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ORIGINAL PAPER

Anthropometric measurement and analysis of the lower face in Turkish rhinoplasty patients

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Abstract
Background Lower face dimensions have a great impact on the perception of nasal beauty. For this reason, evaluation of the lower face is important in patients applied for rhinoplasty. In this study, we aimed to describe the values of lower face anthropometric measurements in Turkish patients who applied for rhinoplasty and to compare these values with measurements of individuals who are pleased with their nasal appearance.
Methods A Turkish population of 252 rhinoplasty-negative individuals and 171 rhinoplasty patients were included in this study as the control and rhinoplasty groups. Using the preoperative photographs of the facial profile, seven vertical measurements were taken and seven indices were used to determine the relationships between measurements of the lower face.
Results In the rhinoplasty group, most vertical profile measurements were greater in males. The only variables with no gender differences were lower and upper vermilion heights. Only variables with a significant difference between two groups were upper lip vermilion height in females and upper lip height in males.
Conclusions This study provides objective reference material for the evaluation of the lower face when planning for rhinoplasty. Besides, the differences found between two groups emphasize the importance of the nasolabial region when planning for rhinoplasty.
Level of Evidence: Level II, diagnostic study.

Keywords Lower face · Anthropometry · Rhinoplasty · Measurement · Nose

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Introduction

A popular axiom concerning physical attractiveness is "Beauty is in the eye of beholder." Literature has identified many different factors that can be related to facial attractiveness including symmetry, averageness, sexual dimorphism, and adherence to ideal ratios [1]. However, attractiveness has proven to have such serious interpersonal and social consequences that science cannot exclude it from its realm of study.

The proportions of facial features have long been recognized as important determinants of the perception of facial attractiveness [2, 3]. Tessier believed that the appropriate proportion indices contributed to facial harmony and balance [4]. Edler recognized that the proportion indices could be useful in the objective quantification of facial attractiveness [5]. These facts have a significant bearing in rhinoplasty surgery, which aims to improve facial aesthetics by altering the dimensions and proportions of the central feature of the face [6, 7].

Lower face dimensions bear some relation to the clinical appearance of the nose [8, 9]. For this reason, when assessing patients for rhinoplasty, it is important to note and discuss the implications of preexisting disharmony in the lower face with the patient, since this may lessen the perceptual impact of improvements in the shape of the nose after surgery [10]. In the clinical setting, most diagnoses and treatment planning have been made by visual inspection. Anthropometric measurements could help surgeons perform objective and quantitative evaluations of the deformities, make preoperative and postoperative assessments, and decide surgical strategies [11–14].

Anthropometric evaluation begins with the identification of particular locations defined in terms of visible features on the subject. Traditionally, data from facial landmarks can be provided by the direct measurement technique using standard instruments. However, physical contact is required, resulting in some errors during the measurement session as most areas on the face are sensitive to touch [15]. For this reason, the latest reports about craniofacial anthropometry suggest photogrammetry technique [16].

In this study, we aimed to describe the average values of lower face anthropometric measurements in Turkish patients who applied for rhinoplasty and to compare these values with measurements of individuals who are pleased with their nasal appearance.

Patients and methods

Patient recruitment

The study was conducted at the Plastic, Reconstructive and Aesthetic Surgery Department of Ahi Evran University Hospital. Approval by ethical committee was obtained. All patients aged 18 years or older seeking rhinoplasty for aesthetic reasons between June of 2012 and February of 2014 were asked to participate. Participants and their families were Turkish and living in Anatolia. They were chosen with respect to geographical origins and economics status in order to form a homogenous group. Subjects were showing normal growth and development with the face; minimal crowding; no previous orthodontic, orthognathic, or prosthodontic treatment; and no craniofacial deformities or trauma. At the preoperative consultation, informed consent for photography was given by all patients and right lateral profile photographs were taken in the natural head position.

Instrumentation and procedure

The photographic setup consisted of a tripod that supported a digital camera (Canon EOS 60D). An easy adjustment of the tripod height allowed the optic axis of the lens to stay horizontal during the recording. The height of the camera was adapted to each subject's body height by lowering or raising the height of the tripod. The tripod and the camera were at the same distance for every recording. Each subject stood on an indicated line on the floor, asked to relax, and instructed to hang stand both arms freely beside their trunk. A vertical measurement scale, divided into millimeters, was placed behind the subject, which allowed for measurements at life size (1:1). A plumb line, suspending a 0.5-kg weight, held by a thick black thread to define the vertical plane on the photographs was hung from the scale. Approximately 120 cm in front of the subject, on the opposite wall, was a mirror marked with horizontal lines. Each subject had to look at his or her own eyes in a mirror, finding an eye level horizontal line, depending on the subject's height. Following this procedure, the right profile records were taken in natural head position, with the subjects' forehead, neck, and ear clearly visible and their lips in repose.

The photographic records were analyzed with the imageJ software. The millimeter paper was attached to the computer monitor. This produced the universal background. Every photograph was reduced to real size, overlaid over the abovementioned calibrating gauge, and oriented so that the true vertical line on the photograph was parallel with the vertical line of the computer monitor. Using the abovementioned method, all photographic records were scaled to life size and six landmarks were located on the digitized image to obtain seven vertical linear measurements. All image preparations and measurements were done by the same operator. Approximately 15 % of all lower face measurements were randomly selected to be measured again, and consistency testing was performed using the two measurements. Consistency varied between 0.928 and 0.997, showing a remarkable reliability of the measurements (Table 1).

On photographs of the facial profile, six landmarks were determined in the area of the lower face as shown in Fig. 1. Seven vertical profile measurements among these landmarks were taken (Fig. 2). Linear measurements were as follows:

Table 1 The evaluation of consistency between the measurements

Measurement	ICC	*p*
Sn-Me	0.983	<0.001
Sto-Me	0.997	<0.001
Sn-Sto	0.996	<0.001
Ls-Sto	0.928	<0.001
Sto-Sm	0.956	<0.001
Li-Sto	0.968	<0.001
Sm-Me	0.993	<0.001

ICC intraclass correlation coefficient

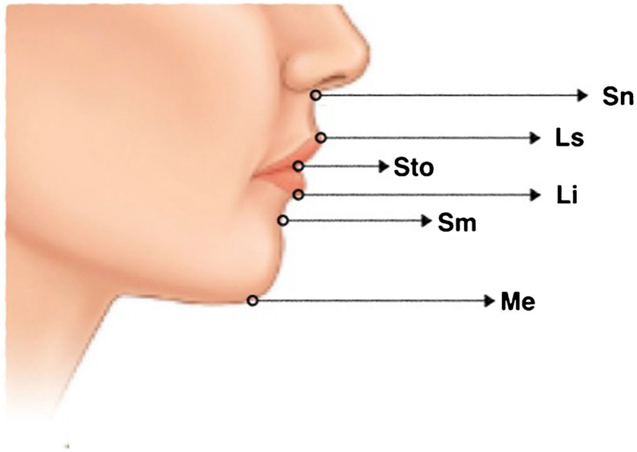

Fig. 1 The six landmarks used in the study are subnasale (*Sn*)—the point where the upper lip joins the columella; labrale superior (*Ls*)—the point that indicates the mucocutaneous limit of the upper lip; stomion (*Sto*)—the point where the upper lip contacts the lower lip; labrale inferior (*Li*)—the point that indicates the mucocutaneous limit of the lower lip; supramentale (*Sm*)—the deepest point of the inferior sublabial concavity; and menton (*Me*)—the most inferior point of the outline of the chin

- Height of the lower face (Sn-Me).
- Height of the lower third of the face (Sto-Me).
- Height of the upper lip (Sn-Sto).
- Height of the upper lip vermilion (Ls-Sto).
- Height of the lower lip (Sto-Sm).
- Height of the lower lip vermilion (Li-Sto).
- Height of the chin (Sm-Me).

Seven ratios were used to determine the relationships between vertical profile measurements in the lower face (Fig. 3). The ratios used in the present investigation were as follows:

- Ratio 1: upper vermilion height/upper lip height.
- Ratio 2: lower vermilion height/lower lip height.
- Ratio 3: upper vermilion height/lower vermilion height.
- Ratio 4: upper lip height/height of the lower face.
- Ratio 5: lower lip height/height of the lower third of the face.
- Ratio 6: lower lip height/chin height.
- Ratio 7: chin height/height of the lower third of the face.

Statistical analysis

The normality of variable distribution was tested by the Shapiro-Wilk test and variance homogeneity by Levene's test.

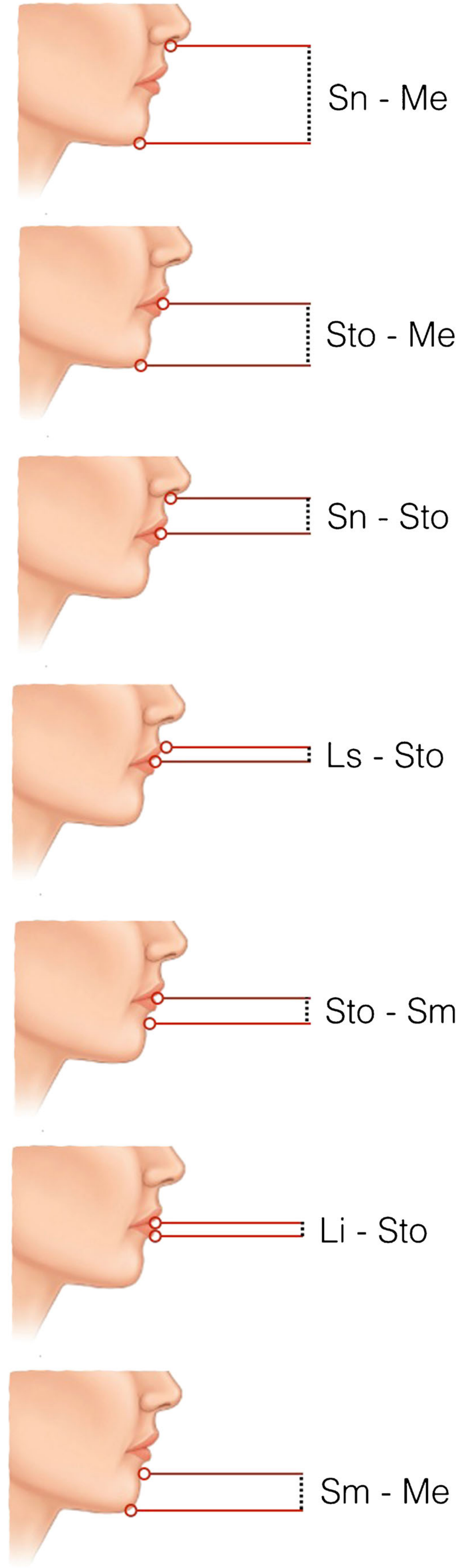

Fig. 2 The seven vertical linear measurements used in the study are *Sn-Me*—height of the lower face; *Sto-Me*—height of the lower third of the face; *Sn-Sto*—height of the upper lip; *Ls-Sto*—height of the upper lip vermilion; *Sto-Sm*—height of the lower lip; *Li-Sto*—height of the lower lip vermilion; and *Sm-Me*—height of the chin ▶

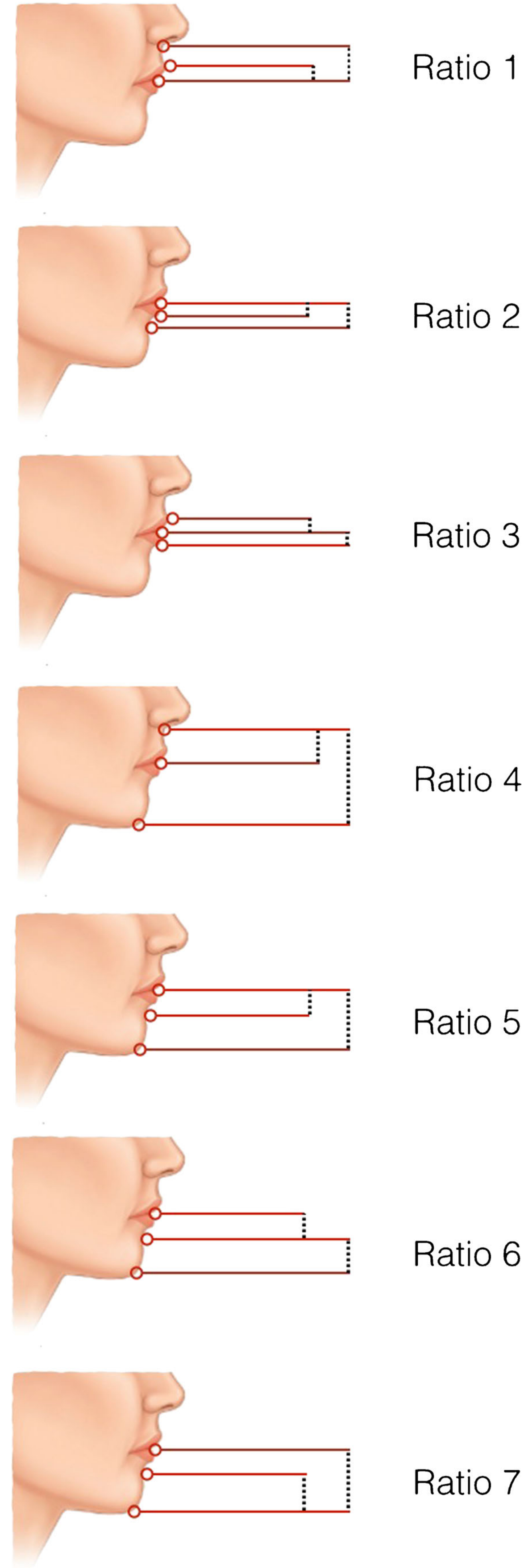

Fig. 3 The seven ratios used in the study are *ratio 1*—upper vermilion height/upper lip height; *ratio 2*—lower vermilion height/lower lip height; *ratio 3*—upper vermilion height/lower vermilion height; *ratio 4*—upper lip height/height of the lower face; *ratio 5*—lower lip height/height of the lower third of the face; *ratio 6*—lower lip height/chin height; and *ratio 7*—chin height/height of the lower third of the face

Group averages for variables satisfying parametric test requirements were compared with Student's *t* test and those which failed to satisfy such requirements were tested using the Mann-Whitney *U* test. Parameters were described as mean±1 standard deviation, median, and lowest and highest values. Correlations between variables were evaluated using either Pearson's correlation coefficient or Spearman's rho correlation coefficient according to the character of the variables' distribution. Consistency across measurements was checked by the intraclass correlation coefficient (ICC). A p value <0.05 was accepted as statistically significant. Data analysis was performed using the SPSS 1.0 software.

Results

Patient characteristics

Two hundred and nine patients sought an aesthetic rhinoplasty in our department between June of 2012 and February of 2014, of whom 197 met the inclusion criteria and 171 agreed to participate in the study. A control group was selected from individuals who were satisfied with their nasal appearance and were not considering aesthetic facial surgery. All patients and individuals included in the study were born in Turkey. Demographic characteristics of our rhinoplasty population and the control group are summarized in Table 2.

Vertical profile height measurements in the control group

Lower face vertical profile height measurements among different landmarks for the control group are shown in Table 3. The following variables were significantly higher in males than in females: height of the lower face, height of the lower third of the face, upper lip vermilion height, height of the lower lip, and chin height (p=0.001). No gender differences were found in the upper lip and lower lip vermilion heights (p>0.05).

The lower face was divided into three segments: upper lip lower lip and chin (Sm-Me). The largest portion of the lower face was occupied by the chin and the smallest by the lower lip height in both genders. Percentage of the contribution of these segments to the lower face height is shown in Fig. 4.

Table 2 Demographic characteristics of the rhinoplasty population and the control group

Demographic characteristics	Rhinoplasty group	Control group
No. of patients	171	252
Age, years	28±16	26±15
Sex		
Female	83	133
Male	88	119
Ethnicity		
Turk	149	227
Kurd	12	16
Arab	6	5
Laz	4	3
Armenian	0	1

Vertical profile height measurements in the rhinoplasty group

Lower face vertical profile height measurements among different landmarks for the rhinoplasty group are shown in Table 4. Almost all measurements were significantly greater in males than in females: height of the lower face, height of the lower third of the face, upper lip height, height of the lower lip, and chin height ($p=0.001$). Line graphs of the abovementioned variables are shown in Figs. 5, 6, 7, 8, and 9. The only variables with no gender differences were lower and upper vermilion heights ($p>0.05$).

The largest portion of the lower face was occupied by the chin and the smallest by the lower lip height in both genders. Percentage of the contribution of these segments to the lower face height is shown in Fig. 4.

Relationships between vertical measurements of the lower face in the rhinoplasty group

In the rhinoplasty group, the calculated height ratios and their comparison between genders are shown in Table 5. Significant differences between males and females were found in ratio 1 ($p=0.001$), ratio 2 ($p<0.05$), ratio 3 ($p<0.05$), ratio 4 ($p=0.001$), ratio 5 ($p<0.05$), and ratio 6 ($p<0.05$). All those ratios were greater in females than in males.

Highest correlations between measurements were observed between the upper lip vermilion height and upper lip height (ratio 1), lower lip vermilion height and lower lip height (ratio 2), upper lip height and lower face height (ratio 4), lower lip height and lower third of the face height (ratio 5), and lower lip and chin heights (ratio 6) ($p<0.001$). No correlation was found in females between the upper vermilion and lower vermilion heights (ratio 3) and chin height and height of the lower third of the face in both genders, which was the only negative correlation. All significant correlations were positive (Table 6).

Comparisons of vertical height measurements between control and rhinoplasty groups

Comparisons of the lower face vertical height measurements between the control and rhinoplasty groups are shown in Tables 7 and 8. In females, the only variable with a statistically significant difference between the two groups was the upper lip vermilion height ($p<0.01$). The upper lip vermilion height was found to be higher in the rhinoplasty group. In males, only the upper lip height showed a statistically significant difference between the two groups ($p<0.01$). The upper lip height was greater in the rhinoplasty group.

Discussion

Today, anthropometric methods and surgical practice intersected at the point to treat congenital or posttraumatic facial disfigurements in various ethnic groups. As the central feature of the face, the nose has a profound effect on facial aesthetics. The size, shape, and proportions of the nose provide a visual basis suggesting the character of the person. Aesthetic surgeons require access to facial databases based

Table 3 Descriptive statistics for the vertical profile measurements in the control group

	Females (n=133)		Males (n=119)		p
	Mean±SD	Min–max	Mean±SD	Min–max	
Sn-Me	69.808±5.648	53.67–85.54	73.285±5.484	58.67–86.33	0.001
Sto-Me	45.575±7.827	18.00–69.00	50.162±5.521	18.33–59.33	0.001
Sn-Sto	22.946±6.116	16.33–49.67	22.788±3.615	15.00–51.77	0.806
Ls-Sto	7.718±1.182	4.67–16.00	8.434±1.804	5.00–13.67	0.001
Sto-Sm	17.402±2.201	12.67–27.67	18.296±2.485	13.00–25.00	0.001
Li-Sto	10.104±1.384	6.67–14.50	10.492±1.909	6.33–15.52	0.702
Sm-Me	29.460±3.862	15.33–39.19	32.201±3.441	24.33–40.33	0.001

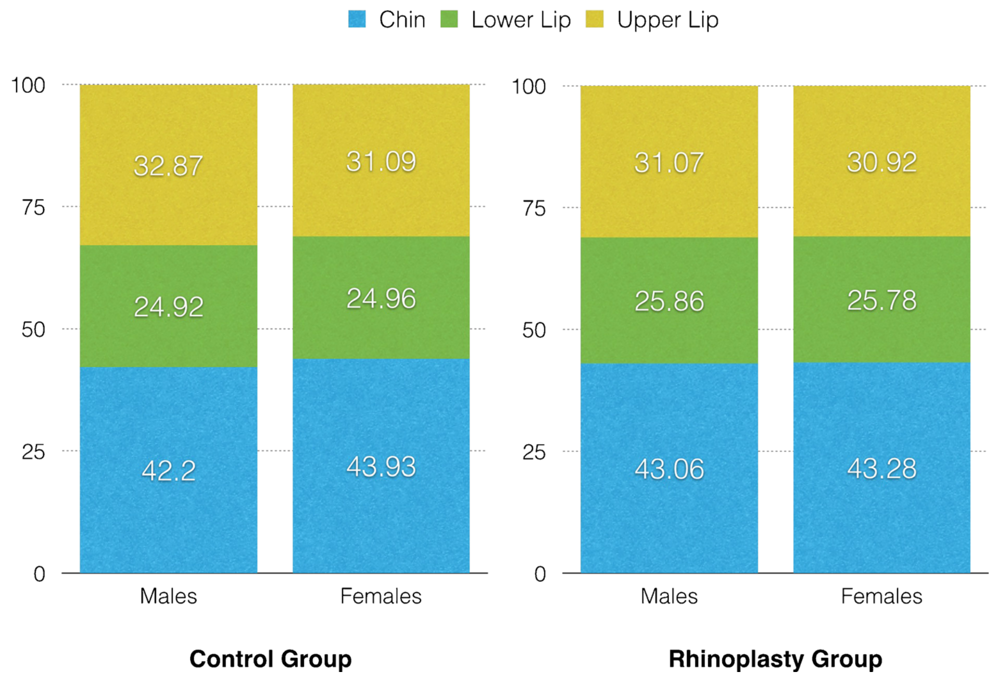

Fig. 4 Percentages of the contribution of the vertical upper lip length, vertical chin length, and vertical lower lip length in the lower face height

on accurate anthropometric measurements to perform optimum correction. There are several anthropometric studies related with the nose, which are bringing forward other different methods [17–22]. However, none of them involves data about the lower face anthropometrics. In the current study, we described the average values of the lower face anthropometric measurements in Turkish patients who applied for rhinoplasty.

It was one of the purposes of this investigation to determine the morphology of the lower face and to evaluate the dimensional values in the rhinoplasty-negative Turkish population who are pleased with their facial appearance. Similar to some previous reports, almost all measurements were greater in males than in females [23–30]. There were no gender dimorphism in the upper and lower vermilion heights. The great variability that was observed between individuals is an important requirement for individuality [31].

Although knowledge of the norm in a particular population is important for the facial analysis of patients, knowledge of the abnormal is also mandatory. We studied the lower facial aesthetic measurements of patients requesting rhinoplasty surgery and compared them with those of a control group. In the rhinoplasty group, we found that most measurements were greater in males. The only variables with no gender differences were the lower and upper vermilion heights. These findings coincide with the findings of Fernandez-Riveiro et al. [29] and Anić-Milosević et al. [23].

The lower vermilion height was greater than the upper vermilion height both in male and female patients. This agrees

Table 4 Descriptive statistics for the vertical profile measurements in the rhinoplasty group

	Females (n=83)		Males (n=88)		p
	Mean±SD	Min–max	Mean±SD	Min–max	
Sn-Me	68.932±5.245	53.67–85.54	73.481±4.560	60.33–84.07	0.001
Sto-Me	47.511±3.995	32.17–58.33	50.757±3.573	41.97–59.42	0.001
Sn-Sto	21.421±2.417	16.58–29.46	22.724±2.315	17.33–28.33	0.001
Ls-Sto	8.417±1.738	4.75–13.06	8.166±1.628	5.00–13.06	0.343
Sto-Sm	17.827±1.889	13.50–23.67	18.946±1.952	14.50–23.17	0.001
Li-Sto	10.703±1.489	6.69–14.50	10.664±1.418	7.17–13.83	0.488
Sm-Me	29.684±3.479	15.67–39.19	31.809±3.074	25.25–39.50	0.001

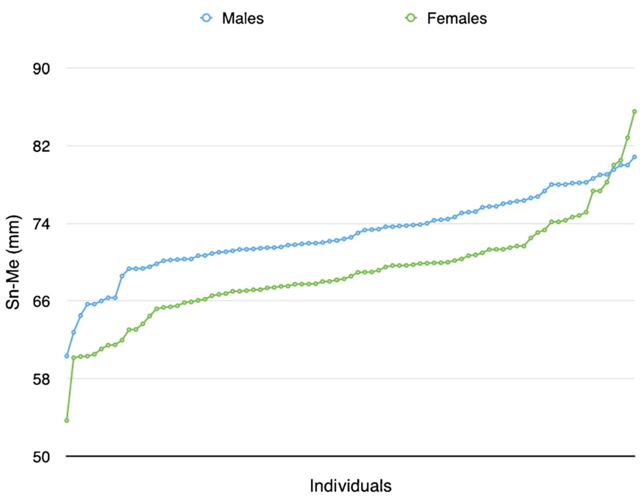

Fig. 5 Line graph of the height of the lower face (*Sn-Me*) regarding gender in the rhinoplasty group

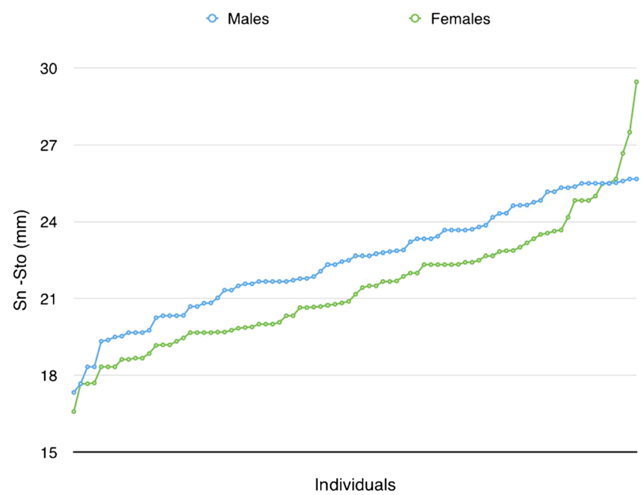

Fig. 7 Line graph of the vertical height of the upper lip (*Sn-Sto*) regarding gender in the rhinoplasty group

with the findings of Farkas et al. [26], Anić-Milosević et al. [23], and Bishara et al. [24, 25]. The difference between these values was greater in our study than reported by other authors. The height of the upper lip was larger in male patients than in female patients. This coincides with the findings of Arnett and Bergman [30], Fernandez-Riveiro et al. [29], Yuen and Hiranaka [28], Park and Burstone [27], Anić-Milosević et al. [23], and Farkas et al. [26]. Measurements of the lower lip height were also larger in male patients and were similar to the findings of the abovementioned authors.

Analysis in the area of the chin showed gender dimorphism characterized by increased height in male patients agreeing with the findings of Fernandez-Riveiro et al. [29] and Anić-Milosević et al. [23]. Park and Burstone [27] found no gender differences on the analysis of vertical chin height. The height of the lower third of the face was found to be greater in male patients than in female patients in accordance with the study of Anić-Milosević et al. [23].

The lower face height was divided into three vertically aligned segments: the upper lip, the lower lip, and the chin. Our results confirmed the findings of Farkas et al. [26] and Anić-Milosević et al. [23] that the largest portion was occupied by the chin and the smallest by the lower lip.

In this study, seven ratios were calculated to present some relationships within the lower face. The height of the upper vermilion in relation to the upper lip (ratio 1) was significantly larger in female patients. Anić-Milosević et al. [23] and Farkas et al. [26] reported the same finding regarding gender. The lower lip proportion (ratio 2) was

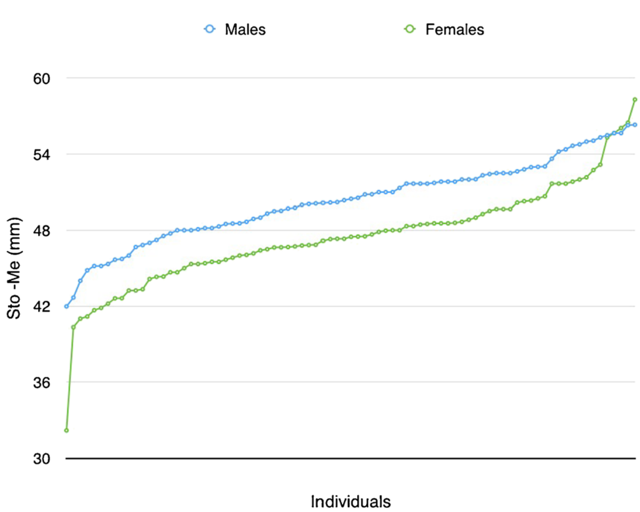

Fig. 6 Line graph of the height of the lower third of face (*Sto-Me*) regarding gender in the rhinoplasty group

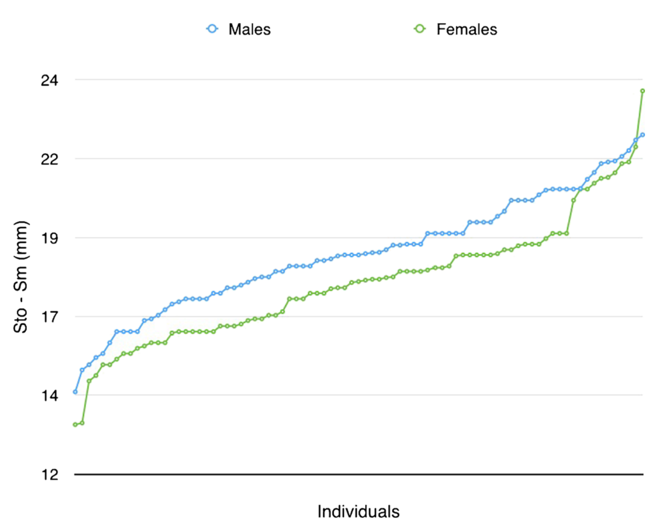

Fig. 8 Line graph of the vertical height of the lower lip (*Sto-Sm*) regarding gender in the rhinoplasty group

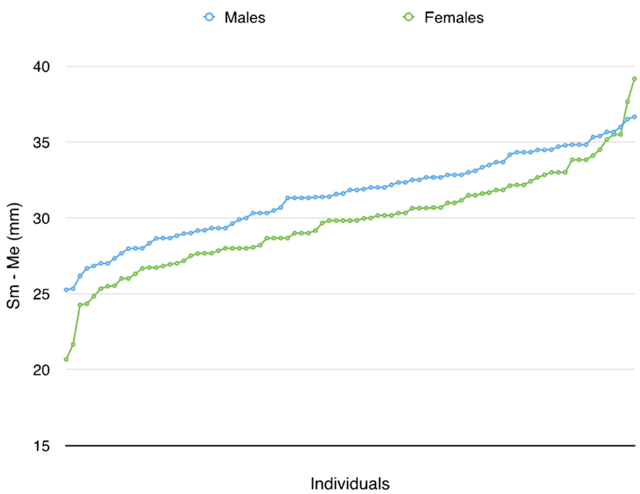

Fig. 9 Line graph of the vertical height of the chin (*Sm-Me*) regarding gender in the rhinoplasty group

Table 6 The correlations between the components of the height ratios

	Gender	Spear. rho	*p*
Ratio 1	Male	0.267	<0.001
	Female	0.163	<0.001
Ratio 2	Male	0.342	<0.001
	Female	0.366	<0.001
Ratio 3	Male	0.371	<0.001
	Female	0.105	0.314
Ratio 4	Male	0.625	<0.001
	Female	0.589	<0.001
Ratio 5	Male	0.557	<0.001
	Female	0.392	<0.001
Ratio 6	Male	0.067	<0.001
	Female	0.656	<0.001
Ratio 7	Male	−0.012	0.508
	Female	−0.015	0.882

significantly greater in female patients in agreement with the findings of Farkas et al. [26]. On the contrary, Anić-Milosević et al. [23] found no significant difference between genders.

The relationships between the upper and lower lip vermilions (ratio 3) showed a significant difference between male and female patients. Contrary to the results of the present study, Anić-Milosević et al. [23] and Farkas et al. [26] reported that the ratio of the upper vermilion height over the lower vermilion height did not show any significant difference between genders.

In our study, the upper lip height (ratio 4) occupied about one third of the face in both genders (males 30.92 %, females 31.08 %). Similar results were obtained by Anić-Milosević et al. [23] (males 33.04 %, females 32.38 %) and Farkas et al. [26] (males 32.4 %; females 31.1 %).

In female patients, the lower lip height in relation to the lower third of the face height (ratio 5) was significantly greater than in male patients (males 37.38 %; females 37.64 %). Similar results were obtained by Anić-Milosević et al. [23] (males 39.70 %, females 41.20 %). Farkas et al. [26] found that the lower lip height, on average, occupied a similar proportion of the lower third of the face in both genders (males 38.70 %; females 37.40 %).

The lower lip height reached 60.97 % of the entire chin height (ratio 6) in female patients. This was significantly greater than in male patients (60.14 %). Same results were obtained by Anić-Milosević et al. [23] (males 66.54 %, females 70.75 %). On the contrary, Farkas et al. [26] found no gender difference (males 63.70 %; females 59.90 %).

The chin proportion in relation to the lower third of the face (ratio 7) was not significantly different regarding gender in the rhinoplasty group; this coincides with the findings of Farkas et al. [26] (males 61.90 %; females 62.90 %). Anić-Milosević et al. [23] showed significant differences between males (60.21 %) and females (58.75 %).

In the comparison of vertical profile height measurements between the rhinoplasty and control groups, the

Table 5 The calculated height ratios and their comparison between genders in the rhinoplasty group

	Females (n=83)		Males (n=88)		*p*
	Mean±SD	Min–max	Mean±SD	Min–max	
Ratio 1	0.3952±0.0818	0.2481–0.6552	0.3618±0.0759	0.2208–0.6252	0.001
Ratio 2	0.6061±0.0995	0.3468–0.8438	0.5674±0.0879	0.3860–0.8462	0.045
Ratio 3	0.7969±0.1804	0.4805–1.4464	0.7762±0.1733	0.4578–1.2562	0.017
Ratio 4	0.3108±0.0258	0.2377–0.4006	0.3092±0.0244	0.2499–0.3608	0.001
Ratio 5	0.3764±0.0380	0.2569–0.5130	0.3738±0.0337	0.2774–0.4489	0.027
Ratio 6	0.6097±0.1029	0.3457–1.0532	0.6014±0.0866	0.3840–0.8147	0.027
Ratio 7	0.6236±0.0380	0.4870–0.7431	0.6262±0.0337	0.5511–0.7226	0.954

Table 7 Comparison of lower face vertical profile height measurements between the control and rhinoplasty groups in females

	Control group (n=133)		Rhinoplasty group (n=83)		p
	Mean±SD	Min–max	Mean±SD	Min–max	
Sn-Me	69.808±5.648	53.67–85.54	68.932±5.245	53.67–85.54	0.735
Sto-Me	45.575±7.827	18.00–69.00	47.511±3.995	32.17–58.33	0.077
Sn-Sto	22.946±6.116	16.33–49.67	21.421±2.417	16.58–29.46	0.161
Ls-Sto	7.718±1.182	4.67–16.00	8.417±1.738	4.75–13.06	0.002
Sto-Sm	17.402±2.201	12.67–27.67	17.827±1.889	13.50–23.67	0.077
Li-Sto	10.104±1.384	6.67–14.50	10.703±1.489	6.69–14.50	0.102
Sm-Me	29.460±3.862	15.33–39.19	29.684±3.479	15.67–39.19	0.667

only variable with a statistically significant difference in males was the upper lip height. The upper lip height was found to be greater in the rhinoplasty group. This finding should be taken into consideration when assessing patients for nasal tip surgery. In rhinoplasty, increasing the nasolabial angle by an upward rotation of the nasal tip influences the appearance of the upper lip and makes it look longer without increasing the upper lip height. For this reason, over-rotation of the nasal tip may overemphasize preexisting upper lip lengthiness in male patients.

In females, only the upper lip vermilion height showed a statistically significant difference between the two groups. The upper lip vermilion height was higher in the rhinoplasty group than in the control group. This finding necessitates the analysis of the upper lip in its subunits in profile including the vermilion. Upper vermilion lengthiness and fullness may lessen the perceptual impact of improvements in the shape of the nasal tip after surgery. This should be kept in mind especially when planning and performing tipoplasty.

The differences found between the control and rhinoplasty groups emphasize the importance of the nasolabial region when planning for rhinoplasty. The complex nasolabial region is composed primarily of two dominant aesthetic structures: the nose and the upper lip. What is really essential is a wide understanding of the changes that nasal reshaping produce on the upper lip. Secondary changes on the nasolabial unit that have occurred following rhinoplasty include the following: the widening of alar bases, changes in tip rotation, and alterations in the nasolabial angle. Appropriate presurgical planning to handle these effects may help in preventing many undesirable secondary changes in the lip.

Conclusion

To the best of our knowledge, our study is the first study of digital anthropometric shape analysis of the lower face on the patients who applied for rhinoplasty. We provided a reference material for the evaluation of the lower face when planning for a cosmetic nasal surgery. Besides, the differences found between the control and rhinoplasty groups emphasize the importance of the nasolabial region when planning for rhinoplasty.

Table 8 Comparison of lower face vertical profile height measurements between the control and rhinoplasty groups in males

	Control group (n=119)		Rhinoplasty group (n=88)		p
	Mean±SD	Min–max	Mean±SD	Min–max	
Sn-Me	73.285±5.484	58.67–86.33	73.481±4.560	60.33–84.07	0.328
Sto-Me	50.162±5.521	18.33–59.33	50.757±3.573	41.97–59.42	0.379
Sn-Sto	22.788±3.615	15.00–51.77	22.724±2.315	17.33–28.33	0.803
Ls-Sto	8.434±1.804	5.00–13.67	8.166±1.628	5.00–13.06	0.293
Sto-Sm	18.296±2.485	13.00–25.00	18.946±1.952	14.50–23.17	0.002
Li-Sto	10.492±1.909	6.33–15.52	10.664±1.418	7.17–13.83	0.879
Sm-Me	32.201±3.441	24.33–40.33	31.809±3.074	25.25–39.50	0.397

Ethical standards This work was approved by decision number 13/36 dated 03.02.2013 by the Başkent University Clinical Study Ethical Committee (project; KA 13:61) and therefore carried out in compliance with the Declaration of Helsinski.

Conflict of interest Ozan L. Abbas, Ayla Kürkçüoğlu, Can Pelin, Ayşe Canan Yazıcı declare that they have no conflict of interest.

Patients consent Informed consent was obtained from all individual participants included in the study.

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