A cephalometric lips analysis and its relation to other cephalometric measurements in Iraqi adult individuals

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ABSTRACT
Background: The aim of this study was to evaluate and analyze the effect and behavior of the upper and lower lips in class I Iraqi subjects.
Material and methods: True lateral cephalometric radiograph of the sample that comprises 60 females and 50 males aged 18-25 years and they possess class I skeletally and dentally. All the data have been analyzed by mean of AutoCAD computer programs where 9 cephalometric angles have been analyzed.
Results: In males the mean value of lower lip inclination, the upper lip inclination, and interlabial angle have no significant difference with that in females, so the mean values are 81.03, 84.2, and 158 respectively. The lower lip is correlated with F. man., upper lip inclination, interlabial angle, interincisal angle, upper and lower incisor inclination. The upper lip inclination is correlated with SGn. FH., F. man., interlabial angle, interincisal angle and lower lip inclination. Interlabial angle is correlated with upper lip inclination, interincisal angle, lower lip inclination, and upper central incisor inclination.
Keywords: upper and lower lip inclination, interlabial angle, soft tissue cephalometric.

INTRODUCTION
Soft tissue covering of the face plays an important role in facial esthetics, speech and other functions (1). A harmonious soft tissue profile, an important goal in orthodontics but sometime difficult to achieve partly because the soft tissue overlying the teeth and bones is highly variable in its thickness (2), lips are flexible structures that consist of muscle covered externally by skin and internally by mucous membrane and submucosa. Several muscles of expression are attached to the muscle of the lips (3). Although both upper and lower lips play a role in development of malocclusion (4-6) the relationship between the lips and the teeth is not clear (7-10). Several lines have been done, worthy of mention is "Ricketts E" line (11), which is influenced a great deal by the growth of the nose. "Steiner's S" line (12) eliminates half of the change in integumental profile due to the growth of the nose."Holdway's H" line (13) has the advantage of of removing the influence of nasal growth in evaluation of lip posture. Merrifield's "Z" angle (14) expresses the full extent of lip protrusion in malocclusions. In this study we are going to analyze the relationship between the inclination of the upper lip, lower lip and interlabial angle with other cephalometric measurements in way to clarify the relation between the above in static situation, so we can conclude the norm for Iraqi individuals, which would help the clinician in the diagnosis and treatment plan.

MATERIALS AND METHODS
This study is based on static situation, so out of 350 college students (from college of dentistry, Baghdad university), 110 subjects were selected for the study. The sample comprised 60 females and 50 males. All subjects in the present study are aged 18-25 years and have class I skeletal and dentally relationship according to ANB angle (2-4), and first molar respectively (3-5), and have competent lips and full set of dentition excluding wisdom teeth. Also they have no history of any kind of surgery in head and neck area. A lateral cephalometric X-ray has been taken for the sample, and the X-ray pictures are traced by help of computer autocad program version 2007.

The variable and the landmarks used in present study are as follows:
Point A, Point B, Orbitale, Porion, Nasion, Pogonion, Gonion, Gnathion, Sella, Labrale superior (Ls), Soft tissue pognion (Pog), Labrale inferior (Li), Posterior columella point.

The angle used in the present study:
1. ANB angle; 2-4 degrees (4-6), as shown in figure 1.
2. The angle between Frankfort plane and SGn plane (15), as shown in figure 1.
3. Mandibular plane angle (4-6,15); this angle between Frankfort plane and mandibular plane, as shown in figure 1.
4. Angulation of the lower lip; the line joining the soft tissue Pog and labrale inferior (Li) will form an angle with the mandibular plane. This angle will be defined as the angle of the lower lip plane, as shown in figure 1. To secure reproducibility of this method 10 X-rays were randomly selected from the sample. These 10 X-rays have been traced.
again after 2 weeks. To avoid memory bias the independent T test has been calculated between the primary and secondary records of the X-rays, and insignificant difference has been concluded.

5. Angulation of the upper lip. The line drawn from PCm to labrale superius (Ls) was termed the "PCm-Ls" line, as shown in figure 1. When this extends superiorly it will intersect the Frankfort horizontal plane. The anteroinferior angle formed at this intersect was considered the relative inclination or angulation of the upper lip and was termed the upper lip to Frankford plane angle.

6. Interlabial angle; this angle occurs between the two lines determining the inclination of upper and lower lips, as shown in figure 2.

7. Interincisal angle; this angle occurs between the two lines determining the inclination of upper and lower incisors, as shown in figure 2.

8. Inclination of upper incisors. The line that represents the long axis of upper central incisor will extend upward to intersect the SN plane. The posterior angle is regarded as the inclination of the upper central incisor, as shown in figure 2.

9. Inclination of the lower incisor. The line that represent the long axis of lower incisor will intersect the mandibular plane, and the posterior angle of this intersection is regarded as the inclination of the lower incisor, as shown in figure 2.

**RESULTS**

All the collected data have been subjected to descriptive statistics for both male and female groups. The independent sample T test revealed that there is no significant difference between males and females (as shown in table 1) in the soft tissue parameters, so we pooled both male and female groups together in one table during calculation of both descriptive and correlative statistics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>t – test (d.f=108)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower lip inclination</td>
<td>-0.34</td>
<td>0.73</td>
</tr>
<tr>
<td>LFH upper lip</td>
<td>1.9</td>
<td>0.061</td>
</tr>
<tr>
<td>Interlabial angle</td>
<td>1.46</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**Table 2: Descriptive statistics for all parameters measured in this study for both male and female groups**

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANB</td>
<td>110</td>
<td>2</td>
<td>4</td>
<td>3.062</td>
<td>0.85</td>
</tr>
<tr>
<td>Sgn. FH</td>
<td>110</td>
<td>48</td>
<td>66</td>
<td>57</td>
<td>3.74</td>
</tr>
<tr>
<td>F. Man</td>
<td>110</td>
<td>9</td>
<td>34</td>
<td>20.84</td>
<td>5.45</td>
</tr>
<tr>
<td>Lower Lip inclination</td>
<td>110</td>
<td>68</td>
<td>97</td>
<td>81.03</td>
<td>7.44</td>
</tr>
<tr>
<td>Upper lip. FH</td>
<td>110</td>
<td>56</td>
<td>110</td>
<td>84.2</td>
<td>11.05</td>
</tr>
<tr>
<td>Interlabial angle</td>
<td>110</td>
<td>76</td>
<td>180</td>
<td>158</td>
<td>16.26</td>
</tr>
<tr>
<td>Interincisal angle</td>
<td>110</td>
<td>96</td>
<td>149</td>
<td>121.39</td>
<td>11.32</td>
</tr>
<tr>
<td>Inclination of upper central incisor</td>
<td>110</td>
<td>86</td>
<td>134</td>
<td>109.6</td>
<td>9.02</td>
</tr>
<tr>
<td>Inclination of the lower central incisor</td>
<td>110</td>
<td>85</td>
<td>121</td>
<td>99</td>
<td>7.74</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>p- value</th>
<th>r</th>
<th>p- value</th>
<th>r</th>
<th>p- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANB</td>
<td>0.032</td>
<td>.001</td>
<td>-0.40</td>
<td>.753</td>
<td>-0.027</td>
<td>.829</td>
</tr>
<tr>
<td>Sgn. FH</td>
<td>-0.032</td>
<td>0.722</td>
<td>0.548**</td>
<td>.000</td>
<td>0.004</td>
<td>.976</td>
</tr>
<tr>
<td>F. Man</td>
<td>-0.380**</td>
<td>0.002</td>
<td>0.335**</td>
<td>.007</td>
<td>0.051</td>
<td>.688</td>
</tr>
<tr>
<td>Lower lip</td>
<td>1</td>
<td>-0.344**</td>
<td>0.005</td>
<td>.000</td>
<td>-0.433**</td>
<td>.000</td>
</tr>
<tr>
<td>LFH upper lip</td>
<td>-0.344**</td>
<td>0.005</td>
<td>1</td>
<td>0.503**</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Interlabial angle</td>
<td>-0.433**</td>
<td>0.000</td>
<td>0.503**</td>
<td>.000</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Interincisal angle</td>
<td>-0.500**</td>
<td>0.000</td>
<td>0.325**</td>
<td>.009</td>
<td>0.474**</td>
<td>.000</td>
</tr>
<tr>
<td>Inclination of the upper incisor</td>
<td>.333**</td>
<td>0.005</td>
<td>-0.243</td>
<td>.053</td>
<td>-0.301</td>
<td>.016</td>
</tr>
<tr>
<td>Inclination of the lower incisor</td>
<td>.505**</td>
<td>0.000</td>
<td>-0.206</td>
<td>.103</td>
<td>-0.173</td>
<td>.171</td>
</tr>
</tbody>
</table>

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Table 2 shows descriptive statistics for all parameters measured in this study for both male and female groups (total sample).

According to table 3 the behavior of lower lip is inversely related to F.man, LFH, interlabial angle, and interincisal angle while it's directly related to upper and lower incisor inclination. The behavior of upper lip is directly related with S Gn FH, F.man, interlabial angle, and interincisal angle while it's inversely related to lower lip inclination. The interlabial angle is directly related to upper lip and interincisal angle while it's inversely related to lower lip and upper central incisor inclination.

**DISCUSSION**

Soft tissue changes have been shown to accompany growth, as well as orthodontic treatment (9,16-21). The direct effect of orthodontic treatment on soft tissue profile is usually apparent. Even more dramatic are the changes in the soft tissue profile that may be induced by orthognathic or plastic surgery. It is for these reasons that the soft tissue profile must be carefully examined before decision regarding orthodontic treatment and/or orthognathic surgery can be made. In this study we use 2 new terms, the first one is inclination of lower lip so we can describe and evaluate the behavior of lower lip.

The second term is the interlabial angle; this value will describe the behavior of both upper and lower lips in combination with each other. In other words it describes the relation between the upper and lower lips when they act against each other.

The finding of this study shows that the soft tissue in both gender groups has the same behavior. This finding will agree with that of Fitzgerald et al. (15), but it disagrees with Singh (9) who examined the soft chin thickness after orthodontic treatment, he found that males showed a greater increase in chin soft tissue thickness than that of females. This disagreement may be due to the fact that the Singh's (9) study was on dynamic situations in addition to that there's difference in the methodology of evaluation of the soft tissues.

Regarding the gender difference the finding of this study also disagrees with that of Oliver (8), who based his study on teenage sample. This disagreement may be due to difference in growth pattern between male and female in teenage years.

The lower lip in this study shows significant correlation with F.man, LFH, interincisal angle, inclination of upper incisor, and inclination of lower incisor. This finding was agreed with Rains and Nanda (1) except for the relation with lower incisor because they did not find significant correlation between the behavior of lower incisor
and lower lip. This disagreement may be due to difference in methodology and sex since they based their study on females only.

The upper lip in this study shows significant correlation with SGN.FH, Fman, lower lip and interincisal angle. This finding disagrees with Kasai (20) who found a relation between thickness of upper lip with the position of lower incisor. Also the thickness of upper lip associates with the horizontal relationship between upper and lower jaws. The significant correlations of upper lip in this study disagree with the findings of Fitzgerald et al. (15) who found negative correlation between soft tissue and other hard tissue measurements in well balanced profile. But the positive correlation of upper lip in this study agrees with that of Rains and Nanda (1) who found positive relation between the upper lip behavior and lower lip behavior and mandibular rotation.

Hershey (20) and Brustone (22) have proposed that the perioral soft tissue may be self supporting and that factors other than dental movement may cause the wide variability of individual response. This means that the response of upper lip varies from one person to the other and this will explain the wide range in findings of upper lip response.

The interlabial angle is formed by two lines, one from the upper lip, and the other from the lower lip and both are dependent or independent to each other (this depends on lip competence). The angular measurement described by these two lines is resultant of interaction between upper and lower lips, so the interlabial angle of a person may be within normal range, small or large.

The measurement of interlabial angle alone provides inadequate information as it does not reveal which component is responsible for the variability. It could be the upper lip, the lower lip or both.

Therefore it is important to analyze each component of this angle to assist in differential diagnosis of normal from its variation.

Generally the positive relation between interlabial angle and interincisal angle may explain that both upper and lower lips when act against each other can make an angle which will reflect the interincisal angle, so it may act as an analogue for interincisal angle.

REFERENCES