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Original Research Article

Establishing Cephalometric Norms of Yen, W and Beta Angles with Evaluation of Sagittal Jaw Relationship in Guntur District Population: An Original Study

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Abstract

Aim: The purpose of this study was to assess the validity of the Yen, W, and Beta angles, as well as to compare them to other regularly used sagittal measurements in the South Indian population.

Methodology: A total of 200 Andhra subjects (Dravidian) were considered for the study. ANB, Wit's appraisal, Beta angle, W angle, and YEN angle were all traced on the lateral cephalograms. With the patient in Natural Head Position, sitting Condyle, and Passive Lips, a Lateral Cephalometric Head film was taken. The cephalograms were then traced by the same operator, resulting in the study's Cephalometric database. The study's final results were compared between males and females to ensure that they met acceptable standards.

Results: There was no statistically significant difference between the genders. As a result, a single normative range for both genders might be provided. The findings suggest that all five skeletal cephalometric sagittal studies, namely the ANB angle Wit's analysis, BETA angle, YEN angle, and W angle, are reliable and may be utilized in diverse populations without producing significant differences in the results.

Conclusion: Based on the findings of this study, no statistically significant differences in any of the parameters were discovered between the subjects of the Local population, as well as between males and females. ANB angle, Wit's analysis, BETA angle, YEN angle, and W angle can be employed based on the above assertion because they are dependable.

Keywords: Cephalometric norms, W angle, YEN angle, Beta angle.

Introduction

Cephalometric analysis, which is based on a variety of angular and linear measures, is an important component of Orthodontic diagnosis and treatment planning. Wylie presented the sagittal plane analysis of jaws in 1947, and it is a crucial step. Many lateral cephalometric analyses have emerged to analyze the skeletal relationships of jaws in the sagittal plane, which is critical in orthodontic diagnosis. [1] There are faults in all of the analyses. In terms of diagnostic and treatment planning, determining the anteroposterior jaw connection is critical. The skeletal architecture influences occlusal development and limits incisor anteroposterior mobility during treatment. [2] Cephalometric analyses have combined numerous angular and linear metrics to aid in finding anteroposterior discrepancies.

Downs was the first to measure the angle created by A-B and N-Pog to analyze the anteroposterior apical base connection cephalometrically in 1948. The relative protrusion/retrusion of the mandible was indicated by positive and negative signals. [3] Steiner quantified SNA and SNB and utilized the difference, ANB, to describe the apical base relationship a few years later, in 1952. This has become the standard approach for determining anteroposterior jaw connections. However, anteroposterior and vertical differences in Nasion affect both Down's and Stenier's techniques. [4] Jacobson proposed the Wits evaluation as an alternative to ANB, which is calculated by drawing perpendicular lines from locations A and B to the functional occlusal plane (FOP). The maxillary/mandibular connection is described by the distance between the sites of intersection (AO and BO). [5,6] Any shift in the functional occlusal plane's angulation will have a significant impact on the locations of A and B, and hence the Wits appraisal reading.

In 2004, Baik and Ververidou [7] introduced the Beta angle. It accurately assesses sagittal anomalies, but it is reliant on A and B, which can be difficult to locate. In rare cases, the condyle is also not easily visible. Because stable landmarks such as Sella, M point, and G point are used, W angle and Yen angle are stated to be among them. The W angle is a measurement of the severity and type of skeletal dysplasia in the sagittal dimension using three skeletal landmarks: point S, point M, and point G. S is the midway of the sella-turcica, M is the midpoint of the premaxilla, and G is the center of the biggest circle that is tangent to the internal inferior, anterior, and posterior surfaces of the mandibular symphysis. [8]

Several studies on ANB and Wits assessment have been published. However, there are few studies on the reliability and validity of the Beta angle. [9,10] W angle and Yen angle have never been tested for validity or compared to other prominent analyses to determine their diagnostic reliability. [11] The goal of this study was to assess the validity of the ANB angle, Wits analysis, Yen, W, and Beta angles in the south Indian population in the Andhra Pradesh region, and to compare them to other regularly used sagittal measurements.

Material and Methods

The current research was carried out in the Guntur area of Andhra Pradesh, India. The samples were screened from the department's available OPD. The study included 200 participants, all of whom were of similar gender and age. The lateral cephalograms, clinical profile, and dental occlusion were used to group the samples. ANB angle of [1-3] degrees and Wits appraisal of 1mm (male), O mm (female) validated the Class I skeletal pattern (female). All of the participants were informed about the study's purpose and design, and their consent was obtained.

- Class I skeletal basis with ANB angle of 1-3 degrees is required for inclusion.
- No missing teeth in the permanent dentition.

• There are no significant skeletal differences

The cephalograms were all taken with the same machine (Villa-rotograph evo-d digital panaromic and Cephalometric System) and printed with the Konica dry pro Laser Printer.

The chosen participants were initially clinically evaluated in their natural head position, with seated Condyles and passive lips. Ear rods and mirrors were utilized to ensure natural head position. Following that, the patient was placed on the Cephalostat Machine. The ear rods were inserted, and the patient was instructed to look into his or her own eyes in the mirror at eye level to create the Natural Head Position. All Lateral Radiograph Films were traced with a sharp 3H pencil on a Transparent Cellulose Acetate Sheet of 0.003" thickness using the X-Ray Viewer, and landmarks were recognized by the same operator. For each cephalogram, the ANB, Yen, W, wits appraisal, and Beta angle were traced and measured.

Analytical Statistics

SPSS Version 15.0 Statistical Analysis Software was used for the statistical analysis. Number (percentage) and Mean SD were used to represent the data. Means, Standard Deviations (SD), and 95% Confidence Intervals are examples of descriptive statistics. For all variables in these groups, intervals were determined, and the level of statistical significance was established at p = 0.05. The values of males and females were compared using the Independent Student's t-Test. Ten radiographs were used in an Error Analysis exercise, which were traced a second time after 3 to 4 weeks. A Paired t-Test was used to look for systematic bias, and the index of dependability was used to estimate random error by correlating repeat measurements. The error analysis revealed no serious errors. When Systematic Bias was evaluated (p 0.05), and correlations were found to be greater than 0.95, Random Error was shown to be insignificant.

Results

There were no statistically significant differences between men and women (Table 1). As a result, a single normative range for both genders might be provided (Table 2). The findings suggest that all five skeletal cephalometric sagittal analyses, namely the ANB angle, BETA angle, YEN angle, and W angle, are reliable and may be utilized in diverse populations without producing significant differences in the results

Table 1: Comparison of genders for the Normative Range of Different study parameters

VARIABLES		N	Mean	SD	Significance of difference (Male vs Female) Independent sample 't' -test	
					't'	'p'
ANB angle	Male	110	1.132	1.211	0.180	0. 857
	Female	90	1.171	1.192		
Wits appraisal	Male	110	.452	.451	0.691	0.401
	Female	90	.400	.415		
Yen angle	Male	110	123.93	3.595	0.540	0.511
	Female	90	123.53	3.387		
Wangle	Male	110	56.31	3.460	0.751	0.447
	Female	90	55.83	2.915		
Beta angle	Male	110	35.91	4.544	0.550	0.525
	Female	90	35.47	3.171		

Table 2: Common normative range relevant for both the genders

	N	Mean	Std. Deviation	Normative Range (Mean±1.96 SE)	
				Lower Limit	Upper Limit
ANB angle	200	1.124	1.21	0.912	1.401
Wits appraisal	200	0.411	0.429	0.331	0.519
Yen angle	200	123.725	3.481	123.01	124.416
Wangle	200	56.079	3.194	55.451	56.714
Beta angle	200	35.700	3.901	34.921	36.479

Discussion

Broadbent introduced lateral cephalometric radiographs, an incredibly valuable diagnostic tool in orthodontic practice, in 1931. [11,12] Because the majority of orthodontic problems occur in the sagittal plane, an anteroposterior plane study of the jaws is critical. For the first time, Wylie evaluated the maxilla-mandibular connection in the sagittal plane; since then, numerous analyses have been introduced. In orthodontic treatment planning, a precise AP measurement of jaw connections is vital. Both angular and linear variables have been proposed in cephalometrics to examine the sagittal jaw relationship and jaw position. [13-16] Changes in facial height, jaw inclination, and overall jaw prognathism can cause angular measurements to be incorrect. The inclination of the reference line, on the other hand, can alter linear variables.

The ANB angle is still commonly employed, although it has flaws; it is influenced by a variety of factors and can be misleading. All of these elements must be considered while employing the ANB angle, making its interpretation much more difficult. The Wits assessment, which is an alternative to the ANB angle, does not rely on cranial landmarks or jaw movement, but it still has the difficulty of correctly defining the functional occlusal plane, which can be difficult at times. A new angle, the Beta angle, was devised to address these issues. Changes in this angle reflect solely changes within the jaws since it employs three points on the jaws: point A, point B, and the apparent axis of the condyle (point C). [17-20] In contrast to the ANB angle, the Beta angle's configuration allows it to stay reasonably stable even when the jaws are rotated. However, identifying the condyle and determining its center is not always straightforward. As a result, some doctors may be hesitant to employ the Beta viewpoint. [21]

Measurements like W angle and Yen angle were established to compensate for the shortcomings of prior parameters. These don't use A and B points as skeletal landmarks because they're impacted by local remodelling from orthodontic therapy. Instead, they use points M and G, which are not impacted by local remodelling and are equivalent to sella as centroid points. Johnson introduced the concept of centroid. [22-24] It is the center of an imaging region reflecting the mean point inside the form, about which it changes the least and so provides more stable reference points as compared to non-mean anatomic sites. [25]

The lateral cephalograms of 200 people were traced in this investigation. The normative value of Yen, W, and Beta angle (for both males and females) in the Andhra population was investigated. The independent sample t test for males and females in the current investigation revealed no significant gender differences. As a result, a single normative range has been developed that applies to both males and girls.

In the Andhra population, the Yen angle is 123.725± 3.481. The values range from 123.041 to 124.416. W angle has a normative range of 56.079 and a standard

deviation of 3.194. The W angle ranges from 55.451° to 56.714°, which is higher than the previous South Indian population studies (55.5±1.95) and Maharashtra's population (55.5±1.95). When compared to Chong et al study, the normative range for Beta angle is 35.70° with a standard deviation of 3.901 and a range of 34.921 to 36.479, which is on the upper side (31.10). 20 Future studies in developing norms for the local community can benefit from a larger sample size of the given population. More research is needed to compare these findings to those of digital tracing and analysis in order to verify and correlate both methodologies.

More research is needed to compare the reliability of the Beta, YEN, and W angles in various malocclusions. Furthermore, the sample size must be divided into three groups: Class I, Class II, and Class III, and the reliability of these angles must be correlated using ANB angle and Wits analysis. A more thorough investigation might be conducted by dividing the Andhra District into grids and selecting an equal number of people from each grid.

Conclusion

According to the findings of this study, there were no statistically significant variations in specific characteristics between the participants of the Andhra population, as well as between males and females. Because the beta angle is unaffected by cranial landmarks, it is thought to be the least affected by cranial base and jaw rotation. Even though the Yen angle uses Sella in its technique, it was stated to be the least impacted by changes in facial height and jaw rotations. Bhad introduced the W angle as a new way to measure skeletal sagittal discrepancies in 2011. All five skeletal cephalometric sagittal analyses, namely ANB angle Witts analysis, BETA angle, YEN angle, and W angle, are reliable based on the findings of this study. When specific conditions make the use of one analysis difficult, all performed analyses have similar diagnostic relevance and reliability and can thus be utilized as backup analyses. This work offers up the possibility of further research to compare the reliability of different angles and incorporate the most reliable angle for diagnostic and treatment planning, as well as a better assessment of antero-posterior treatment progress.

References

1. Qamaruddin I, Alam MK, Shahid F, Tanveer S, Umer M, Amin E. Comparison of popular sagittal cephalometric analyses for validity and reliability. Saudi Dent J 2018; 30:43–46.
2. Tien TL, Chi HP. An Approach for Efficient Detection of Cephalometric Landmarks. Sci Direct 2014.37;293–300.
3. Marinho Del Santo, Jr São Paulo. Influence of occlusal plane inclination on ANB and Wits assessments of anteroposterior jaw relationships. Am J Orthod Dentofac Orthop 2006.129;5:641-8.
4. Oktay HO, Erzurum T. A comparison of ANB, WITS, AF-BF, and APDI measurements. Am J Orthod Dentofac Orthop 1991;99; 2:122-9.
5. Beatty EJ. A modified technique for evaluating apical base relationships. Am J Orthod 1975;68; 3:303-15.
6. Baik CY and Ververidou M. A new approach of assessing sagittal discrepancies: The Beta angle. Am J Orthod Dentofac Orthop 2004;126; 1:100-105.
7. Kumar P, Mascarenhas R, Husain A. A new sagittal dysplasia indicator: the yen angle. World J Orthod 2009;10;147–51.
8. Hussels W, Nanda RS. Analysis of factors affecting angle ANB. Am J Orthod 1985;85; 5:411-23.
9. Kim YH Vietas JJ. Anteroposterior dysplasia indicator: An adjunct to cephalometric differential diagnosis. Am J Orthod 1978;73; 6:301-8
10. Jacobson A. Application of the “Wits”

appraisal. Am J Orthod 1976;70; 2:209-215.
11. Chang HP. Assessment of anteroposterior jaw relationship. Am J Orthod Dentofac Orthop 1981;92; 2:314-20.
12. Nanda RS Merrill RM. Cephalometric assessment of sagittal relationship between maxilla and mandible. Am J Orthod Dentofac Orthop 1994;105;328-44.
13. Aparna P, Kumar DN, Prasad M, Shamnur N, Kumar A, Sridhar KR. Comparative Assessment of Sagittal Skeletal Discrepancy: A Cephalometric Study. J Clin Diagnostic Res 2015;9; 4:38-41.
14. Ferrazzini G. Critical evaluation of the ANB angle. Am J Orthod 1976;69(6):620-26.
15. Marinho Del Santo. Influence of occlusal plane inclination on ANB and Wits assessments of anteroposterior jaw relationships. Am J Orthod Dentofac Orthop 2006;129(5):641- 8.
16. Jenkins DH. Analysis of orthodontic deformity employing lateral cephalostatic radiography. J Nat Sc Bio Med 2013;4(2):409-19.
17. Rotberg S, Fried N, Kane J, and Shapiro E. Predicting the "Wits" appraisal the ANB angle. Am J Orthod 1980;77(66):636-2.
18. Ishikawa H, Nakamura S, Iwasaki H and Kitazawa S. Seven parameters describing anteroposterior jaw relationships: Post pubertal prediction accuracy and interchange ability. Am J Orthod Dentofac Orthop 2000;117(6):714-20.
19. Jacobson A. The "Wits" appraisal of jaw disharmony. Am J Orthod 1975;67(2):125-38.
20. Moore RN, DuBois LM, Patricia A, Igel AK, The accuracy of measuring condylion location. Am J Ortho 1989;95; 4:344-7.
21. Moyers RE, Bookstein FI, Guire KE. The concept of pattern in maxillofacial growth. Am J Orthod 1979;76(2):136-48.
22. Martínez, J. A. P., Saavedra, A. J. G., Bohorquez, G. D. B., Cordero, J. F. B, Barros, B. D., Ríos, M. K. M., Duque, L. E. D., & Martínez, L. J. M. Therapeutic Potential of Heparin in Sepsis Per Gram Negative. Journal of Medical Research and Health Sciences, 2022:5(4), 1881–1885.
23. Scott JH. The maxillary-mandibular planes angle (MM ~ bisector: A new reference plane for anteroposterior measurement of the dental bases. Am J Orthod Dentofac Orthop 1994;105(6):583-90.
24. Downs WB, Aurora I. Variations in facial relationships: their significance in treatment and prognosis, Am Asso Orthod 1948;812-840.
25. Bhad WA, Nayak S Doshi UH. A new approach of assessing sagittal dysplasia: the W angle. Euro J Orthod 2013;35;66-70.