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Research Article

Comparison of Chin Soft Tissue Thickness in Adult Patients with Various Mandibular Divergence Patterns Using Lateral Cephalograms

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ABSTRACT

Introduction: The profile view of the soft tissue can be used to determine the treatments to maintain or enhance the beauty. Accordingly, evaluation of the soft tissue in this view in patients u8ndergoing orthodontic treatment or orthogenetic surgery may perform very important role in the diagnosis and ideal treatment plan. The purpose of this study is to evaluate and compare the thickness of the chin soft tissue in patients with the age 18-32 years old with different vertical skeletal patterns using lateral cephalometric images.

Materials and methods: This is a cross-sectional study using lateral cephalometric radiographs of 67 women and 43 men, 18-32 years old (average 23.52 ± 4.1 years) with normal anteroposterior skeletal relationship in three groups of hyperdivergent (n=36, MP angle ≥ 28°),normodivergent (n=34, 17° ≤ MP angle ≤ 28°) and hypodivergent (n=40, MP angle ≤ 17°). The soft tissue thickness was measured at three points of Gnation, Menton and Pogonion and the data was analyzed using analysis of variance (ANOVA), bonferoni post-hoc and Pearson correlation coefficients in a variety of face form.

Results: The correlations in distance of Pog - Pog' (P = 0.744), Gn - Gn' (P = 0.358) and Men- Men' (P = 0.680) in terms of increasing age number were not statistically significant. However, based on the results of the average thickness of the chin soft tissue in both groups of men and women in all three points the significant difference was observed ($p < 0.0001$).

Conclusion: Based on the outcome of this study for the age group of 18 to 32 years there is no relationship between age and changes in the chin soft tissue. The chin soft tissue thickness at three points has been more in men than women and the most obvious difference in the thickness of the chin soft tissue of men and women were observed in normodivergent face. The thickness of the chin soft tissue at all three points of measurements was more in people with hypodivergent face compared to people with hyperdivergent face.

Keywords:chin , vertical dimension , cephalometry , adult

[I] INTRODUCTION:

Today, beauty is one of the main reasons for patients referring to dental treatment. Regarding orthodontics, this change has been created on the impact of the soft tissue of the mouth on facial beauty (1). It has been shown that facial beauty is strongly influenced by the natural properties of the

soft tissue (2). Holdaway in his study emphasized on the importance of the psychological and social aspects to reach the best condition of facial harmony and balance in patients (3). Whereas this coordination, in addition to the facial skeleton depends on the overlying soft tissue as well. (1) The shape and the form of the soft tissue conforms the underlying hard tissue, but studies have shown that soft tissue can also have an independent growth potential and participates in appropriateness or inappropriateness for the face and even covers the defects of the hard tissue (4-6). As a result, to create the face beauty and harmony and an ideal occlusion in the treatment plan, soft tissue must be considered in addition to the hard tissue (7). Since the profile view of the soft tissue can be used for treatment plans for maintenance or raising facial beauty (2), the evaluation of the soft tissue in this view in patients undergoing orthodontic treatment or orthognathic surgery plays a very important role in the diagnosis and treatment plan.The most important variables which are considered in an ideal profile are the bulge in the chin; chin fat tissue thickness and also shape, position and thickness of the chin soft tissue which can be effective on the changes during surgical interventions of the underlying bone (6). Changes in the soft tissue and what we see in facial appearance can be separated from the underlying bone structure (5) and this can lighten up the degree of the orthodontic treatment and orthognathic and beauty surgery.Recently, based on the information from the facial soft tissues collected from several centers, they have been found that age, gender, race and BMI are effective factors in facial profile (8-14). Majority of the studies have focused on the analysis of the soft tissue thickness in the skeletal malocclusion in anteroposterior view (1), while the form and the shape of the head is not only influenced by the growth pattern of the anteroposterior view, but also by the vertical dimension (4). Several orthodontic treatments and orthognathic surgeries are applied on the patients with vertical malocclusion, thus having knowledge about the relation between the soft tissue and different facial patterns will guide and help the dentist for suitable treatment plan suggestion and prediction of treatment results stability. A limited number of studies have investigated the facial soft tissue in a variety of different faces with vertical dimensions, while knowing the relation between the skeletal form of the head in the vertical dimension and the thickness of the soft tissue can help to achieve an ideal profile after orthodontic treatment. MevultCelkoglu et al, studied the gender effect and variety of the face in the vertical dimension on the chin soft tissue thickness (15). WagarJealani et al, showed that gender does not affect the thickness of the soft tissue.They attributed this to age and body mass index (BMI). (16). Macari and his colleagues did not observe any different thickness of the chin soft tissue in men's face in the vertical dimension (5). According to the discrepancies in previous studies outcomes regarding gender (5, 16), the impact of race (15) and age (4) on the thickness of the chin soft tissue, present study was designed to examine and compare the relation between the thickness of the chin soft tissue and vertical morphology of the face and the impact of age and gender on the thickness of the chin soft tissue.

[II] MATERIALS AND METHODS

Sample collection

This research is a descriptive study which was performed using the 110 radiographs available on the stored files on the computer. X-ray images were prepared with the standard method and the natural head position with the lips at rest with no stretch. The images with good quality and resolution in the chin area were evaluated. The samples included patients images before orthodontic treatment and orthognathic surgery with normal anteroposterior skeletal relation between two genders (67 female - 43 male) with a mean age of 52/23 ± 4.1 (18-32 years old).

Reliability And Validity

The interreliability of 10 samples was examined by the orthodontist with a history of more than 5 years experience. The validity of the points,

measurements and the angles were close to 100% (99/2%). To consider the intrareliability, at first the thickness of the chin soft tissue was measured in 10 radiographs with 3 repeats by measuring the chin soft tissue at 3 points (Men', Pog', Gn'). Detection of different faces in the vertical dimension was conducted before the original study. The reliability of the IntraClass Correlation (ICC) for the distances between points PogPog', Men Men' and GnGn' were obtained 0.751, 0.993 and 0.999, respectively. The reliability of the gauge at three points was valid.

Analysis method

To determine the relation of skeletal CLI, measuring ANB angle was assessed by the normal range (1<ANB<5). This angle was measured by conveyor engineering piersez (18# PudongBuilding, Three-seven village, yuyaocunty, ningbo city, Zhejiang province sure). Different types of the face in vertical dimension were obtained by measuring the angle of the mandible (MP angle) by engineering conveyor:

Short face; hypodivergent: Defined as the face with MP angle less than 17°.
(FIGURE 1)

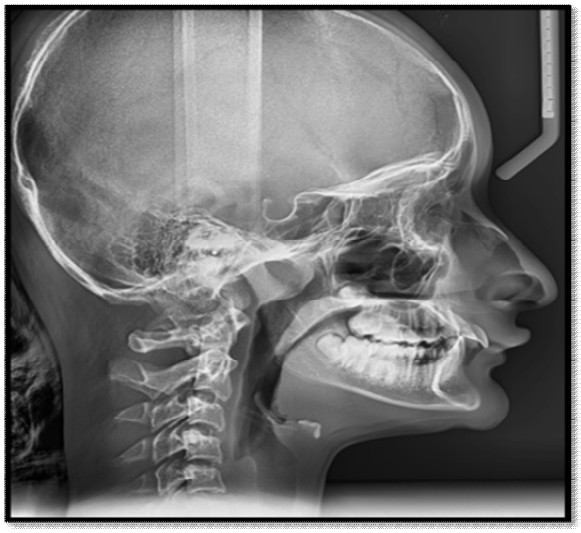

Figure1: Hypodivergent Face

Normal face, Normodivergent: Defined as the face with MP angle between 17° and 28°.(FIGURE 2)

Figure2: Normodivergent Face

Long face; hyperdivergent: Defined as to the face with MP angle greater than 28°.(FIGURE 3)

Figure3: Hyperdivergent Face

Then the distances of skeletal Pog, Gn, Men were measured from the corresponding points on the soft tissue Pog', Gn', Men' using a caliper with an accuracy of 0.01th of a millimeter.

STATISTICAL ANALYSIS

All data wer analyzed using SPSS software version 21. To compare the differences at three points (Men, Gn, Pog) in the chin soft tissue in terms of different shapes in the vertical dimension analysis of variance (one-way ANOVA) and in pairwise comparison, bonferoni post-hoc test were used. ANOVA was used to compare the thickness of the chin soft tissue at the points Pog, Gn, Men in separate forms of the face. To investigate the correlation between the age and the thickness of the chin soft tissue at the points Pog, Gn, Men, Pearson correlation coefficient was applied. [Distances pog - pog', Gn - Gn', Men- Men' according to KS test (Kolmogorov Smearnov test)

followed normal distribution]. The significance level was set at p≤% 0.05.

[III] RESULTS

In general, the greatest difference in the thickness of the soft tissue was observed in normal face and then long face (Table 1).

Table 1:(evaluation of correlation between chin soft tissue thickness and age)

face type	age		Pog-Pog'	Gn-Gn'	Men-Men'
hypodivergent	age	Relative	-.181	-.018	.276
		P*	.305	.918	.114
		N	34	34	34
normodivergent	age	Relative	.143	.250	.254
		P*	.380	.119	.114
		N	40	40	40
hyperdivergent	age	Relative	-.016	-.294	-.249
		P*	.928	.082	.144
		N	36	36	36

* Pearson Correlation

The diffrences in soft tissue thickness at Pog, Gn and Men between short face and long face were obtained as 2.4 ± 0.47, 4.1 ± 0.4 and 3.3 ± 0.35, respectively (Table 2).

Table 2:(comparison of soft tissue thickness at the Pog,Gn,Men in varius divergence pattern faces)

Gender	Distance	(I) face type	(J) face type	Mean Difference (I-J) ±SD	P*
Women	Pog-Pog'	hypodivergent	normodivergent	1.64±0.54	0.010
			hyperdivergent	1.98±0.54	0.002
		normodivergent	hyperdivergent	0.33±0.50	1.000**
	Gn-Gn'	hypodivergent	normodivergent	1.29±0.40	0.006
			hyperdivergent	4.34±0.41	0.0001
		normodivergent	hyperdivergent	3.05±0.37	0.0001
	Men-Men'	hypodivergent	normodivergent	0.32±0.42	1.000
			hyperdivergent	3.53±0.42	0.0001
		normodivergent	hyperdivergent	3.21±0.38	0.0001
Men	Pog-Pog'	hypodivergent	normodivergent	1.09±0.75	0.459
			hyperdivergent	2.61±0.80	0.007
		normodivergent	hyperdivergent	1.51±0.81	0.207
	Gn-Gn'	hypodivergent	normodivergent	0.27±0.65	1.000
			hyperdivergent	3.40±0.69	0.0001
		normodivergent	hyperdivergent	3.67±0.70	0.0001
	Men-Men'	hypodivergent	normodivergent	0.06±0.50	1.000
			hyperdivergent	2.52±0.54	0.0001
		normodivergent	hyperdivergent	2.46±0.54	0.0001

*Bonferroni

** p≥0.05 Not significant difference

Comparison of the average thickness of the chin soft tissue at Pog-Pog' distance based on the gender showed statistically significant differences among three facial forms in women (P=0.001) and men (P=0.009). Also, comparison of the average thickness of the chin soft tissue at Gn-Gn' distance based on the gender indicated that at this distance statistically significant differences were observed in women

(P≤0.0001) and men (P≤0.0001). Finally, comparison of the average thickness of the chin soft tissue at Men-Men' distance was statistically significant in men and women (P≤0.0001) (Table 3).

Table 3: (Mean Measurements of Soft Tissue at the Chin in Groups Stratified on MP/SN and Gender)Group

	Hypodivergentnormpdivergent		hyper divergent			P*
	N	Mean±SD	N	Mean±SD	N	Mean±SD
Men						
Pog-Pog'	16	13.09±2.18	15	12.00±2.41	12	10.49±1.41	0.009
Gn-Gn'	16	9.74±1.91	15	10.01±2.05	12	6.34±1.19	0.0001
Men-Men'	16	7.66±1.54	15	7.60±1.39	12	5.14±1.18	0.0001
Women						
Pog-Pog'	18	11.83±2.05	25	10.18±1.29	24	9.85±1.88	0.001
Gn-Gn'	18	9.19±1.37	25	7.90±1.38	24	4.85±1.18	0.0001
Men-Men'	18	6.89±1.40	25	6.57±1.50	24	3.36±1.09	0.0001

*ANOVA

[IV] DISCUSSION

The effect of age on the thickness of the chin soft tissue

In our study which was conducted on people aged 18 to 32 years old, the thickness of the chin soft tissue did not change with increasing the age. Robert Bergman et al, examined the effect of age on the thickness of the soft tissue in their study too. They concluded that with increasing the age from 6 to 18 years the thickness of the soft tissue is increased (2). The cause of this difference can be explained this way that people in this age group are matured while the most significant changes in the thickness of the soft tissue occur until puberty. Since the orthognathic surgeries are mostly performed in this age range, according to our study the stable results are predicted following the treatment.

The impact of gender on the thickness of the chin soft tissue

In this study, generally, significant difference was observed between men and women soft tissue thickness so that it was more in men than women. As we know, the soft tissue is formed of the skin, muscle and fat and because of testosterone in men facilitating the production of skin collagen; skin thickness is more in men than women. On the other hand, skeleton and muscle growth in all aspects of the body is greater in men than in women, thus the face soft tissue is no exception and it is the reason for the increase of the soft tissue thickness in men.In the studies by GhulamRasool et al, (6) Robert Bergman et al, (2), Macari et al, (5), MevlutCelkoglu et al (15) and Roberto Rongo et al (4), the gender effect on the soft tissue thickness was proved so that soft tissue thickness in men was more than women. But WagarJealani and colleagues did not show significant effect of gender on the soft tissue thickness. They proposed it might be related to the other variables such as age and BMI (16).

The relation of the chin soft tissue thickness in a variety of facial vertical dimension

In this study, there was a relationship between the soft tissue and the facial pattern so that we found the maximum thickness of soft tissue in patients with short face and the minimum thickness in people with long face.There is a negative association between soft tissue thickness and facial skeleton compliance in orthognaticsurgery.Thatis,the less the thickness of soft tissue is the more its compliance with facial skeleton in orthognatic will be. As a result, one of the most common cosmetic surgeries in patients with long face is shifting chin upward and forward,we can expect more predictable results. In studies conducted by GhulamRasool et al (6), WagarJealani et al (16), Macari et al (5) and MevlutCelkoglu et al (15), the thickness of the facial soft tissue was dependent to the height changes on the vertical dimension, while in the study of Feres et al (10) no significant difference

was found between people with different vertical patterns and thickness of the chin soft tissue.

In our study, the chin soft tissue thickness showed significant difference among all three points between short and long faces and between long and normal face. WagarJealani et al showed that the difference in the chin soft tissue thickness was significant only between long and short faces so that the thickness of the soft tissue in short face people was more than people with normal face (16) while Celkoglu et al study showed that this thickness difference was significant only between normal and long faces (15). While in previous studies no significant difference was observed among short and normal faces. In our study this difference was significant in women at the points Pog and Gn, so that people with normal form of the face had less thickness in the soft tissue than those with short form of the face.

In this study, the most difference in the soft tissue thickness was found at Gn point and this difference was less at Men point than Gn. In studies by GhulamRasool and colleagues (6) and Macari et al (5) the biggest difference was observed in the soft tissue thickness at Gn point and this difference was less at Men point followed by Gn point. It was in agreement with our study outcome.

The reason was mentioned as thinner thickness at the point of Menton. With increasing the facial height and divergence, the muscles are stretched to be consistent with the underlying skeleton and for the less thickness of the soft tissue and thus muscles we have less tension and the fewest changes at this point While at Pog point no significant difference was found between various facial forms. The cause of this occurrence was reported as the soft tissue adaptation to hard tissue, due to the different tractions at this point between soft and hard tissue.. In our study, at the Pog point despite the low level of the soft tissue thickness difference between long and short faces at this point compared to the rest of the points, this difference was statistically significant and it means that this adaptation has not taken place in our society which reflects the impact of genetics and ethnicity in inconsistency between studies.

[V] CONCLUSION

According to the results obtained from the data we can conclude:

- There is no correlation between the age ranged from 32-18 year old and the thickness of soft tissue.
- The gender affects on the thickness of the chin soft tissue so that the chin soft tissue thickness is more in men than women.
- People with a variety of facial patterns in the vertical dimension have different thickness of the chin soft tissue and these two factors are related.
- The chin soft tissue thickness is different between short and long faces so that people with short face have thicker soft tissue compared to people with long face.
- In our society, the biggest difference in the soft tissue thickness was observed between men and women with normal face. The difference in the soft tissue thickness is among the three groups at all three points and the maximum difference in thickness was detected at Gn point and the minimum thickness difference was seen at Pog point

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