The prediction of the relation between anterior facial skeleton and sella turcica in Iraqi sample

Article *in* Journal of Baghdad College of Dentistry · March 2021

1 author:

Mohammed Abdulhammed
University of Anbar
1 PUBLICATION   **0** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Research View project

The prediction of the relation between anterior facial skeleton and sella turcica in Iraqi sample

Mohammed Kh. Al-Ani, B.D.S., M.Sc. [(1)]
Dhia'a J. Al-Dabagh, B.D.S., M.Sc. [(2)]

ABSTRACT

Background: The relation between the anterior facial skeleton and sella turcica may vary from individual to individual, and the establishment of normal standards in different skeletal patterns will aid in the process of eliminating any abnormality in such an important region. This study aimed to find the relation of the anterior facial skeleton to the sella turcica in different skeletal patterns and in both gender and also to find the most valid equation for describing these relationships to be applied practically in different skeletal patterns.

Materials and method: The sample consisted of "138" digital true lateral cephalometric radiographs related mostly to patients attended to the college of dentistry /Baghdad University with an age range "18-30" years, they classified into three skeletal patterns . Six cephalometric parameters in addition to shape of Sella Turcica were measured and assessed for each individual radiograph using AutoCAD program 2008.

Results : The linear measurements that assess the relation of sella turcica to anterior facial skeleton in all skeletal patterns showed a very highly significant gender differences; being larger in males than in females, while for the angular measurements, no gender difference were found. Among the three skeletal patterns only the "S-B Length" and the "ASB angle" showed a very highly significant difference. The Pearson's correlation test in all skeletal patterns showed a very highly significant positive correlation among " S-N, S-A & S-B Length " and among " NSA, NSB & ASB angles", however highly predictable regression equations in the three skeletal patterns were found for the first time in Iraq between " NSB & NSA angles ".

Conclusions: The introduction of valid predictable equations for the first time that can assess the relation between Sella Turcica and anterior facial skeleton in Iraqi sample.

Keywords: Sella Turcica, Anterior facial skeleton and predictable equation. (J Bagh Coll Dentistry 2012;24(1):101-110).

INTRODUCTION

The Clinicians should be familiar with the normal radiographic anatomy and morphologic variability of this area, in order to recognize and investigate deviations that may reflect pathological situations, even before these become clinically apparent [1-3].

The sella turcica is an anthropometric landmark commonly used by orthodontists for radiographic cephalometric analysis as a part of orthodontic treatment management[4], in addition to that, one of the most commonly used cranial landmarks for cephalometric tracing is sella point. This point is located in the centre of the sella turcica, with the turcica housing the pituitary gland in the cranial base. This gland lies within the pituitary fossa and consists of the anterior lobe (adenohypophysis), the intermediate lobe, and the posterior lobe. Any abnormality or pathology in the gland could manifest from an altered shape of the sella turcica, to a disturbance in the regulation of secretion of glandular hormones; prolactin, growth hormones, thyroid-stimulating hormone, follicular stimulating hormone, etc.[5].

The sella turcica is a structure readily recognized on lateral cephalometric radiographs and routinely traced for cephalometric analysis. This makes it a good source of additional diagnostic information related to pathology of the hypophysis, or to various syndromes that affect the craniofacial region[6].

MATERIALS AND METHOD

The Sample: The sample of this study included pretreatment digital lateral cephalometric radiographs of patients attended the orthodontic department of College of Dentistry/Baghdad University prior to receiving any orthodontic treatment and some students of the same college. Out of 174 subjects examined, only 138 subjects (66 males and 72 females) met the following inclusion criteria's:

Iraqi Arab subject their age from 18-30 years; a clinically harmonious and symmetrical face; no previous orthodontic treatment or orthognathic surgery; full set of permanent teeth excluding permanent third molar; no craniofacial disorder such as cleft palate and no history of facial trauma.

Distribution of the Sample: According to cephalometric analysis, the total sample 138 radiographs was divided into three major categories on the bases of anther-posterior skeletal variations depending on ANB angle value [7].

(1) MSc student, dep. of Orthodontics, collage of dentistry, university of Baghdad
(2) Assistant professor, dep. of Orthodontics, collage of dentistry, university of Baghdad

Table 1: General Distribution of the Sample according to ANB angle

Skeletal patterns	Male	Female	Total
Skeletal Class I (ANB 2°- 4°)	25	29	54
Skeletal Class II (ANB > 4°)	27	32	59
Skeletal Class III (ANB < 2°)	14	11	25
Total	66	72	138

The Instruments:

Kidney dish; dental mirrors; cotton wool; disposable gloves; disinfectant agent (Spirit 75%) and sterilizer (Memmert, Germany).

The Equipment:

X-ray Machine: The lateral radiographs were taken in the Orthodontic Department, College of Dentistry, University of Baghdad, using PLANMICA PROMAX with DIMAX 3 Digital X-Ray Unit System Machine (FIN-00880, Helsinki, Finland).

Analyzing Equipment

1. Hardware:

•**I.** Core 2 Due Dell portable computer.

•**II.** Mass Storage Device/ USB ported (RAM=512 megabyte).

2. Software:

• AutoCAD 2008 program (version B.51.0 (UNICODE)).

Method:

Clinical Examination:

Each subject was seated on the dental chair, then information's about name, age, history of facial trauma and orthodontic treatment or surgery were taken from him, after that the subject was clinically examined extra-orally by inspection to check for obvious face asymmetry, the occlusion of the subject was also examined to check for any deviation of the mandible on closing and opening. Intraoral examination was done to check his / her fulfillment of the required sample selection criteria.

The Radiographic Techniques:

For each subject extra-oral radiograph was taken with PLANMICA PROMAX with DIMAX 3 DIGITAL X-Ray UNIT SYSTEM Machine, which was the true lateral cephalometric view. This view was taken for each subject at centric occlusion, the subject's head is placed between the two ear posts and faced the nasal positioner; the nasal positioner touched the subject's head at the Nasion point and the angle of the subject's head adjusted until the Frankfort plane became horizontal. The exposure value was 68 kV and 5 mA in case of adult female, 70 kV and 5 mA in case of adult male and 72 kV and 5 mA in case of large adult male [8].

Cephalometric Landmarks & Measurements:

Cephalometric Bony Landmarks (Figure 1): The cephalometric bony landmarks, which were used in this study, include the followings:
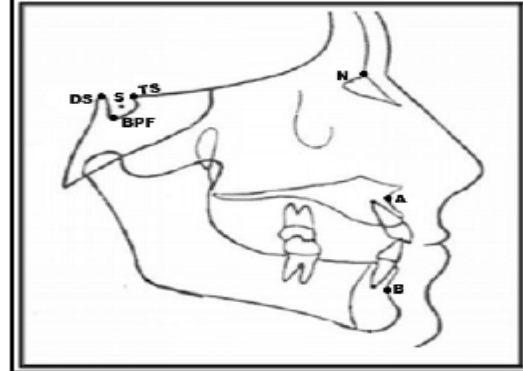
Figure 1: Cephalometric bony landmarks.

1. **Point(S) Sella:** The center of the shadow of the sella turcica[9-10].
2. **Point (N) Nasion:** The most anterior point of nasofrontal suture in the midsagital plane. [10-12].
3. **Point (A) Subspinale:** The deepest midline point in the curved bony outline from the base to the alveolar process of the maxilla, at the deepest point between anterior nasal spine and prosthion [12].
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 (Infradentale) and pogonion [12].
5. **Point (TS) tuberculum sellae:** Anterior boundary of the sella turcica [13].
6. **Point (DS) dorsum sellae:** The most posterior point on the internal contour of the Sella Turcica [14].
7. **Point (BPF) Floor of Sella Turcica:** the lower most (deepest) point on the internal contour of the Sella Turcica[14].

Cephalometric planes:

The following cephalometric planes were determined:

1. **Sella-Nasion (SN) plane:** it is the anteroposterior extent of anterior cranial base[12].
2. **N-A line:** Formed by a line joining Nasion and point A [9].
3. **N-B line:** Formed by a line joining Nasion and point B [9].

Angular Measurements (Fig. 2):

The following cephalometric angles were measured:

1- According to **Rakosi** [12] the following angles were used:

- **A- SNA angle:** It is the anteroposterior position of maxilla relative to the anterior cranial base.
- **B- SNB angle:** It is the anteroposterior position of mandible relative to the anterior cranial base.
- **C- ANB angle:** It is the relative anteroposterior position of the maxilla to the mandible; it represents the difference between SNA and SNB angles.

2- The angles that introduced by the authors:
- **A- NSA angle:** It is the relative anteroposterior (mostly vertical) position of the maxilla to the anterior cranial base; it represents the position of maxilla relative to the Sella Turcica.
- **B- NSB angle:** It is the relative anteroposterior (mostly vertical) position of the mandible to the anterior cranial base; it represents the position of mandible relative to the Sella Turcica.
- **C- ASB angle:** It is the relative anteroposterior (mostly vertical) position of the maxilla & mandible to the Sella Turcica.

Linear Measurements
The following linear measurements were used:
The antero-posterior position of sella turcica was determined by measuring the following:
- **A) S-N Length:** the distance from S to N points [12].
- **B) S-A Length:** the distance from point **S** to point **A (Introduced by the authors)**.
- **C) S-B Length:** the distance from point **S** to point **B (Introduced by the authors)**.
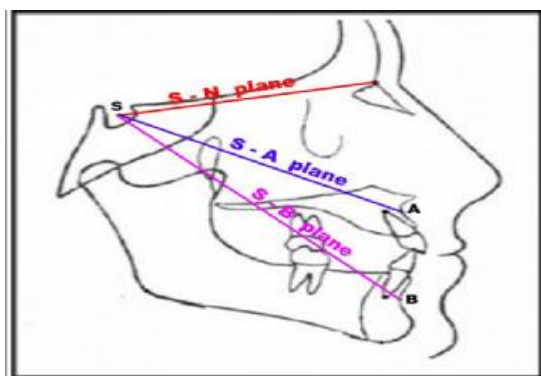

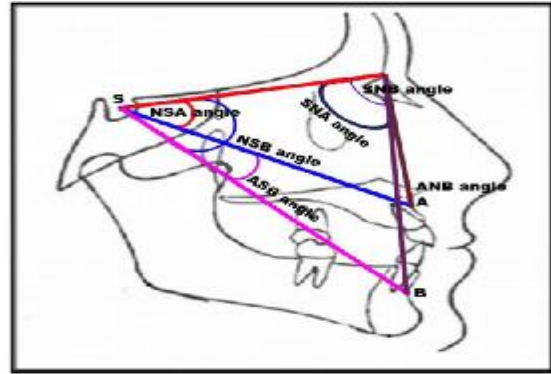**Figure 2: Cephalometric angular measurements**

Figure 3: Cephalometric Linear measurements

Digitization:
The cephalometric radiograph when taken from the computer of the x-ray unit system via the mass storage devices to the personal Computer would be saved as16-8 bit TIFF images which required the use of adobe Photoshop program to be adjusted to the auto contrast level and to mode of 8-bit TIFF and be readable to the AutoCAD 2008 program, then the 8-bit TIFF image opened by the AutoCAD 2008 program in which we start to locate the points and planes on the image by using AutoCAD program tools depending on the definition of each point & measurements and then separately measures the linear and angular measurements for each lateral cephalogram & this reduces the subjectivity of the measurements. Every lateral cephalometric radiograph was analyzed by AutoCAD program to every lateral cephalometric radiograph was analyzed by AutoCAD program to measure the **"NSA; NSB; ASB and ANB"** angles. The **"ANB"** angle indicates the magnitude of the skeletal jaw discrepancy, regardless of which jaw is at fault (as mentioned previously in the sample distribution).

After classifying the sample according to the skeletal patterns, three angular and three linear measurements was recorded for each radiograph. All measurements were put in excel sheet for the whole sample (each class separately); angular measurements were taken directly, while linear measurements were divided by scale for each picture to overcome magnification factor (the ruler of the nasal positioner used to calculate the magnification factor).

Calibration Procedure:
This procedure was undertaken to assess the validity of the measurements (landmarks, planes and angles) Ten randomly selected cephalometric radiographs were analyzed by the same operator with one month interval between the two examinations, **(Intra-examiner Calibration)** to avoid memory bias, and by second examiner with adequate experience **(inter-examiner**

calibration) to assess the accuracy of whole procedure starting from importing the image to AutoCAD program; landmarks identification; drawing the planes; measuring the angular and linear parameters and correction of magnification ,as following:

The results of intra-examiner and inter-examiner calibration of parametric data using paired t-test showed statistically no significant difference for all variables at 0.05 probability level **(Table 2)**.

Table 2: Intra-examiner and inter-examiner calibration of parametric data using paired t-test.

Variables	Intra-examiner calibration (N=10, d.f.=9)			Inter-examiner calibration (N=10, d.f.=9)		
	Mean difference	t-test	p-value	Mean difference	t-test	p-value
S-N Length	-0.17	-1.330	.216 (NS)	-0.178	-1.155	.278 (NS)
S-A Length	-0.089	-0.454	.661 (NS)	-0.588	-1.288	.230 (NS)
S-B Length	.050	.2000	.846 (NS)	-0.766	-1.968	.081 (NS)
SNA angle	.10	.4290	.678 (NS)	.20	1.500	.168 (NS)
SNB angle	.10	.4290	.678 (NS)	.10	.5570	.591 (NS)
ANB angle	-0.1	-0.42	.67 (NS)	-0.1	-0.429	.678 (NS)
NSA angle	-0.1	-0.429	.678 (NS)	-0.2	-1.000	.343 (NS)
NSB angle	-0.2	-0.802	.443 (NS)	-0.3	-1.406	.193 (NS)
ASB angle	0.1	1	.34 (NS)	.20	.3910	.705 (NS)

Statistical Analysis: All the data of the sample were subjected to computerized statistical analysis using SPSS version 15 (2006) computer program. The statistical analysis included:

I. Descriptive Statistics: Includes Mean value; Standard deviation; Percentage and Statistical tables.

II. Inferential Statistics: Includes

1. **Paired t-test**: for intra-examiner, and inter-examiner calibration.
2. **ANOVA** (Analysis of Variance): done for the main study to compare the skeletal linear, angular measurements between different skeletal patterns
3. **LSD test** for variables that show significant differences among the study groups in ANOVA test.
4. **Independent t-test:** used to examine the gender difference of linear and angular measurement in each skeletal pattern.
5. **Pearson's correlation coefficient:** was performed between different measurements in the three skeletal patterns.
6. **Regression correlation** was performed to obtain the practically predictable equation.

In the statistical evaluation, the following levels of significance were used: P values of 5% and more were regarded as statistically insignificant where as values less than 5% (p<0.05) were considered as significant and those values less than 1% (p<0.01) were considered as highly significant and p value of 0.001 or less were considered as very highly significant .

RESULTS

1- Descriptive Statistics and gender differences of linear and angular measurements in different skeletal patterns: Table (4, 5 and 6) showed the descriptive statistics of linear and angular in skeletal I ;II and III, and by using independent t-test we found the followings:

a- S-N; S-A and S-B lengths: There were very highly significant gender differences regarding all those measured lengths in all the skeletal patterns.

b- NSA, NSB and ASB angles**:** There were no significant gender differences regarding all those angular measurements in all the skeletal patterns.

2- Comparison between different skeletal patterns: Table (7) showed a comparison of different linear and angular measurements for total sample in different skeletal patterns was done by using ANOVA test and table (8) a comparison between each two skeletal classes was done by using LSD and as followings:

A- Linear measurements of (S-N, S-A and S-B Length): The mean values of " S-N Length " was higher in Skeletal I followed by Skeletal III and then Skeletal II, while the mean values of " S-A Length " was higher in Skeletal II followed by Skeletal I and then Skeletal III and finally the mean values of " S-B Length " was higher in Skeletal III then Skeletal I and followed by Skeletal II. One way analysis of variance (ANOVA) showed a very highly significant difference in (S-B Length) (F=13.37,

P=0.000***), while the other measurements showed no significant differences among the three skeletal patterns.

Then the least significant difference (LSD) test was performed to compare between each two skeletal classes, and showed that there was a very highly significant difference in " S-B Length " between skeletal II and class III (P=000***), while between skeletal I and skeletal III there was a highly significant difference (P=0.002**). In addition to that, there was a significant difference in "S-B Length" between skeletal I and skeletal II (P=0.013*).

B-Angular measurements (NSA, NSB and ASB angle): The mean value of " NSA angle " was higher in Skeletal III followed by Skeletal I and then Skeletal II, while the mean values of " NSB angle and ASB angles " were higher in Skeletal II followed by Skeletal I and then Skeletal III. One way analysis of variance (ANOVA) showed a very highly significant difference in "ASB angle" (F=26.96, P=0.000***), while the other angular measurements showed no significant differences among the three skeletal patterns.

The least significant difference (LSD) test was performed to differentiate between each two skeletal classes, and showed that there was a very highly significant difference in **" ASB angle "** between skeletal I and class II **(P=0.000***)** & also between skeletal II and class III **(P=0.000***).**

Table 4: Descriptive statistics and gender difference for different measurements in skeletal class I .

Variables	Total (n=54)				Males (n= 25)				Females (n= 29)				Gender difference d.f.=52	
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	t-value	p-value
S N Length	68.57	3.29	60.51	75.92	70.2	3.68	60.51	75.92	67.17	2.12	63.64	71.66	3.77	.000***
S-A Length	83.09	4.11	72.65	92.74	86.16	3.08	80.94	92.74	80.44	2.87	72.65	87.87	7.06	.000***
S-B Length	106.83	5.76	97.20	117.98	111.46	3.85	105.19	117.98	102.85	3.85	97.20	111.43	8.23	.000***
NSA angle	41.59	2.76	37	49	41.48	3.14	37	49	41.69	2.45	37	49	-0.28	.784 NS
NSB angle	60.43	3.74	54	71	60.08	4.60	54	71	60.72	2.84	56	69	-0.63	.533 NS
ASB angle	18.83	1.81	15	25	18.52	1.98	15	22	19.07	1.75	17	25	1.08	.285 NS

The angular measurements were in degrees and the linear were in mm , *** = very highly significant

Table 5: Descriptive statistics and gender difference for different measurements in skeletal class II.

Variables	Total (n=59)				Males (n= 27)				Females (n= 32)				Gender difference d.f.=57	
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	t-value	p-value
S-N Length	68.36	3.71	62.17	78.33	70.89	2.92	64.93	78.33	66.23	2.88	62.17	71.61	6.17	.000***
S-A Length	83.45	4.54	74.47	93.24	86.97	3.44	78.63	93.24	80.48	2.95	74.47	85.35	7.80	.000***
S-B Length	104.19	5.02	92.02	116.16	107.77	3.74	101.69	116.16	101.16	3.85	92.02	108.77	6.66	.000***
NSA angle	40.76	3.07	33	48	40.48	3.36	33	48	41.00	2.84	36	47	-0.64	.523NS
NSB angle	61.90	4.47	52	76	61.52	5.22	52	76	62.22	3.77	55	71	-0.6	.553NS
ASB angle	21.14	2.32	17	28	21.19	2.65	17	28	21.12	2.12	18	27	0.1	.923NS

The angular measurements were in degrees and the linear were in mm, *** = very highly significant
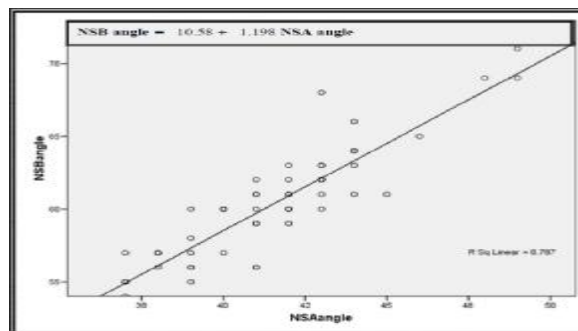

Figure 4: shows scatter diagrams, regression lines, and regression equations of "NSB angle" versus "NSA angle" in skeletal I pattern.

Table 6: Descriptive statistics and gender difference for different measurements in skeletal class III .

Variables	Total (n=25)				Males (n= 14)				Females (n= 11)				Gender difference d.f.=23	
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	t-value	p-value
S-N Length	68.41	3.87	61.49	73.88	71.21	2.17	66.48	73.88	64.84	2.19	61.49	69.05	7.26	.000***
S-A Length	81.28	4.62	71.00	87.71	83.72	3.32	76.18	87.71	78.16	4.23	71.00	87.01	3.68	.001***
S-B Length	111.04	6.44	99.73	126.50	113.83	4.9	105.93	126.5	107.49	6.61	99.73	122.32	2.76	.001***
NSA angle	41.88	2.587	36	46	42.36	2.44	39	46	41.27	2.76	36	46	1.04	.308 NS
NSB angle	59.88	4.136	53	67	60.43	3.9	53	66	59.18	4.51	53	67	0.74	.466 NS
ASB angle	18	2.06	13	22	18.00	1.66	14	20	17.64	2.34	13	22	0.46	.653 NS

The angular measurements were in degrees and the linear were in mm, *** = very highly significant

Table 7: Comparison among the three skeletal patterns in total sample.

variables	Skeletal Class I (n=54)		Skeletal Class II (n=59)		Skeletal Class III (n=25)		ANOVA test d.f.= 2	
	Mean	SD	Mean	SD	Mean	SD	F-value	p-value
S-N Length	68.57	3.29	68.36	3.71	68.41	3.87	0.05	.951 NS
S-A Length	83.09	4.11	83.45	4.54	81.28	4.62	2.21	.113 NS
S-B Length	106.83	5.76	104.19	5.02	111.04	6.44	13.37	.000***
NSA angle	41.59	2.76	40.76	3.07	41.88	2.59	1.82	.165 NS
NSB angle	60.43	3.74	61.90	4.47	59.88	4.14	2.82	.063 NS
ASB angle	18.83	1.81	21.14	2.32	18	2.06	26.96	.000***

The angular measurements were in degrees and the linear were in mm, *** = very highly significant

Table 8: Significant level between each two skeletal classes in Total sample (LSD)

Variables	Class I- Class II		Class I- Class III		Class II- Class III	
	Mean difference	p-value	Mean difference	p-value	Mean difference	p-value
S-B Length	2.65	0.013 *	−4.2	0.002**	−6.85	0.000***
ASB angle	−2.3	0.000***	0.83	0.101 NS	3.13	0.000***

*= significant , **=highly significant ,*** = very highly significant

3- Pearson's Correlation in different skeletal patterns.

The Pearson's Correlation of the linear measurement **"S-N, S-A, & S-B Length"** and of angular measurements **"NSA, NSB, & ASB angles"** showed a very highly significant positive correlation with each other in all skeletal patterns **(Table 9 and 10).**

Table 9: Correlation of "S-N, S-A & S-B Length" with each other in different skeletal patterns.

Skeletal patterns	Variables		S-B Length	S-A Length
Skeletal Class I	S-N Length	r	.615	.685
		p-value	.001***	.000***
	S-A Length	r	.791	/
		p-value	.000***	/
Skeletal Class II	S-N Length	r	.643	.816
		p-value	.000***	.000***
	S-A Length	r	.845	/
		p-value	.000***	/
Skeletal Class III	S-N Length	r	.647	.832
		p-value	.000***	.000***
	S-A Length	r	.720	/
		p-value	.000***	/

*= significant , **=highly significant ,*** = very highly significant

Table 10: Correlation of "NSA, NSB & ASB angles" with each other in different skeletal patterns.

Skeletal patterns	Variables		ASB angle	NSB angle
Skeletal Class I	NSA angle	r	.615	.887
		p-value	.001***	.000***
	NSB angle	r	.719	/
		p-value	.000***	/
Skeletal Class II	NSA angle	r	.720	.876
		p-value	.000***	.000***
	NSB angle	r	.747	/
		p-value	.000***	/
Skeletal Class III	NSA angle	r	.615	.914
		p-value	.001***	.000***
	NSB angle	r	.870	/
		p-value	.000***	/

4- Regression Correlation (prediction equations):

Depending on the value of Pearson's correlation coefficient (r), the followings valid regression equation of **"NSB angle"** versus **"NSA angle"** among the three skeletal patterns were found:

A- In skeletal class I. (Fig.4)

The regression lines show that as the **"NSB angle"** increases by **"1°"**, the "**NSA angle"** increased by **"1.198 °".**

B- In skeletal class II. (Fig.5)

The regression lines show that as the **"NSB angle"** increases by **"1°",** the **"NSA angle"** increased by **"1.27 °".**

C- In skeletal class III. (Fig. 6)

The regression lines show that as the **"NSB angle"** increases by **"1°",** the **"NSA angle"** increased by **"1.45 °".**
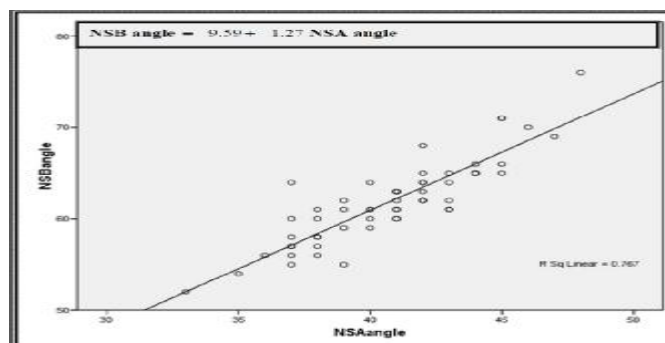

Figure 5: shows scatter diagrams, regression lines, and regression equations of "NSB angle" versus "NSA angle" in skeletal II pattern.
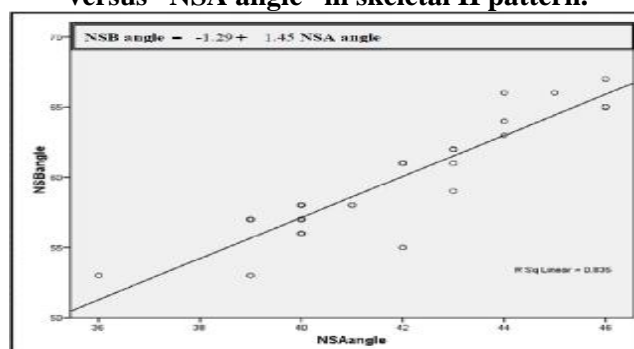

Figure 6: **shows scatter diagrams, regression lines, and regression equations of "NSB angle" versus "NSA angle" in skeletal III pattern.**

DISCUSSION

A- Linear measurements of (S-N, S-A & S-B Length):

In all skeletal patterns the mean value of linear measurements "S-N, S-A & S-B Length" showed very highly significant differences between gender, being larger in males than in females

,table (4,5, &6), these findings indicates that the craniofacial structures are larger in males than in females, may be due to the effect of sex hormones on the formation of facial contour that leads to these differences between males and females and become very evident by adolescence. (the male bony structure is bolder, more prominent, with dominance of the forehead, nose, chin and stronger contour of the mandible), this came to be in agreement with the finding of **Baccettia et al.**[15] and also supported by the finding of **Johannsdottir et al.**[16] and **Moldez et al.**[17] who concluded that the males have larger head than females.

On the other hand, **table (7)** showed that, the mean values of **"S-N Length"** found to be comparable among different skeletal patterns with a non significant difference among them, whereas the mean values of **"S-A Length"** found to be comparable between Skeletal I & II, while in Skeletal III it was the least length with no significant difference among the different skeletal patterns**.**

Regarding the mean value of **"S-B Length"** its found to be higher in Skeletal III than other skeletal patterns, while it was the least length in skeletal II while in skeletal I it was in between, with a very highly significant difference among the different skeletal patterns by using ANOVA test.
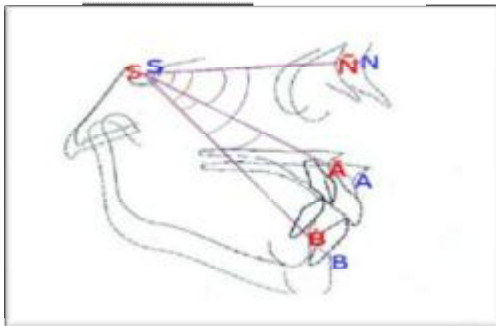

Fig. 7: The blue color points represent (A, B & N points) in males, while the red color points represent (Ā,   & Ñ points) in females.

Therefore, the **"S-B Length"** (which represent the anterio-posterior position of the mandible relative to the sella turcica) showed more effective role on the patient profile anterio-posteriorly than the effect of the **"S-A Length"** (which represent the antero-posterior position of the maxilla relative to the sella turcica), so the mandibular length and position concluded to be the most effective portion of the anterior facial skeleton which should be taken in consideration when we determine the line of treatments in different skeletal patterns, this came to be in agreement

with **Battagel**[18] who concluded that the mandibular discrepancy (both in length and position) is the primarily responsible for the Class III malocclusion and with **Enlow**[19] found that the class II has smaller mandible, but partially supported by **Proffit and White**[20] **and McNamara**[21] who mentioned that the main cause of skeletal class III discrepancy is maxillary retrognathy and mandibular prognathism.

B- Angular measurements (NSA, NSB and ASB angles):

The "NSA, NSB & ASB angles" represent the sagittal (mostly vertical) relation between the cranial base (represented by the sella turcica) and the anterior facial skeleton (represented by the anterior border of maxilla -A point-; mandible -B point- and nasofrontal suture -N point-), in addition to the relation among the anterior facial skeleton components, in the present study these angles showed a non significant differences between males and females ,table (4,5 &6), this may be explained by the following: although the craniofacial structures are larger in males, but the increase in the size is kept in harmonious manner therefore there were no differences found in angles between males and females, figure (9), however this came to be in contrast with the finding of **Shalhoub et al.**[22], **Ali**[23], **AL-Sahaf**[24] who found that the facial angles were higher in females than in males. The difference may be due to the difference in the age and in the criteria of the angles used in the present study and their studies as these angles "NSA, NSB & ASB" are used for the first time in the present study**.**

On the other hand, table (7) showed that, the mean values of **"NSA and NSB angles"** were found to be comparable among different skeletal patterns with no significant difference among them**.**

The **ASB angle** represents the relation of the maxilla and mandible relative to the Sella Turcica to a large extent in vertical plane & to a less extent in antero-posterior horizontal plane**.**

The **"ASB angle"** was higher in skeletal II (**mean=21.14°**) than skeletal I (**mean=18.83°**) and both of them were higher than that of skeletal III (**mean=18°**)**,** with a very highly significant difference among the different skeletal patterns by using ANOVA test and this may be explained by the followings:

1-Skeletal II as seen in the (**figure 10**) they occur either when **point A** (pink color) was more forward than in skeletal class I, or the **point B** (pink color) was more backward than in skeletal class I or both of them, so the **ASB angle** expected to be larger in skeletal class II than skeletal class I.
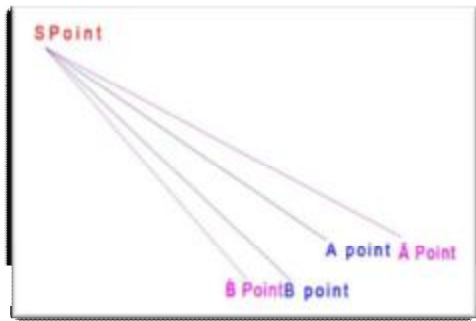
Figure 8: The blue color lines represent the maxilla (A) & mandible (B) relative to Sella Turcica in CL.I, while the pink color lines represent the maxilla (Ā) & mandible ( ) relative to Sella Turcica in CL.II.

2- Skeletal class III as seen in the **(figure 11)** they occur either when **point A** (pink color) was more backward than in skeletal class I, or the **point B** (pink color) was more forward than in skeletal class I or both of them, so the **ASB angle** expected to be smaller in skeletal class III than skeletal class I.
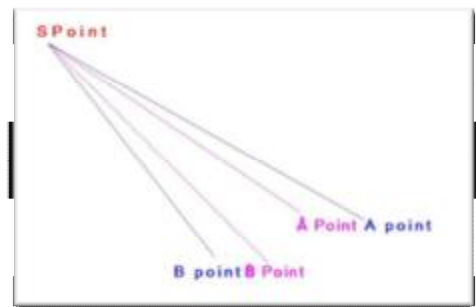

Figure 9: The blue color lines represent the maxilla (A) & mandible (B) relative to Sella Turcica in CL.I, while the pink color lines represent the maxilla (Ā) & mandible ( ) relative to Sella Turcica in CL.III.

C- Regression Correlation (prediction equations).

The reasons for selection the prediction regression equation that predict the "NSB angle" depending on "NSA angle" in different skeletal patterns to be the most important practically predictable equations are:

1- NSB angle represent the relation of mandible to anterior cranial base (mostly vertically and to a less extent antero-posteriorly), the prediction of this angle occur depending on the value of most important angle that is "NSA angle" that relate the maxilla to the anterior cranial base, so combining the variables present in both angle "NSB & NSA angles", we found that this prediction equation will give us an important relations among point "A, B & N" with the sella turcica considered to be in the center of all relations obtained.

2- The validity of these equations chosen depending on the following criteria:
Vardimon and Lambertz [25] chose " r " to get valid practically regression equation, it should be higher than " 0.7 ", while **Betzenberger et al.** [26] divided the validity of " r " into:

$|r| < 0.04$ * Weak correlation
$|r| = 0.4 – 0.8$ ** Moderate correlation
$|r| > 0.8$ *** Strong correlation

So to increase the validity of obtained regression equations in the present study, we selected only the equations with " r " more than " 0.8 " to get highest valid practical prediction equation.

3- Applicable in different skeletal patterns (I, II & III).

4- Applied for both genders as we extracted the equations from a data of total sample .

5 - There were no similar regression equations in Iraq or even in other populations regarding these important variables "NSB & NSA angles" in different skeletal patterns.

REFERENCES

1- Friedland B, Meazzini M C. Incidental finding of an enlarged sella turcica on a lateral cephalogram. Am J Orthod Dentofac Orthoped 1996; 110: 508–12.

2- 2-Feldkamp J, Santen R, Harms E, Aulich A, Mödder U, Scherbaum W A. Incidentally discovered pituitary lesions: high frequency of macroadenomas and hormone-secreting adenomas — results of a prospective study. Clin Endocrin 1999; 51: 109–13.

3- Alkofide E .Pituitary adenoma: a cephalometric finding. Am J Orthod Dentofac Orthop 2001; 120: 559–62.

4- Cederberg RA, Benson BW, Nunn M, English JD. Calcification of the interclinoid and petroclinoid ligaments of sella turcica: a radiographic study of the prevalence. Orthod Craniofac Res 2003; 6: 227–32.

5- Pisaneschi M, Kapoor G. Imaging of the sella and parasellar region. Neuroimaging Clinics of North America 2005; 15: 203 – 19.

6- Andredaki M, Koumantanou A, Dorotheou D, Halazonetis DJ. A cephalometric morphometric study of the sella turcica. Eur J Orthod 2007; 29: 449–56.

7- Foster TD. A textbook of orthodontics. Oxford: Blackwell Scientific publications, 1985.

8- User's manual. ProMax Ceph with Dimax 3. Publication number 10007327, version 6; 2004, 1-44.

9- Downs WB. Variations in facial relationships, their significance in treatment and prognosis. Am J Orthod 1948; 34:812-40.

10- Steiner CC. Cephalometric for you and me. Am J Orthod 1953; 39:729-55.

11- Rickett's RM. Cephalometric synthesis. Am J Orthod 1960; 46:647-73.

12- Rakosi T. An atlas and manual of cephalometric radiography. Wolf Medical Publication. Great Britain. 2nd ed, 1982.

13- Salzmann JA. Practice of orthodontics (Vol. 1). 1st ed. Philadelphia and Montreal, JB Lippincott Co, 1966.

14- Athanasiou EA. Orthodontic cephalometry. Mosby Wolfe, London, 1995.

15- Baccettia T, Reyes BC, McNamara JA Jr. Gender differences in Class III malocclusion. Angle Orthod 2005; 75(4): 510–20.

16- Johannsdottir B, Thordarson A, Magnusson TE. Craniofacial skeletal and soft tissue morphology in Iceland adults. Eur J Orthod 2004; 26 (3): 245-50.

17- Moldez MA, Sato K, Sugawara J, Mitani H. Linear and angular Filipino cephalometric norms according to age and sex. Angle Orthod 2006; 76(5): 800-5.

18- Battagel J. The aetiological factors in Class III malocclusion. Eur J Orthod 1993; 15: 347-70.

19- Enlow DH. Principles of cephalometric analysis, in Ranly DM. Asynopsis of craniofacial growth.1980; ch 9, 167-75.

20- Proffit WR, White RP. Surgical orthodontic treatment. Mosby Co, 1991.

21- McNamara JA. A method of cephalometric evaluation. Am J Orthod 1984; 86: 449 – 69.

22- Shalhoub SY, Sarhan OA, shaikh HS. Adults cephalometric norms for Saudi Arabians with a comparison of values for Saudi and North Americans Caucasians. Br J Orthod 1987; 14: 273 - 9.

23- Ali FA. Skeletodental characteristics of some Iraqi children at nine & ten years of age, cephalometric study. A master thesis, Orthodontic Department, Baghdad University, 1988.

24- Al-Sahaf NH. Cross- sectional study of cephalometric standards and associated growth changes. A master thesis, Orthodontic Department, University of Baghdad, 1991.

25- Vardimon DA, Lambertz W. Statistical evaluation of torque angles in reference to straight-wire appliance (SWA) theories. Am J Orthod 1986; 89 (1): 56-66

26- Betzenberge D, Ruf S, Pancherz H. the compensatory mechanism in high-angle malocclusion: a comparison of subject in the mixed & permanent dentition. Angle Orthod 1999; 69(1): 27-32.