Legan-burstone soft tissue profile values in a Circassian adult sample
Amjad Al Taki, Satanay Yaqoub and Mawada Hassan

Abstract:
OBJECTIVE: To determine the mean soft tissue facial profile for Circassian adults as determined by Legan–Burstone cephalometric analysis.

MATERIALS AND METHODS: 71 lateral cephalometric radiographs for nongrowing Circassian adults with normal occlusion were traced and accurately measured.

RESULTS: With regard to facial form analysis, Circassian adults showed higher facial convexity angle, retruded mandible, and obtuse lower face–throat angle. When compared with lip form norms, Circassians showed increased nasolabial angle, deeper mentolabial sulcus, and increased maxillary incisor exposure. Comparison between men and women showed that mentolabial sulcus depth was significantly increased in Circassian men compared with Circassian women.

CONCLUSION: The results of this study showed that soft tissue facial profiles for Circassians and Caucasians are different in certain values. Such differences should be taken into account when formulating a treatment plan for Circassian patients seeking orthodontic treatment and orthognathic surgery.

Keywords: Cephalometric, Circassian, Legan–Burstone, soft tissue

Introduction
An esthetically pleasing and balanced face is one of the objectives of orthodontic treatment planning.[1] A beautiful face becomes the key to success as well, and therefore, 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.”[2]

The perception of an attractive face is largely subjective, with ethnicity, age, gender, culture, and personality influencing average facial traits.[3] Interestingly, facial features are usually studied in profile. Various methods have been used to evaluate facial characteristics, such as anthropometry,[4] photogrammetry,[5] computer imaging,[6] and cephalometry.[7]

Angle[8] suggested that if teeth were placed in optimal occlusion, good facial harmony would result. In more recent years, a large number of researches[1‑3] demonstrated that soft tissues, which vary considerably in thickness from one race to another, are a major factor in determining the final facial profile of the patient. Holdaway[9] and Legan and Burstone[10] developed soft tissue analyses that gained wide acceptance in clinical and research work in both orthodontics and orthognathic surgeries. However, these cephalometric norms were specific to European-Americans and might not apply to other ethnic groups such as Mexican Americans,[11] African Americans,[12] Chinese,[13,14] Japanese,[15,16] Koreans,[17] Iranians,[18] and Turkish.[19]
Cephalometric soft tissue norms for different ethnic and racial groups had previously been established in many populations. Most investigators had concluded that there were significant differences in the dento-facial relationship of various ethnic and racial groups. Therefore, it is important to develop standards for various populations. No report whatever is available dealing with Circassians’ soft tissue profile norm. This study was carried out to (1) determine soft tissue profile norms among Circassians by means of angular, linear, and ratio measurements, (2) to compare Circassians’ soft tissue values with Caucasian norms, and (3) to investigate the sexual differences between Circassian men and women. These would serve as a guide for esthetic treatment goals.

Materials and Methods

Lateral cephalometric radiographs were taken for 71 nongrowing Circassian adults (37 male, mean age 24.49 years; 34 females, mean age 22.38 years).

Those meeting the following criteria were chosen:
• Circassian with Circassian grandparents
• Balanced facial profile with competent lip
• Class I occlusion with minimum or no crowding
• Normal overjet and overbite
• No previous history of trauma
• No previous orthodontic treatment, maxillofacial, or plastic surgery.

All cephalometric lateral skull radiographs were taken in a natural head position, with the teeth in maximum intercuspation and lips in light contact. Tracings of the cephalometric radiographs were made by hand on 0.003 matte acetate sheets. All radiographs were traced by hand by a single author to avoid interobserver variability and were reviewed by another author for accurate landmark identification.

In this study, three angular, seven linear, and three ratio measurements were made on each radiograph. The landmarks were located according to the definitions of Legan–Burstone.

The following soft tissue and hard tissue points were identified from lateral cephalometric X-rays:
1. Cm: columella point
2. Sn: subnasale point
3. Ls: labrale superius
4. Pog’: soft tissue pogonion
5. Li: labrale inferius
6. Si: soft tissue “B” point
7. Stms: upper lip stomion
8. Ui: upper incisal
9. Stmi: lower lip stomion
10. Me: soft tissue mention
11. N: nasion
12. S: sella
13. G: soft tissue gnathion
14. C: cervical point.

After locating the points, horizontal reference plane (HP) have been drawn, which was constructed by drawing a line through Nasion (N) 7° up from the Sella (S)-N line. Angular, linear, and ratio measurements of Legan–Burstone analyses are shown in Figures 1 and 2.

1. Legan–Burstone soft tissue analysis of facial form [Figure 1]:
   1. Facial convexity angle (G-Sn-Pog’)
   2. Maxillary prognathism (G-Sn)
   3. Mandibular prognathism (G-Pog’)
   4. Lower face–throat angle (Sn-Gn’-C)
   5. Vertical height ratio (G-Sn/Sn-Me’)
   6. Lower vertical height–depth ratio (Sn-Gn’/c-Gn’).

2. Legan–Burstone soft-tissue analysis of lip form [Figure 2]:
   1. Nasolabial angle (Cm-Sn-Ls)
   2. Upper lip protrusion (Ls to Sn-Pog’)
   3. Lower-lip protrusion (Li to Sn-Pog’)
   4. Mentolabial sulcus depth (Si to Li-Pog’)
   5. Maxillary incisor exposure (Stms-Ui)
   6. Interlabial gap (Stms-Stmi)
   7. Vertical lip–chin ratio (Sn-Stms/Stmi-Me’).

Descriptive statistics (mean and standard deviation) were calculated using SPSS program version 17.0. The results were tabulated and compared with Legan–Burstone norms. To compare this ethnic of group with other
ethnics, compare men and female of this specific group, an independent t test was used at 5% level ($P < 0.05$).

**Results**

Table 1 shows the descriptive statistics of the pooled means for both genders representing Circassian soft tissue values compared with Caucasian norms as determined by Legan–Burstone analysis.

The result showed that Circassian values have statistically significant differences in three facial form and three lip form measurements compared with Legan–Burstone norms. Circassian adults had higher facial convexity angle ($P = 0.043$), retruded pogonion ($P = 0.002$), lower face–throat angle ($P = 0.001$), more obtuse nasolabial angle ($P = 0.042$), deeper mentolabial sulcus ($P = 0.000$), and increased maxillary incisor exposure ($P = 0.002$).

An independent samples t-test was used to compare Circassian men with women. Table 2 shows that 1 out of 13 measurements showed significant differences between men and women. Circassian men showed deeper mentolabial sulcus depth compared with Circassian women ($P = 0.012$).

**Discussion**

Nowadays, large numbers of Circassian adults are seeking orthodontic treatment including orthognathic surgery all over the world, hence it is important to determine soft tissue cephalometric norms for this particular ethnic group and to base our treatment plans accordingly.

Legan–Burstone analysis was used in this study because it presents the soft tissue in more detail with simplicity and directness in mind, and it is widely used.

**Facial form**

Facial convexity angle was found to be greater in our study group, which implies a more convex profile in Circassians than in Caucasians. This measurement was approximately $2.5^\circ$ higher in Circassian sample for both genders. Mandibular retrusion was the reason for increased soft tissue convexity for Circassian sample, as smaller values were recorded for mandibular prognathism measurement in Circassian subjects compared with Caucasian samples. This finding was in agreement with Uysal et al. [19] and Garg and Alexander, [20] whereas less convex profile was reported in Japanese [15] and Black Americans. [12]

Lower face–throat angle was more obtuse compared with Caucasians. Legan and Burstone stated that an obtuse lower face–throat angle should warn the clinician not to use procedures that reduce the prominence of the chin. [10]

**Table 1: Comparison between Circassians values and Caucasian norms using Legan-Burstone analysis**

| Variables                        | Circassians ($n=71$) | Norms | $P$  |
|----------------------------------|----------------------|-------|------|
|                                 | Mean | SD   | Mean | SD  |      |
| **Facial form**                  |      |      |      |      |      |
| Facial convexity angle (G-Sn-Pog') | 14.48 | 5.78 | 12  | 4  | 0.043 |
| Maxillary prognathism (G-Sn)    | 6.22 | 4.33 | 6   | 3  | 0.809 |
| Mandibular prognathism (G-Pog') | -4.64 | 7.33 | 0   | 4  | 0.002 |
| Lower face-throat angle (Sn-Gn'-C) | 108.54 | 12.34 | 100 | 7  | 0.001 |
| Vertical height ratio (G-Sn/Sn-Me) | 0.96  | 0.13 | 1   | -  | -    |
| Lower vertical height-depth ratio (Sn-Gn'/c-Gn') | 1.8  | 0.69 | 1.2 | -  | -    |
| **Lip form**                     |      |      |      |      |      |
| Nasolabial angle (Cm-Sn-Ls)      | 106.65 | 10.59 | 102 | 8  | 0.042 |
| Upper-lip protrusion (Ls to Sn-Pog') | 2.57 | 2.65 | 3   | 1  | 0.415 |
| Lower-lip protrusion (Li to Sn-Pog') | 1.56 | 3.08 | 2   | 1  | 0.470 |
| Mentolabial sulcus depth (Si to Li-Pog') | -6.21 | 2.23 | 4   | 2  | 0.000 |
| Maxillary incisor exposure (Stms-U1) | 3.32 | 1.78 | 2   | 2  | 0.002 |
| Interlabial gap (Stms-Stmi)      | 2.29 | 0.5  | 2   | 2  | 0.257 |
| Vertical lip-chin ratio (Sn-Stms/Stdmi-Me') | 0.47 | 0.06 | 0.5 | -  | -    |

SD – Standard deviation
Comparisons between both sexes showed no significant differences, although mandibular prognathism value was smaller in females than males which indicate that females have relatively more convex facial profiles than males.

**Lip form**
Greater nasolabial angle by $4^\circ$ was recorded in Circassian subjects compared with Caucasian sample. Legan and Burstone\[10\] indicated that in surgical procedures, this angle should be in the range of $102^\circ \pm 8^\circ$. Circassian adult values were near the upper border of the range. Similar findings were reported in Japanese,\[15\] Koreans,\[17\] and Turkish.\[19\]

The mentolabial sulcus relative to lower lip pogion line measurement showed that mentolabial sulcus depth was increased in Circassian adult sample which might be attributed to mandibular retrusion. Similar findings were obtained by uysal et al.\[19\] and Celebi et al.\[21\]. Comparisons between both sexes showed that mentolabial sulcus depth was larger in Circassia males than in females. This could be attributed to the fact that males have more prominent chin compared with females.

Statistically significant difference was also found in the maxillary incisor exposure between our study group and the Caucasians. The comparison revealed more incisor exposure in Circassian adults compared with Caucasians.

**Conclusion**
In conclusion, we compared the soft tissue profiles of Circassian adults with those of Caucasians and found out the Circassian adults have
- More convex soft tissue facial profiles
- More retruded chins
- More obtuse lower face–throat angle
- Increased nasolabial angle
- Deeper mentolabial sulcus
- More maxillary incisor exposure.

These differences should be taken into account when treating Circassian patients according to Caucasian norms.

**Financial support and sponsorship**
Nil.

**Conflicts of interest**
There are no conflicts of interest

**References**
1. Anić-Milosević S, Lapter-Varga M, Slaj M. Analysis of the soft tissue facial profile by means of angular measurements. Eur J Orthod 2008;30:135-40.
2. Sforza C, Laino A, D’Alessio R, Grandi G, Tartaglia GM, Ferrario VF, et al. Soft-tissue facial characteristics of attractive and normal adolescent boys and girls. Angle Orthod 2008;78:799-807.
3. Mandall NA, McCord JF, Blinkhorn AS, Worthington HV, O’Brien KD. Perceived aesthetic impact of malocclusion and oral self-perceptions in 14-15-year-old Asian and Caucasian children in greater Manchester. Eur J Orthod 2000;22:175-83.
4. Farkas LG. Anthropometry of the Head and Face in Medicine. New York: Elsevier North Holland Inc.; 1981. p. 285.
5. Gavan JA, Washburn SL, Lewis PH. Photography: An anthropometric tool. Am J Phys Anthropol 1952;10:331-53.
6. Guess MB, Solzer WV. Computer treatment estimates in orthodontics and orthognathic surgery. J Clin Orthod 1989;23:262-8.
7. Garner LD. Soft-tissue changes concurrent with orthodontic tooth movement. Am J Orthod 1974;66:367-77.
8. Angle EH. Treatment of the Malocclusion of the Teeth. Philadelphia: S.S. White Manufacturing; 1907.
9. Holdaway RA. A soft-tissue cephalometric analysis and its use in...
orthodontic treatment planning. Part I. Am J Orthod 1983;84:1-28.
10. Legan HL, Burstone CJ. Soft tissue cephalometric analysis for orthognathic surgery. J Oral Surg 1980;38:744-51.
11. Swlerenga D, Oesterle LJ, Messersmith ML. Cephalometric values for adult Mexican-Americans. Am J Orthod Dentofacial Orthop 1994;106:146-55.
12. Connor AM, Moshiri F. Orthognathic surgery norms for American black patients. Am J Orthod 1985;87:119-34.
13. Cooke MS, Wei SH. Cephalometric standards for the Southern Chinese. Eur J Orthod 1988;10:264-72.
14. Wu J, Hägg U, Rabie A, Bakr M. Chinese norms of McNamara’s cephalometric analysis. Angle Orthod 2007;77:12-20.
15. Alcalde RE, Jinno T, Orsini MG, Sasaki A, Sugiyama RM, Matsumura T, et al. Soft tissue cephalometric norms in Japanese adults. Am J Orthod Dentofacial Orthop 2000;118:84-9.
16. Ioi H, Nakata S, Nakasima A, Counts AL. Comparison of cephalometric norms between Japanese and Caucasian adults in antero-posterior and vertical dimension. Eur J Orthod 2007;29:493-9.
17. Hwang HS, Kim WS, McNamara JA Jr. Ethnic differences in the soft tissue profile of Korean and European-American adults with normal occlusions and well-balanced faces. Angle Orthod 2002;72:72-80.
18. Taki AA, Oguz F, Abuhijleh E. Facial soft tissue values in persian adults with normal occlusion and well-balanced faces. Angle Orthod 2009;79:491-4.
19. Uysal T, Baysal A, Yagci A, Sigler LM, McNamara JA Jr. Ethnic differences in the soft tissue profiles of Turkish and European-American young adults with normal occlusions and well-balanced faces. Eur J Orthod 2012;34:296-301.
20. Garg R, Alexander M. “Are we similar to caucasians”: Orthognathic surgery for north Indians. J Maxillofac Oral Surg 2015;14:271-7.
21. Celebi AA, Tan E, Gelgor IE, Colak T, Ayyildiz E. Comparison of soft tissue cephalometric norms between Turkish and European-American adults. ScientificWorldJournal 2013;2013:806203.