

## A cephalometric study of soft tissue relationship among Saudi female dental students

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لقد تمت دراسة علاقة النسيج المرن في حالات الصنف 1 سنياً وهيكلية وكانت العينه مكونة من ٢٥ شابة سعودية مع طالبات طب الأسنان أعمارهم ما بين ٢٠ و ٢٥ سنة، جميعهن ذوات أصول سعودية من جانب الأب والأم. وهن من طالبات كلية طب الأسنان جامعة الملك سعود بالرياض. وقد أخذت لجميع المشاركات في الدراسة أشعة سفلوماترية والتي تم تحطيطها فيما بعد. لقد تمت دراسة ثمانية متغيرات في الأشعة الأذوية وحسنة متغيرات سنيه وهيكلية. جميع البيانات أجري لها تحليل احصائي. أظهرت النتائج وجود اختلاف عرقي بين السعوديات ومجموعات عرقية أخرى. أظهرت السعوديات الحناء خلفياً للشفة العلوية والسفلية في علاقتها مع الخط الجمالي، كذلك تساويها في طول الشفة العلوية مقارنة مع الأمريكيات السود، وأكثر طولاً للشفة نفسها مقارنة مع الأمريكيات البيض. كذلك وجد أن السعوديات لديهن شفة علوية أرق وشفة سفلية أطول مقارنة بالبريطانيات. علاوة على ذلك، فإن السعوديات يمتلكن مظهرًا جانبيًا مستقيماً للوجه بينما الزاوية الأنفية الشفوية مثل الأمريكيات البيض، بينما الأمريكيات السود يمتلكن مظهرًا جانبيًا محدبًا والزاوية الأنفية الشفوية حادة. إن المقاسات السفلوماترية المأخوذة سوف تكون ذات أهمية كبيرة ليس فقط في التشخيص ووضع خطة لعلاج الحالات الاعتيادية ولكن لعلاج الحالات الجراحية وكقاعدة أيضاً للدراسات مستقبلية حين يكون حجم العينه أكبر وعدد متغيرات الأنسجة المرنة المستخدمة أكثر.

The soft tissue relationship was studied in 25 Saudi female dental students who satisfied the criteria of a pleasing face and the age range of 20 to 25 years. Cephalometric radiographs were taken for all subjects and traced. Eight soft tissue variables were studied in addition to five skeletal and five dental variables. Student's t-test and descriptive statistics were used for data analysis. The results showed that there were racial differences between the Saudi study and studies on other racial groups done by some researchers. Saudi females demonstrated retrusive upper and lower lips in relation to the aesthetic line and an increased upper lip length when compared to the American black and white females, respectively. Also the Saudi female had a thinner upper lip and an increased lower lip length compared to the British females. Further, Saudi females possess a straight profile and a nasiolabial angle similar to the white American females, whereas the black American females have a convex profile and an acute nasiolabial angle. The cephalometric values obtained will be of great value not only in diagnosis and treatment plan of conventional cases but also in surgical cases and as a basis for future related studies.

### Introduction and Review of the Literature

Facial esthetics is considered as one of the main goals of orthodontic treatment and increased emphasis has been placed on it in recent years by both patients and orthodontists.<sup>1</sup> The soft tissue profile has also been studied extensively in orthodontics, primarily from lateral cephalometric radiograph, under the assumption that the form of the soft tissue outline largely determines the esthetics of the whole face.<sup>2</sup>

The environment of the teeth and alveolar bone is subjected to different forces and pressures, primarily from muscular function, which in part determine tooth position.<sup>3</sup>

Soft tissue analysis plays an important role in orthodontic diagnosis and treatment planning.<sup>4</sup> Changes in appearance that are pleasing to all concerned are brought about by correction of malocclusion. It should, however, be determined beforehand that the proposed orthodontic treatment will not result in adverse facial change.

Few cephalometric studies have been carried out so far in Saudi population. Shalhoub *et al.*<sup>5</sup> in 1987 did a study among Saudi males and females with an age range from 20 to 46 years. He compared his results to American data and found that the Saudi subjects had more protrusive maxilla, bimaxillary protrusion of the incisors and

reduced overbite. When the results were compared to these of North American, the Saudis demonstrated an obtuse nasolabial angle and a reduced upper lip length.

Sarhan and Nashashibi<sup>6</sup> also did a study on 50 Saudi male children aged 9 to 12 years. They found that the Saudi children had slightly prognathic face, protrusive upper and lower incisors, and low gonial and saddle angles when compared to a British sample with the same age range. Further, Nashashibi *et al.*<sup>7</sup> compared the cephalometric measurements of Saudi males to the Steiner measurements. They found differences in the skeletal and dental measurements between the Saudi males and American males. The Saudi males showed more protrusive maxilla and bimaxillary incisors protrusion. However, no soft tissue variables were investigated.

Very few studies have so far been reported on Saudi Population on orthodontic soft tissue evaluation. Therefore, the intention of the present study was to study the soft tissue relationship among Saudi female dental students and to compare the results obtained to those of previously published studies.<sup>5,11</sup>

### Materials and Methods

Lateral cephalometric radiographs were taken of twenty-five Saudi female dental students aged from 20 to 25 years who satisfied the following criteria: pleasing face, balanced facial profile, competent lips, and normal overjet and overbite relationship.<sup>8</sup> Each subject selected had a normal dental relationship (Class I molar) without any severe anteroposterior, vertical or transverse

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discrepancies and with no history of orthodontic treatment.

### Method

The selected subject was seated in a chair with the head in a natural position. The radiograph was taken with the teeth in centric occlusion and the lips at rest.

Each radiograph was hand-traced on an acetate paper by one person. Linear and angular measurements were done to the nearest 0.5-millimeter and degree, respectively. The magnification factor was found to be 0.9. All linear measures were corrected for magnifications.

### Lip Measurements

These were done according to the method of Mamandras.<sup>9</sup>

**Upper Lip Length.** The perpendicular distance from the most inferior point of the maxillary vermilion border to the palatal plane.

**Upper Lip Thickness.** The perpendicular distance between the two vertical and parallel planes drawn at 80° to S-N plane and passing through points subspinale and soft tissue A point.

**Lower Lip Length.** The perpendicular distance from the most superior point of the mandibular vermilion border to the mandibular plane.

**Lower Lip Thickness.** The perpendicular distance between two vertical and parallel planes drawn at 80° to S-N plane and passing through point B and soft tissue B point.

**Error of the Method:** The error method of the skeletal, dental and soft tissue cephalometric measurements used in the present study was calculated by means of double determination.<sup>10</sup> Ten randomly selected cephalographs were traced. All landmarks and measurements used were retraced and measured after one week interval. Dahlberg's formula<sup>10</sup> was used for the calculation of the measurement error (M.E.).

### Statistical Analysis

In the formula

$$M. E. = \frac{\sqrt{\sum d^2}}{\sqrt{2n}}$$

(d) is the difference between pairs of the first and second measurements and (n) is the number of pairs.

The data were subjected to statistical tests utilizing the (SPSS) package. Student's t-test was used for comparison between the present results and previously published studies. A level of significance of 5% was used.

### Results

Table 1 shows the error of the method. The results of the measurement errors revealed that the highest error was found to be in the determination of the interincisal angle (1.01) and the lowest in determination of the upper lip thickness and lower incisor in relation to the NB line (0.00). Table 2 shows the mean and the standard deviation for each measurement included in the study.

### Discussion

**Table 1.** Error of the method.

Angular	Dahlberg's value	Linear	Dahlberg's value
SNA	0.34	UI-NA	0.22
SNB	0.34	LI-NB	0.22
ANB	0.22	ULL	0.22
SNPOg	0.60	ULT	0.11
NAPOg	0.34	ULL	0.27
UI-LI	1.01	LLT	0.22
UI-NA	0.78	UL-EL	0.22
LI-NB	0.11	LL-EL	0.00
NLA	0.67	-----	-----
N-Pn-Pog'	0.34	-----	-----

**Table 2.** Cephalometric mean values for the Saudi female dental students (n=25).

Variables	Mean	SD
SNA	79	3.8
SNB	76.9	3.5
ANB	2.1	1.3
SNPOg	78.5	3.5
NAPOg	1.9	4.2
UI-LI	124.2	9.1
UI-NA	24.3	5.5
UI-Na mm	6.2	2.5
LI-NB	30.4	5.9
LI-NB mm	5.9	2.0
Upper Lip Length mm (ULL)	26.5	2.5
Upper Lip Thickness mm (ULT)	15.4	1.7
Lower Lip Length mm (LLL)	44.1	3.0
Lower Lip Thickness mm (LLT)	11.6	1.4
Naso Labial Angle (NLA)	96.6	8.9
Upper Lip-EL mm	-5.8	3.0
Lower Lip-EL mm	-3.1	3.1

The purpose of the present study was to present soft tissue cephalometric relationship for Saudi female dental students, which should be of great value in orthodontic diagnosis and treatment planning.

The importance of studying growth of the lips for orthodontic treatment and prognosis has been a subject of much discussion.<sup>5-8,11</sup>

When the results of the present study were compared to a study carried out among 25 black American and 25 white American females,<sup>12</sup> significant differences were found. The Saudi females were found to have a shorter lower lip (44.1mm) when compared to the white (47.1mm) and black (49.5mm) American females. They also had an increased upper lip length (26.5mm) compared to the white American females (21.5mm). On the other hand, both Saudi females and black American females demonstrated a similar upper lip length (26.5mm) whereas the white American females had a short upper lip length (21.5mm). The black American females also demonstrated an acute nasiolabial angle of 77.1 degrees. This indicated that the black American females possessed a protrusive maxilla unlike the Saudi females (SNA 79 degrees). This variation in the comparison was attributed to the racial difference between the Saudi females (Caucasiod) and the black American females (Negroid).

The results of the present study were also compared to a study carried out among adult Saudi females by Shalhoub *et al.*<sup>5</sup> with the similar criteria of selection and sample size except in the age range. The result of the current investigation showed a low mean value for the lower lip length (44.1mm) and the nasolabial angle (96.6 degrees) and high mean value for the upper lip length (26.5mm) compared to Shalhoub *et al.*<sup>5</sup> (48.9mm, 104.5 degrees and 21.5mm, respectively). No significant difference was noticed in the lower lip thickness and the upper lip length between the Saudi females (11.6mm and 26.5mm) and the British females (11.8mm and 27.0mm), respectively. Also no significant difference was observed for the upper lip length between the Saudi females (26.5mm) and black American females (26.3mm).

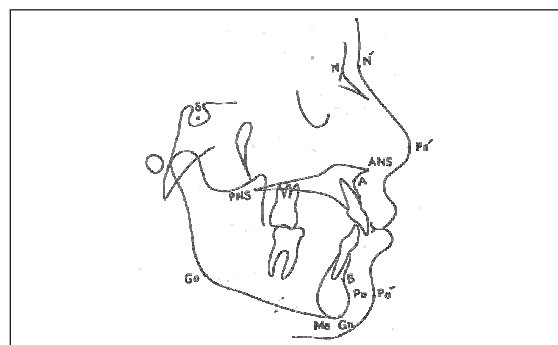
The result indicated that Saudi females studied have straight profile (angle of convexity NAPog Table 2). Holdaway<sup>13</sup> stated that the convexity is directly interrelated to harmonious lip positions and, therefore, had a bearing on the dental relationships needed to produce harmony of the features of the human face. He mentioned further that the observations indicated that as skeletal

convexity increases so also does the convexity of the soft tissue profile, if the entire facial complex is to be one of balance and harmony with its type. Therefore, the angle of convexity obtained in the present study indicated that the Saudi females of the study sample had a harmonious face.

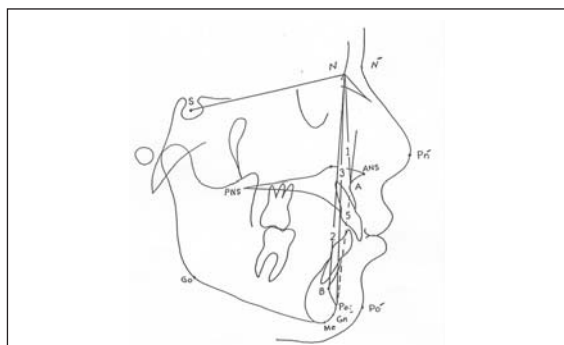
The nasal projection of the females remained virtually constant from age 12 to 17 years.<sup>14</sup> Thus, the relationship of both upper and lower lip to the esthetic line in the present study was found to be in a retrusive position. This could be explained by the fact that the majority of the Saudi females in this sample had slightly prominent nose and chin. This was confirmed by the fact that the angle SNPOg does not follow the SNB angle and also during clinical examination, a prominent nose was observed in the majority of the participants. This observation should make the clinician aware of the relationship of the nose in achieving the most esthetic orthodontic or orthognathic result and treatment decision for a non-extraction borderline case having a prominent nose.<sup>13</sup> The prominence of the nose and chin affect this measurement, as do the underlying teeth and skeleton.<sup>15</sup>

It became obvious from the available literature data that the hard and soft tissue relationship of the Saudi females differ from the white standards. Therefore, it can be concluded with caution that the results of the present study demonstrated areas of differences, which may help to correct the inappropriateness of using white norms. The results of the soft tissue relationship obtained could also be of great help to the orthodontist not only in the diagnosis of conventional and surgical cases, but also in serving as a basis for future studies when a large sample and more soft tissue variables are included.

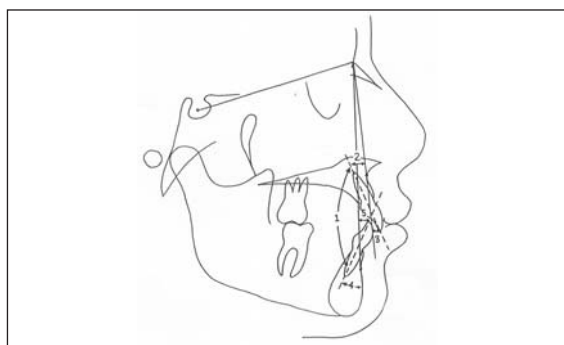
### Conclusions



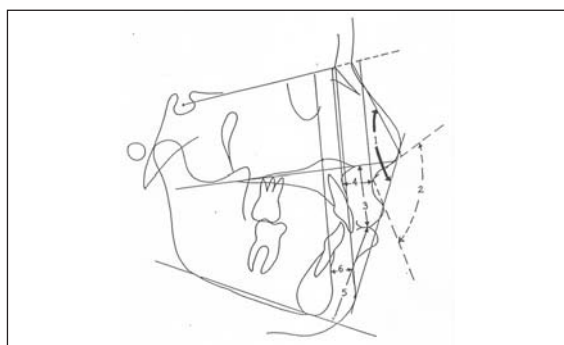
**Fig. 1.** Cephalometric landmarks A point (A), anterior nasal spine (ANS), B point (B), gnathion (Gn), gonion (GO), menton (Me), nasion (N), pogonion (Po), posterior nasal spine (PNS), sella (S), soft tissue pronasal (Pn'), soft tissue pogoion (Pn'') soft tissue nasion (N'')



**Fig. 2.** Skeletal measurements: (1) SNA, (2) SNB, (3) SNPog, (4) ANB, (5) NAPog.



**Fig. 3.** Dental measurements: (1) L-T, (2) L-NA (angle), (3) L-NA (mm), (4) T-NB (angle), (5) T-NB (mm).



**Fig. 4.** Soft tissue measurements :  
(1) N Pn Pog', (2) NLA, (3) ULL, (4) ULT, (5) LLL, (6) LLT.  
See text for lip measurements.

It may be concluded from this data that the studied Saudi females

1. Demonstrated retrusive upper and lower lips in relation to the esthetic line.
2. Had a similar and an increased upper lip length when compared to the black and white American females, respectively.
3. Had a thinner upper lip and an increased lower lip length when compared to the British females.
4. Possessed a straight profile and a nasiolabial angle similar to the white norm.

#### References

1. Bowman SJ. More than lip service: Facial esthetic in orthodontics. *J Am Dent Assoc* 1999;130:1173-1181.
2. Spyropoulos MN, Halazonetis DJ. Significance of soft tissue profile on facial esthetics. *Am J Orthod* 2001;119:5:464-471.
3. Proffit WR. Equilibrium theory revisited: Factors influencing position of teeth. *Angl Orthod* 1978; 48:175-86.
4. Wisth PJ, Thunold K. *Orthodontic diagnosis and treatment planning*. Bergen, 1985.
5. Shalhoub SY, Sarhan OA, Shaikh HS. Adult cephalometrics norms for Saudi Arabians with a comparison of values for Saudi and North American caucasians. *Br J Orthod* 1987;14:273-279.
6. Sarhan OA, Nashashibi IA. A comparative study between two randomly selected samples from which to derive standards for craniofacial measurements. *J Rehab* 1988; 15:251-255.
7. Nashashibi IA, Shaikh HS, Sarhan OA. Cephalometric norms of Saudi boys. *Saudi Dent J* 1990;2:52-57.
8. Christian G, Zylinski CG, Ram SN, Sunil K. Analysis of soft tissue facial profile in white males. *Am J Orthod Dentofac Orthop* 1992; 101:514-518.
9. Mamandras A. Linear changes of maxillary and mandibular lips. *Am J Orthod* 1988;94(5):504.
10. Dahlberg G. *Statistical methods for medical and biological students*. London: George Allen and Unwin Ltd., 1940.
11. Hashim HA, Sarhan OA, Bukhary MT, Feteih R. Vertical and horizontal linear growth of the maxillary and mandibular lips: A longitudinal study. *The J Clin Ped Dent* 1997;21(2):125-129.
12. Andrew M, Connor AN, Moshiri F. Orthognathic surgery norms for American black patients. *Am J Orthod* 1985; 87(2):119-124.
13. Holdaway RA. A soft tissue cephalometric analysis and its use in orthodontic treatment planning. Part I. *Am J Orthod* 1983;84(1):1-28.
14. Graber TM, Vanarsdall JR. *Orthodontics current principles and techniques*. 3rd ed. Chapter 1. St Louis, 2000 p. 35.
15. Chaconas SJ, Fragiskos FD. Orthognathic diagnosis and treatment planning: A cephalometric approach. *J Oral Rehab* 1991;18:531-545.