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The outcome of rhinoplasty in patients undergoing autospreader flaps without notable dorsal hump reduction: A Clinical Trial

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Summary

Background: Reconstruction of the nasal midvault is an important component of successful rhinoplasty outcomes. Use of the autospreader flap is a beneficial technique for preserving the middle vault. In the present study, we evaluated the aesthetic and functional outcomes of this technique in patients without notable dorsal hump reduction.

Methodology: A nonrandomized clinical trial was performed from December 2017 to April 2018 with a minimum follow-up time of 6 months. From among patients seeking rhinoplasty, 38 patients were eligible for inclusion in the study. The autospreader flap was used to recreate the middle vault in patients undergoing open rhinoplasty with up to 2 mm bony and cartilaginous dorsal hump removal. Preoperative and postoperative standard photographs were obtained. Assessment of patients was based on Rhinoplasty Outcome Evaluation (ROE) and Nasal Obstruction Symptom Evaluation Scale (NOSE) scores. Objective assessment included quantitative analysis of anthropometric angles, mean dorsal width, nasal length and projection which was performed on standard pre- and postoperative photos.

Results: Overall, patients had statistically significant improvement in their postoperative NOSE scores (9 vs. 6.92, $p=0.0001$). The majority of patients were satisfied with the postoperative appearance of their noses. The mean nasal dorsal width (NDW) decreased postoperatively (43% vs. 36%). No difference was found between the mean height of the nose and projection pre- and postoperatively. There was a significant postoperative increase in the nasolabial angle and reduction in nasal length.

Conclusions: The autospreader flap is an effective technique in preservation and restoration of the middle vault and dorsal aesthetic line in cases with less than 2 mm dorsal hump reduction. Nasal function can be improved while achieving good cosmetic outcomes

LEVEL OF EVIDENCE: 2

TRIAL REGISTRATION: Iranian Registry of Clinical Trial identifier: IRCT20170130032287N1

Introduction

Midvault restoration is essential in maintaining a functional nose and optimizing dorsal aesthetic lines after rhinoplasty. The standard method for stabilizing the middle vault is spreader graft placement.¹ This is a critical step in patients with large dorsal humps, short nasal bones, or thin upper lateral cartilages (ULC). Of equal importance in cosmetic rhinoplasty, spreader grafts play a significant role in contouring the dorsal aesthetic lines.²

Dorsal hump reduction often involves reducing the cartilaginous dorsal septum and trimming the vertical height of the ULCs. The “spreader flap” or autospreader flap was later introduced as a viable alternative to the spreader graft for middle nasal vault reconstruction.³ The excess vertical height of the ULC was in-folded to act similarly to a spreader graft. A variety of modifications to this technique were employed later on to improve outcomes.⁴⁻⁹

In the initial report Oneal and Berkowitz emphasized, “During primary reduction rhinoplasty when cartilaginous vault lowering is done, the excess height of the ULC is usually discarded.”³ Therefore, the autospreader flap is primarily used in patients undergoing dorsal hump reduction.⁶ In general; patients with adequate ULC height are good candidates for the autospreader flap technique. The minimum requirement for an auto spreader flap formation is ≥ 2 mm of cartilaginous or osteocartilaginous hump resection, especially if associated with a long and thin dorsum, short nasal bones, thin upper lateral cartilage and thin skin.¹⁰ Asymmetric dorsal aesthetic lines, deviated dorsal septum and the bony sidewall requiring more supports are some relative contraindications for the autospreader flap technique.¹⁰ In this study, we seek to expand the indications for

the autospreader flap to include patients undergoing rhinoplasty with a dorsal hump up to 2 mm or even without a dorsal hump. To our knowledge, this is the first prospective study to analyze both the quantitative and qualitative outcomes of patients undergoing the autospreader flap technique in those without a notable dorsal hump.

Materials and Methods

A prospective study was carried out on patients who underwent rhinoplasty with autospreader flap technique with hump removal up to 2 mm by a single surgeon (AAS) at Vali-e-Asr Hospital in Tehran, Iran from December of 2017 to April of 2018. The study was approved by the institutional review board of the Tehran University of Medical Sciences and adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from each participant. Outcome measurement was not blinded. The trial protocol is available in the supplement.

Patients undergoing cosmetic rhinoplasty with a bony and cartilaginous dorsal hump reduction of 2 mm or less were included in the study. The autospreader flap technique was used to correct the dorsal aesthetic line without notable dorsal hump reduction in all patients. Patients with severe septal deviation, history of prior rhinoplasty and septoplasty, congenital malformation such as cleft nose deformity, saddle nose deformity and those who underwent spreader graft placement were excluded from the study.

The primary outcome of this study was the analysis of subjective and anthropometric factors in the nose without notable dorsal hump reduction. Patient self-assessment of functional performance of the nose was obtained with the Nasal

Obstructive Symptom Evaluation (NOSE) questionnaire and cosmetic outcome was assessed with the validated Rhinoplasty Outcome Evaluation (ROE) tool before and at least six months after surgery. Both of these tools have been validated in prior studies.^{11,}
¹² The patients were asked to fill out a questionnaire with a NOSE score concerning nasal patency and satisfactory from changes in the outer appearance of their noses before and after surgery.

Pre-and postoperative frontal and lateral views of patients were produced in standard fashion. The photos were analyzed with Adobe Photoshop Software (Adobe Systems, San Jose, California). The Frankfort horizontal line was the basis for the calculation of the anthropometric angles and other analysis. The line is drawn from the superior aspect of the external auditory canal to the most inferior point of the infraorbital rim. The Photoshop software was set up for calibrating the measurement scale. The objective nasal dorsal width (NDW), nasal height, nasal length, tip projection, and angles were measured on standardized preoperative and postoperative frontal and lateral photos. With this photo-editing program, an intercanthal line was drawn and measured as a fixed distance. The dorsal width between eyebrow-tip aesthetic lines at the level of alar roots was precisely measured. Nasal dorsal width was expressed in relative value by the ratio: $NDW = \text{Dorsal Width} / \text{Intercanthal Distance} \times 100$ (Figure 1).¹³

A right profile view was chosen for assessment. Nasal height is measured at the nasion, at the Frankfort horizontal line and the tip defining points. Reference of origin for the nasion was the most profound depression at the root of the nose, and the nasal height was measured to the anterior corneal plane in this point. The next line perpendicular to the alar crease was drawn, and this line is referenced when measuring the nasal height

and the tip projection as the most anterior projection of the nose on the profile view.

Nasal tip projection was measured with the Goode method. The nasal height on the Frankfort line was expressed by the ratio: bc/ab (Figure 2). The nasal length was defined as the distance between the tip defining point and the nasion.¹⁴ Statistical analyses were performed using SPSS software (version 21, SPSS Inc., Chicago, IL). The paired t-Test was used to compare preoperative and postoperative NOSE and ROE scores.

Surgical Technique

The open rhinoplasty approach was used in all cases. After elevation of the soft tissue envelope, the lower lateral cartilages were separated at the midline to expose the caudal of the septum. Bilateral mucoperichondrial flaps were elevated and extra mucosal tunnels were made from the anterior septal angle up to and under the bony vault. ULCs were released from the dorsal septum and the upper medial portion of each ULC was detached from bone using an elevator. The cartilaginous and bony nasal dorsum was then smoothed and brought down up to 2 mm, under direct vision. Each portion of the dorsal hump reduction was 2 mm or less. After medial and lateral osteotomies and septoplasty (if needed), the dorsal edge of the ULC was partially incised with a 15 blade to prepare for the autospreader flaps (about 2-3 mm wide). The autospreader flaps were then turned down and secured to the dorsal septum with 5-0 nylon sutures in a horizontal mattress fashion. The operation was completed with tip surgery and alar base resection. In all cases, the tongue in groove technique was used for tip plasty with the aim of achieving a desirable tip rotation and projection. (Video 1)

Results

There were 38 patients included in the study (36 females, two males) with a minimum follow-up time of six months. Medial and lateral osteotomy and tip plasty were performed in all patients. There were ten patients who presented with a deviated septum. Narrowing of nasal base with different methods of alar base resection was performed in 29 patients. Nasal surface angles, nasal dorsal width and profile measurements are summarized in Table 1. There was a significant increase in the nasolabial angle post-operatively (P-value = 0.0001). There was no change in the nasofrontal or nasofacial angle. NDW decreased from 43% preoperatively to 36% postoperatively. There was no significant change in the mean nasal height on the Frankfort line pre- and postoperatively (20% vs. 21%). There was a significant reduction in nasal length (from tip defining point to nasion), but there was no substantial change in the tip projection.

The mean preoperative NOSE score value was 9, and the mean postoperative NOSE value was 6.92 (P-value = 0.0001). Thus significant postoperative improvement in nasal airway performance was achieved. The majority of the patients were satisfied with the appearance of their nose after surgery. When questioned about their satisfaction with the surgery outcome, 19 subjects had complete aesthetic satisfaction, 16 were partially satisfied, and one patient was unsatisfied with the cosmetic results. There were no revision cases or complications. The ROE scores are summarized in Table 2.

Discussion

Since the popularization of the spreader graft by Sheen¹⁵, numerous researches have shown the effectiveness of spreader graft placement on the functional and aesthetic consequences of rhinoplasty.^{2, 13, 16-17} The autospreader flap has become an effective alternative to spreader grafts in mid-vault reconstruction. This technique was first employed by Oneal and Berkowitz taking advantage of the excessive height of the ULC.³ All previous studies regarding autospreader flaps have included dorsal hump reduction as part of the procedure. Only Sowder et al. has shown in a retrospective study that autospreader flaps could successfully be used to correct and improve internal nasal valve (INV) collapse without dorsal hump reduction and compared the outcomes of autospreader flap and the traditional spreader graft.¹⁸

We sought to look at both qualitative and quantitative outcomes in patients undergoing autospreader flap technique without a dorsal hump reduction. The scenario is most commonly indicated in patients with a broad but flat nasal dorsum desiring both improved function and cosmesis by narrowing the nose.

In our study, patients had significant improvement in NOSE scores after surgery. The NOSE scale is a validated and reliable tool used to study patients' self-assessment of the effect of their nasal obstruction symptoms on their quality of life. It is based on a scoring scale of 0 to 4 (0 being no problem for the quality of life and 4 being a severe problem). Our results are confirmed by the findings of Sowder et al.¹⁸ They also found a significant improvement in postoperative mean NOSE scores compared with the preoperative scores for autospreader flap technique without hump reduction.

The majority of our patients were satisfied with the cosmetic outcome measured by the ROE tool which is composed of 6 questions capturing three quality of life domains: physical, mental/emotional, and social with each item being scored on a scale from 0 to 4. There was an increase in nasolabial angle and decreased nasal length on lateral views; however, there was no significant change in the mean nasal height on lateral views. To our knowledge, this is the first study to evaluate aesthetic outcomes of autospreader flaps in patients undergoing rhinoplasty without notable dorsal hump reduction.

The mean nasal dorsal width (NDW) to intercanthal distance in our study decreased. Ingles et al. reported an increase in the NDW after using spreader grafts for patients with nasal valve insufficiency.¹³ No prior research assessed NDW after autospreader flap technique in patients without hump reduction. In our study, Nasal tip projection was measured with the Goode method. Mohebbi et al. showed that in general the Iranian population preferred smaller noses. They stated that the Goode method (as we used in our study) was the preferred method for assessment of the nasal tip projection in the Iranian population. This usually results in a shorter ideal projection length when compared to the Crumely method.¹⁹

One of the main advantages of the autospreader flap is saving the harvested cartilage from the septum which is generally used for other grafts such as alar rim graft, tip grafts, columella strut grafts, traditional spreader grafts etc. This scenario is essential in cases with weak tip support and malpositioned lower lateral cartilages requiring significant grafting. Tip support and projection may require a caudal septal extension graft and columellar strut grafts from the straight rigid septum. Furthermore, lateral crural

strut grafts and alar rim grafts are often necessary for the repositioning of cephalically oriented lower lateral cartilages and reinforcement of weak alar rims. This can obviate the need for harvesting ear or rib cartilage.

The use of autospreader flaps does require relatively strong ULC, particularly in cases with no dorsal hump. A weak ULC used for an autospreader flap can result in worsening of the internal nasal valve function. One major disadvantage of the autospreader flap is in cases of mid-vault asymmetry. Generally, flaps created are of similar thickness and cannot account for asymmetry. In these cases, a simultaneous unilateral spreader graft or asymmetric spreader grafts are needed to improve symmetry.

A potential strength of this study was its prospective nature whereas the main limitation was the relatively small number of patients. Furthermore, studies with longer follow-up will be needed to assess the long-term functional and cosmetic outcomes. Additionally, the functional and aesthetic outcomes of the study cannot be solely attributed to the use of autospreader grafts.

Conclusion

The autospreader flap is a useful technique to restore the middle vault in cases without notable dorsal hump reduction. The nasal function can be improved while improving cosmesis. The autospreader flap allows for conservation of harvested septal cartilage that is critical for grafts such as the caudal extension graft and lateral crural strut grafts.

Authorship contribution:

Sazgar AA: Development of the surgical technique, study concept and design.

Sazgar AA, Razmara N, Amali A, Sazgar AK: Acquisition, analysis and interpretation of data.

Razmara N, Razfar A: Drafting of the manuscript.

Sazgar AA, Razfar A, Sazgar AK: Critical evaluation and revision of the manuscript with important suggestions for the content.

Sazgar AA, Razfar A: Revision of manuscript.

Razfar A, Sazgar AK: Language.

Conflict of interest: None

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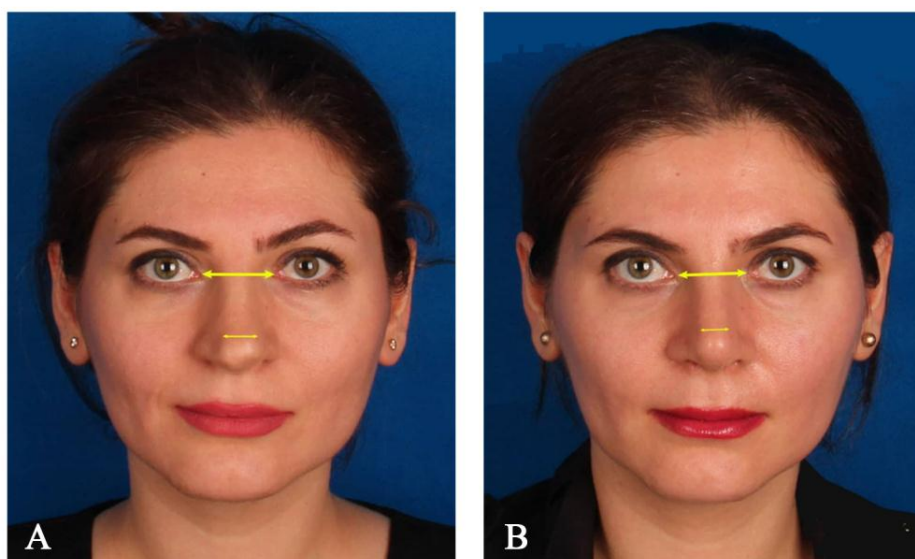
Figure Legends:

Figure 1. Measurement of the cartilaginous nasal dorsal width (NDW) using Adobe Photoshop software; the upper yellow line is the intercanthal line, and the lower line is just above the alar root; Preoperative (A) and Postoperative (B).

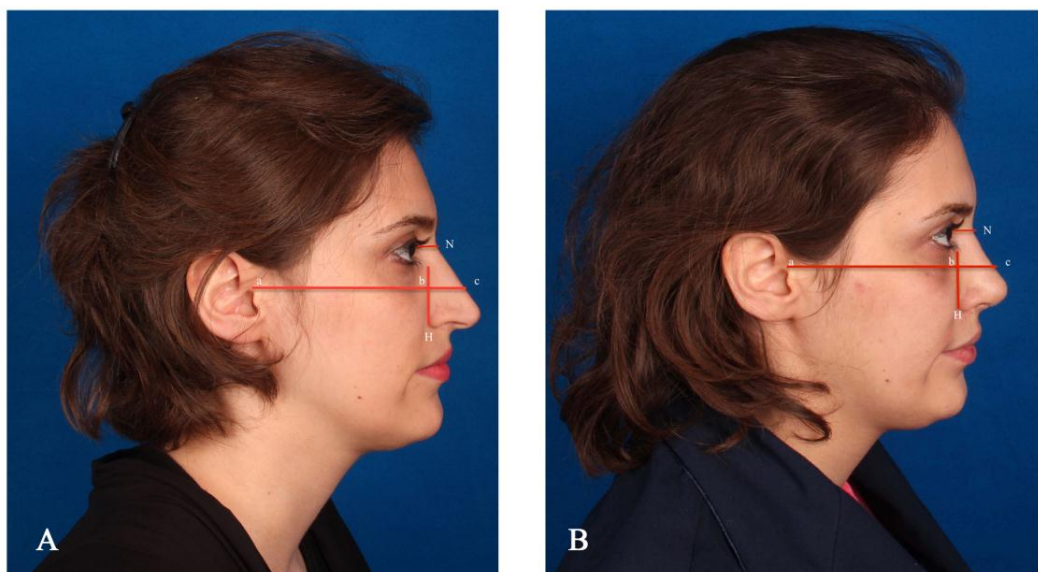
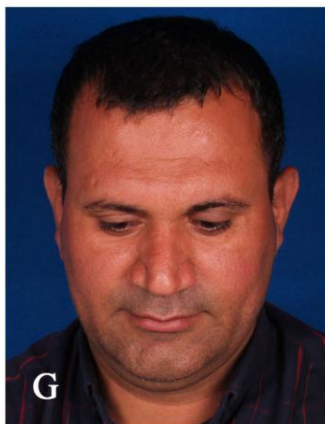
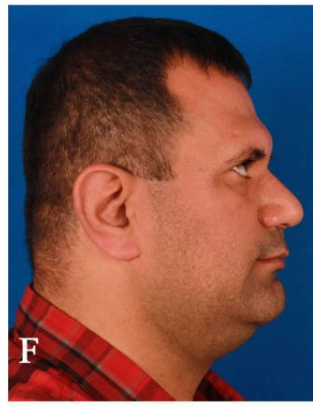
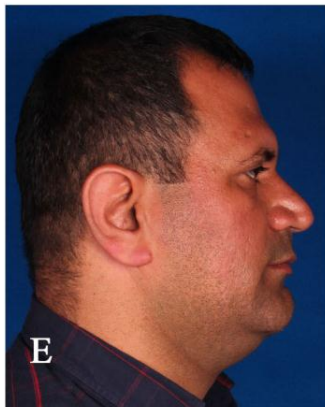


Figure 2. Anatomical landmarks: Nasion (N), Tip defining point (T), Alar crease (d) and measurements of nasal height in a different location were shown pre- (A) and postoperatively (B). The height in the nasion is shown with a red line from the corneal plane. The nasal height on the Frankfort line was measured by the ratio: bc/ab .



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Figure 3. Preoperative (A, C, E, G) and one-year postoperative (B, D, F, H) views of a 28-year-old man with a wide broad nose. In this case, the most deviated central portion of the nasal septum was resected, and the septal L-strut was preserved. Portions of the upper lateral cartilages were bilaterally incised and turned down as autospreader flaps after medial and lateral osteotomy. Moreover, suture technique tip plasty with turn in of the cephalic part of lateral crura, tongue-in-groove method, and alar base were performed.

Table 1. Summary of quantitative measurements reported by ratios, which are the same regardless of the size of the photos.

Variable	Pre-op ¹ mean (SD ²)	Post-op ³ mean (SD)	P value
Nasofrontal angle	137.9° (7.119)	136.2° (4.733)	0.117
Nasolabial angle	96.9° (7.488)	114.7° (4.822)	0.000
Nasofacial angle	35.7° (3.815)	36.5° (2.544)	0.194
NDW ⁴ at alar root	43% (0.518)	36% (0.540)	0.417
Intercanthal distance	34.83 (61.788) mm	34.83 (61.788) mm	
Nasal length/ID ⁵	48.64 (16.80)	42.67 (6.413)	0.031
Tip projection	60.4 (2.457)	60.5 (2.379)	0.082
Height rhinion/FL	0.201 (0.025)	0.213 (0.047)	0.112
Height rhinion/Nasion	1.708 (0.577)	1.43 (0.349)	0.000
Height tip/Nasion	3.19 (1.011)	2.91 (0.778)	0.010
NOSE score	9.000 (3.513)	6.916 (2.143)	0.000

1: Pre-op: Pre-operative, 2: SD: standard deviation, 3: Post-op: Post-operative, 4: NDW: nasal dorsal width, 5: ID: Intercanthal diameter, 6: FL: Frankfort line

Table 2. Rhinoplasty Outcome Evaluation Instrument

Question	No	Slightly	Moderately	Very	Extremely
How well do you like the appearance of your nose?	1	3	13	6	13
How well are you able to breathe through of your nose?	2	3	9	7	15
How much do you feel your friends like your nose?	0	7	8	7	14
Do you think the current nasal appearance of your nose?	8	7	7	8	6
How confident are you that your nasal appearance is the best that it can be?	1	2	7	9	17