Twisted Nose: Preservation Rhinoplasty with Modified Push-Down/Let-Down Technique

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Background: The authors present a retrospective, comparative, and analytical cohort study, that aimed to prove the utility of unilateral or asymmetrical bony wedge resection to straighten the twisted nose as applied in let-down and push-down methods. The study involved objective angle measurements preoperatively and postoperatively on frontal view photographs.

Methods: Preoperative and postoperative angle measurements were made on frontal view photographs of 78 patients with twisted noses classified as type C and type I. Angles of deviation were obtained using Scion Image software, measured in degrees. Statistical analysis was performed using Excel v15.13.3.

Results: Forty-two patients had twisted nose type C and 28 patients had twisted nose type I. The mean age was 19 years. There was an 81% improvement ratio for twisted nose type C and 79% for twisted nose type I, and the angle correction for each type of nasal deformity was statistically significant ($P < 0.01$). The majority of postoperative results were classified as excellent to good, with the exception of four cases with bad outcomes, including two patients with type C and two with type I deviations.

Conclusions: Unilateral or asymmetrical bony wedge resection is a modification of the let-down rhinoplasty technique. This study demonstrates statistically significant improvements in straightening twisted noses among patients with or without preoperative hump and preserving the nasal dorsum. The authors found this modification better suited for type C deviations. *(Plast. Reconstr. Surg.* 151: 749, 2023.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

The twisted nose is one of the most difficult deformities to treat, with frequent postoperative recurrences of crookedness. Generalized facial asymmetry is very common[1] and contributes to nasal crookedness and asymmetries before and after rhinoplasty. Despite the physical and psychological challenges associated with the twisted nose and its correction, it is possible to achieve satisfactory results. Preservation rhinoplasty allows us to make cosmetic and functional alterations to the nose while conserving the native dorsal anatomy and associated physiologic dynamics. Dorsal hump reduction, as first introduced by John Orland Roe in the 1880s,[2] is a commonly requested cosmetic change that may be performed through preservation techniques.

The osseocartilaginous hump may result from traumatic or genetic causes.[3,4] When the dorsal hump is approached from above, careful dorsal reconstruction is required to prevent irregularities that may disrupt dorsal smoothness, yielding poor aesthetic results.[5] In addition, disarticulating the keystone area from above may destabilize the nose and cause an "open roof deformity." In

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the early 1900s,[6] Jacques Joseph introduced "lateral osteotomies" to narrow the dorsum and close the open roof deformity following direct dorsal reduction. Lateral osteotomies, although beneficial for closure of the open roof, may also narrow the nasal airway by narrowing the nasal sidewalls and valve area.

HISTORY OF THE PUSH-DOWN/LET-DOWN TECHNIQUE AND MODIFICATIONS

Since complications along the dorsum were sometimes noted with Joseph's hump reduction and osteotomies, Maurice Cottle published the push-down technique in 1954. The primary aim of the push-down was to reduce the dorsal height while conserving an intact dorsum, thereby preventing iatrogenic valve obstruction, dorsal irregularities, and open roof deformities. The push-down technique is more difficult to achieve among patients with humps larger than 5 mm; Huizing noticed that limitation, and in 1975 he modified Cottle's technique by resecting triangular nasal bony wedges at the junction of the nasal bones and frontal process of the maxilla, allowing the pyramid to "let-down" larger humps into the space created by the excised bony wedges.[2,6–8] Dr. Vernon Gray of Los Angeles, California, named this triangular bony wedge resection technique the let-down procedure.

In the early 1980s Fausto López-Infante proposed a modification of the let-down technique, specifically for the twisted nose deformity. This modification involved the resection of a single wedge of bone on the elongated side of the asymmetric nasal pyramid (or the resection of asymmetric wedges of bones with a larger wedge resected on the elongated side), followed by standard osteotomy on the contralateral side and a transverse root osteotomy to mobilize the entire osseocartilaginous pyramid, thus correcting the asymmetry by equalizing the lengths of the nasal bones.[9] From an historic point of view, dorsal preservation surgical techniques including the push-down and let-down have been reported in the literature for over 50 years. In Mexico, Dr. Fausto López-Infante popularized and practiced the let-down technique in the early 1980s, achieving a smooth dorsum and avoiding disruption of the keystone area and nasal valve, thus preserving nasal form and function.[10] The let-down technique remains a dominant technique among Mexican rhinoplasty experts.

THE TWISTED NOSE

Facial asymmetry presents significant challenges when correcting a twisted nose. The underlying nasal asymmetry can never be completely corrected, and postsurgical imperfections should be expected, as the maxillary foundation on which the nasal pyramid rests is inherently asymmetrical. Preoperative analysis and the establishment of surgical goals may be aided by photographs, computed tomography, a complete clinical examination, and detailed discussions with the patient—all valuable strategies for establishing reasonable patient expectations and outcomes. (**See Figure, Supplemental Digital Content 1**, which shows facial asymmetry in the patient with twisted nose; on the axial computed tomographic scan, note that the nasal bone is larger on the left side. Clinical examination is performed by simple silk placement in the midline. References consist of the glabella, nasion, tip, and midpoint of the upper lip, ***http://links.lww.com/PRS/F677***.)

Causes of nasal crookedness include bony pyramidal asymmetries, septal deformities, upper and lower lateral cartilage asymmetries, all of which may be congenital or acquired.[11] Septal deformity correction and complete mobilization of nasal support structures help in repositioning all nasal components to achieve a straighter nose. Rohrich et al. suggest that the deviated nose should be considered as a single osseocartilaginous unit in which all nasal components require correction to achieve success.[10] Although direct hump reduction is useful from an aesthetic point of view, when performed from above, it disturbs native structural anatomical attachments that must be precisely reconstituted to maintain stability: the upper lateral cartilages (ULCs) must be reattached to the septum, the nasal bones must be attached to the ULCs, the lower lateral cartilages must be positioned properly and strengthened as needed, and the septum must be stabilized and straightend.[12] According to this concept, the use of structural grafts to reinforce, recontour, and reconstruct the nasal skeleton form the foundation of deviated nose correction. Preservation rhinoplasty's let-down technique and the specific crooked nose approach presented herein provides an alternative approach to patients with a crooked nose.

CLASSIFICATION OF THE TWISTED NOSE

The twisted nose is classified into three main types:

1. Type I deviations can be linear; the dorsum and the tip are shifted to one side of the vertical midline of the face.

2. Type C deviations demonstrate a dorsal concavity on one side and a corresponding convexity on the opposite side.
3. Type S deviations demonstrate a concavity to one side and a convexity at a different location along the length of the nose on the opposite side, thus the name type S because the deformity resembles the letter S.[13,14]

PATIENTS AND METHODS

A retrospective comparative study of 78 patients, operated on between January of 2001 and January of 2017, with a twisted nose with or without a dorsal hump were included. Exclusion criteria consisted of patients with craniofacial malformations, maxillofacial structural abnormalities, type S crooked noses, and facial keloid scars, along with those with less than 1 year of postoperative follow-up.

Forty-two patients (53%) had type C noses and 36 patients (47%) had type I noses (Fig. 1). They underwent corrective surgery with wedge resection at the base of the bony vault in the ascending (frontal) process of the maxilla. Those patients with a dorsal hump had asymmetric wedges excised, whereas those without dorsal humps had unilateral wedges resected to help equalize the lengths of the nasal bones. The wedge width is previously measured on the nose scan and is remeasured intraoperatively. [**See Figure, Supplemental Digital Content 2**, which shows (*above, left to right*) preoperative nasal pyramid asymmetry and postoperative symmetry. (*Below*) The wedge width is measured intraoperatively, ***http://links.lww.com/PRS/F678***.]

Standard preoperative and postoperative photographs were taken and included frontal view, left and right lateral views, left and right oblique views, and basal view. The angle measurements were performed only on the photographic frontal view to demonstrate the midline (centralization) of the nasal pyramid postoperatively and to compare the preoperative and postoperative positions relative to the midline, as the lateral view was not thought to be useful to assess and measure angle corrections on the twisted nose.

Statistical analyses were performed using OpenEpi Software (Open Source Epidemiologic Statistics for Public Health, Version 3.01). Differences between preoperative and postoperative angular values were analyzed using the *t* test. The differences between two groups were tested by the chi-square test for independent samples. A value of $P < 0.05$ was considered statistically significant.

Patients with twisted nose type I were measured tracing a vertical line from the glabella (point A) to the middle point of the upper lip (point D). The nasion (point B) and the most prominent point of the nasal tip were also identified (point C). The segment between the nasion and the middle point of the upper lip (segment BD) and the segment between the

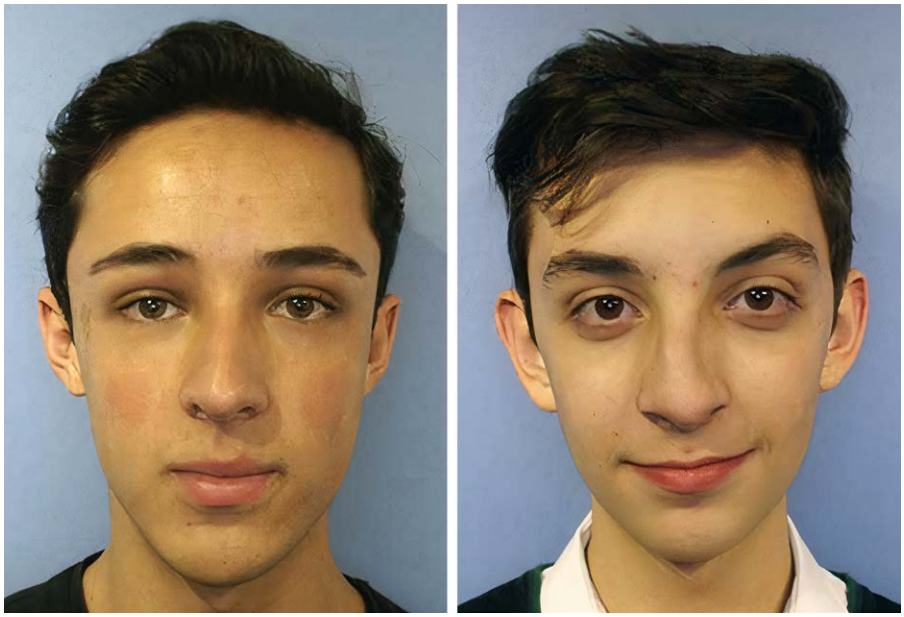

Fig. 1. Frontal view photographs. (*Left*) Type I and (*right*) type C noses.

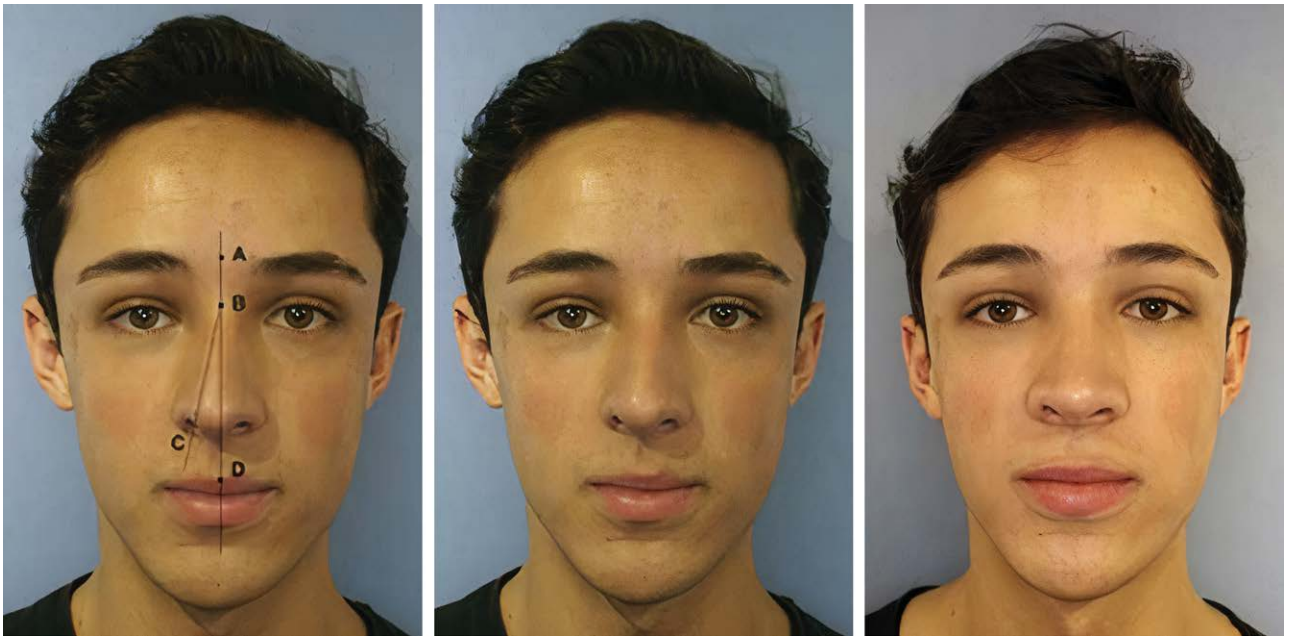

Fig. 2. Angle measurement method in type I nose: *A*, glabella; *B*, nasion; *C*, most prominent point of the tip; and *D*, middle point of the upper lip. Preoperative and postoperative frontal view photographs of a patient with a type I nose.

nasion and the most prominent point of the nasal tip (segment BC) formed the angle of deviation in type I noses (Fig. 2). Patients with twisted type C noses were measured tracing a vertical line from the glabella (point A) to the middle point of the upper lip (point D); then, the nasion (point B) and nasal tip (point C) were identified. The most prominent external edge of the convexity was identified as point E (Fig. 3).

By joining the points B to E and C to E, we obtained a triangle whose base corresponded to segment BC. The angle obtained by joining segments BE and EC corresponded to the deviation classified as a twisted type C nose. Scion Image Software (Beta 4.02 Windows) was used to measure the twisted nose angles in the preoperative and postoperative photographs. (**See Figure, Supplemental Digital Content 3**, which shows a screen shot of the Scion Image program; angle measurements and analysis of the frontal view photograph is shown, ***http://links.lww.com/PRS/F679***.)

The ideal angle considered by the authors for the type C nose is 180 degrees, because 180 degrees is a straight line. The ideal angle considered for a type I nose is 0 degrees.

The ideal degree for correction was calculated using the following formula:

$$(\text{ideal angle} - \text{preoperative twisted nose angle}).$$

Then, the postoperative corrected angle obtained was calculated using the following formula:

$$(\text{postoperative angle} - \text{twisted nose angle}).$$

Then, we divided the obtained correction angle divided by the ideal correction angle. The percentage of postoperative success was obtained after calculating the postoperative angle. It was calculated by the following formula:

$$(\text{postoperative angle}/\text{preoperative angle}) - 1 \text{ [eg, } (3.5/13.5) - 1 = 0.740\grave{a} \rightarrow 74\%].$$

Surgical Technique

Local anesthetic infiltration is achieved with 3 to 5 mL of 2% lidocaine with 1:100,000 epinephrine into the nasion, intercartilaginous area, pyriform aperture, membranous septum, and transfixion incision site. Three to 5 mL of local anesthetic provides adequate block and vasoconstriction without altering the form of the nasal tissues. Most commonly, bilateral intercartilaginous and complete transfixion incisions are made, which allows excellent visualization of the nasal septum and the osseocartilaginous pyramid.[15]

The caudal edge of the ULC is identified, as is the cephalic edge of the lower lateral cartilage, and an intercartilaginous incision and hemitransfixion incision at the caudal septal border are

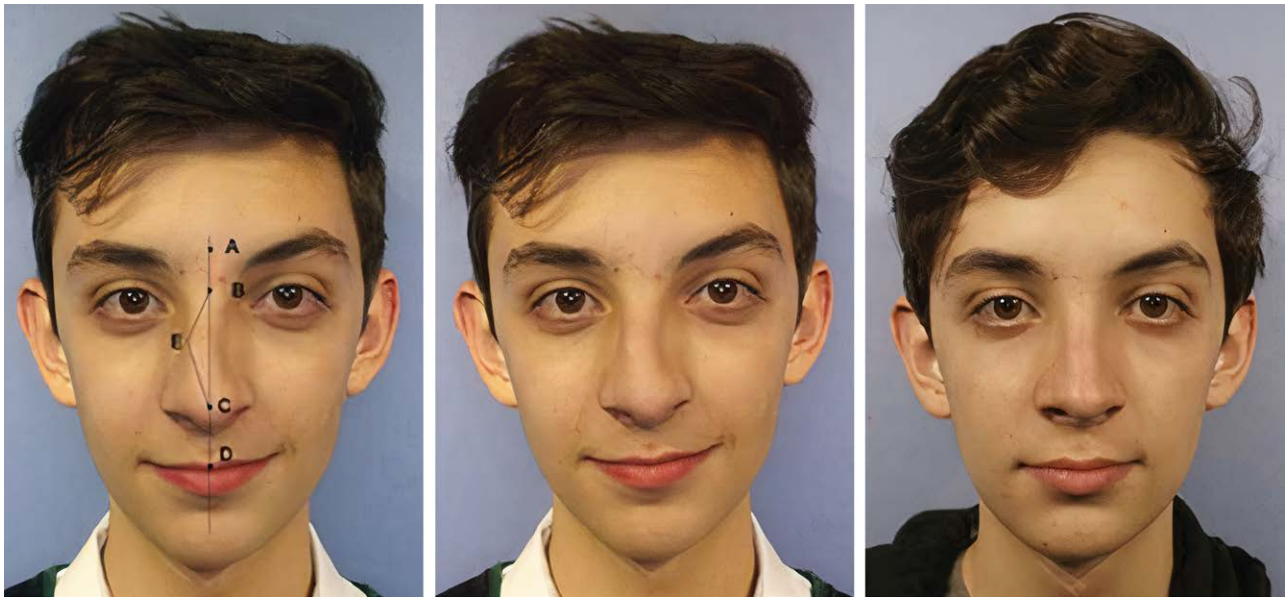

Fig. 3. Type C nose: *A*, glabella; *B*, nasion; *C*, nasal tip; *D*, middle point of the upper lip; and *E*, most prominent external edge of the convexity. Preoperative and postoperative frontal views photographs of a patient with a type C nose.

made with a no. 15 blade, first on the left side and then on the right side. The subperichondrial and subperiosteal nasal septal flap is elevated on both surfaces, from the anterior septal edge to the posterior vomer and from the nasal floor to the dorsum; this allows for ease of posterior mobilization of the nasal pyramid. If there is any deviation of the septum, it is addressed. Complete disarticulation of the ventral cartilaginous septum from the maxillary crest and the posterior cartilaginous septum from the perpendicular plate and vomer is performed to allow for straightening.

A 4-mm vertical incision is made along the nasal sidewall at the level of the pyriform aperture, and periosteum along the intended pathway of the lateral osteotomy is elevated along the internal and external aspects of the frontal process of maxilla and nasal bones. A 3-mm Lempert forceps is introduced in the subperiosteal tunnel made, and the bony wedge is resected from the larger side of the bony pyramid.[16] It may be necessary to remove bilateral wedges, with the longer side requiring a larger wedge resection to even the two sides.

Once the bony wedge is resected, the ipsilateral osteotomy is completed, and a "high-low-high" lateral osteotomy is performed on the contralateral side, respecting the Webster triangle and thereby differing from the technique of Yves Saban.[17,18] Next, a percutaneous transverse osteotomy is accomplished with a 2-mm osteotome. The entire nasal pyramid is mobilized and repositioned to the midline. Just like Saban,[18,19] we believe that elevation of the dorsal soft tissue helps to achieve complete freedom of mobility from the skin and ultimate refixation through scar tissue of the repositioned pyramid, sometimes needing a lateral keystone release as described by Neves.[20] Our preservation rhinoplasty let-down technique incorporates purposeful septal surgery as an indispensable step in deprojecting the dorsal height and in straightening the nose. After mobilizing the pyramid to the midline, the remaining septum height determines the height of the dorsum (Fig. 4).

Trimming of the ventral septum is performed to adjust the dorsum height desired and fit the residual septum securely on the maxillary crest and anterior nasal spine. The caudal septum is fixed to the anterior spine using a 3-0 polydioxanone suture in a figure of-eight design. It should be noted that we have not faced postoperative loss of tip projection or retraction of the columella because the caudal edge of the septum is anatomically adjusted and reinserted to the nasal spine. The entire lobular complex is fixed in a midline and natural anatomical position.

The nasal septal space is filled with residual fragments of septal cartilage and bone, and quilting sutures are applied with 4-0 plain gut suture. An M-plasty may be performed, opening the internal nasal valve angle.[21] A nasal cast is placed over the nasal dorsum and removed on day 6 or 7. Additional nasal tape dressing may

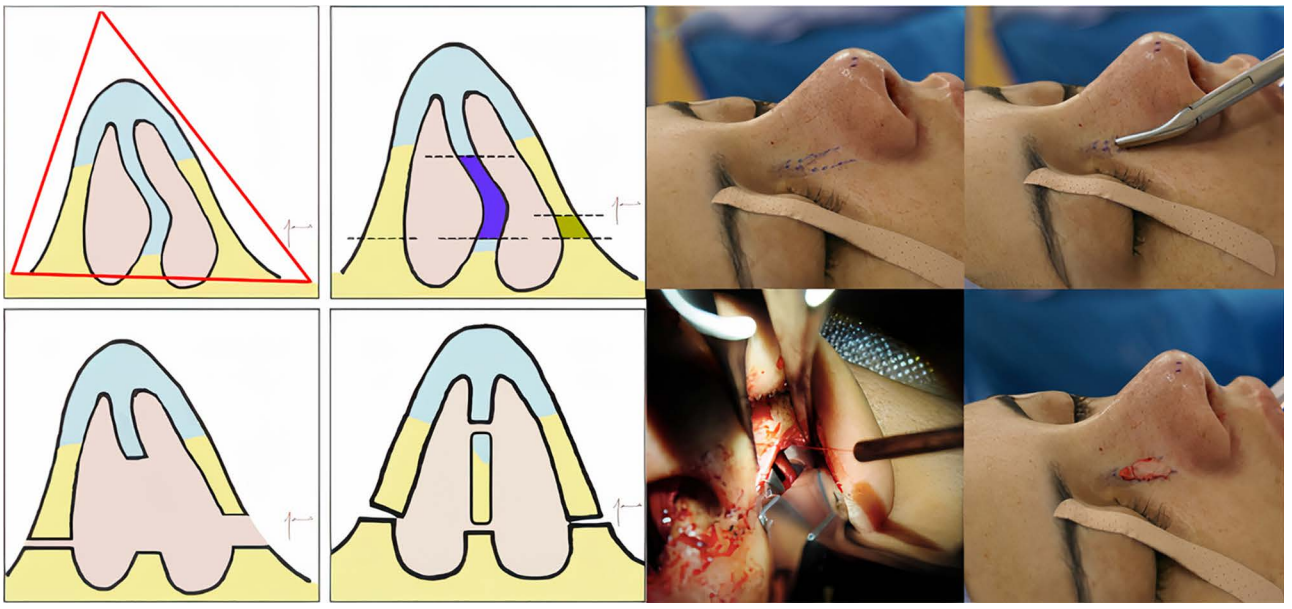

Fig. 4. (*Above*, *left* to *right*) Scheme of the nasal pyramid, basal view. Nose deviation to the right. Nasal bone and maxilla is larger in the left side. Planning of the septal work and intraoperative image of unilateral wedge and osteotomies. (*Below*, *left* to *right*) Scheme of osteotomies, unilateral wedge resection, and resection of osteocartilaginous spur in nasal septum. (*Below*, *second from right*) Intraoperative wedge resection. (*Below*, *right*) Unilateral bony wedge resected.

be placed and remains for an additional 2 weeks as needed.

RESULTS

Seventy-eight patients with twisted noses who underwent rhinoplasty with unilateral or bilateral asymmetric wedge resections performed by a single surgeon (F.L.U.) were included; Scion Image software (Beta 4.02 Windows) was used for measurements. A total of 46 female patients (58%) and 32 male patients (42%) were included. Forty-two patients (53%) had type C deformities and 36 patients (47%) had type I deformities. The median age ± SD was 19 ± 8.05 years (range, 10 to 42 years). The youngest patient was aged 10 years and was included because of severe nasal airway obstruction and severely crooked nose. Septorhinoplasty has been shown to be safe in the pediatric population, with no major effects on craniofacial growth reported, but we reserve surgery in children for only the most severe airway obstruction issues.[22,23]

The average postoperative follow-up time was 18 months, and all the frontal view photographs used were taken at least 1 year following surgery to ensure proper and complete healing (Table 1). In 20 patients (25%) bilateral asymmetric bony wedges were resected to reduce a dorsal hump, and of those 20 patients, 12 had type C and eight had type I noses.

In the type C nose, the mean preoperative angle was 140.05 degrees, and the mean postoperative angle was 175.25 degrees. In the type I nose, the mean preoperative angle was 12 degrees, and the mean postoperative angle was 2 degrees. The difference was statistically significant ($P < 0.01$) for each of two twisted nose classification types (Table 2).

We measured our outcomes in a fashion similar to previous work performed by Erdem and Ozturan; the success rate was divided into four categories (excellent, good, moderate, and bad). If the percentage of postoperative success was 90% to 100%, the result was considered excellent; 70% to 89%, good; and 50% to 69%, moderate; a postoperative percentage below 50% was considered bad.[14]

Twenty-two patients with twisted noses were classified as type C , and 12 patients with twisted nose classified as type I were reported as excellent. These results determined as excellent represented 43% of our operated patients. Results determined as either excellent or good totaled 80% of our entire 78-patient population and are statistically significant ($P < 0.01$) for each group (type C and type I).

Of the 78 patients treated with this technique, four patients (5%) obtained a postoperative

Table 1. Clinical and Demographic Data by Group

Clinical Feature	Type C Nose (%)	Type I Nose (%)
No.	42	36
Age, yr		
Mean ± SD	23 ± 8.9	18 ± 5.57
Range	13–42	10–36
Sex		
Male	20 (47.6)	12 (33.3)
Female	22 (52.3)	24 (66.6)
Wedge resection		
Left	12 (28.5)	20 (55.5)
Right	30 (71.4)	16 (44.4)
Average follow-up ± SD, mo	11.8 ± 14.2	26 ± 31.8
Mean improvement ratio ± SD	81.6 ± 15.8	79.5 ± 13.8

Table 2. Objective Analysis of Twisted Nose Management in the Literature Compared with This Study's Results, Including Preoperative and Postoperative Angle Measurements in Patients with Twisted Nose[a]

	Type C				Type I			
Reference	No.	Preoperative Mean ± SD (deg)	Postoperative Mean ± SD (deg)	*P*	No.	Preoperative Mean ± SD (deg)	Postoperative Mean ± SD (deg)	*P*
Okur et al., 2004[13]	13	146.8 ± 10.1	167.7 ± 7.2	<0.01	14	7.6 ± 2.3	1.9 ± 1.04	0.001
Erdem et al., 2008[14]	72	152.9 ± 9.03	173.67 ± 4.5	<0.01	48	12 ± 2.1	2.01 ± 1.53	<0.01
Ozturan et al., 2002[24]	30	150.7 ± 8.8	163.9 ± 7.7	<0.01	29	6.4 ± 2.2	2.3 ± 1.4	<0.01
López Ulloa et al. (present study)	42	140.05 ± 5.21	175.25 ± 6.1	<0.01	36	6.84 ± 2.58	2 ± 1.85	<0.01

[a]Okur E, Yildirim I, Aydogan B, Kilic A. Outcome of surgery for crooked nose: an objective method of evaluation. *Aesthetic Plast Surg.* 2004;28:203–207; Erdem T, Ozturan O. Objective measurement of the deviated nose and a review of surgical techniques for correction. *Rhinology* 2008;46:56–61; and Ozturan O, Miman MC, Yigit B, Cokkeser Y, Kizilay A, Aktas D. Approaches to twisted noses and results of treatment. *Kulak Burun Bogaz Ithis Derg.* 2002;9:9–21.

success score lower than 50%, corresponding to a bad outcome. Among these patients, the desired straightening was not achieved, because of severe facial asymmetry, but we did not find the patients to have a persistent hump or saddle nose deformity. These bad outcomes occurred in two patients with type C and two patients with type I deformities.

DISCUSSION

Although many surgical techniques have been described over the years, there are few clinical studies investigating the quantitative postoperative results and surgical success.[2,4] Twisted nasal deformities arise from a variety of abnormalities including upper, middle, and lower third problems. Patients with a twisted nose typically present with facial asymmetries,[25] and one side of the bony nasal pyramid is longer than the other. Often, twisted noses also have associated septal deformities (thus, the adage "as the septum goes, so goes the nose"). Our correction of the twisted nose most often requires comprehensive treatment of the septum and of the osseocartilaginous pyramid, similar to the technique named by Dewes as septopyramidal adjustment and reposition).[26] In this article, we present a cohort of 78 patients, treated with varying wedge resections of the ascending process of the maxilla, which is a modification of the let-down technique, which preserves the nasal airway; it allows us to lower the dorsum when needed, and still allows us to straighten the nose (the internal nasal valve area is completely preserved). The modification presented offers an additional option for the surgeon to manage the twisted nose. Other commonly used treatments for twisted nose deformities include cartilage grafting along the dorsum in conjunction with lateral and medial osteotomies, techniques that deconstruct and then reconstruct the dorsum, exposing the patient to the risk of dorsum irregularities, collapse, or inverted-V deformities.[6,21]

Similar to our findings, Ozturan et al. obtained a significant correction in both types of twisted noses. They stressed that C-shaped

crooked noses require more experience and familiarity with a wide range of surgical techniques, and are best approached externally with structural grafts to force the nasal anatomical structures to be straighter ($P < 0.01$). As reported by Erdem and Ozturan,[24] bilateral medial oblique and lateral osteotomies were applied after hump removal in cases with a nasal dorsal hump. In cases without a dorsal hump, bilateral vertical and lateral osteotomies in sequential fashion were performed. Among the 120 patients they report, they demonstrated similar postoperative angles as we found using different techniques. All of our operations were performed with the use of a single surgical technique, whereas their study involved the use of numerous different techniques.

CONCLUSIONS

It is well known that treating the twisted nose is one of the most formidable challenges in rhinoplasty. By combining the principles of Dr. Huizing's bony wedge resection technique, termed the let-down (as coined by Dr. Vernon Gray), and the modifications made by Dr. Fausto Lopez-Infante in which we resect a unilateral or asymmetrical bony wedge, we are able to modify the nasal pyramid and address the septal abnormality while preserving the dorsal and the valve anatomy and function. This technique can be used in all patients with no major effects on craniofacial growth identified.

We believe that the current study, with statistically significant objective evidence, strongly supports the use of this technique in the management of the twisted nose deformity. As our results unambiguously demonstrate, patients classified with type C twisted nose can anticipate an excellent aesthetic result. As with all surgical procedures, there is a "learning curve"; however, once the technique is mastered, the outcomes are extremely satisfactory for both patient and surgeon.

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PATIENT CONSENT

Patients or parents or guardians provided written informed consent for use of patients' images.

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