Original paper

# Soft Tissue Cephalometric Norms for a Sample of Iraqi Population Group Using Legan and Burstone Analysis

**Noor F. K. Al-Khawaja[1], Zainab Moussa Kadhom[1], Rawof Rasheed Al-Tuma[2*]**

1 Department of Orthodontics/ College of Dentistry/ University of Baghdad/ Baghdad/ Iraq
2 Department of Orthodontics/ College of Dentistry/ University of Kerbala/ Kerbala/ Iraq

## Abstract

**Background:** Most classical norms are not applicable to diverse racial and ethnic population and this study was to establish the soft tissue norms of a sample of Iraqi population group using Legan and Burstone's soft tissue analysis.
**Materials and methods:** The study was conducted on 60 adult subjects (30 males and 30 females) with esthetically pleasing profiles aged 18–25 years. Standardized lateral cephalograms were taken in a natural head position and analyzed.
**Statistics:** Descriptive statistics and Standard error of each measurement was calculated. Independent sample t-tests were used to compare the measurements of male and female subjects. One sample t test was used to compare our data with Caucasians group
**Results and discussion:** Iraqis had more convex faces, maxillary prognathism and high variability regarding mandibular prognathism than Caucasians, a more protrusive upper lip, the nasolabial angle was more obtuse, the lower lip was protrusive resulting in a deep mentolabial sulcus, the lower face–throat angle was more obtuse, the maxillary incisor exposure was more, all vertical ratios and the interlabial gap was similar. Regarding to gender differences in Iraqis, the vertical height ratio was greater in females and the lower face-throat angle was larger in males. Males had less nasolabial angle than females.
**Key words**: soft tissue norms, cephalometric analysis, legan and burstone analysis

## Introduction

Cephalometric norms are used for providing guidance to clinicians during diagnosis and treatment planning. Most classical norms are not applicable to diverse racial and ethnic population[(1)].

The need for lateral cephalometric analysis in orthodontic diagnosis and treatment planning is well established. The principle is that the radiographic measurements of each patient are compared with normative values. While small differences between the patient's measurements and the respective norms are interpreted as a normal variation, larger differences indicate structural deviations. A comprehensive cephalometric analysis must include an evaluation of positions, thicknesses and relationships of relevant soft tissue components. The soft tissue part of the analysis will assist the practitioner in determining whether or not the structural changes deemed necessary through the hard tissue analysis are likely to have a favorable effect on the facial profile, hence playing an important role in the extraction decision as well as in the decision whether or not to perform orthognathic surgery as part of the treatment. Proposed soft tissue norms

(1) Assistant Lecturer. Department of Orthodontics, College of Dentistry, University of Baghdad
(2) Assistant Lecturer. Department of Orthodontics, College of Dentistry, University of Kerbala

*For Correspondence: E-Mail raooftoma@yahoo.com

must reflect means and acceptable ranges of clinically meaningful measurements collected from a representative group of subjects to be valid as standards for comparison. Due to the soft tissue profile changes associated with growth and development, the subjects must be of relevant age, and previous findings suggest that gender differences should be explored [1–3].

Moreover, the samples should be limited to subjects with close to ideal occlusion to avoid bias due to effects of the differences in skeletal and dentoalveolar morphology on the soft tissue profile among subjects with different types of malocclusion [4, 5]. Finally, the samples must be large enough to be representative of the population.

Facial esthetics is the most important determinant of facial beauty. It plays a unique role in all social interactions and in establishing self-image. The study of facial esthetic has been primarily the subject of artists and philosophers. Today facial appearance is an essential diagnostic criterion to be considered in comprehensive orthodontic treatment planning.

Orthognathic treatment is a comprehensive approach used to correct severe jaw discrepancy using a combination of fixed orthodontic appliances and jaw surgery. The objective of orthognathic treatment is to achieve a harmonious skeletal, dental and soft tissue relationship for the improvement of facial esthetics and function. In most cases the patient is solely interested in the esthetic outcome of the treatment [6].

Legan and Burstone soft tissue analysis [7] is one of the most common soft tissue analysis systems used for orthognathic surgery [8-10]. It was modified from Burstone's previous soft tissue analysis [11]; reducing the analysis to its most relevant measurements and adding new measurements significant for surgical patient. The standards described young adult Caucasians, but these norms may not be appropriate for patients from other ethnic or racial backgrounds as there are structural differences between different racial populations [12]. Researchers in several countries have designed soft tissue norms for various ethnic and racial groups. Some showed great ethnic differences and others few [8,10,13-15]. The clinician should use esthetic guidelines relevant to subjects of the same age, sex and ethnic group as their patients. Allowance can then be made for variations in facial attractiveness while maintaining the familial and ethnic characteristics that make a person unique.

This study is an attempt to establish the standard soft tissue cephalometric norms of an Iraqi population group using Legan and Burstone soft tissue analysis.

## Materials and Methods

The sample comprised 60 Iraqis adults (30 males and 30 females) aged 18– 25 years. Standardized lateral cephalograms were taken for each subject with the following characteristics: esthetically pleasing faces, Arabic ethnic race, Angle's class I occlusion; normal overjet not exceeding 3 mm and overbite not more than 40%; spacing/crowding of not more than 3 mm; 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.

Standardized lateral cephalograms were taken for each subject on the 'Planmeca ProMax' digital cephalometric machine in a natural head position, with the teeth in maximum intercuspation and lips relaxed. The subject was asked to look into the reflection of his/her own eyes in the mirror mounted on the stand 20X100 cm, 137 cm in front of the plane of the ear rods to obtain a natural head position. The film was exposed while operating the cephalostat at a constant of 70 KVP, 5 mA and 0.8 s film exposure times. The magnification factor of the cephalostat was

1:1.1. All the exposed films were developed and fixed manually by a single technician using standard procedure. All lateral cephalometric films were traced and were analyzed using Legan and Burstone analysis (Figs. 1 and 2).

**Landmarks used in the Legan and Burstone soft tissue analysis.**

- Glabella (G) - the most prominent point in the midsagittal plane of the forehead
- Columella point (Cm) - the most anterior point on the columella of the nose
- Subnasale (Sn) - the point at which the nasal septum merges with the upper cutaneous lip in the midsagittal plane
- Labrale superius (Ls) - a point indicating the mucocutaneous border of the upper lip
- Stomion superius (Stms) - the lowermost point on the vermilion of the upper lip
- Stomion inferius (Stmi) - the uppermost point on the vermilion of the lower lip
- Labrale inferius (Li) - a point indicating the mucocutaneous border of the lower lip
- Mentolabial sulcus (Si) - the point of greatest concavity in the midline between the lower lip (Li) and chin (Pg')
- Soft tissue pogonion (Pg') - the most anterior point on soft tissue chin
- Soft tissue gnathion (Gn') - the constructed midpoint between soft tissue pogonion and soft tissue menton; can be located at the intersection of the subnasale to soft tissue pogonion line and the line from C to Me'
- Soft tissue menton (Me') - the lowest point on the contour of the soft tissue chin; found by dropping a perpendicular from horizontal plane through menton
- Cervical point (C) - the innermost point between the submental area and the neck located at the intersection of lines drawn tangent to the neck and submental areas
- Horizontal reference plane (HP) — constructed by drawing a line through nasion 7 degrees up from sella-nasion line [7]

**Statistical analysis**

SPSS version 15.00 was used for data analysis. Descriptive statistics and Standard error of each measurement was calculated. Independent sample t-tests were used to compare the measurements of male and female subjects. One sample t test was used to compare Iraqis norm with Caucasians norm.

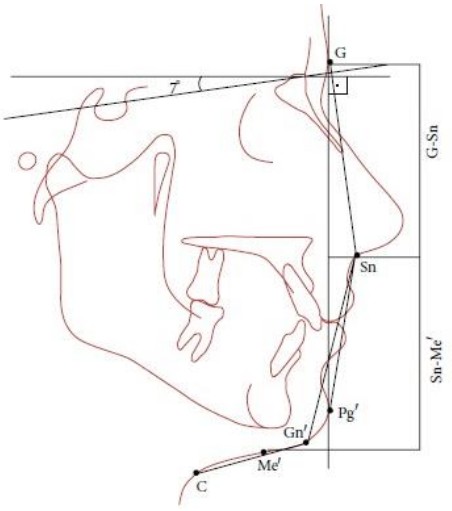


**Figure 1.** Legan-Burstone soft tissue analysis: facial forms. Horizontal reference plane (HP), constructed by drawing a line through nasion (N) 7 degrees up from the sella-nasion line. Facial convexity angle (G-Sn-Pg´); maxillary prognathism (G vertical-Sn);mandibular prognathism (G vertical-Pg´); vertical height ratio (G-Sn/Sn-Me´); lower face-throat angle (Sn Gn´-C); lower vertical heightdepth ratio (Sn-Gn´/C-Gn´).

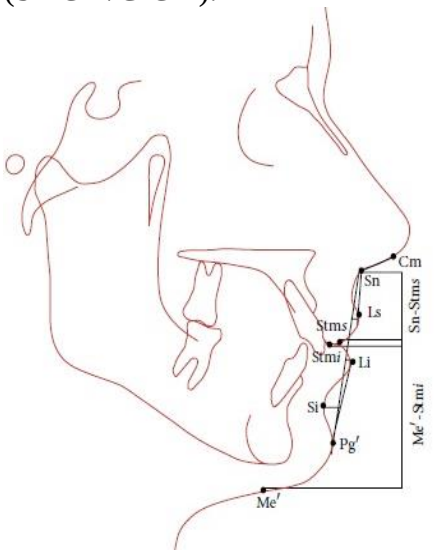


**Figure 2**. Legan-Burstone soft tissue analysis: lip position. Nasolabial angle

(Cm-Sn-Ls); upper lip protrusion (Ls to Sn-Pg´); lower lip protrusion (Li to Sn-Pg´); mentolabial sulcus (Si to Li- Pg´); vertical lip-chin ratio (Sn-Stms/Stmi-Me´); maxillary incisor exposure (Stms-UI); interlabial gap (Stms-Stmi).

## Result

The results showed descriptive statistics of the soft tissue cephalometric measurements for Iraqi male and female subject (Table 2); no statistically significant differences are noticed except for the 3 variables; Iraqi males revealed less vertical height ratio ($P$=0.032) and more lower face-throat angle ($P$=0.001), and smaller nasolabial angle ($P$=0.023) than females.

Table 1 compares Iraqi with Caucasians using Legan and Burstone analysis. Significant differences were found in most of variables except for mandibular prognathism, vertical height ratio, lower vertical height–depth ratio, nasolabial angle and mentolabial sulcus.

Table 3 illustrates other ethnic groups using Legan and Burstone analysis and compared it to Caucasians.

**Table1.** Comparison of soft tissue cephalometric values of Iraqis and Caucasians using Legan and Burstone analysis.

| Variables | Iraqi | | Caucasians | | Mean difference | T test | p- value |
|---|---|---|---|---|---|---|---|
| | mean | SD | mean | SD | | | |
| Facial form | | | | | | | |
| Facial convexity angle | 15.00 | 4.62 | 12 | 4 | 3.00 | 5.038 | 0.000*** |
| Maxillary prognathism (mm) | 15.37 | 8.30 | 6 | 3 | 9.37 | 8.746 | 0.000*** |
| Mandibular prognathism (mm) | 1.14 | 14.78 | 0 | 4 | 1.14 | 0.596 | 0.554 |
| Vertical height ratio | 1.00 | 0.09 | 1 | - | 0.0038 | 0.333 | 0.740 |
| Lower face–throat angle | 109.44 | 9.83 | 100 | 7 | 9.443 | 7.442 | 0.000*** |
| Lower vertical height–depth ratio | 1.20 | 0.17 | 1.2 | - | 0.004 | 0.184 | 0.855 |
| Lip position | | | | | | | |
| Nasolabial angle | 104.85 | 11.17 | 102 | 8 | 2.85 | 1.977 | 0.053 |
| Upper lip protrusion (mm) | 6.36 | 3.04 | 3 | 1 | 3.362 | 8.556 | 0.000*** |
| Lower lip protrusion (mm) | 4.99 | 4.36 | 2 | 1 | 2.992 | 5.318 | 0.000*** |
| Mentolabial sulcus (mm) | 6.79 | 2.08 | 4 | 2 | 2.79 | 3.532 | 0.176 |
| Vertical lip–chin ratio | 0.43 | 0.06 | 0.5 | - | - 0.738 | -10.388 | 0.000*** |
| Maxillary incisor exposure (mm) | 5.93 | 2.87 | 2 | 2 | 3.927 | 10.615 | 0.000*** |
| Interlabial gap (mm) | 2.55 | 1.76 | 2 | 2 | 0.55 | 2.42 | 0.019** |
| $P \geq 0.05$ –nonsignificant (NS), $^{*}P \leq 0.05$, $^{**}P \leq 0.01$, $^{***}P \leq 0.001$. | | | | | | | |

**Table 2.** Comparison of soft tissue cephalometric values of Iraqi males and females using Legan and Burstone analysis.

| variables | Male | | female | | p value |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | |
| Facial form | | | | | |
| Facial convexity angle | 13.88 | 5.00 | 16.12 | 3.97 | 0.059 |
| Maxillary prognathism (mm) | 15.94 | 7.00 | 14.80 | 9.51 | 0.601 |
| Mandibular prognathism (mm) | 3.38 | 13.03 | -1.10 | 16.25 | 0.244 |
| Vertical height ratio | 0.98 | 0.08 | 1.03 | 0.09 | 0.032* |
| Lower face–throat angle | 113.43 | 9.32 | 105.46 | 8.77 | 0.001*** |
| Lower vertical height–depth ratio | 1.22 | 0.18 | 1.19 | 0.15 | 0.477 |
| Lip position | | | | | |
| Nasolabial angle | 101.60 | 12.22 | 108.10 | 9.09 | 0.023* |
| Upper lip protrusion (mm) | 7.12 | 3.24 | 5.60 | 2.68 | 0.052 |
| Lower lip protrusion (mm) | 4.99 | 4.53 | 4.99 | 4.25 | 0.998 |
| Mentolabial sulcus (mm) | 7.58 | 2.33 | 6 | 1.65 | 0.252 |
| Vertical lip–chin ratio | 0.42 | 0.05 | 0.43 | 0.06 | 0.66 |
| Maxillary incisor exposure (mm) | 5.50 | 2.57 | 6.35 | 3.12 | 0.256 |

| | | | | | |
|---|---|---|---|---|---|
| Interlabial gap (mm) | 2.43 | 1.97 | 2.67 | 1.55 | 0.602 |
| $P \geq 0.05$ –nonsignificant (NS), * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$. | | | | | |

**Table 3.** Soft tissue cephalometric values of different ethnic groups using Legan and Burstone analysis.*

| Variables | Chinese | Japanese | Yemeni | Indian | Saudis | Turkish | Caucasians |
|---|---|---|---|---|---|---|---|
| Facial form | | | | | | | |
| Facial convexity angle | 10.5 ± 3.5 | 10.1 ± 5.7 | 16.9 ± 5.2 | 13.34±4.76 | 15.16±4.64 | 14.15±4.65 | 12±4 |
| Maxillary prognathism (mm) | 2.5 ± 3 | 2.3 ± 4.6 | 6.9 ± 4.1 | 5.83± 4.33 | 6.47±4.27 | 5.5±3.85 | 6±3 |
| Mandibular prognathism (mm) | N.A. | - 5.7 ± 8.3 | -4.9±6.7 | -1.3±6.4 | -1.37±7.19 | -2.7±7.25 | 0±4 |
| Vertical height ratio | 1.0 ± 0.1 | 0.9 ± 0.1 | 1.0 ± 0.1 | 1.03± 0.13 | 1±0.09 | 1.05±0.1 | 1 |
| Lower face–throat angle | 96 ± 4 | 98.1 ± 9.5 | 107.6±7.9 | 111.57±8.07 | 102.6±8.24 | 105.65±8 | 100±7 |
| Lower vertical height–depth ratio | 1.1 ± 0.2 | 1.3 ± 0.2 | 1.4 ± 0.2 | 1.22 ± 0.18 | 1.14±.02 | 1.3±0.9 | 1.2 |
| Lip position | | | | | | | |
| Nasolabial angle | 95 ± 3 | 102.3±11.6 | 106.4±9.7 | 95.79± 11.36 | 106.02±11.1 | 107.05±8.45 | 102±8 |
| Upper lip protrusion (mm) | 7.0 ± 1.5 | 5.8 ± 2.1 | 2.6 ± 1.2 | 4.72 ± 1.70 | 3.84±1.56 | 3.35±1.9 | 3±1 |
| Lower lip protrusion (mm) | N.A. | 5.0 ± 2.5 | 2.2 ± 2.2 | 2.83 ± 1.64 | 3.26±2.07 | 2.25±1.75 | 2±1 |
| Mentolabial sulcus (mm) | 3.5 ± 2 | 4.3 ± 1.4 | 5.0 ± 1.1 | 5.83 ± 1.23 | 4.60±1.23 | -5.65±1.6 | 4±2 |
| Vertical lip–chin ratio | 0.5 | 0.4 ± 0.1 | 0.4 ± 0.1 | 0.44 ± 0.05 | 0.44±0.05 | 0.48±0.075 | 0.5 |
| Maxillary incisor exposure (mm) | 1.5 ± 1.5 | 1.8 ± 1.7 | 2.9 ± 1.5 | 2.35 ± 1.45 | 3.26±1.96 | 2.95±1.85 | 2±2 |
| Interlabial gap (mm) | 1.0 ± 1.0 | 1.9 ± 0.9 | 0.6 ± 0.4 | 0.24 ± 0.73 | 2.24±0.93 | 1.1±1.55 | 2±2 |

N.A. not available
*Data obtained from original articles [10,13,14,20,21,22]

## 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. Adults of both sexes were included in the study to segregate soft tissue norms according to gender. Since most patients seeking orthodontic treatment and orthognathic surgery treatment are young adults, this sample was limited to young adults [16,17]. This is important because cephalometric norms are specific for racial types and age related [18].

Lateral cephalograms were taken in the natural head position, as suggested by Moores and Kean [19], and Legan and Burstone soft tissue analysis was carried out.

A constructed horizontal reference plane was used in the analysis because of the arbitrary nature of reference planes [10]. This plane was constructed through the Nasion 7º up from the Sella–Nasion line.

Regarding the comparison with Caucasian norms (Table 1), the facial convexity angle was found to be greater, which implies a more convex profile due to maxillary prognathism in Iraqi than in Caucasians, while mandibular prognathism did not show statistically significant differences. High variability was found in these measurements, which might be due to the variable anterior and posterior position of the glabella.

The lower face–throat angle was more obtuse (109) compared with Caucasians. An 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 vertical ratio, including lower height ratio and lower vertical height–depth ratio, was similar in both groups.

Iraqi had larger nasolabial angle than those in Caucasians samples with no significant differences. Legan and Burstone[7] indicated that in surgical procedures this angle should be in the range of 102±8 degrees. Iraqi adult norms were near the upper border of the range.

Lips were more protrusive in Iraqi than in Caucasians. This resulted in deep mentolabial sulcus in Iraqi. The vertical lip–chin ratio showed clinically insignificance but statistically significant differences. Incisor show was more in Iraqi. The interlabial gap was the same in both groups.

The angle of facial convexity in the Iraqi population was smaller in males than in females. This indicates that males have relatively straighter facial profiles than females. However, the difference was not statistically significant.

Maxillary and Mandibular prognathism did not show significant differences between the genders. However, smaller values were recorded for the mandibular prognathism measurement in females subjects compared to the males. Mandibular retrusion may be the reason for increased soft tissue convexity for females.

Females had more balanced faces with a vertical height ratio of (1.03) and statically significant from the male, While lower face–throat angle was larger in males (113.43) than female with the significant difference.

Both sexes demonstrated similar lower vertical height depth ratio with no significant differences.

When the lip form was assessed, the upper lip was found to be more protrusive in males than in females and hence the nasolabial angle was more acute, the difference in nasolabial angle was statistically significant. Mentolabial sulcus depth was more in male than female, which may be due to larger mandibular prognathism in male, but both sexes have the same amount of lower lip protrusion and Maxillary incisor exposure.

The ratio of upper lip to chin was similar and balanced in both sexes. Both sexes showed an interlabial gap to a negligible amount.

Hence, females have more balanced faces vertically, more convex faces and a nasolabial angle compared with males (Table 2).

Significant differences were also found when other ethnic groups were compared with Caucasians using Legan and Burstone analysis (Table 3). Lew *et al.* [10] showed that Chinese subjects had less convex faces, retrognathic chin, less obtuse nasolabial angle and more protrusive lips in comparison with Caucasians. In a similar study by Alcalde *et al.* [13] Japanese subjects had a retrognathic maxilla, retruded chin with less deep inferior sulcus, obtuse nasolabial angle, and more protrusive lips compared with Caucasians.

In a study by Al-Gunaid *et al.* [14] on a Yemini population, soft tissue analyses showed a more convex facial form, a more retruded mandible, obtuse lower face–throat angle, deep mentolabial sulcus, shorter interlabial gap and increased incisor exposure compared with Caucasians.

While in study by Jain and Kalra [20] North Indians had convex profile, more obtuse lower face-throat angle, protrusive lips, less obtuse nasolabial angle, deep mentolabial sulcus, and shorter interlabial gap than in Caucasians.

Saudis have a more convex profile and reduced lower vertical height depth ratio values, shorter neck distance, and more reduced chin than Caucasians [21].

In study by Celebi *et al* [22] Turkish subjects have increased facial convexity associated with retruded mandible, more obtuse lower face-throat angle, increased nasolabial angle and upper lip protrusion, deeper mentolabial sulcus, and smaller interlabial gap.

In conclusion, when compared with Caucasians, Iraqi had more convex faces, mandibular prognathism and high variability regarding maxillary prognathism, a more protrusive upper lip, the nasolabial angle was more obtuse, the lower lip was protrusive resulting in a deep mentolabial sulcus, the lower face–throat angle was more obtuse, the maxillary incisor exposure was more, all vertical ratios and the interlabial gap was similar.

The vertical height ratio was greater in females and the lower face-throat angle was larger in males. Males had less nasolabial angle than females.

## References


1. Nanda RS, Meng H, Kapila S, Goorhuis J: Growth changes in the soft tissue facial profile. Angle Orthod 1990; 60: 177–190.
2. Bishara SE, Jakobsen JR, Hession TJ, Treder JE: Soft tissue profile changes from 5 to 45 years of age. Am J Orthod Dentofacial Orthop 1998; 114: 698–706.
3. Thilander B, Persson M, Adolfsson U: Roentgen- cephalometric standards for a Swedish population. A longitudinal study between the ages of 5 and 31 years. Eur J Orthod 2005; 27: 370–389.
4. Burstone CJ: Lip posture and its significance in treatment planning. Am J Orthod 1967; 53: 262–284.
5. Holdaway RA: A soft-tissue cephalometric analysis and its use in orthodontic treatment planning. Part 1. Am J Orthod 1983; 84: 1– 28.
6. Stirling J, Latchford G, Morris DO, Kindelan J, Spender RJ, Bekker HL. Elective orthognathic treatment decision making: a survey of patient reasons and experiences. J Orthod 2007: 34: 113–127.
7. Legan HL, Burstone CJ. Soft tissue cephalometric analysis for orthognathic surgery. J Oral Surg 1980: 38: 744–751.
8. Flynn TR, Ambrogio RI, Zeichner SJ. Cephalometric norms for orthognathic surgery in black American adults. J Oral Maxillofac Surg 1989: 47: 30–39.
9. Garg S, Reddy BP, Desai R, Manjunath S, Shubhalakshmi S, Umashan-kar KV. Orthognathic surgery: an art or science! Evaluation of soft tissue changes using burstone analysis. Int J Oral Maxillofac Surg 2007: 36: 1020.
10. Lew KK, Ho KK, Keng SB, Ho KH. Soft-tissue cephalometric norms in Chinese adults with esthetic facial profiles. J Oral Maxillofac Surg 1992: 50: 1184–1190.
11. Burstone CJ. Integumental profile. Am J Orthod 1958: 44: 1- 25.
12. Richardson ER. Racial differences in dimensional traits of the human face. Angle Orthod 1980: 50: 4301–4311.
13. Alcalde RE, Jinno T, Pogrel MA, Matsumura T. Cephalometric norms in Japanese adults. J Oral Maxillofac Surg 1998: 56: 129–134.
14. Al-Gunaid T, Yamada K, Yamaki MA, Saito I. Soft-tissue cephalometric norms in Yemeni men. Am J Orthod Dentofac Orthop 2007: 132 576e7–576e14.
15. Hashim HA, Albarakati SF. Cephalometric soft tissue profile analysis between two different ethnic groups: a comparative study. J Contemp Dent Pract 2003: 4:60–73.
16. Basciftci FA, Uysal T, Buyukerkmen A. Determination of Holdaway soft tissue norms in Anatolian Turkish adults. Am J Orthod Dentofac Orthop 2003: 123: 395– 400.
17. McNamara JA, Ellis Jr E. Cephalometric analysis of untreated adults with ideal facial and occlusal relationships. Int J Adult Orthod Orthognath Surg 1988: 3: 221–231.
18. Forsberg CM. Facial morphology and ageing: a longitudinal cephalometric investigation of young adults. Eur J Orthod 1979: 1: 15–23.
19. Moores CFA, Kean M. Natural head position a basic consideration in the interpretation of cephalometric radiographs. Am J Phys Anthropol 1958: 16: 213–234.
20. Jain P, Kalra JPS. Soft tissue cephalometric norms for a North Indian population group using Legan and Burstone analysis. Int. J. Oral Maxillofac. Surg. 2011; 40: 255–259.
21. AlBarakati SF.Soft tissue facial profile of adult Saudis lateral cephalometric analysis," *Saudi Medical Journal*, vol. 32, no. 8, pp. 836–842, 2011.
22. Celebi AA, Tan E, Gelgor IE, Colak T, Ayyildiz E. Comparison of soft tissue cephalometric norms between Turkish and European- American adults. The scientific world journal 2013.