Evaluation of soft tissue parameters for adults with accepted occlusion using Legan and Burstone analysis

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Abstract

Objective: The purpose of this study was to evaluate soft tissue parameters for adults, and applying a new method for soft tissue analysis to provide good diagnosis and treatment planning.

Material and methods: Cephalometric radiograph of 100 adult subjects randomly selected with accepted facial proportions and normal occlusion aged 18–25 years. It's evaluated with Legan and Burstone analysis and compared with their study on white sample.

Results: Egyptian population group were found to have more convex faces, protrusive lips and acute nasolabial angles. Males had more convex faces and protrusive lips than females. It can be concluded that the Egyptian populations group had significant deviations from the White standard soft tissue.

Keywords: Egyptian cephalometric norms; Legan-Burstone soft tissue analysis

1. Introduction

The face plays a key role in communication and interaction with the environment [1,2]. This part of the body has been extensively studied by scientists, clinicians, artists, and many who have tried to measure and reproduce some of the facial characteristics [3].

A beautiful face becomes the key to success. The clinical specialists working in the facial area encounter an increasing demand for treatments mainly based on esthetic requests. As a result, orthodontists and maxillofacial and plastic surgeons should have a deep understanding of those quantifiable objective facial characteristics that are considered by the public as “attractive” [4].

The facial skeleton and its overlying soft tissue determine facial harmony and balance. However, it is the structure of the overlying soft tissues and their relative proportions that provide the visual impact of the face [5].

On the other hand, several medical specialties (orthognathic and plastic surgery, orthodontics, dental prosthesis) have the ability to change facial features, hence, there is a need for clinicians working in the maxillofacial area to know the esthetic standards of a
face that guide the esthetic soft tissue treatment goals in their patients [6].

The soft tissue profile plays an important part in our orthodontic considerations. Usually, as we correct malocclusions, we bring about changes in appearance that are pleasing to all concerned. However, most orthodontists who have practiced for even a few years have had the unpleasant experience of finding that some patients face looked better before the orthodontic corrections were made [7].

Soft tissue changes and its relevance to orthognathic surgery in the correction of dento-facial deformity further add to its importance in the field of orthodontics [5].

Several investigators have noted the importance of the soft tissue in the determination of facial aesthetics on the basis that soft tissue behaves independently from the underlying skeleton [8]. The results of these earlier reports attracted extensive clinical and research interest in the fields of both orthodontics and orthognathic surgery [9].

Soft tissue cephalometric analysis designed for the patient who requires surgical orthodontic care was developed to complement a previously reported dento-skeletal analysis. To make it clinically practical, the analysis has been reduced to its most relevant and significant measurements. Used along with other diagnostic aids, this soft tissue evaluation will enable the clinician to achieve good facial esthetics for his or her patients [10].

Several researchers set out to quantitatively assess which soft tissue relationships might contribute to or detract from facial harmony and esthetics and to explain how this information could be used in orthodontic treatment planning [11]. However, most classical cephalometric standards were based on sample populations with European or American ancestries [12] and these norms may not be appropriate for the diagnosis and treatment planning of patients from other ethnic or racial backgrounds. Knowledge of the normal dento-facial pattern for each ethnic group would tend to improve treatment success and to establish optimal facial harmony [13]. This has led to the introduction of cephalometric norms for different ethnic and racial groups. Such investigations have shown significant differences between the ethnic and racial groups studied compared with Europeans and Americans [14]. Hence, in this study, we will determine soft tissue cephalometric norms for a sample of Egyptians adult with Legan and Burstone analyses.

2. Materials and methods

The sample comprised a randomly selected 100 Egyptian adults (70 males and 30 females) aged 18–25 years with accepted facial proportion. The selected sample having Angle’s class I occlusion; normal overjet and overbite and a full complement of permanent teeth. Third molars were not taken into consideration. None of the subjects gave any previous history of orthodontic treatment or any orthognathic or plastic surgery. A written consent was taken from each the selected sample. The consent was approved by the research ethics committee of Faculty of Dentistry, Tanta University.

Standardized lateral cephalograms were taken for each subject on the Planmeca Proline XC,1 cephalometric machine in a natural head position, with the teeth in maximum inter-cuspation and lips in repose. To obtain a natural head position the subject was asked to look into the reflection of his/her own eyes in a mirror.

All lateral cephalometric films were traced, the relevant lines and angles were drawn and measured by the manual conventional method according to Legan and Burstone analysis. Figs. 1 and 2.

2.1. Statistical analysis

The cephalometric data were expressed as means ± SD. Soft tissue analysis comparisons were made between the selected Egyptian genders and with that of Legan and Burstone on white population. A statistically T test with probability value (p-value) ≤ 0.05 was used for statistically significant.

3. Results

The descriptive statistics for the soft tissue cephalometric values are presented in tabular form. Table 1 shows intergender comparison of Egyptian population and Table 2 compares Egyptian group with White group using Legan and Burstone analysis.

4. Discussion

Soft tissue cephalometric values are as important as hard tissue values when assessing the success of treatment. Therefore soft tissue values must accurately reflect ideal norms throughout treatment [15].

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One of the primary objectives of orthodontic treatment is to improve facial esthetics. Sometimes the esthetic result is more important to the patient than the occlusal changes. Hence, good occlusion and improved facial appearance are distinct yet parallel objectives of orthodontic treatment [16].

Orthognathic surgery is sought to improve facial esthetics. Thus, the patients’ concerns about the final facial appearance at the start of treatment are anticipated. On the other hand, the different maneuvers currently available for treatment of orthognathic cases have different outcomes on facial esthetics [17].

This study was performed on a random sample of 100 Egyptian [70 males and 30 females] for and their age confined between 18 and 25 years old with mean age of 22.01 years {age suitable for orthognathic surgery}. The sample was selected free from any medical problem as some medical problem may affect the head posture of the subject as example. The sample was selected from Gharbia Governate, it included different social and economic of the Egyptian population.

Regarding the comparison between Egyptian males and females, the facial angle of convexity was found to be greater in males than females despite the difference was not significant. The more convexity of the facial angle in male may be due to the fullness of the upper lip. This finding is in agreement with Fouda (1987) [18], Hafez (2003) [19].

The present study showed marked sexual differences for maxillary and mandibular pragmatism which were greater in males, it contrast with that found with Fahmy (1978) [20] who concluded that the Egyptian population was homogenous, with females having more interincisal angle and bimaxillary pragmatism than males. Similar observations reported by Jain and Kalra (2011) [15], who found that, the North Indian males had more convex facial profile due to maxillary
pragmatism and upper lip was found to be more pro-
trusive in males than females.

The vertical height ratio in males found less than fe-
males 0.890 and 0.930 respectively indicate that, increase
in the lower-third facial height in males than females.
This is my attributed to the increase in lower lip length.
This significant difference in facial heights between
males and females might be significant in treatment
planning because these differences indct the increase or
decrease of face height. This result coincidence with Aziz
(2009) [21] in which he concluded all facial length
measurements greater in males than females.

The lower face—throat angle was more obtuse in
males 112.771° compared with females 105.133°. An

Table 1
Comparison between soft tissue cephalometric analysis of Egyptian sample and North Indians Caucasians sample using Legan and Burstone analysis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Egyptian group</th>
<th>White group</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td><strong>Facial form</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facial convexity angle</td>
<td>17.8</td>
<td>5.3</td>
<td>12</td>
</tr>
<tr>
<td>Maxillary prognathism (mm)</td>
<td>6.4</td>
<td>3.4</td>
<td>6</td>
</tr>
<tr>
<td>Mandibular prognathism (mm)</td>
<td>-3.6</td>
<td>5.6</td>
<td>0.00</td>
</tr>
<tr>
<td>Vertical height ratio</td>
<td>0.90</td>
<td>0.14</td>
<td>1.00</td>
</tr>
<tr>
<td>Lower face—throat angle</td>
<td>110.4</td>
<td>7.6</td>
<td>100</td>
</tr>
<tr>
<td>Lower vertical height—depth ratio</td>
<td>1.17</td>
<td>0.21</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Lip position</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasolabial angle</td>
<td>95</td>
<td>10.4</td>
<td>102</td>
</tr>
<tr>
<td>Upper lip protrusion (mm)</td>
<td>4.7</td>
<td>1.8</td>
<td>3</td>
</tr>
<tr>
<td>Lower lip protrusion (mm)</td>
<td>3.8</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Mentolabial sulcus (mm)</td>
<td>5.92</td>
<td>2.43</td>
<td>4.00</td>
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<tr>
<td>Vertical lip—chin ratio</td>
<td>0.473</td>
<td>0.049</td>
<td>0.50</td>
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<tr>
<td>Maxillary incisor exposure (mm)</td>
<td>2.78</td>
<td>1.58</td>
<td>2.00</td>
</tr>
<tr>
<td>Interlabial gap (mm)</td>
<td>0.98</td>
<td>0.20</td>
<td>2.00</td>
</tr>
</tbody>
</table>

*p_0.05 — non-significant (NS).
*p_0.05 — significant.
**p_0.01 — significant.
***p_0.001 — highly significant.

Table 2
Comparison between soft tissue cephalometric analysis of Egyptian adult males and females using Legan and Burstone analysis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Males group</th>
<th>Females group</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td><strong>Facial form</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facial convexity angle</td>
<td>18.17</td>
<td>5.11</td>
<td>7.00</td>
</tr>
<tr>
<td>Maxillary prognathism (mm)</td>
<td>5.93</td>
<td>2.52</td>
<td>6.65</td>
</tr>
<tr>
<td>Mandibular prognathism (mm)</td>
<td>-4.42</td>
<td>5.08</td>
<td>-3.2</td>
</tr>
<tr>
<td>Vertical height ratio</td>
<td>0.89</td>
<td>0.167</td>
<td>0.93</td>
</tr>
<tr>
<td>Lower face—throat angle</td>
<td>112.7</td>
<td>5.91</td>
<td>5.1</td>
</tr>
<tr>
<td>Lower vertical height—depth ratio</td>
<td>1.21</td>
<td>1.09</td>
<td>0.21</td>
</tr>
<tr>
<td><strong>Lip position</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasolabial angle</td>
<td>94.4</td>
<td>10.23</td>
<td>96.46</td>
</tr>
<tr>
<td>Upper lip protrusion (mm)</td>
<td>4.8</td>
<td>1.6</td>
<td>4.33</td>
</tr>
<tr>
<td>Lower lip protrusion (mm)</td>
<td>4.3</td>
<td>1.89</td>
<td>2.60</td>
</tr>
<tr>
<td>Mentolabial sulcus (mm)</td>
<td>6.22</td>
<td>1.19</td>
<td>5.2</td>
</tr>
<tr>
<td>Vertical lip—chin ratio</td>
<td>0.465</td>
<td>0.039</td>
<td>0.494</td>
</tr>
<tr>
<td>Maxillary incisor exposure (mm)</td>
<td>2.65</td>
<td>1.51</td>
<td>3.067</td>
</tr>
<tr>
<td>Interlabial gap (mm)</td>
<td>2.17</td>
<td>0.725</td>
<td>2.32</td>
</tr>
</tbody>
</table>

p_0.05 — non-significant (NS).
*p_0.05 — significant.
**p_0.01 — significant.
***p_0.001 — highly significant.
appreciation of this angle is critical in treatment planning to correct anteroposterior dysplasias. With an obtuse angle all the procedures that reduce prominence of the chin should be avoided. The finding coincide with the result obtained by Jain and Kalra [16] in which they reported that lower face–throat angle was more obtuse in males than females and also AL-Jasser (2003) [22] study of selected Saudi population suggested that, lower face–throat angle in males greater than females 109.90° and 102.90° respectively.

When the lip form was assessed, the upper lip as well as lower lip was found to be more protrusive in males than in females and hence, the nasolabial angle was more acute, but the difference in nasolabial angle was statistically insignificant. Mentolabial sulcus depth was deeper in males than females, which might be due to increase amount of lower lip protrusion, the same result was reported in agreement with Abul Azm and Fahmy (1980) [23], Abdel Mageed et al. (1989) [25], Azi (2009) [22].

In comparing of the soft tissue variables of Egyptian group and white group, with regard to the anteroposterior relationship, with Legan—Burstone analysis; the Egyptian group had greater facial convexity angle than White group were the mean values of Egyptian group 17.820° while the Caucasians group mean values was12.00°. This was in agreement with the finding of Aziz et al. (2009) [21] in which showed that the Egyptian facial form is more convex than that of White group.

Bishara et al. (2009) [25] showed that Egyptian boys and girls have relatively profile that is more convex and a tendency toward mandibular dental protrusion than those of lowans boyes and girls.

In the present study the maxillary prognathism in Egyptian group showed closer to those in White group where the mean values were 6.4 mm and 6.00 mm respectively. Except for the mandible which observed more retruded in Egyptian group.

According to Legan-Burstone analysis the lower face—throat angle was more obtuse in Egyptian group than that in the White group. It therefore seems reasonable to pay particular attention to this point during treatment planning for Egyptian patients. This was in agreement with the finding of Al-Gunaid et al. (2007) [26], Jain and Kalra (2011) [15] and AL-Jasser (2003) [22] but disagree with the result obtained by Ref. [27] for Japanese adults.

The value of the vertical height ratio in Egyptian group was differed from those obtained in White group according to Legan-Burstone analysis where the lower-third facial height in Egyptian group showed increased more than middle third facial height due to increased in lower lip length.

The nasolabial angle is a vital consideration in treatment planning for patients with dental deformities Scheideman et al. (1998) [28]. In the present study the mean values of nasolabial angle in Egyptian group were generally acute 95° will often allow us to surgically retract the maxilla or retract the maxillary incisors, or both. Legan and Borrstone (1980) concluded that, the nasolabial angle in White group was about 102° which is differing significantly with the current reading [10].

The mean of the basic upper lip as well as lower lip protrusion in the Egyptian group was significantly differed to that of White group where the range of the Egyptian group was large. This was in agreement with the previous studies on Egyptian adults obtained by Abul Azm and Fahmy (1980) [23],Abdel Mageed et al. (1989) [24] and Aziz et al. (2009) [21].

The mean values of the vertical labial chin ratio in the Egyptian group were significantly less than that in white group. Similar values have been reported for Saudi adults AL-Jasser (2003) [23] and slightly higher than values have been reported for north Indians Jain and Kalra (2011) [15] and Japanese Alcalde et al. (1998) [27].

In the present study the incisor maxillary exposure in Egyptian group showed 2.780 mm greater than those in White group 2.00 mm So, the interlabial gap will be increased in Egyptian group 2.25 mm than White group 2.00 mm, the difference in all maxillary incisor exposure as well as interlabial gap were statically significant.

5. Conclusion

From the results of this study, the following conclusions were derived:

1. The mean values of Egyptian males showed greater than females in convex face, maxillary and mandibular prognathism, lower-third facial height, lower face—throat angle, protruded upper and lower lip, acute nasolabial angle and deeper mentolabial sulcus.
2. Females sample have increased maxillary incisor exposure and greater interlabial gap. When compared with White group
3. Egyptian group had more convex faces, maxillary prognathism and high variable mandibular prognathism, more protrusive upper lip, acute nasolabial angle, increased interlabial gap and deep mentolabial sulcus.
4. Obtuse lower face—throat angle.
References


[21] Aziz R. Soft tissue cephalometric norms for sample of Egyptian adults. Faculty of Oral and Dental Medicine, Cairo University; 2009.


