ORIGINAL ARTICLE

Changes of the Soft Tissue Profile During Growth (8-18 years old)

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Background and aim: Today, consideration of soft tissue, esthetic and appropriate facial harmony in patients have been regarded as the base for orthodontic treatments. Therefore, awareness of soft tissue profile changes during growth is essential for orthodontists. The purpose of this study is to determine the changes of soft tissue profile during growth in both sexes.

Materials and method: In this descriptive-analytical cross-sectional study, lateral cephalometric images of 60 individuals (30 boys and 30 girls) between 8 and 18 years old were studied. Cephalometric analysis was done and Independent T and Pearson Correlation tests were used for data analysis.

Results : Findings in the present study indicated that nose height, nose depth, lips height, upper lip thickness and soft tissue chin thickness increased significantly in the both sexes with increasing age. Increasing lip thickness in point Ls and lower lip thickness in point Li were only significant in boys group, whereas angle of soft tissue facial convexity excluding the nose and lower lip thickness had no significant increase in the both sexes. Angle of soft tissue facial convexity including the nose reduced significantly in both sexes with increasing age.

Conclusion : Different measures change variously in males and females between 8 to 18 years old and being aware of these changes will help orthodontist in getting the best decision in preadolescent and adolescent treatment planning.

Keywords: Growth changes, Soft tissue profile, Lateral cephalometry.

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Introduction

Orthodontic diagnosis and treatment planning are in a period of remarkable change, away from a previous focus on dental occlusion and hard tissue relationships and toward a greater emphasis on soft tissue adaptation and proportions. The transition now is toward what is called the soft tissue paradigm, in which the primary goal of treatment is to obtain the best possible adaptation and proportions of the soft tissues of the face and mouth. (1)
We can say that facial harmony and maximum functional occlusion are the two most important goals of orthodontic treatment. To achieve these goals, it is necessary to have information about normal craniofacial growth and effects of orthodontic treatment on the soft tissue profile.(2)
Facial harmony is the result of soft and hard tissue interaction, so that understanding the relationship of these tissues has an important role in treatment planning.(3)
Soft tissue profile changes during growth and orthodontic treatment and these changes are greater and longer than changes in facial skeleton. (4) Also investigations show that relationship between soft and hard tissue changes is not linear and may be the reason of these variations is in facial soft tissue thickness. Therefore, awareness from soft tissue profile changes during growth is essential for the orthodontists due to its effect on treatment planning.(2,5)
Because of all these reasons, facial features were investigated in profile and frontal views and the simplest method for this evaluation is profile's survey. Using lateral cephalograms is one of the most usual methods for these evaluations.In this study, soft tisuue changes during growth (8 to 18 years of age) in both males and females and in Iranian population were assessed.

Material and Methods

In this descriptive -analytical study , the samples consisted of 60 individuals (30 boys and 30 girls) who had Dento-skeletal Cl I relationship with normal overbite (maximum 3mm) and overjet(maximum 2mm) and there was no facial deformity, cross bite, history of orthodontic treatment, orthognatic and plastic surgery in none of these individuals. All the subjects were between 8 to 18 years old.

The variants of this study were consisted of:

Nose height (N'-Sn), Nose depth (Pn –a perpendicular line from N' to FH) , upper lip height (Sn-Sts) , lower lip height (B'-Sti) , upper lip thickness (A-A') , upper lip thickness in Ls point , lower lip thickness (G'- Pn-Pog') , lower lip thickness in Li point , chin soft tissue thickness (Pog-Pog'), facial soft tissue convexity excluding the nose (G'-A'-Pog') , soft tissue convexity including the nose (Ǵ - Pn-Poǵ)

All the cephalograms were taken in a standard method using with a distinct machine. In all the graphs lips were in rest position and also teeth were in occlusion. Cephalograms were traced and landmarks were localized (fig. 1) After tracing (needed distances and angles), measurements were performed by two expert clinician and data analysis were done.

In order to further evaluation, the mean cephalometric variables studied in boys between the age group of 8-14 and 15-18years old were compared. This comparison was done between 8-12 and 13-18 years old for girls' group.

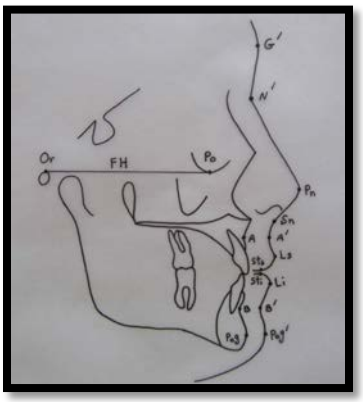

fig 1. Cephalometric landmarks

Results

The statistical analysis of independent T-test and Pearson correlation were used. The comparative results obtained in the two sexes are shown in the following tables.

Finally after tables' review the following results were obtained:

In the present study, nose height, lips height, upper lip thickness (A-A') and soft tissue chin thickness increased significantly in both sexes from 8 to 18 years. Increasing the upper lip thickness in point Ls and lower lip thickness in point Li, were only significant in the boys. Angle of soft tissue facial convexity including the nose reduced significantly in both sexes. Angle of soft tissue facial convexity excluding the nose and lower lip thickness (B-B') did not indicate significant increase in both sexes. In comparison the rate of changes between the two sexes, the nose depth and lower lip thickness in point Li, more increased in the boys, whereas lips height indicated more increase in the girls. The other variables did not indicate any significant sexual difference. In comparison of the average variables between the two sexes, upper lip height, upper lip thickness in point Ls, lower lip thickness in point Li and (B-B') as well as soft tissue chin thickness was significantly more in boys compared to girls, whereas lower lip height was more in girls compared to boys. The other variables indicated no significant difference. Generally, the whole variables had direct relation with age increase, except angle of soft tissue facial convexity including the nose that had reversed relation and angle of soft tissue facial convexity excluding the nose that indicated no significant relation. Angle of soft tissue facial convexity including the nose had direct relation with angle of soft tissue facial convexity excluding the nose and reverse relation with the nose depth. There is reverse relation between angle of soft tissue facial convexity excluding the nose and upper lip thickness (A-A').In comparison of the boys together

in the age groups of 8-14 and 15- 18 years, the average of all the variables in the 15- 18 years group was significantly more, except angle of soft tissue facial convexity including the nose which was more in 8-14 years group. Angle of soft tissue facial convexity excluding the nose and soft tissue chin thickness did not indicate any significant difference between the two age groups. In comparison of the girls together in the age groups of 8-12 and 13- 18 years, the average of all the variables in the 13-18 years group was significantly more, except angle of soft tissue facial convexity including the nose which was more in 8-12 years group. Angle of soft tissue facial convexity excluding the nose, upper lip thickness in point Ls , and lower lip thickness in point Li and (B-B') as well as soft tissue chin thickness did not indicate any significant difference between the two age groups.(table 1, 2)

Mean changes from 8 to 18 years old		
variant	boys	girls
Nose height (mm)	+4.7 * P-Value = 0.01	+ 5.7 *P-Value < 0.001
Nose depth (mm)	+ 8.07 * P-Value < 0.001	+ 3.59 *P-Value = 0.001
Upper lip height (mm)	+ 1.24 * P-Value = 0.001	+ 2.94 *P-Value = 0.003
Lower lip height (mm)	+2.5 * P-Value <0.001	+ 4.44 *P-Value <0.001
Upper lip thickness(A-Á) (mm)	+ 2.94 * P-Value < 0.001	+ 3.02 *P-Value = 0.001
Upper lip thickness in Ls point (mm)	+ 2.55 * P-Value = 0.004	+ 1.5 P-Value = 0.22
Lower lip (B-Ƀ) thichness (mm)	+ 0.62 P-Value = 0.11	+ 0.89 P-Value = 0.06
Lower lip thickness in Li point (mm)	+ 1.5 * P-Value = 0.02	+ 0.3 P-Value = 0.22
Chin soft tissue thickness (mm)	+ 1.5 * P-Value = 0.049	+ 1.65 *P-Value = 0.048
facial soft tissue convexity with considering nose (degree)	- 10 * P-Value < 0.001	- 7 *P-Value = 0.03
facial soft tissue convexity without considering nose (degree)	+ 5 P-Value = 0.08	+ 7.5 P-Value = 0.056

*P-value < 0.05 = significant differences

Table 1. Mean cephalometric changes in both sexes from 8 to 18 years old

Mean changes from 8 to 18 years			
variants	boys	girls	P-value
Nose height (mm)	+ 4.7	+ 5.7	0/13
Nose depth (mm)	+ 8.07	+ 3.59	* < 0.001
Upper lip height (mm)	+ 1.24	+ 2.94	* 0.001
Lower lip height (mm)	+ 2.5	+ 4.44	* 0.01
Upper lip thickness (A- Á’) (mm)	+ 2.94	+ 3.02	0.4
Upper lip thickness in Ls point (mm)	+ 2.55	+ 1.5	0.26
Upper lip thickness (B-B’) (mm)	+ 0.62	+ 0.89	0.53
Upper lip thickness in Li point (mm)	+ 1.5	+ 0.3	* 0.03
Chin soft tissue thickness (mm)	+ 1.5	+ 1.65	0.62
facial soft tissue convexity excluding the nose (degree)	- 10	- 7	0.12
facial soft tissue convexity including the nose (degree)	+ 5	+7.5	0.19

*P-value < 0.05 = significant differences
Table 2.comparison of mean cephalometric changes between sexes from 8 to 18 years old

Discussion

Each of the variables of study is discussed separately:

Nose height: study results showed that the nose height increased between 8 to 18 years in both sexes significantly. In coordination with the findings of this study, Bishara (5), Meny (6), Nanda (7),Genecov (8) and Jahanbin (9) showed that nasal height increases with increasing age.

In comparison between the sexes no significant difference was found, but contrary to this finding, Genecov and colleagues (8) in their study concluded that midface soft tissue in the age of 17 is 3-4 mm longer in men than women. Maybe this difference is because of racial differences.

In this study nose height in 15 years old girls approximates nose size in adults and nose growth continued up to 18 years old in both sexes that were similar to Nanda (7) and Meny (6) findings. Pearson correlation test showed that there is a direct correlation between nose height and age.

Nose depth: Present study showed that between 8 and 18 years age nose depth significantly increases in both sexes. Independent T test showed insignificant difference between males and females that confirms Skinazi findings (10).In this study an increase of 8.07 mm was observed in boys' nose depth that shows significant changes compared to the rest facial soft tissue.

Genecov and colleagues (8) expressed that males tend to grow beyond a few years more women. So we expect a larger nose size at age 18 in men than women (11,12) which is consistent with our findings that shows increasing the depth of the nose more in boys than girls. In Menys' study (6)nose depth in 16 years old girls was near to adult size but nose growth in boys continued up to age 18 that is consistent with our findings.

Upper lip height: the results showed that the upper lip height significantly increases from 8 to 18 years of age in both sexes and average height of the upper lip is significantly higher in boys than girls. In coordination with this study,Subtelny and Mamandras stated that upper lip height in both sexes increased from 8 to 18 years and the average for men were more than women.(13,14)

Upper lip height shows little changes in both sexes from 15 to 18 years .The findings confirms Nanda and colleagues (7) stated that upper lip height growth virtually stops at around age 15.

Subtelny found that after full eruption of incisors, upper lip height increases in order to establish a relationship with a stable vertical incisor incisal edge (13) .As regards to little changes in upper lip height up to 18 years age, this finding is important in the treatment of gummy smile because treatment (due to provide a dental - labial favorable relationship) in these people can start earlier (7).

lower lip height: The results showed that the lower lip height in both sexes significantly increases from 8 to 18 years of age and the average was significantly higher in the group of girls than boys. In harmony with the findings of this study, Mamandras (14), and Nanda (7) stated that the lower lip height increased with age in both sexes but unlike the present study, the rate of increase was announced more in men than women.

Nanda also showed that the highest increase happenes in age from 10 to 11 for males and 11 to 13 for females (7)

Finally, Sabtelny concluded that after full eruption of the central incisors in order to establish a stable vertical relationship, lower lip height will increase.(13)

Upper lip thichness: The results showed that the thickness of the upper lip (A-Á) from 8 to 18 years in both sexes significantly increases and there is no significant difference between males

and females that confirms Wisth's findings (15) but is in contrast to Mamandras (14) , Nanda (7) and Nouri (16) findings. They claimed that average thickness of the upper lip was higher in boys than girls.

Nanda and colleague stated that increase in upper lip thickness between 7 to 18 years of age was 7.4 mm in males and 5.3mm in females and they reported that lip thickness is more in males so that men show more protrusion tolerance than women.(7)

In the current investigation, the greatest difference between the sexes was achieved in 15 years and the thickness was higher in boys than girls. This finding is consistent with the findings of Nanda et al.(7)

Mamandras stated that with increasing age, increasing the thickness of the upper lip in women is expected less than men, so in cases that women's upper lips tend to be retrusive, therapies, including extractions and retraction of the incisors should be done with caution. (14)

Upper lip thickness in Ls point: Our results showed that thickness of the upper lip increases at Ls from 8 to 18 years in both sexes, but the increase is only significant in boys.

Genecov and colleagues (8) stated that women at 7, have thinner lips than men and they show equal amount of lip thickness up to the age 12. At 17 years lip thickness in women is at least 2 mm less than men. So it can be concluded that such an increase does not occur in women between 12 to 17 years old. These findings is in harmony with subtelny findings (13)

In the Present study lip thickness at age 18 in girls were 2mm less than boys so retraction of incisors should do with caution in women of 12 years old because growth in the future is not enough to compensate the problems.

Lower lip thickness: The results showed that the thickness of the lower lip (B - B) from 8 to 18 years in both sexes increase and average thickness of the lower lip was significantly higher in boys than girls.

In Nanda and colleagues study, this index was increased 8.2 mm in men and 6.1 mm in women from 7 to 18 years. This difference was significant after 14 years of age and men had thicker lips than women. In females, at age 14, lower lip growth was almost stopped while in males it continued up to age 18. (7)

Lip thickness at Li point: The results showed that the thickness of the lower lip at the Li point increases in both sexes from 8 to 18 years of age but it is significant just in boys.

Nanda and colleagues (7) claimed that maximum thickness of the lower lip at the Li point is announced in women age 13 and in men at 18 years. In harmony with their findings, the results of this study show that the maximum amount of lower lip thickness can be seen in 14 year old women and 18 years old men. Nanda and colleagues (7) also reported mean lower lip thickness

increase of 2.4mm in boys and 1.4 mm in girls from 7 to 18 years and accordant with the present findings they concluded that changes in the thickness of the lower lip is low at Li point in females and women's have thinner lips.

Chin soft tissue thickness: The results showed that soft tissue chin thickness in both sexes significantly increases between 8 to 18 years and the average of this index was significantly higher in boys than girls.

Wisth, concluded that changes in soft and hard chin tissues is approximately equal and changes in soft tissue chin thickness is equal to the Nasion so the soft tissue chin thickness changes can not be responsible for changing the convexity of soft tissue (15). In confirmation of his opinion, Nanda and colleagues (7) and Subtlny (13) stated that growth in anterior region of the chin is more affected by bone remodeling. In present study the correlation between this index and the thickness of soft tissue facial convexity angle was not obtained.

Facial soft tissue convexity including the nose: The results of current study showed that soft tissue facial convexity angle including the nose, significantly reduced from 8 to 18 years in both sexes. This finding indicates increase in convexity of soft tissue. There was no significant difference between boys and girls.

Bishara et al showed that convexity angle with the nose (Poǵ - Pn - GĹ) between the ages of 5 to 25 years decreases on average, 7.9 ° in males and 8.2 ° in women. The most reduction happened between 5 to 10 and 10 to 15 years of age. They concluded that significant differences in soft tissue profile in women (10 to 15 years old) occur sooner than men (15 to 25 years old). They also claimed that the magnitude and direction of changes are similar in both sexes and in harmony with our study , they did not find significant differences between males and females.(3)

Facial soft tissue excluding the nose: The results showed that the average of this increases between 8 to 18 years in both sexes and due to the lack of a significant increase it can be concluded that the relative stability of this angle tends to increase with age. T test comparing the average index showed no significant difference between the sexes.

In coordination with this study Bishara and colleagues reported that convexity of the face excluding nose shows little changes between 5 to 45 years of age.(5,11,12). Unlike the present findings, Nouri (16), reported that boys faces are more convex than girls, the difference can be because of differences in age range and angle measurements (Poǵ-Sn - Ń).

Conclusion:

Findings in the present study indicated that nose height, nose depth, lips height, upper lip thickness (A-A') and soft tissue chin thickness increased significantly in the both sexes with increasing age. Increasing lip thickness in point Ls and lower lip thickness in point Li were only significant in boys group, whereas angle of soft tissue facial convexity excluding the nose and lower lip thickness (B-B') had no significant increase in the both sexes. Angle of soft tissue facial convexity including the nose reduced significantly in both sexes with increasing age.

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