Determination of Holdaway soft tissue norms in Iranian adolescents

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Abstract

Aim: Facial appearance is an important factor for a successful orthodontic treatment that include soft-tissue profile, finding of standard cephalometric values for various population can be useful. The aim of this study was To detect the mean soft tissue facial profile for Iranian adolescent as determined by the Holdaway analysis and also detect any differences between values of boys and girls.

Materials and Methods: Lateral cephalometric radiographs for 58 Iranian adolescent with normal occlusion were used. sample were consist of 35 girls (mean age 16y,7m) and 23 boys (mean age 15y,3m). All of subjects were positioned in cephalostat with the lips in rest and the teeth in centric occlusion. The landmarks were detected on the basis of Holdaway definition.

Results: Iranian soft tissue showed differences in some variables when comparing to Holdaway ideal values including upper lip sulcus depth, soft-tissue subnasal to H-line, inferior sulcus to H line, skeletal profile convexity and H angle, but all of them were in the normal range. Soft tissue chin thickness was the only parameter that showed differences from normal range. When comparing two sexes, upper lip thickness and soft tissue chin thickness were greater in boys in relation to girls.

Conclusions: Persian people differ from Holdaway's soft tissue norms in an increased skeletal profile convexity, H angle, and soft tissue chin thickness. These are recommended for use when formulating a treatment plan for this ethnic group. Iranian boys had thicker upper lip and greater soft tissue chin thickness in relation to girls.

Keywords: Holdaway norms, Persian, soft tissue analysis

Orthodontic treatment plan is routinely based on hard-tissue analysis whereas the first factor for patients is commonly esthetics. The correction of dentoskeletal relationships and occlusion by orthodontic treatment usually changes soft-tissue position which can be desirable or not.[1,2]

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Facial appearance is an important factor for a successful orthodontic treatment that include soft-tissue profile.[3]Several studies showed that soft-tissue with different thickness is an important factor in determining of final patient's profile and it also is a reflectance of underlying hard-tissue.[4,5]Recently the importance of facial esthetics is increasing, so orthodontic field has to focus more on soft-tissue assesment.6there are several analysis for soft tissue assessments like Steiner[7], Ricketts[8], Burstone[9] and Merrifield[10]. Holdaway was also one the person who emphasize on soft-tissue in diagnosis and treatment planning.

He stated that "systems based on hard-tissue measurements or reference lines alone may produce disappointing results"[11].He emphasized that "better treatment goals can be set if we quantitate the soft-tissue features which contribute to or detract from that 'physical attractiveness stereotype' which has been ingrain into our culture"[12]. So soft-tissue is as effective as hard-tissue and achieving to soft-tissue ideal norms are nesseccary[13], but these norms are specific to one special ethnic group[5]. Racial traits can be effective on orthodontic and orthogenetic treatment planning too1[4].On the basis of previous studies Cephalometric norms may be different from one population to another and each patient has to be treated on the basis of his own racial character, so finding of standard values for various population can be useful[15]. Several investigations have accomplished to determine the soft tissue norms in different races like Turkish[15], Kuwaitis[16], Iraqi[17], Indian [4,16,17] ,Yemeni[5] ,Jordanian18and Japanese19, but just a few researches were done to evaluate the cephalometric norms in Iranian people. Furthermore, most of them were on the basis of dentofacial pattern rather than soft-tissue assesment.6From this point we made an study on Iranian adolescents between 14 and 18 to (1)determine the Holdaway soft-tissue norms, (2) compare the Iranian values with Holdaway norms and (3)detect any differences between values of boys and girls.

Materials and methods

The material included lateral cephalometric radiographs of 58 Iranian adolescents between 14 and 18 selected from high school students. The following steps were done for selection of sample:

1- Symmetry at frontal view, proportionate facial profile without excessive convexity or concavity or increased protrusion or retrusion of lips.

2- Normal occlusion.

3- No history of previous orthodontic therapy, TMD and oral habits.

After informing each individual, the lateral cephalometric radiographs were taken from volunteers. All of subjects were positioned in cephalostat with the lips at rest and the teeth in centric occlusion. It seems that this relaxed position of lips is more reliable for soft tissue analysis when comparing with position in which the lips are slightly closed.7 Some radiographs were excluded from the study because of low quality, inappropriate head position in cephalostat and bite opening. Finally the sample were consist of 35 girls (mean age 16y,7m) and 23 boys (mean age 15y,3m).

The radiographs were traced on matta acetate sheets by an observer. The landmarks were detected on the basis of Holdaway definition.12 The fallowing 12 measurements were used.(Fig1)

1- Soft tissue facial angle: the downward and inner angle formed at a point where the sella-nasion line crosses the soft-tissue(N'), and a line connecting the soft-tissue suprapogonion (Pog') with the Frankfort horizontal plane.

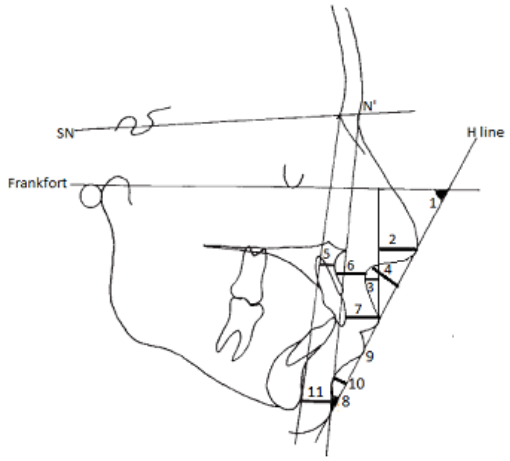
2- Nose prominence: the dimension between the tip of the nose and a perpendicular line drawn to the Frankfort plane from the vermilion.

3- Upper lip sulcus depth: the measurement between the upper lip sulcus and a perpendicular line drawn from the vermilion to the Frankfort plane.

4- Soft tissue subnasal to H line: measurement from subnasal to the H line. (Tangent drawn from the tip of the chin to the upper lip)

5- Skeletal profile convexity: the dimension between point A and the facial line (N-Pog).

6- Basic upper lip thickness: the dimension measured approximately 3 mm below point A and the drape of the upper lip.
7-Upper lip thickness: the dimension between the vermilion point and the labial surface of the maxillary incisor.
8- H angle: the angle formed between the soft tissue facial plane line (N'-Pog') and the H line.
9- Lower lip to H line: measurement of the lower lip to the H line.
10- Inferior sulcus to the H line (lower lip sulcus depth): the measurement at the point of greatest convexity between the vermilion border of the lower lip and the H line.
11- Soft tissue chin thickness: the distance between the hard and soft tissue facial planes at the level of suprapogonion.



1-Soft tissue facial angle2-Nose prominence 3-Upper lip sulcus depth 4-Soft tissue subnasal to H line 5-Skeletal profile convexity 6-Basic upper lip thickness 7- Upper lip thickness8- H angle 9- Lower lip to H line 10- Inferior sulcus to the H line (lower lip sulcus depth) 11- Soft tissue chin thickness.

The angular and linear measurements were analyzed by the same observer. Tracing and measurements were repeated by another observer to determine the errors associated with finding landmarks and radiographic measurements. Any point or value with unreasonable difference between two observations, was analyzed by another observer to get the best fit points and measures.

The data were processed and arithmetic mean, mode, minimum, maximum and standard deviation were calculated for every measurement. Bartlett's test was used for equality of variances. Then t-test applied for variables with equal variances and non-parametric test of Kruskal-Wallis applied for variables with unequal variances for comparison of groups. The significance was evaluated for different means of values between this study and Holdaway norms and also for two sexes.

Results

This investigation showed that except one variable, Iranian soft tissue norms are similar to Holdaway norms12. (Table 1) although the values of upper lip sulcus depth, soft tissue subnasal to H line, skeletal profile convexity, inferior sulcus to H line and H angle in our sample were greater than Holdaway ideal values, all of them were placed still in normal range as reported by Holdaway. Soft tissue chin thickness and H angle were the only parameters that showed differences from normal range, which were even greater than the maximum normal scale. Soft tissue chin thickness found to be 13.08 in our study while the normal range of Holdaway is 10-12.

Table 1 Mean, min, max, mode and standard deviation of cephalometric measurements for 58 Iranians.

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	Our results					Holdaway values		
Variable	**Min**	**Max**	**Mode**	**Mean**	**S.D**	**Holdaway ideal value**	**Holldaway norms**	**P-Value**
Soft tissue facial angle	85	98	94	92.28	2.54	91	91±7	NS
Nose prominence	8	20.5	16	14.24	2.63	14-24	14-24	NS
Upper lip sulcus depth	2	5	3	3.47	0.92	3	1-4	0.005*
Soft tissue subnasal to H line	1	9	6.5	5.48	1.68	5	5±2	=0.025*
Skeletal profile convexity	-3	5	2	1.01	2.23	0	No norm	0.005*
Basic upper lip thickness	12	22	17	16.65	2.9	15	15-16	NS
Upper lip thickness	10	19.5	15.13	14.24	2.17	13-14	13-14	NS
H angle	6	22	14	14.36	3.53	10	7-15	0.005*
Lower lip to H line	-3	4	0	0.55	1.52	0-0.5	-1-2	NS
Inferior sulcus to the H line	2	16.5	6	5.96	2.21	5	5±1	0.005*
Soft tissue chin thickness	9.5	16.5	12	13.08	1.56	11	10-12	0.005*

* significant at $p < 0.05$, NS: Non Significant

Table2 Comparison of mean and standard deviation between 23 boys and 35 girls.

	boys (n=23)		girls (n=35)		
Variable	**Mean**	**S.D**	**Mean**	**S.D**	**P-Value**
Soft tissue facial angle	91.47	2.44	92.8	2.68	0.053
Nose prominence	14.34	2.64	14.17	2.64	0.80
Upper lip sulcus depth	3.30	1.03	3.58	0.83	0.25
Soft tissue subnasal to H line	5.80	1.97	2.28	1.44	0.22
Skeletal profile convexity	1.26	2.47	0.84	2.08	0.50
Basic upper lip thickness	17.76	1.83	15.91	1.93	0.80
Upper lip thickness	15.28	2.30	13.55	1.79	0.002*
H angle	15.32	4.28	13.22	2.82	0.08
Lower lip to H line	0.67	1.40	0.47	1.59	0.62
Inferior sulcus to the H line	5.76	1.97	6.08	2.36	0.59
Soft tissue chin thickness	13.95	1.42	12.50	1.38	0.00*

* significant at $p < 0.05$

Discussion

Human has been always interested in beauty. People do every attempt to have a better appearance and facial characteristics are one of the most important factor of beauty. because of that the number of people who seek for orthodontic treatment are increasing. A successful treatment won't be achieved without regarding soft tissue assessment. At the end of treatment both hard tissue and soft tissue values have to improve to normal. But how can we consider some values as normal? Several analysis were introduced to determine the normal parameters of soft-tissue. Steiner7 was one of the first person who emphasize on normal position of lips. He presented his favorite analysis that define protrusive or retrusive lip on the basis of S-line. A few years later Ricketts8 introduced esthetic line for interpretation of lip protrusion or retrusion. Little by little many other analysis came for assessing of soft-tissue. Holdaway12 soft-tissue analysis was one of the most comprehensive one that include both linear and angular measurements. At the other point various ethnic groups may have different facial soft tissue pattern and every patient has to be compared with the normal values of his population. So finding of normal range for different racial groups would be useful. With this aspect we tried to detect Holdaway soft-tissue norms for Iranian people. Since most of the people who are seeking for orthodontic treatment are young, we prefer to use adolescent with mean age of 16years and 3months for this study.

The results of this study showed that the upper lip sulcus depth, soft-tissue subnasal to H-line and inferior sulcus to H line in our sample were greater than Holdaway ideal but still in normal range. So we can use Holdaway norms for Iranian when assessing these parameters. We also found that Iranians have more profile convexity and greater H angle when comparing Holdaway ideal norms. according to Holdaway12 the ideal value for H angle is 10 when considering 0 for skeletal profile convexity. As the skeletal convexity increase, the H angle have to also increase to maintain facial harmony. Iranian skeletal convexity was 1.01(± 2.23) and H angle also increased to 14.36 (± 3.53). Our result was agreed with findings of Amjad AL Taki et al6 who found that the skeletal convexity and H angle were greater in Persian adult than Holdaway values. In the other study Hajighadimi et al20 showed that Iranian have more convex soft tissue profile. They used Tweed and Steiner's analysis for their research. Mafi et al21 also conclude in his study that Iranian female have faces more convex than American Caucasian women.

The similar results were found in Iraqi, Kuwaitis, Indian, Yemenis and Jordanian people. Abdul-Qadir et al17 observed increased H angle and skeletal profile convexity in Iraqi adult relative to Holdaway norms. Rashed Al-Asemi et al16 also concluded in his investigation that H angle in adolescent Kuwaitis is greater than Holdaway value. Indian people also had increased facial convexity on the basis of Burstone analysis in Jain and Karla's13,14 studies. The findings of Al-Gunaid et al5 in Yemen also showed increased H-angle and skeletal profile convexity. Hamdan AM18 used Holdaway and Ricketts analysis in his reserch and found that Jordanian people had greater H-angle than norms.

The soft tissue chin thickness was the only parameter in our sample that was out of Holdaway norm. This variable in this study was 13.08(±1.56) while the maximum scale of Holdaway is 12. The findings of Amjad AL Taki et al4 confirm our result. In his study Persian people had greater soft tissue chin thickness than Holdaway norm. Iraqi17 and Turkish15 people and Japanese female22 also showed increased thickness of

chin soft tissue than norms. Increasing in this variable may compensate the retrusive chin to reach harmony.

Comparing soft tissue profile between Iranian boys and girls revealed that Iranian boys have greater upper lip thickness and soft tissue chin thickness. Our results were similar to findings obtained from Amjad AL Taki et al4 who showed both values were increased in men in relation to women. In the other study that was done by Ahangar Atashi et al23 also Iranian men had greater soft tissue chin thickness than women. These two studies also showed that nose prominence in men was higher than women, however we did not find any significant difference between two sex for this variable. Our findings were also in agree with some other study that had done to compare soft tissue profile between men and women. Basciftci et al15 showed that Turkish men have greater upper lip thickness and soft tissue chin thickness than women. The same results were also observed in Iraqi men17.

The result of these studies showed that every population and even every sex may have different values when analyzing soft tissue and we have to consider them in our orthodontic treatment plan.

Conclusions

-Iranian soft tissue profile showed differences in some variables when comparing to Holdaway ideal value including upper lip sulcus depth, soft-tissue subnasal to H-line, inferior sulcus to H line, skeletal profile convexity and H angle, but all of them were in the normal range.

-the soft tissue chin thickness in Iranian people were significantly greater than Holdaway ideal value and it was the only parameter that did not place even in normal range of Holdaway.

-Iranian boys had thicker upper lip and greater soft tissue chin thickness in relation to girls.

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