

# Horizontal Lip Position in Twelve-Year-Old Subjects with Class I and Class II/1

Sandra Anić - Milošević<sup>1</sup>  
 Jelena Buršić<sup>2</sup>  
 Marina Lapter - Varga<sup>1</sup>  
 Mladen Šlaj<sup>1</sup>

<sup>1</sup>Department of Orthodontics  
 School of Dental Medicine  
 University of Zagreb  
<sup>2</sup>Medical Health Clinic,  
 Labin, Croatia

## Summary

*The aim of the study was to define the difference of the lip position on lateral cephalograms of subjects with class I and II/1 according to Ricketts and Burstone defining the differences of the variables according to sex. The sample comprised of 57 lateral cephalograms of twelve years old boys and girls. Using measured variables statistic analysis showed following conclusions: Angle class I didn't show any differences between females and males; class II/1 did show the differences according to sex; analysing boys between class I and II/1 differences in position of upper and lower lip are present; analysing girls between class I and II/1 differences in position of upper and lower lip are not present; comparison between classes without sex separations shows differences in position of upper lip according to both lines.*

Key words: lip position, class I, class II/1.

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Address for correspondence:

Sandra Anić-Milošević  
 Department of Orthodontics  
 School of Dental Medicine  
 Gundulićeva 5, 10 000 Zagreb  
 e-mail: sanic@sfzg.hr

## Introduction

Therapy based on dentoskeletal standards alone occasionally results in increased facial disharmony or new unfavourable changes. Consequently there is great interest and need for analysis of soft tissue profiles, in order to determine asymmetry which is reflected in the face, and also for evaluation of how correction of the disrupted dentoskeletal relations will affect the soft tissue (1-4).

Many authors have been engaged in the determination of the antero-posterior position of the lips and aesthetic profile. In their investigations they determined cephalometric norms for different racial and ethnic groups (5-8). Investigations have shown that normal values of one group need not be appli-

cable for all groups, but that different racial groups must be observed within the framework of relevant basic characteristics (9-14).

There has always been aspiration for comparison of the relations of the soft tissues and firm foundation which they cover. The profile of soft tissues has an important role in the planning of orthodontic therapy, since a well-balanced face, particularly of the lower third, and optimal functional occlusion, represents the ultimate goal of successful orthodontic treatment (15-17).

Ricketts (18, 19) for example, for evaluation of anteroposterior position of the lips, used the so-called "Esthetic line" or E-line, which extends from the top of the nose (pronasal point) to the pogonion of the soft tissue (Figure 1), and which serves exclu-

sively for assessment of the position of the lips and their mutual relation. In mixed dentition both lips are on the E-line, and over the years their convexity reduces and they retract (20). In young persons during the early phase of dentition, according to Ricketts, both lips are positioned behind the E-line; the lower by 2 mm and the upper by 3 mm. During analysis of lip position the position of the lower lip is always first examined, because when pressed together the lower lip raises up over the labial surface of the upper incisors by approximately 3 mm.

Burstone (21,22) also emphasises the importance of the position of the lips when planning therapy. During analysis of the profile he uses B-line, which extends from the subnasal point of the soft tissue to the pogonion of the same (Figure 2). He concludes that both lips are in front of that line; the upper  $3.5 \pm 1.4$  mm, and the lower  $2.2 \pm 1.6$  mm. The position of the lips in relation to the Sn-Pg line is of great importance during analysis of soft tissues. Shifting of the teeth changes the position of the lips in relation to the Sn-Pg line and consequently also the overall aesthetic appearance. Extraction should be avoided in cases when retraction of frontal teeth would result in the retraction of the lips, whereby they would be positioned behind the Sn-Pg line. The position of the lips in relation to this line depends on skeletal relations, inclination of the incisors and thickness of the lips. In the case of saggital disharmony, which manifests with aberrations in overjet (positive or negative), the Sn-Pg line has no value at all. In the case of class I the upper and lower incisors must be in symmetrical saggital relations and axial inclination, in order for the lips to be in adequate protrusion in relation to the Sn-Pg line (16). The relation of the lips according to the Sn-Pg line depends on the thickness of the lips, and correct position of the lips according to Burstone, is only possible when the lips are equally thick. Burstone also states that because of differences in the thickness of soft tissue, this tissue does not always follow the skeletal profile (21).

The aim of this study was to determine the difference in structures of the soft tissue in lateral cephalograms, with emphasis on lip position by means of linear variables according to Burstone and Ricketts, for subjects with class II/1 and class I, and to determine differences of the above variables with regard to sex.

## Sample and methods

The study was performed on a sample of 57 lateral cephalograms of subjects aged 12 years, on whom analysis of profile according to Ricketts and Burstone was performed. The subjects were divided into two groups. The first group comprised 30 subjects with dental and skeletal class I, of which 17 were boys and 13 girls, and the second group of subjects with class II/1, 12 boys and 15 girls.

Cephalograms are an integral part of the records of the Department of Orthodontics, School of Dental Medicine University of Zagreb. Each cephalogram was copied on tracing paper with a technical pencil by conventional cephalometric procedure. This was followed by marking the following points of the soft tissue: labrale superius (Ls), labrale inferius (Li), supramentale (Sm), subnasale (Sn), pronasale (Prn) and pogonion (Pg). The two lines used in the analysis were then drawn. The first was Ricketts E-line, which extends from the top of the nose to the pogonion of the soft tissue (Prn-Pg), and the second line, according to Burstone, which defines the points of the subnasal soft tissue and pogonion of the same (Sn-Pg). After precisely drawing the lines the distance was measured in mm with a standard ruler. The following linear variables were measured according to Ricketts (Figure 1):

Ls-E - Distance of the upper lip from E-line.

Li-E - Distance of the lower lip from E-line.

And according to Burstone (Figure 2):

Ls/Sn-Pg - Distance of the upper lip from the subnasal-pogonion line.

Li/Sn-Pg - Distance of the lower lip from the subnasale-pogonion line.

Sm/Sn-Pg - Distance of the mandibular sulcus from the subnasal - pogonion line.

Student's t-test was used for analysis of the variables, which is used to test differences between arithmetic means of small independent samples. Standard deviation was also used for average deviation of measurements from arithmetic mean.  $P < 0.05$  was taken for the degree of statistical significance (23). Smith's Statistical Package Freeware was used for total statistical analysis (Version 2.5, August 30, 2001, [http://www.economics.pomona.edu/Stat site/SSP.html/](http://www.economics.pomona.edu/Stat%20site/SSP.html/)).

## Results

Table 1 shows the statistical analysis of the measured data for skeletal and dental class I, where boys and girls were compared for all parameters. Analysis of data by Student's t-test determined difference with regard to sex in class II/1. This difference relates to the position of the lower lip in relation to the Sn-Pg line (Table 2). Table 3 shows the significance of the differences between the examined parameters in boys with classes I and II/1.

The results of Student t-test did not show statistically significant difference between the girls in classes I and II/1. By comparing class I and II/1, regardless of sex, differences were determined in the position of the upper lip according to Burstone and Ricketts (Table 4).

## Discussion

Methods for analysing soft tissues have an important role in therapy planning and achievement of desired and anticipated results. By including profile analysis in the therapy plan harmonious facial relations are achieved, which is the ultimate goal of orthodontic therapy (2, 16).

Many analyses of soft tissues exist which mutually differ according to values, parameters and method of evaluation (1, 19, 22, 24, 25). Many authors also emphasise racial and ethnic differences in the evaluation of horizontal lip position with regard to the nose and chin. Yuen and Hiranaka (26) and Cooke and Wei (7) conclude for example that the upper and lower lips are more protruded in the Chinese, than in Caucasian or black races, because of the fact that their chin is positioned lower and more posterior. The position of the lips in relation to the Sn-Pg line is of great importance in the analysis of soft tissues. Arnett stresses the importance of this line and considers that all shifting of the teeth, due to the fact that they have an effect on the total aesthetic appearance, should be considered with regard to the expected change in the position of the lips in relation to that line (2, 16). In their investigation Drobocky and Smith demonstrated that in the case of extraction the upper lip, in relation to the Sn-Pg line, retrudes on average by 2.2 mm, and the lower lip by 2.7 mm.

Ninety percent of the cases of extraction show retraction of the upper lip as a consequence of orthodontic therapy. When the upper lip in the region of the vermilion is thicker than 18 mm it changes very little after retraction of the incisure (27).

As previously mentioned in this study attention was paid to measurements according to Burstone and Ricketts because of the uncomplicated evaluation of the position of the lips and simple measurement. Cephalometric analysis was used on soft tissues in an attempt to determine the horizontal lip position in 12-year-olds, and analysis was performed by comparing classes and sexes.

In the study values obtained for boys in class I were similar to those obtained in investigations carried out by Zylinski et al (28) on boys aged 5-10 years (upper lip -0.1; lower lip -0.0) and an investigation by Bishare et al (29) (upper lip -0.64; lower lip -0.22). Analysis of class I showed that at that age there were no significant differences in the position of the lips between the sexes. Only a slightly more anterior lip position, in relation to both lines, was found in boys. This fact can be explained by the size of the nose and chin, because at the age of 12 years growth in girls is more intensive, after which growth in boys is more intensive. Thus, patients in whom growth has not been completed should not be treated according to the standards for adults, as later changes can have an opposite effect on the profile (29). Contrary to horizontal lip position, a longitudinal investigation by Nande et al, on subjects aged 7-18 years, demonstrated that the growth of the length of the upper lip is almost completed by the age of 7 years, which means that diagnosis of a shorter upper lip can be made at an early age. Namely, vertical growth of the upper lip in boys, as in girls, finishes at the age of 15 years. The lower lip shows continued growth after 15 years in girls and up to 18 years in boys (30).

With regard to sex, analysis of class II/1 showed statistically significant difference in the position of the lower lip in relation to the Sn-Pg line, which was on average 2.83 mm more anterior in boys, and the upper lip and submental sulcus also showed a more anterior position compared to girls. According to Ricketts' analysis there are no significant differences, but here also the lips of boys showed a somewhat more anterior position, which can best be seen

in the lower lip, which is 1.4 mm in front of the E-line.

Comparison of the classes within the same sex indicated that in girls there were no statistically significant differences. However, boys showed difference in as many as four parameters. Analysis of the boys showed protrusion of the upper and lower lips, class II/1, with regard to both referent lines. The results showed that according to Burstone the upper lip is on average 1.98 mm more anterior and the lower 2.24 mm compared with the position of the lip in class I. The upper lip in class II/1 is positioned more anteriorly by 2.01 mm in relation to the E-line, and the lower lip by 0.4 mm. Submental sulcus acquires close values. Namely in both classes it is positioned behind the Sn-Pg line. As already mentioned girls did not show statistically significant difference, although a slight anterior position of the lips in class II/1 was determined in relation to both lines.

Finally, classes were compared regardless of sex. Statistical significance was observed in the position of the upper lip in relation to both referent lines. In class II/1 it was situated 1.36 mm in front of the Sn-Pg line, and 1.75 mm in relation to the E-line.

This study was carried out on twelve-year-olds, in whom growth is still not completed, while Burstone's and Ricketts' data were obtained by measuring on adult subjects. As this study involved the

age before maximum puberty growth, deviations can be explained by the growth and development of skeletal structures and pertinent soft tissues, which confirms the fact that application of the standard for adults is inapplicable in the diagnosis and therapy plan for patients in whom growth and development has not been completed (31).

## Conclusions

On the basis of the results of this study the following can be concluded:

- In subjects with class I no statistically significant differences were determined of the examined parameters with regard to sex.
- In subjects with class II/1 difference was observed only in the more anterior position of the lower lip in relation to the Sn-Pg line in boys.
- By comparing boys with class I and II/1 statistically significant difference was found in the position of the upper and lower lips in relation to both lines, while in girls with class I and II/1 no statistically significant difference was found in the horizontal lip position.
- Analysis of classes I and II/1, regardless of sex, showed statistically significant difference in the position of the upper lip in relation to both lines.