Aesth Plast Surg (2014) 38:275–281
DOI 10.1007/s00266-013-0258-2

ORIGINAL ARTICLE AESTHETIC

Are Grafts Necessary in Rhinoplasty? Cartilage Flaps with Cartilage-Saving Rhinoplasty Concept

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Received: 22 July 2013 / Accepted: 3 December 2013 / Published online: 20 December 2013

Abstract

Background Cartilage grafts are used routinely in rhinoplasty, but are they necessary? Can we support the normal anatomy by preserving and transposing the adjacent tissues? In this study we hypothesize that during rhinoplasty, cartilage flaps can give adequate support and may decrease the need for cartilage grafts.

Methods Included in this study were 147 patients who underwent an open rhinoplasty technique under general anesthesia between January 2010 and May 2012. Mean operative time was 73 min (range = 44–120 min). After dissection and septoplasty (if needed), we performed dorsal bone and septal reductions. Following reduction, upper lateral cartilage superior segments were preserved and turned inward as cartilage flaps to replace the spreader grafts. Lower lateral cartilage cranial parts were not excised and were slid over the caudal part to replace the alar strut grafts. Cartilage from the caudal nasal septum was not excised; instead, lower lateral cartilages were cephaloposteriorly displaced with a tongue-in-groove technique to support the nasal tip.

Results Mean follow-up time was 19.6 months (6–30 months). All patients but 12 were satisfied or completely satisfied with the results. Among the 12 unsatisfied patients, four complained of a one-sided inverted-V deformity (secondary spreader grafts were added), three had supratip deformity (secondary additional dorsal septal excisions), two demanded extra tip definition (secondary tipoplasty), two were unhappy with the bone symmetry (secondary osteotomies), and one complained of hanging columella (secondary excision from the caudal septum).

Conclusions Cartilage flaps have some advantages over cartilage grafts. First, graft harvest is not needed in the former; second, because flaps are a part of the normal anatomy, they provide a good tissue match, making fixation easier. However, the tongue-in-groove technique cannot be used in patients who do not need caudal excision, and cartilage flaps can be inadequate in some patients who may need additional grafts.

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Keywords Rhinoplasty · Graft · FLAP · Spreader flap · Septoplasty · Cartilage flap · Strut graft · Tongue in groove

Electronic supplementary material The online version of this article (doi:10.1007/s00266-013-0258-2) contains supplementary material, which is available to authorized users.

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Introduction

In a reduction rhinoplasty, the normal anatomy is generally disrupted. Various autogenous-alloplastic grafts can be used to improve the outcomes [1–8]. The most common graft source in rhinoplasty is cartilage harvested from the base of the quadrangular cartilage. This harvest unnecessarily increases morbidity in patients who do not need a septoplasty. If the patient has had a previous septoplasty, the situation becomes more problematic, as harvesting of cartilage from the ear or ribs may become necessary. In addition to harvesting morbidities, because these grafts, though similar in structure, are not the same and are totally mobile, technical difficulties can be encountered during adaptation.

Cartilage flaps in rhinoplasty gained popularity in the past few years as they offer advantages similar to those of cartilage grafts but with less donor site morbidity [5, 9–12]. Upper lateral cartilage (ULC) flaps can be used to support the keystone area and internal nasal valve [9–11]. Lower lateral cartilage flaps can support the external valve and lateral crura of the lower lateral cartilage [5, 12]. The caudal end of the quadrangular cartilage can be used to support nasal projection with a tongue-in-groove technique or septocolumellar sutures, and various suture techniques can be used to increase the tip definition [13–15].

The purpose of this study was to present primary rhinoplasty cases in which we combined different cartilage flaps and suture techniques to avoid or minimalize the use of cartilage grafts. We also explore our main research question: "Are grafts necessary in rhinoplasty?"

Materials and Method

Included in this study were 208 patients who underwent cosmetic rhinoplasty surgery between January 2010 and May 2012. The first author performed all surgeries. In addition to receiving a routine preoperative physical examination with a nasal speculum, all patients were endoscopically examined under general anesthesia just before the operation to determine the need for septoplasty and concha surgery. Of the 208 patients, 52 were not found to be suitable for the tongue-in-groove technique and were excluded from the study. In addition, nine patients were further excluded from the study because seven needed unilateral spreader grafts and two needed tip grafts for additional cartilage support intraoperatively. Therefore, 147 patients were included in the data analysis. In the sixth postoperative month, patients were asked to rate their cosmetic and functional satisfaction as "very satisfied," "satisfied," or "not satisfied."

Surgical Technique

All patients underwent open rhinoplasty under general anesthesia with endotracheal intubation. Septoplasty was the first step, if needed. As cartilage graft harvest was not necessary, septoplasty was not applied if mechanical passage was open. Following hump reduction from septal cartilage and nasal bones, the superior segments of the ULC were not excised and lateral perichondrial attachments were dissected along the whole length of the cartilage to ease folding in the cartilage flap. This dissection continued under the nasal bones to preserve enough cartilage length to support the keystone region. In every patient, at least 6–7 mm of bendable cartilage was able to be preserved beyond the bony margin. After completing the dissection, ULCs were folded in and fixed with three 5.0 polydioxanone horizontal mattress sutures before lateral nasal osteotomies (Fig. 1, video).

After medial and lateral nasal osteotomies, the cranial part of the lateral crura of the lower lateral cartilages, which we used to excise, was just incised and preserved. After the dissection of the caudal part, the cranial cartilage flaps were slid over the caudal part to support the lateral crura of the lower lateral cartilages. These cartilages were fixed with two 5.0 polydioxanone horizontal mattress sutures (Fig. 2, video).

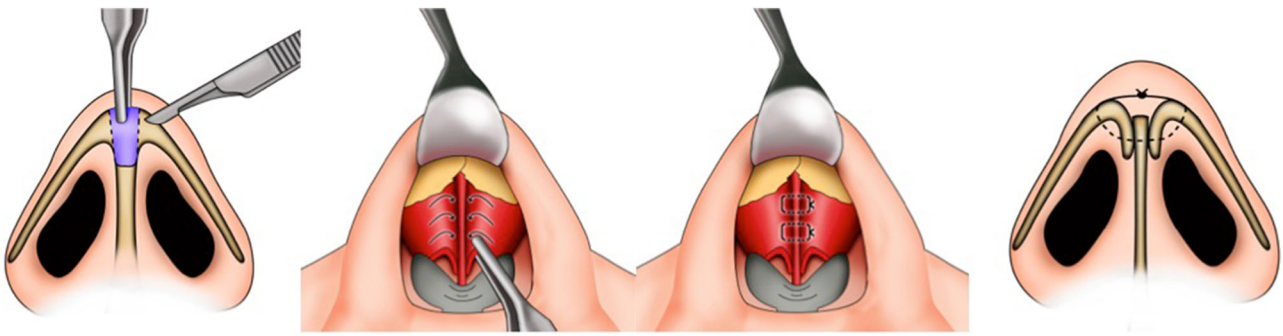

Fig. 1 Upper lateral cartilage fold-in flaps

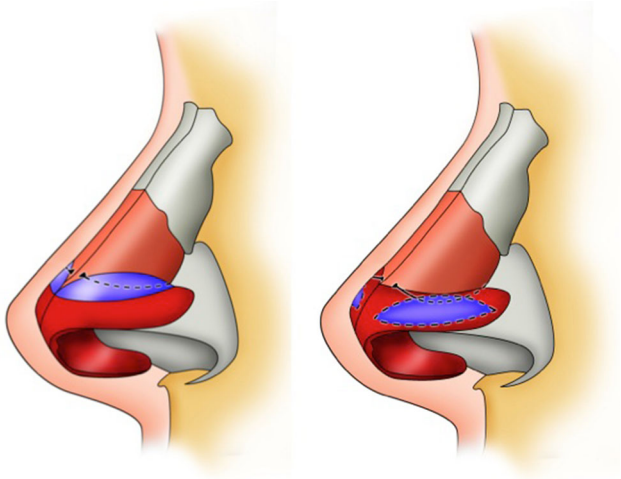

Fig. 2 Sliding alar cartilage flaps

Two individual 5.0 polydioxanone horizontal mattress sutures were used for fixation of the medial crura and quadrangular cartilage. Medially placed individual 5.0 polypropylene cephalic dome sutures (with or without the lateral crural steal technique as needed) were applied to increase tip definition and nasal projection to replace nasal tip grafts. Then, two individual tips were fixed with additional 5.0 polypropylene sutures. Extra care was taken to keep the suture knot posterior to avoid any exposure (Fig. 3, video).

To adjust the nasolabial angle and to support the nasal projection, instead of excising cartilage from the caudal of nasal septum, the lower lateral cartilage medial crura were dissected and displaced cranioposteriorly using a tongue-in-groove technique (Fig. 4, video).

Results

The mean operative time was 73 min (range = 44–120 -min), mean patient age was 29.2 years (17–65 years), and mean follow-up time was 19.6 months (6–30 months). Preservation of the cranial ends of the lower lateral cartilages was ignored in 12 patients (8.1 %); they already had very strong lateral crura in combination with thin skin. In 96 patients (65.3 %), septoplasty was needed to improve the mechanical air passage. In 66 patients, the lower lateral concha was hypertrophic on the contralateral side of the septal deviation, and in 12 patients, concha hypertrophy was bilateral. In the latter patients, ablative surgery was applied with a radiofrequency (RF) device. Ablative surgery was not applied to patients with unilateral concha hypertrophy. Internal nasal silicone splints were used in ablative surgeries for only a week to prevent the formation of nasal synechia. External nasal splints were kept in place for 8 days, followed by nasal tape for 5 days.

Of the 147 patients whose data were included in this study, 135 were satisfied or completely satisfied with the cosmetic results (91.7 % cosmetic satisfaction rate) (Figs. 5, 6). Among the 12 unsatisfied patients, four complained about a one-sided inverted-V deformity, and two of them demanded cosmetic improvement and were secondarily supported with additional spreader grafts. Three patients had a supratip deformity. One was related to dorsal skin thickening and two were related to inadequate excision of the dorsal septal hump. Two demanded extra tip definition; instead of harvesting additional conchal cartilage graft from the ear, the preserved cranial part of the

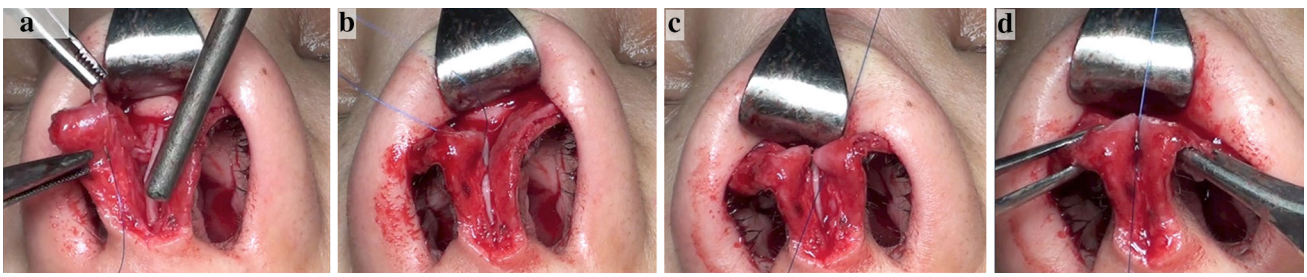

Fig. 3 Nasal tipoplasty with medially placed individual tip sutures

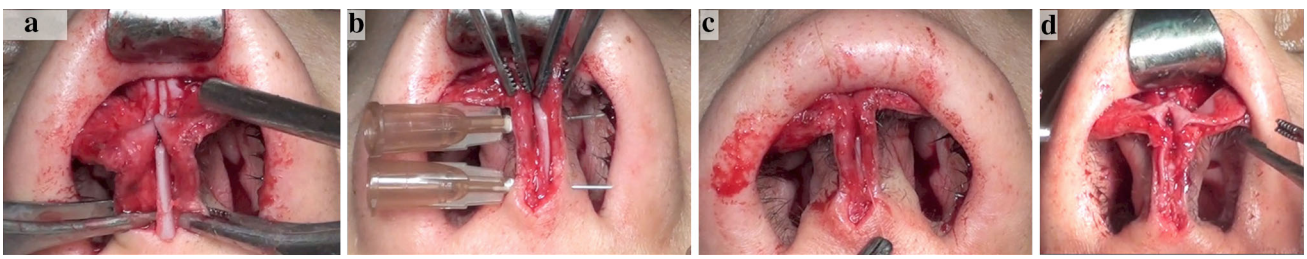

Fig. 4 Tongue-in-groove technique

Fig. 5 22 years old female. (**a–c**) Preoperative and (**d–f**) Postoperative 8 months pictures

medial crura was dissected and transposed to the nasal tip as cap grafts to gain extra tip definition. Two were unhappy with the bone symmetry (secondary osteotomies were done), and one complained about hanging columella that needed additional caudal septal excision in addition to the tongue-in-groove technique. No patient complained of alar retraction or external valve problems.

In the first 3 months, 25 patients complained about the immobility of the nasal tip related to the tongue-in-groove technique. As polydioxanone sutures were used for fixation, this discomfort ended after 3 months in all but three patients. None of them demanded a revision surgery related to this limitation.

When we asked about functional satisfaction, 127 of the 147 patients were satisfied or completely satisfied with the functional result (86.3 % functional satisfaction rate). Among 20 unsatisfied patients, five had concha hypertrophy, which was treated with nasal topical steroids. Four had unilateral and one had slight bilateral nasal valve insufficiency. Additional unilateral spreader grafts were needed in two of the four unilateral valve problems. Ten patients were not satisfied with their nasal air intake, although there were neither mechanical obstructions nor concha problems.

Discussion

Rhinoplasty is a simple procedure, but one that requires a good technique and experience to simplify. Surgeons must know exactly where to reduce and where to support. We found two basic break points in rhinoplasty that are important for improved functional and aesthetic outcomes. One is the middle vault, which includes the internal nasal valve and keystone region. The other is the nasal tip and columella, which is anatomically supported by medial and lateral crura of the lower lateral cartilages. Both of these areas must have smooth but definitive lines in order to produce a good aesthetic result. In addition to these basic areas, some regions, such as the lateral crura of the lower lateral cartilages and nasal dorsum, may need support.

Fig. 6 24 years old male. (**a–c**) Preoperative and (**d–f**) Postoperative 12 months pictures

In a classical reduction rhinoplasty, dorsal extensions of the ULC and cranial parts of the lateral crura of the lower lateral cartilages are excised. In addition, to increase the nasolabial angle, caudal septal excisions may be needed. Controversially, these reduced areas are the most commonly supported areas in rhinoplasty. First we excise cartilage from an area and then, after dorsal and caudal reductions, we add similar cartilages back to these areas as cartilage grafts. Starting from the excised and replaced cartilages, we modified our technique and examined whether it would be possible and reliable to preserve and transpose the normal components of the anatomy to the needed areas as cartilage flaps instead of as cartilage grafts. Actually, many experienced surgeons have already been using these described cartilage flaps. The new modality presented here is the combination of these flaps to decrease the need for cartilage grafts in primary rhinoplasty.

Spreader grafts are widely accepted as the main reconstruction option for supporting the middle vault, with both functional and cosmetic benefits at the same time [1, 8, 16, 17]. However, alongside these accepted advantages of the spreader grafts are some handicaps. First, spreader grafts are totally mobile and easily lose their position during fixation, which increases technical difficulties, especially in inexperienced hands. A second disadvantage is the need for harvesting the graft. If the patient had a previous septoplasty, we are not generally able to harvest enough cartilage and need to harvest grafts from the ear or ribs, leading to extra morbidity. Third, in some cases spreader grafts need to be extended cranially beyond the bone-cartilage junction to give enough support to the keystone area. In this situation, after lateral nasal osteotomy, the cranial ends of the graft may rotate dorsally and become visible. Trimming the rotated part may decrease the risk, but as we presented in a previous study, this rotated cartilage may be

undetectable initially but may become visible over time, leading to revision surgeries [17].

Instead of spreader grafts we prefer using ULC fold-in flaps to support the middle vault. ULC flaps were first introduced in different studies in the late 1990s [9, 19] with some modifications presented thereafter [10, 11, 18, 19]. A basic concern about ULC flaps is their reliability in supporting the middle vault. In a preliminary report, we measured the length of the ULC segment that passes cranially beyond the nasal bones and found that the ULC keeps its curved structure for at least 6–7 mm beyond the bony margin. In this study, ULC flaps have supported the middle vault well in all patients but five. Only two of them demanded cosmetic improvement, secondarily supported with additional spreader grafts. Like ULC flaps, spreader grafts may fail to prevent impairment of the internal nasal valve in some cases [20]. Constantinides et al. [21] reported 89 % improvement in the internal valvular function with spreader graft placement based on subjective data from patients in a minimum of 12 months of follow-up. From these results, we observe that ULC flap support on the middle vault is similar to the support of spreader grafts.

Deformities of the alar rim can be congenital or acquired. Congenital hypoplasia causes flaccid lower lateral cartilages. However, most alar rim deformities are acquired and are mostly secondary to excessive resection and weakening of the lateral crura during rhinoplasty [12]. Many types of cartilage grafts have been described that support and correct alar rim deficiencies [3, 6, 22, 23]. Although these cartilage grafts are effective, they pose potential problems such as infection, malpositioning, distortion, resorption, or palpation of the cartilage graft by the patient [3, 12].

The technique of saving the cranial part of the lower lateral cartilage and sliding it under the caudal part was first described by Özmen et al. in 2009 [12], and Gruber [5] presented a similar technique in 2010. This technique offers three basic advantages. First, as Özmen mentioned, these cartilages support the external valve structure and help prevent its collapse during deep breaths. Second, as Gruber mentioned, they help prevent alar retractions related to over reduced lower lateral cartilages. Third, these cartilages serve as a reserve cartilage that may be used in secondary operations. In the case of thin-skinned noses with very strong cartilages, this technique might lead to a noticeable nasal tip. However, we did not encounter this problem in any of our primary rhinoplasty patients, but we avoided using this technique in 12 patients (8.1 %) who already had very strong lateral crura combined with thin skin.

Another consideration regarding preservation of the lower lateral cartilages is that it is mainly a preventative technique instead of a curative one. In 1997, Gunter and Friedman [2] described supporting the cephalic part of alar cartilages with quadrangular cartilage grafts, which are the main workhorse in alar cartilage support. Unlike quadrangular cartilage grafts, the cephalic parts of alar cartilage are thin and may be insufficient for supporting the lateral crura in severe external valve insufficiencies. In our clinical cases, we encountered severe external valve insufficiency in three primary rhinoplasty patients that resulted in total collapse of the alar rims when deep breaths were taken. In two of these patients, we supported the lateral rim with the cephalic portion of the alar cartilage without any quadrangular cartilage supports; this failed to produce an acceptable valve support. In the third patient we combined alar cephalic grafts with quadrangular cartilage grafts and had a satisfactory outcome.

Strut grafts are the workhorses of columellar support. The tongue-in-groove technique alone or septocolumellar sutures alone or in combination with strut or septal extension grafts can also be used to support the columella [7, 13, 14, 24, 25]. The tongue-in-groove technique is the cephaloposterior displacement of the medial crura onto the caudal septum. It is a practical and reliable way of supporting tip projection and increasing tip rotation [24, 25]. Like the tongue-in-groove technique, septocolumellar suture techniques were reported to be successful in adjusting tip projection and position [14]. In both techniques, the nasal tip is supported by the quadrangular cartilage itself and preserves its support over time [14, 24]. In addition to their advantages, these quadrangular cartilage-supporting techniques have some limitations and disadvantages. First, a limiting factor is the caudal length of the quadrangular cartilage. If the nose is anatomically short, it is quite impossible to use the tongue-in-groove technique alone; we must combine the septocolumellar sutures with wide strut or septal extension grafts. Another disadvantage is that the fixation of the columella and the quadrangular cartilage limits the rolling and rotating movements of the columella over the quadrangular cartilage. In the first 3 months after surgery, nearly 20 % of the patients complained of nasal stiffness related to the septocolumellar sutures. These sutures strongly limit the nasal tip from rolling over the quadrangular cartilage, especially before the absorption of the polydioxanone sutures. This discomfort ended after 3 months in all patients except three, and none of them demanded revision surgery. However, patients should be warned before surgery about the temporary discomfort related to fixation.

Many tip grafts that increase tip projection have been defined [26]. Although tip grafts can effectively increase tip definition and projection, especially in patients with thin skin, there is always a risk of contour deformities related to visibility of the graft. In addition to tip grafts, some suture techniques that increase the tip definition and projection

have also been defined [15, 27–29]. These techniques depend mostly on tapering the nasal tip and fixation of the two lower lateral cartilages together. When we discussed our previous experiences about tip sutures, we mentioned two basic problems. First, most suture techniques fail to gain adequate tip projection. Second, pinpoint tips may form when we try to taper the lower lateral cartilages or when we overfixate the lateral boundaries of the lower lateral cartilages. Using the individual cephalic dome suture technique, described by Çakır et al. [15], we fix only the medial boundaries of the lower lateral cartilages. These individual sutures rotate the lateral boundaries of the lower lateral cartilages laterally and superiorly. This maneuver both increases tip definition and avoids narrowing of the nasal tip after tipoplasty. In addition, with the lateral crural steal technique, we can gain nearly 2 mm of medial crural length, which increases the projection.

Conclusion

Cartilage flaps have some basic advantages over cartilage grafts. First, though they are not similar, they are the same tissue; second, their fixation is easier; and third, they are naturally available and do not require harvesting. With these advantages, cartilage flaps may become the workhorse of primary rhinoplasties in the near future. The answer to our main research question ("are grafts necessary") is "yes"—but they are not as crucial as they were previously.

Conflict of interest The authors have no conflicts of interest to disclose.

References

1. Sheen JH (1984) Spreader graft: a method of reconstructing the roof of the middle nasal vault following rhinoplasty. Plast Reconstr Surg 73:230–239
2. Gunter JP, Friedman RM (1997) Lateral crural strut graft: technique and clinical applications in rhinoplasty. Plast Reconstr Surg 99(4):943–955
3. Rohrich RJ, Raniere J Jr, Ha RY (2002) The alar contour graft: correction and prevention of alar rim deformities in rhinoplasty. Plast Reconstr Surg 109(7):2495–2508
4. Cervelli V, Spallone D, Bottini JD, Silvi E, Gentile P, Curcio B, Pascali M (2009) Alar batten cartilage graft: treatment of internal and external nasal valve collapse. Aesthet Plast Surg 33(4): 625–634
5. Gruber RP, Zhang AY, Mohebali K (2010) Preventing alar retraction by preservation of the lateral crus. Plast Reconstr Surg 126(2):581–588
6. Gruber RP, Kryger G, Chang D (2008) The intercartilaginous graft for actual and potential alar retraction. Plast Reconstr Surg 121(5):288e–296e
7. Rohrich RJ, Kurkjian TJ, Hoxworth RE, Stephan PJ, Mojallal A (2012) The effect of the columellar strut graft on nasal tip position in primary rhinoplasty. Plast Reconstr Surg 130(4):926–932
8. Reiffel AJ, Cross KJ, Spinelli HM (2011) Nasal spreader grafts: a comparison of Medpor to autologous tissue reconstruction. Ann Plast Surg 66(1):24–28
9. Oneal RM, Berkowitz RL (1988) Upper lateral cartilage spreader flaps in rhinoplasty. Aesthet Surg J 18:370–371
10. Gruber RP, Melkun ET, Woodward JF, Perkins SW (2011) Dorsal reduction and spreader flaps. Aesthet Surg J 31(4):456–464
11. Ozmen S, Ayhan S, Findikcioglu K, Kandal S, Atabay K (2008) Upper lateral cartilage fold-in flap: a combined spreader and/or splay graft effect without cartilage grafts. Ann Plast Surg 61(5): 527–532
12. Ozmen S, Eryilmaz T, Sencan A, Cukurluoglu O, Uygur S, Ayhan S, Atabay K (2009) Sliding alar cartilage (SAC) flap: a new technique for nasal tip surgery. Ann Plast Surg 63(5):480–485
13. Williams EF (2012) Alar-columellar disharmony using the tongue-in-groove maneuver in primary endonasal rhinoplasty. Arch Facial Plast Surg 14(4):283–288
14. Tezel E, Numanoğlu A (2007) Septocolumellar suture in closed rhinoplasty. Ann Plast Surg 59(3):268–272
15. Çakir B, Doğan T, Öreroğlu AR, Daniel RK (2013) Rhinoplasty: surface aesthetics and surgical techniques. Aesthet Surg J 33(3):363–375
16. de Pochat VD, Alonso N, Mendes RR, Cunha MS, Menezes JV (2012) Nasal patency after open rhinoplasty with spreader grafts. J Plast Reconstr Aesthet Surg 65(6):732–738
17. Kucuker I, Ozmen S (2013) Extended Spreader graft placement before lateral nasal osteotomy. Aesthetic Plast Surg 37(4):684–691
18. Seyhan A (1997) Method for middle vault reconstruction in primary rhinoplasty: upper lateral cartilage bending. Plast Reconstr Surg 100:1941–1943
19. Rohrich RJ, Muzaffar AR, Janis JE (2004) Component dorsal hump reduction: the importance of maintaining dorsal aesthetic lines in rhinoplasty. Plast Reconstr Surg 114:1298–1308
20. Fischer H, Gubisch W (2006) Nasal valves—importance and surgical procedures. Facial Plast Surg 22(4):266–280 [review]
21. Constantinides MS, Adamson PA, Cole P (1996) The long-term effects of open cosmetic septorhinoplasty on nasal air flow. Arch Otolaryngol Head Neck Surg 122:41–45
22. Guyuron B (2001) Alar rim deformities. Plast Reconstr Surg 107:856–863
23. Toriumi DM, Checcone MA (2009) New concepts in nasal tip contouring. Facial Plast Surg Clin North Am 17:55–90
24. Dobratz EJ, Tran V, Hilger PA (2010) Comparison of techniques used to support the nasal tip and their long-term effects on tip position. Arch Facial Plast Surg 12(3):172–179
25. Kridel RW, Scott BA, Foda HM (1999) The tongue-in-groove technique in septorhinoplasty: a 10-year experience. Arch Facial Plast Surg 1(4):246–258
26. Daniel RK (2009) Tip refinement grafts: the designer tip. Aesthet Surg J 29(6):528–537
27. Gruber RP, Chang E, Buchanan E (2010) Suture techniques in rhinoplasty. Clin Plast Surg 37(2):231–243
28. Dosanjh AS, Hsu C, Gruber RP (2010) The hemitransdomal suture for narrowing the nasal tip. Ann Plast Surg 64(6):708–712
29. Daniel RK (2011) Rhinoplasty: open tip suture techniques: a 25-year experience. Facial Plast Surg 27(2):213–224