

Photographic Analysis of Macro- Aand Micro-Aesthetic Appearance in a Sample of Iraqi Adults With Class I Normal Occlusion

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ABSTRACT

Background: Generally, the facial esthetics depends on the esthetic appearance of the maxillary anterior teeth. The purposes of this study were to analyse the macro-aesthetic appearance of the face and the micro-aesthetic appearance of the maxillary anterior teeth to establish the normative values for class I normal occlusion and to detect possible gender differences.

Materials and methods: The sample consisted of 120 Iraqi adults (60 males and 60 females) aged (18-23) years. Each individual was clinically examined, then with cephalostat based head position, extraoral and intraoral photographs were taken for each subject. The facial and dental measurements were measured using AutoCad program 2014. Descriptive statistics was obtained for the measured variables for both genders and independent samples t-test was performed to evaluate the genders difference.

Results and conclusions: The results showed that there is a highly significant gender difference in most of the measured variables regarding the macro-aesthetic appearance, since the males have a larger facial dimensions than females, while for the micro-aesthetic appearance, there is a non-significant gender difference in most of the measured variables, that means the proportions of maxillary anterior teeth does not affected by gender difference.

Key words: class I normal occlusion; macro-aesthetic appearance; micro-aesthetic appearance; photographic records. (J Bagh Coll Dentistry 2017; 29(1):153-159)

INTRODUCTION

Beauty can be defined as a combination of qualities that gives pleasure to the senses or to the mind. It is a philosophical concept and the aspects of which were studied under the term aesthetics obtained from the Greek word for perception (aisthesis) and was coined by the 18th century philosopher Alexander Baumgarten who established esthetics as a separate field of philosophy, therefore; esthetics is the study of beauty and to a lesser extent, it's opposite to the term ugly. It involves both the understanding and the evaluation of beauty, proportions and the symmetry⁽¹⁾. Facial beauty is a mystery, a complex concept for which there is no equation, or numbers can successfully describe it^(2, 3), whereas the dental esthetics is a complicated branch and may be regarded to be purely subjective; this 'subjective' branch of dentistry encompassed by rules and values that allow us to study it objectively⁽⁴⁾. The Egyptians and the Greeks in the period 365 BC- 300 BC started to understand the Divine or Golden proportion that known as A Golden Ratio which is the ratio of 1:1.618 that considered to be the most esthetically pleasing to the human eye⁽⁵⁾. Enhancement of esthetic appearance is one of the primary consideration for the patients that seeking orthodontic treatment.

The term "appearance" is used in conjunction with the term "esthetics" because it involves a broader assessment of the patient's face other than the teeth, so to achieve this goal, it is essential to make a comprehensive study of several facial and teeth factors to create a pleasing harmony of face and teeth^(6, 7). Two-dimensional photogrammetry has been used in orthodontics to evaluate the facial proportions and assess changes during orthodontic treatment, this method was shown to be sufficiently non-invasive, inexpensive and reproducible since it was simple to achieve in a conventional setting, without the need for a special equipment^(8, 9).

The macro-aesthetics and micro-aesthetics are important divisions of esthetic appearance in orthodontics, this study aimed to analyse the macro-aesthetic appearance and micro-aesthetic appearance of maxillary anterior teeth to establish the normative values for class I normal occlusion in Iraqi adults with the aid of photographs and computer analysis and to detect the possible gender differences in macro and micro-aesthetic appearance.

MATERIALS AND METHODS

Sample

The sample selected from undergraduate students at College of Dentistry-University of Baghdad. Out of 450 students examined, only 120 of them (60 females and 60 males) fitted the criteria of subject selection, which are: 1) All are

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Iraqies with age ranged 18-23 years, 2) having full permanent dentition regardless the third molars, 3) having normal overjet and overbite (2-4 mm), 4) bilateral class I buccal segments "molar and canine" ⁽¹⁰⁾, 5) skeletal class I relationship determined clinically ⁽¹¹⁾ and 6) no spacing or crowding in anterior teeth. Whereas those with 1) history of facial trauma, 2) orthodontic/orthognathic treatment, dento-facial deformities, surgeries, asymmetry or bad oral habits like thumb sucking and tongue thrust, 3) anterior or posterior crossbite, 4) active periodontal diseases and gingivitis, 5) extruded or rotated teeth in the anterior region, 6) signs of attrition and restoration of the maxillary anterior teeth, or proximal caries, 7) developmental anomalies such as supernumerary teeth, 8) prosthesis in the anterior teeth were excluded from the study.

Methods

History

Each subject was seated on the dental chair and information about his/her name, age, medical and dental history was obtained. After that, a written consent form was obtained from the participants to assure their voluntary participation in the study.

Then, each individual subjected to clinical examination which included examination of skeletal and dental relation.

Standardization of the Photographs

The camera (Canon D60, Japan) fixed in position and adjusted in height to be at the level of the individual's eyes with a height adjustable tripod that controls the stability and the correct height of the camera according to the subject's body height. The distance from the camera to the subject was fixed at a distance of about 101 cm measured from the camera lens to the ear rods, that were fit in the external auditory meatus in order to avoid the forward, backward, and tilting of the subject head (Cephalostat based head position) ⁽¹²⁾, and 56 cm from the camera lens to the ear rods for frontal intraoral photographs ⁽¹³⁾. The EF-S 18-200mm f/3.5-5.6 IS lens was used. Subjects were seated in front of a blue background, a ruler was placed on the plastic side of cephalostat near the subject head to correct the magnification.

Photographic exposure

The digital camera was set on the manual exposure shooting and from the wheel dial the camera was set on: ISO 2000, shutter speed of 80, aperture value set on f/5.6 and flash on. Two photographs were taken for each participant, for the facial photographs, each participant was positioned in the cephalostat with the interpupillary plane parallel to the floor ⁽¹⁴⁾,

instructed to keep their teeth in maximum intercuspation and gently closed lips ⁽¹⁵⁾. The camera lens positioned parallel to the individual's face and the subject was asked to look at the center of the camera's lens during taking the photograph. The participant's hair did not cover any part of the face ⁽¹⁶⁾. For the intraoral photograph, the cheek retractor was used to clearly display the maxillary anterior teeth, with the camera lens parallel to the labial surface of the teeth ⁽¹⁷⁾.

Photographic analysis

Each frontal facial and intra-oral photograph were analyzed by AutoCAD 2014 program. The analysis includes:

1-The Macro-aesthetic appearance that includes:

a. Facial landmarks: according to Milutinovic et al. ⁽¹⁸⁾

- Glabella (Gl): It is the most prominent point on the midline of the face, between the eyebrows.
- Nasion (n): It is the point in the midline of both the nasal root and the nasofrontal suture.
- Inner canthus of the eye (Ic): It is the medial angle of the palpebral fissure.
- Pupil of the eye (p): It is the hole that located in the center of the iris of the eye.
- Zygoin (zy): Most lateral point on zygomatic arch.
- Alare of the nose (AL): Point located at each lateral rim of the ala of the nose at its widest width.
- Subnasale (Sn): The point at which the nasal columella merges with upper mucocutaneous lip in the mid sagittal plane
- Chilion (Ch): A point located at angle of the mouth.
- Stomion (Sto): The midpoint of the intra-labial fissure.
- The Labrale Superius (LS): The midline point at the border of the upper lip.
- The Labrale Inferius (LI): The midline point at the border of the lower lip.
- Menton (Me): A most inferior point located at the soft tissue chin.

b. The Linear Facial Measurements: According to Proffit et al. ⁽¹⁹⁾:

- Zygomatic width (zy-zy): The distance between the two zygion points.
- Inter-canthal distance (ICD): The distance between the median angles of the palpebral fissure.
- Interpupillary width (IPW): It is a horizontal line between the center of right and left pupils.

- Interalar width (IAW): The distance between the two alare points of the nose.
- Mouth width (MW): The distance between the two angles of the mouth.

c. Vertical Facial Measurements: According to Proffit et al. (19):

- Facial height (N-Me): The distance between soft tissue nasion and menton.
- Lower face height (Sn-Me): The distance between subnasale and menton.
- Upper lip vermillion (ULV): The distance between labrale superius and stomion.
- Lower lip vermillion (LLV): The distance between labrale inferius and stomion.

2-The Micro-aesthetic appearance includes:

a. The Golden Proportion: It could be defined as the proportion of successive width of the maxillary anterior teeth. It should remain constant, when progressing distally from the midline (20). The mesiodistal width measured parallel to the incisal edge, and at the widest mesiodistal portion of the tooth of each lateral incisor and the canine, as shown in Figure 1. It was calculated as follow:

-For lateral incisor= $\frac{\text{MDW of lateral incisor}}{\text{MDW of central incisor}} \times 100$

-For canine= $\frac{\text{MDW of canine}}{\text{MDW of lateral incisor}} \times 100$

b. The Golden Percentage: The proportional width of each maxillary anterior tooth (for the right and left side) should be: 10% for the canine, 15% for the lateral incisor, 25% for the central incisor of the total distance across the maxillary anterior segment (21), it was calculated as follow:

-Golden Percentage=

$\frac{\text{MDW central, lateral, canine}}{\text{CMDW of all maxillary anterior teeth}} \times 100$

*The mesiodistal dimension measured parallel to the incisal edge, and at the widest mesiodistal portion of the tooth of each central incisor, lateral incisor and the canine, as shown in Figure 1.



Figure 1: Measurement of mesiodistal width of maxillary anterior teeth.

b. Tooth Proportionality-Height and Width Ratio:

The ideal maxillary central incisor width should be approximately 80% compared to its height (22). It was calculated as follow:

-Width-height ratio= $\frac{\text{Width of the tooth}}{\text{Height of the tooth}} \times 100$

* The incisogingival dimensions of the maxillary central incisor were measured at the longest apical-coronal portion of the tooth, as shown in Figure 2

c. Height of Contact Points: Contact between the anterior teeth is where the teeth actually touch (23). The golden ratio was applied to the height of the contact points of the anterior teeth. This ratio was calculated as follow:

-For central incisor=

$\frac{\text{Height of contact point between centrals}}{\text{Height of central incisor}} \times 100$

-For lateral incisor=

$\frac{\text{Height of contact point (central-lateral)}}{\text{Height of central incisor}} \times 100$

-For canine=

$\frac{\text{Height of contact point (lateral-canine)}}{\text{Height of central incisor}} \times 100$

*The height of contact point was measured from the incisal convergence of the gingival embrasure to the gingival convergence of the incisal embrasure (24) as shown in Figure 2

d. Total Maxillary Anterior Teeth Width: The distance between the tips of the maxillary canines in a horizontal straight line was measured (25). (Figure 2)



Figure 2: Measurement of height of maxillary central incisors, height of contact points and total anterior teeth width.

RESULTS AND DISCUSSION

The sample in this study was selected at age between (18-23) years because the individuals maintain the same facial pattern till 25 years (26), and to minimize the effect of any remaining skeletal growth since the majority of facial growth is usually completed by the age of 16-17 years (27), as well as the occlusion at this age has been established regardless of the third molars and the possibility of teeth being mutilated by caries or wasting diseases would be minimal (28).

The results in table 1 showed that the mean values for facial parameters (macro-aesthetic appearance) were higher in males than females, this finding could be attributed to that the human being faces have dimorphic features between the sexes, especially after puberty⁽²⁹⁾, and because males have longer growth period than females, the males were having greater measurements than females⁽³⁰⁾, one exception is for the upper and lower lip vermilion, which were higher in females than males, this finding may be attributed to the suggestion that made by Peck and Peck⁽²⁾ in that the esthetically attractive white female face demonstrated a larger lips, and found to be in agreement with Ahmed et al.⁽³¹⁾ and disagree with Ellakwa et al.⁽³²⁾. Independent sample t-test indicated that there is a high significant difference regarding the measured facial variables except in the Inter-canthal distance (ICD), Zygomatic width (zy-zy), Upper lip vermilion (ULV), and Lower lip vermilion (LLV) where there is a non-significant gender difference, this comes in line with Asghari et al.⁽¹⁵⁾ and disagree with Ellakwa et al.⁽³²⁾.

Regarding the maxillary anterior teeth measurements, table 2 showed that the mean values of the measured variables were higher in males than in females except in the mesiodistal width of left (MDW L2) and right lateral incisor (MDW R2), height of the contact point between “central incisors (CI-CI), lateral incisor and canine (left and right LI-Ca)”, whereas the mean values of mesiodistal width of left canine (MDW

3L) were equal in both genders, this finding comes in line with Murthy and Ramani⁽³³⁾ and disagree with Gillen et al.⁽³⁴⁾ since the sexual dimorphism has been reported for the maxillary tooth dimension in most racial groups⁽²¹⁾. Additionally, the independent sample t-test showed that there is a non-significant difference regarding the maxillary anterior teeth variables except in the inter-canine distance (ICaD), height of left central incisor and mesiodistal width of both central incisors where there is a high significant difference, this could be attributed to sex-linked inheritance, so that the sex-hormonal influences were suggested⁽³⁵⁾, since the sexual dimorphism has a genetic basis according to Garn et al.⁽³⁶⁾, but till now this hypothesis is not proved.

Table 3 showed that there is a non-significant gender difference in micro-aesthetic appearance which is in agreement with Fayyad et al.⁽³⁷⁾ and Ahmed et al.⁽³⁸⁾ and in disagreement with Parnia et al.⁽³⁹⁾, beside that the mean values of the measured variables were higher in females than males, this may be due to that the gender is not considered a significant factor⁽³⁷⁾, since the proportions regarding the micro-aesthetic appearance were depending on the ethnic or racial characteristics rather than gender difference⁽³⁹⁾. In this study the sexual diamorphism was significant in macro-aesthetic appearance with males having larger facial measurements, on the other hand the gender had a non-significant effect on the maxillary anterior teeth proportions.

Table 1: Descriptive statistics and gender differences in macro-aesthetic appearance in both genders

Variables	Descriptive statistics				Gender difference (d.f.= 118)		
	Males (N=60)		Females (N=60)		Mean Difference	t-test	p-value
	Mean	S.D.	Mean	S.D.			
ICD	31.62	3.17	30.89	3.37	0.73	1.230	0.221 (NS)
IPW	63.41	4.69	60.96	4.59	2.45	2.888	0.005 (HS)
zy-zy	127.77	7.68	125.73	9.05	2.04	1.334	0.185 (NS)
IAW	39.68	3.07	35.51	3.26	4.18	7.225	0.000 (HS)
MW	52.54	3.78	49.58	4.56	2.96	3.872	0.000 (HS)
N-Me	125.60	9.02	115.47	7.95	10.13	6.524	0.000 (HS)
Sn-Me	69.92	5.23	60.63	5.43	9.29	9.537	0.000 (HS)
ULV	5.33	1.29	5.38	1.02	-0.05	-0.216	0.829 (NS)
LLV	10.11	1.76	10.29	1.48	-0.18	-0.617	0.538 (NS)

Table 2: Descriptive statistics and gender differences in Maxillary anterior teeth variables

Variables	Descriptive statistics				Gender difference (d.f.=118)		
	Males (N=60)		Females (N=60)		Mean difference	t-test	p-value
	Mean	S.D.	Mean	S.D.			
MDW 1 L	8.80	0.60	8.63	0.49	0.17	1.703	0.091 (NS)
MDW 1 R	10.37	0.96	10.26	1.06	0.11	0.596	0.552 (NS)
H 1L	8.79	0.51	8.58	0.54	0.21	2.200	0.030 (S)
H 1R	10.39	0.94	10.15	1.05	0.24	1.328	0.187 (NS)
MDW 2L	5.84	0.53	5.90	0.64	-0.06	-0.554	0.581 (NS)
MDW 2R	5.84	0.59	5.93	0.50	-0.09	-0.860	0.392 (NS)
MDW 3L	4.79	0.61	4.79	0.57	0.00	-0.028	0.977 (NS)
MDW 3R	4.70	0.61	4.59	0.54	0.11	1.032	0.304 (NS)
MDW I	17.59	1.08	17.21	1	0.38	2.009	0.047 (S)
Height of the contact point CI-CI	3.97	0.83	3.98	0.83	-0.01	-0.060	0.952 (NS)
Height of the contact point Left CI-LI	3.34	1.00	3.28	0.94	0.06	0.363	0.717 (NS)
Height of the contact point Right CI-LI	3.54	0.94	3.48	0.84	0.06	0.391	0.697 (NS)
Height of the contact point Left LI-Ca	2.92	0.86	3.00	0.88	-0.08	-0.529	0.598 (NS)
Height of the contact point Right LI-Ca	3.15	0.89	3.17	0.84	-0.02	-0.141	0.888 (NS)
IID	29.27	1.55	29.04	1.57	0.24	0.826	0.410 (NS)
ICaD	34.51	1.88	33.60	1.84	0.90	2.660	0.009 (HS)

Table 3: Descriptive statistics and gender differences in micro-aesthetic appearance

Variables	Descriptive statistics				Gender difference (d.f.=118)		
	Males (N=60)		Females (N=60)		Mean Difference	t-test	p-value
	Mean	S.D.	Mean	S.D.			
Golden proportion: Left LI to CI	66.71	7.68	68.53	7.83	-1.82	-1.287	0.201(NS)
Golden proportion: Right LI to CI	66.55	6.68	69.29	6.46	-2.74	-2.284	0.024 (S)
Golden proportion: Left Ca to LI	82.55	12.25	81.91	11.42	0.64	0.297	0.767(NS)
Golden proportion: Right Ca to LI	80.95	11.45	77.96	11.27	2.99	1.441	0.152(NS)
Width-height ratio of left CI	85.41	7.72	84.91	8.90	0.50	0.328	0.743(NS)
Width-height ratio of right CI	85.07	7.16	85.21	8.70	-0.14	-0.099	0.921(NS)
CMDW	38.76	2.07	38.42	1.97	0.34	0.926	0.356(NS)
Golden percentage: left CI to CMDW	22.72	1.23	22.48	1.02	0.24	1.150	0.252(NS)
Golden percentage: right CI to CMDW	22.69	1.02	22.33	1.02	0.36	1.927	0.056(NS)
Golden percentage: left LI to CMDW	15.09	1.23	15.35	1.30	-0.26	-1.141	0.256(NS)
Golden percentage: right LI to CMDW	15.05	1.18	15.43	1.10	-0.37	-1.794	0.075(NS)
Golden percentage: left Ca to CMDW	12.35	1.33	12.47	1.24	-0.12	-0.521	0.603(NS)
Golden percentage: right Ca to CMDW	12.10	1.34	11.94	1.24	0.17	0.707	0.481(NS)
Height of contact point % : CI-CI (left)	38.27	6.95	38.80	6.95	-0.52	-0.412	0.681(NS)
Height of contact point % : CI-CI (right)	38.18	6.90	39.19	6.95	-1.01	-0.800	0.425(NS)
Height of contact point % : CI-LI (left)	32.03	8.54	32.03	8.73	0	0	1 (NS)
Height of contact point % : CI-LI (right)	33.93	7.80	34.38	7.85	-0.45	-0.315	0.754(NS)
Height of contact point % : LI-Ca (left)	27.96	7.41	29.26	8.20	-1.30	-0.912	0.364(NS)
Height of contact point % : LI-Ca (right)	30.13	7.49	31.19	7.19	-1.05	-0.785	0.434(NS)

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الخلاصة

الخلفية: بصورة عامة، جمال الوجه يعتمد على المظهر الجمالي للأسنان الأمامية العلوية. هدفت هذه الدراسة تهدف إلى تحليل المظهر الجمالي الكلي للوجه والمظهر الجمالي الجزئي للأسنان الأمامية العلوية لتأسيس القيم المعيارية للفئة الأولى ذات الأطباق الطبيعي والكشف عن الاختلافات المحتملة بين الجنسين. العينة والطرق: تكونت عينة الدراسة من 120 من البالغين العراقيين (60 ذكور و 60 إناث) الذين تتراوح أعمارهم بين (18-23) سنة وأجري فحص كل فرد سريريًا، ثم تم تثبيت الرأس باستخدام جهاز Cephalostat، وأخذت صورة رقمية أمامية لكل فرد للوجه ولداخل الفم باستخدام الكاميرا الرقمية المثبتة في موقعها بمرجل ثلاثي القوائم قابل للتعديل. تم قياس خمس مسافات خطية وأربع مسافات عمودية للوجه إضافة إلى قياسات الأسنان باستخدام نظام الرسم والتصميم بالحاسب الإلكتروني (برنامج AutoCad 2014). تم استخدام الإحصاء الوصفي لقياس المتغيرات لكل الجنسين وأجري اختبار ت المستقل (t-test) لتقييم الفرق بين الجنسين.

النتائج و الاستنتاجات: أظهرت النتائج الاحصائية أن هناك فرقا معنويا بين الجنسين في معظم المتغيرات المقاسة بشأن المظهر الجمالي الكلي، علما أن الذكور يتميزون بأن أبعاد الجمجمة والوجه أكبر من الإناث، في حين أن النتائج الاحصائية أظهرت أن هناك فرقا غير معنويا بين الجنسين في معظم المتغيرات المقاسة بالنسبة للمظهر الجمالي الجزئي، وهذا يعني أن النسب المتعلقة بالأسنان الامامية العلوية لا تتأثر بالفرق بين الجنسين

