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Reliability of beta angle in determination of sagittal skeletal discrepancy in class II patients

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Abstract

Introduction: The debate over an ideal variable to judge the anteroposterior discrepancy has continued over years. The objective of this study was to view the correlation between Beta angle and ANB and to assess whether Beta angle can be used as a guide to assess the severity of skeletal sagittal dysplasia in Class II subjects.

Material and Methods: 97 subjects with mean age of 16.49± 4.63, who presented to Orthodontics Department at Armed Forces Institute of Dentistry with CVM 4, skeletal Class II, having variations in vertical facial patterns and condyles visible clearly on digital radiographs were selected. The Beta angle and ANB were hand traced by four different post graduate trainees on lateral cephalograms and rechecked. Mean, SD, were calculated for age, SNA, SNB, ANB and Beta angles. ANB and Beta angles were evaluated by Pearson correlation test and cross-tabulation was done for the two variables.

Results: Means calculated for the variables were as follows: age was calculated to be 16.49±4.628, SNA 82.73±4.17, SNB 76.31±4.32, ANB 6.54±1.45 and Beta angle 25.86±4.44. Pearson correlation test showed a negative correlation of ANB to Beta angle of 1 to -0.361 showing that as ANB increased Beta angle decreased. Cross- tabulation was done for the two angles. For an ANB of 5°, beta angle ranged between 19° to 21°, for ANB angle 6 beta ranged between 20° to 30° so on and so forth till ANB of 10° for which beta angle ranged between 18°to 27°.

Conclusions: The results of this study confirms that there is a strong correlation between beta and ANB angle, however using beta angle as a guiding variable to determine the severity of sagittal skeletal dysplasia does not seem to be possible due to variations in the range of beta angle for a given value of ANB.

Keywords: ANB; lateral cephalogram; sagittal dysplasia

Introduction

Cephalometry has been and continues to be a cornerstone in Orthodontic diagnosis, treatment monitoring and outcome assessment. Although, aesthetics and norms are based on subjective assessment of what is considered pleasing and treatment is not always carried out to meet ideal cephalometric norms, it remains an important diagnostic and evaluation tool. Over the years, various analyses have been introduced in search for reliable methods for recognizing and interpreting various skeletal discrepancies.

A correct diagnosis leads to the correct treatment plan and hence the final outcome. In these terms the most commonly seen variation is in the sagittal pattern. ANB angle introduced by Riedel[1] in 1952, the angular measurement between the anterior cranial base and point A and B on the maxillary and mandibular dental bases has remained the guiding angular value over the years to decide on the severity of the sagittal skeletal dysplasia. However it has its drawbacks of deviation in the landmarks, rotational component to the jaws, variation with vertical changes and dental heights as given by Hussels W, Nanda RS.[2,11] In an attempt to overcome these problems, Witts appraisal was introduced by Jacobson[3,12] using the occlusal plane with its inherent variations due

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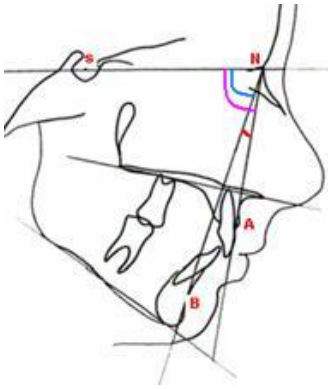
to, dependence on the eruption of the dentition and rotations of occlusal plane and subjective differences in plane determination.
Recently, landmarks housed within the maxilla-mandibular complex are being utilized to view the sagittal relationships. Beta angle[4] is one such angular measurement using points housed within the maxilla and mandible.
Class II is the commonest of sagittal skeletal variation found around the world with treatment ranging from growth modification to surgical camouflage to orthognathic surgery. Severity of skeletal discrepancy does correlate with the degree of aesthetic compromise and hence influences the treatment plan.
The aim of the present study was to evaluate the correlation between beta angle and ANB and to view whether beta angle can reliably be used to assess the severity of sagittal problems instead of ANB as a guiding clinical variable in the Class II population.

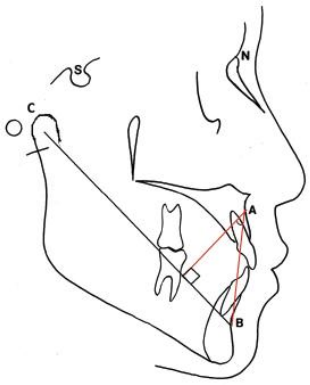
Material and Methods

97 lateral cephalograms of Class II patients ascertained on ANB value, presenting to the Department of Orthodontics, Armed Forces Institute of Dentistry, in growth stage of CVM 4 ,variation in vertical facial patterns, with no previous history of orthodontic treatment or congenital abnormalities were included in the study. The variables calculated were SNA (angle formed between point A and SN plane), SNB (Angle formed between point B and SN plane), ANB (angle formed between point A, B and N points), Beta Angle (angle between AB line and perpendicular), line from point A to CB line where C is the post posterior superior point on the condylar head. Mean and standard deviations were calculated for age, SNA, SNB, ANB and Beta angles. Pearson correlation test was calculated for ANB and Beta angles and cross tabulation was done for the two variables to see the effect of variation of Beta angle.

ANB angle



Beta Angle



Results

The mean ANB angle was calculated to be 6.58±1.53 and the mean Beta angle as 25.56 ± 4.58 showing the greater variation of beta angle for the same population of Class II subjects (Table I).

Table I: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
AGE(years)	97	12	36	16.95	4.642
SNA (degrees)	97	74	93	82.85	3.970
SNB(degrees)	97	67	89	76.37	4.088
ANB (degrees)	97	5	12	6.58	1.536
BETA (degrees)	97	12	33	25.56	4.580
Valid N (listwise)					

Pearson correlation test was applied on ANB and Beta angles that showed a negative correlation of 1 to -3.86 with correlation being significant at 0.01 level showing that as the ANB angle increased, Beta angle decreased (Table II).

Table II Correlations

		ANB	BETA
ANB	Pearson Correlation	1	-.386**
	Sig. (2-tailed)		.000
	N	97	97
BETA	Pearson Correlation	-.386**	1
	Sig. (2-tailed)	.000	
	N	97	97

Correlation is significant at the 0.01 level (2-tailed).

Cross-tabulation was done for the two variables to determine whether Beta angle could be used as an independent variable for assessing the sagittal relation in Class II subjects (Table III).

Table III BETA * ANB Cross tabulation

		ANB						
		5	6	7	8	9	10	12
BETA	12	0	0	1	0	0	0	0
	15	0	0	2	0	0	0	1
	18	0	0	0	1	0	1	0
	19	1	1	0	1	0	0	0
	20	1	4	0	2	0	1	0
	21	2	0	1	1	0	0	1
	22	1	2	2	2	0	0	0
	23	0	1	2	1	0	0	0
	24	0	1	1	0	1	1	0
	25	1	2	1	0	2	1	0
	26	2	0	0	1	0	0	0
	27	1	3	0	1	1	2	0
	28	3	5	3	3	0	0	0
	29	5	3	2	0	0	0	0
	30	3	3	2	0	2	0	0
	31	2	0	0	0	0	0	0
	32	4	1	0	0	0	0	0
	33	1	0	1	0	0	0	0
Total		27	26	18	13	6	6	2

BETA * ANB Cross-tabulation

In cross-tabulation results, no consistency can be seen that shows a progressive decrease in beta angle as ANB increases. SNA angle was found to be within normal range in this Class II sample 82.85±3.9. SNB angle was reduced 76.37±4.0 showing the mandible to be the jaw at fault in most cases and a negative correlation existed between ANB and Beta angle. Lastly, cross-tabulation does not give consistent results for Beta angle.

Discussion

The debate over the ideal variable to judge the anteroposterior discrepancy has continued over the years and in this regard ANB, β,μ ,W angle and unit lengths of the skeletal bases have been evaluated.[4,5] Baik and Ververidou[4] suggested β angle and claimed it to be independent of cranial landmarks, functional occlusal plane and that it was influenced slightly by clockwise and counterclockwise rotation of the jaws. At the same time the angle showed variation associated with growth, orthodontic treatment and orthognathic surgery. In addition to its various positive points, the angle can be difficult to calculate when it comes to locating the centre of the condyle.

Baik and Ververidou[5] calculated the mean of beta angle as 31.1 ± 2 degrees, Fattahi et al[7] 35.5 ± 3.1 and Sadeghian, et al[8] as 31.7 ± 3.3°. All three of these studies obtained the data for all classes of malocclusion with an acute angle stating a class II pattern which is consistent with our results of 25.5±4.58 degrees for the Class II group.

Sridhar Kannan[9] et al showed Class II population mean for males as 22.61±1.35, for females 22.74± 1.02 which was less than mean of 25.5±4.58 for the Class II group found in this study due to variation in settings.

In relation to the effect of growth on Beta angle Sadeghian[8] et al showed direct significant but weak correlation between age and Beta angle (r = 0.435) with increase in age corresponding to an increase in beta angle and thus showing the cephalocaudal gradient of growth.

The negative correlation between ANB and beta angle have been observed by Sadeghian, et al[8] angle (r = – 0.520) and by Geramy, Ghadirian, Kharazifard, Katooki[10] as well (r = -0.785). This is consistent with findings of the present study -0.386 between the two variables reinforcing the fact that an increase in ANB angle is associated with a reduction in Beta angle.

A superiority of beta angle over ANB has been observed in study by Sridhar Kannan[9] et al due to reduced co-efficient of variation for both sexes(3.58 vs11.05% CV respectively). No cross-tabulation data is available for beta angle and any skeletal class of orthodontics and our results show inconsistency between ANB values with beta presenting a large variation of values for the same ANB value. Hence the Beta angle can be used to classify the type of sagittal discrepancy but its severity cannot be judged by the angle.

Conclusions

1. A beta angle in the range of 21 to 30 degrees is associated with a Class II skeletal pattern.
2. A negative correlation exists between beta angle and ANB showing an increase in ANB to be associated with a reduced beta angle.
3. Cross-tabulation results show inconsistencies in the range of beta angle for the same value of ANB.

Although the quest continues for the most ideal variable to diagnose the sagittal skeletal dysplasia, the paradigm shift to, treatment based on soft tissues rather than radiographic variables will also change the requirements of obtaining ideal cephalometric values. Having said that, diagnosis still remains the key to unlocking the door towards accurate treatment.

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