Spare Roof Technique A and B – A Step-by-step Guide to Avoid Suboptimal Outcomes

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KEYWORDS

• Preservation rhinoplasty • Spare roof technique • Osteoplasty • Chondroplasty • Crooked nose • Septal advancement flap • Lateral division maneuver

KEY POINTS

- The Spare Roof Technique (SRT) A and B are applied for nasal dorsum reduction, while the reverse SRT is utilized for augmentation rhinoplasty.
- The SRT A and B were developed through cadaveric, radiologic, and clinical studies assessing aesthetic and functional outcomes.
- Dorsal anomalies must be carefully diagnosed and fixed before any SRT A or B step.
- Surface Techniques, such as SRT A and B, in the era of osteo and chondroplasty can offer a universal approach to all primary rhinoplasties.
- Foundation techniques, such as Push/Let down, have limited indications and can lead to suboptimal outcomes if generally performed in all primary rhinoplasties.

INTRODUCTION

Dorsal Preservation (DP) has seen resurgence in popularity among surgeons in recent years, despite its origins dating back to its introduction by Goodale in 1899, further refined by Lothrop in 1914, and later popularized by Cottle in 1946.[1–5]

The idea of preserving the middle vault and the good features of the dorsum is regarded as preferable to structural procedures. It would have been universally accepted if not for issues of surgical imprecision and loss of control.[6] Fortunately, in the past decade, new concepts of nasal anatomy have emerged from cadaver studies and, more recently, accurate radiologic studies.[7,8] These concepts and findings have allowed new modifications of the early push-down/let-down techniques. Due to the evolution of techniques and a new understanding of anatomy, we are now in the era of advanced preservation rhinoplasty, and patients who were not considered ideal candidates for DP in the Cottle era may now be suitable.[9]

Structural Versus Dorsal Preservation

The middle third is a transition segment between the bony pyramid and the tip, comprising only 1 T-shaped or M-shaped cartilage that, owing to

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Abbreviations

ASA	anterior septal angle
DALs	dorsal aesthetic lines
DP	Dorsal Preservation
FT	foundation technique
LDM	Lateral Division Maneuver
LKA	lateral keystone area
SAF	Septal Advancement Flap
SRT	Spare Roof Technique
SSNB	S-shaped nasal bone
ST	surface technique
ULC	Upper Lateral Cartilage
VSNB	V-shaped nasal bone

academic and historical purposes, is divided into 2 Upper Lateral Cartilages (ULCs) and one Quadrangular Septal cartilage, with different thermomechanical characteristics.[10,11] Based on the integrity of the ULCs, there are 2 different ways to dehump a nose: the Structural Techniques (resection/reconstruction) and the DP Techniques.[12]

The Structural Techniques consist of splitting the ULCs (among them) and the dorsal septum, separating this M-shaped segment into 3 parts.[13,14] It can be done by classical *en bloc* humpectomy or Component Dorsal Hump Reduction.[13–16] In both cases, the dorsal hump is lowered by removing the leading edge of the nasal dorsum, which necessitates reconstructions with spreader grafts or spreader flaps, as well as osteotomies to close an open roof.[17]

DP Techniques involve preservation of the leading edge of the nasal dorsum as the ULCs meet the dorsal septum with some potential modification of the bony cap.[17] The middle vault is not opened as the dorsal hump is lowered by manipulating the nasal septum from below to align the profile.[17] According to Toriumi, DP has experienced a revival because the method preserves the favorable anatomy of the upper two-thirds of the nose and minimizes the need for spreader grafts and spreader flaps.[18]

Dorsal Preservation Techniques

Conceptually and structurally, 2 classes of DP techniques have been described for the bony dorsum: foundation techniques (FT) and surface techniques (ST).[19]

FTs rely on dorsal impaction, which involves embedding the nasal pyramid into the face. This process necessitates impaction osteotomies that create a disruption between the skull and nasal pyramid (push down or let down).

STs focus on dorsal modulation where the hump is addressed superficially, allowing modulation of the middle vault without impaction osteotomies. Ishida Cartilaginous Push-Down (1999), Septorhinoplasty by Disarticulation described by Jankowski (2013), Spare Roof Technique A (2016), Spare Roof Technique B (2022), and Cartilage–only pushdown described by Kosins (2017) are some examples.[1]

Recently, it was reported that STs are increasing in popularity and are considered more stable, predictable, and have a shorter learning curve.[20]

Regarding managing the cartilaginous dorsum by DP, the dorsum (supported by the nasal septum) is modified by removing strips of cartilage at different levels, such as high-strip, medium-strip, and low-strip techniques. All techniques reduce dorsal support, allowing the dorsum's height and shape to be modified.

SPARE ROOF TECHNIQUE

The Spare Roof Technique (SRT) variations, A and B, are employed for nasal dorsum reduction, while the reverse SRT is specifically used for augmentation rhinoplasty.[12,21,22] In 2016, Ferreira MG and colleagues introduced the SRT as a conservative middle-third preservation technique, enabling the surgeon to isolate the entire cartilaginous roof of the middle third without dividing the ULCs.[12] This approach offers a refined method for treating the middle third, maintaining the structural integrity of the nasal anatomy, and minimizing the need for more invasive reconstruction.

Spare Roof Technique—Step by Step

The spare roof technique can be performed using a closed or open approach.

Regarding the bony cap, the SRT has been subdivided into 2 types: A and B.

SRT-A includes ostectomy of the bony cap.[12] However, considering the clinical and surgical experience acquired over the years, for patients with V-shaped nasal Bones (VSNB) and up to medium S-shaped nasal Bones (SSNB), it would be possible to dehump the nose while preserving the Dorsal Keystone Area. Thus, based on a rational anatomic basis acquired experience with SRT-A, described by Ferreira MG and colleagues, and cartilaginous push-down with preservation of the bony cap, described by Ishida LC and colleagues, both authors designed a new technique named SRT-B or *Ferreira-Ishida technique*.[21] This technique, named the Spare Roof Technique B (or the Ferreira-Ishida technique), is specially designed for patients with a dorsal hump and VSNB, preserves the bony cap, and ensures aesthetic brow-tip dorsal lines. In SRT-B, the treatment of the bony hump includes paramedian high parallel osteotomies just below the dorsal aesthetic lines (DALs) followed by inferior

osteotomies to obtain a triangular shape of bone on each side of the bony cap.[21]

Over time, SRT-B has been improved since it has been first described. Nowadays, SRT-B includes the following steps:

Step 1

Draw the desired dorsal brow-tip aesthetic lines on the skin's surface, the pyriform aperture, the rhinion, the amount of triangular bone that must be taken out to allow pushing down the bony cap, and the transversal line at the beginning of the nasal hump. Evaluate the presence of any bony or cartilaginous dorsal irregularity that must be fixed with osteo and/or chondroplasty before any other step (in these cases, one must dissect the dorsum in that specific area).

Step 2

Hydro-dissect both lateral walls with a subperiosteal injection of 5 ccs of iced saline. Dissect both lateral walls through an intercartilaginous incision (with a Colorado® needle).[23]

Optional The dorsum preparation by osteoplasty or chondroplasty: dissect the dorsum only if there is any bony or cartilaginous defect. The most frequent bony anomaly that must be addressed is the kyphion edge of the S-Shape nasal bones, which can be managed with piezo or diamond burr. The most frequent cartilaginous irregularity is the noticeable shoulders that should be managed with a *Colorado needle*.

Perform the 2 triangular ostectomies (just out of the DALs): By endonasal (ultrasonic or osteotome), perform the paramedian high parallel osteotomies exactly below the marked brow-tip DALs. Then, perform the second group of lower osteotomies, until the E-point, to achieve a triangular shape of bone on each side of the bony cap. Perform the ostectomy of the mentioned triangular areas. Release the lateral keystone area (LKA) with a no. 15 blade as needed (**Figs. 1** and **2**).

Perform Lateral conventional osteotomies—low-low-high—and leave the last 8 mm just with a simple *piezo line* to facilitate a real greenstick fracture at this ending level (**Fig. 3**). These lateral osteotomies should be assisted with a proper bony forceps—the Ferreira Bony Forceps®. These 2 lateral osteotomies with the cephalic part in greenstick fracture are part of the Barnsdoors concept, where 3 contiguous greenstick fractures are combined (**Fig. 4**).[24]

Step 3

After the skeletonization of the quadrangular septum, preferably through an intercrural approach, release the ULCs from the dorsal septum

Fig. 1. Releasing the lateral keystone area is a critical step in this technique. The dissection should be subperiosteal.

(high/medium septal strip) or perform the Septal Advancement Flap (SAF), advancing the caudal aspect of the septum in an L-shape fashion, from the nasal spine till the E-Point.[25] Caution should be taken in the anterior septal angle (ASA) due to extreme flexibility/tilting, so caudal mini spreaders grafts must be used on each side (**Fig. 5**).

Step 4

Take out the dorsal septum necessary to dehump (high/medium septal strip). Although the authors use a high-medium septal strip, SRT-B can be combined with a low-strip (SRT-B3 or the Ferreira-Nakamura technique).[26]

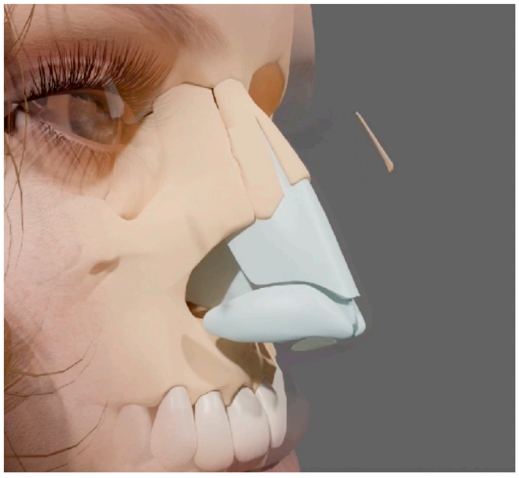

Fig. 2. Triangular ostectomy: the width of the triangle should be slightly shorter than the size of the hump. When performing correction of the crooked nose without hump or reverse SRT, it must be only osteotomy.

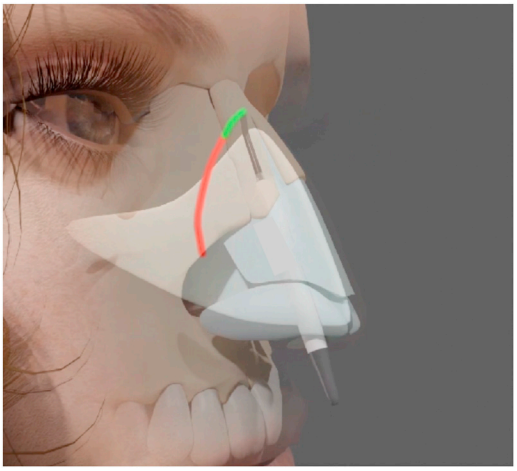

Fig. 3. Lateral conventional Osteotomy with the last segment in Greenstick (draw a *line* with piezo to guide the greenstick fracture).

Step 5

Perform partial ultrasonic ostectomy endonasal, below the nasal bones in the midline, to promote the weakening of the transverse fracture line in the sagittal plane just above the E-point—Subdorsal ostectomy.[27] Gently push cephalo-caudally the rectangular bony cap in a greenstick fashion (this is the third greenstick fracture of the Barndoors concept). The left thumb must apply one force in the caudal direction (**Fig. 6**).

Step 6

Perform regular L-shape septoplasty. Harvest the cartilage from the septum as needed.

Step 7

Perform the suture of the cartilaginous middle vault (ULCs) to the dorsal aspect of the remaining

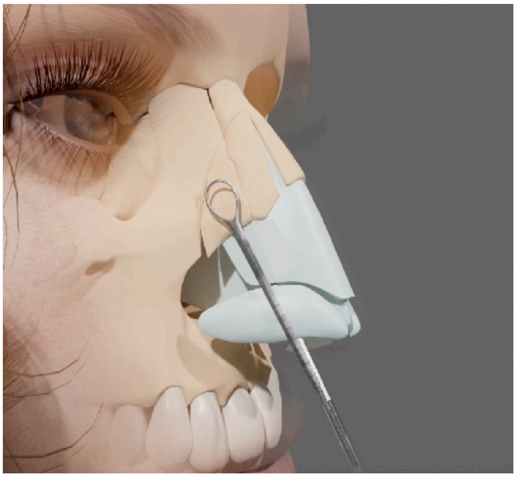

Fig. 4. Lateral osteotomy must be assisted with a forceps.

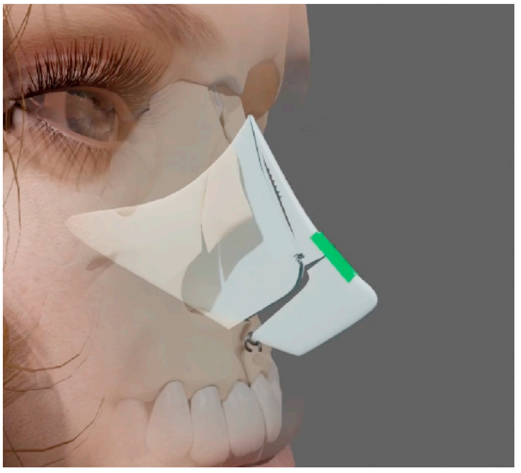

Fig. 5. Final aspect of the septal advancement flap with the caudal spreaders/struct grafts.

septum, just after the rhinion (in the cephalocaudal direction), with absorbable 5-0 polydioxanone, to stabilize the roof, and fix any spring effect that might still exist. It is easier to perform it with an open approach. The first author developed the *hump-apex suture for the closed approach*, a guided suture through the skin and middle vault. It includes 4 main steps, as follows. Step 1: pass the suture through the middle of the septum at a point vertical to the rhinion. After this, one will have the 2 ends of the suture on each side of the septum. Step 2, introduce a no. 18 Abbocath (Abbott Laboratories, Abbott Park, Ill.) in the highest point of the hump, immediately after the rhinion, through the skin plus the ULCs until the left side, and insert the left end of the suture through the lumen of the Abbocath. Step 3, pull the

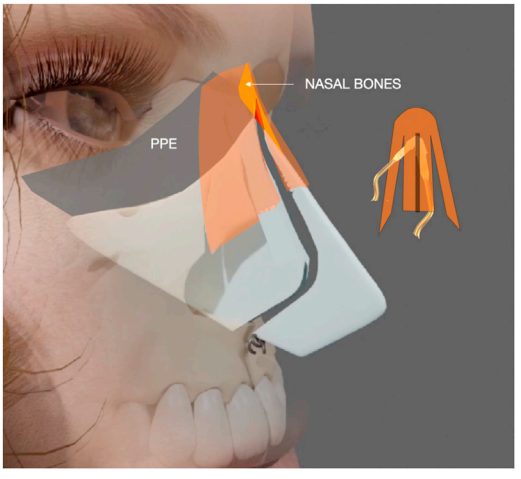

Fig. 6. Subdorsal ostectomy—must be partial and can be done lateral through the triangular ostectomy already created, or classically subdorsal.

Abbocath up the ULCs, but remain below the skin, and move it gently to the opposite side. Then, enter it again through the ULCs and do the same procedure with the right end of the suture. Step 4, pull the Abbocath (with both ends of the suture) out of the skin, and tie the only knot of this suture through the skin hole—not attached to the skin. Finally, release the dorsal skin from the knot.

For medium to large humps with a pronounced convex shape of the ULCs, the first author has been performing the *Lateral Division Maneuver (LDM)*, which he considers essential. This technique enables flattening the convex cartilaginous segment, creating a straight or even concave shape when necessary. Due to the 3-dimensional relationship between the lateral and dorsal walls, a vertical incision is made in both lateral walls while preserving the underlying mucosa. This incision facilitates the flattening and advancement of the cartilaginous middle, maintaining the integrity of the dorsal compartment. Consequently, the segment between the Rhinion and the W-Point can be refined to achieve a concave shape (**Fig. 7**).

Post-operative care

Spongostan nasal packing and Silastic with side tubes are placed and removed after 7 days.

Post-operative care is the same as in all other Rhinoplasty techniques: analgesia (Paracetamol 1000 mg 8/8 hours) and Amoxicillin and Acid Clavulanic (875 + 125 mg 12/12 hours). Doyle and thermic nasal splints are typically taken out 7 to 8 days after the surgery.

Spare Roof Technique Versus Other Techniques

SRT has some important advantages over other techniques:

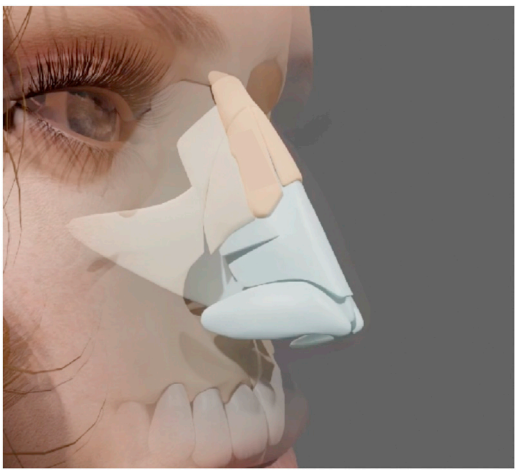

Fig. 7. Lateral division maneuver—to allow flattening in medium/big humps.

1. Due to the 3D geometry of the bony treatment, it is a universal technique, virtually applicable to all primary rhinoplasties. The classical push/letdown, due to the treatment of the bony pyramid as a single block, has limitations in the range of indications to achieve optimal results.[28]
2. SRT aims to achieve 3 greenstick fractures, that is, no skull/nose disruption, in opposition to the vast majority of other techniques that create this point-of-no-return with a more or less noticeable disruption (**Fig. 8**).
3. SRT has no *point-of-no-return*, meaning one can convert it at any time in a structural surgery if one feels uncomfortable at a certain point.
4. SRT has 10 years of experience working with many surgeons practicing worldwide, exchanging ideas/difficulties, and improving technique.
5. In SRT, the cartilaginous segment can be managed with different strategies, keeping the bony wall stable.

The main differences between the old and the new preservation techniques are detailed in **Fig. 9**.

Spare Roof Technique Avoiding Suboptimal Outcomes

One of the significant issues related to classical DP (push or let down) was the *indications*. Due to the many limitations of the technique proposed by Cottle, the item *indications* are frequently reported in the literature regarding both FTs. Things changed after the appearance of STs, such as SRT, and surface modulation by osteoplasty and chondroplasty.

Nowadays, we believe there is no contraindication for DP in primary and secondary rhinoplasties with intact ULCs—cartilaginous middle vault. However, if not diagnosed and corrected, some features can contribute to suboptimal results or be considered contraindications for DP, such as the SSNBs, ULCs shoulders, dorsal irregularities, asymmetries, low radix, low ASA (supratip control), crooked nose, big humps (hump recurrence), and irregular DALs.[9]

Regarding the SSNBs, ULCs shoulders, and dorsal irregularities, the ability to remove the bony cap (SRT-A) or perform surface modification of the bony dorsum (Osteoplasty) and shaving or burring the shoulders of the ULCs (Chondroplasty) has been essential in converting questionable candidates for DP to good candidates for DP.[9] The release of LKA (step 2) also allows for improved symmetry of the ULCs due to the ability to sink the excess of ULCs in the LKA.

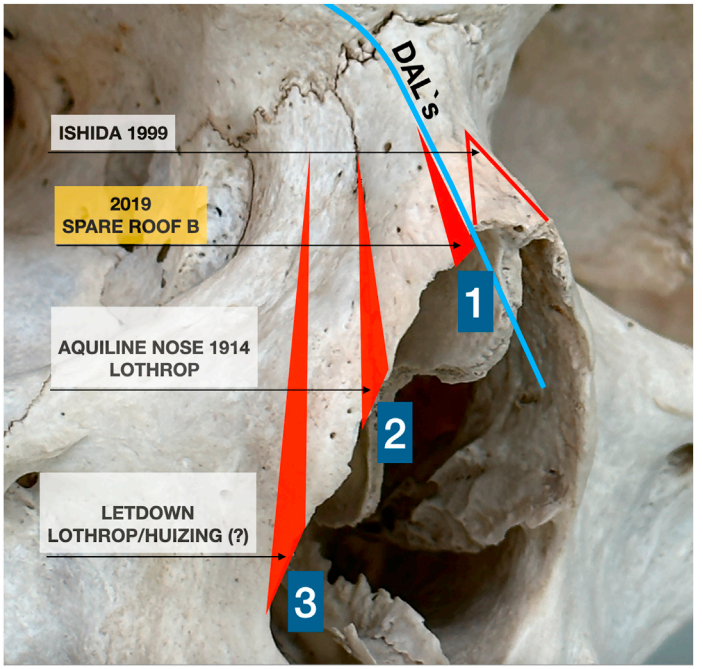

Fig. 8. Different osteotomy levels in preservation rhinoplasty—segments between 1, 2, and 3 have different degrees of medialization according to the level of osteotomy.

The LKA release is essential, particularly in more prominent dorsal humps, because this can act as a blocking point.[9,29,30] It can help to prevent hump recurrence with more prominent dorsal humps. It is mandatory to perform in all cases of DP once it allows splitting the bony and cartilaginous part of the middle vault—achieving the new anatomic relation while flattening the middle vault.

A low radix is frequently considered a contraindication for FTs due to a disruption of the normal dorsal support and contour created by the transverse osteotomy across the nasion, which allows the superior portion of the dorsum to come in.[17] The resulting step-off created may not be visible in the immediate post-operative period. However, concerns about the long-term results exist. In SRT,

PRESERVATION RHINOPLASTY - TECHNIQUES

	SPARE ROOF TECHNIQUE A 2016	SPARE ROOF TECHNIQUE B 2020	ISHIDA 1999	LOTHROP 1914
SURFACE FOUNDATION/IMPACTION	SURFACE	SURFACE	SURFACE	FOUNDATION IMPACTION
DORSAL BONY CAP	REMOVED	PRESERVED	PRESERVED parcial - triangular	PRESERVED (1)
SEPTAL STRIP	HIGH	HIGH ADV FLAP	HIGH / MEDIUM LOW	HIGH
OSTECTOMIES	PARAMEDIAN - DALs + LATERAL	PARAMEDIAN - DALs + LATERAL	DORSAL TRIANGULAR	NASO-MAXILAR SUTURE
ULCs/SEPTUM SUTURE	YES	YES	NO	NO
COMPLETE DORSAL PRESERVATION	NO (bony cap removed)	YES	NO (triangular bony cap)	NO

Fig. 9. Spare roof technique versus other preservation techniques.

this step on the radix does not exist due to its shape in greenstick fashion. Additionally, if there is a low radix, a small tissue radix graft can help camouflage a potential residual hump and aesthetically improve the nasofrontal angle.[31]

A low supratip is also a classical contraindication for the push or let-down technique. After the tip surgery, which typically increases rotation and projection, the supratip gets even worse if one does not predict and fix that. While performing the classical Cottle—low-strip—the advancement/rotation of the septum is excellent for this control. The first author has developed a new Flap—the SAF designed to achieve control/smoothness in this area in the medium-long-term follow-up.[25] The LDM will also allow a smooth transition in this area as well.

Regarding the lateral Cartilaginous Wall and the LDM: In medium/big humps, the lateral wall has a shorter size than the dorsal wall (see **Fig. 7**)—whatever maneuver should be done, it is impossible to flatten the cartilaginous roof without opening the lateral wall, allowing the caudal lateral wall to flatten caudally with the dorsal compartment. Most of the *new preservation* strategies/techniques are focused on the central wall, which concerns the cartilaginous segment. The central compartment is only 1 of the 3 walls when one looks at the 3D geometry of the hump. The LDM allows all the cartilaginous humps to be flattened and simultaneously preserves the dorsal cartilaginous segment—the most critical in DP and nasal aesthetics.

Managing axis deviation in cases of a crooked nose can be challenging with traditional spreader grafts and spreader flaps. However, DP techniques offer a precise method to realign the nose to the midline. One of the key strengths of DP techniques is their ability to shift both the bony and cartilaginous vaults (addressing axis deviations) toward the midline through asymmetric bone reduction and overlapping subdorsal segments—this is considered one of the most significant advantages of these techniques (**Fig. 10**).

According to the rhinoplasty principle, *the nose goes as the septum goes*, in cases of dorsal cartilaginous deviations, the cartilaginous middle vault often realigns to the midline once the high/medium strip is performed. The nasal pyramid is straight at this point, but the septum may remain crooked. The next step involves addressing the septal deviation. A traditional L-shaped septoplasty should suffice for simple deviations, whereas complex deviations may require an extracorporeal septoplasty.

In more complex cases of crooked noses, additional maneuvers—such as intermediate lateral osteotomies, asymmetric osteotomies, and dorsal

Fig. 10. (*A–F*) Pre operation and Post operation pictures, 1 year follow-up, 29 y patient, crooked and humped nose. Spare Roof B with Septal Advancement Flap.

chondroplasty—can be combined with the SRT to enhance the management of the crooked nose. The SRT significantly improves patients' perception of their nasal appearance, consistently delivering long-term results in individuals with crooked noses.[32]

DALs are rhinoplasty's most relevant surface anatomic landmarks. With ST, it is straightforward to preserve or create new DALs—mainly with the SRT B, where the bony cap is preserved exactly with the tailor of the new DALs. With conventional FT in DP is still possible to improve DALs with new devices such as Piezo or Diamond Burrs.

The Scroll Area Block and the *ligaments preservation*—the articulation between the caudal end of the Upper Lateral and the lower Lateral Cartilages are maintained by the *scroll ligament* (vertical and horizontal). When the cartilaginous hump is flattened, the dorsal skeleton has a caudal increment in his size. In this case, the Scroll Ligament is a blocking point and contributes to more tension leading to a relapsing hump in the medium term. This ligament should be released/cut to allow space for the new anatomy. Another reason to be skeptical about the efficiency of *ligament preservation* is when one wants to change anatomy.

SRT has been performed worldwide, and his author uses it in all his primaries. This is possible due to an accurate pre-operative and intra-operative evaluation of the nasal dorsum anatomy and the combination of SRT with some tailored maneuvers in specific cases such as osteoplasty, chondroplasty, SAF, and LDM.

CLINICS CARE POINTS

- The Spare Roof Technique (SRT) A and B were developed through anatomic (cadaveric and radiological) and clinical studies that assessed the aesthetic and functional outcomes in patients undergoing rhinoplasty.
- SRT is a ST for DP performed worldwide.
- Dorsal anomalies must be carefully diagnosed and fixed before any SRT A or B step.
- Accurate pre-operative and intra-operative evaluation of the nasal dorsum anatomy and the combination of SRT with tailored maneuvers in specific cases, such as osteoplasty, chondroplasty, septal advancement flap, and LDM, can offer a universal approach to all primary rhinoplasties.
- FTs, such as Push/Let down, have limited indications and can lead to suboptimal outcomes if generally performed in all primary rhinoplasties.

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DISCLOSURE

The authors have no disclosure.

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