International Journal Dental and Medical Sciences Research
Volume 3, Issue 5, pp: 1579-1583 www.ijdmsrjournal.com ISSN: 2582-6018

Comparison of ANB Angle and MNG Angle as an Indicator For Sagittal Discrepancy-A Pilot Study.

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Date of Submission: 26-11-2021 Date of Acceptance: 12-12-2021

ABSTRACT:
Aim: The aim of the study is to derive the MNG angle for each skeletal base and to compare and correlate it with ANB angle.
*Methods and material:*75 lateral cephalograms of South Indian adults, were grouped into three based on the ANB angle. The corresponding MNG angles were estimated. The mean MNG angle was derived based on the obtained value for each group. Interclass coefficient and Cronbach's Alpha analysis was done to determine the amount of co-relation and the reliability between the two angles.
Results: Analysis of the obtained data revealed a mean MNG angle of 2±1.4, 4±2.6, -6±2.2 for Class I, II and III respectively. Interclass coefficient test, demonstrated a significant co-relation between ANB and MNG angle with a p value of 0.0005. Cronbach's alpha analysis revealed that the alpha coefficient of the two angles under study was 0.867 suggesting that the angles have relatively high internal consistency.
Conclusion: The mean MNG angle, determined in South Indian adult population, was 2±1., 4±2.6, -6±2.2 degrees for Class I, II and III skeletal bases respectively.

KEYWORDS: Sagittal discrepancy, ANB angle , MNG angle , Diagnostic aid, Cephalometric landmarks.

I. INTRODUCTION:

The anteroposterior relationship that exists between the maxillary and mandibular dental bases is termed as the dental base relationship [1]. Assessment of facial skeletal relationship is one of the most critical diagnostic decisions for an orthodontist [2]. Accurate diagnosis and treatment planning are the hallmark ofan orthodontic treatment. Inaccuracies in diagnosis may lead to undue consequences. In order to overcome such problems, cephalometric analysis is being used as a supplemental diagnostic aid. Numerous angular & linear measurements are used to assess the sagittal discrepancy. In general, the ANBangle, wits appraisal and Beta angle were used to quantify the amount of sagittal discrepancy [3]. Unfortunately, these methods involve landmarks that are unreliable, as theycould vary depending upon the amount of

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growth, the rotation of the jaw bases and most importantly the head posture [4]. These parameters candirectly affect the interpretation and diagnosis of orthodontic case.

The most commonly used angle ANB, proposed by Riedel, though appears as a gold standard, and has been proved to be unreliable indicator of apical base discrepancies.As the stability of nasion, point A and point B is under question [5]. Further rotation of jaw bases which can be result of growth or orthodontic treatment can greatly affect the same. With an aim to overcome the shortcomings of the ANB angle Wits appraisal was put forth by Jacobson. This method of measuring the amount of sagittal discrepancy was also not accurate as the functional occlusal plane was employed [6]. A change in the angulation of functional occlusal plane caused profound change in the measurements obtained. Further difficulty in identification of the occlusal plane in mixed dentition stage, open bite, skeletal asymmetries, missing teeth or multiple impactions also posed additional problem[7]. Beta angle, deduced by Baik and Ververidou in 2004, assessed true apical base relationship without the use of cranial reference plane or occlusal plane Although beta angle provided a reliable picture of the amount of sagittal discrepancy, point A and B which were unstable landmarks were used. In addition, the identification of Condylion and point A was not easily reproducible on lateral cephalogram. Recently Neela et al , put forth, a new parameter ,the YEN angle for assessment of A-P discrepancy, the points used in this analysis were center of sell turcica S, Point M- Maxillary point M, G-point[8]. Hence this study was carried out with an aim to employ MNG as an alternate for the ANB angle to quantify the amount of sagittal discrepancy[9].

II. MATERIALS AND METHODS:

Lateral cephalometric radiographs of 75 patients were randomly selected from the archives of the Department of Orthodontics and Dentofacial Orthopedics,Best Dental Sciences College, Madurai,India. Radiographs of good quality and no artifacts were chosen for the study.Subjects exhibiting varying degrees of skeletal and/or dentoalveolar malocclusion, absence of prior orthodontic treatment were included for the study. Patients with congenital anomalies or syndromes or any marked asymmetries were excluded from the study.

The pre-treatment cephalogram were traced manually onto a cellulose acetate sheet by the primary author using fluorescent tracing screens to provide illumination. All cephalogram were obtained in the standard manner with the same radiographic equipment. The landmarks included were as follows:

1. N - Nasion. The most anterior point on the frontonasal suture in the midsagittal plane.
2. S-Sella - The geometric center of the pituitary fossa
3. Point A: Subspinale. The most posterior midline point in the concavity between ANS and the prosthion.
4. Point B: Supramentale. The most posterior midline point in the concavity of the mandible between the most superior point on the alveolar bone overlying the mandibular incisors and Pog.
5. Point M - Midpoint of premaxilla
6. Point G - Center of the largest circle that is tangent to the internal inferior, anterior, and posterior surfaces of the mandibular symphysis[10].

Post sample collection and evaluation, the obtained radiographs were sorted based on the ANB Angle into Class I, II, III. Following stratification of the samples the corresponding MNG angles were deduced(Image 1).

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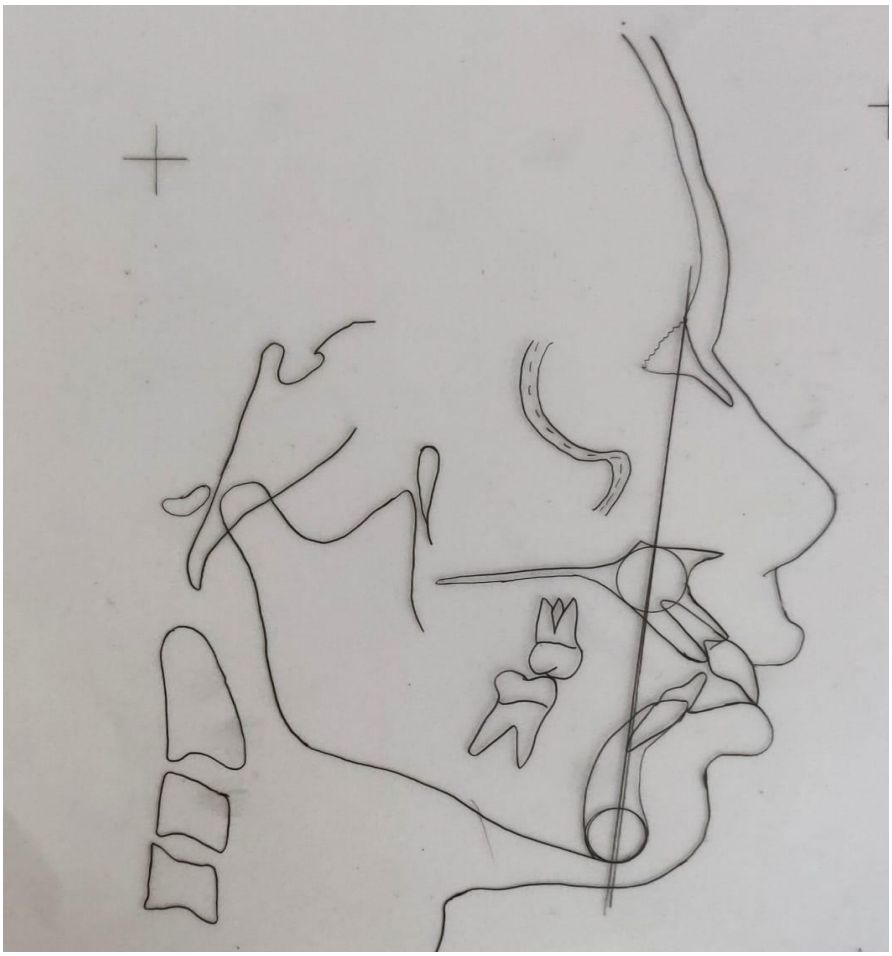

Image1: Depicts the derivation of MNG angle

In order to avoid errors and bias, the samples were verified by a senior staff and the tracings were repeated by the author after 2 weeks, to improve the reliability. The data obtained was tabulated and subjected to statistical analysis using IBM SPSS software (Version 23.0) in order to obtain the results.

III. RESULTS:

The data obtained was stratified and tabulated based on age (Table 1)and ANBangle (Table 2) the collected data were analysed with IBM SPSS Statistics for Windows, Version 23.0. (Armonk, NY: IBM Corp). To describe about the data descriptive statistics frequency analysis, percentage analysis was used for categorical variables and the mean & S.D were used for continuous variables.

AGE	N	MEAN	STANDARD DEVIATION
18-20	50	20.4	4.3
20-35	25		
TOTAL	75		

Table 1: Descriptive statistics stratified based on age

ANB ANGLE	
SKELETAL BASE	FREQUENCY
CLASS I	35

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CLASSII	33
CLASS III	7
TOTAL	75

Table 2: Descriptive statistics stratified based on ANB angle.

Analysis of the obtained layered data revealed a mean MNG angle of 2±1.4, 4±2.6,-6±2.2for class I, II and III respectively (Table3)

SKELETAL BASE	ANB ANGLE	MNG ANGLE (mean)
CLASS I	0-2	2±1.4
CLASSII	<2	4±2.6
CLASS III	>0	-6±2.2

Table 3: Depicts the mean MNG angle obtained for each type of skeletal base

In order to verify the agreement between the ANB and MNG interclass coefficient test was used. This descriptive statistical analysis implies the degree of correlation between the two sets of organised data under scrutiny. The results of this test demonstrated a significant co-relation between ANB and MNG angle with a p value of 0.0005 (Table4).

		95% C.I		F Test with True Value 0			
	ICC	LB	UB	Value	df1	df2	p-value
Average Measures	0.867	.790	.916	7.534	74	74	.0005*

Table 4: Depicts the interclass coefficient

Further in order to determine the internal consistency of the data and to establish how closely the values of ANB and MNG angle are knit, Cronbach's Alpha analysis. The alpha coefficient of the two angles under study was 0.867 suggesting that the angles have relatively high internal consistency.

IV. DISCUSSION:

In the branch of orthodontics, accurate diagnosis of the antero-posterior discrepancy is of utmost importance as a major portion of the treatment plan is dependent on it[11]. Cephalometric radiographs area valuable tool in orthodontic diagnosis and treatment planning. The accuracy of the cephalometric analysis is essential so that the operator can plan the treatment appropriately and also provide various treatment options to the patient with the cephalogram as a visual aid. As mentioned previously , since the inception of the ANB angle in the year 1952, it has been routinely used by many clinicians to gauge the existing amount of sagittal discrepancy and has also been considered as a near gold standard[12]. Variables like age of the patient, upward or downward rotation of the SN plane, upward or downward rotation of the jaws, change in the angle SN to the occlusal plane and the degree of facial prognathism significantly alter the ANB angle[13]. Hence an angle, which utilizes stable and reproducible landmarks and discards the demerits of the existing angles would be considered ideal for the quantification of the amount of sagittal discrepancy[14]. The use of relatively new angles like the YEN angle, Beta angle and the W angle have not been popularized yet as an alternate due to their questionable reproducablity.Hence this study aimed to incorporate easily identifiable landmarks to denote the amount of sagittal dysplasia[15].

For the purpose of this study, the points M and G were chosen over points A and B due to the ease of location and greater degree of reproducibility unlike the later which can be susceptible to changes .The points M and G remain unchanged even when the jaw bases are rotated or when the mandible grows vertically and was therefore chosen as the points of interest . The results of the study predicted a MNG angle of 2±1.4,

4±2.6,-6±2.2for class I, II and III skeletal bases respectively. The MNG angle can be employed not only to determine the amount of sagittal dysplasia but also to keep track of the treatment progress.

Limitations of the study:

- Determination of the pre maxilla requires good quality radiographs.
- The cranial base length, in other terms the position of the nasion can mask the amount of sagittal discrepancy.
- In certain cases of Class I skeletal base with prominent chin (based on ANB angle) , the MNG derived was less than zero, leading to misconception as Class III skeletal base .
- The range of MNG angle could not be accurately established for each class of ANB angle due to the unequal distribution in the sample size. On the other hand since it is a pilot study the drawbacks and the difficulties encountered can be rectified while the study is performed under further standardized circumstances.

V. CONCLUSION:

The mean MNG angle, determined in South Indian adult population, was2±1.4 , 4±2.6 ,-6±2.2degrees for Class I,II and III skeletal bases respectively. Though the results of the study show a positive co-relation and adequate reliability between the ANB and MNG angle, the use of MNG as an indicator for sagittal discrepancy may have to withheld till the shortcoming are rectified or at least justified.

CONFLICT OF INTREST: No conflict of interest among the authors

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