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Role of Spreader Flaps in Rhinoplasty: Analysis of Patients Undergoing Correction for Severe Septal Deviation with Long-Term Follow-Up

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Abstract

Introduction The aim of this randomized controlled study was to analyze the long-term results of patients undergoing rhinoplasty because of severe septal deviation and to evaluate the stability of results.

Materials and Methods The study was performed with a randomized design. Patients were randomly divided into four groups: group 1, spreader flaps were used in combination with spreader grafts; group 2, spreader flaps were used alone; group 3, spreader grafts were used alone; and group 4, neither spreader flaps nor grafts flaps were used. Patients answered the Italian version of the FACE-Q rhinoplasty module. Anthropometric measurements were performed by AutoCAD for MAC. We determined the angle of deviation, and we compared the pre- and postoperative angles and compared patient satisfaction in the four groups using the Chi-squared test for unpaired data. Two plastic surgeons reviewed all the postoperative photographs of the study patients and rated the photographs on a scale of 1 to 5.

Results A total of 264 patients who underwent primary rhinoplasty between January 2010 and September 2016 satisfied the inclusion criteria and were finally enrolled in this study. Anthropometric measurements revealed statistically significant differences ($P < 0.01$) between the preoperative and postoperative values for the angle of septal deviation in group 1 versus the other groups. Over the long-term follow-up, group 1 maintained an angle close to 180 degrees ($P < 0.01$). Group 1 and group 3 were more satisfied compared with groups 2 and 4 ($P < 0.01$). According to evaluations by the 2 reviewers, group 1 and group 3 were the most satisfactory outcomes ($P < 0.01$).

Conclusions This was the first randomized study to show that the combined use of the spreader flap and spreader graft is the best choice for a good long-term outcome and durable correction of septal deviation.

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Keywords FACE-Q · NOSE-Q · Rhinoplasty · Nose · Spreader flap · Graft

Introduction

While septorhinoplasty is among the most commonly performed facial plastic and reconstructive surgeries, the relatively high revision rate reflects its complexities [1–4]. Severe septal deviation is a challenging deformity that is usually treated with aggressive surgical methods; extracorporeal septoplasty is a commonly used approach [5]. Severe septal deviation can be successfully corrected with low risk of postoperative complications by full-thickness resection of the deviated part and reconstruction with bilateral spreader grafts [6–8]. However, we asked

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ourselves a question: Is it useful to use a spreader flap for stabilizing the back of the nose? Patients who decide to undergo septorhinoplasty not only want to breathe more easily, they also want to obtain a straight and beautiful nose [4, 5]. Thus, the two main goals of such a procedure are acceptable functional and cosmetic outcomes. Most patients who turn to the plastic surgeon for rhinoplasty desire a predictable and, above all, stable outcome; however, rhinoplasty is a procedure affected by both predictable and unpredictable factors, which included scarring, reabsorption of cartilaginous grafts, and skin retraction. The design of this study therefore evolved based on the need to identify a standard procedure that could stabilize the nasal pyramid and the dorsum of the nose, providing a lasting result over time. The aim of this randomized controlled study was to analyze the long-term results of patients undergoing rhinoplasty because of severe septal deviation and to evaluate the stability of results.

Materials and Methods

The study population was selected from 383 patients who had undergone rhinoplasty between January 2010 and September 2016 with the same surgeon. Patients answered the Italian version of the FACE-Q rhinoplasty module that we administered electronically to each patient approximately 2 years after the surgical procedure. Patients were randomly divided into four groups : group 1, spreader flaps were used in combination with spreader grafts; group 2, spreader flaps were used alone; group 3, spreader grafts were used alone; and group 4, neither spreader flaps nor grafts flaps were used. All grafts were made from septal cartilage. All of the included study patients had the following characteristics: They had underwent primary reduction rhinoplasty for functional and/or cosmetic problems, had internal nasal valve uni- or bilateral collapse, had moderate or severe septal deviation with C-shape or S-shape deformity, had been followed for almost 2 years, had both standard pre- and postoperative photographic images, had a good understanding of the Italian language, and had signed a consent form for inclusion in the study. We used the Mladina R. classification [6] (Table 1) to define the degree of deviation (mild, moderate, and severe). We used Cottle's classification [7] (Table 1) to evaluate the level of obstruction. All our patients had level of obstruction in area 2 (valve area), area 3 (attic area), and area 4 (anterior turbinate area) following this classification. The C-shape or S-shape deformity was diagnosed with a maxilla-facial CT before surgical procedure. We excluded all patients for the following characteristics: follow-up < 2 years, complications following rhinoplasty, candidate to augmentation rhinoplasty, invalid pre- or postoperative photographic images, inability to answer the FACE-Q instrument [8], no internal valve collapse, or moderate or slight septal deviation.

Table 1 Population data

	Number (N = 264)
Age	
Mean (years old)	32.1
Gender	
Male	110
Female	154
Follow-up	
Mean (years)	2.4
Septal deviation type	
C-shape	191
S-shape	73
Type of access	
Open	182
Closed	82
Number of patients	
Group 1	70
Group 2	60
Group 3	68
Group 4	66
Secondary procedures	
Group 1	0
Group 2	16
Group 3	1
Group 4	21
Degree of deviation (*Mladina classification*)	
Mild	0
Moderate	101
Severe	163
Level of obstruction (*Cottle's classification*)	
Area 1	0
Area 2	90
Area 3	81
Area 4	93
Area 5	0

The study was performed with a randomized design, and both the patients and two of the authors (plastic surgeons) who measured the outcomes of the four groups were blinded to the treatment methods. Randomization in this study is based on a single sequence of random assignments known as simple randomization. This technique maintains complete randomness of the assignment of a subject to a particular group. Computer-generated random numbers were used for simple randomization of participants. The following data were obtained for each patient: age, gender,

duration of follow-up, type of surgical procedure, secondary procedures, types of grafts used, type of incision, and patient satisfaction. All procedures were performed by the same surgical team.

Anthropometric measurements were performed by AutoCAD [9] for MAC on photographs of the frontal view taken preoperatively and postoperatively at the last follow-up visit. We determined the preoperative angle of deviation as follows: (1) on the frontal view, a line was drawn from the pretarsal fold (A) to the maximum projection of the septal deviation (B); (2) a second line was drawn from maximum projection of the septal deviation (B) to the nasal tip (C). The angle between the AB line and the BC line was defined as the angle of deviation (Fig. 1). The nasal tip projection was measured on the profile view with the use of Goode's method. We used AutoCAD software to calculate the angle, and the data were collected and stored in an Excel file. The septal angle should theoretically be 180 degrees, as the purpose of the intervention was septal rectification. At the end of the intervention, each patient undergoing rhinoplasty obtained a 180 degree angle. We compared the pre- and postoperative angles and compared patient satisfaction in the four groups, based on the FACE-Q module, using the Chi-squared test for unpaired data. Two plastic surgeons reviewed all the postoperative photographs of the study patients and rated the photographs on a scale of 1 to 5.

SPSS software version 25.00 for Windows (SPSS, Inc., Chicago, IL, USA) was used for data analysis. Data are presented as numbers and percentages for categorical data and means and standard deviation for quantitative data. The Fisher exact test was used to compare the categorical data between two groups. $P<0.05$ was considered significant.

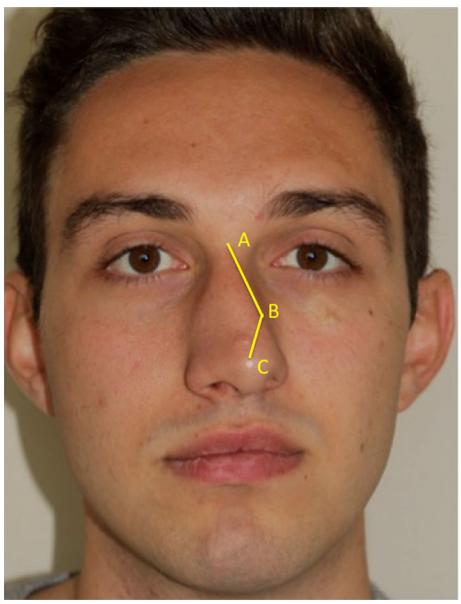

Fig. 1 Anthropometric measurement methods: (1) on the frontal view, a line was drawn from the pretarsal fold (A) to the maximum projection of the septal deviation (B); (2) a second line was drawn from maximum projection of the septal deviation (B) to the nasal tip (C). The angle between the AB line and the BC line was defined as the angle of deviation

Results

A total of 264 (110 male and 154 female) patients satisfied the inclusion criteria and were finally enrolled in this study. All study patients completed the FACE-Q rhinoplasty postoperative module. Demographic data and surgical details are shown in Table 1. The mean patient age was 32.1 years (range, 18–65 years). The mean follow-up time was 2.4 years (range, 2–6 years). All patients underwent primary rhinoplasty for correction of a deviated nose, with a C-shape deformity. All patients showed nasal obstruction preoperatively, with varying severity. Objective outcome measurements in all patients are shown in Table 2. Anthropometric measurements revealed statistically significant differences ($P < 0.01$) between the preoperative and postoperative values for the angle of septal deviation in group 1 versus the other groups. Over the long-term follow-up, group 1 maintained an angle close to 180 degrees. Table 3 shows the FACE-Q results. Group 1 (Figs. 2, 3) and group 3 (Fig. 4) were more satisfied compared with groups 2 and 4 ($P < 0.01$). We compared the secondary procedures of groups 2 and 4 with the other groups, and we obtained a significant difference with a $P < 0.01$.

According to evaluations by the two reviewers, group 1 (Figs. 2, 3) and group 3 (Fig. 4) were the most satisfactory outcomes as shown in Table 4 ($P < 0.01$).

Table 2 Objective outcome measurements

Groups (N = 264)	Preoperative angle (mean ± SD)	Postoperative angle (mean ± SD)	P
Group 1 (N = 70)	166.2 ± 3.8	178.5 ± 1.5	0.002†
Group 2 (N = 60)	166.7 ± 2.3	172.2 ± 2.8	0.3
Group 3 (N = 68)	167.3 ± 2.2	178.3 ± 1.7	0.003†
Group 4 (N = 66)	167.1 ± 2.9	171.1 ± 1.9	0.4

†Statistically significant

Table 3 FACE-Q satisfaction with the nose postoperative module

FACE-Q satisfaction with the nose postoperative module for male patients	Group 1 (70)	Group 2 (60)	Group 3 (68)	Group 4 (66)	P 1-2	P 2-3	P 3-4	P 1-4	P 2-4
The width of your nose at the bottom (from nostril to nostril)?	65 (93%)	40 (67%)	59 (87%)	31 (47%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	< 0.01†
The length of your nose?	64 (91%)	37 (62%)	58 (85%)	29 (44%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	0.02†
How the bridge of your nose looks (where glasses sit)?	67 (96%)	36 (60%)	58 (85%)	28 (42%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	0.02†
How well your nose suits your face?	68 (97%)	35 (58%)	58 (85%)	28 (42%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	0.03†
How straight your nose looks?	68 (97%)	35 (58%)	59 (87%)	29 (44%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	0.06
The overall size of your nose?	66 (94%)	40 (67%)	57 (84%)	30 (45%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	< 0.01†
The shape of your nose in profile (side view)?	68 (97%)	38 (63%)	57 (84%)	31 (47%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	0.03
How your nose looks in photographs?	68 (97%)	35 (58%)	58 (85%)	23 (35%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	< 0.01†
How the tip of your nose looks?	67 (96%)	38 (63%)	59 (87%)	28 (42%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	< 0.01†
How your nose looks from every angle?	68 (97%)	34 (57%)	58 (85%)	24 (36%)	< 0.01†	< 0.01†	< 0.01†	< 0.01†	< 0.01†

*Raw score ≥ 3

†Statistically significant

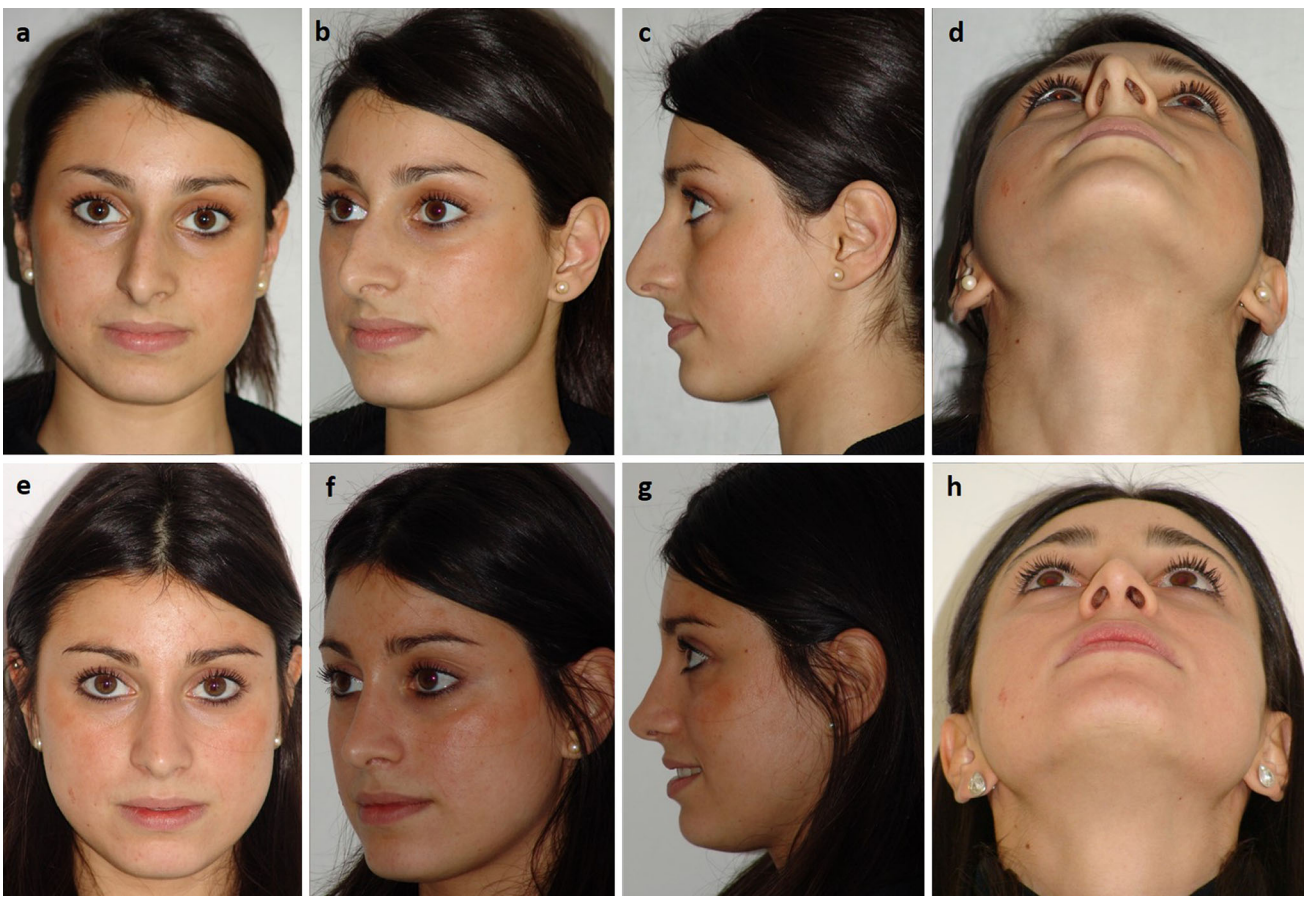

Fig. 2 A 28-year-old female from group 1, **a–d** preoperative photographs, **e–h** 3-year follow-up

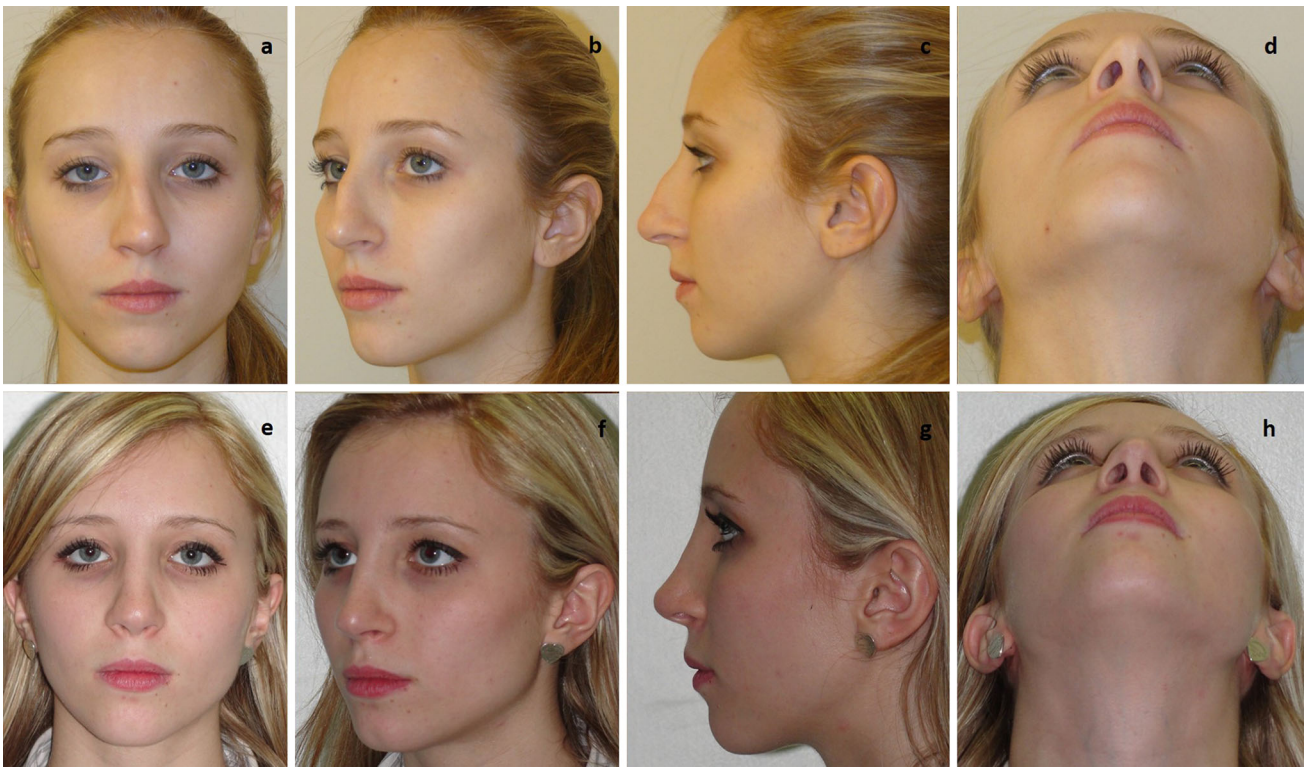

Fig. 3 A 26-year-old female from group 1, **a–d** preoperative photographs, **e–h** 2-year follow-up

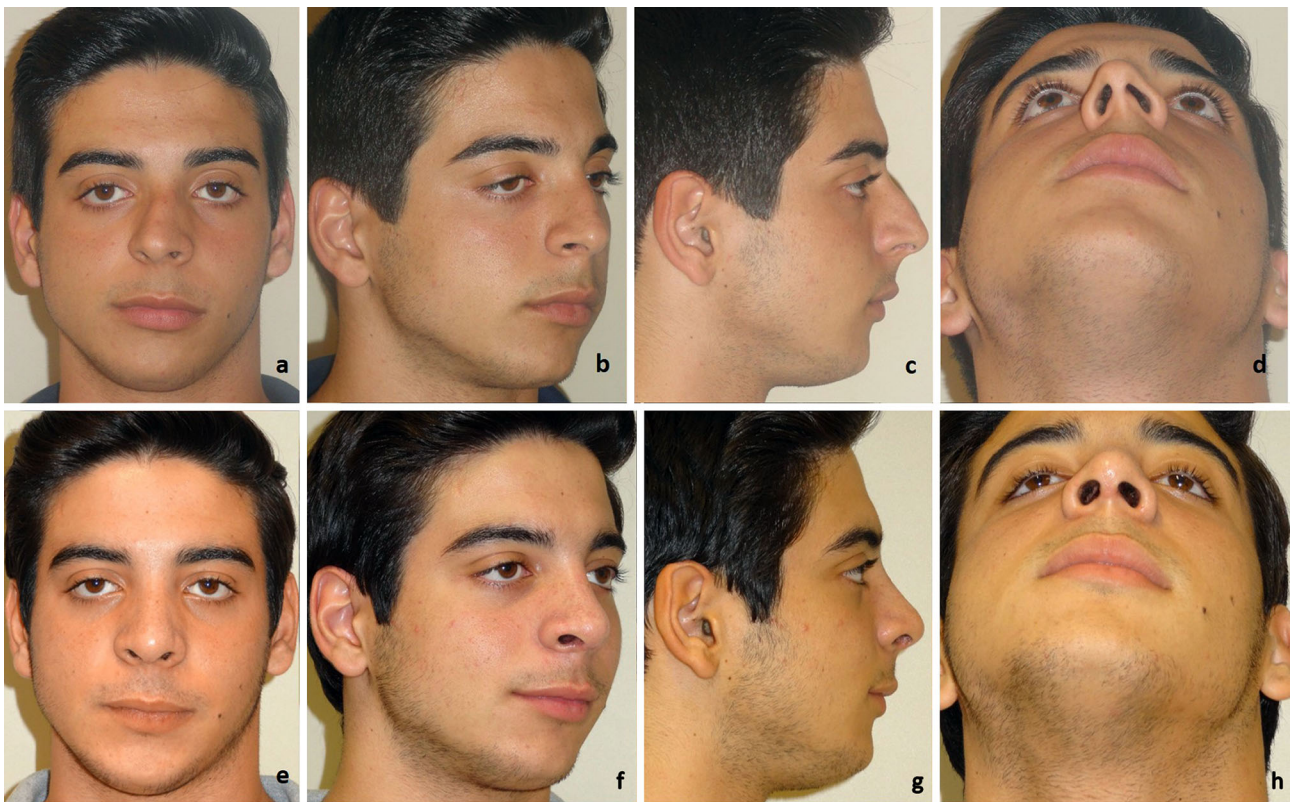

Fig. 4 A 32-year-old male from group 3, **a–d** preoperative photographs, **e–h** 4-year follow-up

Table 4 Surgeons reviewers VAS Scale

VAS scale for male patients	Group 1 (70)	Group 2 (60)	Group 3 (68)	Group 4 (66)	P 1-2	P 2-3	P 3-4	P 1-4	P 2-4
Global cosmetic outcome (mean)	4.6	3.2	4.6	2.6	< 0.01†	< 0.01†	< 0.01†	< 0.01†	0.3
Scarring (mean)	4.8	4.4	4.8	3.9	0.1	0.1	0.01†	< 0.01†	0.05
Profile view (mean)	4.7	3.8	4.4	3.1	0.01†	0.2	< 0.01†	< 0.01†	0.2
Frontal view (mean)	4.8	3.3	4.4	2.6	< 0.01†	< 0.01†	< 0.01†	< 0.01†	0.2
Basal view (mean)	4.8	3.2	4.4	3.6	< 0.01†	< 0.01†	< 0.01†	< 0.01†	0.5
Feminime/Masculine shape (mean)	4.6	4.3	4.6	4.1	0.3	0.3	0.2	0.2	0.8

†Statistically significant

From 0 to 5 points

Discussion

Spreader grafts used for the reconstruction and restoration of the middle vault of the nose are the gold standard in septorhinoplasty [10, 11]. Application of an upper lateral cartilage flap, variably called the spreader flap or auto-spreader, is an interesting technique that has received increased attention in recent years [11–17]. Saedi et al. [18] in 2014 published an interesting article in which they affirmed that the spreader flap is an attractive approach for preserving the middle vault in nasal plastic surgery; however, its effect needs further evaluation. Their study was very interesting and was the first to evaluate the role of the spreader flaps in the correction of septal deviation during a reduction rhinoplasty. The authors performed a randomized control trial but with limitation of sample size and number of group analyzed.

Some authors have reaffirmed that internal nasal valve collapse is a preventable complication of rhinoplasty, for which the spreader graft is the gold standard to prevent it [19–21]. More recently, the spreader flap technique has been espoused as an alternative to spreader grafting [22, 23]. Other authors have affirmed that the spreader graft is the gold standard for rectification of septal cartilage in severe deviations [24].

To the best of our knowledge after reviewing the literature, our study is the only study to have objectively evaluated the correction of severe septal deviation and the role of the spreader flap. Moubayed et al. [25] has affirmed that the spreader flap technique offers many advantages, including maximal use of local tissue, simplicity, and airway preservation. The disadvantages are the use of an external approach and the inability to use the spreader flap alone in the presence of severe asymmetry. Kovacevic et al. [26] described four types of spreader flaps : basic, flaring, support, and interrupted type. The authors affirmed that the spreader flap and its modifications represented reliable alternatives to the standard spreader graft, and when all of the necessary prerequisites were met, this technique obviated the need for additional cartilage grafting in most cases. Similarly, Wurm et al. [27] reported that the spreader flap procedure appeared to be an appropriate and highly promising supplement to existing procedures for reconstructing the middle nasal vault and internal nasal valves. In addition, they emphasized that no additional cartilage grafts were needed. Sowder et al. [28] concluded that the spreader flap is equivalent to the spreader graft for correcting nasal obstruction secondary to collapse of the internal nasal valve.

Because of our experience, we believe that the memory of cartilage tissue [29–36] must be contrasted to obtain a good outcome in rhinoplasty and we must keep in mind other potential anatomical variances that could influence the final results such as scarring, reabsorption of cartilaginous grafts, and skin retraction. Severe septal deviations must be corrected, and the provision of support in the form of a spreader graft and spreader flap is essential for maintaining a long-term correction. To our knowledge, our study is the first controlled study that evaluated the long-term results of rhinoplasty using spreader flaps and grafts for patients with severe septal deviation and compared that treatment with control patients. The study was also randomized and was therefore designed to compare patients with the same characteristics at the start of the study. The aim was to identify a standard indication in this type of patient and to clarify the role of the flap spreader. In the literature, the width or sturdiness of spreader grafts is not being discussed as well and the limitation of outcome assessment in our study was that there were no objective data regarding the thickness of the spreader graft or flaps. Other limitations of our study were the impossibility of performing rhinomanometry in all our patients included in the study and the impossibility of preoperative otorhinolaryngology evaluation in all our patients. Clinically, we

have observed that patients undergoing correction of severe septal deviation obtain the greatest benefit when spreader flaps and spreader grafts are both used during the same surgery.

Conclusions

The combined use of the spreader flap and spreader graft for septorhinoplasty in our clinical practice was the best choice for correction of severe septal deviations. To the best of our knowledge, this was the first randomized study to show that this combination is the best choice for a good long-term outcome and durable correction of septal deviation. Also the combination of spreader grafts and flaps is beneficial and superior to other techniques by maintaining straight dorsal lines in the long-term outcomes. The FACE-Q results showed that patients undergoing the combined procedure are also the most satisfied.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest to disclose.

Ethical Approval This study was approved by the Ethics Committee of our University.

Informed Consent Each study patient provided written informed consent before participating in the study.

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