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Comparison of Different Sagittal Dysplasia Indicators in a Sample from Syrian Population

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Abstract: In orthodontic diagnosis, an accurate evaluation of sagittal jaw relationship is critically important. There are numerous angular and linear measurement could be used to evaluating the antero-posterior jaw discrepancy between maxilla and mandible so as to reach the correct diagnosis such. The usual practice is to compare the cephalometric analysis of the patient with the established normal values. Since craniofacial morphology varies among different populations therefore it becomes important to establish the cephalometric norms of all cephalometric analyses, for every population. The aims of this study were to evaluate the validity of ANB Angle, BETA Angle, W Angle and YEN Angle in Syrian sample. Materials and methods: 60 lateral cephalometric radiographs of Syrian population (35 boys and 25 girls), were traced for ANB, Wits appraisal, Beta angle, W angle and YEN angle. Patients were divided into skeletal Class I, II and III groups. Result: No statistically significant difference was found in all measurements values. ANB, BETA, W and YEN angle not differed significantly from the stander measurements in all three groups ($p<0.05$). The mean value for: the ANB angle for the Syrian population was3.4 degrees with SD of 0.6, and for the Beta angle was30degrees with SD of 4.2, and for the W angle was 53.7degrees with SD of 1.6. YEN angle mean value for the Syrian population was 120 degrees with SD of 1.5. These results suggest that all the performed analyses are valid and can be used to diagnose skeletal discrepancies and diagnosis based on single analysis is insufficient.

Keywords: Sagittal Discrepancy, ANB Angle, Beta Angle, W Angle, YEN Angle, Syrian

1. Introduction

Cephalometric analysis is an integral part of diagnosis as well as treatment planning in contemporary orthodontics.

It is practiced by comparing patient's radiographic measurements with norms or standard values, most of which are obtained from the researches that involved sample from American or European populations [1].

Therefore it is not justified to apply these standard values in other populations because of possible ethnic and racial variations. Many investigators have found marked difference in the cranio facial morphology in various ethnicities which reflects in cephalometric measurements too [2-3].

In a study that involved Chinese and British white children, significant difference was found in sagittal (antero-posterior) and vertical cephalometric measurements [4].

Another study concluded that convex profile with short mandible is more common in Saudis as compared to Europeans-Americans [5].

Korean children are more prone to develop skeletal Class III malocclusion due to smaller anterior cranial base, midface deficiency and larger mandible [6].

The sagittal jaw relationships are difficult to evaluate and can vary in response to many intervening factors as rotation of the jaws during growth, vertical relationship between jaws, the relative stability of the reference planes during growth, Lack of validity of the various method proposed for their evaluation, age, gender and racial origin as well as facial type [7, 8, 9, 10, 11, 12].

2. Aim of the Research and Its Importance

To provide a more precise reliable parameter for assessment of sagittal jaw relationship.

3. Research Methods and Materials

Sixty Caucasian Syrian adult subjects (35 males, 25 females) with the mean age of 22.8 years, with no prior orthodontics treatment (17 to 27 years of age) who seek treatment at orthodontic clinics at the Department of Orthodontics and Dentofacial Orthopedics at Tishreen University (In the period between 2011 and 2014) were selected.

All skeletal classes (class I, II and III) with complete permanent dentition including Second molars were included in the study. Patients having craniofacial malformations, facial asymmetry and cleft palate; patients with history of previous orthodontic treatment and patient with history of interracial marriage in parents or grandparents, were excluded from the study.

All radiographs were traced by single operator in a standard manner for following measurements (Fig. 1 a, b).

To determine the minimum sample size to be statistically significant, a pilot study was realized on 60 subjects. It has been found that descriptive statistics results follow the normal distribution; and with a significance level of 99%requires a sample size of 18 patients as minimum, whereas the size of the sample in this study was n= 60.

lateral cephalometric analysis:

Cephalograms were traced, and ANB, Wits appraisal, and Beta angle, Yen angle and W-angle were measured to find the antero-posterior dysplasia and then they were divided into 3 groups:

Group I - Class I skeletal pattern group (n=20).

Group II - Class II skeletal pattern group (n=21).

Group III - Class III skeletal pattern group (n=19).

For a patient to be included in the Classes I, II, or III skeletal pattern group

To be included in the skeletal class I, a patient had to have a minimum of three of the five parameters (ANB, Wits appraisal, and Beta angle, Yen angle and W-angle)

- A skeletal class1 relationship was indicated by an:

ANB angle of 1° to 3°, a Wits appraisal between 0 and -3 mm, a Beta angle between 27° - 35° degrees, a Yen angle between 117° - 123°(5)W angle between 51° - 56° and pleasant profile.

20 lateral cephalograms (10 female and 10 male) were collected from the screened files that met the above criteria to form the skeletal Class I group.

- A skeletal Class II relationship was indicated by an ANB of greater than 4 degrees, a Wits appraisal with AO ahead of BO in females or AO coinciding with or ahead of BO in males, a Beta angle less than 27 degrees, Yen angle less than 117° and a W-angle less than 51° and the profile had a Class II appearance.

21 lateral cephalograms (12 female and 9 male) were collected from the screened files that met the above criteria to form the skeletal Class II group.

- The skeletal Class III individuals were characterized by an ANB less than 2 degrees, a Wits BO ahead of AO in females or BO ahead of AO by more than 1 mm in males, and a Beta angle greater than 35 degrees, Yen angle more than 123°, and a Wangle more than 56° and the profile had a Class III appearance.19 lateral cephalograms (3 female and 16 male) met the required criteria.
- lateral cephalograms has been scanned into JPEG digital format at 300 dpi and an 8-bit greyscale using scanner with 1600 dpi imaging 40 800 pixels per line and 48-bit color depth, and displayed on 15-inch LCD screen Notebook with resolution of 1366 X 768, high-pixel resolution with pixel pitch of 0.297 mm, a contrast ratio of 450: 1, and a brightness of 250 cd/m 2, with 32-bit color. The digital tracing of the lateral cephalogram was done using Dolphin Imaging Software Version 11 (Dolphin Imaging). All the cephalograms were recorded with the same exposure parameters and in the same machine.
- Landmarks and planes used in this study for analyses:

S: Sella (center of sella turcica) [13, 14].

N: Nasion (frontonasal suture at its most superior point) [13, 14].

Point A: deepest point at concavity on maxillary alveolar bone [13, 14].

Point B: deepest point at concavity on mandibular alveolar bone [13, 14].

Functional occclusal plane: line passing through the occlusion of molars and premolars.

M: midpoint of premaxilla [15].

C: center of the condyle [16].

G: center of mandibular symphysis [17].

- Analyses performed in this research: (Fig. 1 a, b)

1. ANB angle: The angle around the center N and between the markers A and B. (in degrees)[18, 19, 20].
2. Wits appraisal: the distance between perpendiculars drawn from the occlusal plane to Points A and B. Jacobson (1975, 1976), Panagiotidis, Witt (1976) and Ferrazzini (1976).
3. Beta angle: Angle formed between the Line from point A perpendicular to the C-B line and the A-B line. [21]
4. Yen angle: an angle between line SM and MG. [22]
5. W angle: the angle between the perpendicular line from point M to S–G line and the M–G line. [23]

Error of method:

To control the errors in tracing and analysis, Dalhberg's24) formula was applied:

$ME = \sqrt{\sum(x1-x2)2/2n}$

Where x1 is the first measurement, x2 the second measurement and n the number of repeated records [25].

This formula determines the difference between 2 measurements taken at least one month apart.

sixty (20+21+19) randomly selected lateral cephalometric radiographs were retraced and re measured to calculate the error in the method from each population.

This study was designed and conducted according to the guidelines of Strengthening the Reporting of Observational studies in Epidemiology (STROBE), and we applied the STROBE checklist in the preparation of this manuscript [26].

The combined error for any of the variable was small and considered to be within acceptable limit [25].

Statistical Analysis

The data were verified and analyzed statistically using IBM SPSS Statistics Version 20.0 with confidence level set at 5% (P <0.05) to test for significance. Analysis of variance (ANOVA) was applied to evaluate the difference in the values for three skeletal classes in all sagittal measurements. Student's t test was applied to determine any significant sex difference in measurements and Coefficient Correlation analysis was done. All analysis was done using SPSS version 11.

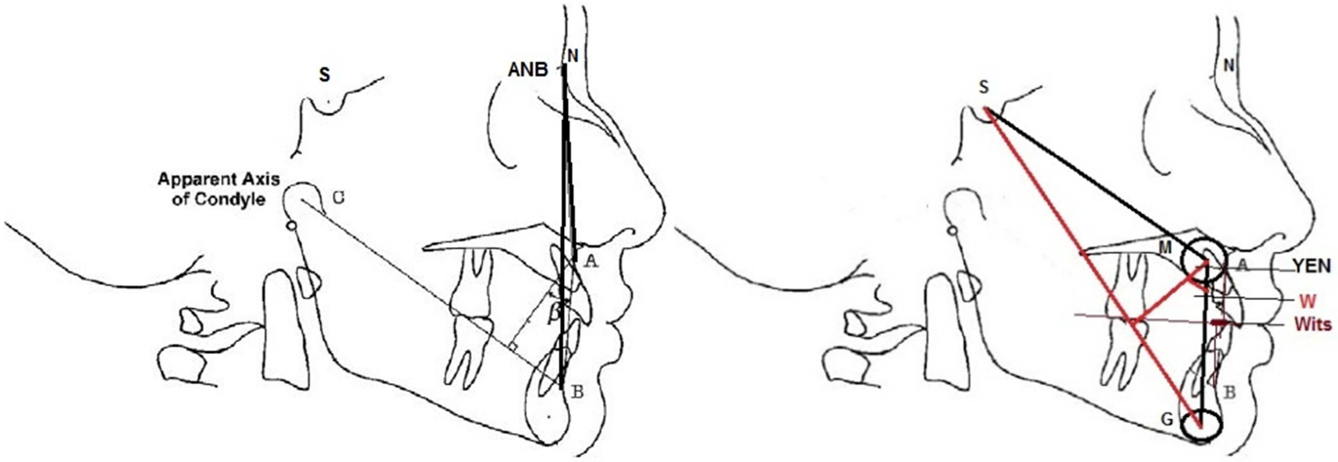

Figure 1. *Cephalometric tracing: ANB, Wits appraisal, Beta angle, W angle and YEN angle.*

4. Results

Descriptive statistics for the age of the male, female, and all subjects of the sample are presented in (Table 1).

Table 1. *Descriptive statistics for the age of the male, female, and all subjects of the sample.*

	Count	Min	Max	Mean	Standard Deviation	Sample Variance
♂ *age*	35	17	27	22.9	3.1	9.5
♀ *age*	25	17	27	22.6	3.2	10.5
♂&♀ *age*	60	17	27	22.8	3.1	9.8

Table 2 shows the mean values for sagittal analyses i.e. ANB, Wits, Beta angle, W angle and YEN angle in Syrian sample, which shows no significant difference in the values among all skeletal classes (p 0.001).

Table 2. *The mean values for sagittal analyses i.e. ANB, Wits, Beta angle, W angle and YEN angle in Syrian sample.*

Class		ANB	WITS	YEN	BETA	W
	Mean	3.415	0.650	120.575	29.915	53.780
I	N	20	20	20	20	20
	Std. Deviation	0.6377	1.8992	1.5525	4.2396	1.5807
	Mean	7.157	4.200	113.119	20.905	48.643
II	N	21	21	21	21	21
	Std. Deviation	1.6774	1.6808	3.1296	6.9621	2.3258
	Mean	.053	-3.768-	129.079	36.795	59.632
III	N	19	19	19	19	19
	Std. Deviation	2.1493	1.7695	2.9440	2.9499	1.9325
	Mean	3.660	.493	120.658	28.940	53.835
Total	N	60	60	60	60	60
	Std. Deviation	3.3254	3.7178	7.0575	8.2490	4.9188
p-VALUE		.000	.000	.000	.000	.000
Sig		***	***	***	***	***

There was no statistically significant difference between our sample and the mean value of these sagittal analyses of the sexes within the groups (Table 3).

Table 3. *The mean value of sagittal analyses of the sexes within the groups.*

class	gender		ANB	WITS	YEN	BETA	W
		Mean	3.440	-.270-	120.050	29.840	53.450
	Male	N	10	10	10	10	10
		Std. Deviation	.6381	2.3152	1.5707	5.3050	1.1806
		Mean	3.390	1.570	121.100	29.990	54.110
I	Female	N	10	10	10	10	10
		Std. Deviation	.6707	.6111	1.4174	3.1289	1.9076
		Mean	3.415	.650	120.575	29.915	53.780
	Total	N	20	20	20	20	20
		Std. Deviation	.6377	1.8992	1.5525	4.2396	1.5807
		Mean	7.000	4.822	114.267	18.822	48.678
	Male	N	9	9	9	9	9
		Std. Deviation	1.8755	1.8880	2.9099	8.8012	1.7130
		Mean	7.275	3.733	112.258	22.467	48.617
II	Female	N	12	12	12	12	12
		Std. Deviation	1.5881	1.4106	3.1248	5.0581	2.7748
		Mean	7.157	4.200	113.119	20.905	48.643
	Total	N	21	21	21	21	21
		Std. Deviation	1.6774	1.6808	3.1296	6.9621	2.3258
		Mean	-.200-	-3.675-	129.081	36.956	59.588
	Male	N	16	16	16	16	16
		Std. Deviation	2.2563	1.6988	3.1663	2.9253	2.0458
		Mean	1.400	-4.267-	129.067	35.933	59.867
III	Female	N	3	3	3	3	3
		Std. Deviation	.4000	2.4685	1.6773	3.5796	1.4572
		Mean	.053	-3.768-	129.079	36.795	59.632
	Total	N	19	19	19	19	19
		Std. Deviation	2.1493	1.7695	2.9440	2.9499	1.9325

Table 4 shows that there is no significant difference in Syrian population in the mean value of all among all skeletal classes (P value ≤0.05).

Table 4. *P value of Anova-test shows that there is no significant difference in syrian population in the mean value of all among all skeletal classes (P value ≤0.05).*

	F	Sig
ANB * class	97.866	.000
WITS * class	99.630	.000
YEN * class	182.094	.000
BETA * class	49.465	.000
W * class	154.030	.000

There is significant correlation between the mean value of sagittal analyses and all skeletal classes.

5. Discussion

This study evaluate and compare some important angular measurement that could be used to evaluating the sagittal jaws relationship relation such as ANB angle, Wits appraisal, Beta angle, YEN angle and W-angle in Syrian Population.

In this study ANB angle, beta angle, W angle and YEN angle in Syrian sample for all three classes cases showed no significant difference as compared to original value of these measurements. (p≤0.001).

In our samples the mean value of Beta angle for class I patients (p≤0.001). The value was comparable to the Caucasians [7, 30, 21].

W angle and YEN angle are relatively new measurements therefore no previous work has been done in Syrian populations yet.

Our main value of ANB angle (3.4±0.6) was close to ANB angle for Saudi population (3.30±2.17) as Al-Jabaa AH and Aldrees AM33suggest in their study, Whereas The norm for ANB angle was 4.14° in class I cases among Pakistani sample 34, which is much higher than Syrian value (3.4±6).

our result was in contrary with (Mohammad Khursheed Alam et al), 35 study in a Sample from Pakistani and Bangladeshi Populations, because he suggested to follow their own cephalometric norms for treatment of patients belonging to their respective populations because Bangladeshi and Pakistani populations differ in craniofacial morphology.

The norm for W angle was established for the Pakistani (54.5±3) and Bangladeshi population (55±3), but in our study it was (53.7±1.6).

The norm for Yen angle was established for the Pakistani (119.40 ± 3.51), whereas in our study was (120.5±1.5).

We can explain that different in values between Bangladeshi and Pakistani populations and original values because their populations differ in character, Size, growth, and shape.

These differences can be explained also due to a complicated interaction of genetic and environmental factors. [36].

So It is illogical to apply the standards of one racial group to another, or to apply the standards of one subgroup to another.

For the same reason there is no significant difference between our measurements in Syrian sample and standards values, because the Syrian people belong to the Caucasian race.

The results of the present study also support the idea that a morphological and anthropological findings indicate each racial group have its own standards [32].

All above is suggested that Syrian populations do not differ very much in craniofacial morphology from Caucasian; therefore the original cephalometric norms could be followed for treatment of patients belonging to Syrian populations.

6. Conclusion

1. ANB angle, beta angle, W angle and YEN angle in Syrian sample for all three classes cases showed no significant difference as compared to original value of these measurements. (($p\leq0.001$)
2. The results suggest that our values similar to the original data. Therefore, all the performed measurements are valid and can also be used on an Arabian or at least a Syrian population to evaluate Sagittal discrepancy.
3. Syrian populations do not differ very much in craniofacial morphology from Caucasian; therefore the original cephalometric norms could be followed for treatment of patients belonging to Syrian populations.

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