Correction of Internal Nasal Valve Stenosis

A Single Surgeon Comparison of Butterfly Versus Traditional Spreader Grafts

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Abstract: Nasal obstruction due to internal nasal valve (INV) collapse is relatively common. This article evaluates 2 different methods repairing the INV.

Our subject population is a single-surgeon group of 82 patients who underwent a septorhinoplasty for nasal airway obstruction. Patients received either a spreader graft or butterfly graft. There are 30 patients who received spreader grafts and 52 patients who received a butterfly graft. All patients had a minimum of 3 months follow-up. All patients were evaluated with standardized questionnaire. Participants were asked to evaluate improvement in their nasal airway on an analog scale of 1 to 5. Participants were also asked to comment on changes in pre and postoperative snoring and sleep habits. Lastly, participants were queried regarding the ear cartilage harvest and if this bothered them.

Patients undergoing both procedures demonstrated an overall improvement in their nasal breathing. Significant differences in improvement were observed for patients in the categories of postoperative snoring, sleep, and continuous positive airway pressure use. Patients were not bothered by the ear cartilage harvest.

In select patients, the butterfly graft is a useful solution for INV collapse correction.

Key Words: butterfly graft, spreader graft, internal nasal valve, rhinoplasty

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There are multiple etiologies for functional nasal obstruction. One important cause is narrowing of the internal nasal valve (INV). This can be due to congenital deficiencies, posttraumatic deformities, or from previous nasal surgery.

The INV is formed by the junction of the upper lateral cartilage and the nasal septum. This valve is the narrowest part of the nasal airway and averages between 10 to 15 degrees. The narrowing of this angle results in functional nasal airway obstruction with nasal sidewall collapse upon inspiration. Poiseuille equation states that a narrowing of the radius will decrease airflow exponentially to the fourth power. This narrowing of the valve is a major cause of functional nasal airway obstruction.[1]

First described by Sheen,[2] spreader grafts are the gold-standard technique used to repair the INV. Spreader grafts are 3 × 20-mm cartilaginous grafts used to reposition the upper lateral cartilages and maintain middle nasal vault width (Fig. 1). Some authors have challenged the utility of spreader grafts, as they may lead to a tendency for the middle vault cartilages to form a rounded arch and thus narrow the angle of the internal valve.[3] Butterfly grafts are made from left ear conchal cartilage and fashioned to be 9 to 12 mm wide and 22 to 25 mm long with tapered lateral edges (Fig. 2). The graft is placed on the nasal dorsum in a subsuperficial musculoaponeurotic system plane and sutured to the upper lateral cartilages to stent open the INV (Fig. 3). The butterfly graft may also be placed through a closed approach (Fig. 4). Others have shown that the butterfly graft is useful for improving the functional and cosmetic results in revision rhinoplasty[4] and in improving snoring and breathing difficulties[5] in all types of rhinoplasties.

The senior author for this study performs INV repair, using both the butterfly and spreader graft methods. The method used depends on multiple factors. The butterfly graft is typically chosen for patients with very significant INV collapse but is avoided in thin-skinned patients where tip contour is a concern. Lastly, spreader grafts are preferred in patients with a twisted nasal deformity as they can provide better stability to the newly straightened nose.

Our hypotheses for this study were 2-fold: (1) butterfly grafts provide a better physiologic repair for the INV and (2) butterfly grafts may result in a cosmetic concern for some patients. As such, we hypothesized that butterfly grafts would relieve nasal obstructive symptoms better than or equally as well as spreader grafts but that we may observe a higher postprocedure cosmetic concern with the procedure.

METHODS

In this study, we retrospectively identified 78 consecutive patients who underwent reconstructive rhinoplasty with either butterfly grafts (48) or spreader grafts (30) placed for INV obstruction. These patients were mailed a questionnaire (Table 1) to assess symptoms before and after their rhinoplasty. There were no financial incentives given for completing the survey and all patients were sent a reminder postcard 1 month after the initial mailing. The questionnaire contained questions about patient symptoms before and after the procedure as well as donor site and cosmetic concern questions. All patients were operated on by the senior author from August 2005 through June 2006 at the University of Wisconsin Hospitals and Clinics. Internal Review Board approval from the University of Wisconsin was obtained before conducting this study. Statistical analysis was performed using unpaired Student t test with a $P < 0.05$ considered significant.

RESULTS

Survey responses were received from 24 of 48 (50%) of the butterfly graft patients and 10 of 30 (33.3%) of the spreader graft patients. The butterfly group consisted of 8 men and 16 women. The spreader group consisted of 3 men and 7 women. The average age was 47 for the butterfly group, whereas 29 for the spreader group. Internal nasal valve dysfunction was due to an acquired nasal deformity secondary to trauma or previous rhinoplasty in 17 of 34 (50%) of patients.

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The majority of patients (32/34) had INV collapse on examination preoperatively as demonstrated by a positive Cottle maneuver and weak lateral nasal sidewall. Two other patients were deemed to have open roof deformities intraoperatively after osteotomies were performed. Three of the 34 patients had external nasal valve collapse in addition to internal valve collapse. All patients had some degree of septal deformity preoperatively.

The butterfly graft was made from conchal cartilage from the left ear. Spreader grafts were all formed from septal cartilage. All of the spreader graft and 75% of the butterfly graft rhinoplasties were performed open. Of the 10 spreader graft patients, 8 had a columellar strut placed and 3 had a dorsal onlay graft placed. Of the 24 butterfly graft patients 5 had a columellar strut placed, 2 had a dorsal onlay graft placed, and 3 had batten grafts placed.

The results from the questionnaire are summarized in Figures 5 and 6. Close to 60% of patients in each group reported snoring prerhinoplasty. A significantly larger number of butterfly graft patients (37.5% vs. 20.0%, $P < 0.05$) did try using Breathe Right strips (CNS Inc, Minneapolis, MN) to assist with breathing before surgery. Almost all of the patients had improvement in their snoring symptoms. There was no statistically significant difference between the 2 groups of patients with regards to cessation of snoring (45.8% vs. 40.0%, $P < 0.382$). Only one patient overall stated that their snoring remained the same.

Obstructive sleep apnea was present in 4 of the butterfly graft patients preoperatively and this subjectively improved in all 4 postoperatively. One patient was able to stop using continuous positive airway pressure postoperatively.

Inferior turbinate hypertrophy was present in 8 of 10 (80%) of the spreader graft patients and 12 of 24 (50%) of the butterfly graft patients. All of these patients underwent concomitant submucosal turbinate resection.

Over 60% of the patients in both groups reported being tired and groggy preoperatively and this again improved in both groups with placement of the grafts. Only one patient in each of the groups had no improvement. Breathing was better or slightly better in the butterfly graft group (90.0%) and the spreader graft group (83.3%), postoperatively. Both groups had a high level of improvement, but his difference was not significant ($P = 0.529$). Of the 24 butterfly graft patients, 20 (83%) stated that the missing ear cartilage did not bother them. Additionally, 21 of 24 (88%) of butterfly graft patients were satisfied with the cosmetic appearance of their nose and 23 of 24 (96%) would recommend the surgery to others.

DISCUSSION

INV obstruction is a major cause of airway obstruction and should be especially considered in postrhinoplasty patients.[6] The deformity can be static or dynamic. It can also coexist with other nasal pathologies including septal deviation, turbinate hypertrophy, and external nasal valve collapse.

Reduction rhinoplasty and osteotomies performed in cosmetic rhinoplasties and their effect on the INV were studied by Grymer, using acoustic rhinometry.[7] He reported a 25% reduction in the cross-sectional area of the valve and 13% reduction in the area at the pyriform aperture.

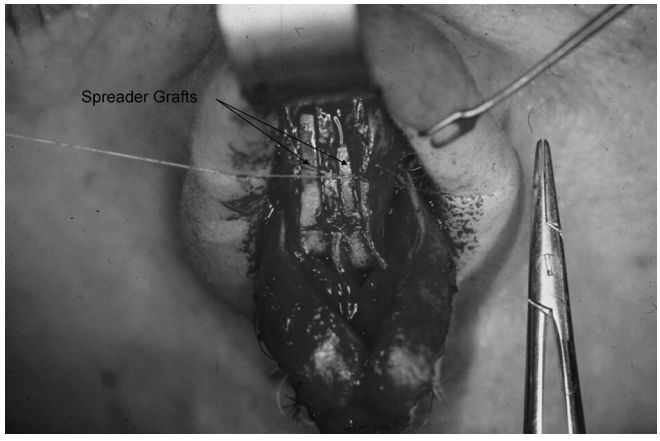

FIGURE 1. Bilateral spreader grafts have been placed in this patient to open the internal nasal valves and widen the middle nasal vault.

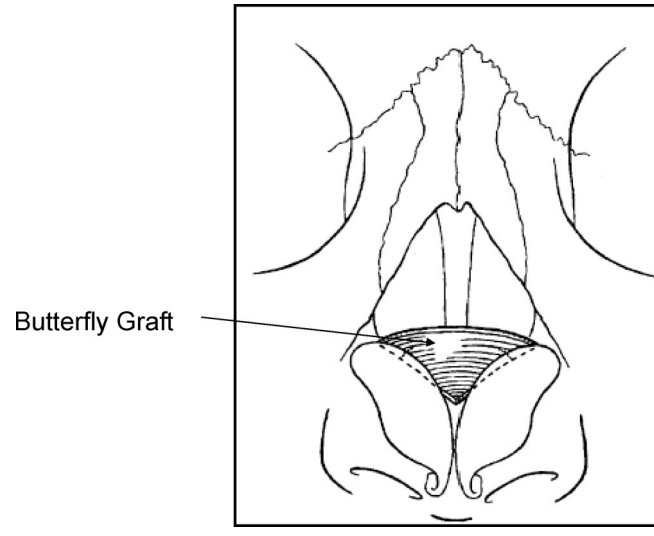

FIGURE 3. A typical butterfly graft placed in the sub-SMAS position and sutured in place to the upper lateral cartilages. The graft stints open the internal nasal valves.

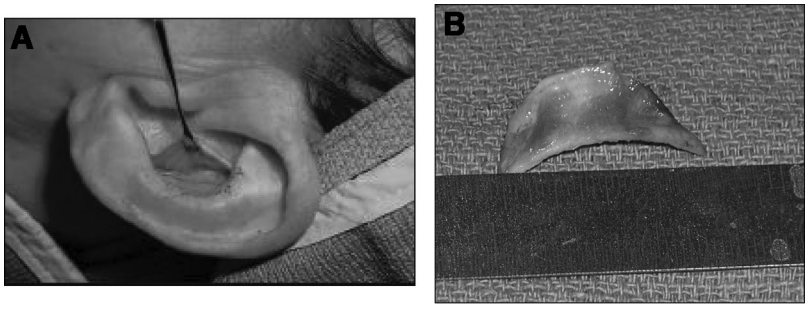

FIGURE 2. Conchal cartilage has been harvested from the left ear (A) and fashioned into a typical butterfly graft which measures 9–12 mm by 22–25 mm and has tapered lateral edges (B).

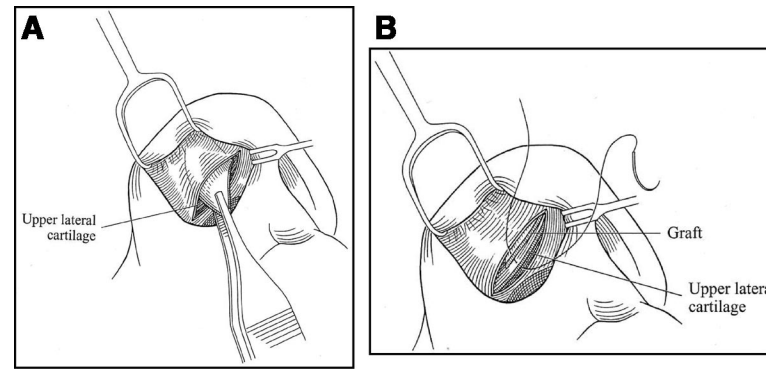

FIGURE 4. The butterfly graft may also be placed through a closed approach using an intercartilaginous incision (A). The graft is placed between the upper lateral cartilage and lower lateral cartilage (B).

TABLE 1. Nasal Airway Obstruction Questionnaire

1. Did you snore before the nasal surgery?
2. Had you tried Breathe-Right strips* prior to the nasal surgery?
3. If "YES" to the above, then was it helpful?
4. After surgery, did your snoring:
   - Resolve
   - Improve significantly
   - Improve slightly
   - Remain the same
   - Get worse
   - Don't know
5. Did you feel tired and groggy on awakening before the surgery?
6. If "YES," when you compared before the surgery, how tired and groggy do you feel upon awakening?
   - Significantly better
   - Slightly better
   - No change
   - Slightly worse
   - Significantly worse
7. Please rate your breathing results following surgery?
   - Significantly better
   - Slightly better
   - No change
   - Slightly worse
   - Significantly worse
8. Are you satisfied with the cosmetic appearance of your nose?
9. Does the missing ear cartilage disturb you?
10. Would you recommend the surgical procedure to your friend or a relative?
11. Did you use continuous positive airway pressure (CPAP) to help with your breathing before your nasal surgery?
12. If "YES," then do you still use CPAP after your nasal surgery?

*GlaxoSmithKline, Middlesex, UK.

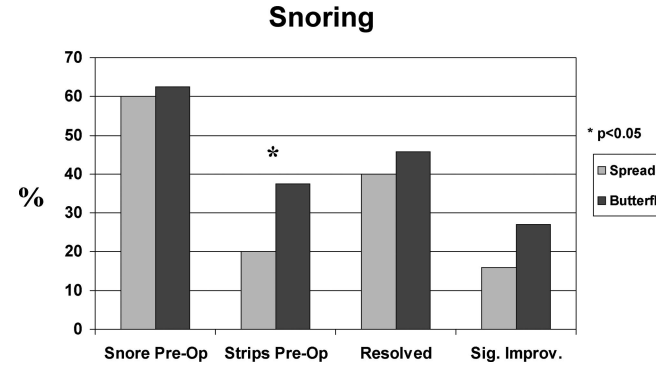

FIGURE 5. The butterfly graft and spreader graft groups both showed improvement in snoring postoperatively. The butterfly group had a higher number of patients who used breathe-right strips preoperatively (38% vs. 20%, $P < 0.05$).

Sheen[2] described placing spreader grafts made of cartilage between the upper lateral cartilages and the septum to increase the angle of the INV. The spreader grafts displace the upper lateral cartilages laterally. Septal cartilage is most often used to fashion these grafts. The graft is 2 to 3 mm wide and made to be the length of the upper lateral cartilage. It is placed submucosally and secured with sutures.

Some authors have advocated using spreader grafts preventatively in primary rhinoplasty patients who have short nasal bones and long, weak upper lateral cartilages.[8] Whether in primary or secondary cases spreader grafts have been reported to improve nasal valve patency by over 80%.[9] Others have described combining spreader grafts with flaring sutures[10] or spreader grafts combined with alar batten grafts[11–13] for nasal airway obstruction. Lateral suture suspensions[14] and overlay grafts[15] have also been used. Mendelshon[16] described using extended spreader grafts made out of porous polyethylene to straighten the middle third of the nose.

Clark and Cook[4] report using the butterfly graft in primary and revision rhinoplasties to strengthen the lateral nasal sidewall and to open the valve angle. Our technique was similar and is summarized below.

The butterfly graft is made from left ear conchal cartilage and is contoured to be approximately 0.9 to 1.2 cm long by 2.2 to 2.5 cm wide with tapered lateral edges (Fig. 2). The graft may be placed by an open or closed endonasal approach. The graft is placed in a pocket at the caudal end of the upper lateral cartilages and deep to the cephalic border of the lateral crura. The graft is secured with 5-0 polydioxane suture.

Clark and Cook[4] described using the butterfly graft for postrhinoplasty INV dysfunction and found results similar to ours. They analyzed 72 patients who were followed for a minimum of 2 years and found almost all of the patients received relief of nasal airway obstruction and reported improvement in the appearance of their noses.

Marcus et al[17] used butterfly grafts (28) and spreader grafts (6) in patients with functional airway obstruction who also received endoscopic sinus surgery and found that 93% of these patients received some improvement in the nasal breathing. The results were not broken down comparing the butterfly graft patients to the spreader graft patients. They reported 92% patient satisfaction with

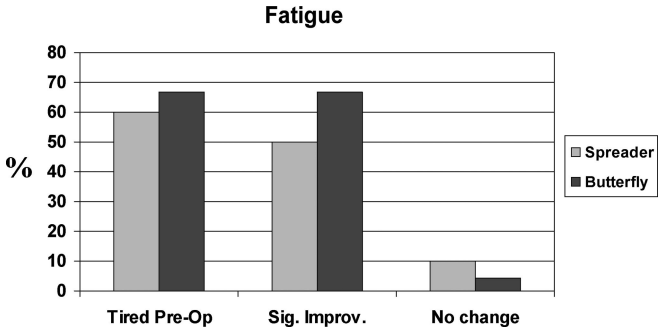

FIGURE 6. The butterfly graft and spreader graft groups both showed improvement in patient fatigue.

FIGURE 7. Preoperative frontal and lateral (A, B) views of a 35-year-old male with bilateral internal nasal valve obstruction secondary a posttraumatic deformity. This patient underwent a closed rhinoplasty with butterfly graft placement (B, D).

the procedure which is similar to our 96% of patients who would recommend the operation to others.

Hurbis[18] described using a spanning butterfly graft made of an adjustable titanium-expanded polytetrafluoroethylene. He reported a decrease in snoring and an enlarged INV on rhinomanometry measurements. This was a small preliminary report and there is concern over using prosthetic material.

We had a high overall rate of satisfaction (88%) with the cosmetic result using the butterfly graft. The butterfly graft does alter the nasal esthetics by widening the supratip area (Fig. 7). The butterfly graft also improved the lateral wall weakness that was noted preoperatively in patients. In patients who suffer from a pinched nasal supratip or a mild saddle deformity the butterfly graft is ideal for restoring form and function.

Snoring results from narrowing of the nasal airway and is associated with daytime fatigue. It is a subjective symptom that can be associated with disruptive sleep patterns and obstructive sleep apnea (OSA). OSA is defined as 5 obstructive events during 1 hour of sleep and it affects in 9% to 26% of middle-aged people.[19] Patients that have OSA complain of inability to maintain attention at work, decrease in memory, and overall decreased quality of life.[19,20] These patients also suffer from increased fatal and nonfatal cardiac events.[21] In our study, there was a trend toward butterfly grafts improving snoring more often than the spreader grafts (72.8% vs. 56.0%, respectively), but this was not statistically significant ($P = 0.241$). The 4 butterfly graft patients with OSA all improved postoperatively which is important given the morbidity and mortality associated with OSA. The authors believe anecdotally that the butterfly graft improves snoring and OSA better than spreader grafts, and that the lack of statistical significance is due to the smaller number of spreader graft patients. Our high rate of improvement in snoring with the butterfly graft patients (72.8%) is similar to the findings of Akcam et al.[5]

Improvement in nasal breathing was excellent in both the butterfly graft and spreader graft patients (83.3% vs. 90.0%, respectively). Additionally, fatigue improved in both the butterfly and spreader graft patients after rhinoplasty (70.9% vs. 60.0%, respectively). Again, all of these comparisons approached statistical significance.

CONCLUSIONS

In the present study, we were able to show that butterfly grafts are at least as efficacious as spreader grafts in treating nasal airway obstruction caused by INV narrowing. The authors believe that one of the reasons there was little statistical difference between the results in the butterfly graft and spreader graft patients, is due to the butterfly graft group containing patients who had more severe INV deformities and subjectively worse symptoms. Although this was not specifically examined in this study, this has been the case when selecting patients who will receive a butterfly graft. The butterfly graft improved snoring, subjective feelings of tiredness, and nasal breathing in almost all of our patients and the donor site deformity was minimal. Also, the butterfly graft gives an excellent cosmetic result.

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