephalogram. The various reference points, planes and angles were drawn and recorded for evaluation.

Angular measurements

- 1) ANB angle: Difference between SNA and SNB

- 2) β angle: Formed between the lines from point A perpendicular to the C-B line and the A-B line
- 3) Yen angle: Formed between SM line and MG line

Linear measurements Wits appraisal:

Distance between A and B point on OP plane. Image shows both Beta and YEN angles. All measured data submitted for statistical analysis.

Statistical Analysis

Data was analysed using SPSS version 22. The tests performed are descriptive statistics and coefficient of variation to identify the most accurate parameters. Pearson Correlation test was used to know the between various parameters in overall data and individual groups. The Mean and SD of the various parameters were obtained for each group. The correlation between YEN angle and various parameters compared. P value < 0.05 is considered as statistically significant.

RESULTS:

Coefficient of variance denotes the least variability in the measured values of that parameter. If less coefficient of variability it is the most accurate parameter among the various parameters compared. Yen angle is statistically highly significantly correlated with various other parameters compared. (table 1)

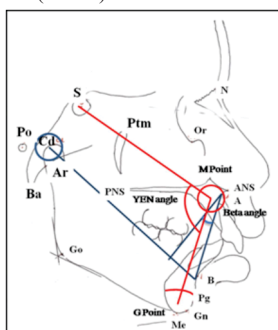


Fig-1: Linear and Angular measurements

Table 1: Mean and SD of the various parameters in study groups

Group	Parameter	N	Minimum	Maximum	Mean	Std. Deviation	Coefficient of Variance
Class I	ANB	15	1.0	2.0	2.33	1.45	62.04
	WITS APPRAISAL	15	0.0	2.0	1.47	0.74	50.67
	β ANGLE	15	22.0	36.0	31.07	3.31	10.64
	Yen ANGLE	15	115.0	125.0	120.80	3.23	2.68
Class II	ANB	15	3.0	8.0	5.33	1.35	25.22
	WITS APPRAISAL	15	3.0	10.0	5.60	1.92	34.28
	β ANGLE	15	21.0	28.0	26.47	1.77	6.68
	Yen ANGLE	15	108.0	117.0	113.67	3.06	2.69
Class III	ANB	10	-14.0	2.0	-1.30	4.79	-368.11
	WITS APPRAISAL	10	-14.0	-1.0	-3.20	3.97	-123.95
	β ANGLE	10	35.0	64.0	41.50	8.32	20.04
	Yen ANGLE	10	120.0	150.0	131.90	7.65	5.80
Pooled Data	ANB	40	-14.0	8.0	2.550	3.67	144.01
	WITS APPRAISAL	40	-14.0	10.0	1.850	4.14	223.89
	β ANGLE	40	21.0	64.0	31.950	7.50	23.47
	Yen ANGLE	40	108.0	150.0	120.900	8.47	7.01

In the table 2 YEN angle is statistically highly significantly correlated with various other parameters compared. There is highly negative correlation present between yen angle and ANB angle (-0.851) and Wits appraisal (-0.869), it is highly positive correlated between beta angle (0.873) when overall data is compared. By this it is proved that Yen angle can be used as a replacement for ANB angle, Wits appraisal and beta angle. But when groups are taken into account individual group correlations should be done (table 2)

Table 2: Correlation between Yen angle and various parameters compared. (overall)

Comparison		ANB	Wits Appraisal	B Angle
Yen ANGLE	Pearson Correlation (r-value)	-.851**	-.869**	.873**

P value	.000	.000	.000
**. Correlation is significant at the 0.01 level (2-tailed).			

YEN angle is statistically significantly correlated with various parameters in group 1 and group 3 but not in group 2. In group 1, it can replace the ANB angle, whereas in group 3 it replaces ANB angle, Wits appraisal and beta angle. So Yen angle can be used as a substitute of ANB angle or any other values compared in this study because all comparisons showed statistically significant correlations. Some of the parameters showed statistically significant differences between the groups compared. (table 3)

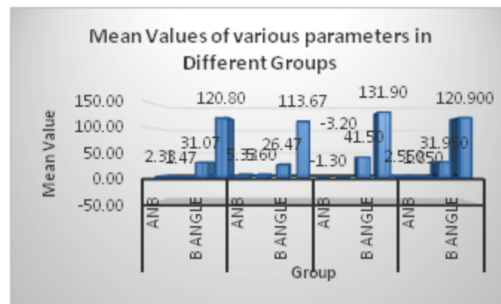


Fig-2 Correlation between Yen angle and various parameters compared

Table 3: Individual group correlations

Group	Comparison		ANB	WITS APPRAISAL	β ANGLE
Class I	Yen ANGLE	Pearson	-.519	.279	.356
		Correlation (r-value)			
		P value	.048	.313	.193
Class II	Yen ANGLE	Pearson	-.110	-.170	-.246
		Correlation (r-value)			
		P value	.697	.545	.376
Class III	Yen ANGLE	Pearson	-.811**	-.817**	.841**
		Correlation (r-value)			
		P value	.004	.004	.002
*. Correlation is significant at the 0.05 level (2-tailed).					
**. Correlation is significant at the 0.01 level (2-tailed).					

DISCUSSION

Lateral cephalometric radiograph as a diagnostic tool in orthodontic practice was introduced in 1931 by Broadbent.⁽⁹⁾ Mostly orthodontic problems occur in sagittal plane therefore analysis of jaws in anteroposterior plane is crucial.⁽¹⁰⁾ Wylie estimated the maxilla-mandibular relationship in sagittal plane for the first time following which numerous analysis have been introduced.⁽¹¹⁾

In present study, sample was classified into three skeletal classes and measured for sagittal analyses (ANB, Wits appraisal, Beta angle, and Yen angle). All measured values were compared for their validity and reliability in diagnosis. The results of this study demonstrated significantly different values for all three skeletal classes ($p < .001$) but also were found equally reliable to diagnose skeletal sagittal discrepancies. Earlier study done by Sachdeva found insignificant difference in the values of ANB and Wits appraisal among skeletal class I, II and III whereas all three classes were significantly different in the values of Beta angle, W angle and Yen angle.⁽¹²⁾ ANB angle is considered to be the most common parameter to analyze the skeletal discrepancies in sagittal plane⁽¹³⁾ but the drawback of ANB angle is that the reliability of ANB angle is affected by changes in SN plane primarily due to superioanterior movement of nasion with growth (Brown, 1981, Chang, 1987, Rotberg⁽¹⁴⁻¹⁶⁾ Various ways to assess the maxilla mandibular jaw discrepancy have been proposed by many

researchers, but none can be universally used with accuracy.

Therefore, the present study was planned to analyze different statistical and geometrical variations in cephalometric measurements which were used to indicate the anteroposterior jaw relationship in malocclusion of beeta angle Yen angle and variability of all the sagittal parameter in assessing the sagittal jaw discrepancy for the young adults of Indian population. New cephalometric measurement, named YEN angle was developed by Neela et al (2009). This angle is formed between three reference points; S, midpoint of the sellaturcica; M, midpoint of the premaxilla and G, centre of the largest circle that is tangent to the internal inferior, anterior and posterior surfaces of the mandibular symphysis⁽⁸⁾

The present study shows that YEN angle is highly reliable and most homogenously distributed angular parameter to assess antero-posterior sagittal discrepancy when compared to Wit's appraisal, ANB and β angle. The findings show that other parameters used in this study also have statistically significant correlation amongst themselves, so instead of relying on one single parameter, others should be checked and correlated with clinical finding.

CONCLUSION

YEN angle was highly reliable parameter to assess the antero-posterior sagittal discrepancy and can be used to correlate the findings incase other parameters like ANB angle and wits appraisal have questioned reliability

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