Sagittal Lips' Positions in Different Facial Types

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ABSTRACT

During diagnosing any orthodontic case, sagittal lips' positions and facial types must be taken in consideration to develop a perfect treatment plan. This study aimed to find out whether different facial types had an effect on the sagittal lips' position in a sample of Iraqi females with normal dental and skeletal relations. Forty two female dental students from the College of Dentistry, University of Baghdad fulfill the inclusion criteria and agree to participate in this study. Frontal and profile standardized photographs were taken for each student. After determination of the facial types, only two students with leptoprosopic facial type were determined so they were excluded for statistical purposes. The sagittal lips' positions using different analyses, nasal projection and facial convexity were measured using AutoCAD program 2016. Comparison between the facial types was done using independent sample t-test. There were no significant differences between the two facial types for all measured variables. Different facial types had no effect on the sagittal lips' positions.

INTRODUCTION

With recent advance in orthodontics, treating of any case is not limited to correction teeth but to get a good facial balance when there is harmony between the nose, lips and teeth.

For evaluation any case, macro-, micro-, mini-esthetic must be taken in consideration. The prominancy of the lips and nose are so important. Lips thickness, strain, fullness are usually determined because the decision of dental extraction will depend on these factor in addition to the facial type, skeletal and dental patterns [1].

Ricketts [2], Holdaway [3], Steiner [4], Merrifield [5], Burstone [6], Sushner [7] separately developed a method for determination the antero-posterior lips' positions in their analyses. They used different lines and measured the shortest distance from these lines to the most anterior points of the upper and lower lips.

Several studies [8-11] used these lines to get the standard values for their populations, others [12-16] compared the obtained values among different skeletal classes but no study compare among the various facial types except that of Murakami *et al.*, [17] for Japanese, so the aim of this study was to compare the antero-posterior lips position in different facial types in a sample of Iraqi young adult females.

MATERIALS AND METHODS

Sample

Sixty female students from the College of Dentistry, University of Baghdad agreed to participate in this study. Only forty two students fulfilled the inclusion criteria which were: the age ranged between 19-23 years, all had complete permanent dentition regardless the wisdom teeth, the dental, skeletal relations were normal with no past history of congenital anomalies, oral habits,

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orthodontic and/ or orthognathic surgery or plastic surgery for the nose or the lips.

Methods

The participants were signed a consent form to participate in the study. They were examined on dental chair both extra- and intra-orally, then profile and frontal facial photographs were obtained in a cephalostat based head position using digital camera (Sony Cyber Shot H 50, 9.1Mega pixels, 15 X optical zoom, Sony Corporation, Nagoya, Japan) according to the method of Ahmed and Ali [18].

Every photograph was analyzed using AutoCAD 2016 software computer program to calculate the linear and angular measurements. Firstly, the magnification was corrected using a ruler found on the nasal rod of the cephalostat, then the points and planes were determined, and the angular and linear measurements were obtained.

Photographic landmarks, planes and measurements

Photographic landmarks

1. Point N' (soft tissue nasion): The point of greatest concavity in the midline between the forehead and the nose [19, 20].
2. Point Pn (pronasale): The most prominent or anterior point of the nose (The tip of the nose) [19, 20].
3. Point Or (soft tissue orbitale): It is the soft tissue point located at the most inferior level of each infraorbital rim [21].
4. Point T (tragion): It is the point located at the upper margin of each tragus [21].
5. Point Sn (subnasale): The point at which the columella merges with the upper lip in the midsagittal plane [19, 20].
6. Point Ls (Labiale superius): It is the midpoint of the vermilion line of the upper lip [19, 20].
7. Point Li (Labiale inferius): It is the midpoint of the vermilion line of the lower lip [19, 20].
8. Point Pog' (soft tissue pogonion): The most prominent or anterior point on the chin in the midsagittal plane [19, 20].
9. Point gn (soft tissue gnathion): The most anterior and inferior point of the soft tissue chin [22].
10. Point zyg (zygoin): The most prominent point on the cheek area beneath the outer

canthus and slightly medial the vertical line passing through it [23].

Photographic lines

1. E-line: It was drawn from the tip of the nose to the soft tissue pogonion [2].
2. H-line: A line tangent to the upper lip from soft tissue pogonion [3].
3. S1-line: It extended from the middle of the S-shaped curve between the tip of the nose and subnasale to the soft tissue pogonion [4].
4. Modified H-line (profile line): A line that extends from soft tissue pogonion to the most procumbent lip [5].
5. B-line: It was drawn from soft tissue subnasale to soft tissue pogonion [6].
6. S2-line: It was drawn from soft tissue nasion to soft tissue pogonion [7].
7. Frankfort plane: A line passing through the points tragion and soft tissue orbitale [19, 20].

Photographic measurements

1. Interzygomatic distance (IzD): The transverse distance between soft tissue zygion on both sides [24].
2. Anterior facial height (N'-gn): The distance between soft tissue nasion and soft tissue gnathion [25].

Facial form was determined on frontal photograph according to Farkas and Munro [26] method by calculating the ratio between inter-zygomatic distance and anterior facial height. The facial type for each subject was classified as followed:

- Euryprosopic IzD/N'-gn. The facial index is > 0.93
- Mesoprosopic IzD/ N'-gn. The facial index is ≤0.93 and ≥0.83
- Leptoprosopic IzD/ N'-gn. The facial index is<0.83

3. The sagittal lip position consisted of measuring the shortest (perpendicular) distance between Ls and Li of the lips and the reference line used E, H, S1, B, and S2. The measured distance was recorded as positive when the lip was ahead of the reference line, as negative when the lip was behind the line, and as zero when the lip was on the line [2-4, 6, 7].
4. Nasal projection (Pn-H line): The shortest distance between the nasal tip (Pn) and H-line [27].

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5. Z-angle: The angle between the profile line and the Frankfort horizontal plane [5].

Statistical analyses

Data were analyzed using SPSS (statistical package of social science) software version 21. In this study, the following statistics were used:

1. **Descriptive statistics:** including means, standard deviations, minimum and maximum values, frequency distribution and percentage.
2. **Inferential statistics:** including independent sample t-test to compare the measured variables between the facial types.

In the statistical evaluation, the following levels of significance are used:

Non-significant	P > 0.05
Significant	0.05 ≥ P > 0.01
Highly significant	P ≤ 0.01

RESULTS

Table 1 showed the distribution of the sample according to the facial types. Mesoprosopic facial type represented 54.762% followed by euryprosopic facial types 40.476% of the sample while the leptoprosopic type was only 4.762%. For statistical purposes, the leptoprosopic facial types was excluded from the whole sample, so only the other facial types were included and the

final sample was 40 individuals (17 euryprosopic and 23 mesoprosopic facial type).

Table 2 demonstrated the descriptive statistics and facial types' difference for the measured variables. The values of standard deviation for the linear measurements may appear high depending on the position of the lips with regard to different lines. Generally, there was non-significant facial types' difference for all variables.

DISCUSSION

The effect of different facial types on the sagittal lips' positions had not been studied in the worldwide researches except in Japan [17] but not like the present study. The samples selected were adults to minimize the effect of growth. Also all of the individuals had class I dental and skeletal relations to eliminate the effect of lips supporting tissues (maxillary and mandibular sagittal, vertical and transverse positions) except for mild acceptable discrepancy that lead to normal occlusion.

Generally, many factors affected the sagittal lips positions like basal and alveolar bones positions and relation, anterior teeth inclinations, nasal projection, lips thicknesses, mandibular rotation, inclination of forehead and presence of abnormal habits. Bones and teeth analyses in addition to the lips thicknesses can not be determined by

Table 1: Distribution of the sample according to the facial types

	Facial types			
	Euryprosopic	**Mesoprosopic**	**Leptoprosopic**	**Total**
No.	17	23	2	42
%	40.476	54.762	4.762	100

Table 2: Descriptive statistics and facial types' difference for the measured variables

Variables	Descriptive statistics								Comparison (d.f.=38)	
	Euryprosopic (N=17)				Mesoprosopic (N=23)					
	Mean	**S.D.**	**Min.**	**Max.**	**Mean**	**S.D.**	**Min.**	**Max.**	**t-test**	**p-value**
Z-angle	70.882	5.765	62	80	68.870	6.159	57	78	1.049	0.301
Pn-H line	7.685	3.275	3.51	13.58	8.580	3.332	2.29	14.46	-0.846	0.403
Ls-E line	-5.954	2.001	-10.09	-2.35	-6.583	1.744	-8.95	-2.77	1.059	0.296
Li-E line	-2.616	2.311	-6.89	1.14	-2.643	1.535	-5.86	-0.12	0.045	0.965
Li-H line	-0.321	1.518	-2.56	2.49	0.152	1.129	-1.84	1.87	-1.131	0.265
Ls-S1 line	-2.754	1.732	-6.22	0.4	-3.061	1.638	-6	0.77	0.573	0.570
Li-S1 line	-1.021	2.158	-5.38	2.49	-0.718	1.565	-4.11	2.48	-0.515	0.609
Ls-B line	2.288	1.540	-0.32	4.61	2.270	1.284	-0.3	4.38	0.038	0.969
Li-B line	1.794	2.106	-0.87	5.6	2.059	1.500	-0.63	4.6	-0.465	0.644
Ls-S2 line	8.337	2.849	4.52	13.7	9.645	2.548	4.07	13.46	-1.527	0.135
Li-S2 line	4.675	2.735	0.93	9.2	5.908	1.371	4.03	8.58	-1.873	0.069

All of the measurements were in millimeters except the Z-angle in degrees

photographs and need true lateral cephalometric radiographs to be assessed perfectly, so discussing the results will mainly revolve around the characteristics of different facial types.

Enlow and Hans [28] stated that two extremes of shape of the head are present namely; dolichocephalic and brachycephalic head forms. The facial complex attached to the basicranium, and the early growing cranial floor, both acted as template that ascertained numerous dimensional, angular, and topographic characteristics of the face. The dolichocephalic head form, therefore, sets up a developing face that became correspondingly narrow, long, and protrusive. This facial type was termed leptoprosopic. In opposition, the brachycephalic head form established a face that was more broad, but to some extent less protrusive, and this was called the euryprosopic facial type. A distribution range from one extreme head form or facial type to the other usually existed within a given population, even if one or the other particular side of the range was the more common. An intermediate head form type (mesocephalic) could occur, and the facial features tended to be correspondingly intermediate. They listed the facial characteristics of brachycephalic face as followed:

1. The face is wider and flat.
2. The forehead is more bulbous and upright, and the frontal sinus tends to be thinner because of the lesser degree of separation between the inner and outer tables of the forehead.
3. Small nose, straight or often concave, and it frequently tips up, with the external nares usually showing in a face-on view.
4. Squared cheekbones.
5. The broad but anteroposteriorly shorter anterior cranial fossa sets up a wider but shorter and shallower palate and maxillary arch.
6. The brachycephalic face, conversely, relates to a more "closed" basicranial flexure. As a result, the lower jaw tends to be variably more protrusive, with a greater tendency for a straighter or even concave facial profile and a more prominent-appearing chin.

On the other hand, the facial characteristics of dolichocephalic head form were:
1. The face appears more angular.

2. The forehead sloping more with the glabella and upper orbital rims tend to be much more prominent.
3. Large, long nose with a higher nasal bridge, an aquiline or more vertically aligned nasal contour with a downturned and more pointed nasal tip.
4. Longer anterior cranial fossa results in a correspondingly longer but narrower and deeper (high vaulted) maxillary arch and palate.
5. The "open" (obtuse) form of its basicranial flexure relate to a downward-backward rotational alignment of the mandible. This results in a tendency for a retrusively placed mandible and retrusive lower lip with a retrognathic (convex) facial profile.

Returning to the results of the present study, all of the measured variables showed non-significant difference between the two facial types because many of the facial characteristics of mesoprosopic facial type come from euryprosopic face. The number of other extreme (dolichocephalic head form) was only two in the sample so they were excluded.

Z-angle depended on the Frankfort and the profile lines. The latter line is affected by which lip is procumbent and the position of soft tissue pogonion. In euryprosopic, the mandible rotated anteriorly and the maxillary complex bearing the upper lip was retruded so the profile line tends to be straighter making this angle higher in euryprosopic facial types.

Nasal projected on H-line was non-significantly more in mesoprosopic facial type, this because euryprosopic facial type possessed small and straight of concave nose. At the same time, point soft tissue pogonion is directed forwards and labrale superius backwards.

The distances between labrale superius and inferius relative to E-line appeared more in euryprosopic. Again the position of point pogonion and the small nose in addition to the position of bone supporting lips played major role. The same explanation was true for the position of lower lip with H-line.

As euryprosopic faces had small nose and forward positioned pogonion, the upper lip will project

more on S1 in euryprosopic faces and just the reverse for the lower lip. B-line extended from subnasale to pogonion. Subnasale located in a forward position in mesoprosopic facial type and pogonion slightly backward. This made the upper lip in euryprosopic facial type projected more than of mesoprosopic facial type and the opposite were true for the lower lip.

With regards to S2 line, the mean values of lips' positions were more in mesoprosopic type, because euryprosopic had backward position of point soft tissue nasion and forward rotated mandible making projections of the lips less than mesoprosopic facial type.

There is no study to compare with also the normal values presented by the authors in their analyses applied for subjects with unidentified facial type just normal with no separation according the facial types.

CONCLUSIONS

Within the limitations of this study, different facial types had no effect on the sagittal lips' positions. It is recommended to conduct another study to include larger sample to get good numbers for leptoprosopic facial type to be compared with other facial types.

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