The Effect on Snoring of Structural Nasal Valve Dilatation With a Butterfly Graft

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Objective: To evaluate the effect on snoring of structural nasal valve dilatation with butterfly spreader grafts in patients with nasal valve insufficiency.

Design: Retrospective medical chart review and telephone follow-up; mean ± SD follow-up time, 20.7 ± 11.34 months (range, 3-48 months).

Settings: Tertiary care referral center.

Subjects: A total of 37 snoring patients with nasal valve insufficiency who underwent nasal valve dilatation with a butterfly spreader graft.

Interventions: The conchal cartilage butterfly graft technique was performed during rhinoplasty through either an external or endonasal approach.

Main Outcome Measure: To establish through a retrospective review that butterfly graft conchal cartilage nasal reconstruction is effective in reducing snoring.

Results: After surgery, 30 patients (81%) had significant improvement in breathing, 5 (14%) had slight improvement, and 2 (5%) had no benefit in breathing. Snoring stopped completely in 11 (30%) of the patients after surgery. The improvement in snoring was significant in 13 patients (35%) and slight in 3 (8%). Twenty-six patients (70%) reported tiredness and grogginess on awakening before the surgery. Surgery significantly improved patients' tiredness and grogginess on awakening in 15 cases (58%), slightly improved them in 5 (19%), and did not change the patients' tiredness and grogginess in 6 cases (23%).

Conclusion: The conchal cartilage butterfly graft yields successful results not only in breathing but also in snoring symptoms in patients with nasal valve insufficiency.

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Subject: Snoring

Snoring is an inspiratory noise related to a narrowing of the upper airway, as may occur with nasal obstruction. Habitual snoring is defined as snoring nearly every night. Many habitual snorers complain of excessive daytime tiredness, fatigue, and sleepiness. A report from a large epidemiologic study in the United States has found the prevalence of subjectively reported habitual snoring to be 19% in women and 33% in men older than 65 years. Overall, among all age groups, approximately 18% of men and 7% of women snore.

Snoring is characterized by high-frequency oscillations of the soft palate as well as the pharyngeal walls, epiglottis, and tongue. These oscillations alternate to occlude and open a narrowed airway. Although the nose is not the site of sound generation, there are several studies implicating nasal obstruction as a causative factor in breathing disturbances during sleep. Other reports have shown that increasing nasal patency improves snoring.

The internal nasal valve is the narrowest portion of the nasal airway and is formed by the junction of the upper lateral cartilages with the nasal septum. The normal angle between these 2 structures is 10° to 15° and represents the nasal region with the smallest cross-sectional area. Because the nasal valve is the narrowest part of the nose, it offers the greatest resistance to nasal airflow. The narrower the site, the more vulnerable it is to pathologic nasal obstruction.

Nasal obstruction due to nasal valve abnormalities may result from either dynamic or static problems and is one of the most important and common reasons for nasal obstruction. Despite these facts, nasal valve collapse is a frequently overlooked cause of nasal obstruction. Elwan and Thabet reported that 13% of patients complaining of nasal obstruction had nasal valve dysfunction. Collapse of the na-
surval has been previously reported. In the present study, vision rhinoplasty for functional and cosmetic improve-
value of the butterfly graft when performed during re-
grafts in patients with nasal valve insufficiency.

crasses by 22% to 25% after reduction rhinoplasty. The
mean cross-sectional area of the nasal valve de-
also cause nasal valve collapse. It has been shown that
ing, and congenitally flaccid upper lateral cartilages may
cosal wall structural support. Iatrogenic injury, as may oc-
cur with rhinoplasty, is one of the most common causes
of lateral nasal wall weakness. In addition, trauma, ag-
and congenitally flaccid upper lateral cartilages may
also cause nasal valve collapse. It has been shown that
the mean cross-sectional area of the nasal valve de-
creases by 22% to 25% after reduction rhinoplasty. The
value of the butterfly graft when performed during re-
vision rhinoplasty for functional and cosmetic improve-
ments has been previously reported. In the present study,
we have tried to evaluate the effect on snoring of struc-
tural nasal valve dilatation achieved with butterfly spreader
grafts in patients with nasal valve insufficiency.

**METHODS**

**PATIENTS**

The present study consists of a retrospective medical chart re-
view carried out at the Oregon Health and Science University

<table>
<thead>
<tr>
<th>Table 1. Questionnaire Used in the Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Did you snore before the surgery?</td>
</tr>
<tr>
<td>2. Have you tried Breathe-Right strips prior to surgery?</td>
</tr>
<tr>
<td>3. If ‘YES’ was it helpful?</td>
</tr>
<tr>
<td>4. After surgery did your snoring</td>
</tr>
<tr>
<td>☐ Resolve</td>
</tr>
<tr>
<td>☐ Improve significantly</td>
</tr>
<tr>
<td>☐ Improve slightly</td>
</tr>
<tr>
<td>☐ Don’t know</td>
</tr>
<tr>
<td>5. Did you feel tired and groggy on awakening before the surgery?</td>
</tr>
<tr>
<td>☐ Significantly better</td>
</tr>
<tr>
<td>☐ Slightly better</td>
</tr>
<tr>
<td>☐ No change</td>
</tr>
<tr>
<td>6. If ‘YES,’ when you compared before the surgery, how tired and groggy do you feel upon awakening?</td>
</tr>
<tr>
<td>☐ Significantly better</td>
</tr>
<tr>
<td>☐ Slightly worse</td>
</tr>
<tr>
<td>☐ No change</td>
</tr>
<tr>
<td>7. Please rate your breathing results following surgery.</td>
</tr>
<tr>
<td>☐ Significantly better</td>
</tr>
<tr>
<td>☐ Slightly better</td>
</tr>
<tr>
<td>☐ No change</td>
</tr>
<tr>
<td>8. Are you satisfied with the cosmetic appearance of your nose?</td>
</tr>
<tr>
<td>9. Does the missing ear cartilage disturb you?</td>
</tr>
<tr>
<td>10. Would you recommend the surgical procedure to your friend or a relative?</td>
</tr>
</tbody>
</table>

in Portland. The charts of all patients diagnosed with nasal valve obstruction were reviewed, and those who had undergone sur-
cical correction of their nasal obstruction with a conchal car-
tilage butterfly graft were asked to answer a multiple-choice questionnaire over the telephone (Table 1). In this way, we
identified those patients who had preoperative snoring. The data
analyzed for this study were from the group of patients who
snored, had nasal obstruction due to nasal valve abnormali-
ties, and underwent conchal cartilage butterfly grafting to cor-
rect their nasal obstruction.

Patients were deemed to be good surgical candidates for the
butterfly graft if they presented with a primary complaint of nasal obstruction that was relieved with the Cottle maneuver. They all had physical examination findings of visible nasal valve collapse on gentle inspiratory effort and palpably weak lateral nasal wall support. The study group included patients with prior rhinoplasty and patients with no previous surgical interven-
tions on their nose. The surgery was not primarily aimed to
 correct sleep-disordered breathing; therefore, polysomnogra-
phy was not part of our evaluation process. The patients in our
study did not undergo polysomnography or nasal surgery for
correction of sleep-disordered breathing or snoring. The sur-
gery was performed only for nasal breathing complaints, and
the patients were identified as snorers only through the retro-
spective questionnaire. Those with septal deviation and turbi-
nate hypertrophy were excluded from the study.

At the end of the chart review process, 40 patients were found
to be in compliance with the study standards. We were unable
to reach any conclusion in 3 patients regarding the status of
snoring after surgery. These patients were excluded from the
study, and the final group consisted of 37 patients. Among those, 23 (62%) were women and 14 (38%) were men, with a mean ±
SD overall age of 50.3 ± 11.1 years (range, 20-83 years). Of those
37 patients, 26 had at least 1 prior septorhinoplasty. Mean ±
SD follow-up time was 20.7 ± 11.3 months (range, 3 to 48

**SURGICAL TECHNIQUE**

All procedures were performed by the senior surgeon (T.A.C.)
ening either the external or endonasal approach with the pa-
tient under general anesthesia or monitored anesthesia with lo-
cal anesthetic. The butterfly graft, harvested from the conchal
bowl of the left ear (Figure 1), was shaped to be 0.9 to 1.2 cm
long by 2.2 to 2.5 cm wide with tapered lateral edges (Figure 2).

Through the endonasal approach, intercartilaginous inci-
sions were made on either side of the nose and continued as a
partial complete transfixion incision along the dorsal 1 cm of
the caudal membranous septum. The incisions on either side

![Figure 1](https://example.com/figure1.png)

**Figure 1.** An anteriorly based skin and perichondrium flap is elevated anteriorly, and the conchal bowl is exposed. The graft is harvested from the ascending portion or “shoulder” of the conchal bowl.

![Figure 2](https://example.com/figure2.png)

**Figure 2.** The graft is shaped to be 0.9 to 1.2 cm long by 2.2 to 2.5 cm wide with tapered lateral edges.
of the nose were connected by elevating the skin—superficial musculoaponeurotic system envelope off the nasal dorsum until the upper lateral cartilages on both sides of the nose were in clear view. The graft was then placed on the nasal dorsum (Figure 3) and attached to the upper lateral cartilages on either side of the nose with a single 5-0 polydioxanone suture on either side. The intercartilaginous incision was then closed with 3-0 chromic suture.

The external approach was performed with the standard midcolumellar and marginal incisions. The skin and superficial musculoaponeurotic system were elevated in the standard fashion. The vestibular skin next to the cephalic margin of the lower lateral cartilages was released to accommodate placement of the butterfly graft. After the graft was sutured to cephalic margin of the lower lateral cartilages laterally with a 5.0 polydioxanone suture, the skin incision was closed (Figure 4).

A splint was then applied to the nose. The patients were seen in the clinic 1 day after surgery to evaluate the site for septal and auricular hematoma. They were seen again at the end of the first week for splint removal.

RESULTS

After surgery, 30 patients (81%) had significant improvement in breathing, 5 (14%) had slight improvement, and 2 (5%) had no benefit in breathing. Snoring of 11 patients (30%) stopped completely after surgery. The improvement in snoring was significant in 13 patients (35%) and slight in 3 (8%). Twenty-six patients (70%) reported tiredness and grogginess on awakening before the surgery. After surgery, 15 patients (58%) reported significant improvement, 5 (19%) reported slight improvement, and 6 (23%) reported no change in their tiredness and grogginess. None of the patients experienced worsening of their symptoms after surgery. The relationship of breathing improvement after surgery with improvement in snoring and tiredness and grogginess on awakening is outlined in Table 2. Two of the patients who had significant improvement in breathing but did not have any improvement in snoring after surgery were later found to have obstructive sleep apnea syndrome. Of the 2 patients who had slight improvement in breathing but no change in snoring after surgery, 1 had allergic rhinitis, and the other had chronic sinus disease in addition to the nasal valve insufficiency.

Twenty-three patients had used nasal dilator strips (Breathe Right; CNS Inc, Whippany, NJ) prior to surgery and 16 of those reported that the strips were somewhat helpful. The distribution of results of butterfly grafting on breathing and snoring regarding the benefit of previous dilator strip use is outlined in Table 3. Of 16 patients who had derived benefit from the nasal dilator strips, 3 reported allergic skin reactions, 2 were reluctant to wear it, and 1 patient wanted a permanent solution.

Regarding the cosmetic changes associated with the surgical procedures, 30 patients (81%) reported no change or improved cosmesis, while 7 (19%) reported dissatisfaction with the appearance of their nose. Among the female patients, 18 (78%) reported improved or unaltered cosmesis, while 5 (22%) reported dissatisfaction with the appearance of their nose. Of 14 male patients, 12 (86%) were satisfied with the cosmetic result, and 2 (14%) were dissatisfied. Interestingly, those patients who did not benefit from the surgery’s functional goals were the same ones who experienced dissatisfaction with the cosmetic results.

Thirteen (93%) of the men and 17 (74%) of the women were unencumbered by auricular changes associated with the conchal cartilage graft harvest, while 1 man (7%) and 6 women (26%) were dissatisfied with the ear. The specific comments regarding the ear included sensation

![Figure 3](http://archotol.jamanetwork.com/pdfaccess.ashx?url=/data/journals/otol/18382/)

![Figure 4](http://archotol.jamanetwork.com/pdfaccess.ashx?url=/data/journals/otol/18382/)

| Table 2. The Relationship of Breathing Improvement After Surgery With Improvement in Snoring and Tiredness and Grogginess on Awakening* |
|-----------------|-----------------|-----------------|-----------------|
| Characteristic  | Level of Improvement | Breathing Improvement |
| Snoring         | Significant  | Slight | No Change |
| Resolved        | 11 (37)      | 0      | 0          |
| Significant     | 11 (37)      | 2 (40) | 0          |
| Slight          | 2 (7)        | 1 (20) | 0          |
| No change       | 6 (20)       | 2 (40) | 2 (100)    |
| Tiredness and grogginess | Significant | 15 (65) | 0 | 0 |
| Slight          | 6 (22)       | 0      | 0          |
| No change       | 3 (13)       | 2 (100)| 1 (100)    |

*Data are given as the number of patients (percentage of patients’ level of improvement) in the appropriate area of improvement.
changes and aesthetic changes that generally resolved within a few months.

To evaluate the overall satisfaction of the patients, we asked them if they would recommend this surgery to a friend or a relative with the same symptoms. Thirty-three patients (89%) (21 women and 12 men) responded that they would strongly recommend the procedure. The distribution of the functional results, cosmetic satisfaction, and ear disturbance of the patients with regard to recommending the surgery to others is reported in Table 4.

Table 3. Results of Butterfly Grafting on Breathing and Snoring Relative to Benefit Derived From Nasal Dilator Strip Use*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Level of Improvement</th>
<th>Use of Nasal Dilator Strips Before Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>After Surgery</td>
<td>Helpful (n = 16)</td>
</tr>
<tr>
<td>Breathing</td>
<td>Significant</td>
<td>13 (81)</td>
</tr>
<tr>
<td></td>
<td>Slight</td>
<td>1 (6)</td>
</tr>
<tr>
<td></td>
<td>No change</td>
<td>2 (13)</td>
</tr>
<tr>
<td></td>
<td>Resolved</td>
<td>5 (31)</td>
</tr>
<tr>
<td></td>
<td>Significant</td>
<td>7 (44)</td>
</tr>
<tr>
<td></td>
<td>Slight</td>
<td>1 (6)</td>
</tr>
<tr>
<td></td>
<td>No change</td>
<td>3 (19)</td>
</tr>
</tbody>
</table>

*Data are given as the number of patients who met the criteria for both categories (percentage of patients in the appropriate Nasal Dilator category).

Table 4. Selected Results Relative to the Patients’ Recommendation to Their Friends to Undergo Similar Surgery*

<table>
<thead>
<tr>
<th>Function</th>
<th>Level of Improvement</th>
<th>Recommend (n = 33)</th>
<th>Not Recommend (n = 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing</td>
<td>Significant</td>
<td>30 (100)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Slight</td>
<td>3 (60)</td>
<td>2 (40)</td>
</tr>
<tr>
<td></td>
<td>No change</td>
<td>0</td>
<td>2 (100)</td>
</tr>
<tr>
<td>Snoring</td>
<td>Resolved</td>
<td>11 (100)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Significant</td>
<td>12 (92)</td>
<td>1 (8)</td>
</tr>
<tr>
<td></td>
<td>Slight</td>
<td>3 (100)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No change</td>
<td>7 (70)</td>
<td>3 (30)</td>
</tr>
<tr>
<td>Tiredness and grogginess</td>
<td>Significant</td>
<td>15 (100)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Slight</td>
<td>5 (100)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No change</td>
<td>4 (67)</td>
<td>2 (33)</td>
</tr>
<tr>
<td>Cosmetic satisfaction</td>
<td>Yes</td>
<td>29 (97)</td>
<td>1 (3)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>4 (57)</td>
<td>3 (43)</td>
</tr>
<tr>
<td>Ear disturbance</td>
<td>Yes</td>
<td>5 (71)</td>
<td>2 (29)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>28 (93)</td>
<td>2 (7)</td>
</tr>
</tbody>
</table>

*Data are given as the number of patients (percentage of patients’ recommendations) in the appropriate area of improvement.

The management of snoring includes careful evaluation and correction of upper airway obstruction. Even though one of the contributing factors to snoring is nasal obstruction, nasal valve insufficiency is frequently over-looked as a cause of nasal obstruction and has certainly been overlooked as a contributor to snoring. Ricci et al15 showed that septoplasty alone or associated with lateral osteotomies did not increase nasal air flow but that correcting a narrowed nasal valve created a 2.5 times reduction in nasal respiratory resistance. They also showed that even in the presence of septal deviation, air flow may be improved with repair of an obstructing nasal valve. Therefore, it has become evident that the evaluation and correction of the collapsed nasal valve in a patient with nasal obstruction is essential.

Since air resistance is inversely proportional to the fourth power of the nasal radius, a small increase in diameter of the limiting segment will produce a large decrease in resistance, and vice versa (as we know from Poiseuille law). Furthermore, if the velocity of air movement is increased, the pressure difference will be increased in the narrowed segment. As the velocity of air passing through the nasal valve increases, the lateral nasal walls can no longer resist the atmospheric pressure relative to the negative pressure generated within the nasal cavity by the passing air. Naturally, the therapeutic modalities that increase the nasal valve area and strengthen the lateral wall of the nose help to improve nasal patency.

A number of surgical techniques have been described to increase the nasal valve area. The most frequently used method involves the use of spreader grafts, as described by Sheen.14 This technique aims to increase the angle of the nasal valve by inserting a cartilaginous graft between the upper lateral cartilage and the septum. The flaring suture technique described by Park15 increases the nasal valve angle with the use of a mattress suture placed through the caudal and lateral aspects of both upper lateral cartilages. A similar technique described by Ozturan et al16 bends the upper lateral cartilages upward through the use of separate mattress sutures. In addition to these, a variety of other suture techniques have proven useful for suspending the nasal valve.17,18 The technique we have used for most of our patients with dynamic valve collapse is the butterfly graft technique. We have found this technique to yield predictably good functional and cosmetic results in revision rhinoplasty cases, and we have extended its use to primary rhinoplasty in patients with dynamic valve collapse.

The treatment methods for nasal valve dysfunction focus on either repositioning the upper lateral cartilages or strengthening them. The natural curve, elasticity, and strength of the conchal cartilage, when it is placed on the caudal end of the upper lateral cartilages, not only increases the nasal valve angle but also strengthens the upper lateral cartilages (Figure 5). These 2 factors help to improve both static and dynamic nasal obstruction due to nasal valve collapse.

The importance of nasal resistance in respiratory sleep disturbance has been studied by several investigators. Metes et al10 showed that nasal resistance has a significant correlation with the snoring index. There is an association between nasal resistance and pharyngeal airway measurements at the base of the tongue as well as with tongue length in the supine position. Furthermore, nasal resistance is known to be an independent pre-
60%. This compliance rate decreased to 21% in a 5-year patient compliance with internal nasal dilators was only invasive and easy to use, in a 6-month follow-up study, ing substantially.

Additionally, there are a number of disadvantages to the use of nasal dilators, including allergic reactions and foreign body sensation. Of the patients in the present study, 23 (62%) used external nasal dilators previously and 16 (70%) reported benefit from them. Although not documented in the literature, it has been our experience that patients are almost universally unwilling to wear external nasal dilators during the day when they are seen in public. The present study shows that the butterfly graft improved breathing in 14 (87%) of the patients who benefited from the nasal strips. It also provided a permanent structural correction that was well accepted cosmetically.

Many habitual snorers complain of excessive daytime tiredness, fatigue, or sleepiness. When the snoring sound and frequency are reduced, patients wake up less tired and exhibit improved daytime function. The daytime symptoms of snoring as well as sleep apnea may result from the changes occurring during sleep. Hoffstein et al21 report that snorers had significantly more arousal per hour of sleep than nonsnorers, and patients with many arousals during the night snored more frequently and more loudly than those with fewer arousals. Snoring is most prevalent in slow-wave sleep (stage 3-4),25 and improving the nasal airway during sleep reduces slow-wave sleep time and increases rapid-eye-movement sleep time significantly.7 Although the present study has not aimed at determining changes in sleep architecture, we have observed that when snoring was improved with nasal valve reconstruction, patients derived significant improvement in sleep quality and felt better rested on awakening in the morning.

As nasal obstruction and snoring are somewhat subjective problems, we strongly believe that a subjective questionnaire is a very useful tool to determine the value of surgical procedures aimed at improving these complaints. In the survey we have completed, the overwhelming majority of patients reported that knowing what they know now (once all of the healing was complete and the postoperative discomfort resolved), they would not only recommend the procedure to friends with the same problem but would go through the procedure again themselves. We believe these statements are very telling and help to confirm that we are truly improving the quality of people’s lives.

In conclusion, although the patients included in the study were not initially seeking help for a snoring problem, the correction of nasal valve insufficiency for their nasal obstruction resulted in either cessation or significant improvement of snoring in most patients. This emphasizes the importance of nasal valve evaluation in snorers. We have found the conchal cartilage butterfly graft to be a reconstructive technique that yields successful results in improving snoring among many patients with nasal valve insufficiency.

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