External Ultrasound-Assisted Liposuction of the Abdomen: A Report of Our Experience

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Introduction

Zocchi introduced the use of ultrasonic energy to the tumescent liposuction technique in the United States 1992(1). This first combination of ultrasound and liposuction incorporated ultrasonic energy into the tip of the liposuction cannula to emulsify the fat and facilitate its removal. This became known as Ultrasound-Assisted Liposuction (UAL). This technique is currently an accepted and commonly used method, though the incidence of complications is noteworthy. The drawbacks of UAL include the added cost and operating time as well as the risk of thermal tissue injury, seromas and paresthesias (1). In 1997, Silberg introduced the concept of external ultrasound-assisted liposuction (XUAL) to facilitate the standard technique with an expected decreased incidence of complications when compared to UAL. The thought was that the ultrasonic energy applied pre-operatively would loosen the intercellular connections and facilitate the removal of the fat with the traditional tumescent technique. He also predicted that other potential benefits would include reduced operating time, improved skin contracture and shorter recovery time (2). Both Silberg and Wilkinson found that XUAL was safe and beneficial in preliminary studies, noting good skin contracture, ease of fat removal and decreased post-operative pain and swelling(2,3). Several other preliminary studies have shown similar benefits and no significant adverse events associated with the use of pre-operative XUAL(4,5,6).

This study was undertaken to report our experience with XUAL of the abdomen at a single cosmetic surgery center over a one year period. The primary question being addressed was whether XUAL of the abdomen would result in a higher rate of adverse events when compared to the traditional tumescent technique.

Materials and Methods

Beginning January 1st, 2006 fifteen consecutive patients undergoing abdominal liposuction without the use of external ultrasound were prospectively included in the study. Data collected included each patient's body mass index (BMI), volume of tumescent fluid infused, fat volume removed and total volume of aspirate. The traditional tumescent technique with a 10 gauge Capistrano aspiration cannula was applied in this group of patients. These patients were labeled group 1. In addition, 6 months later, on July 1, 2006, fifteen consecutive patients were treated with external ultrasound prior to abdominal liposuction, again using the traditional tumescent technique. Each case was performed in an identical manner. The ultrasonic energy was applied to the entire abdominal area in a standard fashion using a setting of 1.5 watts/cm2 for 10 minutes immediately following infusion of the tumescent solution, with the amount infused calculated based on the tumescent technique. All patients were under general endotracheal anesthesia during the infusion, the ultrasound application and the liposuction procedure, again using a 10 gauge Capistrano cannula for aspiration. Data collected included each patient's body mass index (BMI), tumescent fluid infused, fat volume removed and total volume of aspirate. There were no pre-operative, intraoperative or immediate post-operative adverse events in any patient in either group.

Results

The abdominal liposuction procedures were uneventful in all patients in groups 1 and 2. All patients were dressed with the routine post-operative abdominal compression garments with absorbent cotton padding between the skin and the garment. These were worn continually for the first 7 days in all patients and only removed for showering on post-operative day two. Post-operative instructions were given to each patient in written form with detailed information about activity restrictions, diet, wound care and follow-up appointments.

The incidence of adverse events in both groups was evaluated in the post-operative period. Adverse events were defined as excessive edema, ecchymosis, seroma greater than 50cc, hematoma, infection or wound breakdown. There were no cases of adverse events in any patient in the immediate post-operative period. However, at the first post-operative appointment it was notable that 2 of 15 patients in group 1 (13%) had developed a significant (>50cc) lower abdominal seroma. Both patients were successfully treated with a single closed drainage procedure in the office via needle aspiration. In group 2 at the first post-operative visit it was notable that 5 of the 15 patients (33%) presented with a significant (>50cc) lower abdominal seroma. All patients in group 2 were successfully treated with drainage of the fluid via either needle aspiration or by opening the midline lower port and placing a passive drain in several cases. An average of 2.5 drainage procedures were required for resolution of the seromas in group 2. No patient in either group required additional surgery or anesthesia, and there were no associated infections or other complications. Compression garments with padding were worn continually until the seromas had completely resolved. All patients in both groups went on to full recovery with satisfactory results. Data from both groups are presented in table 1.

Statistical analysis of our data was done with a non-pooled inference test, with alpha set at 0.05. The analysis showed that the data provided sufficient evidence that group 2 has a significantly different seroma rate with 95% confidence, which gives borderline results at 5% significance. The analysis of the data suggests that any bias would likely be removed with 25 patients per group.

Discussion

The practice of incorporating ultrasound technology with liposuction is a time-tested and well-accepted technique. For over 15 years cosmetic surgeons have used both internal and external ultrasound energy to assist in the procedure of fat removal through liposuction. The concept of external ultrasound combined with liposuction was developed by several surgeons after the incidence of complications with the internal technique were noted to be higher than the standard liposuction procedure (2,3). The intention was to facilitate fat removal with a lower risk of adverse events. Previous studies of XUAL have shown a good safety profile and subjective clinical benefits, including less post-operative pain, swelling and bruising (1,3). In 1997, Havoonjian also reported a higher degree of skin contracture in his preliminary study of XUAL. Based on this early data, XUAL appeared to be safe and beneficial when added to the traditional tumescent liposuction technique as described by Klein and Lillis in 1985.

Our study of XUAL was based on these early findings and the anticipated benefits to our patients. Silberg and Wilkinson found that some of these benefits included reduced pain, reduced edema that resolved more quickly and a shorter recovery time. Though our results in the early post-

operative period were subjectively improved, or at least not changed, the incidence of seroma formation in the XUAL group (group 2) shifted our focus from the benefits to the possible adverse events. The data were analyzed and the two groups compared, specifically noting fat volume removed, total aspirate removed and the patients' pre-operative BMI. The incidence of seroma formation was clearly linked to higher BMI and total fat volume removed. The consistent variables included tumescent volume infused, amount of ultrasound energy delivered and cannula size used during the aspiration procedure. In most patients the flanks and low back were also sculpted with the liposuction technique, however the abdomen was the only area treated with ultrasound pre-op. It is notable that the only area to develop a seroma was the abdomen, which suggests that the ultrasound could be related to the seroma formation. The cause of the seroma formation remains unknown, however the possibilities of septal breakdown, lymphatic and venous damage and cavity formation are reasonable.

In our practice, abdominoplasty is sometimes staged following abdominal liposuction. Frequently small pseudobursa are found in the areas of prior liposuction. While this makes sense and can explain the seroma incidence in general, we do not have data to implicate XUAL in these instances, and this could be a topic of further study. It is also notable that we often use external ultrasound in our liposuction patients to reduce swelling in the early post-operative period. This application has subjectively shown to be very beneficial, and seems to even reduce the duration of post-operative discomfort.

Our data suggests that XUAL of the abdomen will result in a higher incidence of seroma formation when compared to abdominal liposuction without the use of ultrasound assistance. Our study is limited by the small number of patients involved and non-randomized design. A prospective, randomized trial with an increased number of patients would certainly add value to our literature and confirm or refute our findings of an increased incidence of seroma with XUAL of the abdomen. There could also be other variables not evaluated by our study that could have contributed to our findings. A larger prospective trial could also show that XUAL does not significantly increase the incidence of seroma formation.

Conclusions

Based on this information we have concluded that there may be an increased incidence of seroma formation with XUAL of the abdomen. We have not used the technique in our abdominal liposuction cases since discovering this information and will not resume the technique until further studies prove that the benefits outweigh the risk of adverse events.

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Table 1. Patient Data

	Patient #	BMI	Fat Aspirate (cc)	Total Aspirate (cc)	Seroma (cc)
Group 1	1	19	425	875	no
	2	31	3475	4500	no
	3	27	3875	4800	no
	4	23	3400	4150	no
	5	28	1825	2300	no
	6	23	3550	4550	100
	7	16	400	950	no
	8	29	3025	3825	15
	9	29	2450	3300	no
	10	26	2225	3825	no
	11	22	2700	3600	no
	12	21	1500	2000	no
	13	28	2550	3850	120
	14	25	4150	5600	no
	15	28	4550	5950	no
Group 2	1	26	4125	5275	no
	2	30	6300	8050	250
	3	34	7450	8550	300
	4	24	3850	5450	450
	5	31	5100	6600	no
	6	35	2100	3150	no
	7	30	5150	7250	no
	8	34	6000	8200	no
	9	27	4800	6600	no
	10	24	4200	5850	20
	11	28	3550	4600	no
	12	21	1700	2800	no
	13	27	4775	6825	300
	14	23	1800	2400	no
	15	32	5600	7000	250

CLINICAL TECHNIQUE

Treating Internal Nasal Valve Collapse: The Intranasal Valvuloplasty

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Introduction: *Nasal obstruction requires a careful and thorough examination of the nose and nasal cavity. Particular interest should be placed on the internal and external nasal valves and their collapse. We discuss a simple yet effective technique to resolve obstruction of the internal nasal valve, called the intranasal valvuloplasty/valvulopexy. These procedures can be of benefit for valvular obstruction, especially postrhinoplasty.*

Objective: *Nasal obstruction as sequela to aesthetic surgery may occur more often than recognized. The purpose of this paper is to explain a relatively simple yet expedient technique to address nasal valvular collapse.*

Method: *Retrospective review of patients treated with the intranasal valvuloplasty/valvulopexy technique in the outpatient setting.*

Results: *We reviewed our last 6 patients with the technique our senior author has been performing for 20 years. The patients noted 80–100% subjective improvement and we noted comparable objective improvement. Of the 6 patients, 50% were done bilaterally and 33% were combined with either a septoplasty or with a septorhinoplasty. Of these, 66.7% had a history of prior nasal surgery, usually rhinoplasty.*

Discussion: *The valvuloplasty is an effective and straightforward approach to nasal valve collapse either alone or in conjunction with other rhinological procedures.*

Introduction

Nasal obstruction requires a careful and thorough preoperative examination of the nose and nasal cavity. Particular interest should be placed on the internal and external nasal valves and their collapse. It is paramount that if cosmetic surgery is performed on a nose it should be functional as well as aesthetic. One should not compromise the airway, creating a nasal cripple for an aesthetic outcome. Nasal septal deviation and hypertrophic turbinates are a common cause of obstruction and easy to evaluate; the nasal valves, however, require more diligence during examination. Numerous techniques have been devised for repair of valvular collapse,[1] from anchoring suspensions[2] to cartilage grafting[1,3,7] and lateral crural "J" flaps,[4] with varying degrees of success and operator expertise needed. We have devised a simple yet effective technique that addresses the collapse of the internal nasal valve, and it can easily be done alone or in conjunction with other nasal procedures.

The internal nasal valve consists of the attachment of the upper and lower lateral cartilages, the anterior portion of the inferior turbinate, and the attachment of the nasal septum to the lower lateral cartilages.[5] It is located approximately 1.3 cm from the nares, with an average cross-sectional area of 0.73 cm,[2] and is normally the narrowest segment of the nasal airway.[5] Anterior rhinoscopy should be performed to evaluate the nasal septum, the turbinates, the valves, and the mucosa (Figure 1). Further testing of the nasal valve using the Cottle maneuver and the modified Cottle maneuver helps to identify valvular collapse. This can be secondary to aging with collapse and descent of the redundant soft tissue envelope and/or iatrogenic disruption of the scroll with or without overresection of the lower lateral cartilage (Figures 2 and 3) and/or trauma, etc.

Several techniques have been used to treat this malady. We will describe these to demonstrate the simplicity of our technique. Suspension techniques use a bone anchor from the bony orbital rim area. A suture from the bone anchor is placed in the valvular cartilage followed by tightening of the suture.[2] The suture can often be palpated following this procedure. Spreader

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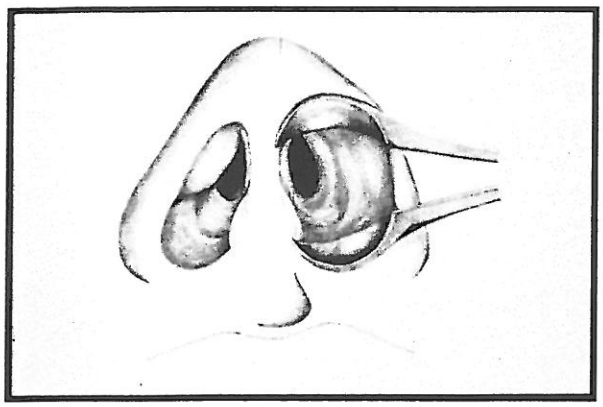

Figure 1. *Using anterior rhinoscopy, valvular redundancy identified.*

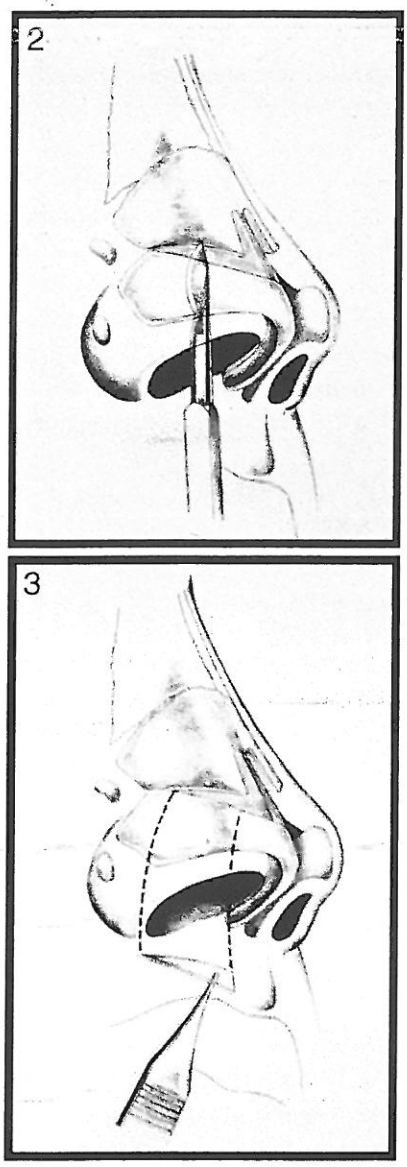

Figure 2. *Iatrogenic damage to scroll area.*

Figure 3. *Overresection of cartilage leading to valvular collapse.*

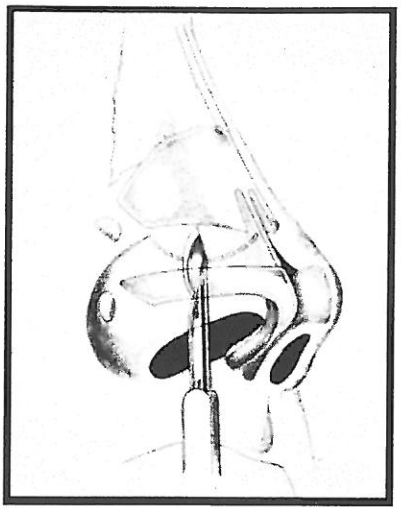

Figure 4. *A curvilinear incision is created with a #15 blade starting at the posterior limit of the lower lateral cartilage, taking care not to approach the septum.*

grafts work but require the use of graft material harvested from other locations, increasing time and possible donor site problems. Perceptible widening of the nose is also possible. Alar batten grafts work in the appropriate patient but again require graft material and can have some external contour changes that have to be considered.[1,3] Flaring sutures may be used with or without spreader grafts but work best in conjunction with spreader grafts and require an open technique. Injectable fillers have recently been used, though long-term results are yet to be seen. The lateral crural "J" flap consists of redundant vestibular skin removal in the valvular area through an incision caudal to the lower lateral cartilage in a more lateral fashion.[4] Lateral crus pull-up techniques involves freeing the lower lateral cartilage and suture fixation after drilling a hole in the bony pyramid for attachment.[6]

Technique

The patient is prepped and draped in the usual fashion with the nose initially packed with pontacaine and phenylepherine for 5–8 minutes, at which time the packing is removed. The incision site is injected conservatively with 2% lidocaine with 1:50 000 epinephrine to prevent distortion. Next, a curvilinear incision is created with a #15 blade starting at the posterior limit of the lower lateral cartilage to avoid an incision too deep within the nose to close. The incision should not approach the septum, so as to prevent cicatricial scar formation (Figure 4). It is most important to make certain that your incision is at the

lower lateral cartilage to provide support. A submucosal pocket is then dissected using scissor technique and carried superiorly under the upper lateral cartilage in a supraperichondral plane (Figure 5). The pocket should be widely undermined to allow the tissue to be advanced easily without distortion (Figure 6). The tissue is then advanced anteriorly, back cuts are made with excision of mucosal excess, and the incision is then closed with 5-0 chromic suture in an interrupted fashion taking care not to ensnare the surface outer skin or cartilage (Figure 7). The nose is then taped in the standard rhinoplasty fashion and a 4-0 plain gut suture on a short Keith needle is placed through the external tape, nasal skin, cartilage, internal valve across the incision internally, and back out, and then tied over the tape, effectively pexiing the internal valve up and removing any dead space. Do not overtighten the sutures, as this could lead to skin necrosis with subsequent swelling (Figure 8A–C). On postoperative day 6, the patient is reevaluated and the pexy suture is cut and the taping removed. The nasal valve is then inspected by anterior rhinoscopy and should be patent with minimal edema (Figure 8D).

Results

Using the methods described on the last 6 patients treated and reviewing both on subjective and objective parameters, a retrospective review was performed. The subjective parameter used was nasal congestion and improvement noted at 1 week and 1 month. Final results were at 6 to 12 months. Objective improvement was anterior rhinoscopy of the internal valve. Six patients were treated with this technique, with an average age of 46.8 years and a male to female ratio of 1:2. Fifty percent of the procedures were done bilaterally and 33% were combined with either a septoplasty or with a septorhinoplasty. It was also noted that 66.7% of patients presented to us had a history of prior nasal surgery, usually rhinoplasty. Follow-up revealed that 80–100% noted subjective total improvement, and we noted significant objective improvement as well (Table 1).

Discussion

Valvular collapse can be a troublesome dilemma to both the rhinologic surgeon and the patient. There are a multitude of treatments for this with varying degrees of success and complexity. The intranasal valvuloplasty/valvulopexy we have shown is an effective and straightforward approach to nasal valve

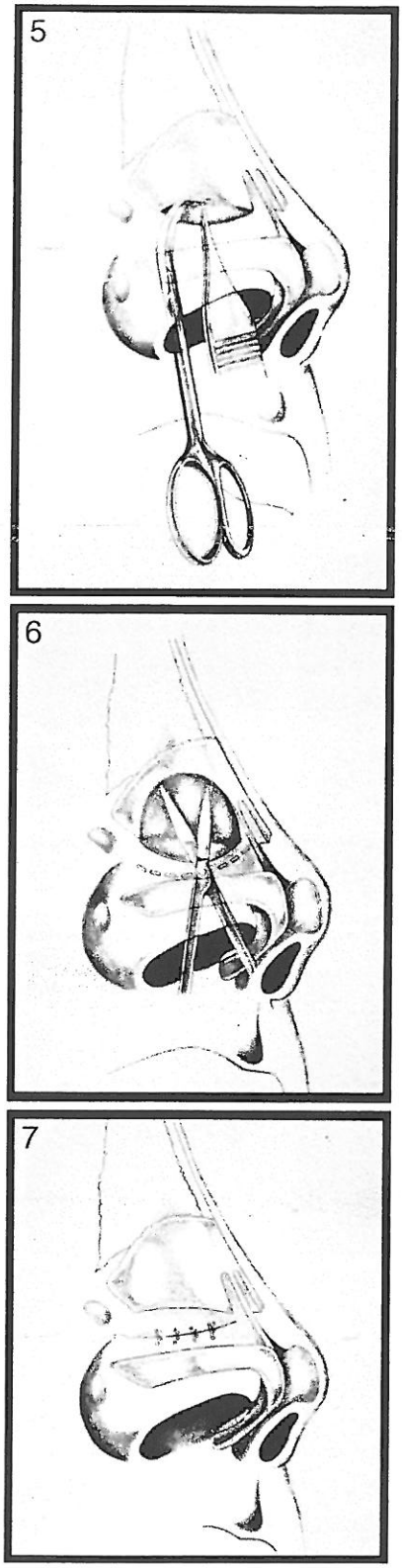

Figure 5. *Undermining of nucosa below the upper lateral cartilage in a supraperichondrial plane.*

Figure 6. *Extent of wide undermining to facilitate advancement without distortion.*

Figure 7. *Simple closure of flap with 5-0 chromic suture.*

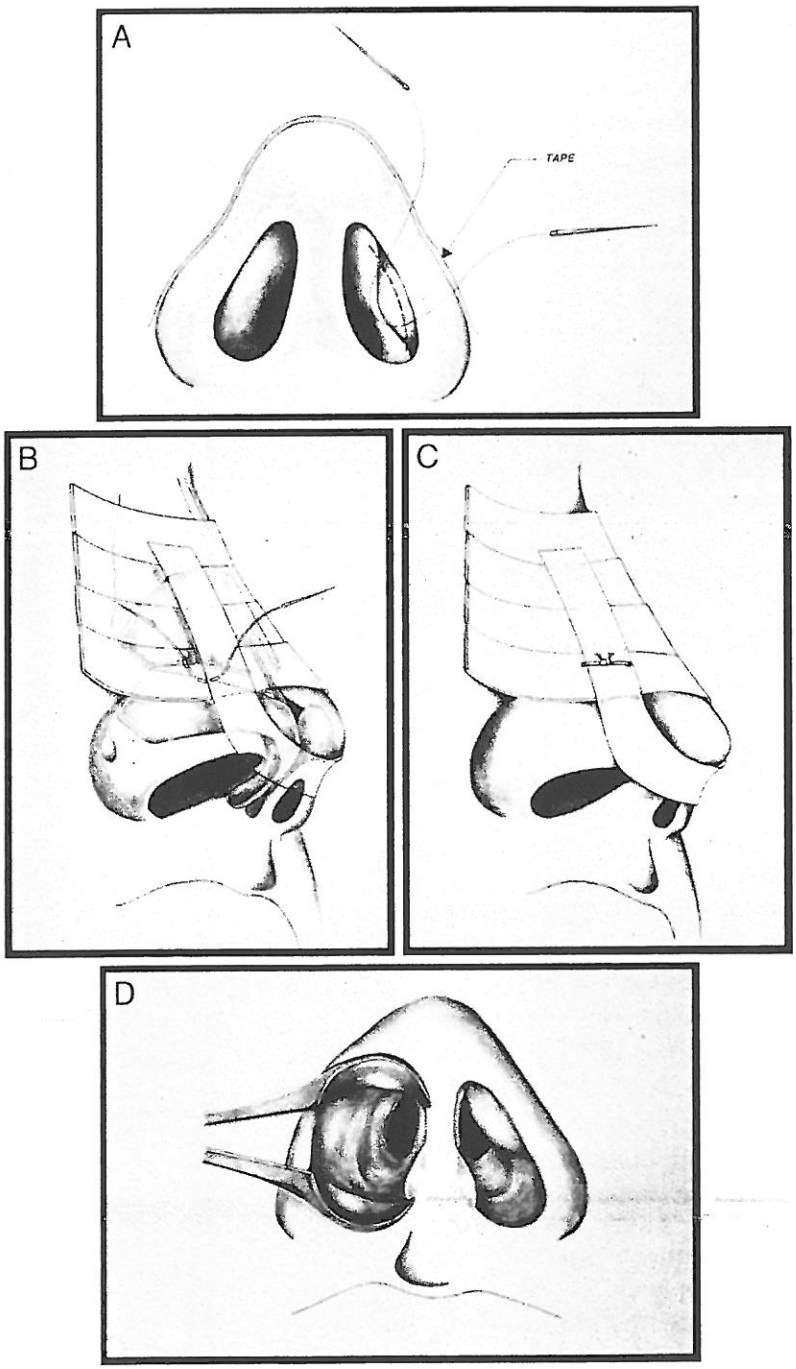

Figure 8A. *Pexy suture placement of 4-0 plain gut over flap.*

Figure 8B. *External view demonstrating nasal taping and pexy suture.*

Figure 8C. *The pexy suture must not be overly tight. Should be just tight enough to remove dead space, pexiing the valve up and open.*

Figure 8D. *Postoperative day 6 following removal of tape and pexy suture demonstrating patent nasal valve with minimal edema.*

Table 1. Post Valvuloplasty Satisfaction

Sex	Age	Side	Other Surgical Procedures	Objective Improvement	Subjective Improvement
M	50	R	Previous rhinoplasty	Improved	Improved
F	61	B	Previous rhinoplasty	Improved	Improved
F	52	B	Previous rhinoplasty	Improved	Improved
M	33	L	Septoplasty	Improved	Improved
F	51	B	Rhinoplasty	Improved	Improved
F	34	L	Previous rhinoplasty	Improved	Improved

collapse either alone or in conjunction with other rhinocological procedures.

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