Frequency and Characteristics of Facial Asymmetry in Patients With Deviated Noses

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IMPORTANCE Facial asymmetry is frequently detected in patients who are seeking rhinoplasty for a deviated nose, and its presence often leads to failure to create a straight-looking nose.

OBJECTIVE To analyze the frequency and characteristics of facial asymmetry in patients with a deviated nose and to identify representative parameters to describe types and severity of facial asymmetry.

DESIGN, SETTING, AND PARTICIPANTS Retrospective review of at a tertiary referral center of preoperative photographs of 152 patients who underwent rhinoplasty for a deviated nose between January 2008 and December 2012. The incidence of facial asymmetry in these patients was compared with the incidence in 60 control patients undergoing septoplasty without external nose deviation.

INTERVENTIONS Using frontal photographs, the presence of facial asymmetry and the types of deviated nose were noted and measured by 2 observers.

MAIN OUTCOMES AND MEASURES Facial asymmetry was categorized into 4 types depending on which subunit of the face was affected, and deviated nose shapes were classified into 5 types. Anthropometric measurements were also performed.

RESULTS Facial asymmetry was more common in patients with a deviated nose (84 of 152 [55%]) than in controls (19 of 60 [32%]) ($P = .04$). Mixed-type facial asymmetry was the most common type in the patient group. Among the anthropometric measurement parameters, the distance between the midpoint of the interpupil line to the most prominent malar point, lateral canthal angle, lateral alar angle, lip margin angle, and tilted chin angle were significantly different between the patient group and the control group ($P < .05$ for all comparisons). There was no difference in the incidence of asymmetry with respect to deviation type.

CONCLUSIONS AND RELEVANCE Facial asymmetry was more common in patients with a deviated nose than in control patients, and mixed-type facial asymmetry was the asymmetry most often associated with deviated nose. This study suggests that deviated nose may be a developmental defect caused by a discrepancy in the growth of facial bony skeleton between the 2 sides of the face. The objective anthropometric measurements developed in this study could be useful for making appropriate preoperative facial assessments.

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Because the nose is located in the center of the face, the shape of the nose is often regarded as an important determining element of overall facial aesthetics. Therefore, rhinoplasty has become one of the forms of facial plastic surgery most frequently performed. Facial symmetry is also recognized as a crucial factor in determining the attractiveness of the face. In our daily rhinoplasty practice, we frequently encounter patients with a deviated nose who are unaware of their underlying facial asymmetry. Rhinoplasty surgeons often find that, despite their best efforts to straighten the nose, patients quite often continue to perceive their nose as being deviated, and this observation is more prevalent in patients with concurrent facial asymmetry. Therefore, it seems plausible that a close relationship exists between a deviated nose and facial asymmetry.

Several studies\(^1\)-\(^3\) have been performed to investigate the interrelation between deviated nose and facial asymmetry.\(^2\)-\(^3\) A recent retrospective study by Nouraei et al\(^2\) reported that 97\% of patients referred for consideration for aesthetic rhinoplasty had considerable degrees of facial asymmetry, and the rate of revision rhinoplasty was high.\(^2\) It has also been reported that patients with deviated noses tend to have more severe facial asymmetry than the control group.\(^4\) Another study\(^4\) examining the visual impact of symmetry on the perception of beauty showed that faces with crooked noses are rated as less symmetrical overall and at the nasal subunit compared with those with noncrooked noses. The objective of the present study was to expand these findings and to establish the frequency and characteristics of facial asymmetry in patients with deviated noses to obtain a comprehensive understanding of this difficult-to-treat condition. This study was also done to identify predictable parameters for the detection of the types and severity of facial asymmetry using detailed anthropometric measurements.

Methods

Patients and Study Design

We retrospectively reviewed preoperative frontal views of patients who underwent rhinoplasty for a deviated nose in the Department of Otolaryngology, Asan Medical Center (Seoul, South Korea), between January 2008 and December 2012. Patients who underwent septoplasty for correction of a deviated septum without external nasal deviation were used as controls. The study design was approved by the institutional review board of Asan Medical Center. All surgical procedures had been performed by 1 senior surgeon (Y.J.J.). Patients with a history of nasal surgery, nasal trauma, or congenital deformity were excluded. A total of 212 participants, including 152 patients and 60 controls, were included in the analyses. The mean ages for the 2 groups was 30 years for patients and 28 years for controls (\(P = .12\)). The patient group comprised 107 men and 45 women, and the control group comprised 41 men and 19 women. For the evaluation of the existence and type of facial asymmetry and nasal deviation, 2 observers examined frontal photographs of the subjects. All frontal photographs were taken by 1 trained facial photographer under the same conditions. Head position was corrected by using a camera with a built-in dotted middle crossed line to indicate when a patient’s head was tilted or rotated. Furthermore, the relationship between the direction of nasal deviation and the smaller side of the face was also examined. To investigate the perception of facial asymmetry, the face was divided into 3 subunits (upper, mid, and lower). Each subunit was sequentially presented to the observers for 10 seconds to evaluate asymmetry (Figure 1). Facial asymmetry was categorized into 4 types according to the subunits involved: upper, mid, or lower face only, and mixed.

Anthropometric Measurements

Anthropometric measurements on facial photographs were performed with the MB-Ruler Pro (version 5.0; Markus Bader-MB Software Solutions) software program. Various soft-tissue landmarks, including the lateral canthal point (a), vertical midpoint between pupils (b), the most prominent alar attachment point to the face (c), lip margins (d), the most prominent malar point (e), and midpoint of the chin (f) were marked (Figure 2A).\(^1\)-\(^2\)-\(^3\) As shown in Figure 2B, a vertical reference line was drawn from the glabella to the cupid's bow [labeled (a)], which is known to be fixed, and transverse reference lines were also drawn parallel to the ground at each soft-tissue point [labeled (b)].\(^3\)

Two distances representing the horizontal dimensions of the face, including the distance from the midpoint of the interpupill line to the most prominent malar point (D1) and the distance of the lip margin to the mandible angle (D2), were measured and compared with those on the contralateral side (Figure 2B). The absolute values were converted into ratios by dividing the smaller number by the larger one.

Four angles representing the central compartment of the face were also measured; these were the horizontal angles between the white dotted reference lines and lateral canthal angle...
Soft-tissue landmarks. A, Soft-tissue landmarks (a-f) to measure lines and angles. The lateral canthal point (a), vertical midpoint between pupils (b), most prominent alar attachment point to the face (c), lip margins (d), most prominent malar point (e), and midpoint of chin (f) were marked. B, vertical and horizontal reference lines (labeled (a) and (b), respectively) were also drawn. B, Measurement of horizontal distances. Two horizontal distances were measured; the distance of a horizontal line from the midpoint of the interpupil line to the most prominent malar point of the upper face (D1) and the distance of a horizontal line from the lip margin to the mandible angle for the lower face (D2). C, Measurement of facial angles. Four angles were measured: the horizontal lateral canthal angle (A1), alar angle (A2), lip margin angle (A3), and vertically tilted chin angle (A4) between the reference lines.

Assessment of Types of Nasal Deviation
Nasal deviation was classified according to our previously published classification: type I is a straight tilted bony pyramid with a straight tilted cartilaginous vault in the opposite direction; type II, a straight tilted bony pyramid with a concavely or convexly bent cartilaginous vault; type III, a straight bony pyramid with a tilted cartilaginous vault; type IV, a straight bony pyramid with a bent cartilaginous vault; and type V, a straight, tilted bony pyramid and a tilted cartilaginous dorsum in the same direction (Figure 3).

Statistical Analysis
Statistical analysis was performed using SPSS software for Windows (version 17.0; SPSS Inc). Differences between the 2 measurements in the groups were assessed using the Mann-Whitney U test, and the analysis of variance test was performed to estimate the frequency of deviation in each type. Statistical significance was set at $P < .05$.

Results
Facial asymmetry was more frequently detected in the patient group (84 of 152 patients [55%]) than in the control group (19 of 60 [32%]) with statistical significance ($P = .04$). The patients were subcategorized into 4 groups according to the subunits that were perceived to be involved in asymmetry. The results showed that most of the facial asymmetry was mixed (51% [42 patients]), and asymmetry rates in the lower face and the upper face were 26% (22 patients) and 21% (18 patients), respectively. Only 2 (2%) had midface asymmetry.
Anthropometric measurement outcomes in all patients are shown in Table 1. The ratio of distances was calculated by dividing the smaller number by the larger one. The ratio of D1 (both sides), the distance from the midpoint of interpupill line to the most prominent malar point, was significantly different between the patient group and the control group (P < .001). However, there was no difference in the ratio of D2, the horizontal line from the lip margin to the mandible angle between the groups. The mean of A1 (lateral canthal angle), A2 (lateral alar angle), A3 (lip margin angle), and A4 (tilted chin angle) was greater in the patient group than in the control group (P < .001).

Table 2 shows the numbers of patients per deviation type and their asymmetry rates. There was no significant difference in the frequency of facial asymmetry according to deviation type (P = .35).

When the correspondence between the direction of the deviated bony axis and the smaller side of the face was examined, we found that the bony dorsum tended to deviate toward the smaller side of the face in patients with type I and V deviations (60% and 68%, respectively). The results are shown in Table 2. Moreover, an accompanying tilted chin was often noticed in those patients. This indicates that a deviated nose may be caused by a developmental defect in the facial bony skeleton.

**Discussion**

The present study evaluated the frequency and characteristics of facial asymmetry in patients who underwent rhinoplasty for a deviated nose. Regardless of the types of nasal deviation, facial asymmetry was more frequently detected in patients with a deviated nose than in the control patients. According to our observation, despite our best efforts to straighten the nose, patients with concurrent facial asymmetry often continue to perceive their nose as being deviated. This result would be caused not only by persisting deviation after surgical correction but also by newly detected disharmony of the face even after the nose had been straightened. Our result is in agreement with findings of previous reports that indicated a high recurrence rate of deviated nose in patients with facial asymmetry. A number of studies have been conducted to demonstrate the relationship between a deviated nose and facial asymmetry. Hafezi et al reported that a deviated nose was accompanied by facial asymmetry in 74% of cases, and a severely crooked nose was associated with major disharmony of the face. In their study, orbital dystopia, an asymmetric mandible angle, and a nasolabial angle were identified as asymmetric components. Chatrath et al also documented the nature of facial asymmetry in patients requesting rhinoplasty, and they found a significant association between asymmetry of the midline to lateral alar margin and subjective perception of facial asymmetry. As a result, they suggested that the symmetry in nasal dimensions is the most significant factor determining the perception of facial asymmetry. Roxbury et al also examined observers’ perceptions after rhinoplasty and concluded that rhinoplasty can help minimize asymmetry and improve attractiveness. While reviewing the literature, we found that many previous studies have consistently focused on the relationship between midfacial asymmetry and nasal deviation. Despite the proven positive impact of rhinoplasty on facial asymmetry, surgeons often find that a nose that is deviated in appearance often remains so even after their best efforts to straighten it. Thus, we studied the types of facial asymmetry in patients demanding rhinoplasty for a deviated nose and found that a mixed-type facial asymmetry characterized nearly half of the patients. This implies that the nose is not the sole subunit determining patient perception. This finding is not surprising and may explain why patients with a deviated nose and accompanying facial asymmetry are often dissatisfied with the surgical outcome and request revision surgery. This means that asymmetry in other subunits contributes to the overall perception of the deviated appearance of the nose and thus, correction of concurrent facial asymmetry is required for the successful correction of a deviated nose.

In the assessment of facial asymmetry, particular objective measurements that can be predictably used for preoperative assessment of facial asymmetry have been reported. In the preoperative assessment of correction of facial asymmetry, certain measurements are used to predict the existence of asymmetry. Chatrath et al used an imaginary sagittal midline originating at the central hairline crossing to the central point of the cupid’s bow in the upper lip to measure the distances of each soft-tissue landmark, including the lateral canthus, lateral ala margin, and oral commissure from this line. According to their study, only the asymmetry of the midline to the lateral alar margin is significantly associated with subjective perception of facial symmetry. However, this approach has a limitation in evaluating other facial deformities.
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tive facial assessments.

Although facial asymmetry was more frequently detected

in patients with a deviated nose, the incidence of each type of

facial asymmetry did not differ significantly with the type of de-

viation. Another important finding of this study is that the direc-

tion of bony dorsal deviation tends to correspond to the smaller side of the face. Because the nose is completed by fusion between the frontonasal prominence and the maxillary prominence embryologically, discrepancy in the bone growth rate between the 2 sides of the face can result in nasal deviation toward the more slowly growing side. This result is supported by a report by Hafezi et al,1 who proposed that the deviated nose may be caused in part by congenital facial growth retardation induced by inhibition of multiple facial growth centers.

The control group in our study was composed of patients with septal deviation who had no sign of an externally deviated nose. This may be a limiting factor in our study design because the patients in the control group were not representative of normal individuals with no anatomic abnormalities of the nose. Despite this limitation, given the fact that it is almost impossible to find controls with a perfectly straight nasal septum in the general population, it stands to reason that patients with deviated noses have a higher incidence of facial asymmetry.

Conclusions

Facial asymmetry was more common in patients with a deviated nose, and mixed-type asymmetry constituted nearly half of the facial asymmetry observed in these patients. This study suggests that a deviated nose may be a developmental defect resulting from a growth discrepancy in facial bony skeleton development between the left and right sides of the face.

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