Treatment Outcomes of Extracorporeal Septoplasty Compared With In Situ Septal Correction in Rhinoplasty

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**IMPORTANCE** Extracorporeal septoplasty (ECS) in rhinoplasty is a useful surgical procedure that can achieve considerable functional and aesthetic improvements in the treatment of a deviated nose. However, to our knowledge, no study has compared the treatment outcomes of ECS with those of in situ septal correction (ISSC) in rhinoplasty.

**OBJECTIVE** To compare the surgical outcomes of ECS with those of conventional ISSC in the treatment of a deviated nose.

**DESIGN, SETTING, AND PARTICIPANTS** We retrospectively reviewed the medical records of 169 patients who underwent rhinoplasty from July 1, 2006, through December 31, 2012. For ECS, we used a modified technique. For ISSC, several techniques, including batten and spreader grafting and caudal cutting and suture, were used alone or in combination. Eighty-four patients underwent ECS. The remaining 85 patients, who were age- and sex-matched controls who were operated on at a similar time point, were treated by ISSC for the correction of a deviated nose.

**MAIN OUTCOMES AND MEASURES** Surgical outcomes were assessed and compared using the anthropometric measurement of photographs and by reviewing medical records to evaluate functional outcomes and complications after surgery.

**RESULTS** There were 52 I-shape (61.9%) and 32 C-shape (38.1%) types of external nose deviations in the ECS group. There were 59 I-shape (69.4%) and 26 C-shape (30.6%) types of external nose deviations in the ISSC group. Postoperative deviation angle \( < .001 \), nasofrontal \( < .05 \) and nasolabial \( < .001 \) angles, and nasal tip projection \( < .001 \) values were significantly improved from the preoperative values in both groups. The mean operating times of ECS and ISSC were 135 and 128 minutes, respectively. The rates of complications, such as an irregular contour of the dorsum, saddling, and postoperative infection, were similar between the 2 groups. However, no patients in the ECS group experienced postoperative nasal obstruction, whereas 5 of 78 patients (6.4%) in the ISSC group experienced persistent or unresolved nasal obstruction that required revision septoplasty.

**CONCLUSIONS AND RELEVANCE** We found that ECS is a useful technique for markedly deviated noses that can achieve a comparable aesthetic success but better functional outcome than ISSC in rhinoplasty.

**LEVEL OF EVIDENCE** 3.
The nasal septum plays an important role in the function and shape of the nose. In patients with deviated noses, septal correction is essential for treatment success. Many septal correction techniques, such as bony batten grafting, septal extension grafting, and cutting and suture techniques, were introduced to correct the aesthetic and functional aspects of severely deviated noses. These in situ septal corrections (ISSCs) are highly effective approaches for correcting the nasal septum and external nose in patients with deviated noses. Therefore, these procedures may not always be sufficient for the successful correction of some severely deviated noses. Therefore, extracorporeal septoplasty (ECS) has been suggested as a more fundamental corrective method for a severely deviated septum in rhinoplasty.

Jang and Kwon previously described a modified ECS method that is a safe, effective, and easy way to achieve stability when performing ECS. In this modified method, the cartilage tail is preserved to avoid injury to the keystone area and is securely fixed between the arms of a newly designed Y-shape dorsal L-strut. The anterior nasal spine (ANS) is also securely fixed in an inverted Y-shape. In rhinoplasty, ECS is considered a useful surgical procedure that can achieve considerable functional and aesthetic improvement in the treatment of severely deviated noses. However, to our knowledge, no studies have compared the treatment outcomes of ECS with those of ISSC in rhinoplasty. Therefore, in this study, we aimed to compare the surgical outcomes of ECS with those of conventional ISSC in the treatment of a deviated nose.

Methods

We retrospectively reviewed the medical records of 169 patients who underwent rhinoplasty for the correction of a deviated nose from July 1, 2006, through December 31, 2012. Institutional review board approval was obtained from the Asan Medical Center Review Committee. Because this study was retrospective, informed consent was not required. All operations were performed by the senior author (Y.J.J.) via an open approach. For ECS, the modified ECS technique was used. For ISSC, several techniques, including a batten graft, spreader graft, and caudal cutting and suture, were used alone or in combination. Eighty-four patients underwent ECS for the correction of a deviated nose. The remaining 85 patients, who were matched for age and sex and were operated on at a similar time point, were treated by ISSC. All patients underwent a detailed physical examination and standard preoperative and postoperative facial photography for rhinoplasty.

When performing rhinoplasty for patients with deviated noses, we decided whether to use ECS or ISSC techniques intraoperatively by exploring the entire septum after elevation of the septal mucoperichondrium. There was no strict indication for ECS or ISSC in our rhinoplasty. However, if we found the nasal septum to be so severely deviated that management with the ISSC technique was expected to be difficult, we used the modified ECS technique to perfectly correct the deviated septum. Our indication for ECS has continued to broaden as our experience has increased. Generally, we prefer to conduct ECS to correct severely deviated septae that are mainly caused by a deformity of the thick, large, and well-developed septal cartilage.

Surgical outcomes in both groups were assessed and compared by using anthropometric measurements of preoperative and postoperative photographs with the MB-Ruler 5.0 software program (Markus Bader). These anthropometric measurements were performed by 2 otolaryngologists (S.B.L. and Jong Sook Yi, MD, Department of Otolaryngology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea) who were not involved in the operations. Anthropometric measurements of the nose were made with lateral views to assess the nasolabial angle, nasofrontal angle, and nasal tip projection. The degree of external deviation was assessed using a frontal view following the analysis of Erdem and Ozturan (Figure 1). Deviations that were linear and in which the nasal osseous and cartilaginous dorsal margins were in line were termed I-shape deviations. Deviations that consisted of a concave contour on one side and a convex contour on the other side were termed C-shape deviations. I-shape deviation angles were measured by a vertical line between the midpoint of the glabella and the midpoint of the upper lip and a line that represented the nasal dorsal axis, consisting of the osseous and cartilaginous parts from the nasion to the tip. In patients with a C-shape deviation, angles were measured between an oblique line between the nasion and the most prominent point of convexity and a line between the most prominent point of convexity and the nasal tip. In subsequent measurements of angles, most consistent values were accepted as I-shape or C-shape angles to reduce intermeasurement variability. During subsequent measurements, we used the final angle result taken by the 2 otolaryngologists to eliminate interexaminer variability. After the surgical correction of deviated noses, the degree of the deviation angle in I-shape deviations decreased to 0°, whereas the degree of the deviation angle in C-shape deviations increased to 180°.

Medical records were reviewed to evaluate the functional outcomes and complications after surgery. Postoperative complications were evaluated, including an irregular contour of the dorsum, saddling, asymmetric nostrils, upper lip stiffness, infection, septal perforation, septal hematoma, and persistent nasal obstruction. Demographic data and preoperative acoustic rhinometry were also reviewed to compare the characteristics of the 2 groups. An Eccovision Acoustic Rhinometer (Eccovision Nasal Version 3.72; Hood Laboratories) was used to check the minimum cross-sectional area (MCA) and nasal volume. Measurements were made according to the guidelines recommended by the Standardization Committee for Acoustic Rhinometry. We examined the preoperative subjective assessment of nasal obstruction by using a visual analog scale (VAS).

All operations were performed with the patient under general anesthesia via an open approach. After the osseocartilaginous skeleton was exposed, the septal mucoperichondrial flaps were elevated. Septal cartilage was harvested, but a few millimeters of the dorsal strip at the keystone area was spared. Multiple techniques, including wedge excisions, cartilage splitting, and spreader and batten grafting, were performed.
to extracorporeally make a new L-strut, which is straight and strong. The dorsal aspect of the newly created septal cartilage L-strut and a spreader graft were fashioned into Y-shape cartilage and then fixed with the preserved cartilage tail to the keystone with 4-0 polydioxanone sutures. Caudal septum stability was achieved by suturing the newly shaped septal cartilage to the soft tissue around the ANS with 5-0 polydioxanone sutures such that the ANS was securely fixed in the middle. Therefore, the arms of the new septum and caudal septal extension graft created an inverted Y-shape. After fixation of the new L-strut, the dorsal aspect of the septal cartilage was reconnected to the upper lateral cartilages with 4-0 polydioxanone sutures to provide additional stability.9

We used t tests to compare the anthropometric and acoustic rhinometry measurements in the ECS and ISSC groups. Statistical analyses were performed with SPSS software, version 16.0 (SPSS Inc), and P < .05 was regarded as statistically significant.

Results

The mean ages of the ECS and ISSC groups were 30.0 years (range, 16-70 years) and 29.2 years (range, 16-63 years), respectively (Table 1). There were 74 male patients and 10 female patients in the ECS group. The ISSC group comprised 74 male patients and 11 female patients. Fifty-five patients (65.5%) in the ECS group and 51 patients (60.0%) in the ISSC group had a history of nasal trauma. The mean postoperative follow-up was 16 months (range, 3-181 months).

The preoperative acoustic rhinometry assessment revealed significantly smaller MCA1 (initial MCA) and MCA2 (MCA after topical decongestion of the nasal mucosa) values in the ECS group than in the ISSC group (P < .05) (Table 2). There were no statistically significant differences in the nasal volumes and VAS scores between the 2 groups (P > .05). There were 52 I-shape (61.9%) and 32 C-shape (38.1%) types of external nose deviations in the ECS group (Table 3). The mean (SD) preoperative and postoperative deviation angles were 6.80° (2.28°) and 1.76° (0.83°) for I-shape deviations, respectively, and 158.01° (7.87°) and 174.41° (2.46°) for C-shape deviations, respectively. These deviation angles were significantly different between the preoperative and postoperative ECS groups (P < .001). Two representative cases of the ECS group are presented in Figure 2 and Figure 3. Comparison of preoperative and postoperative facial photographs revealed complete correction of deviated noses.

There were 59 I-shape (69.4%) and 26 C-shape (30.6%) types of external nose deviations in the ISSC group. The mean (SD) preoperative and postoperative deviation angles were 6.25° (2.83°) and 1.58° (0.92°) for I-shape deviations, respectively, and 158.01° (7.87°) and 175.15° (2.63°) for C-shape deviations, respectively. The postoperative changes in the deviation angle were significantly different (P < .001). Similarly, the postop-

Table 1. Characteristics of the ECS and ISSC Groupsa

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>ECS (n = 84)</th>
<th>ISSC (n = 85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean, y</td>
<td>30.0</td>
<td>29.2</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Revision cases of rhinoplasty</td>
<td>4 (4.8)</td>
<td>8 (9.4)</td>
</tr>
<tr>
<td>History of previous nasal trauma</td>
<td>55 (65.5)</td>
<td>51 (60.0)</td>
</tr>
<tr>
<td>Preoperative nasal obstruction</td>
<td>81 (96.4)</td>
<td>78 (91.8)</td>
</tr>
<tr>
<td>Follow-up period, mean (range), mo</td>
<td>13.2 (2.7-43)</td>
<td>16 (2.1-79.4)</td>
</tr>
</tbody>
</table>

Abbreviations: ECS, extracorporeal septoplasty; ISSC, in situ septal correction.

a Data are presented as number (percentage) of patients unless otherwise indicated.
The present study has compared the aesthetic and functional outcomes of ECS with those of ISSC. A comparable degree of aesthetic improvement was acquired in the ECS and ISSC groups. However, no persistent symptoms of nasal obstruction were found in the ECS group, suggesting that ECS is an effective and reliable technique for markedly deviated noses and can result in better functional outcomes than ISSC in rhinoplasty.

Initially, ECS was described in 1952 by King and Ashley. Subsequently, various authors have discussed their different techniques and outcomes. In 2005, Gubisch described his series of 219 ESCs, performed via an endonasal and open approach; he sutured the pieces of cartilage together and reimplanted them for support. In 2010, Jang and Kwon described a modified ECS technique in which a small remnant of dorsal cartilage is preserved at the keystone area to increase stability and facilitate the ECS. We were able to achieve considerable stability through Y- and inverted Y-shape cartilage grafts and through secure fixation with the ANS. Because of the powerful effect on stability shown by ECS, the method was used for correcting severely deviated noses.

Interestingly, the MCA1 and MCA2 values of the ECS group were significantly smaller than those of the ISSC group in preoperative acoustic rhinometry measurements (Table 2). Severely deviated septal cartilage, which is represented as a narrower nasal cavity, induces symptoms of nasal obstruction. When the deviation is located at the L-strut, patients will continue to have symptoms of nasal obstruction after septorhinoplasty if the deviation is left uncorrected. Therefore, ECS was used for treating severely deviated noses, and ECS could correct deviated septal cartilage.

The mean operation time, excluding that of the anesthetist, was similar in the ECS and ISSC groups. Extracorporeal septoplasty took approximately 7 minutes longer than ISSC when the severely deviated septal cartilage was identified in the operating field, it took a few seconds to decide which septal...
plasty procedure could straighten the deviated cartilage. If costal cartilage or conchal cartilage grafting was necessary for additional cartilage grafting, additional time was needed to harvest the cartilage. In the ECS group, 24 conchal cartilages and 4 costal cartilages were harvested. In the ISSC group, 11 conchal cartilages and 7 costal cartilages were harvested. There were 28 (33.3%) and 18 (21.2%) harvested cartilages in the ECS and ISSC groups, respectively. Therefore, the higher rate of cartilage harvesting in the ECS group might be partially, but not significantly, responsible for the longer surgery time. Anthropometric changes were assessed in preoperative and postoperative facial photographs to evaluate the aesthetic improvement (Table 3). A statistically significant improvement in the external nose deviation angle, nasofrontal angle, nasolabial angle, and nasal tip projection was seen after surgery in the ECS and ISSC groups. However, no significant differences were observed in the degree of improvement in anthropometric measurements between the ECS and ISSC groups (Figure 4), indi-
patients when performing the extracorporeal technique. In our
deformities (4%-8%). All these complications were also pos-
hesive or synechiae (7%), hyposmia (0.3%), and aesthetic
overcorrection (2%), septal perforation (1%-6.7%), ad-
ons or septal hematoma (3%), and harvest-induced blood
number of studies about the complications of endonasal sep-
b Patients without preoperative nasal obstruction were excluded.
Data are presented as number (percentage) of patients.
Table 4. Postoperative Complications of the ECS and ISSC Groupsa

<table>
<thead>
<tr>
<th>Complications</th>
<th>ECS (n = 84)</th>
<th>ISSC (n = 85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular contour of the dorsum</td>
<td>1 (1.2)</td>
<td>2 (2.4)</td>
</tr>
<tr>
<td>Sadding</td>
<td>4 (4.8)</td>
<td>3 (3.5)</td>
</tr>
<tr>
<td>Asymmetric nostril</td>
<td>0</td>
<td>2 (2.4)</td>
</tr>
<tr>
<td>Stiffness of upper lip</td>
<td>1 (1.2)</td>
<td>0</td>
</tr>
<tr>
<td>Postoperative infection</td>
<td>1 (1.2)</td>
<td>0</td>
</tr>
<tr>
<td>Septal perforation</td>
<td>1 (1.2)</td>
<td>0</td>
</tr>
<tr>
<td>Nasal obstructionb</td>
<td>0/81</td>
<td>5/78 (6.4)</td>
</tr>
</tbody>
</table>

Abbreviations: ECS, extracorporeal septoplasty; ISSC, in situ septal correction.
* Data are presented as number (percentage) of patients.
* Patients without preoperative nasal obstruction were excluded.

cating that these septoplasty techniques were successful with
satisfactory aesthetic outcomes.

Bloom et al11 published a review article that covered a large
number of studies about the complications of endonasal septo-
plasty. The possible complications from a standard endo-
nasal approach included hemorrhage or septal hematoma
(6%-14%), cerebrospinal fluid leak (rare), infection (0.048%-2.5%), overcorrection (2%), septal perforation (1%-6.7%), ad-
hesions or synechiae (7%), hyposmia (0.3%), and aesthetic
deformities (4%-8%). All these complications were also possible
when performing the extracorporeal technique. In our
study, there were several complications in the ECS and ISSC
groups (Table 4). However, no patients in the ECS group had
postoperative nasal obstruction, whereas 5 patients (6.4%) in
the ISSC group experienced persistent or unresolved nasal ob-
struction that required revision septoplasty.

Kantas et al12 suggested that ECS is strongly contraindi-
cated in a revised deviated nose. However, patients who had
weak cartilage support due to repetitive rhinoplasty could be
treated by harvesting costal cartilage. The costal cartilage is
an appropriate graft material for providing strong support to
the cartilage framework in revision rhinoplasty.

This study has some limitations, principally from the ret-
rospective design and the lack of postoperative objective func-
tional outcome measurements. The presence or absence of
postoperative nasal obstruction was confirmed by the med-
ical record of subjective symptoms 6 months after surgery. Pre-
operative VAS scores and acoustic rhinometry were checked
documentation purposes to evaluate functional problems
preoperatively. Postoperative acoustic rhinometry and VAS
scores were checked only when patients experienced unre-
solved or recurrent nasal obstruction postoperatively. Any mi-
nor issues with incomplete correction of functional nasal ob-
struction were deemed serious, and we took some measures
to correct the disturbed nasal breathing. Fortunately, how-
ever, in our ECS group, no patients reported unsatisfactory
functional outcome. That was the reason why we could not pro-
vide postoperative acoustic rhinometry and VAS score data in
our patient group.

There was no strict indication for ECS or ISSC in our se-
ries, which made randomization of patients to each study group
difficult. In terms of preoperative acoustic rhinometry mea-
asurements, the nasal patency parameters were significantly
smaller in the ECS group than in the ISSC group. This result
reveals that the ECS group included patients who had more se-
verely deviated septal cartilage.

Conclusions

Although we could not provide objective data on the degree
of postoperative functional improvement in our patient groups,
we suggest that ECS could prevent persistent or unresolved na-
sal obstruction in severely deviated noses, as indicated by the
lower rate of functionally unsatisfactory outcomes com-
pared with the ISSC group. Extracorporeal septoplasty is a use-
ful technique for markedly deviated noses that can achieve
comparable aesthetic results but better functional outcomes
than ISSC in rhinoplasty.

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REFERENCES
1. Gubisch W. Extracorporeal septoplasty for the
markedly deviated septum. Arch Facial Plast Surg.
2. Cho GS, Jang YJ. Deviated nose correction:
different outcomes according to the deviation type.
3. Song HM, Kim JS, Lee BJ, Jang YJ. Deviated nose
cartilaginous dorsum correction using a dorsal

jamafacialplasticsurgery.com


