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The relationship between Iraqi method used for assessing the sagittal skeletal patterns with other methods

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Abstract: ***Background****: This study aimed to evaluate the relationship between Iraqi method used for assessing the sagittal skeletal relationship with other popular methods.*
Materials and methods*: The sample included 60 digital true lateral cephalometric X-rays selected from the files of the patients attending the postgraduate Orthodontic clinic in the College of Dentistry/ University of Baghdad with an age raged between 18-30 years. The sample classified according to ANB angle into three skeletal classes. One angular and three linear parameters were measured using AutoCAD program. Descriptive statistics were performed for each variable and Pearson's correlation coefficient was obtained to determine the relationship between the variables in the study.*
Results: *The results showed direct significant relation between FMO with ANB angle and Wit's appraisal and non-significant relation with MVI.*
Conclusion: *FMO was correlated significantly with ANB and Wit's appraisal so it can be used in conjunction or as a substitution to these measurements.*
Key words: *Sagittal relation, ANB, Wits appraisal, FMO, MVI.*

I. Introduction

After the introduction of point A and B by Downs [(1)] in 1948, Reidel [(2,3)] introduced the S-N-A and S-N-B angles and used their difference, or angle A-N-B, as an expression of dental apical base relationship. Reidel's study of normal occlusions resulted in a mean for the S-N-A– S-N-B difference (angle ANB) of 2º for his 52 adult normals, and 2.77º for his 24 child normals. Since that time, the ANB angle was considered as the most commonly used measurement for appraising anteroposterior disharmony of the jaws.

In 1975, Jacobson [(4)] developed the Wits (University of Witwatersrand, South Africa) appraisal of anteroposterior jaw disharmony. It is a measure of the extent to which the jaws are related to each other. The method of assessing the degree or extent of the jaw disharmony entails drawing perpendicular lines on a lateral cephalometric head film tracing from points A and B on the maxilla and mandible, respectively, on to the occlusal plane, which was drawn through the region of the overlapping cusps of the first premolars and first molars. The points of contact on the occlusal plane from points A and B are labeled AO and BO, respectively.

Jacobson [(4)] found in a sample series of 21 adult men selected on the basis of excellence of occlusion that point BO was approximately 1 mm ahead of point AO. The calculated mean reading was 1.17 mm (range, -2 to 4 mm). On the other hand, in 25 adult women selected on the same basis, points AO and BO generally coincided. The calculated mean reading was -0.10 mm (range, - 4.5 to 1.5 mm). Therefore, the average jaw relationship according to the Wits reading is -1.0 mm for men and 0 mm for women. In skeletal Class II jaw dysplasias, point BO would be located well behind point AO (a positive reading), whereas in skeletal Class III jaw disharmonies, the Wits reading would be negative (i.e., point BO being forward to point AO). The greater the Wits reading deviation from -1.0 mm in men and 0 mm in women, the greater the anteroposterior jaw disharmony.

Al-Khannaq [(5)] introduced a new anteroposterior distance resembling the Wits appraisal and called it FMO in reference to the initials, the name of him and his supervisor (F= Fuad, M= Mohammed, and O= for the occlusal plane). Al-Khannaq [(5)] used the occlusal plane that bisects the molars and incisors occlusion instead of the functional occlusal plane used by Jacobson [(4)]. The latter preferred the functional occlusal plane because of the possibility of incisors supra- or infra-eruption in malocclusions.

In this new distance, perpendiculars were drawn from ANS and Gn points to the occlusal plane. Al-Khannaq [(5)] used this measurement on a sample of Class II Division 1 and found that the mean value for total sample was 7.87 mm, and for males group was 8.08 mm, while for female group was 7.47 mm, and there was significant correlation between this measurement with Wits appraisal and ANB angle.

Noar *et al.* [6] developed the Mount Vernon Index (MVI), named after the now-closed Mount Vernon Hospital in Middlesex, North London. The MVI was determined by measuring the perpendicular distance (d) between B point and a line extending from nasion through A point. They found that in Class I the range of normal value between 3-7mm. Values of less than 3mm and more than 7mm were defined as indicators of Class III and Class II skeletal patterns, respectively.

The aim of this study was to evaluate the relationship between Iraqi method used for assessing the sagittal skeletal relationship with other famous methods.

II. Materials And Methods

Sample

The sample consists of 60 digital true lateral cephalometric X-rays selected from the files of the patients attending the postgraduate Orthodontic clinic in the College of Dentistry / University of Baghdad. All of the patients are adults (with an age raged between 18-30 years) having full permanent dentition regardless the third molars. The sample was classified, according to the sagittal skeletal relation using ANB angle, into: Skeletal Cl I: $2° \leq ANB \leq 4°$, Skeletal Cl II: $ANB > 4°$, and Skeletal Class III $< 2°$.

Method

Cephalometric Analysis

Every lateral cephalometric radiograph was analyzed by AutoCAD program 2007 to calculate the angular and linear measurements. After importing the picture to the AutoCAD program, the points were localized, the planes were determined, and the angle and distances were measured. The angle was measured directly as it was not affected by magnification, while the linear measurements were divided by scale for each picture to overcome the magnification.

Cephalometric Landmarks, Planes, and Measurements

A. Cephalometric Landmarks

1. Point N (Nasion): The most anterior point on the nasofrontal suture in the median plane [7].
2. Point ANS (Anterior Nasal Spine): It is the tip of the bony anterior nasal spine in the median plane [7].
3. Point A (Subspinale): The deepest midline point on the premaxilla between the Anterior Nasal Spine and Prosthion [1].
4. Point B (Supramentale): The deepest midline point on the mandible between Infradentale and Pogonion [1].
5. Point Gn (Gnathion): A point located by taking the midpoint between the anterior (Pogonion) and the inferior (Menton) points of the bony chin [8].
6. Point AO: Point of intersection of the perpendicular line drawn from point A on to the functional occlusal plane [4].
7. Point BO: Point of intersection of the perpendicular line drawn from point B on to the functional occlusal plane [4].
8. Point F: (modified from Al-Khannaq [5]): Point of intersection of the perpendicular line drawn from point ANS on to the functional occlusal plane.
9. Point M: (modified from Al-Khannaq [5]): Point of intersection of the perpendicular line drawn from point Gn on to the functional occlusal plane.

B. Cephalometric Planes

1. N- A line: Formed by a line joining Nasion and point A [1].
2. N- B line: Formed by a line joining Nasion and point B [1].
3. Functional occlusal plane: A line drawn through the region of the overlapping cusps of the first premolars and first molars [4].
4. A perpendicular line from point A onto the functional occlusal plane [4].
5. A perpendicular line from point B onto the functional occlusal plane [4].
6. A perpendicular line from point ANS onto the functional occlusal plane (modified from Al-Khannaq [5]).
7. A perpendicular line from point Gn onto the functional occlusal plane (modified from Al-Khannaq [5]).

C. Cephalometric Measurements

1. ANB angle: The angle between lines N-A and N-B. It is measured directly on the radiograph [2,3].
2. Wits appraisal: The distance between AO and BO [4].
3. FMO distance: The distance between F and M points [5].
4. d: Perpendicular distance between B point and line from Nasion through A point [6].

Statistical Analyses

All the data of the sample were subjected to computerized statistical analysis using SPSS version 19 computer program. The statistical analysis included:

1. Descriptive Statistics including; means, standard deviations (SD), minimum and maximum values, and statistical tables.
2. Inferential Statistics; Pearson's coefficient of correlation (r).

In the statistical evaluation, the following levels of significance are used:

Non-significant	$P > 0.05$
Significant	$0.05 \geq P > 0.01$
Highly significant	$P \leq 0.01$

III. Results

Table 1 showed the descriptive statistics of all variables used in this research. All the measurements shared in the highest mean values for Class II sample followed by Class I and III.

Table 2 demonstrated the relationship among variables measured in each class. Generally, FMO, MVI and Wit's appraisal showed direct significant relation with ANB angle. On the other hand, FMO correlated significantly with Wit's appraisal and non-significantly with MVI. The latter did correlate with Wit's appraisal insignificantly.

Table 1: Descriptive statistics and classes' difference for the measured variables

Variables	Classes	Descriptive statistics			
		Mean	S.D.	Min.	Max.
ANB (Degree)	I	3	0.79	2	4
	II	6.4	0.99	5	8
	III	0.3	0.66	-1	1
Wits (mm.)	I	1.17	1.87	-1.6	4.08
	II	3.18	2.29	0.23	6.67
	III	-1.86	1.07	-3.91	0.77
FMO (mm.)	I	2.51	2.29	-2.55	5.51
	II	6.45	2.69	2.65	9.99
	III	0.14	1.59	-3.27	2.35
MVI (mm.)	I	4.01	1.28	2	6.64
	II	10.69	1.55	8.43	12.85
	III	0.48	1.02	-1.41	1.92

Table 2: Pearson's correlation coefficient test between the variables in three classes

Variables			FMO (mm)	MVI (mm)	Wits (mm)
ANB (Degree)	I	r	0.447	0.741	0.607
		p	0.048	0.000	0.005
	II	r	0.464	0.889	0.636
		p	0.039	0.000	0.005
	III	r	0.473	0.931	0.639
		p	0.045	0.000	0.030
Wits (mm)	I	r	0.544	0.161	
		p	0.013	0.497	
	II	r	0.874	0.423	
		p	0.000	0.063	
	III	r	0.616	0.146	
		p	0.004	0.539	
MVI (mm)	I	r	0.354		
		p	0.126		
	II	r	0.391		
		p	0.088		
	III	r	0.064		
		p	0.787		

IV. Discussion

Many methods for assessing the sagittal jaw relation had been discovered since 1947. All of these methods had argued from other authors and ANB angle of Riedel [(2)] stayed the famous and most widely used till now.

In 1975, Jacobson [(4)] introduced his linear method for evaluating the anteroposterior jaw relation and researches showed direct significant relation with ANB angle [(5,9)].

Al-Khannaq [5] drew perpendiculars from point ANS and Gn on the occlusal plane and introduced the FMO measurement. It was correlated significantly with ANB angle and Wit's appraisal in class II sample.

In this research, MVI is used for the second time to correlate with other ANB angle and Wit's analysis. Generally, the mean values of the measurements used in this study lied within the normal range of the original analyses. As the severity of the jaw relation worsening towards class II, the mean values increased in all variables and vise versa for class III.

Discussing the relation among variables, ANB and Wit's analyses were correlated significantly confirming the previous findings [5,9]. FMO measurement correlated significantly with ANB and Wit's analysis as proved by Al-Khannaq [5] who stated that FMO can substitute the other methods.

On the other hand, MVI showed highly significant relation with ANB angle only and non-significant relation with Wit's and FMO measurements. This may be attributed to the use of an extra-cranial perpendicular reference plane (d) in assessing this sagittal jaw relationship. The severity of a skeletal inconsistency depends on the relationship of the jaws to each other, rather than on their relationships to extra-cranial landmarks; so it is better to combine more than one method to get accurate relation assessment.

V. Conclusion

In conclusion; the Iraqi method FMO was correlated significantly with ANB and Wit's appraisal so it can be used in conjunction or as a substitution to these measurements.

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