Objective Assessment of Facial Asymmetry in Rhinoplasty Patients

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Objectives: To determine the incidence and nature of facial asymmetry in patients referred for consideration of aesthetic rhinoplasty and to assess whether objective anthropometric facial measurements correlate with subjective perceptions of asymmetry.

Design: Two independent observers measured facial features, including midline to medial and lateral canthi, tragus, ala, and oral commissure distances, in 234 prerehionoplasty surgical photographs. The photographs were rated by 10 independent observers for a global “first impression” of facial symmetry, and the relationship between anthropometric measurement and subjective perception of facial symmetry was explored with logistic regression.

Results: Objectively, 97% of patients had significant degrees of facial asymmetry, with the midline to ala distances showing the most variations and the midline to oral commissures showing the least variations. Subjectively, 38% of results were perceived as asymmetrical, with the degree of midline to lateral alar margin asymmetry being an independent predictor of the perception of facial asymmetry on binary logistic regression (P<.003).

Conclusions: A significant correlation was found between the degree of objective facial asymmetry, particularly in anthropometric nasal measurements, and the subjective perception of a face as asymmetrical in patients requesting aesthetic rhinoplasty. This relationship may be a factor in patients who request rhinoplasty and should be explored in this patient group.

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The proportions and symmetry of facial features have long been recognized as determinants of the perception of facial attractiveness.1,2 These findings have significant bearings in rhinoplasty surgery, which aims, inter alia, to improve facial aesthetics by altering the dimensions and proportions of the central feature of the face.3,4 Furthermore, when assessing patients for rhinoplasty, it is important to note and discuss the implications of preexisting facial asymmetry with the patient, since they may lessen the perceptual impact of improvements in the shape of the nose after surgery.5,6 Our goals were to document the incidence and nature of facial asymmetry in a large population of patients requesting rhinoplasty surgery and to explore whether any correlations exist between objective anthropometric measurements of facial symmetry and subjective perceptions of the face as symmetrical or asymmetrical.

METHODS

ANTHROPOMETRIC MEASUREMENTS

All photographs were shown to 10 individuals (5 from medical and 5 from nonmedical backgrounds), none of whom were directly involved in the design or analysis of the study or the care of patients. The photographs were loaded onto a PowerPoint (Microsoft Corp, San Jose, Calif). Anthropometric measurements were obtained based on facial soft tissue landmarks,6 starting with an imaginary sagittal line that begins in the central hairline point and crosses the central point of the nasal bridge, the central point of cupid’s bow in the upper lip, and the bottom of the chin (Figure 1). The absolute values thus obtained were converted to ratios by dividing the measurements from the 2 sides. Given that some patients were more asymmetrical on the left and others on the right and that the variable of interest was the degree and not the laterality of asymmetry, the ratios were always calculated by dividing the smaller number by the larger.

PERCEPTUAL DOMAIN ANALYSIS

The anteroposterior preoperative photographs of 300 patients requesting rhinoplasty surgery taken in the Frankfurt position, the plane of view most conducive to the study of nasal and facial symmetry, were studied. Sixty-six photographs were excluded from analysis because they were not oriented in a strictly midline plane or because they were oriented in a plane in which measurements could not be accurately obtained owing to the presence of excess facial hair or blurring. All measurements were made by 2 independent observers. Photographs were inspected with commercially available software (Adobe Photoshop Version 7.0; Adobe Inc, San Jose, Calif). Anthropometric measurements were obtained based on facial soft tissue landmarks,6 starting with an imaginary sagittal line that begins in the central hairline point and crosses the central point of the nasal bridge, the central point of cupid’s bow in the upper lip, and the bottom of the chin (Figure 1). The absolute values thus obtained were converted to ratios by dividing the measurements from the 2 sides. Given that some patients were more asymmetrical on the left and others on the right and that the variable of interest was the degree and not the laterality of asymmetry, the ratios were always calculated by dividing the smaller number by the larger.
Redmond, Wash) slide show and shown sequentially to each observer. A period of 3 seconds was allowed for viewing each photograph, followed by a 3.5-second window during which the viewer was asked to express his or her opinion as to whether the face looked symmetrical or not. The opinions were recorded by one of us (J.A.). A 1-minute break was introduced after every 20 photographs and a 5-minute break after every 75 photographs. Because the slide show was designed according to an automated fixed schedule, no opportunity for variation between viewers resulting from variations in viewing times was possible. A brief viewing time was deliberately chosen to optimize the chances of obtaining the global first impression of the viewer as to the state of symmetry of the face. A face was considered symmetrical if more than half of the viewers considered it so.

### STATISTICAL ANALYSIS

The degree of facial asymmetry between men and women and the different racial groups and the differences in the degree of asymmetry between the different regions of the face were compared using analysis of variance with post hoc Student-Newmann-Keuls tests. When the data were not normally distributed and the normality of distributions were tested using the Anderson-Darling test, the Kruskal-Wallis test with the Dunn method of post hoc comparisons was used instead. The relationship between the degree of objective facial asymmetry and subjective perception of a face as symmetrical or asymmetrical was explored with binary logistic regression analysis. The relationship between the degree of objective facial asymmetry and subjective perception of a face as symmetrical was explored with receiver operating characteristic plots. \( P < .05 \) was considered significant, and data were analyzed and illustrated using commercially available statistical software (MedCalc; Mariakerke, Belgium).

### RESULTS

There were 116 women and 118 men in our study. There were no significant differences in the degree of facial asymmetry between men and women in midline to tragus and midline to oral commissure distances, but there were significant differences between the sexes when midline to canthi and midline to lateral alar margin distances were compared, with women exhibiting lesser degrees of facial asymmetry than men (Table 1). We found no significant differences in the degree of facial asymmetry between the different races. No patient had a “perfectly symmetrical” face, and all patients showed some degree of facial asymmetry in 1 or more of their anthropometric measurements (Figure 2). There were significant differences in the degree of facial asymmetry between the different regions of the face (Table 2). However, only 38% of faces were considered asymmetrical on subjective assessment by 10 independent observers. A stepwise binary logistic regression analysis, using the subjective perception of symmetry as a dichotomous outcome and each patient’s race, sex, and different anthropometric ratios as input variables, identified the midline–lateral alar margin ratio as a significant independent predictor of the subjective perception of asymmetry \( (P < .003) \). Receiver operating characteristic analysis failed

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**Table 1. Degree of Facial Symmetry Between Different Ethnic Groups and Between Men and Women**

<table>
<thead>
<tr>
<th>Variable</th>
<th>( R_{MLLC} )</th>
<th>( R_{MLMC} )</th>
<th>( R_{MLAM} )</th>
<th>( R_{MLOC} )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M (n = 118)</td>
<td>0.94 ± 0.05</td>
<td>0.95 ± 0.05</td>
<td>0.88 ± 0.10</td>
<td>0.91 ± 0.12</td>
</tr>
<tr>
<td>F (n = 116)</td>
<td>0.94 ± 0.09</td>
<td>0.96 ± 0.03</td>
<td>0.91 ± 0.07</td>
<td>0.94 ± 0.06</td>
</tr>
<tr>
<td><strong>P value (ANOVA)</strong></td>
<td>NS</td>
<td>0.03</td>
<td>0.05</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White (n = 135)</td>
<td>0.94 ± 0.09</td>
<td>0.96 ± 0.03</td>
<td>0.10 ± 0.08</td>
<td>0.12 ± 0.10</td>
</tr>
<tr>
<td>Asian (n = 35)</td>
<td>0.95 ± 0.06</td>
<td>0.95 ± 0.15</td>
<td>0.89 ± 0.08</td>
<td>0.95 ± 0.06</td>
</tr>
<tr>
<td>Middle Eastern (n = 32)</td>
<td>0.94 ± 0.06</td>
<td>0.94 ± 0.05</td>
<td>0.91 ± 0.06</td>
<td>0.90 ± 0.06</td>
</tr>
<tr>
<td>Latino (n = 19)</td>
<td>0.94 ± 0.05</td>
<td>0.95 ± 0.05</td>
<td>0.89 ± 0.09</td>
<td>0.90 ± 0.06</td>
</tr>
<tr>
<td>Afro-Caribbean (n = 11)</td>
<td>0.95 ± 0.04</td>
<td>0.96 ± 0.03</td>
<td>0.89 ± 0.09</td>
<td>0.90 ± 0.06</td>
</tr>
</tbody>
</table>

Abbreviations: ANOVA, analysis of variance; MLLAM, midline to lateral alar margin; MLLC, midline to lateral canthus; MLLOC, midline to oral commissure; MLTr, ratio of distance from midline to tragus; NS, not significant; R, ratio.

*Values other than \( P \) values are expressed as mean ± SD.
to reveal any significant relationships between the degree of objective asymmetry and the perception of a face as symmetrical (Figure 3 and Figure 4).

**COMMENT**

We studied the incidence and nature of facial asymmetry in a population of patients requesting rhinoplasty surgery and correlated objective anthropometric measures of facial asymmetry with global subjective perception. Our findings show that there are significant differences in the degree of facial asymmetry within different regions of the face and between sexes. We noted a statistically significant and independent association between asymmetry of the midline to lateral alar margin and the subjective perception of facial asymmetry. This observation suggests that asymmetry of nasal dimensions is the most significant determinant of others’ perception of the patient’s face as asymmetrical. These findings are not inherently surprising and may go some way toward explaining why rhinoplasty patients become fixated on the shape and proportions of their nose and request surgical readjustment.

What was more surprising was the great disparity that existed between the objective anthropometric facial measurements, indicating the presence of significant degrees of facial asymmetry in well over 90% of patients, and the rate of subjective perception of the face as asymmetrical, which was under 40%. Facial proportions and symmetry have long been recognized as determinants of attractiveness, and our study suggests that there is a correlation between objective measures of nasal asymmetry and subjective perceptions of the face as asymmetrical in the population of patients requesting corrective nasal surgery. Further studies in populations of patients requesting adjustments to other parts of the face are needed to determine whether asymmetries in other
parts of the face are also associated with subjective perceptions of asymmetry in the patient groups requesting facial aesthetic surgery. We were unable to identify a “threshold of asymmetry” above which most faces were perceived as asymmetrical, and the relationship between the degree of objective asymmetry and subjective perception of a face as symmetrical or otherwise was far from linear.

To our knowledge, the identification of several sources of nasal asymmetry and in particular correlation of the midline to lateral alar margin value with the subjective impression of asymmetry are novel, hitherto unreported clinical observations. We hope that awareness of these key findings by facial plastic surgeons will improve the quality and objectivity of preoperative facial assessment. These findings have particular relevance with respect to involving the patient to a greater extent in the decision-making process and in conveying a realistic appraisal of the main goals of rhinoplasty surgery. It is not unusual for a small degree of asymmetry to persist after surgery, and the patient should be made aware of this potential residual effect and reassured that minor asymmetries are relatively commonplace and difficult to detect.

In conclusion, our study demonstrated the presence of significant degrees of facial asymmetry in patients requesting aesthetic rhinoplasty and found a correlation between nasal asymmetry and the perception of a face as asymmetrical. Rhinoplasty aims to restore facial proportion by improving the symmetry and dimensions of the nose, and facial measurements could form part of the assessment of the success of the procedure. However, the relationship between objective measurements and subjective perceptions of facial symmetry is complex, and, in particular, the perception of a face as symmetrical or asymmetrical does not appear to be dictated simply by the degree of objectively measured facial asymmetry. Further research is needed to discern the relationship between objective measurement and subjective perceptions of symmetry, proportion, and attractiveness. Facial plastic surgery is very much concerned with perception, and although the idea of using objective measurements to assess outcome in facial plastic surgery is inherently very appealing in the era of evidence-based medicine, we need to be aware of the potential fallacies that can be involved in using numbers, in isolation, as markers of surgical outcome.

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