

The Journey to Dorsal Preservation Rhinoplasty (Foundation and surface Technique)

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Abstract:

Dorsal preservation rhinoplasty (DPR) has evolved significantly as an alternative to traditional hump resection methods. This review explores the anatomical principles, historical development, and modern classification of DPR techniques and tries to show why these techniques had many limitations, while now it is popularly used.

Suggested Keywords

- Dorsal preservation.
 - Rhinoplasty.
 - Pushdown technique.
 - Letdown technique.
 - Surface techniques.
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INTRODUCTION

Rhinoplasty is considered one of the most difficult surgical procedures and from the earliest days of this procedure, the nasal dorsum had a lot of interest in rhinoplasty regarding its stability, functionality, and its aesthetic lines (1). Preservation of the nasal dorsal keystone area (DKA) is important for maintaining of nasal dorsum stability and integrity. So, understanding anatomy of (DKA) will show the issues of dorsal reduction rhinoplasty and will give us ideas to find ways to solve these issues (2). In 1931, classic nasal hump reduction technique was first presented by Joseph, in which involved en-block resection of dorsal hump which has become a hallmark of rhinoplasty, then other technique developed and described for reduction of nasal hump as component dorsal hump reduction (3). These techniques are effective in dorsal hump reduction and improving the profile view, but it is thought that when the natural keystone is disrupted it leads to long-term consequences on integrity of the nasal dorsum, dorsal aesthetic lines, internal nasal valve (INV) patency, and inverted V shaped deformity on the dorsum (3, 4). There for, (PRP) is growing globally as an alternative technique to the en-block resection of nasal hump (5). Generally, Preservation rhinoplasty consists of 3 elements: (a) subperichondrial-subperiosteal dissection to elevate the whole skin flap; (b) Dorsal preservation; and (c) Alar cartilages preservation with minimal excision when needed and using sutures to obtain the intended shape (6).

Anatomy

The keystone area refers to the junction of the upper lateral cartilages (ULCs), cartilaginous septum, bony septum, and nasal bone. Each component is firmly connected with muco-perichondrium, muco-periosteum, and dense fibrous articulations (2, 7). The ULCs extend underneath the nasal bones with variable length (average 9 mm). Thus, there are dorsal and lateral keystone areas, and the nasal hump is formed from both bone and cartilage (as shown in Fig. 1) (7, 8).

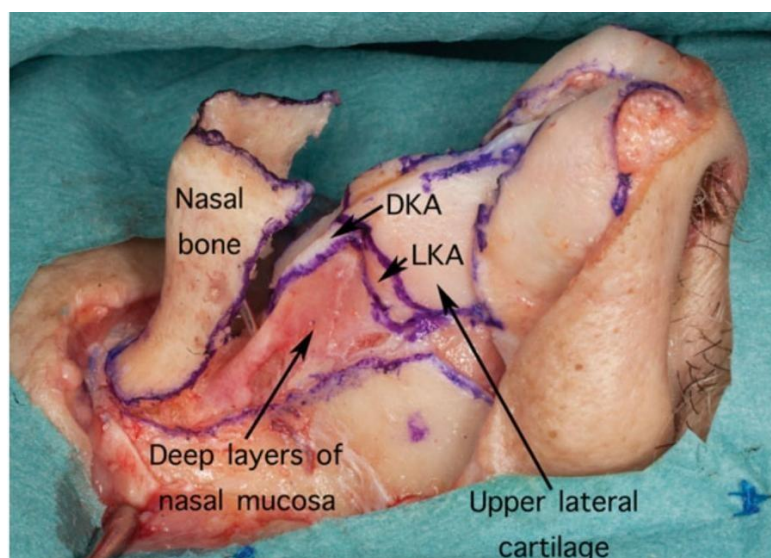


Figure (1) Oblique view of dorsal keystone area with nasal bone raised during dissection (9).

There are important anatomical landmarks in the supra-tip region.

The *W point*, the caudal point of separation of the upper lateral cartilages from the septum, at this point the ULCs have a free distal medial border (8, 10).

The *anterior septal angle (ASA)* refers to the point of junction of dorsal part of the nasal septum and caudal part of the cartilaginous septum(8).

In dorsal preservation techniques requiring a high septal strip excision, the incision shouldn't start at the ASA point, and is preferred to start at the W point. Finally, W-ASA segment is the part of dorsal segment between these 2 points measuring 6-8 mm.(10). [Figure \(2\)](#)



Figure (2) :lateral view for W-point & ASA.(9)

In the Caucasian nasal hump, there are two main configurations of nasal hump, the majority is S-shaped nasal bone (88%), and the remaining is V-Shaped Nasal Bone. This classification will illustrate the limitations that affect different techniques of DPR (11). [Figure \(3\)](#)

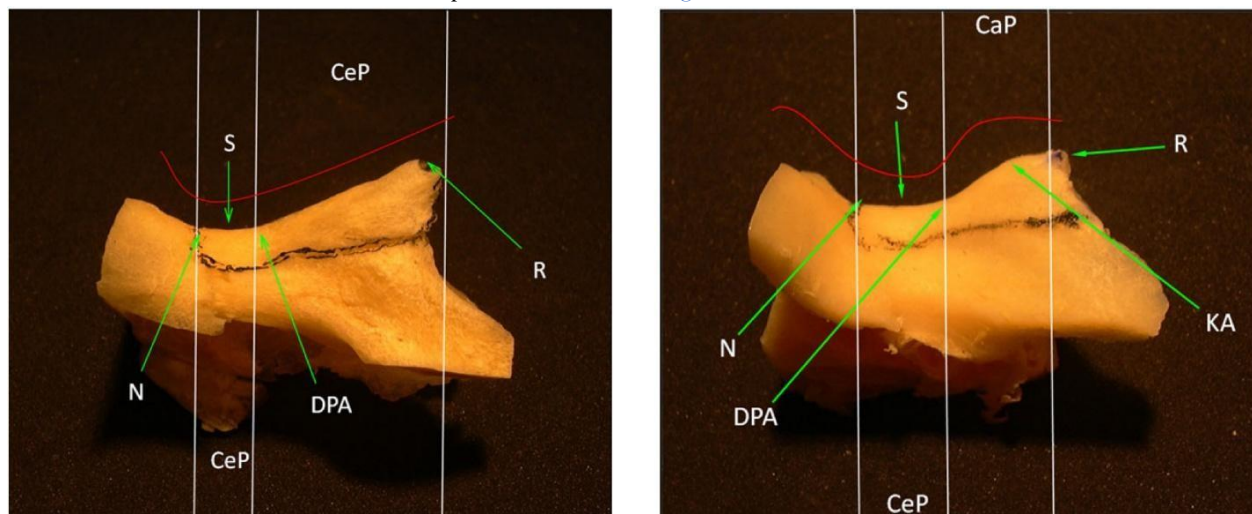


Figure (3): “V-shaped & S-shaped” nasal bones: N, Nasion. S, Sellion. CeP, Cephalic portion. CaP, Caudal Portion. KA, Kyphotic angulation. R, Rhinion and DPA, Dorsal profile angulation (11).

Historical

synopsis

In 1899, The idea of dorsal preservation was proposed by otolaryngologist Goodale, who was working at Massachusetts General Hospital and Boston Children's Hospital (12).

He reported a case of 13-year-old girl, who had a DPR surgery by excision of subdorsal cartilage, and lateral osteotomies to enable descend of dorsal hump, and rested on a lowered septum after the nasal-frontal junction was disarticulated. the nasal bony vault was impacted medial to the maxilla into the nasal cavity leading to removal of dorsal hump (13).

Neither the “push down” nor “dorsal preservation” terms were in the dictionary at that time, and the terminology employment was different from today's narrative vocabulary, but this surgical technique was obviously the “push down” technique (13).

In 1914, Oliver A. Lothrop, an assistant otologist at Massachusetts General Hospital and clinical assistant at Massachusetts Charitable Eye and Ear Infirmary, defined his technique which composed of:

- (1) Removal of a high septal strip of and from perpendicular plate of ethmoid.
- (2) Resection of bony wedge from the frontal processes of the maxilla.
- (3) Transverse radix percutaneous osteotomy.

Thus, enable descend of the dorsum instead of displacement of the bony vault medially to the maxilla (14).

Lothrop did not acknowledge his predecessor's work, Goodale, in his 1914 paper, Although they mostly lived in the Boston and were at Massachusetts General Hospital (13).All over the years, many surgeons were reporting their own experience until 1946, when Cottle, noted during a case of fractured nose, that cartilage resection at the premaxilla was sufficient for adequate mobilization. A three-part resection was done:A vertical segment from keystone area to vomer, which located at the bony cartilaginous junction.A triangular part from the ethmoid bone beneath the nasal bone. An inferior cartilaginous strip along the maxillary crest, which is resected to identify the degree of dorsal reduction.Then the nasal bone is managed by a single lateral osteotomy to allow its bone down-fracture. Finally, the nasal vault is rotated down and lowered to the maxillary spine to flatten the dorsal hump [Figure \(5\)](#) (15).This technique that was named “pushdown” (PD) procedure (similar to Goodale’s technique) (16).In the 1960s, Cottle’s PDO technique gained popularity, but then gradually neglected by most plastic surgeons who preferred Joseph’s dorsal resection technique (16).Dr Egbert Huizing, reassessed the basic PDO procedure in 1975, but added resection of bony wedge from the

frontal ascending processes of maxillary bones, so this permits descending of the nasal pyramid. This technique gained his name as the “let down” operation (LDO) (16).

Recently, Saban described a high-subdorsal technique, which depends on a superior incision corresponding to the configuration of the preoperative dorsum and the inferior incision corresponding to the desired shape of dorsum (17, 18) [Figure \(5\)](#).

Also, Saban explained why DP was gradually neglected despite its success. First, Cottle procedure were considered technically difficult. Then, the approaches were deemed insufficiently adaptable for the severely deformed dorsum(17).

All mentioned surgeons and surgical techniques were aiming to preserve both upper lateral cartilages, and depending on impaction of the nasal vault using osteotomies, that classically was divided into Push down and let down techniques, but now it is classified into:

foundation techniques which include Push and let down techniques.

surface techniques.

Goncalves Ferreira M and Toriumi DM were the first to publish this classification in 2021(19). Before that time there was no term of “foundation and surface tech” but actually first surface technique was in 1999 by Ishada (mentioned later).

Types of DPR:

DPR is classified into:

Foundation techniques

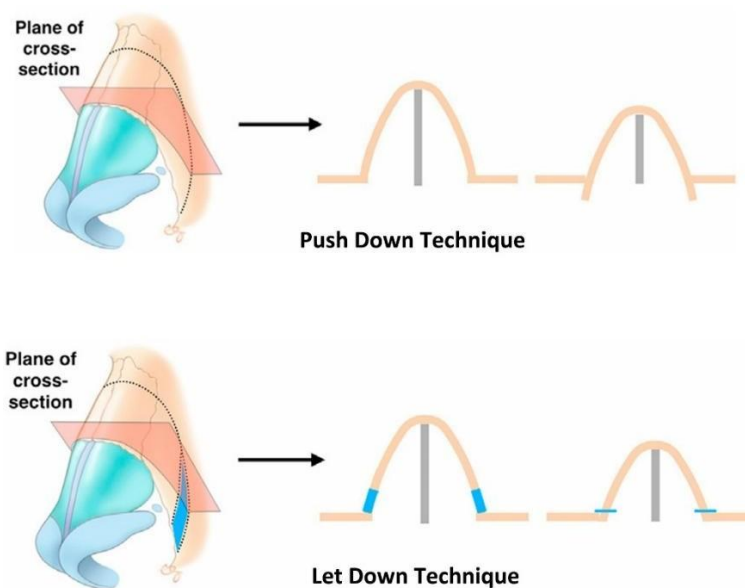
B) Surface techniques.

A) Foundation techniques

In these techniques, Reduction of nasal dorsum via *nasal pyramid impaction into the face* by management of nasal pyramid and nasal septum (20).

Nasal pyramid:It depends on impaction osteotomies to allow nasal pyramid impaction into the face. In the PD technique, perform lateral and transverse osteotomies then en-block mobilization of the bony vault is done [Figure \(4\)](#). While the LD operation demand of bony wedge resection at the frontal process of the maxilla is to allow more impaction and descend of nasal Vault. [Figure \(4\)](#)

So, PD Technique is not suitable for cases with hump more than 4 mm and LD will be more preferable in these cases. In a study reviewed the effect on INV, it showed that the LD operation doesn't affect INV while PD Technique decreases the patency of INV (21).



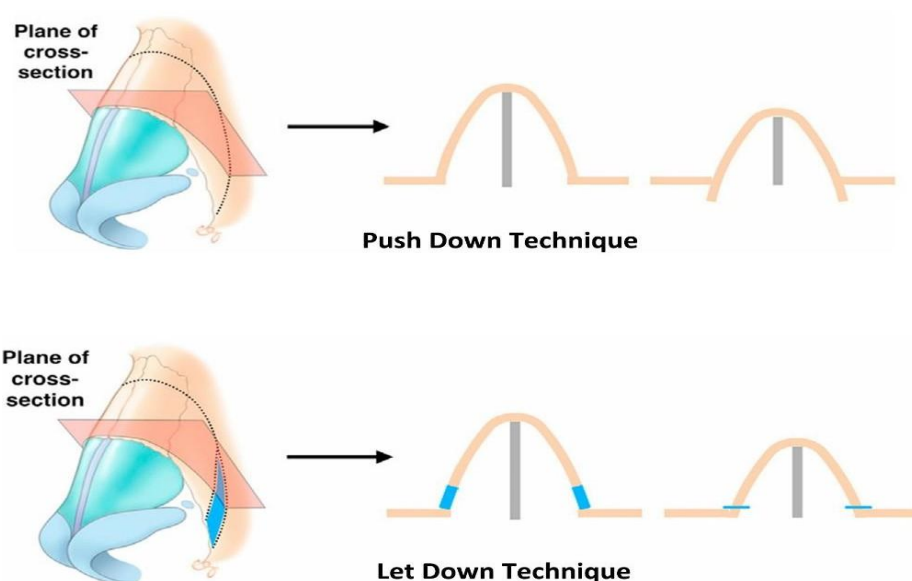


Figure (4): Pushdown and Letdown Technique(22)

Nasal septum
The amount of septal strip excision is the main determinant for nasal dorsum lowering, not the amount of bone resected. Excision of septal strip is mandatory to allow hump reduction. All over the years many surgeons have described their own technique depending on the difference in the site of septal strip that will be resected. The major techniques for management of the septum are summarized in Figure (5).

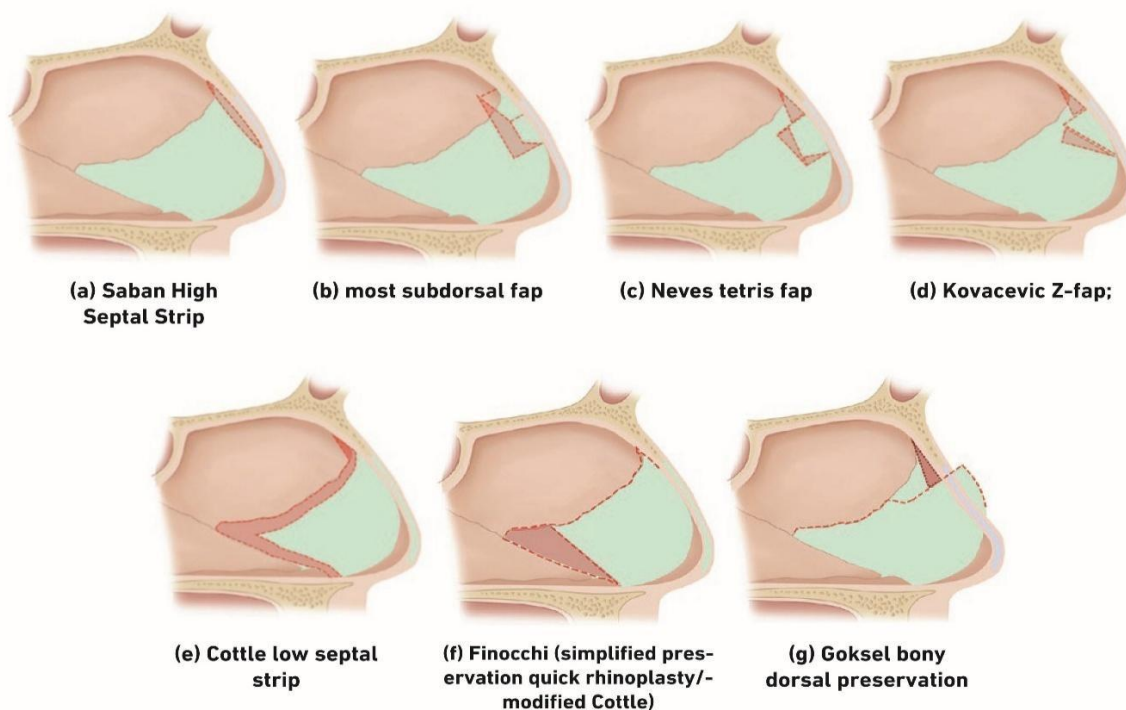


Fig. (5): Septal Preservation Techniques.
mid-septal strip various techniques include; (b), (c), (d);
low septal techniques include; (e) and (f) (23).

Choosing the suitable technique will depend on the surgeon experience and his learning curve and other factors summarized in the table (1).

Table (1): indications of septal Techniques in DPR.

HSS approach:
Nasal hump less than 5mm, and mostly cartilaginous hump.
V shaped hump.
High septal deviation with caudal septum in midline.
Straight nose.
Radix: over projected.
Mid septal approach:
Same indications of HSS approach + slight deviated nose.
Low septal strip approach:
Same indications of HSS approach.
Crooked nose with straight dorsal aesthetic lines.
If there is pathology along the connection of the ANS and maxillary crest with the septal cartilage.
Bony dorsal preservation:
Same indications of HSS approach.
Crooked nose with straight dorsal aesthetic lines, with no pathology at the septal base.

Surface techniques:

These techniques don't depend on impaction osteotomies, and with or without preservation of the bony cap, and this can be done by dorsal hump superficial modification (20).

Also by these techniques, patients with suboptimal anatomy can be converted into appropriate DPR candidates (e.g. contouring the ULC shoulders or bony cap resection) (20).

1) Ishada: Cartilaginous Pushdown technique:

In this technique, cartilaginous part of nasal hump is preserved and repositioned while bony portion is managed through conventional osteotomies.

Resection of septal strip from cartilaginous septum, which should be parallel to the nasal dorsum, and usually at the most deviated part of cartilaginous septum. when there is minimal or absent septal deviation, it is preferred to resect strip approximately 3- 4 mm beneath the nasal dorsum. High septal strip resection, allows preservation of caudal part of the septal cartilage which can be used in managing difficult nasal tips.

The ULCs is released by insertion of a Freer dissector between it and nasal bone from the nasal bones.

The determinants of how far the dorsum will be Lowered is the length of lateral dissection between pyriform aperture and the ULCs; so, this step should be done very carefully.

Now, middle third stability will depend mainly on the remaining attachments between the nasal bones and the ULCs.

Then complete detachment of septal cartilage from the PPE to allow mobilization of the cartilaginous portion of nasal hump.

The bony hump is either preserved or resected. [Figure \(6\)](#)

In 2020, ishada described his technique to preserve the bony cap by performing two osteotomies in the (KSA) starting just short of the widest point in the middle third of the nose and come together to the midline at midpoint of nasal bones length. This allows lowering bony cap in the (KSA) together with the cartilaginous hump. Then the residual lateral bony hump is rasped to the desired level [Figure \(7\)](#) (24).

In this technique, the lateral osteotomies are mandatory for more stabilization of LKA, as it makes the nasal bones close to ULC .

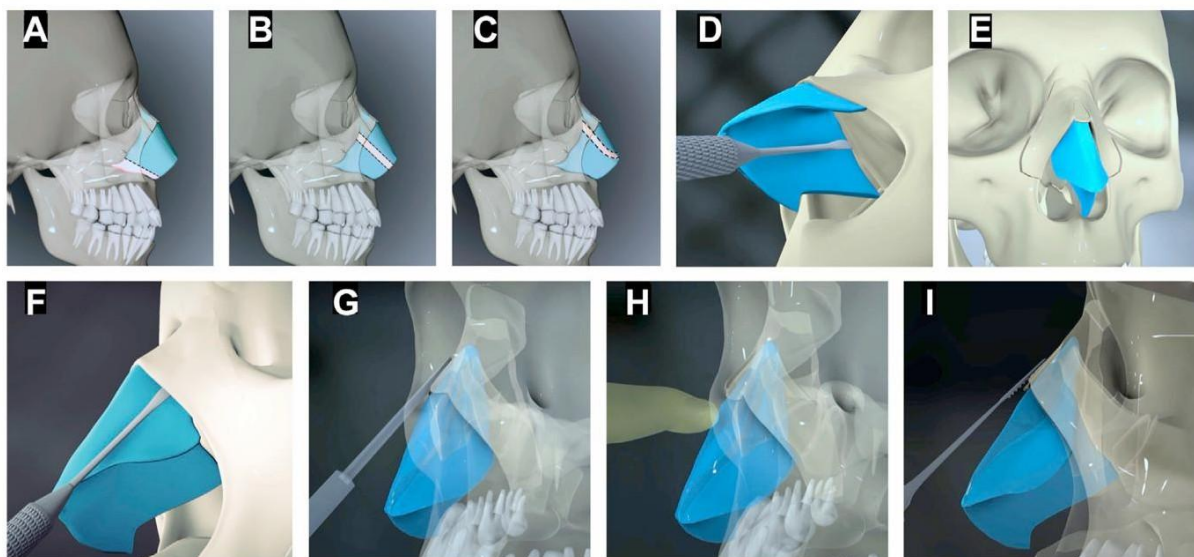


Figure (6): Ishida :Cartilaginous Pushdown technique(different sites of septal strip excision) (20)

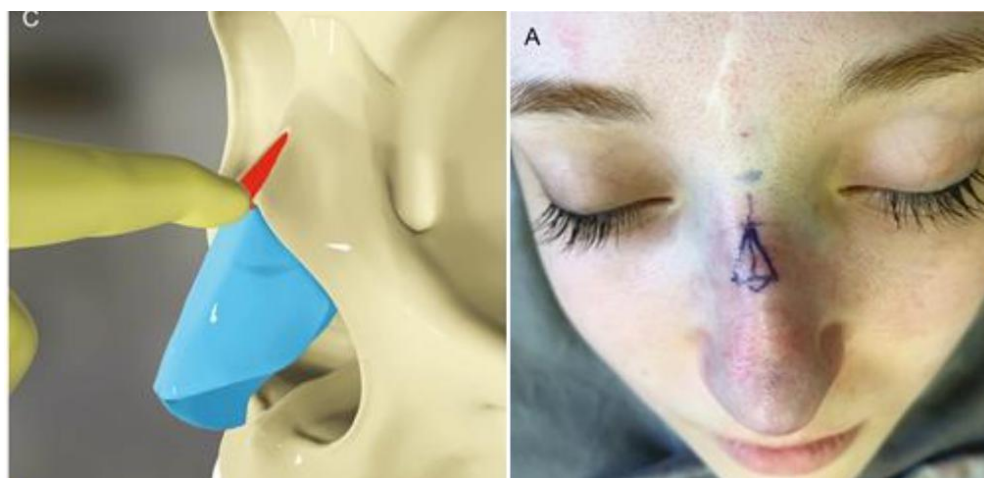


Figure (7): **ISHIDA** : Cartilaginous Pushdown technique with preservation of bony cap (24)

Spare roof Technique (A) Figure (8)

1st step: separation of Dorsal septum from ULCs by longitudinal incision that begins from the anterior nasal angle and extends to the perpendicular plate of the ethmoid, this allows complete separation of ULCs from the dorsal aspect of the septum and avoid division of ULCs.

2nd step is resection of excess dorsal septum (1 to 5 mm, as needed) to allow lowering the hump to desired level. This should be performed with caution, removing 1mm excisions in each time, until the desired level has been achieved and with preservation of anterior septal angle.

3rd step: osteotomy of the bony cap (DKA and LKA) and this can be done by using rasp or burr or piezo.

4th step: Introduce blade no. 15 between the nasal bones and the ULCs to release the LKA and this allow descend of mid vault.

5th step The ULCs are sutured to the dorsal aspect of the reshaped or remaining septum by using absorbable (PDS 4.0).

Finally, lateral osteotomy is done when needed (25).

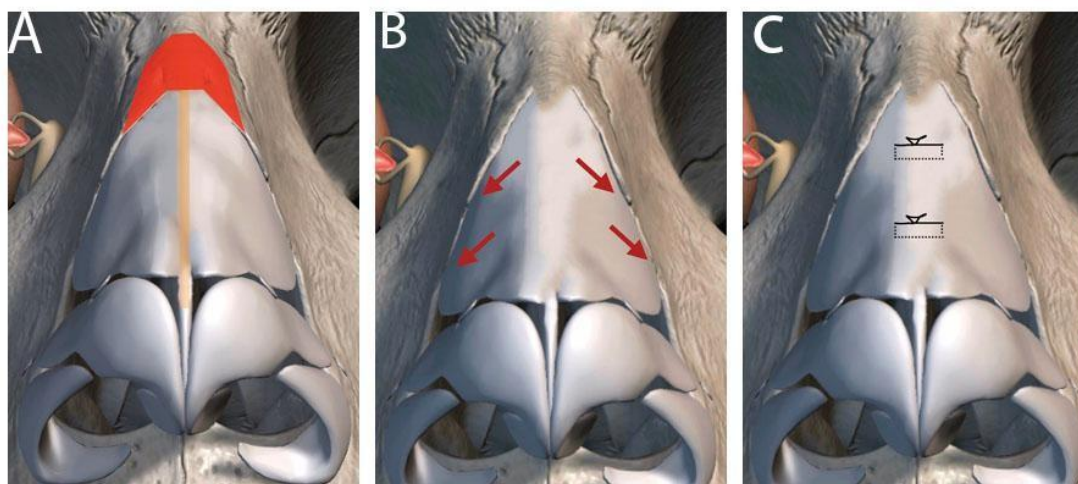
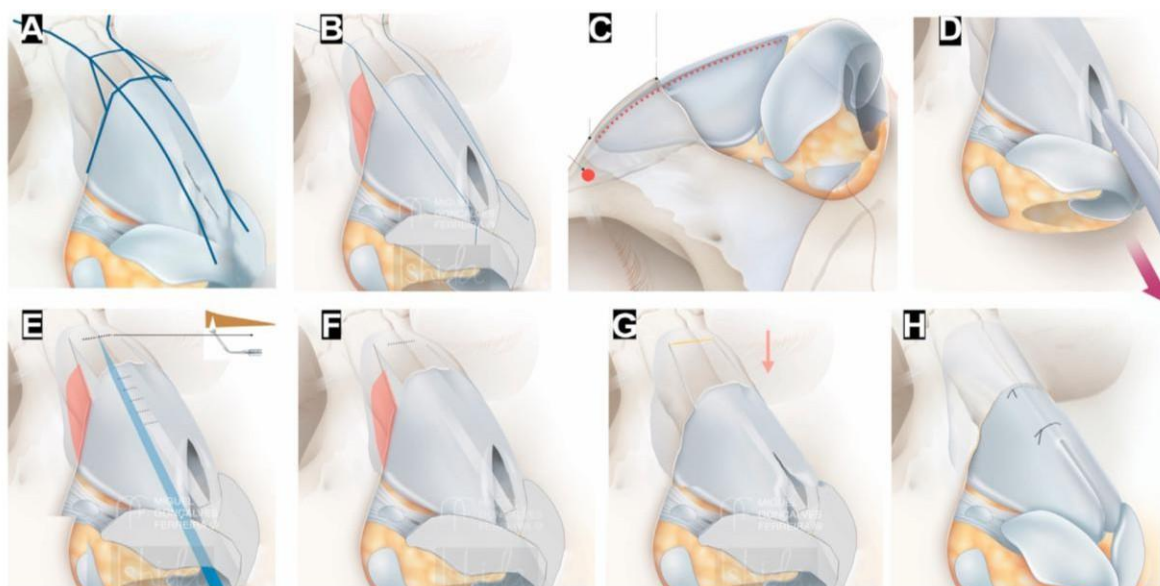


Figure (8) SRT (A): including resection of excess dorsal septum and osteotomy of bony cap (B) after release of LKA the mid vault descend (C) suturing the ULCs to the dorsal aspect (25).

Spare roof Technique (B): [Figure \(9\)](#)

Before initiation of this procedure, the surgeon must draw the main skin landmarks with awake patient to facilitate the steps of this technique. Then osteotomy of triangular bone from the pyriform aperture to beginning of the nasal hump. This done by performance of high bilateral paramedian parallel osteotomies followed by bilateral oblique osteotomies reaching to cephalic level of the E-point and matched with the paramedian osteotomies (26). After that, release of (LKA) to allow descend of osseocartilaginous vault. Release of ULCs from the nasal septum from W point to E point, then a longitudinal septal cartilaginous strip is excised, from the W to E-Point. The septal strip will determine the amount of nasal hump that will be decreased. Palisade cuts in the remaining of septal strip on the undersurface of ULCs to avoid any residual hump and convexity of nasal septum (26). Then the remaining bony cap needs to be descended and to perform this, on undersurface (subdorsal) transverse osteotomy done by using piezo. Then hold the dorsal aesthetic line and by the thumb, gentle pushdown the bony cap in greenstick fracture to descend it. Finally, traditional lateral osteotomy as needed to narrow the dorsum (26).



Figure(9) : Spare Roof (B)(26)

KOSINS: Cartilage-Only Pushdown tech. and Cartilage modifications:

Cartilage-only push down is a hybrid technique which consists of 4 steps:

Osteotomy and modification of the bony cap including the lateral key area converting the bony dorsum into cartilage. This increases the amount of exposed cartilage, while removing excess bone which change the proportions of the dorsum effectively. This procedure decreases the convexity of the nose and make a more flexible osseocartilaginous joint (27). A high septal strip is resected directly below the dorsum starting at the W-point. At first, only 1.5 to 2 mm will be resected to break the osseocartilaginous joint tension, so it allows it to be easily flattened. Perpendicular plate of ethmoid is preserved and not removed because this technique doesn't depend on bony impaction (27). Then suturing of cartilaginous vault to the underlying remaining septum. Sutures passed independently from each ULCs shoulder down to the underlying septum. In this way, the cartilaginous vault shape and width can be incrementally modified. Partial release of LKA is needed if more than 2 mm of reduction is required to allow fixation. This technique isn't suitable for nasal humps larger than 3.5 mm because it need a larger amount of disarticulation, and release of LKA, which decrease the stability of key stone area (27). Once the cartilaginous profile is adjusted to the desired piezoelectric rhinosculpture and osteotomies to sculpt and narrow the nasal bony pyramid (27).

CONCLUSION:

Dorsal preservation rhinoplasty isn't an idea born nowadays. This idea started a longtime ago as mentioned in the history of DPR. But the main consequences restricted its distribution and usage. The limitations and contraindications of each technique and another factor were that: DPR techniques needed an experienced surgeon, which not fit for the learning curve of many of rhinoplasty surgeons. All over the years many techniques developed to expand the indications, and to facilitate the DPR. now the idea of Dorsal preservation has a global interest and acceptance. The S-shaped nasal hump has a Kyphotic configuration, which means the caudal part of the nasal bones is convex. This makes it difficult to de-hump with traditional foundation techniques, such as push and let-down techniques. This shows why these foundation techniques with its variations have many limitations and not fit for many cases of nasal hump. The only way to this S-shaped nasal humps and the larger hump is osteotomy of bony cap i.e. dorsal modulation as in COP and SRT (A) and that's why the surface techniques made the DPR fit for many cases. Miguel Goncalves Ferreira - professor of Otolaryngology-Head and Neck Surgery in Portugal - who demonstrated the DPR and classified it into foundation and surface techniques. He also developed his technique SRT (A). He confined the contraindications of his technique SRT (A) when the ULCs are deformed (20). While SRT (A) expanding the circle of DPR to include all 1^{ry} and even many of 2^{ry} rhinoplasty cases, in spite that ULCs are intact and not deformed (20). The main step that makes this technique more suitable for many cases is release of LKA. Many surgeons don't prefer this step for fear of destruction of stability of keystone area and developing inverted V deformity. Miguel Ferreira did a powerful study on 250 cases of rhinoplasty to compare differences between component technique and DPR. This study revealed better improvement of both functional and aesthetic outcomes in SRT (A) group more than component technique group, and no cases developed inverted V deformity (25). This technique was preserving the mid-vault, but the bony cap should be descended and modified by osteotomy. Miguel Ferreira hoped to preserve the entire dorsum including the bony cap and ULCs that's why developed SRT (B) and inspired by his colleague Ishada, this technique allows preserving the entire dorsum, but limits the indications to involve V shaped nasal hump (26). This technique is faster and gives more regular and smooth dorsum in comparison to SRT (A) and other structural techniques. Aron Kosin developed his own technique; Cartilage only push down. This technique looks like SRT (A), but the main difference is that the LKA is partially or limited released and so that it is not suitable for hump larger than 3 mm. Nowadays, many rhinoplasty surgeons are trying to start their own experience in DPR, and they don't know from where they should start, we tried to give an overview for them to decide how they start. From this review and from our experience we can suggest to start with SRT (A) in primary cases with smaller hump and with straight dorsum then with advancing the learning curve, it can expand the indications.

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