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Severe deviated nose treatment: importance of preserving the dorsal septal remnant

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Abstract

Purpose To compare the surgical outcomes of modified extracorporeal septoplasty and anterior septal reconstruction for the management of the severe deviated nose.

Methods In a prospective cohort study, we selected 86 patients referred for septorhinoplasty to a tertiary center in May 2015–April 2017 with a primary complaint of nasal obstruction and deformity. They had moderate-to-severe septal deviation and severely deviated noses, particularly in the dorsum. Forty-three patients underwent each procedure. The cohorts were age- and sex-matched, and were operated at a similar time point. Surgical outcome was assessed and compared using anthropometric measurement of photographs, acoustic rhinometry, and The Nasal Obstruction Septoplasty Effectiveness questionnaire (including a visual analog scale).

Results In all patients, MCA1 (initial minimum cross-sectional area) and MCA2 (minimum cross-sectional area after topical decongestion of the nasal mucosa), anthropometric angles (nasolabial, nasofacial and tip projection), and The Nasal Obstruction Septoplasty Effectiveness questionnaire significantly improved after surgery in both groups ($p=0001$), with no significant difference in improvement between two groups. However, anthropometric angles and minimal cross-sectional area were better in anterior septal reconstruction group.

Conclusion Both methods are effective in patients with a severely deviated nose for correction of deviation and obstruction. Anterior septal reconstruction is the preferable method in patients with more deviation.

Keywords Septoplasty · Rhinoplasty · Deviated nose · Nasal obstruction

Introduction

The nasal septum plays an important role in both function and the shape of the nose [1]. In patients with a deviated nose, correction of septal deviation is essential for the treatment outcome [2]. Various septoplasty techniques, such as bony batten grafting, septal extension grafting, and cutting and suture techniques, were introduced to correct the esthetic and functional aspects of severely deviated noses [3]. These procedures may not always be sufficient for the successful correction of some severely deviated noses. Therefore, extracorporeal septoplasty (ECS) has been suggested as a more fundamental corrective method for a severely deviated septum in rhinoplasty.

King and Ashley [4] described ECS for improvements of severe deviation of the caudal and dorsal septum. They described total septal reconstruction by removing cartilaginous septum totally and replanting after correction. In this research, the results of the study were qualitative, and long-term results and complications were not examined [4]. Gubisch described his series of 2119 ESCs in 2005. He performed the technique via both endonasal approach and external approach. He sutured septal cartilage pieces together and reimplanted them for more support. Spreader grafts for flaring of internal nasal valve and onlay graft for prevention of dorsal irregularity were key points of the technique. He

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concluded that ECS was suitable methods for severe septal deviation [1].

However, owing to some specific complications of ECS such as dorsal irregularity and saddling, modifications were introduced for achieving better cosmetic and functional results [5–9]. In these modifications, total extraction of the septal cartilage is not performed. The different modifications were characterized based on distinctive parts of the septal cartilage that were harvested and the method that the extracted cartilages were attached and fixed together [5–9]. In Anterior Septal Reconstruction (ASR), a small portion of the dorsal part of the nasal septum or the dorsal stump (at least 1.5 cm long in anteroposterior dimension and 1 cm in vertical height) was preserved, and reconstructive grafts were placed on the concave side of mid vault and act as a spreader grafts and splint for the dorsal remnant [5, 6]. The dorsal strut or actually the dorsal part of the nasal septum is always completely preserved in the modified extracorporeal septoplasty (MES), and curved spreader graft and caudal septal graft are placed for correction of severe deviation [9].

Several studies compared the results of different surgical methods for septoplasty. Lee and Yang compared MES with in situ septal correction (ISSC). They found that MES is a useful technique for markedly deviated noses that can achieve a comparable esthetic success but a better functional outcome than ISSC in rhinoplasty [10]. Taken together, these techniques introduced effective methods for the severely deviated nose. However, to our knowledge, no studies have compared the treatment outcome of ASR and MES.

Materials and methods

Institutional review board approval was obtained for this prospective cohort study. Eighty-six patients who were referred to a tertiary hospital for septorhinoplasty were selected based on inclusion criteria from May 2015 to April 2017. These patients had complained of nasal obstruction for at least 3 months and concomitant nasal deformity. All patients filled informed consent. Exclusion criteria included patients with rheumatologic or immune deficiency diseases, any history of sinonasal caner, polyposis, head and neck chemo radiation, cleft lip and palate deformity, nasal trauma, or surgery. All patients underwent a detailed physical examination and standard preoperative and postoperative facial photography for rhinoplasty. For all patients, preoperation sinonasal CT scan was done. The patients had moderate-to-severe septal deviation and severe deviation especially in dorsum on physical and endoscopic examination [10, 11]. For qualitative evaluation of nasal obstruction, The Nasal Obstruction Septoplasty Effectiveness (NOSE) questionnaire and Visual Analog Scale (VAS) were administered [12]. For quantitative evaluation, we used acoustic rhinometry (minimal cross-sectional area, MCA) with and without nasal decongestant. Measuring of acoustic Rhinometry was based on the standardization Committee for Acoustic Rhinometry (GM Instruments, Kilwinning, Scotland). All operations were performed by the senior author (A.A.S) via an external approach. He examined the patients and decided the method of surgery (MEC or ASR) based on physical examination, photographic assessment, radiologic evaluation, and, especially, intraoperative finding. All evaluations were done preoperatively as well as 6 and 12 months after surgery.

Under general anesthesia, an external approach was used for exposure in all cases. The domes, middle, and medial crura were separated in the midline, and the upper lateral cartilages were released laterally, creating excellent exposure of the septum. Bilateral sub-mucoperichondrial flaps were elevated, exposing the entire cartilaginous and bony septum. In this step, the surgeon chose the preferable method. In curved dorsal deviation of the septum, MES was performed, and in the angulated dorsum or S-shaped deformity, ASR was preferred. The ASR and MES were performed based on most technique and Sazgar technique, respectively [5, 6, 9]. Frequently, dorsal onlay graft or crushed cartilage was used on dorsum as a final step. Medial and lateral osteotomy and tip plasty were performed for all patients. A quilting suture was placed. No intranasal splints were used. External taping and splinting were left in place for 1 week.

Surgical results were evaluated by anthropometric measurement in pre- and postoperation standard photography using Digimizer version 4.1.1.0 software (MedCalc Software bvba, Belgium) by two other specialists who were not involved in surgery. In the lateral view, the nasofrontal angle, nasolabial angle, and tip projection were evaluated. Degree of deviation was evaluated in frontal view based on the Erdem and Ozturan study [13]. Patients were followed 6 months and 12 months after surgery with photography and acoustic rhinometry and VAS and NOSE (Figs. 1, 2). Complications such as dorsal irregularity, saddling, nostril asymmetry, infection, bleeding, and septal hematoma was evaluated and compared between two groups.

We used *t* tests to compare the anthropometric, VAS, NOSE, and acoustic rhinometry measurements in both groups. Statistical analyses were performed with the SPSS software, version 16.0 (IBM SPSS Statistics 25), and $p < 0.05$ was regarded as statistically significant.

Result

Eighty-six patients were enrolled in this study (43 in MES group and 43 in ASR group). The mean age was 30.7 years (range 21–46 years) in ASR group and 28.5 (range 19–42 years) in MES group. There were no statistically significant differences between groups ($p = 0.1$). There were

Fig. 1 Preoperative (left) and postoperative (right) views of a patient with severe deviated nose. In this case, the septum was curved and modified extracorporeal septoplasty was used

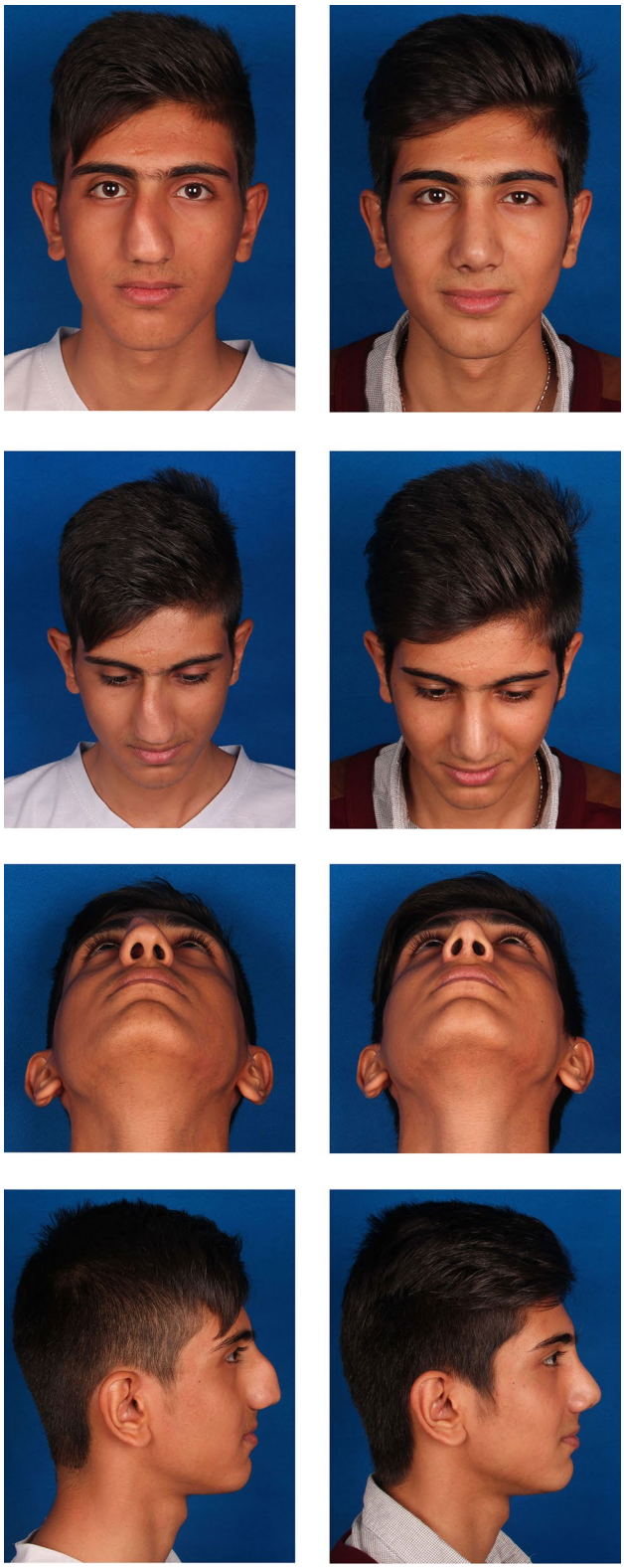

Fig. 2 Preoperative (left) and postoperative (right) views of a patient with severe deviated nose. In this case, the septum was angulated and anterior septal reconstruction technique was used

15 (34.9%) female and 22 (65.1%) male in ASR group, and 21(48.8%) female and 22 (51.2%) male in MES group. There were no statistically significant differences in both groups ($p > 0.5$). Participants had no history of facial trauma and septorhinoplasty. No costal or ear cartilage grafts were used in any patients.

Quantitative results of nasal obstruction were evaluated by measuring of MCA1 (initial minimum cross-sectional area) and MCA2 (minimum cross-sectional area after topical decongestion of the nasal mucosa) and total nasal volume preoperation and 6 months and 12 months after surgery. There were no statistically significant differences between MCA1 and MCA2 and total nasal volume before surgery in both groups ($p = 0.38$, $p = 0.791$, $p = 0.901$). In all patients, MCA1 and MCA2 significantly improved after surgery ($p = 000$). Improvement of MCA2 in ASR group was more than MES group ($p = 0.030$). There were no statistically significant differences between degree of changes in MCA1 and MCA2 before and after surgery between two groups ($p > 0.1$). Results were not changed between two groups in 6 months and 12 months after surgery ($p > 0.5$) (Table 1).

In ASR group, 11 patients (25.5%) had I shape and 32 (74.5%) had C shape deviation. Septal deviation angle (10) before and after surgery was 3.23 (1.15) and 1.42 (0.49) in I shape group, and 166.43 (6.69) and 176.45(10.38) in C shape group. There were statistically significant improvements in septal deviation angle between before and after surgery in both groups ($p = 0.00$) (Table 2).

Degree of improvement of septal deviation angle after surgery in both I shape deviation (1.42 SD = 0.49) and C shape deviation (176.45 SD = 4.25) was more in ASR group than MECS group (I shape: 2.08 SD = 1.07; C shape: 174.06 SD = 2.66). There were no statistically significant differences between degrees of changes of septal deviation angles before and after surgery between two groups ($p > 0.1$).

In all patients, nasofrontal and nasolabial angles and tip projection were significantly improved after surgery ($p = 0.000$). There were no statistically significant differences

Table 1 Quantitative and qualitative comparisons of nasal obstruction before, 6 months and 12 months after surgery between ASR and MES approach

Variable	MES ($n = 43$)				ASR ($n = 43$)			
	Pre Op	Post Op 6 m	Post Op 12 m	*p* value	Pre Op	Post Op 6 m	Post Op 12 m	*p* value
MCA1 (mm^2)	0.37 (0.03)[a]	0.41 (0.02)	0.41 (0.02)	0.000	0.37 (0.01)	0.41 (0.11)	0.41 (0.11)	0.000
MCA2 (mm^2)	0.41 (0.01)	0.46 (0.02)	0.46 (0.02)	0.000	0.41 (0.07)	0.47 (0.01)	0.47 (0.01)	0.000
Volume, (mm^3)	4.67 (0.37)	4.67 (0.37)	4.67 (0.37)	0.000	4.66 (0.15)	4.66 (0.15)	4.66 (0.15)	0.000
VAS	Severe	None	None	0.000	Severe	None 88.4% Medium 11.6%	None 88.4% Medium 11.6%	0.000
NOSE	18.84 (0.75)	5.79 (1.20)	5.79 (1.20)	0.000	17.91 (0.94)	6.65 (0.38)	6.65 (0.38)	0.000

ASR anterior septal reconstruction, *MES* modified extracorporeal septoplasty, *Pre Op* preoperative, *Post Op* postoperative, *MCA1* initial minimum cross-sectional area, *MCA2* minimum cross -sectional area after topical decongestion of the nasal mucosa, VAS visual analog scale, *NOSE* Nasal Obstruction Symptom Evaluation, *m* months, mm^2 square millimeter, mm^3 cubic millimeter

[a]Standard deviation

Table 2 Comparison of anthropometric angles, before, 6 months and 12 months after surgery between ASR and MES approaches

	MES ($n = 43$)				ASR ($n = 43$)			
	Pre Op	Post Op 6 m	Post Op 12 m	*p* value	Pre Op	Post Op 6 m	Post Op 12 m	*p* value
ENA[b]								
I	3.12 (1.27)[a]	1.98 (1.01)	1.92 (0.86)	0.000	3.23 (1.15)	1.42 (0.49)	1.37 (0.45)	0.000
C	135.14 (7.80)	143.52 (8.60)	144.57 (9.57)	0.000	166.43 (6.69)	176.45 (2.66)	176.63 (2.57)	0.000
NFA[b]	91.55 (11.71)	98.95 (9.68)	98.68 (9.75)	0.000	137.33 (6.56)	145.74 (10.38)	146.85 (10.74)	0.000
NLA[b]	91.55 (11.71)	98.95 (9.68)	98.68 (9.75)	0.000	88.9 (12.90)	96.10 (10.07)	95.91 (9.83)	0.000
NTP	0.62 (0.06)	0.66 (0.07)	0.67 (0.07)	0.000	0.62 (0.04)	0.66 (0.04)	0.66 (0.05)	0.000

ASR anterior septal reconstruction, *MES* modified extracorporeal septoplasty, *Pre Op* preoperative, *Post Op* postoperative, *ENA* external nose angle, *NFA* nasofrontal angle, *NLA* nasolabial angle, *NTP* nasal tip projection

[a]Standard deviation

[b]Degree, I: I shape, C: C shape

between degree of changes of these before surgery and after surgery between two groups ($p > 0.1$) (Table 2). Anthropometric angles were not significantly changed between 6 and 12 months in both groups ($p > 0.1$).

Dorsal irregularity [MES: 1 (2.3%), ASR: 2 (4.7%)], nostril asymmetry [MECS: 1 (2.3%), ASR: 1 (2.3%)], necessity for revision surgery because of residual deviation [MECS: 2 (4.7%), ASR: 1 (2.3%)], and postoperation infection [MEC: 1 (2.3%), ASR: 0] were surgical complications in this study. There were not any saddling, septal perforation, and hematoma in patients. Totally, we had 4 (9.3%) complications in ASR group and 5 (11.6%) in MES group, but there were no statistically significant differences between two groups (Fisher's exact test = 1.00).

Discussion

ECS was initially described in 1952 [4]. Subsequently, various authors have discussed different modifications of the techniques and their outcomes. In 2005, Gubisch described his series of 2119 ESCs, performed via an endonasal and open approach; he sutured the pieces of cartilage together and reimplanted them for more support [1]. In 2006, most introduced the ASR technique as a modification of ECS that allowed for aggressive treatment of the deviated septum/nose while preserving a dorsal remnant, thus reducing significantly the risk of dorsal notching [5]. In 2015, most published a larger study of the ASR technique [6]. Jang and Kwon [8] described a modified ECS technique in which a small remnant of dorsal cartilage is preserved at the keystone area to increase stability and facilitate the ECS method.

Lee and Jang compared the surgical outcomes of ECS with those of the conventional ISSC in the treatment of a deviated nose. There were no statistical significant differences in anthropometric angles between two groups. That was similar to our results between two groups of MES and ASR. Surgical outcomes in both groups were assessed and compared using anthropometric measurements of preoperative and postoperative photographs. Nasal obstruction was examined by acoustic rhinometry and VAS pre- and postoperation. Follow-up was done 13 and 16 months after operation. This was a retrospective study that was one of the limitations of this study [10]. Our study was prospective and we similarly acquired improvement in both group.

Final angles after surgery (I shape and C shape deviation) in the ASR group were closer to maximum possible correction (0° and 180°). We cannot rule out that this better result in the ASR group was related to selection bias during surgery. The senior surgeon preferred the ASR in cases of an angulated dorsal septum and the MES in C-shaped and curved dorsal septum. Furthermore, resection of the cartilaginous septum in the ASR typically more than MECS and probability of correction of septal deviation is higher than MES that is more conservative. Interestingly, a follow-up study by most described occasional preservation of the entire dorsal strut in ASR [6]. By increasing the sample size or random sampling, results may be changed.

Most acquired a significant improvement in anthropometric and NOSE in patients who underwent ASR approach for the deviated nose after surgery compared with before surgery, similar to our study. However, his prospective study did not include a matched cohort, and improvement in nasal obstruction was measured only by NOSE and VAS [5]. Jang and Kwon acquired a significant improvement in anthropometric and VAS in patients who underwent MES approach for the deviated nose postoperatively similar to our study. However, they did not have control group and improvement in nasal obstruction was qualitative, without use of a validated outcome measure such as the NOSE [8]. Sazgar and Amali acquired a significant improvement in anthropometric and nasal obstruction in patients who underwent MES approach for deviated nose after surgery similar to our study. However, the absence of a control group, small sample size, and only qualitative evaluation of nasal obstruction were limitations of their study [9].

We evaluated quantitative results of nasal obstruction by measuring of MCA1 and MCA2 as well as qualitative results by VAS and NOSE questionnaire, all of which showed a significant improvement in both groups. Improvement of MCA2 in ASR group was greater than in the MES group. The dorsal graft and spreader graft in the ASR approach were placed more than in the MES approach. This may lead to increased wideness of internal nasal valve and more improvement of nasal obstruction and MCA2 in ASR. Interestingly, improvement of the septum/valve complex also reduces lateral wall insufficiency [14].

Some previous studies reported improvement of the NOSE after surgery. However, these changes were unaffected between 6 and 12 months. We acquired similar result [15]. A study by Kandathil et al. demonstrated that, in functional rhinoplasty, NOSE scores decrease dramatically after surgery and are stable beyond 3 months postoperatively [16, 17].

Boom et al. reported the complications of endonasal septoplasty in a review study. They reported bleeding and septal hematoma in (6–14%), CSF leak (rare), infection (0.048–2.5%), overcorrection (2%), septal perforation (1–6.7%), hyposmia (3%), adhesion (7%), and deformity (4–8%) [18]. We had lower complication in our study. As in the original ASR description, saddling and septal perforation were not observed in our study patients.

An important difference between the two methods which we examined is preservation of a longer dorsal part in MES than ASR as performed herein. In both methods, preservation of the keystone is critical to maintaining dorsal stability

and reduced notching. Both methods improved anthropometric angles and nasal obstruction, but final angles after surgery (I shape and C shape deviation) in the ASR group were closer to maximum possible correction (0° and 180°).

One of the limitations of this study was nonrandomized patient selection that was based on surgeon preference during surgery. We tried to diminish the effect of this by equal numbers of patient in each group, and noted similar preoperative anthropomorphic measurements in each group. In addition, the effect of inferior turbinate in nasal obstruction result was not considered. By measuring MCA2 after using decongestant, we omitted the effect of allergic mucosal inferior turbinate hypertrophy, but we did not evaluate the effect of bony inferior hypertrophy in nasal obstruction.

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Compliance with ethical standards

Conflict of interest There are no potential conflicts or financial relationships.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (Ethical code: IR.TUMS.REC.1394.1925), and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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