



Evaluation of facial soft tissue parameters for Northwestern students in Iran

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ARTICLE INFO	ABSTRACT
<p>Article Type: Original Article</p> <p>Received: 14 Apr 2015 Revised: 18 May 2015 Accepted: 30 May 2015</p> <p>*Corresponding author: Mohamad Amin Bakhshali Sahand University of Technology, New Sahand Town, Tabriz, Iran.</p> <p>Tel: +9841-33458233 Fax: +9841-33444350 Email: amin.bakhshali@gmail.com</p>	<p>Introduction: We studied and measured facial parameters of 160 students, aged 22-24 years attended at Sahand University of Technology in Northwest of Iran.</p> <p>Material and Methods: In this paper, six linear and six angular facial parameters are measured. These parameters are measured in frontal and profile facial images. The measured values are the mean and standard deviation (SD) of distance between the two medial canthi, width of alar base, length of nose, width of mouth, length of upper lip, length of lower lip, interlabial gap, nasofrontal angle, nasofacial angle, nasomental angle, nasolabial angle, mentolabial angle, and throat angle. The mean (SD) of the above mentioned parameters were 33mm (3), 38mm (2), 49mm (2), 46mm (3), 16mm (3), 14mm (1), 4mm (0.75), 127° (3°), 31° (2°), 127° (3°), 112° (5°), 135° (3°), 124° (2°), respectively.</p> <p>Results: Most of the parameters we measured were comparable in men and women. When we compared our results with studies in South of Iran and elsewhere many differences were found and this shows that the measurement of the facial parameters in different races, ethnic groups, and regions of country is necessary.</p> <p>Conclusion: Measurement of these parameters is vital in facial surgeries especially in aesthetic, maxillofacial, rhinoplasty and orthognathic surgeries.</p> <p>Keywords: Frontal image, Profile image, Facial soft tissue analysis, Horizontal measurement, Transverse measurement.</p>

Introduction

Achieving paramount facial aesthetics is one of the main goals for orthodontists, maxillofacial surgeons, and individuals seeking orthodontic treatment. Today, the guidelines for facial beauty and attractiveness used by the clinicians are based on artistic facts.

For facial operations like rhinoplasty or blepharoplasty, surgeons need the exact measurement of the facial soft and hard tissue parameters. These parameters are length and angles of jaws, nose, chin and cheeks. The evaluation of hard tissue can be obtained by routine plain radiography or computed tomography, but the evaluation of soft tissue is more difficult [1,2]. Some research have computed norms of different races and ethnic groups from patients' images [3-7]. Therefore, in this paper, we decided to evaluate these parameters for Iranian Northwestern students.

The aim of this study was to evaluate the soft-tissue measurements of Iranian Northwestern students with normal occlusion. Additionally, normal values for Northwestern Iranian were established and compared to another region of Iran.

Material and methods

Due to the retrospective nature of this study, it was granted an exemption in writing by the Sahand University of Technology and Tabriz University of Medical Sciences. This study was conducted at the Department of Biomedical Engineering, Sahand University of Technology, Tabriz, Iran. We selected 80 men and 80 women randomly, from 200 students at vocational centers in Tabriz city in Northwest of Iran. The sample met the following criteria: the average age of the women was 22 years, with a

standard deviation of 1 year, and for the men 24 years, with a standard deviation of 1.5 years. We excluded students who had rhinoplasty, chin augmentation (genioplasty), or the other operations in the maxillofacial region. Students with abnormal bony protuberance or enlargements of facial soft tissue were also excluded.

We used facial frontal and profile color images sized 2600×2300 pixels. These images belonged to database of our developed orthogonal stereo imaging system at Sahand University of Technology, Tabriz, Iran. The designed system is based on orthogonal placement and calibration of three cameras. These cameras are working by remote control and have specific technical characteristics such as simultaneous, fast, accurate and high quality imaging. Also, the system contains a head fixer which increases the accuracy of imaging and sets the head in its best position. It helps surgeons in gathering orthogonal images from different sides with high quality and accuracy, simultaneously. This system that includes both hardware and software parts not only has the ability of accurate imaging but also has the power of data analysis. We took standard frontal and profile images. During imaging the soft tissue of chin and face were in a relaxed position and the head was in a natural position.

As shown in Figure 1, a marker of calibration has been used at upward of the face. Calibration marker is useful to estimate the correct size of each image. Each square's area in calibration marker is 10×10mm. By defining two points in the image that is 10mm, actual dimensions of the image can be estimated. As mentioned in [11], actual size of a measurement was extracted by the following

formula:

$$\text{Actual size of a measurement (mm)} = \frac{\text{Measurement size in image (mm)}}{\text{Calibration marker in image (mm)}} \times 100\text{mm}$$

Frontal images were divided into three transverse and three horizontal measurements as follows (Figure 1):

1. (tri-gb): Measurement between a horizontal line passed through the trichion (tri) and a horizontal line passed from glabella (gb).
2. (gb-sn): Measurement between (gb) and a horizontal line passed from subnasal (sn).
3. (sn-me): Measurement between (sn) and a horizontal line passed from menton (me).
4. (lc-mc): Measurement between (lc) and a perpendicular line passed from medial canthus (mc) on both right and left sides.
5. (mc-mc): Measurement between two perpendicular lines passed from medial canthus (mc) on both right and left sides.

Linear parameters that were measured on frontal images were alar base width (abw) and mouth width (mw) (Figure 1) and on profile images were nasal length (nl), upper lip length (ull), interlabial gap (ilg), and lower lip length (lll) (Figure 2).

Angular parameters that were measured on profile images were nasofrontal (nfr), nasofacial (nfa), nasomental (nm), nasolabial (nl), mentolabial (ml), and throat (th) angles (Figure2).

All the parameters were measured by the first and second authors and re-checked twice by the third author to achieve a reliable data.

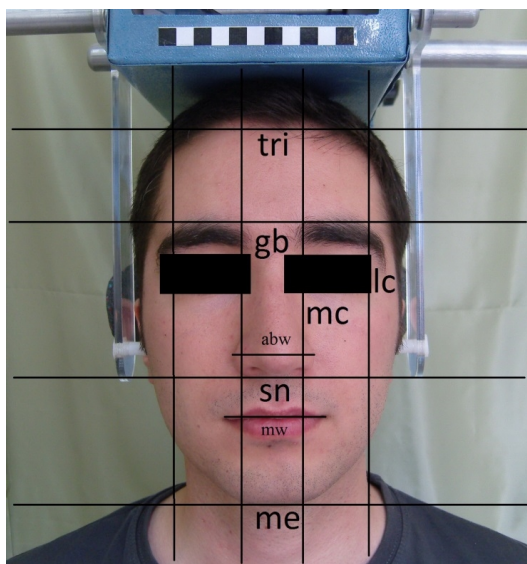


Fig. 1. A sample image of our database, calibration marker, horizontal and transverse divisions of frontal images, the alar base width (abw) and the mouth width (mw) are shown in the image.

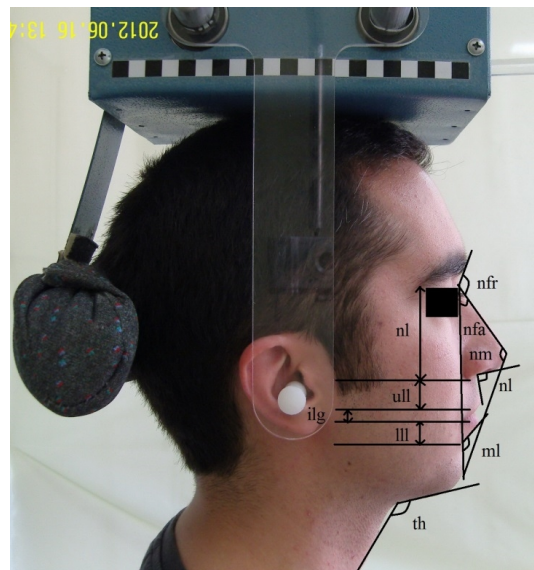


Fig. 2. Linear and angular parameters on profile Images.

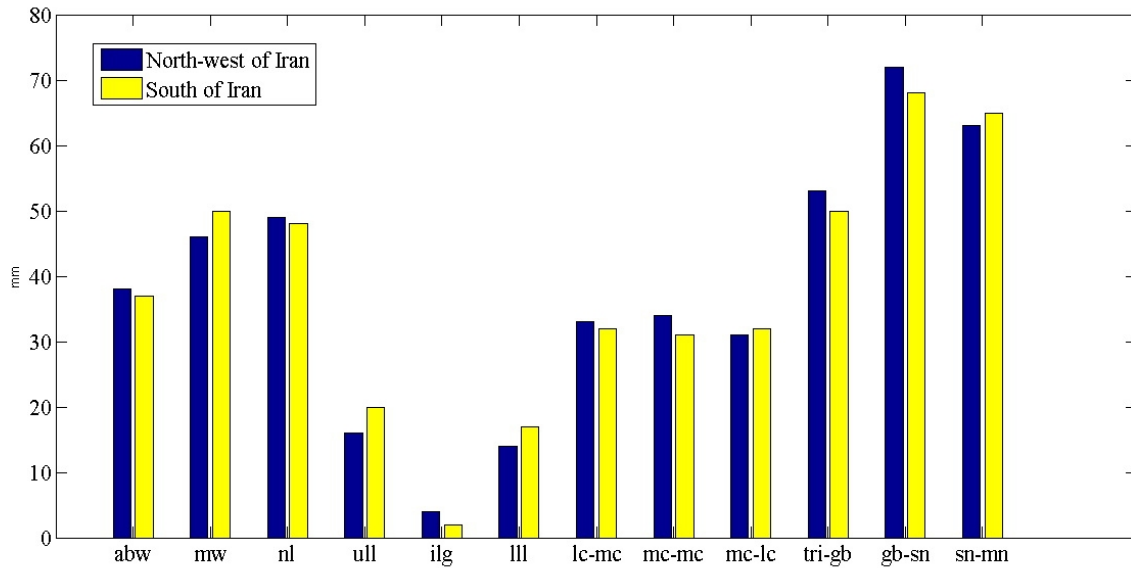


Fig. 3. A comparison between linear facial parameters of Northwestern and Southern people of Iran.

Results

The largest value of the three transverse measurements in women (frontal images), is the distance between the right and left medial canthi. It is followed by the left lateral canthus to the left medial canthus and the right lateral canthus to the right medial canthus (Table 1).

The largest value of the three transverse measurements in men (frontal images), is the distance between the right and left medial canthi. It is followed by the left lateral canthus to the left medial canthus and the right lateral canthus to the right medial canthus (Table 1).

In the horizontal measurements in men and

women, vertical distance of glabella to subnasal (middle third of face) had the highest value, then vertical distance of subnasal to menton (the lower third of face) and finally the upper third (Table 1).

We used one-sample Kolmogorov-Smirnov and Pearson (two-tailed) tests for statistical analysis. Our quantitative variables were normally distributed as showed by the Kolmogorov-Smirnov test.

The other results of frontal and profile images analysis are summarized in Table 2. In Table 2, the linear and the angular parameters of frontal and profile images from Iranian Northwestern students are presented.

In Figures 3 and 4, a comparison between facial parameters of Iranian Northwestern students and

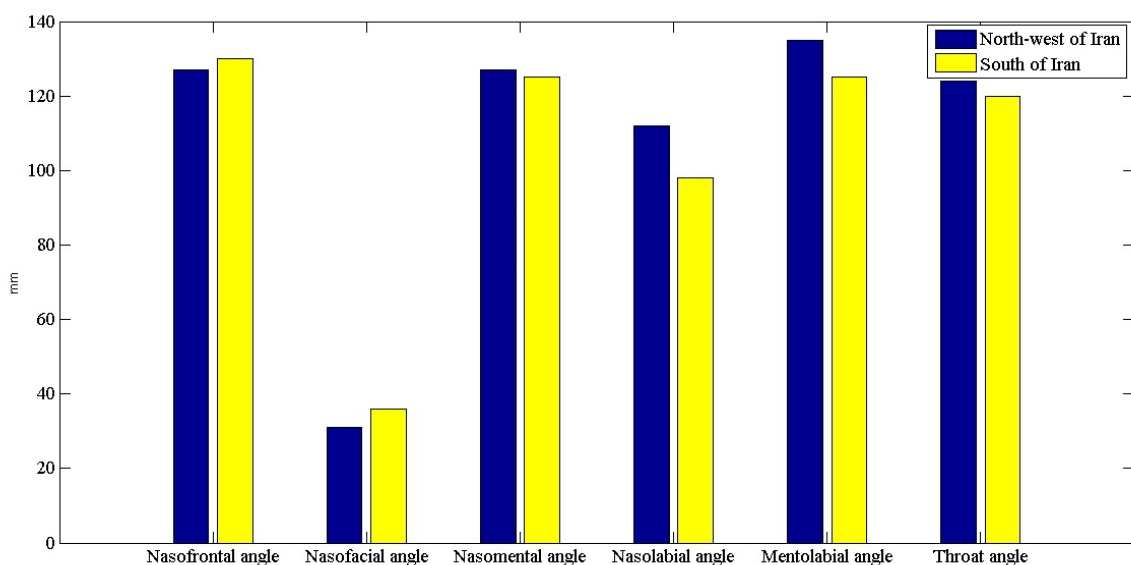


Fig. 4. A comparison between angular facial parameters of Northwestern and Southern people of Iran.

Table 1. Mean value of transverse and horizontal measurements of frontal images in 80 men and 80 women in Northwest of Iran.

Sex	Transverse measurements			Horizontal measurements		
	lc-mc	mc-mc	mc-lc	tri-gb	gb-sn	sn-me
Men	33	34	31	53	72	63
Women	31	33	32	51	68	61

Table 2. Soft tissue measurements on profile images in 80 men and 80 women in Northwest of Iran.

Variables	Women		Men		Total		P		
	Mean	S.D	Mean	S.D	Mean	S.D	Min	Max	
Alar base width (abw)	37	2	40	2	38	2	23	47	<0.01
Mouth width (mw)	45	3	47	3	46	3	40	63	<0.001
Nasal length (nl)	48	2	50	2	49	2	38	55	<0.001
Upper lip length (ull)	15	3	17	3	16	3	12	27	<0.001
Interlabial gap (ilg)	3	0.5	5	1	4	0.75	1	8	<0.01
Lower lip length (lll)	13	1	15	1	14	1	11	21	<0.001
Nasofrontal angle (nfr)	128	3	126	3	127	3	103	151	<0.001
Nasofacial angle (nfa)	31	2	31	2	31	2	24	49	0.24
Nasomental angle(nm)	127	3	128	3	127	3	112	147	0.05
Nasolabial angle (nl)	112	5	113	5	112	5	76	128	0.01
Mentolabial angle (ml)	136	3	134	3	135	3	80	150	0.21
Throat angle (th)	125	2	123	2	124	2	84	153	0.14

Southern students [11] is presented.

Discussion

The results of the three horizontal measurements in both men and women were similar (measurement in men are a little greater than in women). The maximum value was respectively owned by the middle third, the lower third and the upper third. In contrary to our results, in 62 people (50 men and 12 women) in Santiago, the largest part is the lower third, then middle, and finally upper third of face. It shows the differences among various races [8]. The horizontal measurements of Iranian Southern students are smaller than the Northwestern ones.

In frontal images, the intercanthal distance and the distance of the two lateral canthi are larger in men than in women. According to our studies, the intercanthal distance of our subjects is less than Europeans (mean value in our subjects was 32mm compared with 34 in Europeans) [3].

In comparison between men and women, men have wider base of nose (40mm compared with 37mm). Peterson et al. [3] concluded that by adding 2–3mm to the intercanthal distance, we can extract the width of the alar base but according to our studies in this paper, by adding 4–7mm to the intercanthal distance, we can reach the width of the alar base. Iranian Northwestern students had wider the base of nose than the Iranian Southern ones.

The length of the nose in men was 2mm larger than in women. The nasal length of women is 48mm. This result is comparable to the results of Fernandez-Riveiro et al. [8] in Santiago but the results of our study for the length of nose is less than their results (men 53mm, women 50mm).

We found difference between men (113°) and women (112°) in nasolabial angle, the mean value being 112°. Other authors have reported different numbers; for example Viazis [9] reported an angle of 100°, and Bell [1] of about 90° in men and 110° in women, and a study from Oklahoma of 112° [10]. The nasolabial angle in Northwest of Iran was significantly larger than that in South of Iran (98°) [11].

The nasofrontal angle was significantly larger in women than in men (128° compared with 126°). The nasofrontal angle was not different between the Northwest and South of Iran.

The nasofacial angle was not significantly different between the sexes and the mean value of this angle (31°) was smaller from that reported by Peterson et al [3] and Fariaby et al [11].

The mouth was wider in men than in women (47mm compared with 45mm) and the mouth width in South of Iran was larger than Northwest of Iran.

The length of upper and lower lips was larger in men than in women which are similar to but smaller than reported by Fernandez-Riveiro et al [8]. The length of lips was larger in Southern rather than Northwestern students in Iran.

The interlabial gap was approximately equal in both sexes. Other authors have reported interlabial gaps of 0.3mm in men and 0.6mm in women. The interlabial gap in Southern students in Iran was 2mm [3,8].

The mentolabial angle was longer in women than in men (136° compared with 134°) and was longer than that reported by Viazis [9] (130°) and Faribay et al [11] (125°). The mentolabial angle in

Northwestern students in Iran was larger than that in Southern students.

We conclude that soft-tissue measurements are specific for each ethnic group. The normative data for Northwestern students in Iran could be used as a guide for diagnosis and planning of oral and maxillofacial, ENT, and plastic surgeries. The results of this study revealed that some measurements were different from the measurements of Southern students in Iran, including; nasolabial, nasofrontal, and nasofacial angles.

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Conflict of interest: Due to the retrospective nature of this study, it was granted an exemption in writing by the Sahand University of Technology and Tabriz University of Medical Sciences.

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