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Association between Upper Dental Arch Dimensions and Facial Type in Adult with Class I Normal Occlusion

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INTRODUCTION

Harmonious facial esthetics and optimal functional occlusion have long been recognized as the two most important goals of orthodontic treatment. (Bishara 2001, Gallão et al 2013) The standard or orthognathic face, exhibits a harmonious relationship between the following parts (Graber and Vanarsdall, 2000):

- The facial structure and the cranium.
- The mandible and the maxilla.
- The maxilla and the maxillary dentition.
- The mandible and the mandibular dentition.
- The maxillary and mandibular dentition.
- The soft tissue profile and the underlying hard tissue structure.

CLASSIFICATION OF THE FACIAL TYPES

1. Frontal View: Facial Index was introduced by The Kollmann for anthropology in (1892), it relates facial width to facial height, it is calculated by the formula: "facial height ×100/ zygomatic width" Accordingly, they can be divided into:

1. Mesoprosopic faces have the ratio between bizygomatic width to the facial height of 0.88 (the most average ratio).
2. Leptoprosopic faces have a smaller ratio (Long faces).
3. Euryprosopic faces have a bigger ratio (Short faces).

Euryprosopic Mesoprosopic Leptoprosopic

Figure (1): Frontal View of Facial Types

2. Lateral View: In 1957 Bimeler introduced a lateral "suborbital facial index "that relates suborbital facial height to facial depth .

Ruel et al (1977) described the face into three basic facial patterns:

1. Mesofacial: which is the most average facial pattern.

2. Brachyfacial: which is a horizontal growth facial pattern.

3. Dolicofacial: which is a vertical growth pattern.

Bimler (1985) used palatal plane (PP): mandibular plane (MP) angle as a key measurement to describe differences in facial types. He defined (up to 15° (PP: MP)) angle as a Euryprosopic facial types, (15° to 30°) as mesoprosopic, and more than (30°) a leptoprosopic facial types. Paranhos-2014''fac-arc'' Others use skeletal vertical relationships, on the basis of the ML-NSL values (Normal = 30° =< ML-NSL =< 40°; low angle = ML-NSL < 30°; high angle = ML-NSL > 40°) ML-NSL°: the inclination of the mandibular line to the nasion-sella line. (Baccetti et al, 1997, Paranhos-2014 ''face-arch'').

Brachyfacial Mesofacial Dolichofacial

Figure (2) The Facial Types Depend on Clinical Deviation from the Normal Five Measurements (Facial Axis Angle, Mandibular Plane Angle, LFH Angle, Facial Angle and Mandibular Arc)

AIMS OF THE STUDY

1. To investigate whether or not there is association between the facial form and the form of the upper dental arch in adult males and females.
2. To find out the most frequent facial type (lateral and frontal) and dental arch form in Mosuli adults.
3. To obtain data in three dimensions (posterior-anterior and lateral) of craniofacial skeleton of Iraqi adults in Mosul city with normal class I occlusion, and to define the possible sex differences in craniofacial skeleton in the three dimensions.

MATERIALS AND METHODS

The Sample:

The sample of this study involved students from Mosul University selected randomly from the following colleges (College of Dentistry, College of Law, College of Education, College of Agriculture and College of Arts). 448 clinically examined adult subjects, 100 were selected, and those who fit the criteria of clinical sample selection. Then cephalometric radiographs and impression were taken for them and only 95 (58 female 61%, 37 male 39%) were selected. The age of the sample ranged between (18 – 25) years old, They were normal healthy individuals of Mosul origin.

Criteria for Sample Specification:

1. Full complement of permanent dentition (excluding the third molars).
2. Bilateral Class I molar and canine occlusion
3. There are no:

i. History of previous orthodontic treatment.
ii. Clinical detectable massive interproximal or occlusal caries.
iii. Heavy dental restorations.
iv. Fractured or crowned teeth or fixed prosthodontic therapy.
v. Supernumerary teeth.
vi. History of bad oral habits.
vii. Facial disharmony (deformation).

Materials and Supplies:

A- Diagnostic Instruments : Dental mirrors, Kidney dishes , Cotton & Disinfectant solution

B-Impression and Cast Materials and Instruments : Wide bladed plaster spatula ,Rubber bowel ,Upper and lower perforated plastic orthodontic trays ,Irreversible hydrocolloid impression material & Dental stone.

C-Digitizing Equipments : Sharp pen, Metal ruler, Lab Top (hp) (Pentium IV), Compact disc ,Computer scanner (hp),.Software Planmeca dimaxis program .

METHODS:

The History and Clinical Examination:
The selected students were asked to tell information concerning their names, ages, history and then subjected to a thorough clinical examination to reassure the fulfillment of the required sample specifications

Construction of the Study Models:

Individual impression of the both dental arches was taken while the student was seated on a dental chair after instructing him / her about the procedure in order to cooperate with the researcher.

The Radiographic Technique:
Under standardized condition, two digital Cephalometrics were taken for each selected subject, one for lateral view and the other for frontal view. The subject was set in a standing position with his head fixed by two ear rods laterally and a locking nasal positioner was then secured against the bridge of the patient's nose to eliminate the possibility of rotation around ear rods in the sagittal plane and for future reference in subsequent exposures. Also it acts as a ruler caliber for the measurement to avoid magnification in the image, so the Frankfort horizontal plane is kept parallel to the floor. The subject was in centric occlusion during exposure.

The Landmarks:

1-Incisal Point: The midway point between the incisal edges of the two central incisors .
2-Canine Point: The cusp tip of the right and left permanent canines .
3- First Molars Point: The mesiobuccal cusp tip of the right and left permanent first molars .
4- Second Molars Point: The distobuccal cusp tip of the right and left second permanent molars .

Dental Arch Dimensions

Linear distances were measured on the copy of the study models for the maxillary dental arches to determine the dental arch width and length. The linear dimensions are: (Figure 3)

A. Dental Arch Width

The breadth of dental arch is determined by measuring distance between the corresponding contralateral teeth Daskalogiannakis (2000)that includes:

1-Intercanine Distance (ICD): The linear distance between the cusp tip of the right and left permanent canines (Warren and Bishara, 2001; Murad, 2008).
2-Inter First Molar Distance (IMD): The linear distance between the mesiobuccal cusp tip of the right and left permanent first molars (Salem, 2003).
3-Inter Second Molar Distance (I2MD); the linear distance between the distobuccal cusp tip of the right and left permanent second molars (Al-Shalabi, 2002**).**

B. Dental Arch Length:

1-Anterior Arch Length (Canine Vertical Distance) (C.V.D):
The vertical distance from the incisal point perpendicular to the intercanine distance at the cusp tip (Salem, 2003)**.**

2-Posterior Arch Length (Molar Vertical Distance) (M.V.D):
The vertical distance from the incisal point perpendicular to the intermolar distance at the mesiobuccal cusp tip of permanent first molars (Ramdan, 2000; Salem, 2003).

3-Total Arch Length (TAL):
The vertical distance from the incisal point to the line joining the distobuccal cusp tips of the second permanent molars (Al-Shalabi, 2002).

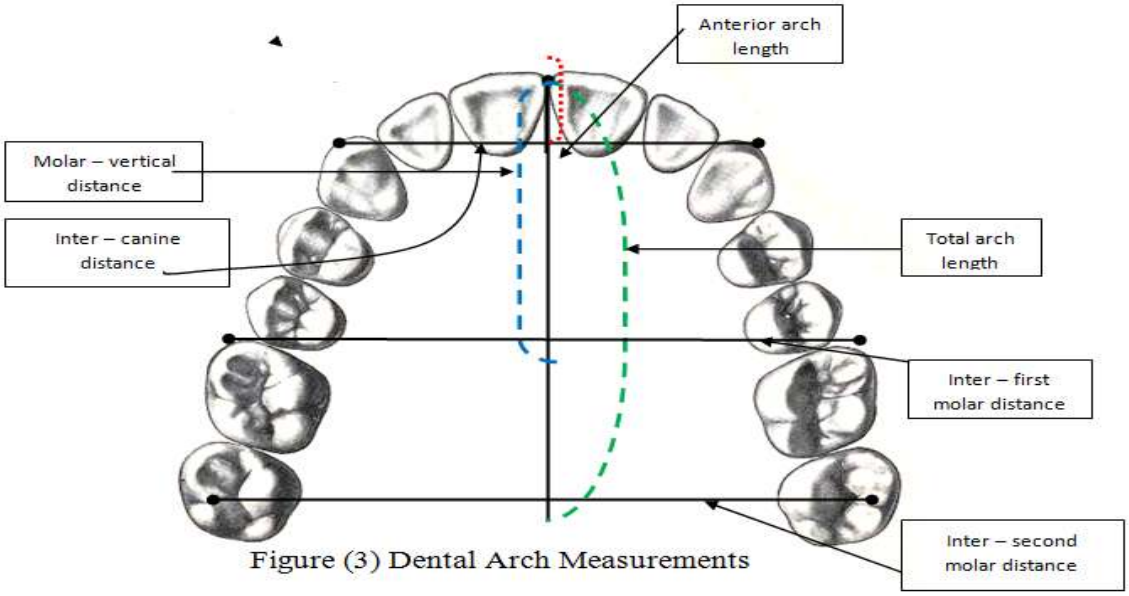

Figure (3) Dental Arch Measurements

Dental Arch Form: The size and shape of the arches have considerable implications in orthodontic diagnosis and treatment planning, affecting the space available, dental esthetics, and stability of the dentition (Uysala et al, 2005).

Computer Analysis of the Study Models
The models were directly placed on the glass window of the flat bed computer scanner with a metal ruler **(**Haralabakis et al , 2006). Distortion caused by the scanning procedure was corrected by the use of metal ruler that was scanned with each dental cast then corrected automatically by the software Dimaxis program (Mutinelli et al, 2004).

Figure (4) Scanning of the Dental Cast

Lateral Cephalometric Landmarks:

The following landmarks were used in this study:

1. **Point N (Nasion):** The most anterior point of nasofrontal suture in the midsagittal plane.
2. **Point Or (Orbitale):** The lowest point in the inferior margin of the orbit.
3. **Point Po (Anatomical Porion):** The highest point on the bony external acoustic meatus.
4. **Point ANS (Anterior Nasal Spine):** The anterior tip of the sharp bony process of the maxilla at the lower margin of the anterior nasal opening .
5. **Point Ba (Basion):** The lowest point on the anterior rim of the foramen magnum in the mid-sagittal plane.
6. **Point Pog (Pogonion):** The most anterior point of the bony chin in the median plane.
7. **Point Pt (Pterigoid):** The anatomical point representing the foramen rotundum located at the junction of foramen rotendum with the upper region of the pterygomaxillary fissure.
8. **Point Dc (Condyle):** The point in the center of the condylar neck where the Basion-Nasion plane croses it.
9. **Point Pm (Protuberance Menti)**: The point at the anterior border of the symphesis between point B and Pogonion where the curvature changes from concave to convex.
10. **Point Me (Menton):** The lowest point in the symphyseal shadow of the mandible.
11. **Point Go (Gonion):** the most posterior and inferior point at the angle of the mandible, where the bisector of the angle between tangents to the posterior and inferior borders of the mandible meets the mandibular outline.
12. **Point Gn (Gnathion):** The most anterior and inferior point of the bony chin.
13. **Point Xi (at the Center of the Ramus):** the location of this point is keyed geometrically to the Frankfort horizontal and pterygoid vertical planes.

Point Xi: This point located at the geographic center of the ramus and it could be determined by defining four major bony landmarks on the external border of the mandible and four lines figure(5) ,those are

1. R1-Mandible: the deepest point on the curve of the anterior border of the ramus, one-half the distance between the inferior and superior curves.
2. R2-Mandible: a point located on the posterior border of the ramus of the mandible opposing to R1.
3. R3-Mandible: a point located at the center and most inferior aspect of the sigmoid notch of the ramus of the mandible.
4. R4-Mandible: a point on the lower border of the mandible directly inferior to the center of the sigmoid notch of the ramus, opposite to R3.
5. A Line Tangent to the Anterior Border of the Ramus at R1 perpendicular to Frankfort plane and parallel to the pterygoid vertical plane.
6. A Line Tangent to the Posterior Border of the Ramus at R2 perpendicular to Frankfort plane and parallel to the pterygoid vertical plane.
7. A Line Tangent to the Superior Aspect of the Mandible at point R3 parallel to Frankfort plane and perpendicular to the pterygoid vertical plane.
8. A Line Was Done at the Lower Aspect of the Mandible parallel to the Frankfort plane and perpendicular to the pterygoid vertical plane at point R4. The intersections of these lines would produce a rectangle representing the entire ramus, from each two contralateral angles a plane can be drawn, the intersection between these two planes can represent the Xi point (RMO, 2000;Al-Tamimy, 2006)

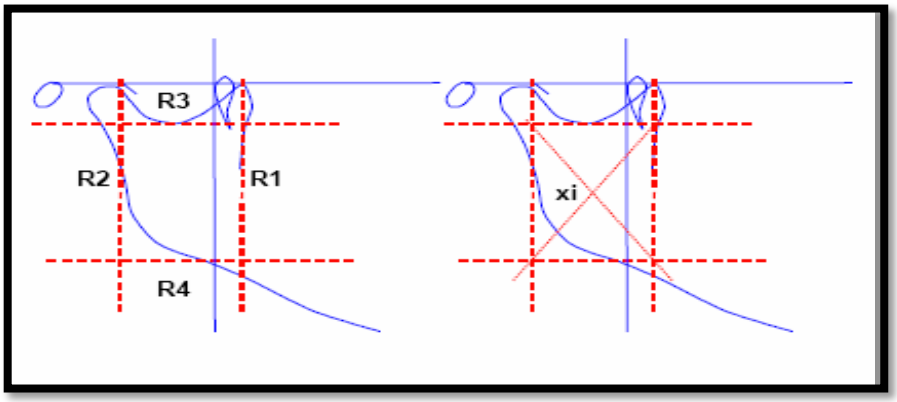

Figure (5) Diagrammatic Detection of Xi Point in the Mandible (RMO, 2000)

Frontal Cephalometric Landmarks:

The following landmarks were used in this study

1. **Point Zy (Zygomatic Arch):** At the most lateral border of the center of the root of the zygomatic arch (right and left).
2. **Point Nasion:** The most anterior point of nasofrontal suture in the midsagittal plane.
3. **Point Menton:** The most caudal point in the outline of the symphesis, it is regarded as the lowest point of the mandible.

Angular Measurements:
For describing the face Ricketts used five angles. These five angles are:

1. The facial axis angle (Ba-N-Pt-Gn lines) which is formed between the facial axis or the central axis of the face and the Basion-Nasion plane .This angle gives information about the chin.
2. The facial angle (FH-N-Pog) which is formed between facial plane (N-Pog) and (FH) plane. This provides some indication of mandibular prognathism.
3. The lower facial height angle (ANS-Xi-Xi-pm) which is formed by intersection of a line from anterior nasal spine to the center of the ramus (the Xi point) and the corpus axis (from the center of the ramus to the supra pogonion(pm)). It gives an indication of skeletal open bite.
4. The mandibular plane angle (FH-MP) which is formed between frankfort horizontal and mandibular planes. It was used as an indicator of skeletal morphology of the mandible.
5. The mandibular bend angle (DcXi-XiPm): measures the angulation of the condylar process to the body of the mandible.

Frontal Linear Measurements: Linear measurements (2 Skeletal) were recorded:
1. **Zy-Zy:** This represents the facial width or interzygomatic distance, measured from left Zy to right Zy.
Total Anterior Facial Hight (Nasion –Menton); this represents the total anterior facial height. It was measured as the direct distance from nasion to menton**.**

Dental Arch Forms:

For determination of the dental arch form, the method used by standardization, six dental cast's measurements were divided into three sagittal measurements, and three transverse measurements were utilized to calculate three independent ratios, which are:

- Anterior arch length (canine vertical distance) / inter-canine distance.
- Molar vertical distance / inter-first molar distance.
- Total arch length / inter-second molar distance.

For each ratio, the average was calculated for the maxillary dental arches for each sex, then standardization was done for each of three ratios for each subject by the excel program. Then the mean of these standardized numbers was calculated for each subject which gave the base for classification as fellows:
Form 1, (Narrow) the three sagittal /transverse ratios are positive (greater than the mean).the mean of standardized number >+1.
Form 2, (Mid) none of the ratios significantly deviated from the average. the mean of standardized number between (+1 and -1).
Form 3, (Wide) the three sagittal /transverse ratios are negative (lesser than the mean). The mean of standardized number <-1.

Lateral Facial Type
In this study the mean of standardization of each five values of the person was calculated for each gender (by standardization compare the values with the mean according to the standard deviation) The standardized numbers of the facial axis angle, the facial angle, the mandibular bend angle multiplied by (-1).So that the dolichfacial pattern would have a mean of standardized number more than (+1), the brachyfacial had a mean of standardized number less than (-1) and the mesofacial had a mean of standardized number between (-1 and +1).

Frontal Facial Type: Determined facial types by calculating the ratio between interzygomatic distance and total anterior facial height then the face type for each subject is classified as follows;

- Euryprosopic
  Facial Index=N-Me (height)/ IZD (Bizygomatic breadth) <average
- Mesoprosopic
  Facial Index= N-Me (height)/ IZD (Bizygomatic breadth) with in average
- Leptoprosopic
  Facial Index= N-Me (height)/ IZD (Bizygomatic breadth) > average.

By standardization the facial index the person that has standardized number more than (+1) would be Leptoprosopic facial type, the person that has standardized number less than (-1)would be Euryprosopic facial type and the person that has standardized number between (+1 and -1) would be Mesoprosopic facial type (Cakirer et al, 2001).

Statistical Analysis:
The data recorded in this research were subjected to computerized statistical analysis using both Excel-2007, and SPSS version 15 programs
The statistical analysis included
1. Descriptive Statistics (Mean, standard deviation, minimum, maximum) for all facial measurements angles, liner and ratios taken from the (lateral and frontal)digital cephalogram, and also for the maxillary dental arch widths, lengths and ratios for the sample.
t-test" was applied to test the significant differences between the mean of all dimensions of upper dental arches &facial measurements in Male and Female.

2. Standardized number of the five angles (from lateral cephalometric)and ratio of the total anterior facial height/interzygomatic distance (from frontal cephalometric).
3. Standardized number of three ratios(from study models).

- Anterior arch length/inter-canine distance.
- Molar-vertical distance/inter-first molar distance.
- Total arch length/inter-second molar distance.

RESULTS

Dental Arches:
Description and Comparison between Males and Females:
All the variables of the maxillary dental arch widths and, T-test was applied to see if there were any differences between males and females. It revealed that the males had larger arch width with a highly significant difference at $P < 0.01$ in all width dimensions in maxillary arches as illustrated in Table (1) and Figure (6). for maxillary dental arch lengths. The statistical analysis showed that there were high significant differences between males and females in maxillary vertical distance, all of the vertical measurements showed that males had larger arch length than females with a high significant difference at $P < 0.01$ Table (2) and Figure (7).

Table (1) Descriptive Statistics for Maxillary Arch Width with Comparisons between the Genders.

Variable	sex	Mean	± SD	Min	Max	t-test
Inter Canine	M	36.19	1.91	32.58	41.18	5.450**
	F	34.11	1.73	30.9	38.52	
	T	34.92	2.06	30.90	41.18	
Inter 1st Molar	M	55.96	2.83	49.56	61.7	5.658**
	F	52.93	2.31	47.62	59.44	
	T	54.11	2.92	47.62	61.7	
Inter 2nd Molar D	M	60.07	2.74	53.17	64.78	6.293**
	F	56.58	2.54	52.34	63.29	
	T	57.94	3.12	52.34	64.78	

NS. : Non Significant at $P > 0.05$. ** : Significant at $P < 0.01$. All dimensions in mm

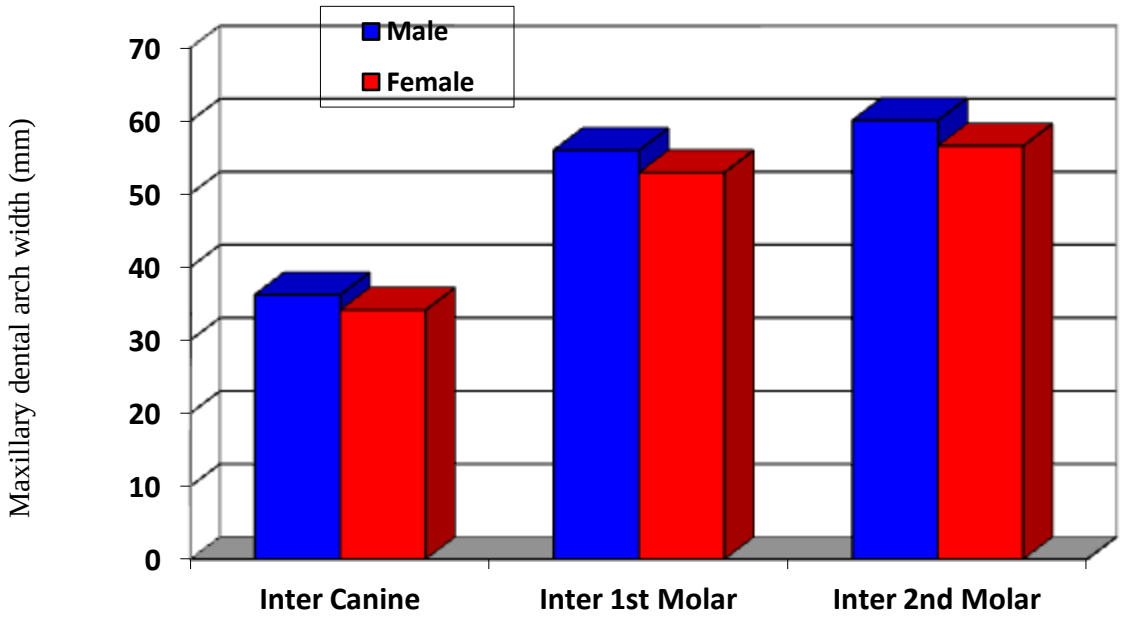

Figure (6) Mean of Maxillary Dental Arch Width for both Genders.

Table (2) Descriptive Statistics for Maxillary Arch Length with Comparison between the Genders.

Variable	Sex	Mean	± S.D	Min.	Max.	t-value
Anterior Arch Length	M	8.81	0.90	6.67	10.68	2.790**
	F	8.31	0.83	6.56	10.35	
	T	8.50	0.89	6.56	10.68	
Molar Vertical D	M	30.09	1.56	26.57	33.85	4.560**
	F	28.51	1.70	24.34	33.61	
	T	29.13	1.81	24.34	33.85	
Total Arch Length	M	44.86	1.98	40.71	48.75	6.267**
	F	42.37	1.83	37.53	47.31	
	T	43.34	2.24	37.53	48.75	

NS : Non Significant at P > 0.05. ** : Significant at P < 0.01. All dimensions in mm

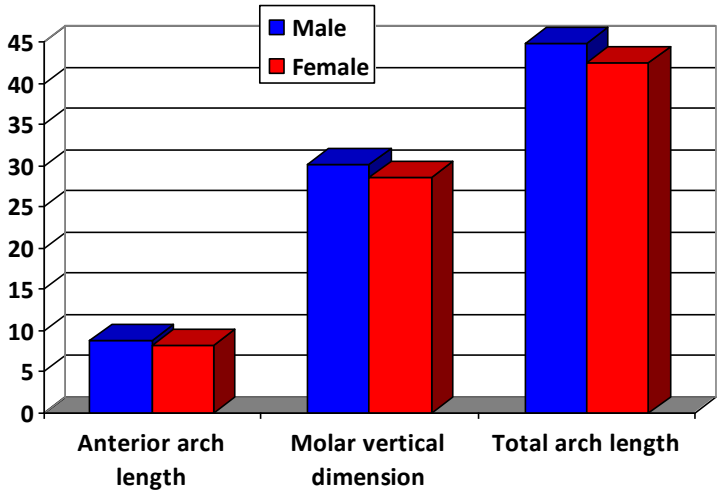

Figure (7) Mean of Maxillary Dental Arch Length for both Genders.

Arch Form:

Table (3) and Figure (8) showed the average of the three ratios used in the determination of the dental arch forms (Anterior arch length/inter-canine distance; molar-vertical distance/inter-first molar distance, total arch length/inter-second molar distance) for the maxillary dental arches. there was no significant difference between males and females in the three ratios.

Table (4) and Figure (9) showed the distribution of the three forms of maxillary dental arch, It could be noticed that the most prevalent arch form among the sample was the Mid form (54,05%, 55,17% and 54.73%) followed by the Narrow form (24,32%, 24,13% and 24.21%), while Wide forms being (21,62%, 20,68% and 21.05%) for males, females and the total sample respectively .

Table (3) Description for the Three Ratios for (Males and Females) with Comparisons between the Genders.

Sex / Ratio	Sex	Mean	Sd.	Min	Max	T-Value
Canine Vertical / Inter Canine	M F	0.244 0.244	0.0269 0.0236	0.193 0.180	0.313 0.292	0.023NS
Molar Vertical / Inter 1st Molar	M F	0.5430 0.5340	0.0303 0.0266	0.491 0.485	0.622 0.624	0.342NS
Total Arch Length / Inter 2nd Molar	M F	0.747 0.749	0.0294 0.0278	0.669 0.629	0.845 0.827	0.162NS

NS: Non Significant at P > 0.05.

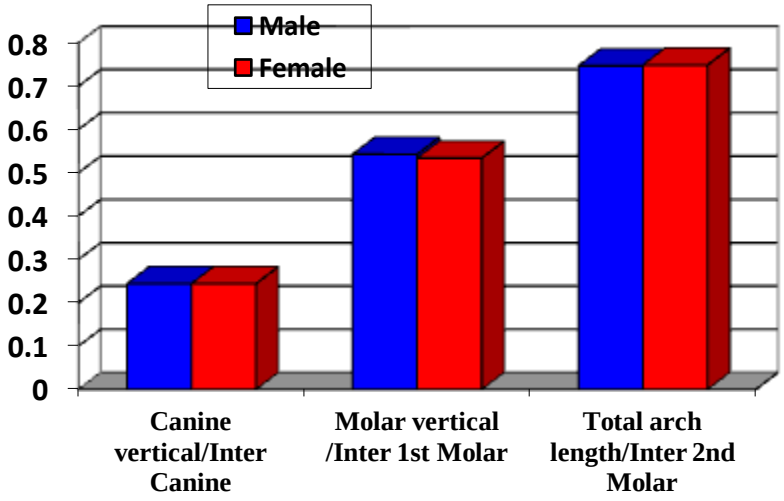

Figure (8) The Three Ratios for (Males and Females) with Comparisons between the Genders.

Table (4) Distribution of the Three Maxillary Arch Forms for (males, females and the Total) (Frequencies and Percentages)

	Males		Females		Total	
Arch Type	**No.**	**%**	**No.**	**%**	**No.**	**%**
Narrow	9	24.32	14	24.13	23	24.21
Mid	20	54.05	32	55.17	52	54.73
Wide	8	21.62	12	20.68	20	21.05
Total	37	100	58	100	95	100

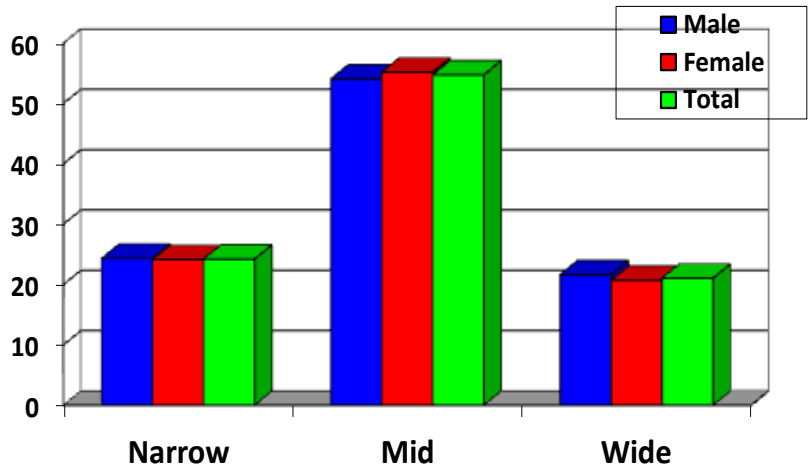

Figure (9) Percentages of Three Maxillary Arch Forms for(Males, Females and the Total).

LATERAL FACIAL MEASUREMENTS

1. DESCRIPTIVE STATISTICS:

The description & Comparison of facial measurement & the distribution of the five angles according to gender There was no significant difference in angular measurements between males and females by using t-test as showed in Table (5).

LATERAL FACIAL FORMS:

The distribution of the lateral facial types among males, females and the total sample showed in Table (6). This table illustrated that the most frequent lateral facial type was the Mesofacial type (59,45%, 58,62 % and 58.94%) followed by Dolichofacial (21,62%, 20,68% and 21.05%) and then the Brachyfacial type(18,91%, 20,68% and 20%) in males, females and the total sample respectively.

Table (5) Descriptive Statistics for the Five Angles for (Males, Females and the Total) with Comparison between the Genders.

Variable	Sex	Mean	S.D	Min	Max	T-Value
Facial Angle	M F T	90.05 89.52 89.73	2.49 2.99 2.80	85 83 83	95 96 96	0.90 NS
Facial Axis Angle	M F T	88.56 88.43 88.48	2.63 3.07 2.89	83 80 80	94 95 95	0.21 NS
Mandibular Plane Angle	M F T	22.76 24.02 23.53	3.86 4.37 4.20	15 15 15	32 35 35	1.43 NS
Lower Facial Height Angle	M F T	43.64 43.22 43.38	3.58 3.76 3.68	35 36 35	54 55 55	0.53 NS
Mandibular Bend Angle	M F T	33.62 32.43 32.89	4.48 4.15 4.29	23 24 23	41 42 42	1.31 NS

Table (6) Distribution of the Lateral Facial Types for (Males, Females and the Total) (Frequencies and Percentages).

	Males		Females		Total	
Facial Type	No.	%	No.	%	No.	%
Dolichofacial	8	21.62	12	20.68	20	21.05
Mesofacial	22	59.45	34	58.62	56	58.94
Brachyfacial	7	18.91	12	20.68	19	20
Total	37	100	58	100	95	100

COMPARISON BETWEEN MALES AND FEMALES ACCORDING TO LATERAL FACIAL TYPE

The difference in angular measurements between males and females in Dolichofacial , Mesofacial & Brachyfacial by using t-test showed in Table (7). It was found that there was a significant difference between males and females for Mandibular plane angle for Dolichofacial & Mesofacial type and a non significant difference for other angular measurements at $P < 0.05$.

ASSOCIATION BETWEEN THE LATERAL FACIAL TYPE AND DENTAL ARCH FORMS:

The association between the type of face and the dental arch form in (males, females and the total) showed in Table (8), expressed as frequencies and percentages. It was found that the Mid maxillary arch form was associated with Mesofacial (63.63%, 64.70% and 64.28%).Also we can see that there was an association between Narrow arch and Dolichofacial type (62.5% , 58.33% and 60%), and there was an association between Wide arch and Brachyfacial type (57.14%, 58.33% and 57.89%) for males, females and the total sample respectively.

Table (7) Descriptive Statistics for the Five Angles According to Lateral Facial Type with Comparison between Genders

		Dolichofacial			Mesofacial			Brachyfacial		
Variable	**Sex**	**Mean**	**S.D**	**T-Value**	**Mean**	**S.D**	**T-Value**	**Mean**	**S.D**	**T-Value**
Facial Angle	M	87.19	1.89	1.110 NS	90.02	1.45	1.485 NS	93.43	1.27	0.63 NS
	F	86.18	1.99		89.32	1.89		93.9	1.66	
Facial Axis Angle	M	85.78	1.67	1.297 NS	88.52	1.86	0.019 NS	91.86	1.77	0.59 NS
	F	84.50	2.38		88.51	1.71		92.45	2.19	
Mandibular Plane Angle	M	27.63	2.66	2.076 *	22.05	2.76	2.263 *	19.43	2.81	0.61 NS
	F	30.27	2.79		23.62	2.47		18.6	2.67	
Lower Facial Height Angle	M	48.19	3.44	0.372 NS	43.05	1.96	1.010 NS	40.28	2.75	0.23 NS
	F	48.73	2.88		42.46	2.25		39.95	3.00	
Mandibular Bend Angle	M	28.11	2.47	1.132 NS	33.72	2.88	1.989 NS	39.57	1.61	1.05 NS
	F	26.82	2.44		32.43	2.10		38.6	2.01	

Table (8) Association of the Three Maxillary Arch Forms According to Lateral Facial Type for (Males ,Females and the Total) (Frequencies and Percentages).

	Males						Females						Total					
	dolichofacial		mesofacial		brachyfacial		dolichofacial		mesofacial		brachyfacial		dolichofacial		mesofacial		brachyfacial	
Arch Type	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Narrow	5	62.5	4	18.18	0	0	7	58.33	7	20.58	0	0	12	60	11	19.64	0	0
Mid	3	37.5	14	63.63	3	42.86	5	41.67	22	64.70	5	41.67	8	40	36	64.28	8	42.10
Wide	0	0	4	18.18	4	57.14	0	0	5	14.70	7	58.33	0	0	9	16.07	11	57.89
Total	8	100	22	100	7	100	12	100	34	100	12	100	20	100	56	100	19	100

FRONTAL FACIAL MEASUREMENTS

1. DESCRIPTION & COMPARISON BETWEEN MALES AND FEMALES IN LINER MEASUREMENTS

The descriptive statistics of facial measurement of the total anterior facial height, inter zygomatic distance and the ratio of total anterior facial height and inter zygomatic distance with The comparison between males, females from frontal digital cephalometric as showed in Table (9) .It was found that males had higher values than females with a significant difference at $P < 0.01$ for all dimensions, but the ratio was nearly equal and the difference was not significant at $P < 0.05$.

Table (9) Descriptive Statistics for Liner Measurement and (TAFH/IZD) Ratio for(Males, Females and the Total) with Comparison between Genders.

	Males		Females		T-Value	Total	
Variable	**Mean**	**S.D**	**Mean**	**S.D**		**Mean**	**S.D**
Total Anterior Facial Height	127.89	7.61	120.32	5.11	5.679 **	123.28	7.24
Inter Zygomatic Distance	144.42	6.94	135.32	5.27	6.958 **	138.76	7.32
Ratio TAFH/IZD	0.887	0.05	0.890	0.05	0.181 NS	0.889	0.05

** : Significant at $P < 0.01$.

2. FRONTAL FACIAL FORMS

The distribution of the frontal facial types among the males, females and the total sample showed in Table (10). This table illustrated that the most frequent facial type was the Mesoprosopic (54.05 %, 60.34% and 57.89%) type followed by Leptoprosopic (24.32%, 18.96% and 21.05%) and Euryprosopic (21.62%, 20.68% and 21.05%) for males, females and the total sample respectively.

Table (10) Distribution of the Frontal Facial Types for (Males, Females and the Total) (Frequencies and Percentages).

	Males		Females		Total	
Facial Type	**No.**	**%**	**No.**	**%**	**No.**	**%**
Leptoprosopic	9	24.32	11	18.96	20	21.05
Mesoprosopic	20	54.05	35	60.34	55	57.89
Euryprosopic	8	21.62	12	20.68	20	21.05
Total	37	100	58	100	95	100

3. COMPARISON BETWEEN OF GENDERS ACCORDING TO FRONTAL FACIAL TYPE

The comparison in liner, measurements (TAFH, IZD, ratio of TAFH/IZD) between males and females in (Leptoprosopic) & (Mesoprosopic) by using t-test showed in Table (11). there was a high significant difference at $P < 0.01$ between males and females for all dimensions (TAFH, IZD) but the ratio showed non significant difference at $P < 0.05$. In (Euryprosopic) there was a significant difference at $P < 0.05$.in interzygomatic distance and a non significant difference for the total anterior facial height and the ratio.

Table (11): Descriptive Statistics for frontal Liner Measurement and (TAFH/IZD) Ratio

(Comparison between Males and Females) for (Leptoprosopic, Mesoprosopic and Euryprosopic).

		Leptoprosopic			Meso prosopic			Euryprosopic		
Variable		**Mean**	**S.D**	**T-Value**	**Mean**	**S.D**	**T-Value**	**Mean**	**S.D**	**T-Value**
Total Anterior Facial Height	**M**	133.88	2.48	6.218 **	128.68	6.35	5.572 **	118.38	7.21	1.637 NS
	F	125.08	3.39		120.70	4.54		114.55	2.51	
Inter Zygomatic Distance	**M**	138.50	4.24	3.908**	145.34	6.20	6.626 **	146.57	8.94	2.400 *
	F	131.16	3.90		135.36	5.15		139.53	3.31	
Ratio TAFH/IZD	**M**	0.967	0.03	1.054 NS	0.885	0.019	1.197 NS	0.808	0.024	1.244 NS
	F	0.954	0.02		0.892	0.021		0.821	0.020	

ASSOCIATION BETWEEN THE FRONTAL FACIAL TYPE AND DENTAL ARCH FORMS:

The association between the facial types and the dental arch form, expressed as frequencies and percentages for all the sample showed in Table (12) . It was found that the Mid maxillary arch form was associated with Mesoprosopic (65%, 62.85% and 63.63) for males, females and the total sample respectively and those males had higher records than females.
We can see that there was an association between Narrow, maxillary arch forms and Leptoprosopic (55.55%, 54.54% and 55%) for males, females and the total sample respectively and that males had higher records than females.
Also we can see that there was an association between Wide maxillary arch forms with Euryprosopic (62.5%, 58.33% and 60%) for males, females and the total sample respectively and that males had higher records than females.

6- ASSOCIATION BETWEEN LATERAL AND FRONTAL FACIAL TYPES:

The association between the lateral facial types and frontal facial Type expressed as frequencies and percentages showed in Table (13) . It was found that the Mesoprosopic facial type associated with Mesofacial (63.63%, 76.47% and 71.42%) for males, females and the total sample respectively and those females had higher records than males. We can see that there was an association between Leptoprosopic and Dolichofacial (62.5%, 66.66% and 65%) for males, females and the total sample respectively and that females had higher records than males. We can see that there was an association between Euryprosopic face type and Brachyfacial (57.14%, 58.33% and 57.89%) for males, females and the total sample respectively and that females had higher records than males

Table (12): Association of three arch forms according to frontal facial types

	Males						Females						Total					
	Leptoprosopic		Mesoprosopic		Euryprosopic		Leptoprosopic		Mesoprosopic		Euryprosopic		Leptoprosopic		Mesoprosopic		Euryprosopic	
Arch Type	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Narrow	5	55.55	4	20	0	0	6	54.54	8	22.85	0	0	11	55	12	21.81	0	0
Mid	4	44.44	13	65	3	37.5	5	45.45	22	62.85	5	41.66	9	45	35	63.63	8	40
Wide	0	0	3	15	5	62.5	0	0	5	14.28	7	58.33	0	0	8	14.54	12	60
Total	9	100	20	100	8	100	11	100	35	100	12	100	20	100	55	100	20	100

Table (13) Association of the Frontal with Lateral Facial Types

	Males						Females						Total					
	Dolichofacial		Mesofacial		Brachyfacial		Dolichofacial		Mesofacial		Brachyfacial		Dolichofacial		Mesofacial		Brachyfacial	
Facial Type	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Leptoprosopic	5	62.5	4	18.18	0	0	8	66.66	3	8.82	0	0	13	65	7	12.5	0	0
Mesoprosopic	3	37.5	14	63.63	3	42.85	4	33.33	26	76.47	5	41.66	7	35	40	71.42	8	42.10
Euryprosopic	0	0	4	18.18	4	57.14	0	0	5	14.70	7	58.33	0	0	9	16.07	11	57.89
Total	8	100	22	100	7	100	12	100	34	100	12	100	20	100	56	100	19	100

THREE DIMENSIONS FACIAL FORMS

The distribution of the three dimension facial types showed in Table (14) . This table illustrated that the most frequent facial type was the Three dimension-average type (56.75%, 55.17% and 55.78%) followed by the Three-dimension long (24.32%, 22.41% and 23.15%), then Three-dimension short type (18.91%, 22.41% and 21.05%), for males, females and the total respectively.

ASSOCIATION OF MAXILLARY ARCH FORMS TO THREE-DIMENSION FACIAL TYPES

The association between the facial types and the dental arch form expressed as frequencies and percentages showed in Table (15) .It was found that there was a highly association between Narrow, maxillary arch forms and Three-dimension long (77.77%, 84.61% and 81.81%) females had higher records than males. Also we can see that there was a highly association between Mid maxillary arch form with Three-dimension average (80.95%, 87.5% and 84.90%) females had higher records than males. Also we can see that there was a highly association between Wide maxillary arch forms with the Three-dimension short face type (85.71%, 84.61% and 85%) but here males had higher records than females.

Table (14) Distribution of the Three Dimensions Facial Type

	Males		Females		Total	
Facial Type	**No.**	**%**	**No.**	**%**	**No.**	**%**
3D-long	9	24.32	13	22.41	22	23.15
3D-average	21	56.75	32	55.17	53	55.78
3D-short	7	18.91	13	22.41	20	21.05
Total	37	100	58	100	95	100

Table (15) Association of the Three Maxillary Arch Forms According to Facial Type Three-Dimension

	Males						Females						Total					
	3D-long		3D-average		3D-short		3D-long		3D-average		3D-short		3D-long		3D-average		3D-short	
Arch Type	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Narrow	7	77.77	2	9.52	0	0	11	84.61	3	9.37	0	0	18	81.81	5	9.43	0	0
Mid	2	22.22	17	80.95	1	14.28	2	15.38	28	87.5	2	15.38	4	18.18	45	84.90	3	15
Wide	0	0	2	9.52	6	85.71	0	0	1	3.12	11	84.61	0	0	3	5.66	17	85
Total	9	100	21	100	7	100	13	100	32	100	13	100	22	100	53	100	20	100

DISCUSSION

DENTAL ARCH DIMENSION

For inter canine distance, the current study for males and females were more than that of Henrikson (2001) and Al-Zubair (2003), but near that of Salem (2003) and Al-Hadithy (2005). the mean values of Inter 1st & 2nd molar distance for this study for males were more than that of Henrikson (2001), Salem (2003) and Al-Zubair (2003) but near to that of Al-Hadithy (2005) and Haralabakis (2006), while for females sample this study was larger than that of Henrikson (2001) and Salem (2003), but near to that of Al-Zubair (2003), Al-Hadithy (2005) and Haralabakis (2006) , while for the total sample, this study was larger than that of Henrikson (2001) and Salem (2003) and Kim and Gianelly (2003) but near that of Al-Zubair (2003), Al-Hadithy (2005) and Haralabakis (2006). The difference might be due to racial factor or the difference in the analyzing technique. the mean values of total arch length for this study for males were more than that of Al-Zubair (2003) and Al-Hadithy (2005), but nearly equal to that of Salem (2003),and less than that of Haralabakis (2006), but for females and the total sample, the mean value was nearly equal to that of Salem (2003), Al-Zubair (2003) and Al-Hadithy (2005),and less than that of Haralabakis (2006) .

We can notice that the most frequent maxillary dental arch form in both genders was the Mid type. This findings agreed with Borgan (2001) who found that the most frequent Jordanian maxillary arch form was the Mid form and Salem (2003) who found that the most frequent Palestinian maxillary arch form was the Mid form, also Haralabakis (2006) found that the most frequent maxillary arch form was the Mid form. In general, it is obvious that the mean values of all measurements taken for the dental arch length were slightly differed from that of other studies, these slight differences might be due to the sample selection and ethnic variation.

FACIAL TYPES AND DENTAL ARCH FORMS

persons with Dolichofacial face showed a larger value of Mandibular plane angle, Lower facial height angle and low value of Facial angle, Facial axis angle and Mandibular bend angle than other types of face. Persons with Brachyfacial face showed a low value of Mandibular plane angle, Lower facial height angle and a large value of Facial angle, Facial axis angle and Mandibular bend angle than other types of face. Persons with mesofacial face show a value of five angles in between the Dolichofacial and the Brachyfacial. It was found that the mid maxillary arch form was associated with mesofacial type (63.63 % for males, 64.70% for females, 64.28% for the total). Also we can see that there was an association between Narrow arch and Dolichofacial type (62.5% for males, 58.33% for females, 60% for the total). Also there was an association between Wide arch and Brachyfacial type (57.14% for males, 58.33% for females, 57.89% for the total). This means that the person with Dolichofacial face type, mostly has a Narrow dental arch , the person with Mesofacial face type, mostly has a Mid dental arch, and the person with Brachyfacial face type, mostly has a Wide dental arch .This is one of the characters of each facial type that's supported by (Enlow, 1982; R.M.O, 2000; Al-Taee & Al-Joubori 2014). there was an association between Narrow, maxillary arch forms and Leptoprosopic . Also there was an association between Wide maxillary arch forms and Euryprosopic face type. an association between the face types and the dental arch form in males and females expressed as frequencies and percentages. It was found that the Mid maxillary arch form was associated with Mesoprosopic**.** This agreed with Salem (2003).

There was also an association between Narrow maxillary arch forms and Leptoprosopic, and between Wide maxillary arch forms with Euryprosopic face type. Our finding were in agreement with Graber (1988) which stated that there was a sort of correlation between facial morphology and dental arch form. So Leptoprosopic individuals had Narrow dental arches, while Euryprosopic individuals had broad, round dental arches; whereas Mesoprosopic individuals fitted somewhere in between the two types. Ramadan (2000) stated that the association was not unexpected; Al Shalabi (2002) agrees on that there is no clear relationship between facial forms and arch forms. It was noticed that there was an association between Leptoprosopic and Dolichofacial, and between Euryprosopic face type and Brachyfacial. Anterior facial height affects both lateral and frontal facial types so most but not all of Dolichofacial type had Leptoprosopic this is because the lateral facial type is affected also by facial depth, but frontal facial type is affected by facial width instead of facial depth. This was the same for Mesofacial and Brachyfacial types. So that not every long face of lateral type had the same characteristics of frontal type, this was the same for short and averaged face.

The lateral facial type represent the relationship between the facial height and facial depth, the frontal facial type represents the relationship between the facial height and facial width. As the face is three dimensional object, so we need three dimensional relationship that represents the relationship between the facial height, facial depth and facial width. As the

facial bone grows in three dimensions, the face should be studied in its three dimensions as the transverse dimensions of the face affects all the determinations of the dentofacial proportion as well as balance and harmony this was in accordance to (Hatcher and Aboudara, 2004). In this study the distributions of facial type (lateral, frontal and three dimension) were nearly the same. It was noticed that the (Mesofacial, Mesoprosopic, Three-dimension average)had the most frequent facial type (more than halve 54-60 %) and then followed by (Dolichofacial, Leptoprosopic, Three-dimension long) and (Brachyfacial, Euryprosopic, Three-dimension short) both types had about less than halve of the sample, each one had about (18-24%) of the sample. It is found that there was a highly association between Narrow maxillary arch forms and Three-dimension long ones.(77.77%, 84.61%, 81.81%) Also there was a highly association between Mid maxillary arch form with a Three-dimension average (80.95, 87.5%, 84.90%) and between Wide maxillary arch forms with Three-dimension short face type (85.71%, 84.61%, 85%) for males, females and the total sample respectively.

CONCLUSION

In general for this study there was an increase in the association between a Three-dimension facial type and the upper dental arch form than that of (lateral and frontal), so that the characteristic features of facial type appeared more clear in the three dimensions than that of the two dimensions.

REFERENCES

[1]. Al-Shalabi F.S.(2002): The Relationship between Skeletal Facial Form and Lower Dentalarch Form in an Iraqi Sample Aged 20-25 Years with Class I Normal Occlusion. "A Computerized Analysis". **Master thesis, Baghdad University.**
[2]. Al-Tamimy E (2006) The reliability of Ricketts analysis using cephalometric tracing of Iraqi sample aged 8-10 years. Al-Mustanseria DJ. , Vol. 3(2), 88-96.
[3]. Al-Hadithy S.F.(2005): Dental arch dimensions and forms in Sulaimania Kurdish population sample aged 16-24 years with class I normal occlusion. **Master thesis, Baghdad University.**
[4]. Al-Zubair N.(2002): Maxillary and mandibular dental arch dimensions and forms in a sample of Yemeni population aged (18-26) years with class I normal occlusion. **Master thesis, Baghdad University.**
[5]. Al-Taee H & Al-Joubori S (2014) Dental arches dimensions, forms and its association to facial types in a sample of Iraqi adults with skeletal and dental class II-division 1 and class III malocclusion. J Bagh Coll Dentistry; 26(2): 160-166.
[6]. Baccetti T, Antonini A, Franchi l, Tonti M and Tollaro I (1997) Glenoid Fossa Position in Different Facial Types: a Cephalometric Study **British Journal of Orthodontics.,Vol. 24:55–59**
[7]. Bishara S.E.(2001): Text book of orthodontics. **W.B Saunders Company. Section I, pp.45-48.**
[8]. Borgan B.E. (2001): Dental arch dimensions analysis among Jordanian school children. **Master Thesis. Cairo University- Egypt**.
[9]. Cakirer.B, Hans M.G, Graham G, Aylor J, Tishler P.V And Redline S.(2001): The Relationship Between Craniofacial Morphology and Obstructive Sleep Apnea in Whites and in African-Americans. **journal of respiratory and critical care medicine. Vol 163:947-950.**
[10]. Daskalogiannakis J. (2000): Glossary of orthodontic terms. **Quintessence publishing Co Inc.**
[11]. Enlow D.H. (1982): Handbook of Facial Growth. 2nd ed. **Philadelphia, PA: WB Saunders.**
[12]. Gallão S, Faltin K, Santos L, Ary D, Martins L (2013) Facial type measurements influence on transverse dimensions of normal occlusion arches. J Health Sci Inst.;31(3):20-3.
[13]. Graber T.M. (1988): orthodontics, principles and practice. **W.B. Saunders company pp:209,210.**
[14]. Graber T.M. and Vanarsdall R.L. (2000): Orthodontics current principles and techniques. **Third ed Mosby Inc pp:385.**
[15]. Haralabakis n.b., sifakakis L., papagrigorakis M., papadakis G. (2006): The correlation of sexual dimorphism in tooth size and arch form. **World .j.orthod. 7 (3):254-262.**
[16]. Hatcher D.C. and Aboudara C.L. (2004): Diagnosis goes digital. **Am.J.Orthod.Dentofac.Orthop. 125: 512 – 515.**
[17]. Henrikson J., Persson M. and Thilander B. (2001): Long-term stability of dental arch form in normal occlusion from 13 to 31 years of age. **The Euro. J. Orthod. 23 (1): 51-61.**
[18]. Kim E. and Gianelly A.A.(2003): Extraction vs Nonextraction: Arch Widths and Smile Esthetics. **Angle. Orthod. 73:354–358.**
[19]. Murad S.M.(2008): Accuracy of measurements made on digital and study models (A comparative study). **Master thesis, Baghdad University.**
[20]. Mutinelli S., Cozzani M., Manfredi M. and Siciliani G.(2004): Dental arch analysis system. **Progress In Orthodontics. 5(2): 200-2011.**
[21]. Panhos L, Zaroni M, Carlil J et al (2014) Association between the facial type and morphology of upper central incisor in normal occlusion subjects. Journal of contmperary dental practice, 15(1), 29-33.
[22]. Paranhos L, Ramos M, Benedicto E et al (2014) Is there any association between facial type and mandibular dental arch form in subjects with normal occlusion? Acta Scientiarum. Health Sciences Maringá, vol. 36(1), p. 129-134.
[23]. R. M. O. (2000): Diagnostic services.

[24]. Ramadan O.Z. (2000): Relation between photographic facial Measurements and lower dental arch measurement in adult Jordanian males with class I normal occlusion. **Master Thesis, Mousl University.**
[25]. Salem N.M.(2003): Facial and arch form and dimensions in a sample of 16-21 years old Palestinians class I occlusion. **Master Thesis. Baghdad University- Iraq.**
[26]. Uysala T., Memilib B., Usumezc S. and Sarid Z.(2005): Dental and Alveolar Arch Widths in Normal Occlusion, Class II division 1 and Class II division 2. **Angle. Orthod. 75:941–947.**
[27]. Warren J.J. and Bishara S.E. (2001): Comparison of dental arch measurement in the primary dentition between contemporary and historic samples. **Am.J.Orthod.Dentofac.Orthop. 119:211-215.**