Assessment of Skeletal and Dental Pattern of the Mandible of Class II Division 1 Malocclusion.
[A Comparative Cephalometric Study]

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Abstract:

Class II division 1 malocclusion represents the most common skeletal discrepancy which orthodontists see in daily practice. The understanding the morphology of the mandible is a key element in diagnosis and treatment planning in the field of orthodontics and orthoganathic surgery. This study provides new information about the skeletal and dental pattern of the mandible with class II division1, based on skeletal II for Iraqi adult sample aged (18 - 26) years in comparison with normal occlusion by means of cephalometric measurements used by clinical practitioners. (20) males and (21) females with a skeletal Class II were chosen and compared with (26) males and (28) females with normal occlusion by using the (ANB) angle. Nine angular measurements and eight linear measurements have been used in this study and the results were as follows: When the angular and linear measurements of skeletal class I and II overall ,males and females samples were compared, the retrusion of mandible with a short length of the ramus and a tendency of a backward rotation of the mandible in relation to the cranial base in skeletal class II are the most important causes of class II malocclusion with the facial profile is more convex in skeletal class II overall and males samples while, all the angular and linear measurements used in this study show no significant difference between skeletal class I and II females, except the facial profile is more convex in skeletal class II females sample. The lower incisors is more procline in class II than in class I overall sample but this difference is not statistically significant in males and females sample. No significant difference could be noted between sexes of skeletal class II in the angular measurements. Most linear measurements were larger in males than in females class II division 1 except for two measurements the posterior cranial base length and the length of the body of the mandible show no significant difference between class II division 1 males and females.

الخلاصة:

الصنف الثاني قسم الاول من سوء الاطباق يُمثّلُ التعارض الهيكليَ الأكثر شيوعاً الذي يَراه اختصاصي تقويم الاسنان في الممارساتهم اليوميةِ. فَهْم شكل الفَكِّ السفلي هو عنصر رئيسي في التشخيصِ وخطة المعالجةِ في حقلِ تقويم الأسنانِ والجراحة التجميلية. تُزوّدُ هذه الدراسةِ معلومات جديدةً حول النمط الهيكلي و الأسنانِ للفكّ السفلي للصنفِ الثّاني قسم الاول للصنف الهيكلي الثّاني لعيّنةِ العراقيين البالغين بعمرِ (١٨ - ٢٦) سَنَوات بالمقارنة بالاطباقِ الطبيعي بواسطة المقاييسِ الإشعاعية القياسية للرأس المستعملة من قبل الممارسين السريريين. (٢٠) ذكور و(٢١) إناث للصنف الهيكلي الثّاني إخترتْ وقُارنتْ مَع (٢٦) ذكور و(٢٨) إناث لصنف الاطباقِ الطبيعي بإستعمال زاوية (ANB). تسعة مقاييسِ زاويةِ وثمانية مقاييسِ خطيّةِ إستعملتْ في هذه الدراسةِ والنّتائج كَانتْ كالتّالي: عندما قُورنتْ المقَاييس الزاوية والخطيّة للصنفِ الهيكلي الاول والثّاني عموماً، عينات الذكور والنساء ، ارتداد الفَكِّ السفلي مَع قصر طول ramus و ميل للدوران الخلفي للفكّ السفلي بالعلاقة مع القاعدةَ القحفية في الصنفِ الهيكلي الثاني هي الأكثر الأسبابَ أهميةً والمؤدية لصنفِ سوء الاطباق الثّاني مع الجانبية ألوجهية أكثرُ تحدّباً في الصنفِ الهيكلي الثّاني للعينات العامّة والذكور بينما، كُلّ المقاييس الزاوية والخطيّة إستعملتْ في هذا الدراسةِ **لا** إختلافَ هامَّ بين الصنفِ الهيكلي الأول والثاني إناث، ماعدا الجانب ألوجهي أكثر محدّبةً في الصنفِ الهيكلي الثّاني للعينات النسائية. إنّ القواطعَ السفلية procline أكثر بروزا في الصنفِ الثّاني مِنْه في الصنفِ الاول للعينةُ عموماً لكن هذا الإختلافِ

لَيسَ هامَّ بشكل إحصائي في العيناتِ الذكورِ والنساء. لا إختلافَ هامَّ يُمْكِنُ أَنْ يُلاحظَ بين أجناسِ الصنفِ الهيكلي الثّاني في المقاييسِ الزاويةِ. معظم المقاييسِ الخطيّةِ كَانتْ أكبر في الذكورِ مِنْ صنفِ الإناث لسوء الطباق الثّاني قسم الاول ماعدا مقياسي طول القاعدة القحفية الخلفية وطول جسمِ الفَكَّ السفلي لا إختلافَ هامَّ بين ذكورِ وإناث الصنفِ الثّاني القسم الأول.

KEYWORDS:

Mandible; Skeletal II; Angle class II division I; Cephalometry; Iraqi adult; Malocclusion.

Introduction:

Class II division 1 malocclusion represents the most common skeletal discrepancy which orthodontists see in daily practice. The prevalence of class II malocclusion in Iraq is 21% (Kinaan)**1**. (Al-Khannaq)**2** found among 1888 with a percentage of 6.8% come in a relative accordance with (Al- Alousi et al)**3** bout 6.1%., and the percentage of class II division 1 among Iraqis seems to be less than other population when compared to that of (Goose et al.)**4** English; (Haralabanks)**5** Greece; (Bjork)**6** Swedish ; (Altemus)**7** for a Negroes ;and (Brehm and Jackson) **8** USA. The Class II malocclusions have a strong hereditary component as etiologic factor, both in families and in ethnic and racial groups **9**. The findings from the literature review are still inconclusive regarding the dentofacial characteristics of Class II division 1. The opinions of leading orthodontic researchers are controversial **10**. Clinically widely accepted term "skeletal Class II" does not specify whether the mandible is retruded in relation to the maxilla, or whether the maxilla is protruded in relation to the mandible **10** .The Class II division 1 malocclusion is the most frequent in particular clinics, caused, in most times, by a retrognathic mandible, but opinions of orthodontic researchers are controversial about characteristics of Class II malocclusion **11-13**. It has been written in many orthodontic literatures about the components of Class II malocclusion;

Some investigators have reported in their studies the presence of retrognathic mandible, excessive vertical development of the lower face and neutral lower incisor position **11,14**, other investigators showed decreased vertical development of the lower face **10,15-17**, and greater dental protrusion especially of mandibular incisors **18** . Numerous researches have considered the components of Class II malocclusion, with most focusing on patients in the adolescent or adult age. These studies have shown that the term Class II malocclusion is not a single diagnostic entity but rather can result from numerous combinations of skeletal and dentoalveolar components **9,19** (McNamara) **11** concluded that mandibular skeletal retrusion was the most common single characteristicof the Class II sample, where as maxillary skeletal protrusion was not common finding. In contrast, (Rothstein) **13** stated that, "The mandible was most often within the range of normal for size, form and positional characteristics". (Rosenblum) **20** found that 56,6% of subjects with Class II malocclusion had maxillary protrusion and only 26.7% had mandibular retrusion **10**. It is unclear whether malocclusion characterized by jaw discrepancy is caused by variations in mandibular position, mandibular size, or a combination of the two. The mean plots for each of the group were superimposed on S–N and Go–Gn. These showed mandibular form and size to be similar in the Class I and in both divisions of Class II **21**. (Lavelle) **22** was compare mandibular shape derived from lateral cephalometric between class I and class II samples of female patients aged (12–15) years, marked overall similarity was noted between them . According to (Kerr and adams)**23** the Cranial base length correlated strongly with maxillary length but weakly with mandibular length. So that the cranial base size and shape influence mandibular prognathism by determining the anteroposterior position of the condyle relative to the facial profile. According to (Gasgoos et.al)**21** No sex differences were seen in the majority of the linear and angular measurements except for LAFH distance in Class II which were significantly higher in males than in females and for angular measurements: (SN–MP) in Class II was higher in females than in males; (SAr) were higher in class II than in class I overall samples while (SN) demonstrated no significant differences between them; while for dental angular measurements : lower incisor to MP was significantly higher in class II than in class I overall samples.

Aims of this study were to identify the dentoskeletal pattern and features of mandible of class II division 1 malocclusion based on skeletal class II in Iraqi adult sample aged (18-26) years. And to determine the differences between skeletal class I and skeletal class II in overall samples and with in each sex and between males and females skeletal class II by means of cephalometric measurements used in everyday clinical practice.

Materials and Methods :

The sample of this study was selected from orthodontic department in the college of Dentistry and the student of the 4th and 5th classes of college of Dentistry, University of Babylon, 122 Iraqi adult(65 with Class I normal occlusion as control, 57 with Class II malocclusion) were fulfilled of the following criteria.

1) The sample of a class I was selected according to the following specifications.
A) Bilateral class I molar and canine relationships based on Angle classification **24,25**.
B) Normal overbite and overjet (2 – 4 mm) **26**.

2) The sample of a class II division 1 malocclusion was selected according to the following specifications:
A) Bilateral class II molar and canine relationships based on Angle classification **24,25**.
B) Overjet of more than 5 mm **1,27,28,29**.

After taking the cephalometric radiographs and traced we exclude some radiographs on the basis of ANB angles so that: In Class I, ANB angle must be(0– 4°) and in Class II, ANB angle must be(> 4°)**24,30,31** after this selection the sample of (93) were selected as a final size of sample which consisted of 52 skeletal class I (26 males and 26 females) and 41 skeletal class II (20 males and 21 females).

The criteria of total sample selection (class II division 1 and class I) :
1. Full set of permanent dentition excluding third molars.
2. No functional displacement of the mandible during opening and closing.**32**
3. No history of orthodontic treatment or orthognathic surgery.**33**
4. No congenital missing, cleft or other congenital craniofacial problems.**33**
5. Good medical history.**34**
6 .Very mild spacing or crowding (0 – 1 mm) **26,35** .
7 .No history of abnormal habits in oronasal region with normal nasal breath.
8 .No history of facial trauma.
9 .Free of local factors that disturbs the integrity of dental arches (congenital missing teeth; retained Openbite deciduous teeth; supernumerary teeth).
10 .Openbite and class II division 2 were excluded from the sample.
11 .All the subjects are Iraqi in origin, aged (18 - 26) years.
12. All subjects are Iraqi in origin and live in center of Hilla City.

All radiographs were taken in the X– Ray Department of special center of Dentistry, in Hilla city using Dimaxis proline classic Panoramic / Cephalometric imaging system, planmeca Asentajankatu Corporation, Helsinki, Finland. The machine is set at 10 m Amp and 75 Kv with 1.2 sec. impulse. Cephalometric lateral skull radiographs were taken as follows: each subject stood with the head in a natural position with teeth held in centric occlusion with lips in relaxed position under standard conditions. The head was fixed by fitting the ear rods of the cephalostat in the external auditory meatus**36** and a plastic nasal stopper on the bridge of the nose anteriorly. So the final position of the head was obtained with Frankfort Horizontal plane parallel to the floor **37**. The distance from the focus to the mid-sagittal plane and from the film to the mid-sagittal plane are kept constant at 52 and 8 inches respectively **30**. The films were traced on the viewer with the image facing to the right**42**. The radiographs were traced in random order to reduce bias. A sliding caliper was used to measure distances between reference points to a nearest half millimeter. Angular measurements were made to the nearest degree, using cephalometric protractor (ORMCO CORP., GLENDORA, CA 91740-5339), When there were two images of a structure, the reference point was placed at the midpoint between the images. The following landmarks were used in this study as described in (fig. 1&2) and were located by (Rakosi)**41** { Sella(S); Nasion(N); point A(A); point B(B); Pogonion(Pog); Gnathion(Gn); Menton(Me); Gonion(Go); Articulare(Ar); Condylion(Cd) }. In this study, points Po(Porion) and Or(Orbitale) were not used since poor reproducibility has been reported previously **39**.

Seventeen measurements(Nine angular measurements and Eight linear measurements) were obtained from tracing of lateral cephalometric radiographs, (Fig. 1).
The angular measurements include (Angle's measured in degrees) :
1) SNB: Anteroposterior position of the mandible relative to anterior cranial base.**9**
2) ANB: Magnitude of the horizontal skeletal jaw discrepancy between the maxilla and the mandible, obtained by subtracting SNB from SNA.**40**
3) SNPog: Determine the basal position of the mandible. **41**
4) NAPog: Angle of convexity.**42**
5) NSAr: Saddle angle is the angle between the anterior and posterior cranial base.**21**
6) ArGoMe: Gonial angle formed by the mandibular plane and the mandibular ramus plane.**40,43**
7) SN/MP: Cranial base to mandibular plane angle.**26,44**
8) LI/M: The mandibular central incisor to the mandibular plane;{ L1 to the mandibular plane}**9**
9) NSGn: Cranial base to S-Gn angle. Y-axis.**9**

The linear measurements include (Length measured in millimeters) :

1)S-N: The anterior cranial base length.**41**
2) S-Ar: The posterior cranial base length.**41**
3) Ar-Gn: Total mandibular effective length.**36,45**
4) Go–Pog: The length of the body of the mandible. **41,46,47**
5) LAFH: Lower Anterior Facial Height (perpendicular line from the maxillary plane to menton). **48**
6) Ar-Go: Length of the ramus(1st measurement). **41**
7) B-Gn: Anterior border of mandible. **49**

8) Cd-Go: Length of ramus(2nd measurement). **41**

Statistical Analysis:

All statistical calculations were performed with Microsoft Office Excel 2003 and the Statistical Package for the Social Sciences for Windows (SPSS11.0). The statistical analysis includes: Descriptive statistics (mean, standard deviation, minimum and maximum) for all the angular and linear measurements. " T " test was used to determine the significant differences between skeletal class I and II overall samples, skeletal class I and II for both sexes, and males and females class II division and to identify the groups of variables which were responsible for the differences between different skeletal Classes at $p<0.05$.

Method error:

The reliability of the method was tested by tracing and measuring 25 randomly selected lateral cephalograms twice. The estimated error between the measurements was calculated using the Dahlberg's formula. **50**:

$$ME = \sqrt{\sum (d_1 - d_2)^2 / 2(n-1)}$$

Where d1 – first measurement, d2 – second measurement; N – number of patients.
The measurement errors were very small. The error of measurement given in ±2SD of the differences between the repeated measurements ranged between ±0.13and ±1.07 degrees for angular and between ±0.16 and ±0.82 mm for linear measurements. These errors were deemed to have insignificant effect on reliability of the results.

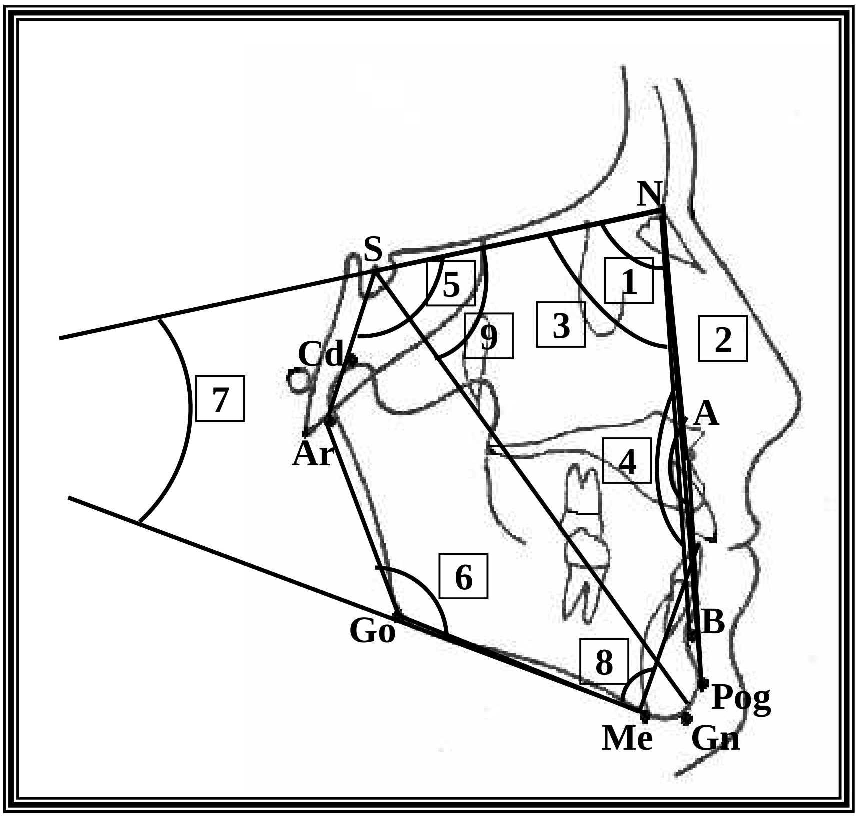

Figure (1): Cephalometric landmarks and Angular measurements(1=SNB; 2=ANB; 3=SNPog.; 4=NAPog; 5=NSAr; 6=ArGoMe; 7= SN/MP; 8= LI/M; 9= NSGn) Angles measured in degrees.

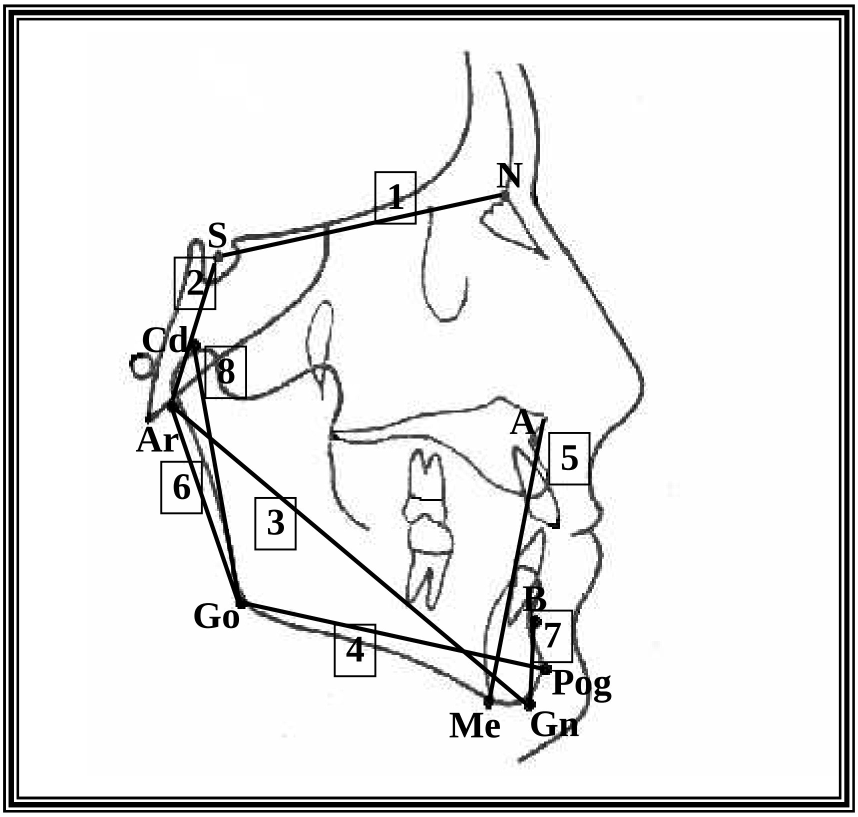

Figure (2): Cephalometric landmarks and linear measurements(1= S-N; 2= S-Ar; 3= Ar-Gn; 4= Go–Pog; 5= LAFH; 6= Ar-Go; 7= B-Gn; 8= Cd-Go) Length measured in millimeters.

Results:

The sample:

The sample of this study is 93 subjects; mean age is 21.65 years consisting of 41 class II division 1 based on skeletal II (20 males and 21 females) mean age is 20.81 years, the mean of the ANB angle is 7.26° and the mean of the overjet is 8.9 mm; and 52 subjects of skeletal class I (26 males and 26 females), mean age is 23.5 years, the mean of the ANB angle is 2.54° and the mean of the overjet is 2.05 mm Table (1).

1) Comparison between overall sample skeletal class I and skeletal class II (angular and linear measurements):

The comparison of the angular measurements between overall skeletal classes I and II demonstrated in Table (2) and Figure (3) indicates that the (SNB) angle, (SNPog) angle and (NAPog) angle in skeletal class II are significantly smaller than that in skeletal class I. the (NSAr) angle, (MP/SN) angle and(L1/MP) angle in skeletal class II are significantly larger than that in skeletal class I, Whereas the (ArGoMe) angle and (NSGn) angle show no significant difference between skeletal class I and II.

The comparison of the linear measurements between overall skeletal classes I and II demonstrated in Table (3) and Figure (4) indicates that no significant difference except in (ArGo) and (CDGo) which is significantly larger in skeletal class I than in skeletal class II.

2) Comparison between skeletal class I and skeletal class II males sample (angular and linear measurements):

The comparison of the angular measurements demonstrated in Table (4) and Figure (5) indicates that the (SNB) angle, (SNPog) angle and (NAPog) angle in skeletal class II are significantly smaller than that in skeletal class I . the (NSAr) angle, (MP/SN) angle in skeletal class II males are significantly larger than that in skeletal class I males, Whereas the (ArGoMe) angle, (L1/MP) angle and (NSGn) angle show no significant difference between skeletal class I and II males.

The comparison of the linear measurements between skeletal classes I and II demonstrated in Table (5) and Figure (6) indicates that no significant difference except in (SAr) and (CDGo) which is significantly larger in skeletal class I than in skeletal class II.

3) Comparison between skeletal class I and skeletal class II females sample (angular and linear measurements):

The comparison of the angular measurements between skeletal class I and II females sample demonstrated in Table (6) and Figure (7) indicates no significant difference between skeletal class I and II except in(NAPog) angle which is significantly larger in skeletal class I than in skeletal class II.

The comparison of the linear measurements between skeletal class I and II females demonstrated in Table (7) and Figure (8) indicates no significant difference in all linear measurements between skeletal class I and II.

4) Comparison between skeletal class II males and females sample(angular and linear measurements):

The comparison of the angular measurements between males and females skeletal class II demonstrated in Table (8) and Figure (9) indicates that there are no significant differences between them.

The comparison of the linear measurements between males and females skeletal class II demonstrated in Table (9) and Figure (10) indicates that the males are in general significantly larger than females in all linear measurements except in tow linear measurements (SAr)and (GoPog) that show no significant difference between the two sexes.

Table (1) Descriptive statistics of the sample ages (18-25years), ANB angle, and overjet

variables	Skeletal class	Mean	S.D.
Age (years)	Class I	23.5	1.17
	Class II	20.81	2.08
ANB angle (Degrees)	Class I	2.54	1.36
	Class II	7.26	2.56
Overjet (mm.)	Class I	2.05	0.59
	Class II	8.93	2.96

Table (2) Descriptive statistics of the angular measurements and P-value between overall sample skeletal class I and II

Variable	Skeletal Class	No.	Mean	Std. Deviation	P-value	Sig *
SNB	CL. I	52	79.64	2.62	0.006	S.
	CL. II	41	75.78	3.91		
SNPog	CL. I	52	81.27	2.97	0.022	S.
	CL. II	41	77.91	4.13		
NAPog	CL. I	52	177.3	2.97	0.000	S.
	CL. II	41	170.2	4.64		
NSAr	CL. I	52	120.6	6.48	0.019	S.
	CL. II	41	126	5.46		
ArGoMe	CL. I	52	123.4	6.95	0.132	N.S
	CL. II	41	126.5	4.68		
MP/SN	CL. I	52	29.73	3.98	0.008	S.
	CL. II	41	35	5.48		
L1/MP	CL. I	52	92.55	6.67	0.044	S.
	CL. II	41	98.7	8.54		
NSGn	CL. I	52	66.27	2.72	0.091	N.S
	CL. II	41	68.7	4.19		

Skeletal Class I (n = 52); Skeletal Class II (n= 41)

*** N.S = not significant ; S = significant at P á 0.05**

Table (3) Descriptive statistics of the linear measurements and P-value between overall sample skeletal class I and II

Variable	Skeletal class	No.	Mean	Std. Deviation	P-value	Sig *
SN	CL. I	52	79.3	4.29	0.87	N.S
	CL. II	41	79	3.74		
SAr	CL. I	52	43	5	0.08	N.S
	CL. II	41	39.9	4.51		
ArGn	CL. I	52	124	10	0.25	N.S
	CL. II	41	121	5.67		
GoPog	CL. I	52	85.5	5.75	0.33	N.S
	CL. II	41	83.3	6.15		
LAFH	CL. I	52	79.2	4.87	0.41	N.S
	CL. II	41	77.5	5.9		
ArGo	CL. I	52	56.2	9.3	0.04	S
	CL. II	41	50.7	5.47		
BGn	CL. I	52	21.5	2.54	0.44	N.S
	CL. II	41	22.3	2.43		
CDGo	CL. I	52	71.1	8.37	0.03	S
	CL. II	41	65.5	5.53		

Skeletal Class I (n = 52); Skeletal Class II (n= 41)

*** N.S = not significant ; S = significant at P á 0.05**

Table (4) Descriptive statistics of the angular measurements and P-value between skeletal class I and II males sample

Variable	Skeletal Class	No.	Mean	Std. Deviation	P-value	Sig *
SNB	CL. I	26	80.83	1.83	0.0197	S
	CL. II	20	75.73	4.54		
SNPog	CL. I	26	82.67	2.25	0.052	S
	CL. II	20	78.18	4.87		
NAPog	CL. I	26	178.5	1.64	0.0045	S
	CL. II	20	171.2	5.15		
NSAr	CL. I	26	119.5	7.71	0.0367	S
	CL. II	20	127	5.33		
ArGoMe	CL. I	26	122.7	8.26	0.2648	N.S
	CL. II	20	125.8	2.99		
MP/SN	CL. I	26	28.33	4.37	0.0233	S
	CL. II	20	34.45	4.97		
L1/MP	CL. I	26	91.5	8.22	0.1782	N.S
	CL. II	20	97.82	9.1		
NSGn	CL. I	26	66	1.26	0.1414	N.S
	CL. II	20	69.09	4.72		

Skeletal Class I males (n = 26); Skeletal Class II males (n= 20)

*** N.S = not significant ; S = significant at P á 0.05**

Table (5) Descriptive statistics of the linear measurements and P-value between skeletal class I and II males sample

Variable	Skeletal class	No.	Mean	Std. Deviation	P-value	Sig *
SN	CL. I	26	81.83	3.92	0.784	N.S
	CL. II	20	81.36	2.98		
SAr	CL. I	26	45.83	4.79	0.043	S
	CL. II	20	41.5	3.06		
ArGn	CL. I	26	129.3	10.6	0.261	N.S
	CL. II	20	124.9	4.61		
GoPog	CL. I	26	90	2.97	0.199	N.S
	CL. II	20	85.73	7.38		
LAFH	CL. I	26	82	3.22	0.841	N.S
	CL. II	20	81.55	4.87		
ARGO	CL. I	26	58.83	11.5	0.263	N.S
	CL. II	20	54.4	3.37		
BGn	CL. I	26	22.83	2.14	0.718	N.S
	CL. II	20	23.27	2.45		
CDGo	CL. I	26	75.17	8.11	0.036	S.
	CL. II	20	68.45	4.03		

Skeletal Class I males (n = 26); Skeletal Class II males (n= 20)

*** N.S = not significant ; S = significant at P á 0.05**

Table (6) Descriptive statistics of the angular measurements and P-value between skeletal class I and II females sample

Variable	Skeletal Class	No.	Mean	Std. Deviation	P-value	Sig *
SNB	CL. I	26	78.2	2.86	0.197	N.S
	CL. II	21	75.8	3.43		
SNPog	CL. I	26	79.6	3.05	0.303	N.S
	CL. II	21	77.7	3.52		
NAPog	CL. I	26	176	3.7	0.009	S.
	CL. II	21	169	4.14		
NSAr	CL. I	26	122	5.15	0.31	N.S
	CL. II	21	125	5.63		
ArGoMe	CL. I	26	124	5.81	0.371	N.S
	CL. II	21	127	5.9		
MP/SN	CL. I	26	31.4	3.05	0.177	N.S
	CL. II	21	35.5	6.08		
L1/MP	CL. I	26	93.8	4.82	0.176	N.S
	CL. II	21	99.5	8.32		
NSGn	CL. I	26	66.6	4.04	0.415	N.S
	CL. II	21	68.3	3.82		

Skeletal Class I females (n = 26); Skeletal Class II females (n= 21)

*** N.S = not significant ; S = significant at P á 0.05**

Table (7) Descriptive statistics of the linear measurements and P-value between skeletal class I and II females sample

Variable	Skeletal class	No.	Mean	Std. Deviation	P-value	Sig *
SN	CL. I	26	76.2	2.28	0.649	N.S
	CL. II	21	76.92	3.088		
SAr	CL. I	26	39.6	2.702	0.688	N.S
	CL. II	21	38.58	5.195		
ArGn	CL. I	26	117.2	3.033	0.951	N.S
	CL. II	21	117.1	3.704		
GoPog	CL. I	26	80.2	2.49	0.62	N.S
	CL. II	21	81.17	3.904		
LAFH	CL. I	26	75.8	4.494	0.371	N.S
	CL. II	21	73.75	4.048		
ARGO	CL. I	26	53	5.385	0.064	N.S
	CL. II	21	47.58	4.981		
BGn	CL. I	26	20	2.236	0.26	N.S
	CL. II	21	21.33	2.103		
CDGo	CL. I	26	66.2	6.181	0.247	N.S
	CL. II	21	62.55	5.355		

Skeletal Class I females (n = 26); Skeletal Class II females (n= 21)

*** N.S = not significant ; S = significant at P á 0.05**

Table (8) Descriptive statistics of the angular measurements and P-value between males & females sample of skeletal class II

Variable	Skeletal Class	No.	Mean	Std. Deviation	P-value	Sig *
SNB	Male	20	75.73	4.54	0.95	N.S
	Female	21	75.83	3.43		
SNPog	Male	20	78.18	4.87	0.77	N.S
	Female	21	77.67	3.52		
NAPog	Male	20	171.2	5.15	0.35	N.S
	Female	21	169.3	4.14		
NSAr	Male	20	127	5.33	0.43	N.S
	Female	21	125.1	5.63		
ArGoMe	Male	20	125.8	2.99	0.53	N.S
	Female	21	127.1	5.9		
MP/SN	Male	20	34.45	4.97	0.66	N.S
	Female	21	35.5	6.08		
L1/MP	Male	20	97.82	9.1	0.65	N.S
	Female	21	99.5	8.32		
NSGn	Male	20	69.09	4.72	0.68	N.S
	Female	21	68.33	3.82		

Skeletal class II Male (n = 20) ; Skeletal class II Female (n = 21)

*** N.S = not significant ; S = significant at P á 0.05**

Table (9) Descriptive statistics of the linear measurements and P-value between males & females sample of skeletal class II

Variable	Skeletal class	No.	Mean	Std. Deviation	P-value	Sig *
SN	Male	20	81.4	2.98	0.002	S
	Female	21	76.9	3.09		
SAr	Male	20	41.5	3.06	0.134	N.S
	Female	21	38.6	5.2		
ArGn	Male	20	125	4.61	0.000	S
	Female	21	117	3.7		
GoPog	Male	20	85.7	7.38	0.075	N.S
	Female	21	81.2	3.9		
LAFH	Male	20	81.5	4.87	0.000	S
	Female	21	73.8	4.05		
ARGO	Male	20	54.4	3.37	0.002	S
	Female	21	47.6	4.98		
BGn	Male	20	23.3	2.45	0.054	S
	Female	21	21.3	2.1		
CDGo	Male	20	68.5	4.03	0.008	S
	Female	21	62.5	5.35		

Skeletal class II Male (n = 20) ; Skeletal class II Female (n = 21)

*** N.S = not significant ; S = significant at P á 0.05**

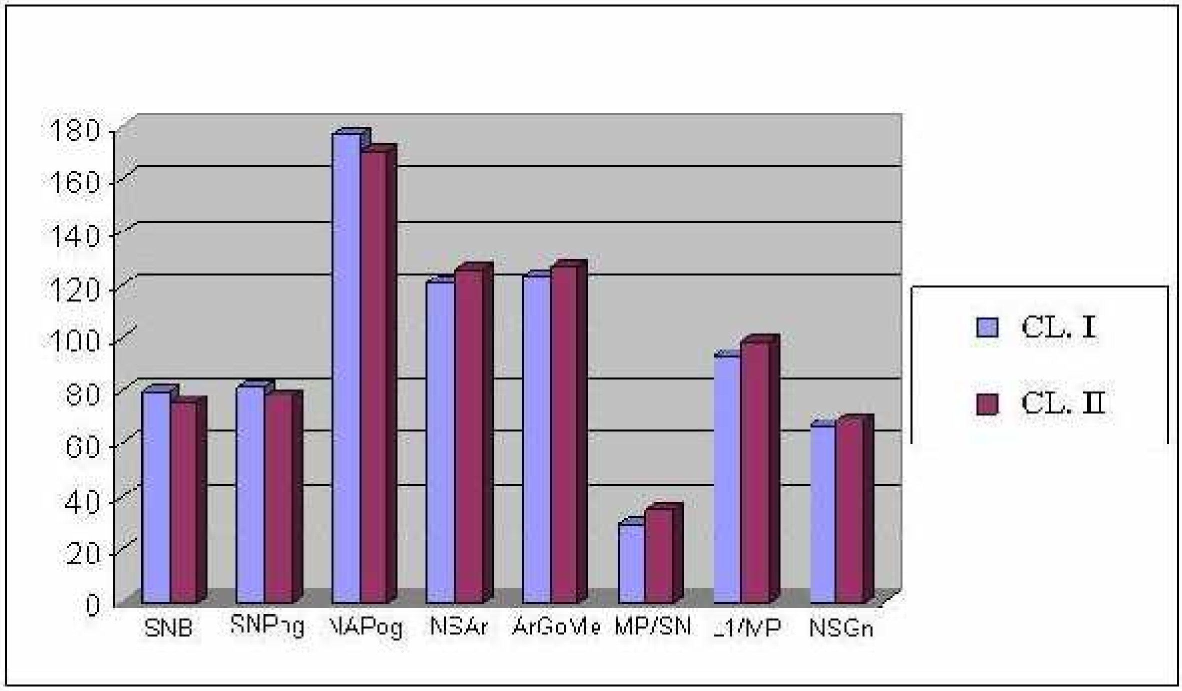

Figure (3): The means of angular measurements of the overall sample skeletal class I and II

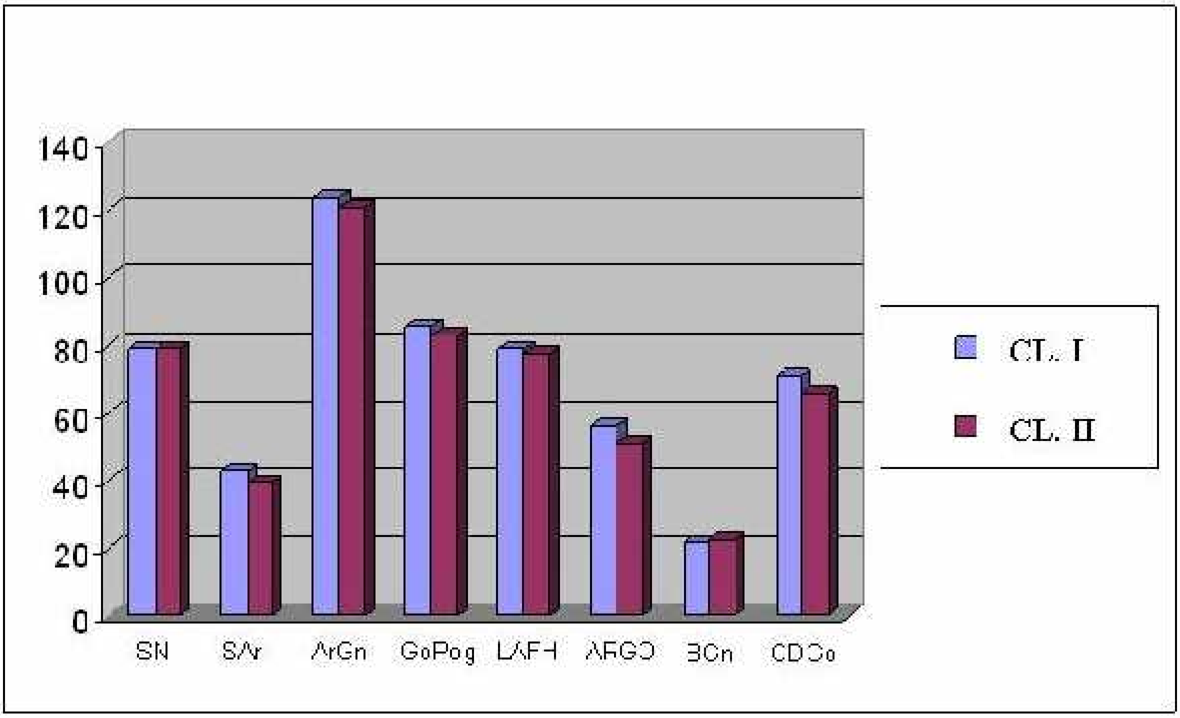

Figure (4): The means of linear measurements of the overall sample skeletal class I and II

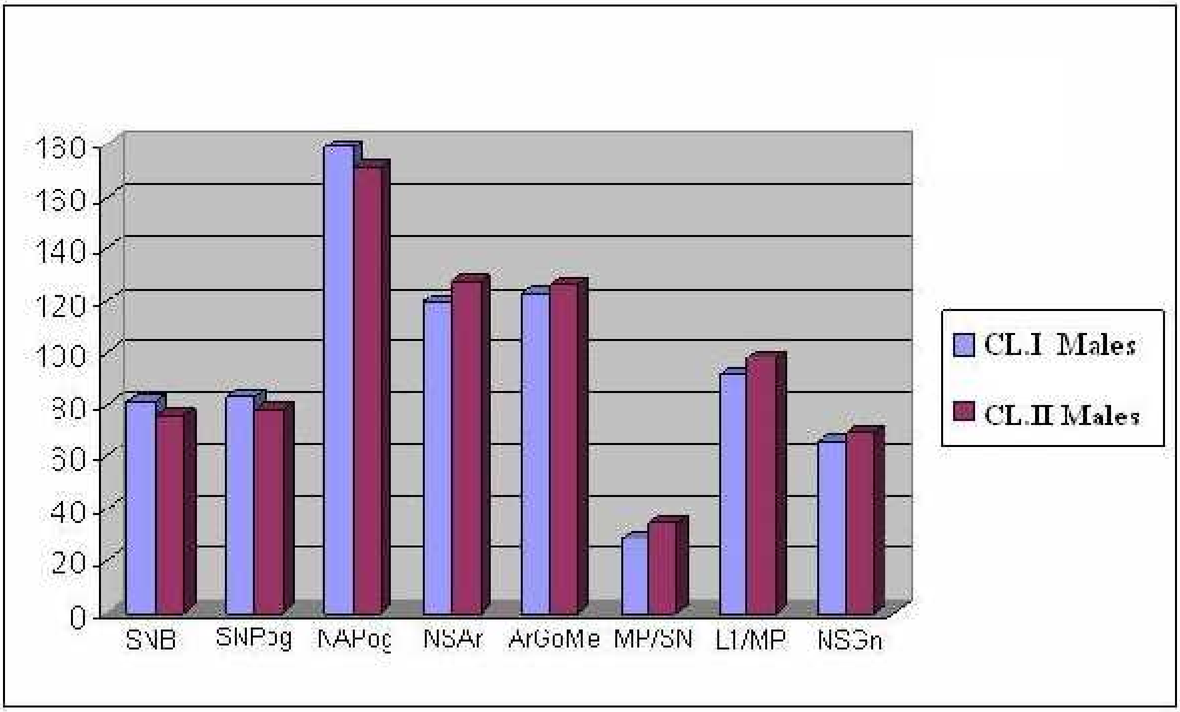

Figure (5): The means of angular measurements of skeletal class I and II males sample

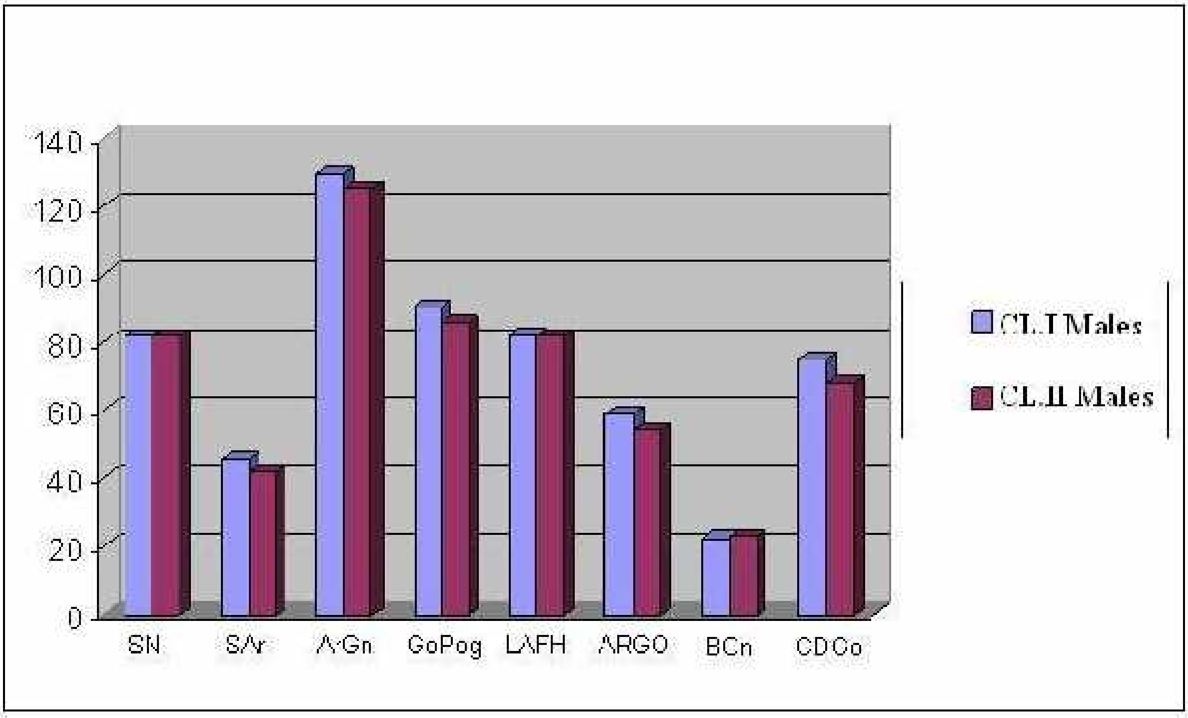

Figure (6): The means of linear measurements of skeletal class I and II males sample

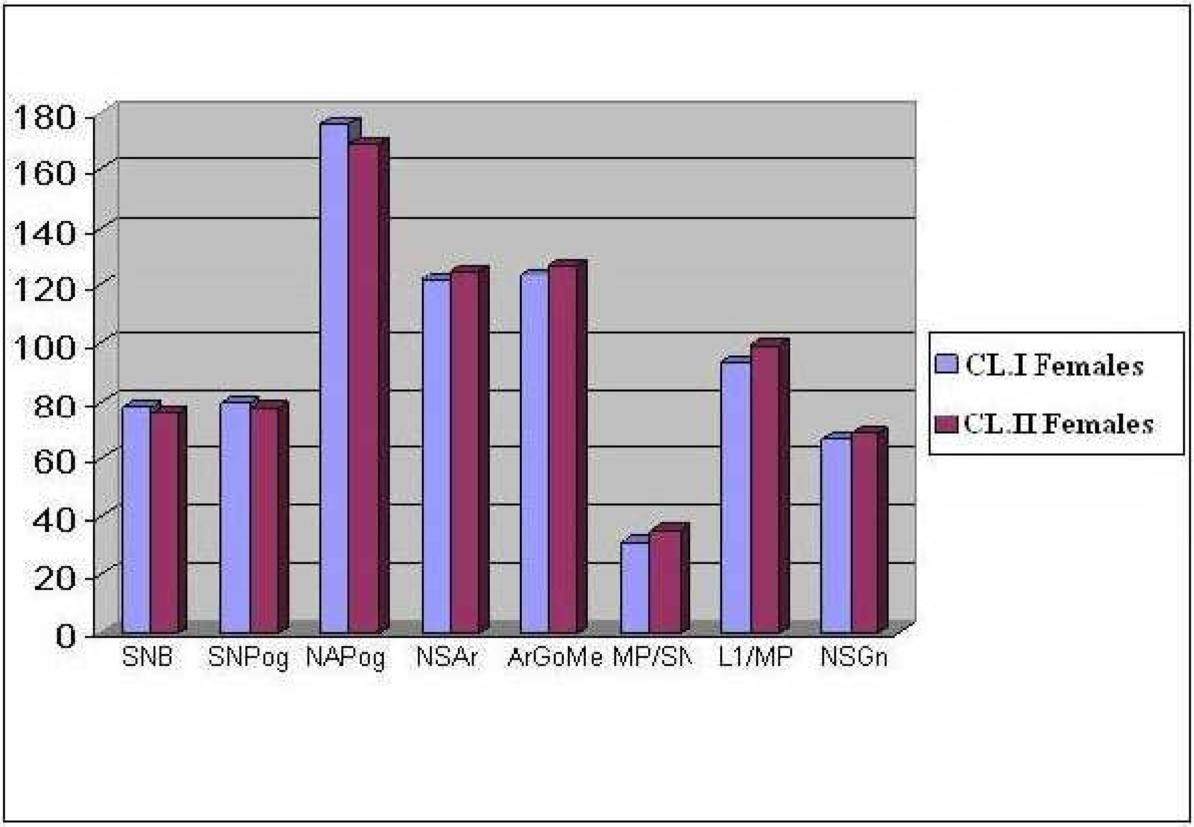

Figure (7): The means of angular measurements of skeletal class I and II females sample

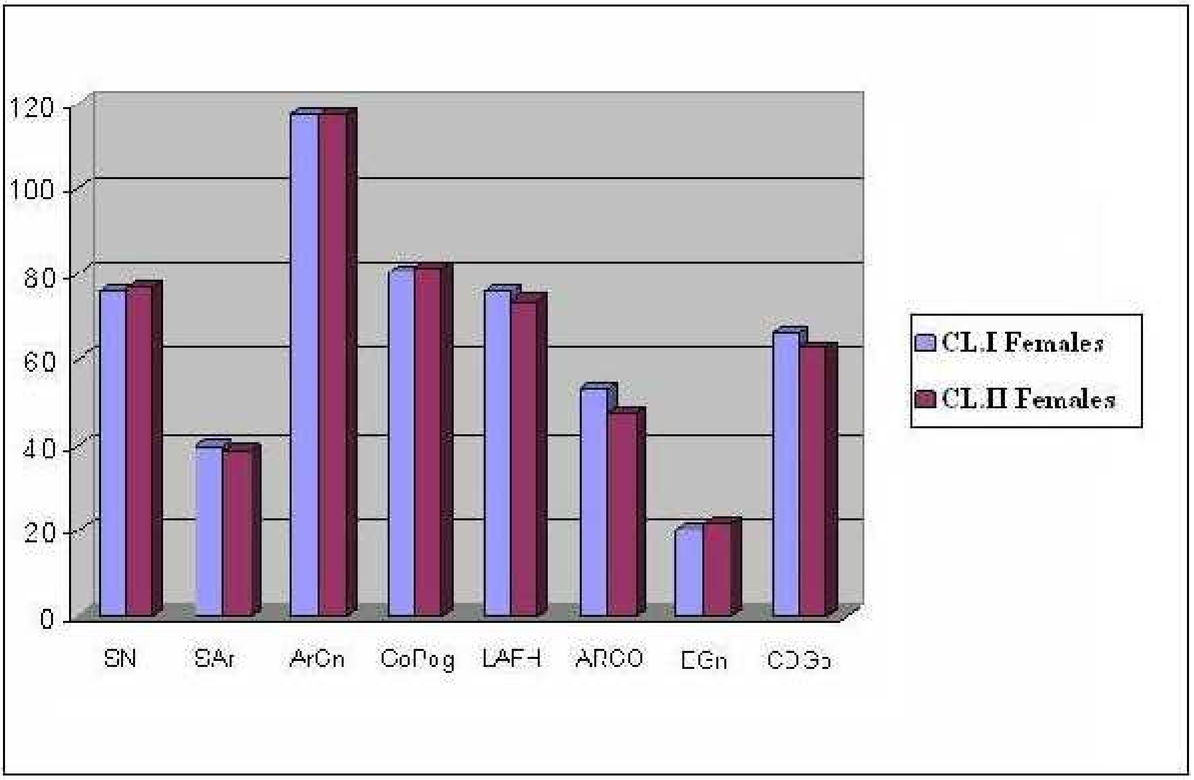

Figure (8): The means of linear measurements of skeletal class I and II females sample

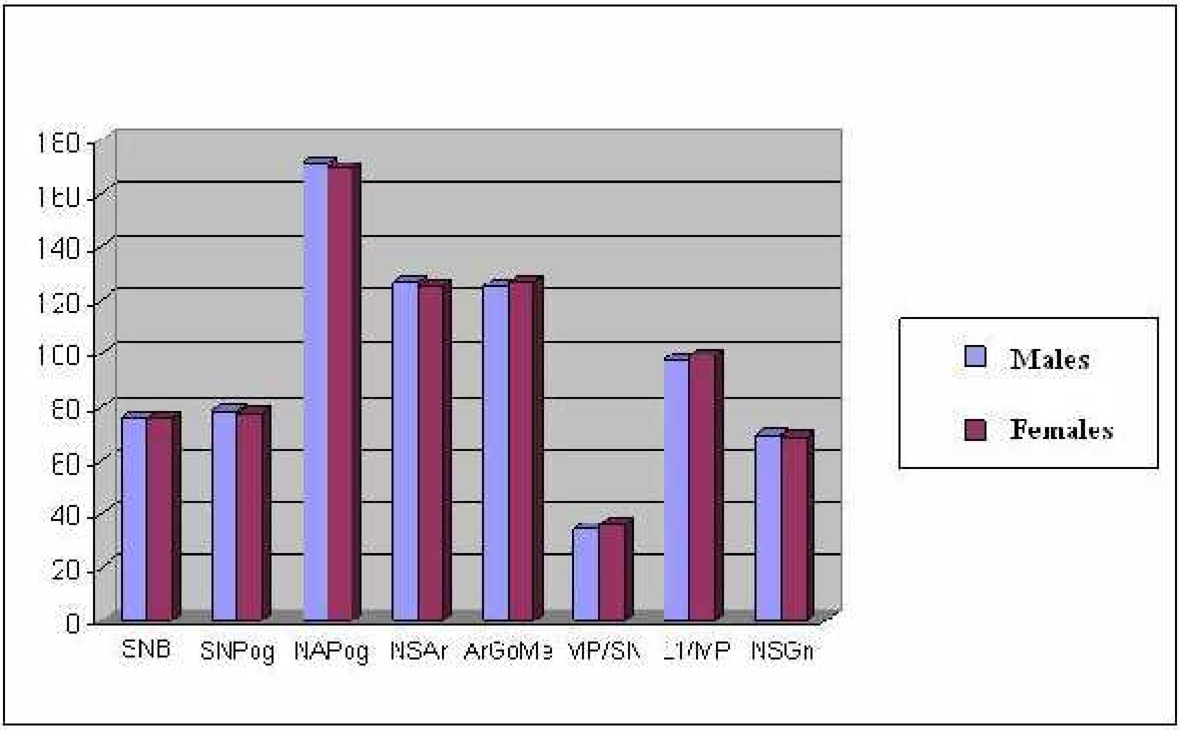

Figure (9): The means of angular measurements of skeletal class II males & females sample

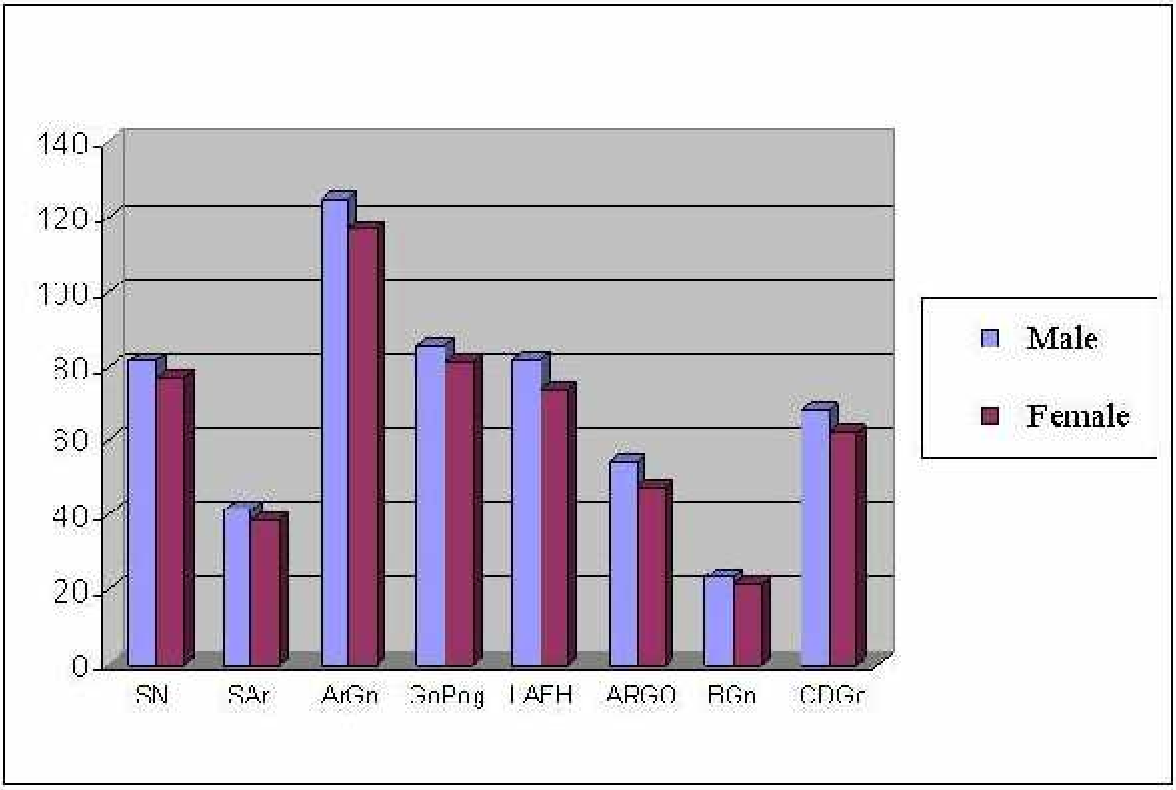

Figure (10): The means of linear measurements of skeletal class II males & females sample

Discussion:

This study provide a new information about the dento-skeletal features of the mandible with class II division 1 based on skeletal II and compared with skeletal class I of adult males and females. The previous studies **10,14,15,21,51-54** have shown that the term Class II malocclusion is not a single diagnostic entity but rather can result from numerous combinations of skeletal and dento-alveolar components**19**. It has been found from these studies that the discrepancy of the sagittal jaw relation was mainly caused by protrusive or retrusive position of the mandible relative to the cranial base **55**. So that the class II division 1 malocclusion incorporates many variations of dental, skeletal and functional components that can significantly influence the treatment plan**58**. In this study we used only cephalometric measurements generally accepted and used in everyday orthodontic practice expecting to attract primarily attention of the clinicians. The differences with the findings of other studies that have been observed in this work for angular and linear measurements may be attributed to the variations in the Ethnic groups, sample size and methods of study.

The sample:

It has been found in this study that the ANB angle of skeletal class II is (7.26) and the overjet is 8.9 mm Table (1). This indicates that our sample possessed a moderate class II division 1 malocclusion based on a mild to moderate skeletal class II .

1) Comparison between overall sample skeletal class I and skeletal class II (angular and linear measurements):

Generally, the comparison of the angular and linear measurements between overall skeletal class I and overall skeletal class II is presented in tables (2) and (3) as well as in figures (3),(4).

It is shown that (SNB) and (SNPog) angles are significantly smaller in skeletal class II than in skeletal class I and (NSGn) angle are greater in class II group than in class I group, but this difference is not statistically significant, (N-S-Ar) angle are significantly larger in skeletal class II than in skeletal class I which play rule in the skeletal discrepancy between maxilla and mandible similar to the finding of (Hoyer) **59**. Which may result from posteriorly positioned articulation and/or significantly decrease in the effective length of the ramus (ArGo) and (CDGo) in skeletal class II than in skeletal class I, as shown in Table (2), causing an increase in (N-S-Ar) angle **41**, where as other studies **21,58** have found no difference in the saddle angle between classes I and II.

(N-A-Pog) angle is significantly smaller in skeletal class II than in skeletal class I which means that the facial profile in skeletal class II is more convex than in skeletal class I, this finding suggest that the position of the maxilla and mandible in relation to nasion (N) in the tow classes with the advancement of maxilla or retrusion of the mandible in class II and the normal position of both in Class I could be responsible for this variation in facial convexity among the tow classes, which comes in agreement with the studies of **10,52-54**.

(MP/SN) angle is significantly larger in skeletal class II than in skeletal class I and (ArGoMe) angle is greater in class II group than in class I group, but this difference is not statistically significant this finding suggests that there is a tendency of a backward rotation of the mandible in relation to the cranial base in skeletal class II, which may result from significantly decrease in the effective length of the ramus (ArGo) and (CDGo) in skeletal class II than in skeletal class I causing an increase in these angles**41**, which is similar to the finding of(Freirss et,al) **54** but it disagrees with others **10,21** who show that the (MP/SN) angle and (ArGoMe) angle were significantly smaller for skeletal class II.

(L1/MP) angle is significantly larger in skeletal class II than in skeletal class I ,this finding indicate that the lower incisors is more procline in class II than in class I. This could be considered as a dentoalveolar adaptation compensating for retrognathic mandible. The same results have been reported by other investigators **52,59,60**.

In general, the linear measurements are not significantly different between the overall sample of skeletal classes I and II, except for (ArGo) and (CDGo) which are significantly smaller in skeletal class II than in skeletal class I, as shown in Table (3). According to the (Mortazavi et, al) **61** the mandibular length and ramal heights are smaller in Class II Division I subjects. (Rothstein and Yoon-Tarlie) **72** did not report small mandibular size as contributor in their studies. (Change et al.)**62**, and (Kasai et al.)**63** show that (S-N) anterior cranial base length is not significantly different between classes I and II, but disagreed with that of (Dibbets) **64**, who reported that (SN) shortened systemically from Class II, over Class I while others found the that the anterior cranial base of the skeletal II group was significantly longer than the skeletal I group**65,66**. The body length of the mandible: (Go–Pog) and (Ar–Gn) are not significantly different between the overall sample of skeletal classes I and II, but it disagrees with the findings of other researchers who reported a smaller mandible in Class II.**21,53,54**

This study shows no significant difference in the posterior cranial base length (SAr) between skeletal class I and II, which is similar to the finding of **21**.

No significant difference was noticed in the (LAFH) lower anterior facial height and (B-Gn) anterior border of the mandible between skeletal class I and II which means that the skeletal class I and II have the same vertical relation anteriorly between the mandible and the maxilla and this may be due to that the open bite conditions were excluded from the sample but it disagrees with (Gasgoos et.al)**21** who show that the (LAFH) is significantly larger for skeletal class II. where as (Pancherz et al.) **15** found that most Class II patients had a short lower anterior facial height.

From these findings we support idea that the retrusion of mandible with a short length of the ramus and a tendency of a backward rotation of the mandible in relation to the cranial base in skeletal class II are the most important causes of Class II malocclusion. Our findings are in agreement with other cephalometric studies **2,9,10,20,21,46,52-54,57,61,67,72,76** which indicating that the mandible is significantly retrusive with the chin located posteriorly.

2) Comparison between skeletal class I and skeletal class II males sample (angular and linear measurements):

Generally, the comparison of the angular and linear measurements between skeletal class I and II males are presented in tables (4) and (5) and figures (5),(6).

It is shown that (SNB) and (SNPog) angles are significantly smaller in skeletal class II than in skeletal class I males and (NSGn) angle are greater in class II than in class I males, but this difference is not statistically significant and the (N-S-Ar) angle are significantly larger in skeletal class II than in skeletal class I males, which play rule in the skeletal discrepancy between maxilla and mandible similar to the finding of (Kapoor et.al)**57**. Which may result from posteriorly positioned articulation and/or significantly decrease in the effective length of the ramus (CDGo) in skeletal class II than in skeletal class I males, as shown in Table (5), causing an increase in (N-S-Ar) angle **41**, which follows a similar pattern of the overall sample. Our findings are in agreement with (Mortazavi et.al)**61**, but it disagrees with the findings of (Rothstein and Yoon-Tarlie)**72**, which showed that the (SNPog) angle are not significantly different between the skeletal classes I and II males sample.

(N-A-Pog) angle is significantly smaller in skeletal class II than in skeletal class I males which means that the facial profile in skeletal class II is more convex than in skeletal class I males, which follows a similar pattern of the overall sample , which comes in agreement with (Mortazavi et.al)**61**.

(MP/SN) angle is significantly larger in skeletal class II than in skeletal class I male and (ArGoMe) angle is greater in class II group than in class I group, but this difference is not statistically significant, this finding follows a similar pattern of the overall sample, which comes in agreement with (Mortazavi et.al)**61**, However, in contrast to these finding, vertical growth pattern was not reported as being seen by (Rothstein and Yoon-Tarlie)**72** .

The inclination of the lower incisors are similar in skeletal class I and II males, as the (L1/MP) angle show no significant difference between skeletal class I and II males, but this finding disagree with other cephalometric studies **61,72**.

All the linear measurements used in this study show no significant difference between skeletal class I and II males, except for(SAr) and (CDGo) which are significantly smaller in skeletal class II than class I males, as shown in Table (5)

3) Comparison between skeletal class I and skeletal class II females sample (angular and linear measurements):

Generally, the comparison of the angular and linear measurements between skeletal class I and II females are presented in tables (6) and (7) and figures (7),(8).

All the angular measurements used in this study show no significant difference between skeletal class I and II females, except for(NAPog) angle, which are significantly smaller in skeletal class II than in skeletal class I female samples. This finding suggests that there is no significant difference in the anteroposterior and vertical position of the mandible between skeletal class I and II females and that the inclination of the lower incisors are similar in skeletal class I and II females, except that the facial profile in skeletal class II is more convex than in skeletal class I female samples which follows a similar pattern of the overall sample and males sample, but this finding disagree with other cephalometric studies **24,52,68**, who have found that a posteriorly positioned and rotated mandible, protrusive mandibular incisors, and an increased cranial base angle were all mean characteristics of skeletal class II than in skeletal class I female samples and

All the linear measurements used in this study show no significant difference between skeletal class I and II females. This finding suggests that there is no significant difference in the anteroposterior and vertical linear measurements of the mandible between skeletal class I and II females this finding disagree with (Menezes) **68**, who noted that all mandibular dimensions, overall mandibular length, mandibular body length, and vertical ramus were significantly shorter in Class II division 1 subjects. Other investigators have also reported the presence of a short mandibular body length **14,69,70**. However, in these Caucasian studies, there was no significant difference in the mandibular ramus length between Class II and I. . (S-N) anterior cranial base length in this study show no significant difference between skeletal class I and II females, which is similar to that of (Ali)**30**; and (Ngan et al)**71**; but, according to (Bishara et al.)**12**, all cranial parameters in females have no significant difference between class II division 1 and normal subjects, except for (S – N) which is significantly larger in the class II division 1 females than in class I females; where as (Ishii et al)**24** indicate that the (S – N) tend to be significantly smaller in class II division 1 females than in class I females only at the early permanent dentition stage.

No significant difference was noticed in the (LAFH) lower anterior facial height between skeletal class I and II females which means that the skeletal class I and II females have the same vertical relation anteriorly between the mandible and the maxilla and this may be due to that the open bite conditions were excluded from the sample, following a similar pattern of the overall sample and males sample.

4) Comparison between skeletal class II males and females sample(angular and linear measurements):

Generally, the comparison of the angular and linear measurements between skeletal II males and females is presented in Tables (8) and (9) and Figures (9) and (10).
All the angular and linear measurements used in this study show no significant difference between class II division 1 males and females, this finding is in agreement with the literature, which has stated that gender exerts little or no effect on skeletal and dental components in Class II malocclusions**2,7,51,54,73**. But, according to(Gasgoos et.al)**21** (MP/SN) angle was higher in females than in males.

Most of the linear measurements are significantly larger in males than in females except for (SAr) and (GoPog). Although these measurements (SAr) and (GoPog) are higher in males, this difference is not statistically significant; most previous studies show that the linear measurements are usually larger for males than females with skeletal class II **2,51,54,74-77** , while according to (Qamar and Chaudry)**73**; all the sagittal skeletal parameters showed no significant difference between class II division 1 males and females except for the SN length variable where males had a significantly larger value than that of female subjects. and our finding may be due to the fact that in any case, growth in males continues longer than it is in females; therefore, the final size is larger **78**.

Conclusions:

1) Cephalometric analysis of the mandible for class II division 1 based on skeletal II Iraqi adults aged (18 - 26) years were obtained to help in diagnosis and treatment planning in the field of orthodontics and orthognathic surgery.
2) When the angular and linear measurements of skeletal class I and II overall ,male and female samples were compared, the retrusion of mandible with a short length of the ramus and a tendency of a backward rotation of the mandible in relation to the cranial base in skeletal class II are the most important causes of Class II malocclusion with the facial profile is more convex in skeletal class II overall and male samples while, all the angular and linear measurements used in this study show no significant difference between skeletal class I and II females, except the facial profile is more convex in skeletal class II female samples.
3) The lower incisors is more procline in class II than in class I overall sample but this difference is not statistically significant in male and female samples .
4) No significant difference could be noted between sexes of skeletal class II in the angular measurements.

5) Most linear measurements were larger in males than in females class II division 1 except for two measurements the posterior cranial base length (S-Ar) and the length of the body of the mandible (Go-Pog) show no significant difference between class II division 1 males and females.

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