

Dorsocaudal reconstruction of previous caudal septal resections with partial split spreader graft

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Ethics Committee Approval

This study was approved by institutional ethical review board of Eskişehir Osmangazi University Medical School (02.09.2021, E-25403353-050.99-165875).

The written consent was obtained from the patients presented with images in the study. All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Nasal obstruction is caused mainly by nasal septal deviation, and submucosal resection is usually performed to treat this problem. However, if over-resected, nasal tip deprojection, deprojection of the dorsum, or pseudo-hump formation may be seen. Spreader grafts are used to restore the nasal septum in these cases, and different techniques have been described for this restoration; however, these techniques may not be the best fit for such restoration. This study presents a novel and effective method for septal reconstruction in patients with previous septal resections.

Methods: Between March 2012 and October 2014, a case series of 14 male patients with tip deprojection and pseudo-hump formation who had undergone corrective surgery in our clinic was retrospectively examined. Partial-split, caudal extension costal spreader grafts were used and were fixed to the dorsum of the remnant septum cranially to prevent warping while avoiding nasal dorsum widening. Pre- and post-operative comparisons were performed, and the Nasal Obstructive Symptoms Evaluation questionnaire for the functional results and subjective Esthetic Appearance test for the esthetic outcomes were administered.

Results: The mean age was 36.8 years (19–56 years), and the mean follow-up time was 14.6 months. Functional outcomes and esthetic appearance led to significantly improvements in all post-operative categories ($P < 0.05$) without any major complications. Common complaints were usually the same as seen in conventional rhinoplasty procedures, such as facial swelling, nasal stuffiness, pain, and/or epistaxis. None of the patients requested revision surgery.

Conclusion: Using partial-split, caudal extension costal spreader grafts in the reconstruction of dorsocaudal septum in patients with previous septal resections appears to provide favorable functional and esthetic results.

Keywords: Partial-split, Spreader grafts, Reconstruction of dorsocaudal septum, Nasal tip deprojection, Deprojection of dorsum

Introduction

Nasal septum deviation is the most common cause of nasal obstruction [1], and submucosal septal resection is routinely performed as treatment [2]. Although removal of the deviated septum improves nasal airways in most patients post-operatively, over-resection without supportive reconstruction may cause further problems, including nasal tip deprojection and over-rotation, deprojection of the dorsum and pseudo-hump formation, columellar retraction or broad nasal tip [3, 4]. To prevent these deformities, preservation of the L-strut is crucial. Classically, at least 1 cm in width of dorsal and caudal septal cartilage is preserved as an L-shaped structure [5]. However, in severe caudal septal deviations, some surgeons may remove the deviated part without providing adequate support and reconstruction, leading to airway collapse that can cause nasal obstruction [6].

Besides the functional problems, esthetic appearance of the nose can change after removal of the deviated caudal part. Tip deprojection and pseudo-hump formation can be evident in patients who had prior septoplasties with caudal septal resection [7, 8]. In these types of nasal deformities, the nasal support solely depends on the nasal dorsum. If these patients request secondary septo-rhinoplasties, the surgeon should be aware that nasal support may weaken after further nasal hump removal. In these situations, the dorsal and caudal parts of the septum should both be restored and using support grafts is the mainstay of the treatment. Spreader grafts are commonly used for this purpose [9].

Although it is best to obtain spreader grafts from septal cartilages, patients who had previous septoplasties are usually devoid of adequate septal cartilage. Other sources of spreader grafts can be conchal or costal cartilages. Since conchal cartilage is usually inadequate, lacks strength, and can easily be twisted, costal cartilage grafts are often preferred as spreader grafts for reconstruction. The main disadvantage of using costal cartilage grafts is its potential to warp [3]. Although 90% of warping occurs within 1 h, warping may continue until a month after initial harvesting [10]. Besides, as has been suggested in some studies, a pair of spreader grafts customized from costal cartilage can cause widening of the nasal dorsum [3]. To prevent warping and preventing nasal dorsum widening with a pair of spreader grafts, a novel technique using costal cartilage as spreader grafts in a specially designed way is described.

Materials and methods

This study was approved by the Institutional Ethical Review Board of Eskisehir Osmangazi University Medical School (02.09.2021, E-25403353-050.99-165875). Informed consent was obtained from all patients for being included in the study. Additional written informed consents for patient information and images to be published were provided by the patients for whom identifying information is included in this article. A retrospective study of medical and personal records of 14 male patients who underwent corrective surgery with partial-split, caudal extension costal spreader grafts between March 2012 and October 2014 was conducted. All patients had undergone previous septoplasty or septorhinoplasty with caudal

septal resection that caused tip deprojection and pseudo-hump formation.

Revision operations were performed by a single surgeon at a university tertiary care medical center. Inclusion criteria required at-least 1-year follow-up of the patients in the office, pre- and post-operative photographic documentation, and completion of a Nasal Obstructive Symptoms Evaluation (NOSE) questionnaire, which effectively evaluates the functional results [11]. Esthetic results, on the other hand, were assessed subjectively and were evaluated by the patients themselves. Medical records, including main pre-operative complaints and surgical indications, intra-operative surgical techniques and findings, and post-operative results, such as infection, graft extrusion and/or resorption and loss of the structural support over time were evaluated.

Surgical technique

All patients underwent surgery under general anesthesia. Nasal dorsum, lateral nasal walls, tip, and septum were infiltrated with 1% lidocaine hydrochloride and 1:100,000 epinephrine. An open rhinoplasty approach was used to provide wide exposure to nasal structures [12]. Transcolumellar and mucosal infracartilaginous incisions were made, and the nasal skin-soft tissue envelope was dissected. Septal exposure was started initially from the anterior septal angle and advanced between upper lateral cartilages and dorsal septum cranially. Bilateral mucoperichondrial flaps were created under the sub-perichondrial plane, and the remnant septum was exposed. The dissection was difficult in most instances because of previous surgeries. Maximum care was carried out not to perforate mucoperichondrial flaps. In case of residual dorsal hump, the cartilaginous and bony dorsum was reduced according to the component dorsal hump reduction technique [13].

Septal support was insufficient in all patients; therefore, the surgical area was switched to the chest wall to obtain costal cartilage graft. The fifth or sixth rib was marked and harvested as described by Marin et al. [14]. En bloc excision of the selected cartilaginous rib, approximately 4 cm in length, was performed. The central portion of the costal cartilage was reshaped in rectangular fashion. A spreader graft which has a size of 3 mm x 30 mm was obtained. Approximately two-thirds of the length (20 mm) of the graft was split horizontally from the midline, whereas, the other one-third of the graft remained intact (Figure 1). This partially split, caudally extended spreader graft was fixed with 5/0 Polydioxanone (PDS) sutures to the dorsum of the remnant septum cranially as it resides in the middle (Figure 2). Another rectangular graft was also sutured both to the anterior nasal spine and the partially split caudally extended spreader graft caudally in vertical fashion to restore the vertical part of the reconstructed L-strut (Figure 3). The nasal tip complex was fixed to the neo-septum in a tongue-in-groove manner. Routine medial and lateral osteotomies were performed if required. All incisions were closed properly. A plaster cast and intranasal Doyle splint was applied. The cast was removed after the first week; however, the intranasal splints were kept for two weeks to protect the integrity of the reconstructed septum.

Figure 1: Vertically split costal spreader cartilage graft



Figure 2: a. Patient with inadequate septal cartilage detected during secondary septorhinoplasty, b. Half-split, caudal extension costal spreader graft residing in the middle of the septal cartilage, c. Half-split, caudal extension costal spreader graft and caudal septal extension graft sutured together and to the septum

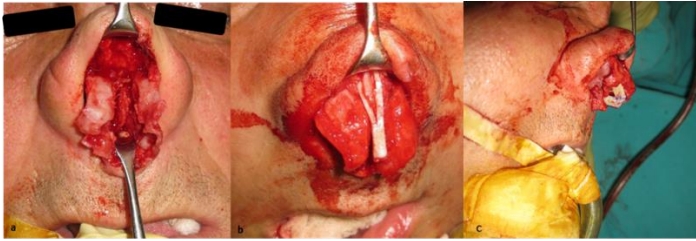


Figure 3: A rectangular graft is sutured both to the anterior nasal spine and the partially-split caudally extended spreader graft caudally in vertical fashion to restore the vertical part of the reconstructed L-strut



Statistical analysis

The data were analyzed using IBM SPSS 21.0 (IBM Corp., Armonk, NY, USA). The categorical variables were assessed both by numbers and decimals. The cross tabulations were generated according to the former and later score values. A marginal homogeneity test was used to analyze the cross tabulations. The significance level was set at $P < 0.05$.

Results

The youngest patient was 19 years old and the oldest was 56 years of age. The mean age was 36.8 years. The mean follow-up time was 14.6 months. All patients previously underwent septoplasty or septorhinoplasty (Table 1). They had breathing problems of varying degrees. Nasal tip drooping and exacerbation of the dorsal hump was evident in all cases due to previously over-resected caudal septum. When the amount of septal cartilage was inadequate, the graft for reconstruction was obtained from the fifth or the sixth costal cartilages. Improvement in the tip projection and elimination of the pseudo-hump became visually evident in all patients (Figures 4–6).

Table 1: General patient features

Patient No.	Age	Gender	Type of Previous Surgery	Follow-Up Duration (Month)
1	32	M	Septoplasty	18
2	26	M	Septorhinoplasty	16
3	19	M	Septoplasty	12
4	44	M	Septoplasty	12
5	29	M	Septorhinoplasty	13
6	41	M	Septoplasty	16
7	56	M	Septorhinoplasty	18
8	48	M	Septorhinoplasty	14
9	33	M	Septorhinoplasty	12
10	41	M	Septoplasty	14
11	27	M	Septorhinoplasty	19
12	36	M	Septoplasty	13
13	52	M	Septoplasty	16
14	31	M	Septorhinoplasty	12

Figure 4: Pre- and post-operative results from patient No.3. a/b/c: Pre-operative, d/e/f: Post-operative six months



Figure 5: Pre- and post-operative results of patient No.7. a/b/c: Pre-operative, d/e/f: Post-operative four months



Figure 6: Pre- and post-operative results of patient No.9. a/b/c: Pre-operative, d/e/f: Post-operative nine months



Pre- and post-operative functional results were evaluated using the NOSE questionnaire [11] and showed statistically significant improvements in all categories with the smallest change occurring in trouble sleeping although this result was still significant ($P = 0.012$). Most improvement was seen in nasal breathing (pre-operative 2.79, post-operative 0.86, $P < 0.001$) as shown in Tables 2 and 3.

Table 2: Nasal Obstructive Symptoms Evaluation (NOSE) questionnaire [11]

	Not a problem	Very mild	Moderate	Fairly bad	Severe
1. Nasal congestion and stuffiness	0	1	2	3	4
2. Nasal blockage and obstruction	0	1	2	3	4
3. Trouble breathing through my nose	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Unable to get enough air through my nose during exercise and exertion	0	1	2	3	4

Table 3: Results of Nasal Obstructive Symptoms Evaluation (NOSE) questionnaire

Patient	Nasal Congestion / Drainage		Nasal Blockage/ Obstruction		Breathing Through Nose		Trouble Sleeping		Nasal Obstruction During Exercise	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	2	0	3	0	3	0	1	0	3	0
2	2	1	2	0	3	1	2	0	2	0
3	3	1	3	0	3	0	2	0	2	0
4	0	0	2	1	2	0	1	0	2	1
5	2	0	3	1	4	1	2	0	3	1
6	1	0	2	0	2	1	0	0	1	0
7	3	1	2	1	3	2	1	1	1	1
8	2	1	2	0	2	1	0	0	1	1
9	1	0	2	2	3	2	1	1	2	1
10	3	1	3	0	3	0	2	0	2	1
11	0	0	2	1	2	1	0	0	1	0
12	3	0	2	1	3	0	3	3	0	1
13	1	2	3	2	3	3	1	1	0	0
14	2	0	3	1	3	0	1	0	2	1

Overall satisfaction rate from the final appearance was high among the patients ($P < 0.001$) as shown in Table 4. No major complications occurred during the follow-up. Stable postoperative appearance of the nose indicated the maintenance of the structural support. No additional interventions were required or requested by the patients.

Table 4: Results of Subjective Esthetic Appearance (3 = Severe, 2 = Moderate, 1 = Mild, 0 = None)

Patient	Deprojection		Pseudo-hump Appearance		Tip Definition		Unsatisfaction	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	3	1	2	1	2	0	3	0
2	2	0	3	1	2	1	2	0
3	1	0	3	0	2	0	3	1
4	3	0	3	1	1	0	2	0
5	1	0	2	1	3	1	2	1
6	2	0	1	0	2	1	1	0
7	3	1	2	1	3	0	3	1
8	3	1	3	1	2	1	3	0
9	2	0	2	1	3	1	2	1
10	3	1	3	0	1	0	3	0
11	2	1	2	0	2	1	2	0
12	3	0	2	1	2	0	2	1
13	1	0	3	1	2	1	1	0
14	2	1	3	0	2	0	3	0

Postoperative complaints were usual as seen in conventional rhinoplasty procedures, facial swelling, nasal stuffiness, pain, and epistaxis being the most common. Almost all these complaints resolved during post-operative recovery. No infections or other complications at the donor sites were reported.

Discussion

It is not always possible to obtain septal cartilage grafts for secondary rhinoplasty procedures in patients who underwent previous septo-plasty/septo-rhinoplasty. In these patients, the

septum is mostly over-resected, however; not further reconstructed with immediately obtained graft material. Septal support is lost with time, tip projection decreases, and the hump becomes more prominent. Therefore, the need for alternative sources of cartilage can arise during revision surgery due to an inadequate residual septum.

When the septal cartilage is not available in secondary operations, conchal or costal cartilages should be used as graft material [15]. Although conchal cartilage grafts are easier to obtain compared to costal cartilage grafts [16], conchal cartilage grafts lack the strength, can easily be twisted, and usually are inadequate for the reconstruction. Therefore, costal cartilage grafts are often preferred as spreader grafts in dorso-caudal reconstruction. The main disadvantage of costal cartilage grafts is the potential to warp. Different techniques have been described to overcome warping. The first principle to reduce cartilage warping was established earlier by Gibson and Davis when the struts are carved symmetrically [17]. Later internal stabilization with K-wires was proposed by Gunther et al. [18]. Farkas et al. [19] studied the warping effect on costal cartilages of fresh cadavers. They found carving in either antero-caudal or dorsocaudal central planes had no effects on prevention of warping. However, Taştan et al. [20] prepared costal cartilage grafts in a diagonal plane and used an oblique split method to prevent warping. The prepared cartilages were quite thin and could provide enough support for the dorso-caudal framework. Warping is prevented due to diagonal forces. This method was successfully applied to septal reconstruction in revisional cases [21]. Another method to prevent cartilage warping is opposite positioning of graft pieces [22]. Counterbalancing with two opposing costal cartilage grafts has been widely used in different studies [3, 23]. However, use of a pair of cartilage grafts can cause widening of the nasal dorsum. The one-piece frameworks used in dorsal augmentation provide narrower aesthetic dorsa, which are mostly used in patients with saddle-nose deformity [24, 25]. This type of reconstruction improves the appearance in case of near-total septal defects. However, if a septal remnant is available, fixation of cartilage grafts as spreaders ensures better stabilization and elongates the dorso-caudal septum. In the present study, a single unit of costal cartilage was split cephalically and fixed to the septum bilaterally. Therefore, a straighter nasal dorsum was achieved without warping or widening.

Two details deserve special attention in terms of our surgical technique. First, the loss of anterior septal support due to over-resection caused a relative hump formation. It can be defined as pseudo-hump (a relatively prominent hump) formation. This detail is important because one should pay attention to the incremental removal of the osteo-cartilaginous hump. Second, splitting the graft should be performed meticulously to prevent cutting the graft into two separate pieces although shaping the graft is otherwise very easy.

In the present study, the functional outcomes were also tested. It was demonstrated that nasal breathing improved significantly according to the NOSE questionnaire in all categories. The NOSE Scale was constructed by Stewart et al. [26] and published in February 2004. Each item in this survey was validated using a correlation and comparison analysis, and

items with low response sensitivity were removed from the survey composing the final version of NOSE scale. Although the scale and the answers to the items are still subjective, the scale has been used by many other authors and cited many times in the literature. The scale had been adapted and translated into many other languages and used actively in the literature suggesting that it is widely accepted and become quite an objective scale [27–30]. Therefore, our results based on this scale suggest that our method was quite effective in fixing functional problems arising from the deviated septum or unsupported nasal dorsum.

For the esthetic results almost all patients desired resolution for their breathing problems without radically changing their facial authenticity, and they were quite satisfied with their final appearances. Tip deprojection and pseudo-hump significantly improved after the surgery while better septal support was provided. Although the evaluation of the results was obtained via a subjective questionnaire, which is not as widely used as NOSE scale, it still yielded an accurate reflection about the esthetic outcomes. A very significant decrease in the overall dissatisfaction compared to pre-operative appearances was a notable esthetic outcome. In summary, our technique not only ensures better functional results but also yields more satisfactory esthetic outcomes.

No major complications, such as infection, graft extrusion, resorption, or loss of structural support during follow-up were noted. The main complaints were similar to those seen in conventional rhinoplasty operations and included facial swelling, nasal stuffiness, pain, and epistaxis [31] which resolved within two weeks. Furthermore, no complications associated with the donor site were detected. Therefore, these results suggest not only the satisfying functional and esthetic results but also the safety of the surgical technique.

Although this technique is applicable for most revision cases that lack septal cartilage, its use may be limited in more extensive cartilage deficiencies, such as saddle nose. It may be also not be applicable for crooked nose cases that require stronger cartilage support to straighten the nasal dorsum. In cases of saddle and crooked noses, more enduring cartilage grafts may be necessary to ensure sufficient septal support [3, 16, 32]. In this case, providing thinner nasal dorsum may be sacrificed to ensure sufficient septal support.

Limitations

The limitation of this study includes small sample size, retrospective design, and subjective assessment of the esthetic results. Although the functional results were assessed with a more reliable scale, the NOSE questionnaire, it is almost impossible to assess the esthetic results with a more established method. Furthermore, no control group or comparison with another technique has been suggested by other authors were included. Therefore, conducting a prospective, larger sample study with a control or comparison group would yield more precise results.

Conclusion

In this study, a novel dorso-caudal septal reconstruction method was proposed to provide structural support for both the tip and the septum in patients with previous septal resections. With this method, in addition to the advantages described above, warping of costal cartilage grafts and widening of the dorsum

with thick spreader grafts can be prevented. Using partial split costal spreader grafts is a reliable surgical technique that can be used safely for suitable indications.

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