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Reliability of SAR Angle in Assessing Anteroposterior Apical Base Discrepancy in Different Growth Patterns

Research Article

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Abstract

Aim and Objective: The aim of this study was to compare and verify the accuracy of SAR angle in predicting sagittal jaw discrepancy among subjects with different growth pattern.
Materials and Method: The study material includes lateral cephalometric radiographs of ninety individuals with thirty in each group. It was further divided into three subgroups as hypodivergent, normodivergent and hyperdivergent with 10 samples per group. The SAR angle was measured as given by the author using FACAD. The values of SAR angle obtained for each subgroup was subjected for statistical evaluation.
Results: The mean of groups 1, 2 and 3 were 55.98±2.24, 50.18±2.70 and 63.65±2.25 respectively. Oneway ANOVA shows a statistically significant difference between horizontal and vertical growth patterns in skeletal class III cases with a significance value of 0.013 ($P<0.05$).
Conclusion: Within the limitations of the study, it is concluded that SAR angle can be used as a reliable alternative measurement to determine the discrepancy in apical jaw bases.

Keywords: SAR Angle; Anteroposterior Jaw Relation; Apical Jaw Base Discrepancy.

Introduction

Assessment of jaw relationship in all three planes (anteroposterior, transverse, and vertical) forms an integral part of orthodontic diagnosis treatment planning. Orthodontic diagnosis became more reliable with the use of cepahlometrics along with proper history taking, models and photographs [1, 2]. There are several analyses used to assess the anteroposterior discrepancy with numerous angular and linear measurements [3-13]. Few of the most commonly used analyses are the ANB angle,Wits appraisaland Beta angle. However, the validity of each of these parameters was questionable because of the variability of landmarks with jaw rotation, head posture, orthodontic treatment as well as growth.

Several studies have shown that the ANB angle is not reliable because of the Nasion point, which is not fixed during growth that affects the ANB angle. Rotation of the jaws due to growth or orthodontic treatment also change ANB angle. The length of cranial base, anterior facial height also affects ANB angle. ANB angle decreases due to counter clockwise rotation of the mandible with advancing age [14].

Wits appraisal overcomes the shortcomings of ANB angle. Perpendiculars from Point A and B on the maxilla and mandible were used in this analysis by Jacobson. Wits appraisal uses occlusal plane, which is a dental parameter to describe skeletal jaw discrepancies. Occlusal plane can be easily affected by tooth eruption or by orthodontic tooth movement [15, 16]. Accurate identification of occlusal plane is not easy or accurately reproducible [17, 18].

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Beta angle, derived by Baik and Ververidou in 2004, assessed the true apical base relationship independent of cranial reference plane or occlusal plane. Although it gave a reliable picture of the sagittal discrepancy, it used points A and B which were unstable landmarks as they were subject to alveolar bone remodeling with the change in position of incisors. Also, identification of the Condylion point was not easily reproducible in cephalometric radiographs [19]. Furthermore, in a study by shobha et al, in 2019, it was found that Beta angle may not be a valid tool for assessment sagittal jaw discrepancies in patients exhibiting vertical growth patterns in skeletal class I and class II malocclusions [20].

The SAR angle is a new parameter for assessing the sagittal apical base discrepancy. It was put forth by Sonahita Agarwal in the year 2014. It uses the three skeletal reference points: Point M, Point G and Point W [21]. The mean SAR angle was 53 to 59 degree for skeletal class I, <53degree for skeletal class II and >59 degree for skeletal class III. The SAR angle is not inflenced by growth, jaw rotations, orthodontic treatment or any other factor previously associatedwith other angles. The Walkers point was found to be stableafter the age of five.Hence, the aim of this study was to compare and verify the accuracy of SAR angle in predicting sagittal jaw discrepancy among subjects with hyperdivergent, hypodivergent and normodivergent growth patterns in skeletal class I, class II and class III malocclusions.

Materials and Methods

The total sample size was set as 90 with a power of 95% and alpha error of 0.05. This study consisted of three groups with sample size of 30 each based on skeletal malocclusions. It was further divided into three subgroups as hypodivergent, normodivergent and hyperdivergent with 10 samples per group. The age group was from 18.3 years to 38.7 years. Ethical approval was obtained from the Institutional Ethical Committee prior to the start of the study. All the lateral cephalograms obtained for evaluation were checked for its standard. They were taken with the patients Frankfurt's horizontal plane parallel to the floor, mandible in centric occlusion and their lips at rest.

The SAR angle

Point M: Midpoint of the premaxilla.

Point G: Center of the largest circle that is tangent to theinternal inferior, anterior, and posterior surfaces of themandibular symphysis.The centre of premaxilla and mandibular symphysis were identifid by constructing a template with concentric circleswhose diameters increased in 0.5 inch increments. Centerof the template was marked, and Point M and Point G wereidentifid on the tracings.

Point W (Walkers Point): The mean intersection point of thelower contours of the anterior clinoid processes and thecontour of the anterior wall of sellaturcica.The three lines that would form joining these points are:

- Line connecting Point M and Point G
- Line connecting Point W and Point G
- Line from point M perpendicular to the W-G line

The angle that would be measured will be between theperpendicular line from point M to W-G line and the M-G lineis the SAR angle (Figure 1).

A computerized cephalometric analysis was carried out with FACAD(software). The values of SAR angle obtained for each subgroup was subjected for statistical evaluation. All statistical analyses were performed with the SPSS software package. For each variable, the arithmetic mean and SD were calculated. Oneway ANOVA and post hoc Tukey's HSD analysis was performed to check for statistical significance.

Results and Discussion

The mean and standard deviation of SAR angle for skeletal Class I, Class II and Class III with normal, horizontal and vertical growth patterns were significantly different ($P<0.05$). The normal range of SAR angle values as given by the authors were 55.98 ± 2.24, 50.18 ± 2.70 and 63.65 ± 2.25 for skeletal class I, class II and class III respectively. The results of the current study are in accordance with the original values.

One-way ANOVA shows that the SAR angle values were within the normal range for skeletal Class I and Class II cases in all types of growth pattern. However, there was a significant($P<0.05$) difference in SAR angle in skeletal Class III cases alone, between the horizontal and vertical growth pattern (Table 1).

Interpretation of anteroposterior relationship of jaws plays a vital role in orthodontic treatment planning. This relationship might also get affected by the varied growth patterns. Many linear and angular measurements were introduced in cephalometrics for this purpose. The SAR angle purports to be unaffected by the varying growth patterns. Thus the reliability of the accuracy of this angle needs to be studied.

Figure 3 shows the distribution of SAR angle in Skeletal Class I,

Figure 1. SAR angle.

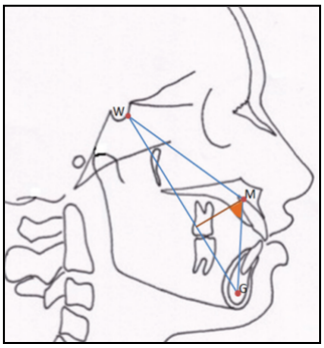

Figure 2. A Sample Cephalogram Tracing Carried Out in FACAD.

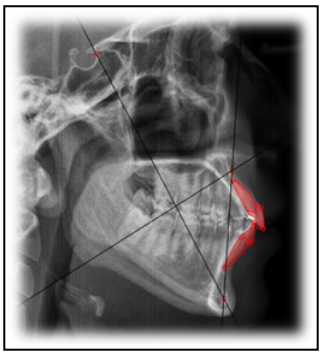

Figure 3. Distribution of SAR angle among Skeletal Class I, Class II and Class III.

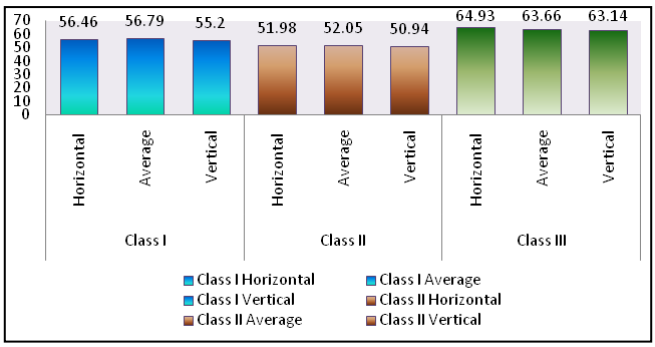

Table 1. Shows the descriptive statistics (mean and Std. dev) of each type of growth pattern.

Skeletal class	Average GP	Horizontal GP	Vertical GP	Original values
Skeletal class I	56.79	56.46	55.2	55.98
	-2.77	-3.54	-3.4	-2.24
Skeletal class II	52.05	51.98	50.94	50.18
	-3.4	-2.83	-6.14	-2.7
Skeletal class III	63.66	64.93	63.14	63.65
	-1.48	(0.93)*	(1.96)*	-2.25

*Statistically significant

Class II and Class III individuals in the current study.

Subjects with average growth pattern exhibited good adherence to SAR angle values. Individuals with horizontal and vertical growth pattern in Class I and Class II cases also showed reliable values closer to the normal range. Though the accuracy of this value in a Class III case with horizontal and vertical pattern is low, the values fall within the normal range. There were no previous studies to compare the effectiveness of SAR angle and this happens to be the first one.

The findings of this study support the fact that SAR angle would remain stable even when jaws are rotated. Clockwise and anticlockwise rotation of mandible did not significantly affect the SAR angle values and they remained within the limits making it a reliable parameter. Unlike the findings by Shobha et al, that beta angle may not be a valid tool for assessment of sagittal jaw discrepancy in patients exhibiting vertical growth patterns with skeletal Class I and Class II malocclusions, SAR angle was stable enough in all types of growth pattern [20].

The accuracy of this angle could be due the three points chosen that are not direct representatives of skeletal structures. Points M and G have already been proven to be advantageous in locating over points A and B, which are susceptible to remodeling changes [21]. Several studies have shown that, the thirs point, the Walkers point is stable after the age of five [22].Arat et al found out that the mid cranial base (W-SE) remained unchanged during all stages of pubertal growth [23].

The limitation of this study could be the use of FACAD software owing to minor deviation in measurement of SAR angle but within the acceptable range. SAR angle is an additional toolin cephalometrics to aid in accurate diagnosis and treatment planning in orthodontics.

Conclusion

SAR angle is a reliable indicator of sagital dysplasia in horizontal, vertical and average growth patterns in skeletal class I and class II individuals. However, in a skeletal class III condition the vertical growth pattern showed significantly decreased SAR values than horizontal growth pattern, but the values still being within the acceptable range. SAR angle can be used as a reliable alternative measurement or an additional aid to determine the discrepancy in apical jaw bases.

References

[1]. Agarwal S, Bhagchandani J, Mehrotra P, Kapoor S, Jaiswal RK. The SAR Angle: A ContemporarySagital Jaw Dysplasia Marker. Orthodontic Journal of Nepal. 2014;4(2):16-20.

[2]. Arat M, Köklü A, Ozdiler E, Rübendüz M, Erdoğan B. Craniofacial growth and skeletal maturation: a mixed longitudinal study. Eur J Orthod. 2001 Aug;23(4):355-61. PubMed PMID: 11544785.

[3]. Baik CY, Ververidou M. A new approach of assessing sagittal discrepancies: the Beta angle. Am J OrthodDentofacialOrthop. 2004 Jul;126(1):100-5. PubMed PMID: 15224065.

[4]. Bhad WA, Nayak S, Doshi UH. A new approach of assessing sagittal dysplasia: the W angle. Eur J Orthod. 2013 Feb;35(1):66-70. PubMed PMID: 21303811.

[5]. Binder RE. The geometry of cephalometrics. J ClinOrthod. 1979 Apr;13(4):258-63. PubMed PMID: 296153.

[6]. DOWNS WB. Variations in facial relationships; their significance in treatment and prognosis. Am J Orthod. 1948 Oct;34(10):812-40. PubMed PMID: 18882558.

[7]. Frank S. The occlusal plane: Reliability of its cephalometric location and its changes with growth [Thesis]. University of Oklahoma, Oklahoma; 1983.

[8]. Haynes S, Chau MN. The reproducibility and repeatability of the Wits analysis. Am J OrthodDentofacialOrthop. 1995 Jun;107(6):640-7. PubMed PMID: 7771370.

[9]. Jacobson A. Application of the "Wits" appraisal. Am J Orthod. 1976 Aug;70(2):179-89. PubMed PMID: 1066054.

[10]. Jacobson A. The "Wits" appraisal of jaw disharmony. Am J Orthod. 1975 Feb;67(2):125-38. PubMed PMID: 1054214.

[11]. Jacobson A. Update on the Wits appraisal. Angle Orthod. 1988 Jul;58(3):205-19. PubMed PMID: 3056122.

[12]. Järvinen S. The JYD angle: a modified method of establishing sagittal apical base relationship. Eur J Orthod. 1982 Nov;4(4):243-9. PubMed PMID: 6959814.

[13]. McNamara JA Jr. A method of cephalometric evaluation. Am J Orthod. 1984 Dec;86(6):449-69. PubMed PMID: 6594933.

[14]. Melsen B. The cranial base: the postnatal development of the cranial base studied histologically on human autopsy material. ActaOdont Scan. 1974; 32: Suppl.64.

[15]. Moore RN, DuBois LM, Boice PA, Igel KA. The accuracy of measuring condylion location. Am J OrthodDentofacialOrthop. 1989 Apr;95(4):344-7. PubMed PMID: 2705415.

[16]. Neela PK, Mascarenhas R, Husain A. A new sagittal dysplasia indicator: the YEN angle. World J Orthod. 2009 Summer;10(2):147-51. PubMed PMID: 19582259.

[17]. Rathi SS, Sivakumar A. Comparison of macro lens with normal lens in digital single lens reflex cameras for orthodontic intraoral photographs. Drug Invention Today. 2019 Jun 15;11(6).

[18]. Rathi SS, Sivakumar A. Variation in Lip Thickness in Individuals with Angle's Class 1, Class II and Class III Malocclusion-A Cephalometric Study. Indian Journal of Public Health Research & Development. 2019;10(9):319-23.

[19]. Richardson M. Measurement of dental base relationship. Eur J Orthod. 1982 Nov;4(4):251-6. PubMed PMID: 6959815.

[20]. Rushton R, Cohen AM, Linney AD. The relationship and reproducibility of angle ANB and the Wits appraisal. Br J Orthod. 1991 Aug;18(3):225-31. PubMed PMID: 1931857.

[21]. Steiner CC. Cephalometrics for you and me. Am J Orthod. 1953;39:729–55.

[22]. Sundareswaran S, Kumar V. Reliability of Beta angle in assessing true anteroposterior apical base discrepancy in different growth patterns. J Nat SciBiolMed. 2015 Jan-Jun;6(1):125-30. PubMed PMID: 25810649.

[23]. Wylie WL. The assessment of anteroposterior dysplasia. Angle Orthod. 1947;17:97–109.