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Evaluation of Transverse Facial Proportions (Facial Symmetry) by Rule of Fifths in a Sample of Iraqi Adult Males with Normal Occlusion

Dana R. Mohammed*

Department of Pedodontics, Orthodontics and Preventive Dentistry, College of Dentistry, University of Basrah, Basrah, Iraq

**Corresponding e-mail: danarifat@yahoo.com*

ABSTRACT

Background: *The rule of fifths describes the facial proportions in a transverse relation. This study aimed to evaluate the transverse facial proportions by the rule of fifths in a sample of Iraqi adult males with class I normal occlusion, and to find if there is a correlation between alar width and the distance between the inner canthus and between the mouth width and the distance between the points at the most medial margin of the iris of the eyes.* ***Materials and methods:*** *The sample of this study consisted of 50 Iraqi adults, dental male students of 18-25 years of age. After clinical examination of each individual, a full frontal facial photograph with a cephalostat head position was taken for each individual. Each photograph with facial landmarks and measurements was analyzed by AutoCAD 2014 program and then were subjected to statistical analysis which included the descriptive statistics of the measured variables.* ***Results and conclusions:*** *The statistical analysis showed that there was a non-significant difference between the medial two fifths on the right side and the left side of the face, and a highly significant difference between the lateral two fifths on the right and the left side of the face, since a small degree of facial asymmetry is present in most individuals and it is considered to be a normal feature. Pearson correlation coefficient showed a high significant and moderate correlation between interalar width and inner canthal distance and a high significant and moderate correlation between the mouth width and the distance between the points at the most medial margin of the iris of the eyes, since these measurements are considered to be a part of the symmetrical face (normal transverse facial proportions).*

Keywords: Rule of fifths, Facial proportions, Facial symmetry, Normal occlusion

INTRODUCTION

Throughout the history, mankind tried to define the beauty [1]. In the human body, the commonest element in defining the beauty of the individuals is the face, although the perception of beauty may vary among the beholders [2]. The concept that 'ideal' proportions were the secret of beauty was the oldest idea regarding the nature of beauty [3]. The human sculptures that were created by ancient Greek-derived from proportions that followed the established rules or so-called "canons" [4]. A number of important soft tissue landmarks were used in the assessment of facial aesthetics and the patient should be examined for facial proportions in full face and in profile view [5]. The rule of fifths is practical, and a convenient guideline is used to analyze the transverse facial proportions, in which the ideal face could be transversely divided into five equal parts, each one is equal to one eye width [6]. Herzberg pointed out that standardized photographs could be the best method to evaluate faces several times and enable the orthodontist to determine the facial characteristics of each subject because only with them it would be possible to evaluate in details the facial measures and the proportions [7,8].

The most common reason for the individuals to seek the orthodontic treatment is the enhancement of the facial beauty in which 3 out of 4 patients have specifically requested an improvement of the facial appearance, and since the beauty of the individual's face is determined by the harmony of proportions and symmetry [9,10].

This study aimed to evaluate the transverse facial proportions (facial symmetry) by rule of fifths in a sample of Iraqi adult males with normal occlusion by using photographs and computer analysis, and to find if there is a correlation between alar width and the distance between the inner canthus and the eye's width, and also to find if there is a correlation between the mouth width and the distance between the medial margin of the iris of the eyes.

Research Hypothesis

H_o: There is no significant difference between the right and the left sides of the face (the face is usually symmetrical), and there is a correlation between alar width and the distance between the inner canthus and the eye's width, and between the mouth width and the distance between the medial margin of the iris of the eyes.

H_1: There is a significant difference between the right and the left sides of the face (the face is usually asymmetrical), and there is no correlation between alar width and the distance between the inner canthus and the eye's width, and between the mouth width and the distance between the medial margin of the iris of the eyes.

PATIENTS AND METHODS

Sample

The sample for this study was selected from undergraduate students at the College of Dentistry, University of Baghdad and Basrah, Iraq. Out of 125 male students examined according to the specific criteria, only 50 of them were included in the study. The criteria of sample selection include:

- All should be Iraqi's with age ranged 18-23 years and have full permanent dentition regardless of the third molars.
- Having dental and skeletal class I relationship, determined clinically with normal overjet and overbite [11,12].
- No history of facial trauma, orthodontic/orthognathic treatment, dentofacial deformities, asymmetry or bad oral habits.

History

After each participant was seated on the dental chair, information regarding his name, age, medical and dental history was taken, and a written consent form was obtained from each individual. Then, each participant was subjected to a clinical examination which included skeletal and dental relation examination.

Photographical Exposure

The camera (Canon 70D, Japan) was fixed in a position and adjusted in height with a height adjustable tripod. The distance from the camera to the participant was fixed at a distance of about 101 cm measured from the camera lens to the ear rods, that was fit in the external auditory meatus (cephalostat based head position) [13]. The camera lens was positioned parallel to the participant's face and the participant 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 [14]. A ruler was placed on the plastic side of cephalostat near the participant's head to correct the magnification.

Photographical Analysis

Facial measurements:

- The middle fifth of the face (ICD): The middle part of the face that is delineated by the inner canthus of the right and the left eyes and should be coincident with the alare of the nose.
- The medial two-fifths of the face (IC-OC): The medial parts of the face that is delineated by the inner and the lateral canthus of the eyes.
- The lateral two-fifths of the face (OC-LH): The lateral parts of the face that is delineated by the lateral canthus of the eyes and the lateral helix of the ears at the most posterior point on the outer rim of the ear.
- Interalar width (Al-Al): The distance between the two alare points of the nose.
- Mouth width: The distance between the two angles of the mouth.
- The distance between the points at the most medial margin of the iris of the eyes (Ir-Ir) (Figure 1).

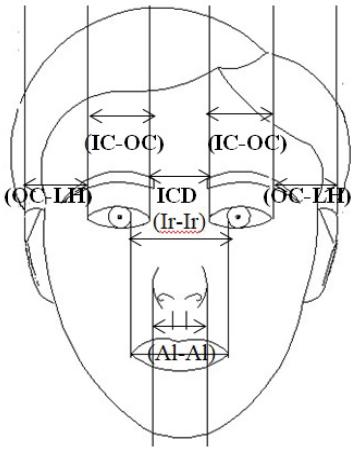

Figure 1 The facial measurements were taken in full frontal facial photographs, (IC=inner canthus, OC=outer canthus, ICD=inner canthal distance, LH=lateral helix, Ir=the point at the most medial margin of the iris of the eye, Al=alare of the nose)

RESULTS

The data of the sample were analyzed using a computerized statistical analysis using SPSS Software (version 23) (Table 1). The statistical analysis included the descriptive statistics (mean and SD) and inferential statistics (paired sample t-test: for right and left sides of the face, and Pearson's correlation coefficients (r) to test the relationships between the alar width and the distance between the inner canthus and the eye's width, and between the mouth width and the distance between the medial margin of the iris of the eyes (Table 2-5).

Table 1 Descriptive statistics

Descriptive Statistics N=50		
Variables	**Mean**	**Std. Deviation**
ICD	31.451736	3.1924406
IC-OC (right)	29.754662	2.4752271
OC-LH (right)	35.792124	4.3304038
IC-OC (left)	29.786	2.4175635
OC-LH (left)	38.68942	4.4726787
Al-Al	39.47331	3.1952333
Ch-Ch	51.38379	4.5010591
Ir-Ir	51.666644	4.3382577
All measurements were in mm; ICD: inner canthal distance; IC-OC: inner canthus to outer canthus; OC-OH: outer canthus to lateral helix; Al-Al: interalar width; Ch-Ch: mouth width; Ir-Ir: the distance between the medial margin of the iris of the eyes		

The results in Table 2 showed a highly significant correlation between the inner canthus and outer canthus distance on the right side and the left side of the face, and a non-significant and moderate correlation between the outer canthus and lateral helix distance on the right and the left side of the face.

Table 2 Paired samples correlations

Variables N=50	Correlation	Significance
IC-OC (right) and IC-OC (left)	0.929	0.000
OC-LH (right) and OC-LH (left)	0.361	0.01
All measurements were in mm; IC-OC: inner canthus to outer canthus; OC-LH: outer canthus to lateral helix		

The results in Table 3 showed a non-significant difference between the inner canthus and the outer canthus distance on the right side and the left side of the face, and this is confirmed by a highly significant correlation between them as stated in Table 2, according to that the H_0 could be accepted and H_1 could be rejected. A highly significant difference between the outer canthus and lateral helix distance on the right and the left side of the face in Table 3 is confirmed by a non-significant and moderate correlation between them as stated in Table 2. According to that, the H_1 could be accepted and H_0 could be rejected.

Table 3 Paired samples t-test

Variables	Mean	Std. Deviation	t-test	Significance
IC-OC (right) and IC-OC (left)	-0.0313380	0.9233726	-0.240	0.811
OC-LH (right) and OC-LH (left)	-2.8972960	4.9760362	-4.117	0.000
All measurements were in mm; IC-OC: inner canthus to outer canthus; OC-LH: outer canthus to lateral helix				

The results in Table 4 showed a highly significant and moderate correlation between interalar width and inner canthal distance, according to that the H_0 could be accepted and H_1 could be rejected.

Table 4 Pearson correlation between the interalar width (Al-Al) and inner canthal distance (ICD)

Variables		ICD
Al-Al	Pearson correlation	0.557**
	Significance	0.000
All measurements were in mm. ICD: inner canthal distance, Al-Al: interalar width		

The results in Table 5 showed a highly significant and a moderate correlation between the mouth width and the distance between the points at the most medial margin of the iris of the eyes, according to that the H_0 could be accepted and H_1 rejected.

Table 5 Pearson correlation between the mouth width (Ch-Ch) and the distance between the medial margins of the iris of the eyes (Ir-Ir)

Variables		Ir-Ir
Ch-Ch	Pearson correlation	0.616**
	Significance	0.000
All measurements were in mm; Ch-Ch: mouth width; Ir-Ir: the distance between the medial margin of the iris of the eyes		

DISCUSSION

Cicero quoted "*The face is a picture of the mind as the eyes are its interpreter.*"

The transverse facial proportions are important in orthodontics, especially in the correction of bilateral asymmetries to improve facial aesthetics, or in orthognathic surgeries to alter the shape of the jaws to improve the dental occlusion stability and to improve the temporomandibular joint function [15].

According to the results in Table 1, there was a variation in the measured proportions of the face (fifths of the face), the mean value of the eye's width (IC-OC) was lesser than that of inter-canthal distance and this is concurrent with the studies in the white and the Asian subjects that also found a variations in the horizontal facial proportions [16-18], and also consistent with Zimbler MS and Ham J, who stated that the normal intercanthal distances for men are 26.5 mm to 38.7 mm [1]. Additionally, the mean value of the intercanthal distance is lower than that of the nasal width (Al-Al) and this is consistent with the study done by Al-Sebaei and differed from a study carried on Saudi Arabian population by Al-Qattan, et al., this difference in results could be due to the different sample population [19,20]. The mouth width (Ch-Ch) mean value was very close to that of Al-Jassim, et al., study but the nasal width mean value was higher than that of the study conducted by Al-Jassim, et al, [21]. These differences could be due to the different methodology that is used both in studies so we couldn't compare between the two studies directly since the environmental climatic conditions role affects the shape of the nose (the broad nose is associated with hot moist climate) is still unproven [22]. The mean value of the mouth width is very close to that of distance between the points at the most medial margin of the iris of the eyes, and this result is concurrent with the study done by Naini and Gill in 2008 [5].

In Table 2 and Table 3, a non-significant difference between the inner canthus and outer canthus on the right side and the left side of the face indicate a facial symmetry at the medial two fifths of the face, whereas a highly significant difference between the outer canthus and lateral helix on the right and the left side of the face indicates a facial asymmetry at the lateral two fifths of the face. Although the mean difference is 2.8 mm which could be neglected clinically, it may result from the differences in the amount of protrusion of the ear from the skull. These results are in accordance with that of Djordjevic, et al., who stated the average difference between the right and the left measurements was 3 mm [23], but differed from Skvarilova in 1993, who stated that the range of normal facial asymmetry for facial dimensions was 4-5 mm [24].

In Table 4, a high significant and a moderate correlation between the interalar width and the inner canthal distance is considered to be important, since the anterior repositioning of the maxilla procedure tends to increase the interalar width (alar base width), and this may affect the symmetry of the face, but it may be partially abolished by the placement of a 'cinch suture' at the surgery time to maintain the interalar width [5,25].

As a part of the facial symmetry, the mouth width should be equal to the distance between the points at the most medial margin of the iris of the eyes, the highly significant and moderate correlation between them in Table 4 comes concurrently with the facial symmetry.

CONCLUSION

The non-significant side difference between the medial two-fifths of the face indicates a facial symmetry (normal transverse facial proportions), whereas the significant size difference between the lateral two-fifths of the face could be clinically neglected since a small degree of facial symmetry is considered to be normal in most of the individuals. The significant moderate correlation between the interalar width and inner canthal distance and between the mouth width and the distance between the points at the most medial margin of the iris of the eyes should be considered when evaluating the transverse facial proportions in that when the interalar width increased the inner canthal distance is increased and vice-versa, and that is the same for the mouth width and the distance between the points at the most medial margin of the iris of the eyes.

DECLARATIONS

Conflict of Interest

The author has disclosed no conflict of interest, financial or otherwise.

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