

Analysis of Determinants of Postoperative Satisfaction After Rhinoplasty

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Objectives/Hypothesis: To analyze different variables that influence postrhinoplasty quality of life outcomes to ascertain the determinants of postoperative satisfaction.

Study Design: Prospective, observational study.

Methods: This was a prospective, observational study where patients were divided into two groups based on the postoperative Rhinoplasty Outcome Evaluation (ROE) score: high satisfaction group, when postoperative ROE scores were >50, and low satisfaction group, when postoperative ROE scores were ≤50. Patients' general characteristics, Portuguese version of the Nasal Obstruction Symptom Evaluation (NOSE-p) score, the Body Dysmorphic Disorder Examination, nasal angles, and measures from the esthetic facial analysis of postoperative photographs were compared between the groups.

Results: Seventy-eight patients were included: 19 in the low satisfaction group and 58 in the high satisfaction group. The median reduction in the NOSE-p score was −45 (interquartile range [IIQ] −20 to −60) ($P < .001$) in the high satisfaction group and −10 (IIQ −10 to −30) in the low satisfaction group ($P = .053$). The high satisfaction group had a significantly higher reduction in NOSE-p scores. There was no significant difference between the groups in terms of the analyzed facial parameters, although a significant difference was found when comparing them with the ones established in the literature as a pattern. Previous rhinoplasty, preoperative crooked nose, and higher NOSE-p scores were significantly associated with lower ROE scores ($P < .05$) in the robust Poisson regression model.

Conclusion: Functional results play an important role in satisfaction after rhinoplasty. Neoclassical canons were not fulfilled even in a group of patients with a high postoperative satisfaction evaluation.

Key Words: Rhinoplasty, nasal obstruction, quality of life, patient satisfaction.

Level of Evidence: 3

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INTRODUCTION

Rhinoplasty is the oldest esthetic surgical procedure performed in history. It was initially developed by Sushruta Samhita in ancient Greece and India.¹ According to the American Society of Plastic Surgeons, 207,284 rhinoplasties were performed in 2019, and it is among the five most commonly performed esthetic procedures worldwide.²

Rhinoplasty is an extremely challenging procedure in terms of satisfactory postoperative outcomes that requires accurate facial analysis and detailed preoperative

planning as the final result influences the overall facial appearance,³ nasal function, and quality of life.^{4,5}

Restoring or preserving nasal airflow is one of the objectives of rhinoplasty,⁶ and it is important to remember that nasal obstruction is a prevalent symptom in patients considering revision rhinoplasty.^{7,8} Furthermore, nasal function can influence postoperative satisfaction, even in purely esthetic rhinoplasty. Previous studies have described that patients complaining of postoperative nasal obstruction have worse postoperative esthetic evaluation.^{6,9}

Moreover, to ensure that patients are satisfied after rhinoplasty, every surgeon dedicates most of their time in the facial esthetic analysis and in the study of the patient's nose and its anatomical alterations, for complete and adequate surgical planning. In surgical planning, anthropometric parameters are important as models of beauty.¹⁰ However, studies have failed to prove them as representative measures for the general population.^{11,12} Likewise, a study that analyzed Italian models showed that some parameters appear to have changed over time.¹³

A few other studies have attempted to find a relationship between neoclassical canons and ideal measures for postoperative satisfaction in rhinoplasty. Ozturk et al.¹⁴ described that nasal dorsal alignment was the only objective parameter that correlated with the

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patient's esthetic perception. Zojaji et al.,¹⁵ in an Iranian prospective study, reported no significant association between patient satisfaction and facial proportions, such as nasolabial angle, nasofacial angle, and nasal tip measures.

Unfortunately, unsatisfactory outcomes after rhinoplasty do not depend solely on good nasal airflow and adequate measures or nasal angles. Psychological and personality traits are extremely important in this context. Body dysmorphic disorder (BDD) symptoms are prevalent among patients who seek rhinoplasty and other cosmetic procedures. Body image dissatisfaction is a major factor in this disorder that may affect patient satisfaction with the results of esthetic surgical procedures. Some authors suggest that every rhinoplasty candidate should be evaluated for BDD symptoms.^{16,17}

The final goal of rhinoplasty is the patient's well-being after the procedure, which depends on multiple variables and is difficult to assess and to compare. This study aimed to objectively analyze the association of the Rhinoplasty Outcome Evaluation (ROE) score, a widely used validated quality of life outcome in rhinoplasty, with nasal obstruction validated scores, specific nasal facial analysis measures, and BDD symptoms to identify the determinants of postoperative satisfaction.

MATERIALS AND METHODS

Study Design and Patients

This was a single-center, prospective, observational study conducted at the Facial Plastic Surgery Clinic of Otolaryngology department of our institution, a tertiary care university hospital in

Brazil. Patients who underwent either primary or revision rhinoplasty between 2010 and 2019 and were older than 16 years with at least 6 months of postoperative follow-up were included. These patients were first admitted to the institution for management of nasal obstruction and during clinical evaluation also manifested esthetic complaints. The research protocol was approved by the Ethics and Research Committee of the Hospital de Clínicas de Porto Alegre. Written informed consent was obtained from each patient prior to enrollment (no. 09471118.0.0000.5327).

Data Collection

All patients completed the preoperative evaluation through a brief questionnaire that determined their demographic and baseline characteristics. Nasal Obstruction Symptom Evaluation (NOSE-p), ROE, and Body Dysmorphic Disorder Examination (BDDE) scales were applied before and after rhinoplasty in all postoperative appointments.

The patients were also submitted to postoperative standardized photographs, which were taken by the same medical photographer, with the same camera and standardization. The incidences were anteroposterior and right profiles. All patients had standard photographs: open eyes, closed lips, and looking at a horizontal plane, with a 30-cm ruler at the side of the face for posterior calibration.

Definition of Groups

The ROE scale is a quality of life scale comprising six questions in three quality-of-life domains: physical, mental/emotional, and social. Each question was scored from 0 to 4 on a Likert-type scale, and total scores were converted to range from 0 to 100 by dividing by 24 and multiplying by 100. Higher scores indicate

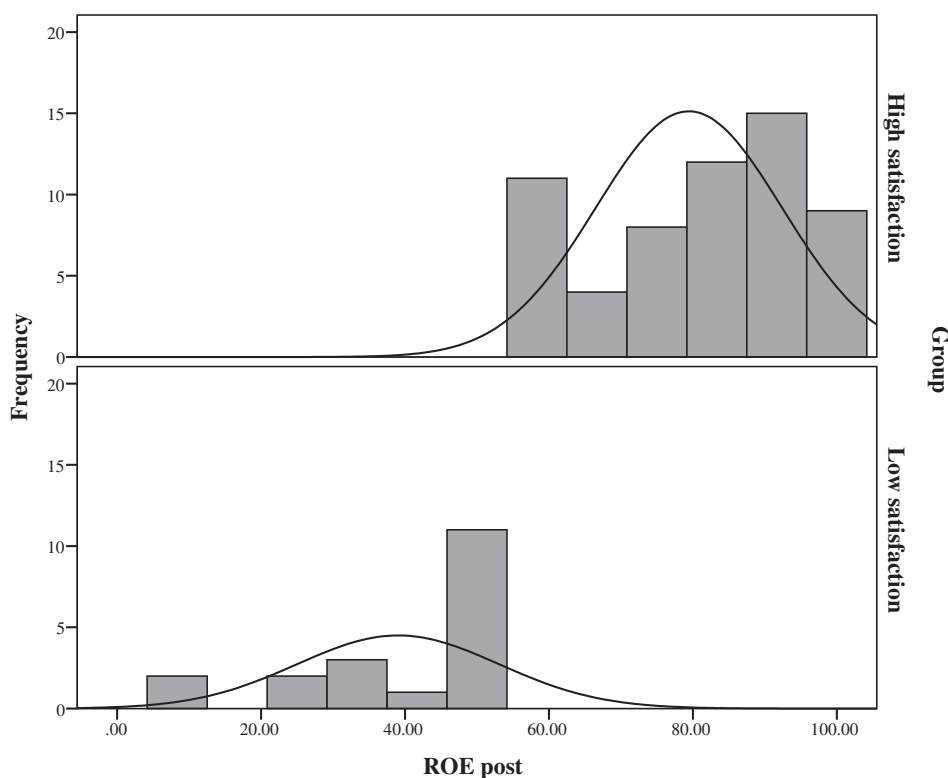


Fig. 1. Distribution of postoperative Rhinoplasty Outcome Evaluation (ROE) scale between the high satisfaction and low satisfaction groups.

greater satisfaction, and a score of 0 represents major dissatisfaction.¹⁸ Based on the postoperative ROE score, patients were divided into two groups: high satisfaction group, when postoperative ROE scores were >50, and low satisfaction group, when postoperative ROE scores were ≤50. The distribution of postoperative ROE in each group is shown in Fig. 1.

Outcomes

Nasal Obstruction Symptom Evaluation.

Functional outcomes between the groups were assessed using the NOSE-p, a quality-of-life questionnaire¹⁹ that comprises five obstruction-related items addressing the severity of a patient's complaints within the past month. Total scores range from 0 to 100, with higher scores indicating greater severity of problems related to nasal obstruction. NOSE-p variation was calculated as the difference between preoperative and postoperative scores.

Body Dysmorphic Disorder Examination. The Brazilian version of the BDDE was also administered to the included patients. This is a validated quality-of-life measurement used to evaluate a patient's perception of body image. The questionnaire included 34 questions that evaluated the degree of dissatisfaction related to a given physical feature to facilitate the diagnosis of BDD. The score variation ranged from 0 to 168, and a score greater than 66 was considered clinically relevant. The total score on the BDDE is calculated as the sum of ratings for the 28-symptom items (all items except 1, 2, 3, 22, 33, and 34). This provides an overall severity index that considers all BDD symptoms. It is important to highlight that, for the diagnosis of BDD, specific criteria must be fulfilled, which was not the goal of this study. Previous studies have described the association between the severity of BDD symptoms and mean BDDE total score.^{16,20,21}

Anthropometric Parameters

In addition, analysis of facial proportions, nasal angles, and measures of postoperative photographs were performed using

the Rhinobase[®] software by a blind researcher. In this software, a photometric analysis is performed through a calibration based on a ruler presented in the picture at the side of the patient's face, and the landmarks (trichion, glabella, nasion, tip, subnasale, and menton) were marked on the pictures, which helped Rhinobase to automatically calculate the required distances and angles.²² The results were analyzed posteriorly by the groups.

Sample Size

The sample size was calculated to detect a 5° difference in the nasolabial angle between the high and low satisfaction groups, using the study by Zozaji et al.¹⁵ In this study,¹⁵ the standard deviation (SD) of the nasolabial angle was 7 before rhinoplasty (used as a reference for the low satisfaction group) and 6 in the postoperative rhinoplasty (used as reference for the high satisfaction group). A 5% significance level and a power of 80% were used to calculate a total sample size of 67 patients divided into two groups in a 3:1 subject ratio. With this sample size, it is possible to detect a difference of 80% in the SD of any of the analyzed quantitative variables, considering a 5% significance level and a power of 80%.

Statistical Analyses

Statistical analyses were performed using SPSS version 18.0.3 (IBM Corp., Armonk, NY). Normally distributed variables, described using means and SDs, were analyzed using an independent-sample Student's *t* test. Nonparametric variables were described using medians and interquartile ranges and were compared using the Mann-Whitney *U* test. For comparison within the groups, paired-sample Student's *t* test and Wilcoxon test for normally distributed variables and nonparametric variables were used, respectively. Qualitative data were described as numbers and percentages and were analyzed with Pearson's χ^2 test; if necessary, Yates' continuity correction or Fisher's exact test was used. A robust Poisson regression model was developed to estimate the relative risk of some characteristics for low postoperative satisfaction. The characteristics used in this regression

TABLE I.
Patient Characteristics (*n* = 78).

Characteristics, n (%), Mean (SD) or Median (IR)	High Satisfaction (59)	Low Satisfaction (19)	<i>P</i> Value
Sex (female)	34 (57.6)	12 (63.2)	.874
Age, yr	37.43 ± 17.3	36.37 ± 14.42	.808
Self-reported race/ethnicity (Caucasian)	52 (88.1%)	15 (78.9%)	.448
Allergic symptoms	45 (76.3)	17 (89.5)	.330
Postoperative follow-up	12 (7–31)	15 (12–25)	.292
Comorbidities	21 (35.6)	8 (42.1)	.812
Type			.219
Hypertension	6 (28.6)	3 (37.5)	
Asthma	4 (19.0)	2 (25.0)	
Psychiatric disorder	1 (4.8)	2 (25)	
Others	10 (47.6)	1 (12.5)	
Prior nasal surgery	16 (27.1)	8 (42.1)	.345
Type			.423
Rhinoplasty	10 (62.5)	7 (87.5)	
Septoplasty	5 (31.3)	1 (12.5)	
Nasal trauma	11 (18.6)	6 (31.6)	.337

IR = interquartile range; SD = standard deviation.

model were those that correlated with low satisfaction in the univariate analysis ($P < .05$) or others with clinical relevance.

RESULTS

Of the 78 patients included in this study, 59 were classified into the high satisfaction group (postoperative ROE score >50) and 19 in the low satisfaction group (postoperative ROE score ≤ 50) (Table I).

A significant postoperative increase in ROE scale scores was recorded in both the groups (34.37 vs. 80.28 in the high satisfaction group [$P < .001$]; 29.60 vs. 39.03 in the low satisfaction group [$P < .001$]). In addition, a significant difference was observed between the groups in the delta ROE score (45.90 vs. 9.42 in the high satisfaction group vs. low satisfaction group [$P < .001$]). As expected, more patients in the low satisfaction group were candidates for revision rhinoplasty than in the high satisfaction group (8 [42.1%] vs. 2 [3.4%], respectively [$P < .001$]).

Most patients had septal deviation in the preoperative clinical evaluation in both the groups (high

satisfaction group, 55 [93.2%]; low satisfaction group, 16 [84.2%]; $P = .352$). In the postoperative evaluation, a significant difference was found between the groups when the residual septal deviation was analyzed (high satisfaction group, 10 [16.9%]; low satisfaction group, 9 [47.4%]; $P = .013$).

A significant reduction in the delta NOSE-p score was observed in both the groups. The median reduction in NOSE-p score was -45 (IIQ -20 to -60) ($P < .001$) in the high satisfaction group and -10 (IIQ -10 to -30) in the low satisfaction group ($P = .053$). In addition, when comparing the two groups, the high satisfaction group had a significantly higher reduction in NOSE-p scores (Fig. 2).

BDDE analysis revealed that 12 patients (27.3%) in the high satisfaction group and seven (43.8%) in the low satisfaction group had 66 or more points in the preoperative evaluation, which is a possible cut-off point for relevant symptomatology. No significant differences were found between the groups. The high satisfaction group had a significant reduction in the postoperative BDDE score, with a median of 47 (IIQ, 21–73) versus 18 (IIQ, 6.5–33.5) ($P < .001$). The low satisfaction group showed no significant difference in postoperative BDDE score. BDDE score variation was higher in the high satisfaction group than in the low satisfaction group (median of reduction -23 [IIQ, -45 to -3] vs. 4 [IIQ, -15 to 23] [$P = .014$]). Therefore, in our study, patients with higher rates of postoperative satisfaction, according to the ROE score, also showed a significant reduction in the postoperative BDDE score and symptoms related to body image dissatisfaction. However, no association was found between the preoperative BDDE scores and postoperative satisfaction rates.

There was no significant difference between the groups in terms of the analyzed facial parameters ($P > .05$; Tables II and III). In addition, the columellar and alar positions did not differ between the groups ($P > .05$).

Comparing the results obtained in both the groups of this study and those presented in the literature, the population measurements were statistically different from the esthetic ideal parameters (Table IV).

A robust Poisson regression model was developed to estimate the relative risk of certain characteristics for low postoperative satisfaction. The characteristics used

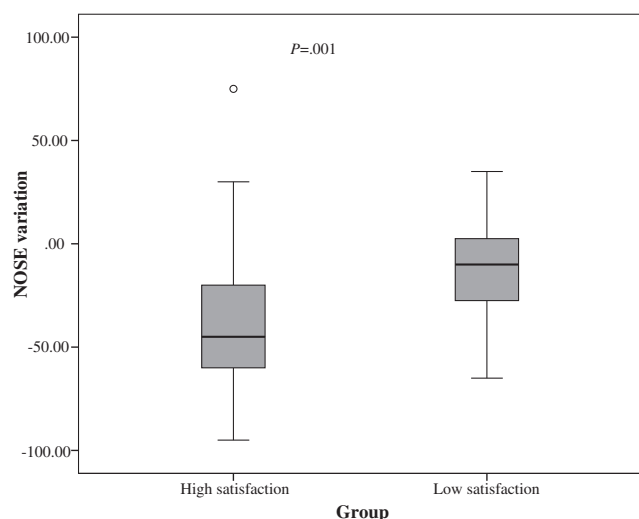


Fig. 2. Box whisker plots of variation (pre and postrhinoplasty) in Nasal Obstruction Symptom Evaluation-Portuguese (NOSE-p) scale between the high satisfaction and low satisfaction groups.

TABLE II.
Postoperative Facial Angles According to Postoperative Satisfaction.

Parameters	High Satisfaction Group Mean (95% CI)	Low Satisfaction Group Mean (95% CI)	P Value
Nasofrontal			
Women	147.24 (144.21–150.26)	147.75 (143.14–152.36)	.483
Men	144.88 (142.29–147.47)	147.43 (142.45–152.40)	
Nasolabial			
Women	112.79 (108.01–117.56)	110.80 (104.73–116.88)	.893
Men	110.00 (104.63–115.36)	112.00 (104.41–119.58)	
Nasofacial	30.99 (30.28–31.71)	30.08 (27.84–32.32)	.424
Nasomental	130.55 (129.53–131.58)	131.21 (127.04–135.37)	.754

CI = confidence interval; SD = standard deviation.

TABLE III.
Postoperative Facial Parameters by Groups.

Parameter	High SatisfactionMean (SD)	Low SatisfactionMean (SD)	P Value
Height of nasium	1.98 (±1.35)	2 (±1.33)	.950
Radix	18 (±3.72)	19.57 (±3.76)	.125
Percentage of calculated radix	24.91 (±26.48)	33.95 (±27.49)	.204
Simons tip projection	0.71 (±0.12)	0.73 (±0.14)	.576
Goode tip projection	29.40 (±3.53)	29.88 (±4.28)	.623
Percentage of calculated Goode tip projection	17.40 (±14.43)	19.53 (±16.51)	.592
Alar/intercanthal distance ratio	1.03 (±0.12)	1.02 (±0.16)	.660
Alar width/length ratio	85.90 (±13.59)	89.05 (±10.64)	.359

SD = standard deviation.

TABLE IV.
Statistical Analysis of Nasal Proportions by Group in Comparison With Esthetic Ideals.

Parameter	Ideal Value	High SatisfactionMean (SD)	P Value*	Low SatisfactionMean (SD)	P Value**
Nasofacial angle	35 (30–40) ¹⁵	30.99 (2.73)	<.001	30.08 (4.64)	<.001
Nasomental angle	126 (120–132) ¹⁵	130.55 (3.972)	<.001	131.21 (8.63)	.017
Nasolabial angle (women)	103 (95–110) ³³	112.79 (13.68)	<.001	110.80 (9.56)	.016
Nasolabial angle (men)	93 (90–95) ³³	110 (12.99)	<.001	112 (8.20)	.001
Nasofrontal angle (women)	120 (115–125) ¹⁵	147.24 (8.68)	<.001	147.75 (7.26)	<.001
Nasofrontal angle (men)	125 (120–130) ¹⁵	144.88 (6.28)	<.001	147.43 (5.38)	<.001
Alar/intercanthal distance ratio	1 ^{10,34}	1.03 (0.12)	.033	1.02 (0.16)	.602
Altura nasium	5 ²²	1.98 (1.35)	<.001	2 (1.33)	<.001

*Comparison between ideal values and the high satisfaction group.

**Comparison between ideal values and the low satisfaction group.

SD = standard deviation.

TABLE V.
Risk Factors to Low Satisfaction Scores After Rhinoplasty Using Robust Poisson Regression Model Analysis.

Variable	P Value	Relative Risk*	95% CI	
			Lower Limit	Superior Limit
Postoperative septal deviation	.232	1.700	0.713	4.055
Allergic symptoms	.882	1.086	0.363	3.246
Previous rhinoplasty	.010	2.854	1.282	6.354
Nasal trauma	.473	1.401	0.557	3.522
Crooked nose	.020	2.212	1.133	4.319
Postoperative NOSE-p score	.038	1.013	1.001	1.026
Preoperative ROE score	.178	0.937	0.853	1.030
Preoperative BDDE score	.759	0.998	0.984	1.012
Nasolabial angle	.917	1.002	0.970	1.034

*Relative risk for low satisfaction after rhinoplasty.

BDDE = Body Dysmorphic Disorder Examination; CI = confidence interval; NOSE-p = Nasal Obstruction Symptom Evaluation; ROE = Rhinoplasty Outcome Evaluation.

Bold values signifies $p < 0.05$.

in this regression model were those that correlated with low satisfaction in the univariate analysis ($P < .05$) and others with clinical relevance (Table V). Previous rhinoplasty, a preoperative crooked nose, and higher NOSE-p scores were significantly associated with lower ROE scores ($P < .05$).

DISCUSSION

Nasal function is an important outcome in rhinoplasty because nasal obstruction is one of the causes of revision rhinoplasty, in addition to negatively impacting quality of life. All patients in this study showed a significant

reduction in the NOSE-p scores after surgery. These findings are consistent with those of other studies.²⁵

The variation in the preoperative and postoperative NOSE-p scores was correlated with higher postoperative ROE scores and satisfaction, which is consistent with the concept of form and function as a unity in rhinoplasty. Ozturk et al.¹⁴ reported that among 50 patients who underwent cosmetic or functional rhinoplasty, the patient's overall postoperative nasal health and satisfaction score were significantly correlated with both nasal breathing and nasal appearance scores. Radulesco et al.,⁶ in a study that correlated function and esthetic results, concluded that patients complaining of postoperative nasal obstruction had a worse esthetic evaluation than others. Previous studies described respiratory problems as the main reason for revision surgery in 8.7%⁸ and 62%²⁶ of patients, respectively.

Septal deviation is common among rhinoplasty candidates and must always be carefully evaluated. The nasal septum plays a critical role in nasal airflow and external nasal appearance, as it is responsible for the support of the external nose.²⁷ In our study, upon performing univariate analysis, it was observed that the low satisfaction group had a residual septal deviation more frequently than the high satisfaction group (9 [47.4%] and 10 [16.9%], respectively; $P = .013$). However, in the robust Poisson regression model, postoperative septal deviation was not correlated with lower satisfaction ($P > .05$).

A crooked nose is a challenge for rhinoplasty surgeons who desire good functional and esthetic results.^{28,29} In general, this is attributed to a complex septal deviation, asymmetric nasal bones, and cartilages, but can also be part of an asymmetric face. Trauma, previous surgery, or congenital deformities can cause a twisted nose.²⁸ In the current Poisson regression model, patients with a crooked nose had a relative risk of 2.212 ($P = .020$) to present a lower postoperative ROE score. This result emphasizes that a crooked nose is a possible risk factor for worse postoperative outcomes in terms of satisfaction.

Objective facial analysis was performed, and no statistical differences between the groups in terms of satisfaction were found. Therefore, measurements such as nasolabial, nasofrontal, and nasofacial angles, height of the nasium, and tip projection means, did not differ between the high and low satisfaction groups based on the ROE score.

The differences between standard measurements based on neoclassical canons and those found in this study, even among patients with high postoperative satisfaction, confirm that the concept of beauty is variable and changes over the years and is also influenced by the patients' ethnic origin.

Neoclassical canons define the ideal face and are used to analyze an attractive face. They were referenced from ideal, yet ancient, standards of beauty derived from a small group of people and do not represent the majority.³⁰ Previous anthropometric studies also could not apply most neoclassical canons to the general population.^{11,12,31,32}

The current population is mostly Caucasian. In addition, most Caucasian nose characteristics were maintained after surgery in both the groups. The characteristics of Caucasian noses are well-developed nasal bones with

a high radix, narrower dorsum, well-defined and well-projected tips, slightly obtuse nasolabial angle, adequate tip rotation, and thin skin envelope.²³

No differences in preoperative BDD symptoms were observed between the groups in this study. The BDDE score in the high satisfaction group significantly decreased during the postoperative period. Felix et al.²⁴ described a similar reduction in BDD symptoms in postoperative rhinoplasty patients with mild and moderately severe BDD, whose dissatisfaction with appearance is focused on the nose. However, most patients in this study did not meet the criteria for the diagnosis of the disorder or even a score with clinical relevance. The only conclusion that the current analysis permits is that, amongst patients with higher postoperative ROE scores, a reduction in body dissatisfaction was observed.

This study had some limitations. Most anthropometric studies are based on the facial analysis of models or misses to create beauty parameters. This study, however, included people in general, and compared these parameters with the nasal measurements of patients after rhinoplasty. Therefore, these well-established beauty parameters were tested in a real-world setting and even the patients with higher postoperative satisfaction failed to fit the classic model.

In our study, the nasal functional outcome might be even more important because these patients were first admitted to the otolaryngology clinic for the management of nasal obstruction, and then during evaluation, manifested esthetic issues. This may explain the low prevalence of BDD among the included patients.

The postoperative surveys were completed with variable durations of follow-up between patients which could be a limitation because it may have affected the results. The relatively small number of patients may limit the power of the study; thus, we included the most important variables in the robust Poisson regression model to avoid confounding factors.

Another limitation is the fact that the analysis was performed using two-dimensional photographs, like the clinical practice of most rhinoplasty surgeons in Brazil, and the nose is a well-known three-dimensional structure.

Finally, in this study, photogrammetric analysis was performed in the postoperative period alone because preoperative photographs did not have the same standardization to enable a comparison of measurements before and after rhinoplasty.

Despite these limitations, this study was able to determine important factors related to the risk of lower postoperative satisfaction in rhinoplasty.

CONCLUSION

Functional outcomes play an important role in satisfaction and quality of life after rhinoplasty. Neoclassical canons were not fulfilled even in a group of patients with a high postoperative satisfaction evaluation. These might be associated with changes in beauty concepts through the centuries and also because many characteristics of patients influence general satisfaction, including ethnicity, sex, height, personality, and personal expectations. It

is undeniable that facial and nasal beauty parameters are truly important guides for facial plastic surgeons. However, the association of classical parameters, the surgeon's sense of beauty, and knowledge of the patient's preferences is better in achieving a successful postoperative treatment and a happy patient.

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