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Evaluation of the Lips' Positions in Adolescent Class I Individuals According to Gender

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ABSTRACT:

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Objective: Facial soft tissues and lip thickness are influenced by age, gender, race, juvenescence and growth. This aspect is particularly of interest to forensic anthropologists, dentists, and cosmetic surgeons. Plump and beautiful lips that are in harmony with other facial features are the most important esthetic symbols in enhancing the visuality of a woman. Actually, eyes constitute the most important focal point in the upper half of the face, whereas lips are the focal point in the lower half of the face. In this study, we aimed to evaluate the position of the upper and lower lips of a group in Turkish society by gender and to compare the findings with those of people of other races.

Materials and Methods: A total of 140 (68 women and 72 men) healthy individuals with Class I malocclusion (ANB angle 2°±2) participated in this study. The mean age of women and men was 23.2±4.2 years and 24.3±3.4 years, respectively. The distance between the three different points marked on soft tissue on lateral cephalometric radiograph images and the Ricketts' E line were measured using Image-J software. Different statistical methods were utilized for the comparison of the distribution of the groups and measurement results. An associated p value of <0.05 was considered statistically significant.

Results: The distance of Ls (Labium superius)-E, Sto (Stomion)-E, and Li (Labium inferius)-E in women ranged between -3.21 mm and -16.08 mm, between 10.71 mm and -24.21 mm, and between -2.88 mm and -14.83 mm, respectively. The corresponding measurements in men were between -4.84 mm and -17.21 mm, between -13.21 mm and -23.43 mm, and between -3.21 mm and -11.12 mm, respectively. A statistically significant difference between men and women was observed only for the Li-E values (p=0.041).

Conclusion: Knowing the position of the lips, which constitute the focal point of the lower half of the face, will help orthodontists to predict the facial profile of patients at the end of the treatment. It may also aid forensic anthropologists in facial reconstruction and help cosmetic surgeons in predicting the lower face harmony after esthetic surgery.

Keywords: Cephalometry, position of the lips, Rickett's E line

ÖZET:

Dudak pozisyonlarının adolesan sınıf I bireylerde cinsiyete bağlı değerlendirilmesi

Amaç: Yüz yumuşak doku ve dudak kalınlıkları, yaş, cinsiyet, ırk, büyüme ve gelişmeye bağlı olarak değişim göstermektedir. Bu konu adli antropologlar, diş hekimleri ve estetik cerrahlar açısından oldukça önemlidir. Yüz harmonisi ile uyumlu dolgun ve güzel dudaklar özellikle kadınların görselliklerinde en önemli estetik simge oluşturmaktadır. Gerçekten de yüze bakıldığında üst yarıda gözler, alt yarıda ise dudaklar odak noktasını oluşturmaktadır. Bu çalışmada amacımız, Türk toplumunun bir bölümünde üst ve alt dudak pozisyonunu cinsiyete bağlı olarak değerlendirmek ve sonuçları diğer ırklara ait insanların yapısal özellikleri ile karşılaştırmaktır.

Gereç ve Yöntem: Bu çalışma Sınıf I maloklüzyon yapısında (ANB açısı 2°±2) 140 sağlıklı (68 kız ve 72 erkek) birey üzerinde gerçekleştirilmiştir. Kızların yaş ortalaması 23.23±4.27 yıl, erkeklerin 24.35±3.45 idi. Lateral sefalometrik X-ray görüntülerde yumuşak doku üzerinde belirlenen üç farklı noktanın Ricketts'ın E doğrusuna olan uzaklıkları bilgisayar ortamında Image-J Software yöntemi kullanılarak ölçülmüştür. Grupların dağılımları ve ölçüm sonucu karşılaştırması için farklı istatistiksel yöntemler kullanılarak, p<0.05 önem düzeyi istatistiksel olarak anlamlı kabul edilmiştir.

Bulgular: Tüm sefalometrik görüntülerde Ls (Labium superius)-E, Sto (Stomion)-E ve Li (Labium inferius)-E mesafeleri ölçülmüştür. Kızlarda yapılan ölçümlerde; Ls-E, -3.21 mm ile -16.08 mm arasında, Sto-E; -10.71 mm ile -24.21 mm, Li-E; -2.88 mm ile -14.83 mm arasında değişim göstermekteydi. Erkeklerde ise; Ls-E, -4.84 mm ile -17.21 mm arasında, Sto-E; -13.21 mm ile -23.43 mm, Li-E; -3.21 mm ile -11.12 mm en büyük ve en küçük değerler olarak belirlenmiştir. Cinsiyetler arasında Li-E değerleri açısından istatistiksel olarak anlamlı fark olduğu (p=0.041) diğer ölçümler arasında ise, istatistiksel açıdan anlamlı bir fark olmadığı gözlenmiştir.

Sonuç: Yüzün alt yarısında odak noktası olan dudak pozisyonun bilinmesinin; ortodontistlere tedavi sonunda hastaların yüz profilinin nasıl bir hal alabileceğinin değerlendirilmesinde, adli antropolojide yeniden yüzlendirme tekniğinde ve estetik cerrahisinde alt yüz uyumunun değerlendirmesinde yardımcı olacağını düşünmekteyiz.

Anahtar kelimeler: Sefalometri, dudak pozisyonu, Ricketts E çizgisi

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INTRODUCTION

A compatable facial aesthetics and optimal functional loss are considered as the most important goals of long orthodontic treatment, and aesthetic and reconstructive surgery (1,2). Lips, located in the lower half of the face, are the elements of great importance for people to look attractive and beautiful. Facial soft tissues and lip thickness are influenced by age, gender, race, juvenescence and growth, and this aspect is particularly of interest to dentists, forensic anthropologists and aesthetic surgeons (3,4). Careful examination and determination of soft tissue characteristics will help the elimination of the negative characteristics of the individuals, and maintain the positive features. Thus, the clinical treatment will terminate more successfully (5,6).

The facial soft tissue profile has always played an important role in orthodontic diagnosis and treatment planning. In addition, the compliance in the facial profile today is one the most important goals of orthodontic treatment, because the attractiveness of the patient's face is an important factor in social acceptance by the society, as well as in his success (6,7). Reconstruction operations may be applied due to cancers located in the lip region or following tissue loss due to injuries. The aesthetic concern in the lip structure as well as no functional loss are important in these operations (8). The forensic anthropologists use the information of facial soft tissue and lip positions in identification of identity, in facial reconstruction techniques and in identifying the identity by establishing the similarities to the fasial tissue (4,9,10). The face and the characteristic data of the face are important in terms of identification of the identity in resolving the forensic cases and finding the missing persons. Because the general structure of the face and the lips are distinctive and unique in both terms of morphological features and anthropometric measurements and proportions, it may be used effectively in identification of a dead person with redetermining his face, or in finding missing persons (4,11).

The main factors that determine the soft tissue profile are the skeletal structure, the tooth structure and the soft tissue components (nose, chin and the lips) (5,12). The position of the lips in different soft tissue profile measurements is extremely important in the lower third of the face. The factors that determine the position of the lips are the skeletal features, the position of the incisor teeth, the structure of the nose and the chin, the lip thickness and the lip tension (5,13).

A beautiful face or profile categorizing ability is innate; however, it is difficult for the goal of the determined treatment to comply fully with such an innate target. According to a hypothesis, for a particular race or ethnic group, a particular average profile property and proportional values were determined and non-compliance to these values are considered as deformities and different irregularities (6,14,15). Despite the debate on the reliability of the correlation between the soft and hard tissue, it is wrong for the physicians to give up the assessment of the lip position (6,16). In cephalometric analyzes, different reference lines determining the upper and lower lip anterior-posteriror positions are used. Among these, the most widely used are Steiner S1 line, Rickett's 'E' line, Burstone 'B' line, Holdaway 'H' line and Sushner 'S2' line (16-19).

The aim of this study is to evaluate the position of the upper and lower lips of a group in Turkish society by gender and to compare the findings with those of people of other races.

MATERIAL AND METHOD

This study was conducted with healthy 68 women and 72 men subjects with skeletal Class I malocclusion (ANB=2.19±1.43), with age distribution of 19-26 years. The mean age of women and men was 23.23±4.27 years and 24.35±3.45 years, respectively. All images were chosen from the lateral cephalometric radiographs of patients who applied to the orthodontia department for diagnosis and treatment, following the required project approval (KANO/19 Ekim 2013). The participants and their families were chosen from people who are Turkish and living in Anatolia, and patients of other ethnicities were excluded from the study. Patients that show abnormal groth and development, with previous orthodontic-surgical treatment, with a history of trauma on the face and with congenital defects were not included in the

study. In each radiograph, the cephalostat was placed in the ear of the patient as the x-rays would meet with the sagittal plane perpendicularly and the head of the patient was positioned as the pupillary plane would be parallel to the ground. The patients teeth were kept at the centric occlusion and the lips as slightly closed. In the choice of radiographs, care was taken as the patients to take their permanent teeth, the absence of any periapical lesion and the graphs to be at sufficient quality. At images for each patient, Plancema Cephalometer (PM 2002 EC Proline, Helsinki, Finland) device was used. All x-ray images were recorded in the computer in TIFF format, and for the tissue parametric measurements Image-J program was used. Before the measurements 'set measurement' function was chosen, and for each image, calibration settings were performed. The calibration measurement mark of 1 cm at each graph was performed and then, the actual length of the marks were set from the "Analyze>Set scala" menu. Following this setting, the lip positions were determined by measurements from 3 different points. At these soft tissue points, distance to the Rickett's E line were determined and results were obtained from the "Analyze>Measure" section. All data were stored in Image-J data and then transferred to the Microsoft Excel program electronically. On each cefalometric image, first the Rickett's E line, which means the line that is drawn between the tip of the nose and the soft tissue pogonion point (subnasal-pogonion) was determined. Then, the upper lip soft tissue's most protruding point (Ls=Labium superius), the lower lip soft tissue's most protruding ponit (Li=Labium inferius) and the soft tissue point that the 2 lips come into contact (Sto=Stomion) were marked. The distance of these 3 points to Rickett's E line (in perpendicular angle) were measured and the positions of the lips were determined (Figure-1). The distances measured to be in front of the determined Ricketts E line were stated as 'positive (+)', behind as 'negative (-)',and at exactly on the line as '0'.

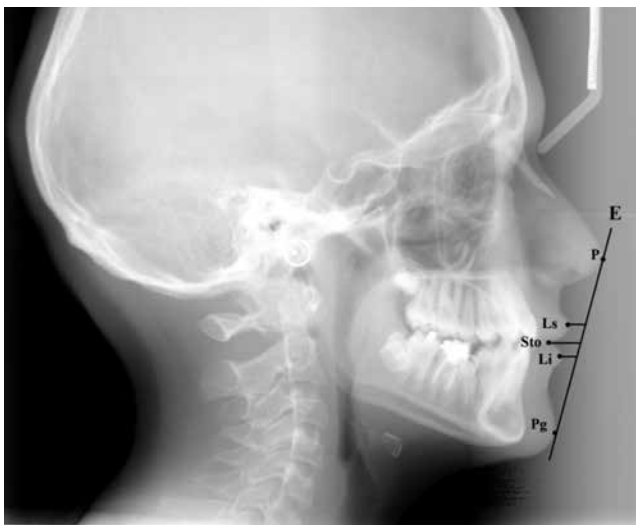

Figure-1: The measurement points and their distances used in the determination of the upper and lower lip positions according to the Rickett's E line (E: Rickett's E line, Ls: Labium Superius, Li: Labium Inferius, Sto: Stomion, Pg: Pogonion, P: The most protruding point of the nose)

The compliance of the variables to the normal distribution was controlled with Shapiro-Wilk test. The homogeneity of the variances were analyzed with Levene test. In comparison of the group averages of the variables that provide the assumption of the parametric tests, Student's t test was used. For the comparison of the median values of groups of variables that do not provide assumptions, Mann Whitney-U test was used. The results were stated as mean±standard deviation, median value and minimum-maximum values. The consistency between the measurements were evaluated with intraclass correlation coefficient (ICC). $P<0.05$ was considered statistically significant. For the data analysis, SPSS 17.0 statistics pocket program (Statistical Package for the Social Sciences, Version 17.0, SSPS Inc, Chicago IL, USA) was used.

About 15% of all measurements were randomly chosen and measured twice by the same researcher, and the consistency between the measurements was evaluated. The consistency values were detected to vary between 0.983–0.996 and all measurements were detected to be highly reliable (Table-1).

Table-1: The results of evaluation of the consistency between the measurements

Measurement	*ICC	p
Ls-E	0.983	<0.001
Sto-E	0.997	<0.00
Li-E	0.996	<0.00

*ICC: Intraclass Correlation Coefficient

RESULTS

The cefalometric measurement results of lower and upper lip positions of a total of 140 (68 female and 72 male) individuals with Class I malocclusion were shown in Table 2. The distance of Ls (Labium superius)-E, Sto (Stomion)-E, and Li (Labium inferius)-E in women ranged between -3.21 mm and -16.08 mm, between 10.71 mm and -24.21 mm, and between -2.88 mm and -14.83 mm, respectively. The corresponding measurements in men were between -4.84 mm and -17.21 mm, between -13.21 mm and -23.43 mm, and between -3.21 mm and -11.12 mm, respectively. According to the group statistics, the mean Ls-E values were detected as in women; -9.69±5.69 mm, in men; -8.09±5.12 mm, the Sto-E values in women; -15.96±5.61 mm, in men; -17.51±4.52 mm, Li-E values in women; -6.50±6.12 mm, in men; -3.56±5.23 mm (Table 2). A statistically significant between-group difference between the two genders was observed only for the Li-E values (p=0.041).

Table-2: The value of distances to Rickett's E line of the upper lip the most protruding tip point (Ls), lower lip the most protruding tip point (Li) and the midpoint of the two lips (Sto) (mm)

Parameters	Gender	n	Mean±std (min-max)	p
Ls-E	Female	72	-9.69±5.69 (-3.21-16.08)	0.966
	Male	68	-8.09±5.12 (-4.84-17.21)	
Sto- E	Female	72	-15.96±5.61 (-10.71-24.21)	0.341
	Male	68	-17.51±4.52 (-13.21-23.43)	
Li-E	Female	72	-6.5±6.12 (-2.88-14.83)	0.041
	Male	68	-3.56±5.23 (-3.21-11.12)	

For all measurements in both gender groups, no result was observed as the value that meets Rickett's E line (0) or the (+) value that falls in front of it. In 66% of women, the upper lip was found more in the front than the lower lip, in other terms, closer to the E line, while this ratio in men was 78%. As a result, in both gender, the upper lip was found to be more frontly positioned than the lower lip. The distance of Sto point to Rickett's E line is further in men than in women (-17.51±4.52 mm), while no statistically significant difference between gender in term of values was detected.

DISCUSSION

Social acceptance, psychological well-being and self-esteem depend on physical appearance. Self-rescpect is also thought to depend on primarily the facies (3). In this context, the position of the lips is important in terms of facial aesthetics. Although different reference angles and lines were used to determine the lip position in cephalometric studies until today, "lip relations rule" was determined according to Rickett's E line (the line betwen the tip of the nose and pogonion). According to this rule, the lower lip is closer to the E line, with both upper and lower lips being generally behind the Rickett's E line (19-22). We also determined the position of the upper and lower lips according to the Rickett's E line in individuals with Class I malocclusion in our study, and investigated the differences between genders.

Some cephalometric studies performed in Anatolian Turkish society occupied an important place in providing the standards for adolescents and young adults with Turkish origin (11,23,24). Erbay et al. (25,26) have performed studies that determined the horizontal lip positions in Anatolian Turks by

using the Steiner, Rickett's, Burstone, Sushner and Holdaway analyses. In their studies they measured the Ls-E and Li-E distances according to the Rikett's E line in 2 different groups. In the first group, Ls-E values were evaluated as; -5.8±2.9 mm in men, in women; -5.2±1.8 mm, Li-E in men; -4.9±3.5 mm, and in women; -3.7±2.2 mm. The results in the second group were as follows; Ls-E values in men; -3.8±2.4 mm, in women; -5.2±1.7 mm, Li-E in men; -2.7±2.3 mm, in women; -2.6±1.4 mm. These results were found to be closer to the E line, compared to our results, however, consistent with our results, the upper lip posture was observed to be further to the E line, compared to the lower lip (25).

In Başçiftçi et al. (26) 's according to Rickett's E line, their results were as follows; Ls-E: in men; -4.97±2.55 mm, in women; -5.03±2.09 mm, Li-E: in men; -2.70±2.98 mm, in women; -2.70±2.27 mm. In terms of these values, they didn't find a statistically significant difference between the genders. In our study, however, it is known that there is difference between the genders in Li-E values (p=0.041). Şahinoğlu (6) in his study, stated the normal value of upper lip thickness as 10-14 mm, and the lower lip thickness as 11-15 mm, without specifying a gender. In this case, even though the lower lip and the upper lip seem to be at the same vertical plane, the lower lip is slightly thicker than the upper lip. This result also supports the result of our study which states that the lower lip is located closer to the vertical plane.

Freitas et al. (27) evaluated the upper and lower lip position in Brezilian white (74 people) and blacks (56 people) according to the subnasal-pogonion line. They found that it was smaller in whites than blacks and all values were found to be in front of this line (+). In this study, upper lip protrusion in whites was found to be further than the lower lip, and in blacks, this protrusion was also applied, however the difference was found to be too small. Janson et al. (28) measured the upper and lower lip positions according to the subnasal-pogonion line in Caucasians and African Caucasus without gender segregation, and found significant differences between groups and stated that they found very close results to the study of Freitas et al. We couldn't compare the results of these study with our values, because these were the studies where different lines were norms. However, it is possible to say that the results were in common in terms of upper and lower lip positions.

In a study conducted in China, Gu et al. (29) evaluated different cephalometric measurements, as well as the distance of the most prominent points of the lower and upper lips to the Rickett's E line. Accordingly; they stated Ls-E in women as -5.8±2.9 mm, in men as -6.2±3.0; Li-E in women as -3.8±2.4 mm, and in men as -5.0±3.0. In addition, in the same study, they found no difference between the genders in terms of the uppper lip position, but statistically significant difference in term os the lower lip position. In this context, the obtained results were found to be parallel to our measurements, but the lower and upper lips were stated to be more prominent forwardly in Chinese people.

The distance of the upper lip to the Rickett's E line was measured in Japanese and American adults, and in Japanese, the values were -2.5±1.9 mm in women, -2.9±2.2 mm in men, and in Americans, -5.7±1.9 mm in women, and in men, -6.4±2.4 mm (30). It can be stated that the results of the American race were close to our values and the upper lip position is more behind than the E line in Turkish race, compared to these 2 races.

In the study of Gu et al. (29) to determine the lip positions, Li-E results were stated to be so close in Chinese, Korean and Japanese races (-2.2 and -2.9 mm), but the protrusion to be less in the Caucasian race (-6.2 mm). At the same time, the Far East race was stated to have a more convex profile than the Caucasians and the lip position is said to adapt it. In this comparison between groups, the Caucasians were highlighted to have the most orthognatic profile with their least protruding lip structure. When we compare our results with these results, we can say that the nearest results show compliance with the Caucasian race.

Soft tissue profile is known to have changes during the orthodontic treatments. Therefore, soft tissue measurements should be made, as well as the dental structures, at the planning stage of the treatment. Otherwise, soft tissue changes constitute

a major problem during the orthodontic treatment. Because, soft tissue is the determinant of the facial aesthetics and the harmony (6,30,31). Drobocky et al. (32) have studied the effect of 1st premolar teeth extraction and orthodontic treatment on facial profile in Class I individuals. They investigated the effects of Tweed, Begg and Edgewise techniques in 160 individuals with ages ranging between 10-30. The position of the lips, the facial profile and the nasolabial angle before the study, and as a result, found that the upper lip was located 3.4 mm behind the Rickett's E line, and the lower lip 3.6 mm behind. However, in patients using the Tweed apparatus, the lower lip retrusion is stated to be more compatible, and thus, the facial profile is much more in harmony. Scott et al. (33) evaluated the profile and the tooth soft tissue protrusions in African American individuals with Class I and II occlusion before the treatment. In both groups, they stated the results were similar. In addition, the lower lip protrusion in whites was found as +2 mm, in blacks as +4 mm, and they stated that the lower lip protrusion to be 4 mm in front of the E line can be considered acceptable as facially aesthetic.

Facial skeleton and the surrounding soft tissues determine the facial harmony and the balance. The structure that allows the visual effect of the face is the covering soft tissues and their relative proportions with each other (3,4). If the orthodontist ignores these proportions and makes his predictions for the possible changes in the soft tissues with only the normal values of the hard tissues, it may cause some aesthetic problems (6). Therefore, the soft tissue profile of the patient should be evaluated, taking advantage of the patients' soft tissue analyses (34). In different ethnic groups and ages, the normal dento-facial structure should not be ignored. There are many studies including the cephalometric norms of different groups with ethnic and racial differences. As a result of these studies, the researchers concluded that there are major differences between these groups, and developed different cephalometric norms (34-36). Another consequence with this result is that different racial groups should be treated on their own merit, the age-related changes should not be ignored and the results for Class I gorup should be accepted as normal (4,11). Hwang et al. (35) in their study in individuals of different ethnic origin; studied the differences in human faces. According to this study; in individuals of different ethnic groups and races, they expressed differences in dento-facial relationship and the position of lips. In the same study, it is emphasized that these studies which are conducted with a variety of communities are important in terms of determining the standards.

As well as the clinical examination and the other patient data, to know the differences of cephalometric measurements of different ethnic groups and genders, is beneficial in orthodontic treatments, and also in the planning stage of facial surgery. However, these norms should not be used as a template (6). The treatment should be planned always according to the needs and wishes of each patient. Even though the first objective of surgical approaches is perceived as the correction of the hard tissue relations, the aesthetic success is only achieved when the soft tissue relations is obtained (35,36).

In conclusion, we believe that to know the lip posture which is the focal point at the lower half of the face would be helpful to orthodontists in assessing the face profile at the end of their treatment, and in forensic anthropology, in assessing the lower facial competence at the facial reconstruction technique and aesthetic surgery.

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