

Mount Vernon Index vs Yen Angle for Assessment of Anteroposterior Apical Jaw Base Relationship

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ABSTRACT

Aims and objectives: This research aimed to determine the predictability and variability of the Yen angle and Mount Vernon Index (MVI) in relation to the other four sagittal discrepancy parameters, as well as to evaluate and explain any correlations that exist. The Lateral Cephalograms of 100 Class I Indian participants aged 17–24 years were recorded. The lateral cephalograms were traced for six distinct AP characteristics, including ANB, Wits appraisal, facial convexity, and beta angle, Yen angle, and MVI. The gathered data were evaluated statistically using S.P.S.S. version 10. To determine the difference between males and females, an independent “t” test was used. The coefficient of variability and correlation methods were used to determine the correctness of the Yen angle and MVI, as well as the association between the variables.

Results: The results of this study indicate that the most predictable and highly dependable parameter was the Yen angle (CV = 5.63), followed by the beta angle (5.63), the MVI (CV = 13.6), the ANB, Rickett’s analysis, and Wit’s analysis. Throughout all five analyses, the most statistically significant positive association between the MVI and the BETA angle was determined.

Conclusion: The derived inferences from the study included the high reliability of the yen angle for assessing the AP skeletal patterns of a patient, followed by the beta angle and MVI.

Keywords: A-P skeletal relationship, Class I malocclusion, Mount Vernon Index, Yen angle.

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INTRODUCTION

Up till now various methods of assessing the sagittal jaw base relationship have been formulated. Earlier the skeletal pattern may be analyzed clinically by an overall profile view of the patient and by palpation of the anterior surfaces of the basal part of the jaws with the teeth in occlusion but after the introduction of the cephalometrics, a better and more accurate method of recording, measuring and quantifying skeletal morphology became possible. To determine the sagittal jaw base relationship various angular and linear parameters were studied and documented.

In this article, Yen angle and Mount Vernon Index (MVI) were compared with four accepted methods of cephalometrics analysis to determine the most reliable parameter.^{1–6}

Numerous approaches for measuring the sagittal jaw base relationship have been established to date. Traditionally, the skeletal pattern could be evaluated clinically by looking at the patient’s overall profile and palpating the anterior areas of the basal part of the jaws with the teeth in occlusion, but with the advent of cephalometrics, a more precise method of recording, measuring, and quantifying skeletal morphology became possible. Numerous angular and linear characteristics were investigated and reported to identify the sagittal jaw base connection.

To find the most reliable parameter, the Yen angle and MVI were compared to four well-known methods of cephalometric measurement.

MATERIALS AND METHODS

The study examined 100 Indian participants ranging in age from 17 to 24 years utilizing lateral cephalogram. The ethics committee for the institution where this work was conducted authorized it, and all participants provided informed consent. Clinical examinations of 100 patients were conducted to identify those with Class I dentoalveolar malocclusions who had an acceptable profile.

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Respondents were notified about the investigation’s aim and provided with informed consent.

Methods

Each participant had lateral cephalometric radiographs taken in their natural head position. The wire plumb line and suspended weight were used to record the true vertical on every cephalogram. The participant was then asked to ascertain the self-balanced posture of the head and to stare into his/her own eyes in the mirror. A lateral cephalogram was eventually taken in a standardized way while keeping the teeth in centric occlusion.⁷ Tracings were done

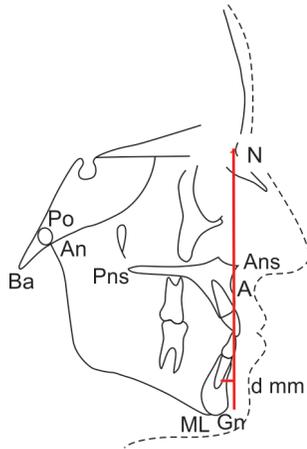


Fig. 1: Mount Vernon Index: perpendicular distance in mm (*d*) between B point and line from nasion through A point

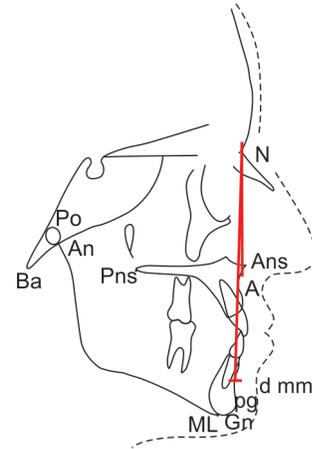


Fig. 2: Steiner analysis to determine ANB angle

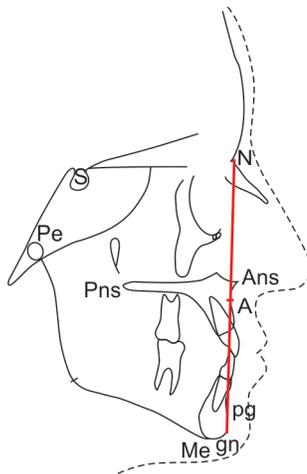


Fig. 3: Ricketts analysis used to determine facial convexity

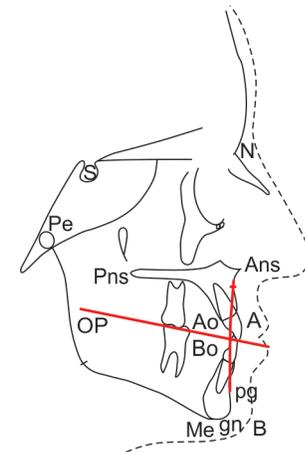


Fig. 4: Wits appraisal

by hand in a dark room with an X-ray viewer using a sharp 3H pencil on acetate tracing paper. Six well-established cephalometric methods were used to analyze the AP skeletal pattern: Yen angle, MVI, ANB angle, facial convexity, Wits evaluation, and Beta angle¹⁻⁶ (Figs 1 to 5).

The data were evaluated statistically by employing the SPSS® 10.0 software. The following statistical techniques were used in the current research:

- Twenty radiographs were randomly selected from the observational group to test the reliability and repeatability of radiographic measurements. Their tracing and measurements were redone and compared to the initial ones using the independent “*t*” test.
- For each analysis, the mean, standard deviation, variance, minimum and maximum values, and range were computed.
- To determine whether there were any statistically significant differences in the measures between the male and female samples, an independent *t*-test was performed.
- Coefficients of variance and correlation tests were performed to determine the most reliable parameter and the degree of correlation between both the parameters employed in this investigation.

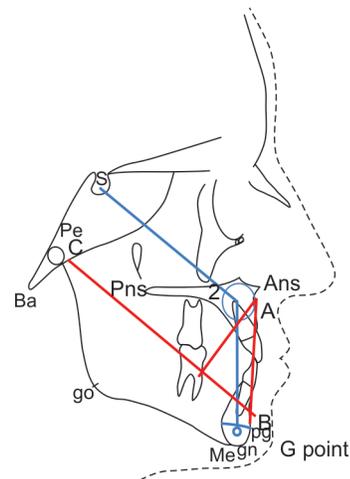


Fig. 5: (1) Beta angle and (2) Yen angle

RESULTS

The statistical analysis performed to determine the inaccuracy between repeated observations indicated that there was no

statistically significant difference between them ($p > 0.05$). Table 1 contains statistical data on measurements such as mean, standard deviation, standard error of the mean, and *t*-test for males and females. The research's findings indicate that there are no statistically significant differences between males and females ($p > 0.05$), hence all measurements from both sexes were combined and a correlation analysis was performed. Table 2 summarizes the coefficients of variation for all parameters. The measurements with the most homogeneous distribution throughout the group were the Yen angle (CV = 2.03), the BETA angle (CV = 5.63), the MVI (CV = 13.6), the ANB, Rickett's analysis, and Wit's analysis. The coefficient correlation matrix in Table 3 shows the relationship between several factors in the Class I group. Across all five investigations, the most statistically significant positive association between the MVI and the BETA angle was discovered. Other angles, such as the Yen angle,

Rickett's face convexity angle, and ANB angle, all correlated positively with the MVI.

The statistical analysis to check the error between repeated measurements suggested no significant difference between them ($p > 0.05$). Statistical data relating to measurements such as mean, standard deviation, standard error of the mean, and *t*-test for males and females are presented in Table 1. The results of the study suggest no statistically significant differences between the two sexes ($p > 0.05$), so all the measurements belonging to both the sexes were pooled and a correlation analysis was performed among them. The coefficient of variability of all parameters was represented in Table 2. The measurements with the most homogeneous distribution in the group were Yen angle (CV = 2.03), followed by BETA angle (CV = 5.63), MVI (CV = 13.6), ANB, Rickett's analysis, and Wit's analysis. Table 3 depicts coefficient correlation among various parameters of the Class I group. Among all five

Table 1: Measurements in Rajasthani population with normal occlusion ($n = 100$)

Measurements	Male ($n = 60$)			Female ($n = 40$)			"t" value	p value*
	Mean	SD	Range	Mean	SD	Range		
ANB	2.59	0.60	2.5	2.6	0.56	2.5	-0.69	0.736
Rickett's analysis	1.20	1.14	5	1.375	1.11	5	-0.756	0.471
Beta	30.87	1.72	7	31.28	1.78	5	-1.145	0.586
MVI	4.35	0.59	5	4.30	0.58	5	0.192	0.248
Wits	0.73	0.79	3	0.6	0.83	4	0.806	0.926
Yen	120.49	2.21	9	120.41	2.91	16	0.158	0.875

*Correlation is significant at the 0.05 and 0.01 levels, respectively

Table 2: Range of measurements of combined group ($n = 100$) with coefficient of variability

Measurements	Range	Mean	SD	Coefficient of variability
ANB	2.5	2.59	0.58	22.53
Rickett's	5	1.27	1.13	89.08
Beta	7	31.03	1.74	5.63
MVI	5	4.33	0.59	13.62
Wits	4	0.68	0.80	118.9
Yen	16	120.47	2.45	2.03

***Correlation is significant at the 0.05 and 0.01 levels, respectively

Table 3: Coefficient correlation between measurements of Class I group

		ANB	Wits	Ricketts	MVI	Beta angle	Yen angle
ANB	<i>r</i>	1					
	<i>p</i>						
Wits	<i>r</i>	-0.021	1				
	<i>p</i>	0.840					
Ricketts	<i>r</i>	0.686**	-0.065	1			
	<i>p</i>	0.000	0.523				
MVI	<i>r</i>	0.698**	-0.029	0.696**	1		
	<i>p</i>	0.000	0.776	0.000			
Beta angle	<i>r</i>	1**	1.072	-0.244*	1**	1	
	<i>p</i>	0.006	0.478	0.014	0.000		
YEN angle	<i>r</i>	-0.434**	-0.093	0.11	0.33**	0.414**	1
	<i>p</i>	0.000	0.345	0.275	0.000	0.000	

*** Correlation is significant at the 0.01 and 0.05 levels.

analyses, a statistically significant highest positive correlation was found between MVI and BETA angle. Other angles like Yen angle, Rickett's facial convexity angle, and ANB angle showed a significant positive correlation with MVI.

DISCUSSION

Precise analysis of the A–P jaw relationship is vital for therapeutic interventions in orthodontics. Both angular and linear variables have indeed been previously proposed in cephalometrics to examine the sagittal jaw relationships. Angular measures can be inaccurate and misleading as a result of changes in facial height, jaw inclination, and complete jaw prognathism; linear variables can be influenced by the reference line's inclination.⁶

The ANB angle particularly has been established on a craniofacial reference plane, remains the most often used metric for measuring the sagittal jaw relationship. Numerous research outlines the factors that influence the ANB angle, which complicates this technique.^{8–16} The severity of a skeletal disparity is determined by the jaws' relationship to one another, not by their relationship to cranial or extracranial landmarks. As a result, at least two different types of investigation may be required to corroborate the orthodontist's clinical findings. When the coefficients of variability of the five analyses are compared, the Yen angle is the most trustworthy and uniformly distributed parameter, followed by the Beta angle and the MVI. The yen and beta angles had the strongest positive association with the MVI, which suggests that if the value of the yen or beta angle increases, the MVI increases as well, or vice versa. Other measures, such as Rickett's face convexity angle and ANB angle, had the second-highest connection with the MVI, correlating with the prior study.² There was no statistically significant link between Wit's evaluation and the other parameters studied in this study. This is in contradiction to the previous study's findings.² Wit's evaluation also shown the highest amount of variability among the study's metrics, suggesting that it is the least reliable (Table 2), which was consistent with earlier findings.^{8–16}

CONCLUSION

The Yen angle is a uniformly distributed and highly consistent angular indicator, whereas the beta angle is the second possible most reliable parameter for assessing anteroposterior sagittal disparity. Mount Vernon Index is the third most uniform distribution indicator. Rather than depending on a single parameter, these three together can be an effective clinical diagnostic tool; other parameters should be reviewed and connected with clinical results for a more accurate diagnosis.

ETHICAL APPROVAL

This work has been approved by the ethical committee related to the institution (Darshan Dental College and Hospital) in which it was performed and all the subjects gave informed consent to the work.

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