

Guidelines for Dorsum Preservation in Primary Rhinoplasty

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Abstract

The multiplication of scientific articles related to the fast-growing interest in preservation rhinoplasty (PR) may lead to confusion in the decision-making process, thus requiring a need for guidelines through a focus on benefit–risk ratio and revisions. This study analyzes a 352 consecutive primary rhinoplasties series during a 3 year (2016 to 2019) period with 1-year follow-up. The evaluation of the most appropriate procedure to the patient's nasal anatomy and expectations requires to correlate (1) a convenient classification of nasal profile lines; (2) a review of the dorsum preservation techniques (DP) classified as: full DP, DP + resurfacing, bony cartilaginous disarticulation, and finally traditional rhinoplasty; (3) the role of septoplasties, subdividing this series in two main groups; (4) analyzing the revisions in the different subgroups and to the literature. Thirty-five revisions (9.94%) were done. Correlations between profile lines, surgical procedures, and revisions show (1) 129 straight noses underwent full DP in 88 cases with 5.68% revisions; however, DP+ hump resurfacing in 32 patients with no revision. (2) Among 71 tension noses, 33 underwent full DP with 6 revisions (18.18%), while 32 patients had bony cap resurfacing, 1 revision (3.13%). (3) Among 109 kyphotic noses, 64 patients underwent DP + resurfacing with 10 revisions (15.63%); 27 patients had cartilage-only DP with two revisions (7.41%). (4) In the 43 difficult noses group, revisions were done equally in DP + resurfacing and cartilage-only subgroups. Septum stability modifies the correlations, introducing Cottle's septorhinoplasty in the paradigm. The revision rate is jumping $\times 2.50\%$ when a septoplasty is associated with the rhinoplasty. Correlated to the benefit–risk ratio and the revisions, the following guidelines may be suggested in primary rhinoplasty: (1) Straight noses: full DP, (2) tension noses: DP + dorsum resurfacing and/or Cottle's variations, (3) kyphotic noses: cartilage-only DP, and (4) difficult noses: traditional rhinoplasties.

Keywords

- guidelines
- preservation rhinoplasty
- primary rhinoplasty
- dorsum preservation
- revision

First described by Goodale¹ in 1898, the philosophy of preserving the natural nasal structures has seen resurgence in primary rhinoplasty. Three years after the “Revolution Rhinoplasty” editorial² and recent publications including the “Push Down Reassessed”³ the need for guidelines appeared timely. The publication by Saban et al discusses dorsum preservation techniques, scoping an alternative for lowering the nasal dorsum in addition to structure rhinoplasty and

Joseph's technique. Recent anonymous polls^{4,5} of over a thousand surgeons confirmed that while 60% were interested in this philosophy, only 23% performed the procedure. Recent literature on preservation rhinoplasty (PR) procedures focuses on revisions,^{6,7} functional results,^{8–10} complications,¹¹ and a variety of surgical options, but they are creating a cloud of confusion. This article aims to provide clear guidelines by introducing a classification based on the

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patient's dorsum profile lines (DPL) corresponding to specific PR and septorhinoplasty techniques.

Methods

Study Design

Four-hundred and seventy consecutive patients who underwent septorhinoplasty performed by the senior author (Y.S.) from June 2016 to June 2019 were assessed retrospectively. Patients undergoing secondary rhinoplasty (operated elsewhere $n = 66$), exclusive tip and/or alar base surgery ($n = 47$), exclusively wide bony dorsum with good profile lines ($n = 10$), and with < 1 -year follow-up were excluded from the study. The final cohort contained 352 patients who underwent primary rhinoplasty including 129 with septal deviations who underwent septorhinoplasty.

Informed consent and Helsinki Declaration were applied to all patients. Data included age, gender, history, assessment, examinations, cone beam computed tomography, and computer simulation. Follow-up evaluation included functional complaints questionnaire, physical examination, photographs at 1 week, 1 and 3 months, and 1 year. Further data was collected regarding the revisions and the reason for the revisions.

Classification of Dorsum Profile Lines Through a Dorsum Segmental Profile Examination

According to Neves' analysis, three main dorsal segments are critical.¹² These include three options for the radix (normal, high, low), three options for the keystone-area (straight, convex, kyphotic including Lazovic¹³ S-shaped nasal bones), and two options for the supratip segment (straight or curved), producing a complex of 18 variations in DPL. To minimize this complexity, the study uses frequent nasal "morphotypes and the most common DPL" and correlates this to specific dorsal PR procedure. Consequently, a classification of four types of nasal profiles is suggested: (1) straight noses, (2) tension noses (classic Roman or Semitic profiles), (3) "Humpy" or kyphotic noses (classic Aztec nose with humps 6 + mm), and (4) challenging noses and W-shaped nasal dorsum. A heterogeneous group consisting of "lorgnette," Assyrian noses is allocated to nonpreservation group. The radix represents a segment of the nose where all the bony structures meet, creating a bony block in the intercanthal area that is difficult to mobilize. Hence, high radix has been considered separately in the study.

All analyses were performed both by the senior author (Y.S.) and a PhD (non-MD) observer independently.

Surgical Data Recording and Classification of the Dorsum Preservation Techniques

The original "high strip" dorsum preservation technique has been pioneered by Saban,^{14–16} popularizing Gola's procedure¹⁷ with a few changes. Technical details recorded included type of dorsal preservation procedure, amount of reduction, straightening maneuvers, nasal bone management, cartilaginous modifications, and bony cartilaginous pyramid fixation.

Type 1 PR: Full Dorsum Preservation Procedure with No Skin and Soft Tissue Elevation

Type 1 PR is mainly applied to the straight noses. The procedure is less traumatic and allows dorsum lowering. It consists of a sequence of 10 precise steps using an endonasal approach¹⁸: (1) Septum step: septal approach through unilateral interseptocolumellar incision not extending laterally into an intercartilaginous incision, to avoid disruption of the lateral scroll ligaments. Then, a limited bilateral subperiosteal subperiosteal undermining in a L-strut shape fashion, creating a "superior tunnel," till the septum-upper lateral cartilages (ULC) W-point is identified. (2) Septum first incision is done precisely at the W-point, then septum is divided from the dorsum vaults and high strip resection, parallel to the DPL is performed keeping as high as possible below the vaults. This step often requires resection of a small fragment of the anterosuperior segment of the perpendicular plate of the ethmoid. This is a safe procedure, done with a sharp cutting forceps. (3) Complete bony pyramid osteotomies (lateral, transverse, radix) fully separating the bony pyramid from the face. In case of high bony vault requiring 4 mm + lowering, lateral osteotomy is replaced by a pyriform bony wedge resection leading to a "let-down" procedure instead of push-down procedure.³ (4) Bony cartilaginous pyramid en-bloc horizontal mobilization: this critical maneuver relies on complete osteotomies. (5) Dorsum impaction, pinching slightly the bony base and impacting down in between the frontal processes of the maxillae, without forcing this impaction. (6) DPL alignment by incremental cartilaginous septum resection. (7) K-area resurfacing-curling by releasing the blocking points causing a "coat-hanger effect": mainly septal remnants below the vault must be removed. (8) Cartilaginous middle third width refinement by reducing the medial part of the ULC scrolls that create an excess volume due to what we name the "scroll-winding-effect"¹⁹: a "W-point-shift"¹⁹ will allow for pinching the middle third. (9) Supratip and W-ASA segment alignment. (10) Bony cartilaginous vault stabilization by sutures, fixing the vaults to the newly designed stable septum. Two 3–0 Vicryl sutures are recommended: "high suture" is inserted as cephalic as possible, transosseous being the best choice and the "lower suture" attaching the ULC to the septum. Finally, tip and alar base procedures are performed only if required.

Based on this technique, further modifications may be performed to achieve refinements if required. Three areas of common modification include (1) the bony dorsum resection, (2) the septal work, (3) dorsal K area and lateral K area (DKA–LKA) bony cartilaginous disarticulation.

Type 2 PR: Dorsum Preservation Procedure with Bony Cartilaginous Vault Resurfacing

The bony cap resurfacing/resection is mainly indicated in patients with small bony humps, S-shape nasal bones,¹³ with aesthetic dorsum lines. Skin and soft tissue elevation (SSTE) is performed either in the sub-SMAS or subperiosteal plane. Then, nasal bones are reshaped (using rasp for 1 mm bone removal or Rubin's osteotome for osteotomy of up to 3 mm), and the superior bony edges are

smoothened. This when done properly will not produce an open-roof and osteotomies are not warranted to close the roof, even if the bony dorsum is flattened to a degree. Objectives achieved are (1) thinning the nasal bones allowing for hump height reduction, (2) “rhinion-shift”¹⁹: where cephalad displacement of the bony-cartilaginous junction pivot point gives the opportunity to hinge the cartilage at a higher level and then reduce the hump by flattening or even curving downward the dorsal cartilage around this new pivot point. Occasionally, further disarticulation of both DKA and LKA²⁰ may become mandatory to drop the dorsum further.

Type 3 PR: Cartilaginous-Only DP Procedure: Nasal Bony-Cartilaginous Disarticulation and Cartilaginous Push-Down
Three authors Ishida et al,²¹ Jankowski,^{22,23} and Ferreira et al²⁴ have suggested dorsum lowering through nasal bony-cartilaginous disarticulation as their preferred technique. Saban²⁵ presented this technique limiting it to difficult noses. The main difference in these techniques is related to management of the septum: Jankowski performs a typical Cottle technique with a low cartilaginous strip and a posterior septal bony-cartilaginous disarticulation, Ishida uses midseptal division and Ferreira a high subdorsal strip resection. The “ballerina maneuver” described by Göksel²⁰ involved completely disarticulating the LKA, without injuring the inner lining allowing for a true lateral relapse of the blocking points. This maneuver consequently frees the ULC allowing a cartilaginous lowering without tension and avoiding the “Spring-Effect”¹⁹ or popup phenomenon and is particularly useful in managing the curved dorsum.

Management of Septum is Key in the Dorsum Preservation Procedures

In this series, septorhinoplasty was performed in a subset of these patients as elucidated below.

Group 1 (G1): 210 patients underwent a rhinoplasty without septoplasty.

Group 2 (G2): 142 patients underwent a septorhinoplasty. Different philosophies may be followed for septoplasty. In the author's practice, Cottle's method²⁶ following the swinging-door technique is the preferred choice, as it allows for maximum cartilage preservation: the so-called “low-strip” septoplasty. Three other types include intra-septal fragmentation or limited resections, Killian's²⁷ L-Strut technique, and²⁸ intra- or extracorporeal septal repositioning. This forms part of rhinoplasty procedure keeping with the four types already described in G1.

Revision Cases Analysis

To understand various parameters related to revision surgery,⁷ we also analyzed motivations, duration, type of anesthesia, surgical procedures chosen, and the ease of the surgical intervention.

Correlation between Dorsum Profile Lines and Surgical Procedures

Choice of surgical procedure applied based on DPL takes into consideration two criteria: (1) Effective and easiest/safest

Table 1 Dorsum procedures: basic paradigm in absence of septoplasty associated with rhinoplasty

Straight noses	Full dorsum preservation
Tension noses	DP and hump resurfacing
Humpy kyphotic noses	Disarticulation techniques: Bony hump resection associated with K-A cartilaginous push-down
W-noses and difficult noses	Either classic dorsum resection/ reconstruction procedures or discuss Cottle's technique

Abbreviation: DP, dorsum preservation.

procedure, (2) offering the best aesthetic and functional outcome, with the least or easiest revisions, both offering high benefit-risk ratio. Kosins²⁹ suggests four forms of PR based on the level of difficulty. The senior author (Y.S.) suggests “sequential rhinoplasty”³⁰ protocol that involves switching intraoperatively from PR to, or perform *d'emblée*, non-PR. The decision-making algorithm published in 2018³ is summarized in ►Table 1.

Results

Dorsum Profile Lines

Statistical evaluation of DPL classification related to the multiethnic group of patients in this series is summarized below.

Straight Noses

One-hundred twenty-nine (36.65%) patients show (quasi) straight dorsum profiles (►Table 2). They represent the commonest group of patients seeking rhinoplasty including 20 high radix—Greek noses (5.68% of total, 15.50% of straight noses: ►Table 3). Though surprising that a higher number of patients with straight noses seek rhinoplasty, preoperative photographs confirmed macrorrhinia, Pinocchio noses, or “masculine” nose in females, who desired smaller noses and/or lower radix (►Figs. 1A, B and 2A, B).

Tension Noses

This group comprised of humps < 5mm, 71 patients (20.17%) including 10 high radix (2.84% of total, 14.08% of tension noses) (►Figs. 3A, B and 4A, B).

Kyphotic Noses (Hump > 6mm)

One-hundred nine patients (30.96%) including 15 high radix (4.26% of total, 13.96% of kyphotic noses)(►Fig. 5A, B and 6A, B).

The Difficult Noses

The challenging noses form a group of 43 patients (12.22%) including 1 high radix (prevalence 0.28% of total, 2.33% of difficult noses). These difficult noses are not suited for DP procedure. However, in our series, in selected cases, DP procedure was performed predominantly in men seeking mainly functional improvement. In three cases, a sequential rhinoplasty, starting in preservation, switching intraoperatively to resection technique was used (►Fig. 7A, B, C).

Table 2 Prevalence of types of surgery correlated to types of dorsum shape in overall 352 patients

		Dorsum shape												Total					
		Straight				Tension				Kyphotic									
		All	G1	G2	All	G1	G2	All	G1	G2	All	G1	G2	All	G1	G2	All	G1	G2
Full DP	N	88	63	25	33	24	9	10	7	3							134	96	47
	%	25.00	30.00	17.61	9.38	11.43	6.34	2.84	3.33	2.11							38.07	45.71	33.10
Hump Resurfacing	N	32	15	17	32	25	7	64	37	27							148	87	61
	%	9.09	7.14	11.97	9.09	11.90	4.93	18.18	17.62	19.01							42.05	41.43	42.96
Hybrid	N	5	2	3	1	0	1	27	8	19							45	15	30
	%	1.42	0.95	2.11	0.28	0.00	0.70	7.67	3.81	13.38							12.78	7.14	21.13
Resection	N	4	2	2	5	3	2	8	4	4							25	12	13
	%	1.14	0.95	1.41	1.42	1.43	1.41	2.27	1.90	2.82							7.10	5.71	9.15
Total	N	129	82	47	71	52	19	109	56	53							352	210	142
	%	36.65	39.05	33.10	20.17	24.76	13.38	30.96	26.67	37.32							100	100	100

Table 3 Prevalence of radix height and skin quality correlated to dorsum shape

		Dorsum shape				Total
		Straight	Tension	Kyphotic	Difficult	
High radix	n	20	10	15	1	46
	%	15.50	14.08	13.69	2.33	13.06
Thin skin	n	29	16	21	13	79
	%	22.48	22.53	19.26	30.23	22.44

Key Points: Dorsum Profile Lines and Rhinoplasty

1. Straight noses represent the largest group (37%)
2. Difficult noses (12%): no preservation is indicated.
3. Both tension and kyphotic noses are managed with dorsum preservation, but the latter requires further disarticulation techniques and cartilage-only push-down.
4. High radix prevalence is equal in all types of dorsum (13%).

Do Age and Gender Change the Indications?

Age: These demographics are summarized in ► **Table 4**. It is worth observing that when carefully selected, PR in teenage group provide fantastic surgical psychotherapy, allowing for harmonious social integration of young patients (► **Fig. 8A, B**). The majority of revisions (15.40% 14 of 91 patients) were in 30 to 39-year-old group, with lower rates in those patients aged between 18 and 29 years.

Gender: classic sex ratio is 1:4, male: females. No significant difference in the subgroups was observed. Males account for 8.90%, while 91.10% were females: 2/12 sex-ratio in revisions. This follows the published literature that while body dysmorphic disorder is more common in males, females are more demanding and are less likely to accept a slight residual bump, preferring thinner, more curved noses, regardless of their ethnicity. This study also confirms that PR significantly reduces revision rates in males compared with other surgical techniques, possibly secondary to a more natural result and less chance of feminization. Thus, PR looks like a highly recommendable procedure in male patients.

Key Points: Age and Gender

1. Slightly overdone procedure with bony hump reduction and LKA disarticulation is preferable in females
2. Age: 15+ adolescent patients, consider performing PR if all inclusion criteria are met.
3. Considering higher revision rate in females, the beginner PR surgeons are advised to operate on male patients.
4. Patients belonging to the 30–40 years age group are at higher risk of revision, with no gender predominance.

Does Thin Skin Change the Results in Preservation Rhinoplasty?

The prevalence of thin skin in the patient cohort was 22.44% (► **Table 3**); these patients are excellent candidates for



Fig. 1 Straight nose. Type 1 full DP endonasal procedure. 24-year-old male patient presenting a high straight nose a with high radix corresponding to macrorrhinia appearance. (A) Preoperative and (B) 4 years postoperative photographs.



Fig. 2 Straight nose. Type 1 full DP endonasal procedure. 29-year-old female patient presenting a straight dorsum but complaining of male nasal profile. (A) Preoperative and (B) 14 months postoperative photographs.

preservation as this procedure significantly reduces the risks of potential postoperative dorsum irregularities.

Results on Overall Primary Rhinoplasty Procedures Data

These are systematically presented to draw the attention of the reader.

Correlations between Dorsum Profile Lines, Surgical Procedures, and Revision Rate

► **Tables 5 and 6**

The Role of Septoplasty in Primary Rhinoplasty: Does It Change the Revision Rate and the Rhinoplasty Procedure?

► **Table 2 (G2).**

► **Table 6**

Note that revision rate increases twofold when a septoplasty is associated with rhinoplasty procedure.

Deviated Noses and Septoplasties

In this series, 129 patients had deviated noses (36.65%) with 77 demonstrating a straight-deviation and 52 patients a C- or S-shape-deviation. The vast majority, 117 (90.69%), required Cottle's septoplasty, and rest high strip procedure in cases of stable septum.³¹ Eight (6.84%) revisions were undertaken in this group for recurrence of septal deformity causing aesthetic concerns, but none for functional issues. The remaining 12 patients with high deviation (9.3% of deviated noses) did not require septoplasty as the deformity was corrected with high septal strip (3.41% of 352 procedures).

Discussion

Critical review of our 2018 study³ raised several questions: First, is it possible to extend the indications of DP to a wider group of patients, can DP be performed as a primary procedure in patients with unfavorable/difficult anatomy, can the



Fig. 3 Tension nose. Type 2 DP endonasal procedure and bony cap resurfacing by rasping. 19-year-old female showing a tension nose and an under projected tip. (A) Preoperative and (B) 1 year postoperative photographs. Nasal tip remodelling by suture through marginal access.



Fig. 4 Tension nose. Type 2 DP endonasal procedure with bony cap resurfacing. 19-year-old female patient seeking reduction rhinoplasty for over projected tension nose. She underwent a type 2 associated to tip deprojection and alar base reduction. (A) Preoperative and (B) 1 year postoperative photographs.



Fig. 5 Kyphotic nose. Type 3 DP endonasal cartilage-only PD. 31-year-old female patient seeking reduction rhinoplasty for humpy nose and high radix, wishing a more feminine nose. She underwent the procedure with bony dorsum resection and radix deepening, associated to tip deprojection and cephalic rotation. (A) Preoperative and (B) postoperative photographs.



Fig. 6 Kyphotic nose. Type 3 DP endonasal cartilage-only push-down. 21-year-old male patient seeking reduction rhinoplasty for over projected kyphotic nose and high radix. He underwent the procedure with bony dorsum resection associated radix deepening. No tip surgery. (A) Preoperative and (B) postoperative photographs.

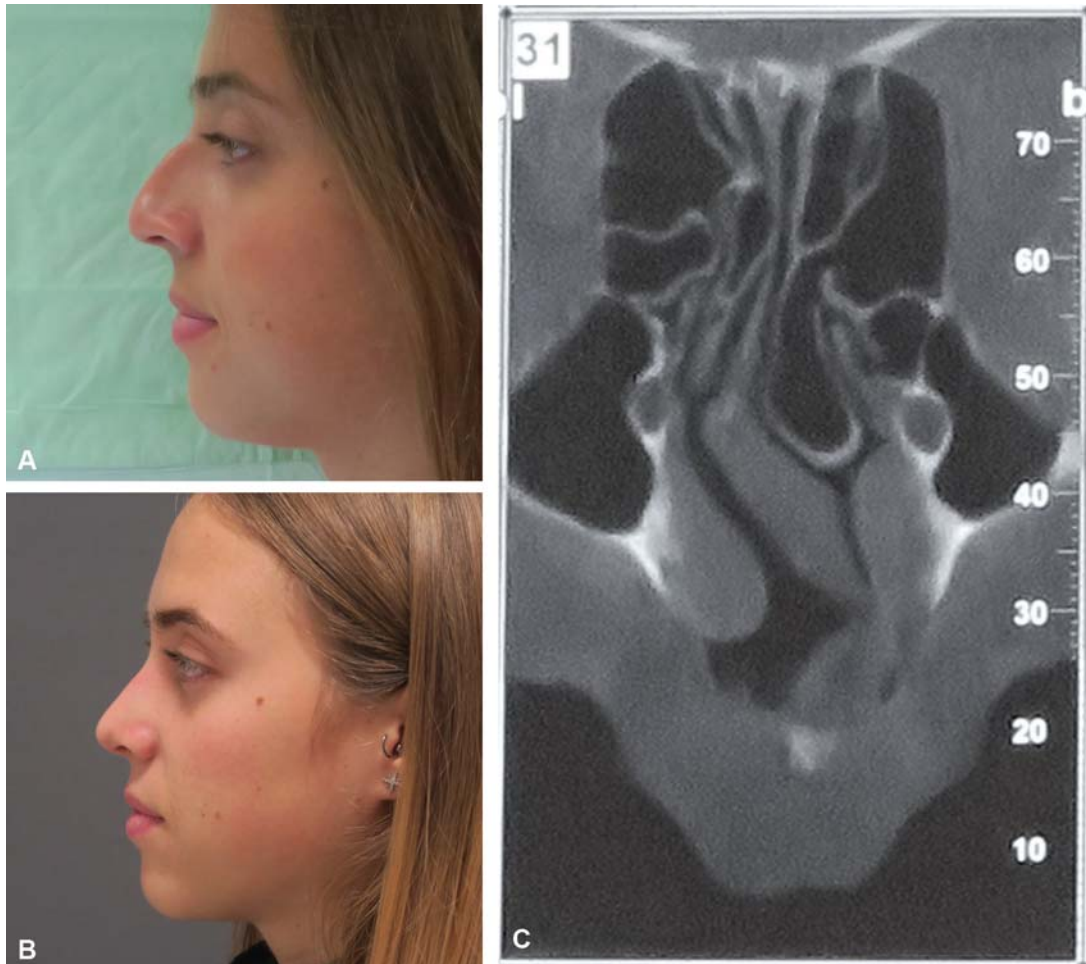


Fig. 7 (A–C) Difficult Nose. Type 3 cartilage-only DP. Young female 19 years old, having a distorted nose after trauma in childhood. Major septal and nasal pyramid deformity. Discussion was to decide whether to perform an open approach, a traditional rhinoplasty and a total septal extracorporeal reposition, or to do an endonasal septoplasty and a cartilage-only push down with nasal bones resection. As her cartilaginous vault was thin and nice, we decided to perform a preservation procedure thanks to her youth, and to switch intraoperatively to a sequential resection, if ever. Thus, she underwent a Type 3 cartilage-only DP and an endonasal septal reconstruction. Tip was approached through extended marginal incision and suture techniques were done to project and rotate the LLC.

Table 4 Prevalence of rhinoplasties and revisions related to age and gender

Age	Female		Male		Total		%	
	G1 + G2	Revisions	G1 + G2	Revisions	G1 + G2	Revisions	G1 + G2	Revisions
13–17	13	0	6	1	19	1	5.40	5.26
18–29	160	17	31	0	191	17	54.26	8.40
30–39	75	12	16	2	91	14	25.85	15.40
40–49	17	2	13	0	30	2	8.52	6.66
> 50	14	0	7	1	21	1	5.97	4.74
Total	279	31	73	4	352	35	100	9.94
Sex ratio	79.26	88.57	20.73	11.43				



Fig. 8 Surgical social therapy. 13-year-old female patient seeking reduction rhinoplasty for tension nose and convex profile with retrogenia. She underwent a Type 2 DP endonasal procedure with bony cap resurfacing associated to tip cephalic rotation by LLC cranial segment reduction. All the bony cartilaginous fragments harvested during the rhinoplasty have been transplanted as autologous implants for chin augmentation through an endoral subperiosteal approach. (A) Preoperative and (B) postoperative photographs.

Table 5 Cross table correlating dorsum shapes to surgical procedures in dorsum shapes subgroups

Over all rhinoplasties		Dorsum shape								Total	
		Straight		Tension		Kyphotic		Difficult			
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Procedures	Full preservation	88	68.22	33	46.48	10	9.17	3	6.98	134	38.07
	Hump resurfacing	32	24.81	32	45.07	64	58.72	20	46.51	148	42.05
	Desarticulation	5	3.88	1	1.41	27	24.77	12	27.91	45	12.78
	Classic resection	4	3.10	5	7.04	8	7.34	8	18.60	25	7.10
	Total	129	100	71	100	109	100	43	100	352	100

procedure be safely simplified by removing surgical steps such as SSTE, neo-dorsum sutures, nasal bone reshaping, and LKA disarticulation. Finally, is it possible to establish an alternative technique involving variations in the DP procedures. Consequently, our main aim was to determine the limits of the different DP rhinoplasty procedures and to perfect the indications regarding these various surgical procedures, while achieving the highest benefit–risk ratio

by designating one of the 4 discussed procedures to each DPL derived patient group.

Septoplasties and the Revisions

The need for septoplasty may change the basic DP rhinoplasty paradigm.³² In cases of stable septum, both high strip and Cottle's procedures may be performed prior to DP. However, if the septum is unstable Cottle technique is preferred.

Table 6 Prevalence of revisions correlated to dorsum shape

		Dorsum shape												Total				
		Straight				Tension				Kyphotic							Difficult	
		All	G1	G2	All	G1	G2	All	G1	G2	All	G1	G2	All	G1	G2	All	G1
Full DP	N	5	2	3	6		4	1	1	0			0	0	0	12	5	7
	%	5.68	3.17	12.00	18.18	8.33	44.44	10.00	14.29	0.00			0.00	0.00	0.00	8.96	5.21	14.89
Hump Resurfacing	N	0	0	0	1		0	10	3	17			5	2	3	16	6	10
	%	0.00	0.00	0.00	3.13	4.00	0.00	15.63	8.11	25.93			25.00	20.00	30.00	10.81	6.90	16.39
Hybrid	N	1	0	1	0		0	2	1	1			3	1	2	6	2	4
	%	20.00	0.00	33.33	0.00	0.00	0.00	7.41	12.50	5.26			25.00	20.00	28.57	13.33	13.33	13.33
Resection	N	0	0	0	0		0	1	1	0			0	0	0	1	1	0
	%	0.00	0.00	0.00	0.00	0.00	0.00	12.50	25.00	0.00			0.00	0.00	0.00	4.00	8.33	0.00
Total	N	6	2	4	7		4	14	6	8			8	3	5	35	14	21
	%	4.65	2.44	8.51	9.86	5.77	21.05	12.84	10.71	15.09			18.60	15.00	21.74	9.94	6.67	14.79

However, in difficult septoplasties (multiple fractured septum, S-shaped crooked noses, septal perforations, and L-Strut deformities, etc.) one has to consider the classic reduction rhinoplasty technique (see ►Fig. 7A, B).

Variations in rhinoplasty procedures

It is imperative to modify procedures depending on intraoperative findings and specific patient expectations as outlined in ►Table 5. The senior author (Y.S.) alludes to and warns against “sin of pride”—trusting too much in the type 1 DP technique, ignoring echoes of experience and not following the recommended sequence of type 2 DP and other procedures resulting in some suboptimal outcomes.

Key Points

Septum	Septorhinoplasty paradigms
Septoplasty is always the first surgical step	Rhinoplasty technique depends on septal stability
✓ Stable septum or no septoplasty	➤ Basic DP rhinoplasty paradigm
✓ Unstable septum	➤ Cottle's technique
✓ Total septal reposition	➤ Structure rhinoplasty, or DP if expert

Key Points: Intraoperative Modifications and Postoperative Revisions Related to Surgery Failures or to Patient's Overexpectations

1. Respect surgical sequence and steps: do not commit the “sin of pride.”
2. Patients with high expectations or extreme macrorrhinia must be aware of revisions in >10% cases.
3. The more difficult the nose, the higher the revision rate.
4. Lateral LKA disarticulation does not provoke either lateral wall destabilization, or an inverted V deformity.
5. DKA removal and intraoperative switch to a nonconservative procedure (sequential rhinoplasty) is always an option.

Dorsal Preservation Stigmata

These include residual or recurrent hump, supratip saddling, radix step-off, axis deviation, and broader nose mostly middle third widening. The revision rate (9.94%) in this series appears in hindsight to be related to the failure to follow surgical steps as recommended and/or an inappropriate choice of procedure for a given patient's morphology or expectations including incomplete disarticulation in humpy kyphotic noses, not undermining SSTE and inadequate bony hump resurfacing in tension noses and poor fixation.

Tünel and Aydogdu^{6,7} reported that hump recurrences were in >4mm group, higher the hump, greater the recurrence. The complication rate dropped from 12.1 to 5.3% with additional maneuvers and proper patient selection.

Table 7 Summarizing the revision procedures: number of cases and surgery duration

Number of patients	35	Revision duration time	Extreme durations	Standard deviation
Bone rasping/upper lateral cartilage shaving	23	22.74 mn	7–47 mn	12.69
Strip procedures	11	34.18 mn	17–73 mn	16.69
Low radix	1	13.00 mn	NA	NA
Lateralization	9	32.11	13–55 mn	13.14
Septoplasty	21			
Total of procedures	65			
Mean of procedures per patient	1.86 Procedures per patient			
Extremes	1–3 Procedures per patient			

Patients Selection in Primary Rhinoplasties, Focussing on the Indications for Dorsum Preservation Procedures: Who Are the Good Candidates for Dorsum Preservation?

Straight Noses

These straight dorsum patients only need height reduction, keeping intact the shape, dorsum lines, nasal valve, and the natural appearance and are best suited for type 1 full DP. When done through an endonasal approach, the nasal tip and the soft tissues including ligaments are fully preserved. However, in huge macrorrhinia reduction is limited using type 1 DP as cartilaginous vault lowering leads to an overbroadening of the middle third that necessitates adjunctive maneuvers including cartilage resection, lateral disarticulation, with pyriform ligament and LKA division.

Tension Noses

Though they look remarkably like straight noses, they remain deceptive. Applying type 1 DP here has resulted in higher revision rate. In practice, one must not only reshape the bony cap to perform a rhinion-shift, making the DKA more flexible and reducing a possible small bony hump or S-shaped nasal bones but also ensure this flexibility by freeing the LKA. The problem is not the convex shape, dorsum height, or the V/S-shape nasal bones but the lateral restraining forces that must be overcome. Hence, a type 2 hump resurfacing in conjunction with adjunctive maneuvers eliminated revision completely.

Nasal Hump Reduction Preserving Only the Cartilaginous Vault

First described by Ishida et al²² and known as “cartilage-only push-down” this can create an open roof where the overlying nasal bones are removed and cartilage irregularities. To avoid these problems and broaden the spectrum of the cartilaginous push-down technique, Ishida et al³² preserve the whole DKA during dorsum reduction and performs a “DKA push-down.” Kovacevic³³ also suggests an osteotomy separating the DKA/bony cap from the nasal hump in broad noses as the first step, followed by a classic push-down, that he named

“double let-down operation.” In the high-strip technique, Saban²⁵ introduced the concept of complete LKA–DKA bony cartilaginous disarticulation associated with high septal strip resection and bony dorsum resurfacing through classic osteotomies.

Septum Work

Septoplasty follows two classic schools: (1) Killian: the whole cartilaginous septum is removed preserving only “L-Strut” for nasal support. (2) Cottle: preserving the whole cartilaginous septum, performing a “swinging-door” procedure through complete disarticulation of the quadrangular cartilage from the bony components of the nasal septum. The partisans of the L-Strut are the “structuralists,” while the “Cottleists” are “preservers.” The “structuralists” argue the need for a strong L-Strut support to the dorsum. They suggest preservation philosophy weakens the classic L-Strut structure, thus reducing the ability to stabilize the dorsum. However, the senior author (Y.S.) argues that in his experience the high strip PR reduces dramatically the need for grafting, and eventually follows the L-Strut principles where dorsum is not weakened. Additionally, the high strip, and particularly swinging door technique require less cartilage resection; moreover, it keeps the availability of cartilage reserve that can be harvested if required. Further senior author (Y.S.) uses “Septal-Triangular Unit Distraction” (STUD) technique for the “push-up” procedure which yields to (1) lowering of the cartilaginous dorsal hump if required, (2) cartilaginous push-up of the supratip area, (3) filling the nasolabial angle. Stable fixation of the cartilaginous posterior septal angle onto the bony anterior maxillary spine is the critical step, to avoid backward displacement in the postoperative period. It is important to adopt the procedure to patient’s anatomy and aesthetics by partial and incremental resections of the inferior and/or the caudal edges of quadrangular cartilage to achieve the desirable result.

Barelli³⁴ in a series of 100 consecutive cases of septorhinoplasty with Cottle technique reported 12% revisions. Many variations following Cottle’s technique have been described that are reliable procedures: SPAR technique by Dewes,³⁵ Tetris procedure by Neves,¹² and Most⁹ introduces an

intermediate flap. Neves describes an interesting squared high septal flap allowing for very stable dorsum lowering and fixation. Finocchi repopularises the original Cottle's technique naming this "SPQR". Kovacevic³⁶ designs a septal triangular Z-plasty section that he named "subdorsal Cottle." This Z-plasty leaves more septum intact below the cartilaginous vault, thus weakening less the underlying septum and allowing better dorsum stability and more place for septal cartilage harvesting.

Whatever the procedure, the philosophy of these variations is to handle the septum together with the ULCs cartilaginous vault in a STUD en-bloc forward mobilization and firm fixation. The main interest in our opinion lies in the possibility to reshape the hump corresponding to tension noses.

In summary, considering different techniques and associated benefit–risk ratio, we suggest that (1) straight DPL should be allocated to type 1 DP procedure performed through an endonasal approach, preserving the dorsal structural integrity completely, including SSTE, ligaments, and bony cartilaginous vault. (2) Tension noses, the dorsal convexity must be straightened or curved. Thus, all the techniques in type 2 DP armamentarium including bony cap resurfacing and STUD represent excellent indications associated with LKA partial disarticulation: Saban's type 2 hump resurfacing and high strip procedure, Kovacevic's Z-plasty flap, Neves' Tetris concept, Most's intermediate, LC Ishida's DKA preservation with lateral disarticulation. (3) Kyphotic noses with large bony humps that cannot be reshaped, desire type 3 DP, corresponding to total LKA–DKA disarticulation and a cartilaginous vault preservation. Ishida, Jankowski, Ferreira, and Saban advocate cartilage-only push down procedure, the main variation being the septal work. (4) In difficult noses, one should consider traditional rhinoplasty techniques or structure rhinoplasty concept. In case of intraoperative difficulty while performing a DP, the surgeon should consider the possibility to perform a sequential rhinoplasty, by switching intraoperatively either to a type 3, or even to a traditional or structure rhinoplasty.

Learning Curve

Introducing the preservation concepts in primary rhinoplasty is challenging. PR surgeons must think in terms of biomechanical surgical anatomy (pivot points, anatomical shifts, restraining forces, etc.) and not focus exclusively on technical ways to reshape, change volume, and choose the appropriate grafts. This article aims to shorten and sharpen learning by offering specific guidelines by an experienced PR Surgeon. One has to be cognizant that preservation procedures are applicable to primary rhinoplasties and are not applicable to post-traumatic, complex shapes, and secondary rhinoplasties, though exceptions do exist in experienced hands. Probably the most appropriate way to start is to use an open approach in men presenting with a high dorsum. The learning curve should encompass other philosophies and techniques. At this juncture, the authors would like to cite D. Toriumi³⁷: *"After 31 years in practice, changing how I man-*

aged the upper two-thirds of the nose was challenging. However, I thought the upside was significant. Now that I have made the transition, I do not regret my decision."

Study Limitations

This retrospective study is based on two cohorts of multi-ethnic patients ($n=670$ in total), of primary endonasal rhinoplasties performed by the senior author (Y.S.) following the same philosophy through years. Comparing this series to open approach in PR suggests similarities in classification,³⁸ but a lower revision rate.³⁹ The study focuses on surgical techniques and morphological aspects and functional issues have not been emphasized, as other studies.^{8–10}

Further multicenter prospective research is essential to aid the decision-making process, in a variety of nasal shapes, function, and patient expectations, as well as a range of procedures from the easiest and safest to the most challenging ones, ensuring that a high benefit–risk ratio should be the leading parameter.

Conclusion

With the introduction of the preservation concepts and a variety of techniques published in combination with several variation in nasal shapes one has to deal with, a novice preservation surgeon has to be able to work to a classification to achieve the best possible outcome that is set out in this article. Four types of noses have been described and correlated to four specific rhinoplasty procedures, with a simple paradigm, including few variations. The role of septoplasty is discussed, which in combination with rhinoplasty reduces revision rate, improving patient satisfaction while reducing the length of the learning curve.

Conflict of Interest

None.

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