

An important morphological feature of the face: upper lip length

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Abstract

The oral cavity, including the lips, is considered one of the most important features of the face, taken into consideration when people inter-relate. Upper lip, in particular, can have a great influence on the aspect of a smile, which is why its proportional length and thickness can improve a lot a persons' smile. The aim of this study was to determine the average length of the upper lip in the Caucasian population, considering age and gender. The average upper lip length determined on the lateral skull radiography was 20.25 ± 2.555 mm. The average length of the upper lip was 19.79 ± 1.641 mm in the age category under 12 years and 20.32 ± 2.664 mm in the age category over 12 years. The average length of the upper lip was 19.95 ± 2.4 mm in women and 21.18 ± 2.79 mm in men. We can conclude that women have lower values, while men have higher values of the upper lip length, and that the younger the patient is, the shorter the length of the upper lip is. Moreover, the Caucasian population proved to have a shorter upper lip compared to the Asian or Negroid population.

Keywords: upper lip length, Caucasian population, cephalometric.

Introduction

In their inter-individual relationships, people tend to take more into consideration the aspect of their interlocutor's eyes and mouth [1]. Edward H. Angle (1907) introduced the term of "facial harmony", considering the mouth as a defining feature of the face [2]. A scientific approach over the analysis of the facial and dental aesthetics can be obtained using the golden proportion, introduced by Ricketts, in 1982 [3]. The following year, Holdaway (1983) sustained Ricketts' findings and showed that any correction of a dento-maxillary anomaly produces alterations of the facial appearance [4].

There are various ways of measuring the length of the upper lip [5]. Many studies have shown that there are only very few statistically significant differences between anthropometric and cephalometric measurements of the facial profile [6].

The upper lip length can be measured between subnasale (Sn) point and superior stomion (Sts) point and its values around 22 ± 2 mm in a Caucasian male adult and 20 ± 2 mm in a Caucasian female adult [7].

The discrepancies noticed between the average length of the upper lip at the same population in studies of different authors may be related to different racial origins of the people taken into study, studying only patients with normal occlusion, the use of radiographs performed with the head guided by skull structures or in his natural position, human errors when fixing the anthropometric points even if the analyses of the lateral radiographs was digitally performed, etc. [8].

The main aim of this study was to determine the average value of the upper lip length in a population of Crișana

(Romania) geographic area taking into consideration gender and age, aiming at the same time to identify any significant differences between women and men, and between the under 12 and over 12 years category.

Materials and Methods

This study was conducted on 152 lateral radiographies with the head held in his natural position, the dental arches maintained in central relationship and the lips at rest. The lateral X-rays were performed by the same radiologist. The patients taken into study were aged between 9 and 62 years old. The analysis of all the radiographies was done digitally using the OnyxCeph software. The parameter followed on the lateral radiographies of the skull was the upper lip length measured from the Sn point to the Sts point. The points needed for the digital analysis were manually chosen by the same person after a careful study of the anatomy of each lateral cephalometric. To determine the accuracy of the measurements, 30 randomly selected lateral skull radiographies were digitally re-analyzed by the same operator, the newly obtained results not presenting statistically significant differences.

The value of the parameter measured on each cephalometric was automatically generated by the digital analyzing software and included in a Microsoft Excel table, thus eliminating any human error that might have occurred when gathering the data. All the results were then gathered into a table and statistically analyzed using the IBM Statistical Package for the Social Sciences (SPSS) 20 software. Quantitative variables were tested for normal distribution using the Shapiro-Wilk test and were written as averages with standard deviations, while categorical

variables were written as counts or percentages. Quantitative variables with normal distribution were tested using Student's *t*-test and their correlations were demonstrated using Pearson's correlations. Any value less than 0.05 in Student's *t*-test was considered statistically significant. The correlations of the quantitative variables with non-parametric distribution were demonstrated using Spearman's rank-order correlation. Categorical variables were tested using Pearson's χ^2 (*chi*-square) test and all existent correlations were demonstrated using Pearson's correlations.

The inclusion criteria in this study refer to: full dentition, no previous orthodontic treatment, no history of cranio-facial trauma, normal occlusal relationships, harmonious facial profile and maybe some mild dental crowding. Patients were classified into two age categories, depending on the type of dentition: under 12 years (20 patients) and over 12 years (132 patients), respectively by gender: 115 women and 37 men. We have obtained the informed patient consent for processing the data gathered from the cephalometric analysis.

Results

The average upper lip length determined on the lateral skull radiography regardless of gender or age in the studied population was 20.25 ± 2.555 mm, with a minimum value of 13.49 mm and a maximum value of 28.77 mm. The median value was around 20.2 mm (Table 1, Figure 1).

Table 1 – The average value of the upper lip length in the studied population

Measured parameter	Average value \pm standard deviation	Median value	Minimum value	Maximum value
Upper lip length [mm]	20.25 ± 2.555	20.2	13.49	28.77

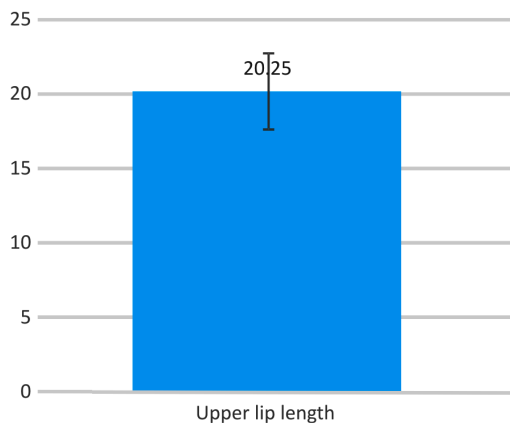


Figure 1 – The average value of the upper lip length [mm] in the studied population.

The average length of the upper lip in the age category under 12 years was 19.79 ± 1.641 mm, with a minimum value of 16.72 mm and a maximum value of 22.81 mm. The median value was 20.335 mm. The average length of the upper lip in the age category over 12 years was 20.32 ± 2.664 mm, with a minimum value of 13.49 mm and a maximum value of 28.77 mm. The median value was 20.165 mm. The distribution of this parameter was analyzed using the Shapiro–Wilk test, the result proving a normal distribution ($p=0.489$), while the Student's *t*-test showed that there were no statistically significant

differences ($p=0.392$) of the upper lip length between the age groups taken into consideration. In the age category under 12 years, the distribution of higher and lower values of the upper lip length than the average length of the upper lip was similar, while in the age category over 12 years, higher values than the average length of the upper lip seem to prevail (Table 2, Figure 2).

Table 2 – The average value of the upper lip length [mm] in the studied population considering age groups

Age category	Average value \pm standard deviation	Median value	Minimum value	Maximum value	p^* ($p=0.489$)**
6–12 years	19.79 ± 1.641	20.335	16.72	22.81	0.392
Over 12 years	20.32 ± 2.664	20.165	13.49	28.77	

*Student's *t*-test; **Shapiro–Wilk test.

The average length of the upper lip in women was 19.95 ± 2.4 mm, with a minimum value of 13.49 mm and a maximum value of 26.34 mm. The median value was 19.99 mm. The average length of the upper lip in men was 21.18 ± 2.79 mm, with a minimum value of 15.76 mm and a maximum value of 28.77 mm. The median value was 21.06 mm. There was a statistically significant difference between men and women ($p=0.011$) and the positive and significant correlation ($p=0.011$, $R=0.207$) shows that there was a higher prevalence of lower values of the upper lip length in women and a higher prevalence of greater values of the upper lip length in men (Table 3, Figure 3).

Table 3 – The average value of the upper lip length [mm] in the studied population considering gender

Gender	Average value \pm standard deviation	Median value	Minimum value	Maximum value	p^*
Females	19.95 ± 2.4	19.99	13.49	26.34	0.011 $R=0.207$ **
Males	21.18 ± 2.79	21.06	15.76	28.77	

*Student's *t*-test; **Pearson's correlation coefficient.

Upper lip length can be successfully correlated with age, gender and upper lip categories leading eventually to statistically significant results (Table 4).

Table 4 – Statistically significant correlations in this study

Correlation	p^*
Age \times Upper lip length	0.016, $R=0.195$ ** ($p<0.001$ – age***)
Gender \times Upper lip length	0.011, $R=0.207$
Age \times Upper lip length categories	0.024, $R=0.184$ **

*Pearson's correlation coefficient; **Spearman's *rho* correlation coefficient; ***Shapiro–Wilk test.

To analyze the correlation of the upper lip length with age, Shapiro–Wilk test was applied. The results demonstrated a non-parametric distribution, which deviates statistically significant from a normal distribution ($p<0.001$). The age was positively and significantly correlated with the upper lip length ($p=0.016$, $R=0.195$), so that younger patients will have smaller values of the upper lip length and vice versa (Figure 4).

Age was also positively and significantly correlated with the upper lip length categories ($p=0.024$, $R=0.184$),

so that the younger patients are, the shorter upper lip they have. Patients aged 17.9 ± 5.604 years, with a minimum of 11 years and a maximum of 35, a median value of 16 years, seem to have a short upper lip. Patients aged 20.09 ± 9.141 years, with a minimum of 9 years and a maximum of 62, a median value of 18 years, seem to have a normal upper lip length. Patients aged 21.86 ± 7.101 years, with a minimum of 13 years and a maximum of 37, a median value of 21 years, seem to have a long upper lip (Table 5, Figure 5).

Table 5 – The average value of age [years] considering upper lip length category

Length category	Average value \pm standard deviation	Median value	Minimum value	Maximum value
Short upper lip	17.9 ± 5.604	16	11	35
Normal upper lip	20.09 ± 9.141	18	9	62
Long upper lip	21.86 ± 7.101	21	13	37

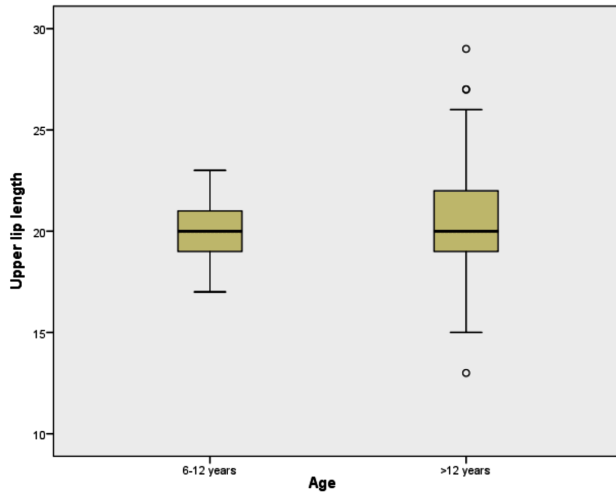


Figure 2 – The average value of the upper lip length [mm] in the studied population considering age groups.

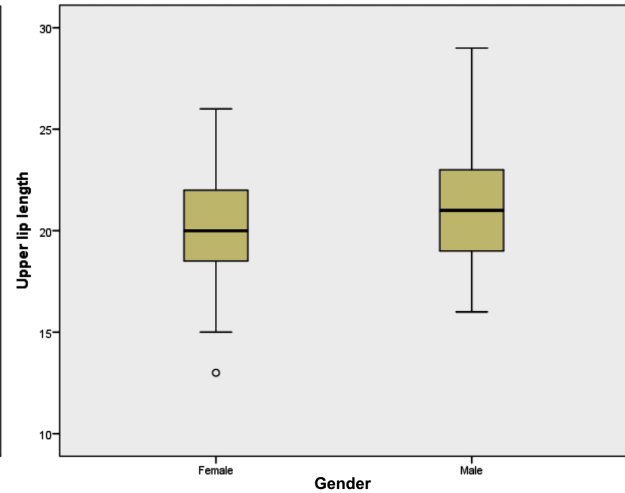


Figure 3 – The average value of the upper lip length in [mm] the studied population considering gender.

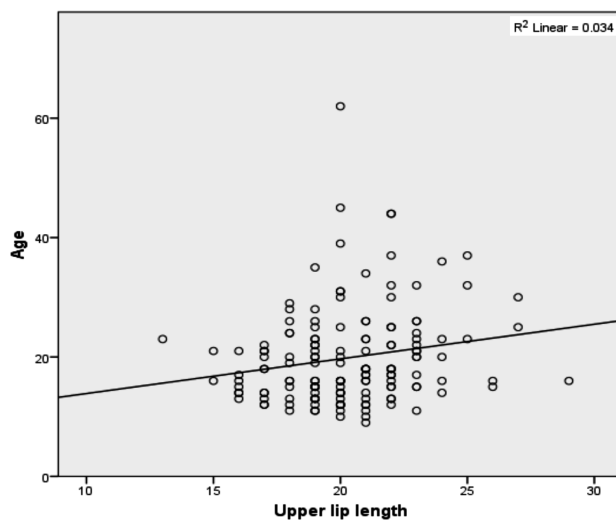


Figure 4 – Upper lip length [mm] correlations considering age groups [years].

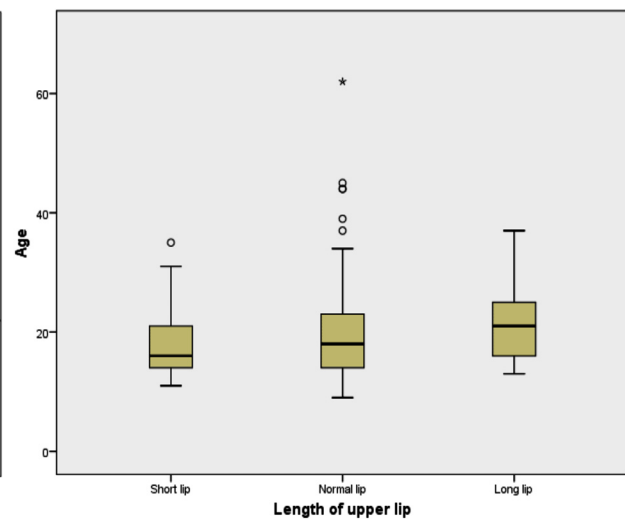


Figure 5 – The average value of age [years] considering upper lip length category.

Discussions

Nowadays, people consider more often the aspect of their interlocutor's eyes and mouth (including lips) rather than other facial features [9], asking doctors for bright and white teeth along with thick lips. It is well known that lips, as a craniofacial landmark, can be considered an important criterion in forensic criminal investigations to identify a missing person [10]. Moreover, lips along with teeth play an important role in how a person is perceived by its entourage, their harmony having psychological and social consequences on every human being [11, 12].

In a harmonious face, the length of the upper lip should be equal to the distance between the mouth commissures and the horizontal line that passes through the Sn point [13]. Even though harmonious faces appear to be symmetrical, they may have skeletal asymmetries camouflaged by the soft tissues that are covering them, therefore eliminating the underneath asymmetry [14–16].

In our study, the average length of the upper lip regardless of gender or age for the Caucasian population was 20.25 ± 2.555 mm. This value is according to the results published for the Caucasian population by Daenecke *et al.* (2006) $20.52 - 22.77$ mm [6] and Burstone (1967) 21.67 ± 1.7 mm [17].

In women, we obtained an average length of the upper lip of 19.95 ± 2.4 mm. This value is according to the results published by Bhatia & Leighton (1993) 20.9 ± 2.5 mm [18], by Farkas (1994) 19.6 ± 2.4 mm [19], by Cattoni (2003) 17–23 mm [20] and by Prabu *et al.* (2012) 20.02 ± 2.89 mm [21] (Table 6).

Table 6 – Average length of the upper lip [mm] in Caucasian women and men by several authors

	Average length of the upper lip in women	Average length of the upper lip in men
Bhatia & Leighton (1993) [16]	20.9 ± 2.5	21.8 ± 1.7
Farkas <i>et al.</i> (1994) [17]	19.6 ± 2.4	21.8 ± 2.2
Cattoni (2003) [18]	17–23	21.2–26
Prabu <i>et al.</i> (2012) [19]	20.02 ± 2.89	23.4 ± 3.42
<i>Our results</i>	19.95 ± 2.4	21.18 ± 2.79

In men, we obtained an average length of the upper lip of 21.18 ± 2.79 mm. This value is according to the results published by Bhatia & Leighton (1993) 21.8 ± 1.7 mm [18], by Farkas (1994) 21.8 ± 2.2 mm [19], by Cattoni (2003) 21.2–26 mm [20] and by Prabu *et al.* (2012) 23.4 ± 3.42 mm [21] (Table 6).

These results show that the average length of the upper lip is lower in women than in men, with lower values in women and higher values in men.

Regarding the length of the upper lip considering age, in this research we obtained an average length of 19.79 ± 1.641 mm for people aged under 12 years and 20.32 ± 2.664 mm for people aged over 12 years. These values are according to the results published by Farkas (1994), which determined for both age categories an average length between 19.9–20.8 mm [19].

It has also been shown that over 90% of patients under the age of 12 years have slightly lower values of the upper lip length than the average length and over 85% of patients over 12 years have greater values of the upper lip length than the average length. This proves a linear increase of the upper lip length, as patients get older. Thus, lower values of the upper lip length are more common in younger and female patients, while higher upper lip lengths are more common in adult and male patients.

A short upper lip is considered unaesthetic because the upper lip line is reversed at rest. Moreover, a short upper lip frequently found in oral breathers allows not only a greater exposure of upper teeth, but also of the gingival tissue, which pathognomonically can be swollen and congested [22]. In teenagers, a short upper lip may be considered normal due to the fact that the lips length continues to increase even after the vertical skeletal growth has ceased [23, 24].

The length of the upper lip is not influenced only by gender or age. Race origin can also influence the length of the upper lip. Thus, according to our study, the Caucasian female population has an upper lip length of 19.95 ± 2.4 mm. This value is lower than the upper lip length in the Asian female population {Farkas (1994) [19] 21.6 ± 2.1 mm, Aghili *et al.* (2016) [25] 20.45 ± 2.46 mm} or in the African female population {Farkas (1994) [19] 24.5 ± 3 mm, Isiekwe *et al.* (2012) [26] 23.66 ± 2.31 mm}.

Also, according to our study, the Caucasian male population has an upper lip length of 21.18 ± 2.79 mm. This value is lower than the upper lip length in the Asian male population {Farkas (1994) [19] 23.5 ± 2.2 mm, Aghili *et al.* (2016) [25] 21.73 ± 2.61 mm} or in the African male population {Farkas (1994) [19] 26.1 ± 2.5 mm, Isiekwe *et al.* (2012) [26] 25.58 ± 3.1 mm}. These results show that craniofacial morphological characteristics vary both racially and interracially, from one geographic region to another [27]. Thus, it can be observed an increase in the length of the upper lip in Asians compared to Caucasians, and in Africans compared to Asians.

The identification of craniofacial, racial and group morphological characteristics helps improving the accuracy of diagnosis of growth and development abnormalities in children by guiding the orthodontic and orthopedic treatment [28]. Morphological abnormalities appear in the whole population by impairment of organogenesis of the midfacial skeleton under the influence of various etiological factors. They may occur independently or within complex syndromes associated with multiple congenital malformations [29–32]. Also, any morphological abnormality of the maxillary bases, transversal or sagittal, can change upper lip length due to the fact that teeth are considered to be supporting lips [33, 34].

☐ Conclusions

Based on the results of our research, we have determined the average length of the upper lip in the Romanian population regardless of gender or age and, subsequently, we tried to make various correlations between the length of the upper lip and the age and gender of the patient. Thus, we can conclude that the length of the upper lip depends both on the patient's gender (women have lower values and men have higher values of the upper lip length) and the patient's age (the younger the patient is, the shorter the length of the upper lip is). Moreover, all measurements published in recent articles, including those determined by our research in the Caucasian population, show that this population has a shorter upper lip compared to the Asian or Negroid population. Also, we can conclude that is necessary to establish a standard protocol for determining the length of the upper lip.

Conflict of interests

None of the authors has any competing interests in the manuscript.

Authors' contribution

Bianca Maria Negruțiu and Ioana Elena Lile equally contributed to the manuscript.

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