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Are preservation rhinoplasty techniques safer than structural ones?

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Abstract. – This narrative review paper evaluates the preservation rhinoplasty (PR) technique in all aspects. The literature survey was performed in PubMed, EBSCO, UpToDate, and Proquest Central databases of Kırıkkale University, Google and Google Scholar databases.

The advent of the preservation rhinoplasty (PR) approach has led to a radical shift in the mindset surrounding rhinoplasty procedures. K-area (keystone region) loss, lateral cartilage collapse, and nasal stenosis are all avoidable with preservation measures. The nasal bones, the superior lateral cartilage, the quadrilateral cartilage, and the perpendicular blade of the ethmoid meet at the point known as Zone K. The variety of problems that might develop due to carelessness in this area demonstrates the significance of maintaining the nose's stability and structure. The three components of a preservation rhinoplasty (PR) procedure are (1) preserving the scroll ligament complex by elevating the soft tissue envelope (STE) in a subperichondrial-subperiosteal plane, (2) preserving the nasal dorsum without creating an open roof deformity, and (3) preserving the alar cartilages and achieving the desired shape using sutures rather than excision. Dorsal preservation is one of the three components that make up PR. However, the two concepts are not synonymous.

PR involves elevating a skin sleeve from the subperichondrial-subperiosteal plane, preserving the osteocartilaginous dorsum, maintaining the alar cartilages with minor excision and using sutures to achieve the desired form.

Key Words:
Preservation rhinoplasty (PR), Technique, Nasal dorsum, Soft tissue envelope (STE), Alar cartilage.

Introduction

K-area loss, cartilage collapse, and nasal stenosis can be prevented with preservation measures. The nasal bones, the superior lateral cartilage, the quadrilateral cartilage, and the perpendicular blade of the ethmoid all come together to form zone K[1,2]. The variety of problems that might develop due to negligence demonstrates the significance of maintaining the nose's stability and structure. When performing structural rhinoplasty that involves removing the nasal dorsum, preservation techniques can reduce the need for modifications and grafts[3,4].

Over time, doctors will always wonder if there is a way to avoid damaging healthy tissue when operating. The nasal ligaments, lateral crura, and dorsal soft tissue envelope can usually be saved. Dorsal preservation rhinoplasty has a high success rate in carefully selected individuals. More dorsum can be saved, and dorsal aesthetics can be enhanced with adjustments to the bony cap. Long-term problems with the middle vault and keystone area may be avoided by keeping the natural dorsum[2,5]. Examining the orbit, brow, insertion of the alar base of the cheek, the cant of the smile, and dentition (if the patient has not already undergone orthodontia) can help a surgeon determine if a nasal deformity is part of facial asymmetry caused by the underlying foundation of the nose and maxilla. A head-down frontal shot or circling behind the patient to look up at the nose from above are both simple ways to evaluate bone asymmetries. This determines whether the deviation is concentrated in the nasal pyramid (bone), the nasal septum (cartilage), or both. It enables the evaluation of nasal wall and tip asymmetry. Even though the nose's axis is perfectly straight, asymmetrical sidewalls might make it look crooked[6,7].

Considerable improvements in understanding the nose's architecture and its link to the surgical techniques involving nasal surgeries have been made recently, even though minor revisions and large secondary rhinoplasty remain after open rhinoplasty. The two most fascinating anatomical structures

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were the osteocartilaginous vault and the nasal ligaments. The surgical outcomes are susceptible to any alteration in the soft tissue envelope[6,8].

Methods

The literature survey was performed in PubMed, EBSCO, UpToDate, Proquest Central databases of Kırıkkale University, Google and Google Scholar databases.

Anatomy

To perform rhinoplasty successfully, the physician must be familiar with both typical and uncommon facial structures. Knowing how a surface's shape affects its appearance and performance is crucial.

The nose is composed of skin, dermis, and subcutaneous fat covering, the nasalis muscle, and accompanying fascia[9]. This outer envelope has a slack areolar layer between it and the support layer below. The nasal cover can be safely lifted through the areolar layer, an uncomplicated, somewhat avascular dissection plane, to expose the underlying osteocartilaginous support.

The perichondrium and periosteum cover and protect the underlying cartilage and bone, which gives the skin its form and structure. The position of the tip is held steady by fibrous ligaments that connect the top lateral, alar, and septal cartilages.

Vestibular stratified squamous, septal, and nasal mucosa line the nasal cavity. The lining of the nose should be kept in place during standard rhinoplasty. Rarely does the lining layer show signs of significant change.

Nasal Lining Skin

When compared to the more flexible and thinner skin on the dorsum and sidewall, the skin on the tip and ala is thicker and more sebaceous. It is more likely that the skin will contract and redrape over the skeleton if it is thin. For the underlying support to be seen through the covering skin envelope, the thick sebaceous skin of the tip contracts less and necessitates a more robust and angular structure. If a patient has thick skin, a rhinoplasty may not be possible.

The primary artery, venous and lymphatic vessels, are located in the musculoaponeurotic layer. Hence the nasal skin flap should be lifted in the deep areolar plane, slightly above cartilage and bone. Tissue necrosis and excessive scarring of soft tissues should be avoided[9].

Encouragement in the Center

There is the upper bone vault, the central upper lateral cartilage vault, and the lower alar cartilage vault that together make up the nose. The external valve is in the lower lateral vault (the tip and ala). It comprises the nasal rim and inner nostril (the alar cartilage at its caudal border, the soft tissue ala, the membrane septum, and the nasal sill).

The alar cartilage provides the skeletal skeleton of the nose's tip. Each ala contains the medial, intermediate, and lateral crus, which can be easily identified. The most lateral side of the alar cartilage gives way to a series of small accessory cartilages that are held together by continuous perichondrium. Suspensory fibrous attachments to the adjacent septum and upper lateral cartilages and the thickness of the skin and soft tissues define the shape and position of the distal nose. They all provide the support for the tip. Over the septal angle, these ligaments attach the upper lateral cartilages to the lower lateral cartilages at their cephalic edge.

The accessory cartilages are linked to the piriform aperture by other ligaments. The medial crura are held in place by the soft tissue between the inferior aspect of the medial crura's foot and the premaxilla, as well as by the fibrous attachments that connect the crura to the caudal septum. In order to expose and change the tip cartilages, surgical incisions and excisions must be made, which disrupt these suspensory ligaments. Simple skin elevation off the underlying cartilage framework, intercartilaginous, transfixion incisions, rimming incisions, cephalic trim of the alar cartilage, excision of the septal angle and caudal septum, and disruption of the various suspensory ligaments all reduce overall tip support[9].

Anatomical, Nasal, and Aesthetic Considerations

The nasal tip is a complex 3D structure made up of a variety of curves and angles. The tip lobule is supported and shaped by the alar cartilage. Surface anatomy reflects the paired alar cartilages' size, form, and location. The three crus structures that make up each alar cartilage contribute to the unique structure and function of the region of the nose to which they are attached.

Medial crus begin at the columellar breakpoint (columella/lobular junction) and extend within the columella to the medial genu. The middle crus regulates the ratio of columellar to lobular segments and the cephalad to the caudal orientation of the columella.

The median crus connects the lateral and medial crus. The infra-tip lobule's shape, height, and projection are established by its length, arrangement, and angularity. The angle of rotation that initiates at the columellar/lobular junction is known as cephalad angulation. The intercrural distance is based on the angle of diversion or how far to the side of the midline it is. The central crus continues until it meets the lateral crus, also known as the lateral genu or domes.

The tip's projection, width, and definition are all established by the domes of the alar cartilages. The lateral crura on both sides get together and create the tip lobule. Thus, a tripod is produced by the two lateral crura extending laterally within the tip lobule and the two medial crura attached within the columella by fibrous tissue, supporting an inferior central leg.

Grafts or struts can be used to enhance the strength and length of this cartilage unit. The legs of the tripod are supposed to be in concordance. The shorter medial crura causes the tip to go downward. If the upper legs are shorter, the tip point will be higher and more projected.

The loss of support in the cartilage triangle can cause the skin, muscles, and even alar cartilage to sag, block airflow, and lead to a collapsed external valve[9].

Aesthetics

The underlying skeleton is responsible for the aesthetics of the nasal tip[9]. The lateral projections of the right and left domes, the sites of tip divergence from the dorsum (supra tip break), and the columellar/lobular junction (columellar break) are the fundamental hallmarks of a sophisticated tip[9].

The cartilage at the nose's tip contributes to the nose's shape and function. However, this is rarely emphasized. The alar cartilages determine the tip/lobular contour, the length, width, and position of the columella, the form of the nostrils, the position of the alar rim, the strength of the alar airways, and the appearance of the nasal length. All three alar cartilage's anatomic and functional components must be preserved or restored for the reconstruction to be reliable.

The surgeon considering a rhinoplasty must consider the nose as a whole or the nasal "gestalt", including the dorsum, tip, sidewalls, etc. Aesthetic advice is crucial[9].

Two lines, slightly skewed from the medial brow ridges to the tip, define the nasal dorsum when viewed from the front. Depending on the patient's ancestry, the alar bases should be within a line dropped from the medial canthi. The typical width of the alar flare is 2 mm broader than the width of the alar base. The surgeon has to tell the difference between an alar flare and excessive internal width[10]. Symmetry and an inferior-lateral outward flare at the alar bases are ideal. The front view of the columella should be placed just below the alar rim, mimicking the soft curve of a flying seagull.

When viewed from below, the columella and nasal base should form a triangle with equal sides. The ideal form of a nostril is that of a teardrop, with the long axis of the teardrop pointing somewhat medially from the nostril's base to its tip[9].

The correct dorsal nasofrontal angle, as seen from the side, is midway between the top eyelash and the supratarsal fold when the eyes are level. The tip projection is measured from where the alar rim and the cheek meet. Half to two-thirds of the point should be in front of a vertical line drawn next to the upper lip's most protruding section.

The ratio of nasal length to the points that define the tips of the nose is used to establish the ideal nasal length. The distance between the station (the horizontal intersection of the upper and lower lips) to the mentum should be 0.67 X RT (radix-to-tip distance)[9].

The two equilateral triangles formed by the tip's four defining landmarks (bilateral tip-defining points, supratip break, and columellar lobular angle) are ideal. Women's supratip breaks are meant to be more pronounced than men. It adds definition and makes the dorsum stand out from the tail. When viewed frontally, the columella and nostril rims should form a gullwing shape, with the columella resting just below the alar rim. Between 30 and 45 degrees is ideal for the columellar lobular angle, where the columella meets the infraction lobule (columella breakpoint).

The angle of rotation is equal to the rotation at the tip. A line connecting the nostrils in front and behind can be drawn straight regarding the horizontal plane. Ideally, a woman's rotation angle should be between 95 and 100 degrees, whereas a man's should be between 90 and 95 degrees[9].

Definition for Preservation Rhinoplasty

Preservative Rhinoplasty[10,11]

The preservation principle's popularity has skyrocketed since 2011 when it was first introduced. Indications and methods for the preservation of rhinoplasty have grown as its popularity among surgeons has spread. When it comes to the nasal dorsum, most rhinoplasty surgeons agree that avoiding the removal of any healthy

tissue is preferable and that a natural appearance is always preferable to an artificial one[2].

With preservation rhinoplasty, the upper lateral cartilage (ULC) is not detached from the nasal septum. The procedure consists primarily of the following steps: preparation of the septum and its resection can be at "different levels [high or low, i.e., SPAR (septum pyramidal adjustment and repositioning)], preparation of the pyramid, transversal osteotomy, lateral osteotomy(s), and septo-pyramidal adjustment"[12].

The three components of a preservation rhinoplasty (PR) procedure are (1) "preserving the scroll ligament complex by elevating the soft tissue envelope (STE) in a subperichondrial-subperiosteal plane", (2) "preserving the nasal dorsum without creating an open roof deformity", and (3) "preserving the alar cartilages and achieving the desired shape using sutures rather than excision". It is essential to distinguish between PR and dorsal preservation, which refer to the same thing[2].

Indications

Facial features that point to this condition include a nose whose radix is lower than the original, whose deprojection of the nasal dorsum tends to maintain its original shape, whose internal distance (IAD) has increased, and whose nasal middle 13 has enlarged, and whose nasal tip has lost its projection and whose nostrils are round. Therefore, the ideal candidate has a tension nose, defined as a high radix and a dorsally projected nasal tip, a wide anterior nasal septal angle (ANSA), a narrow middle 1/3, a narrow internal alar diameter (IAD), thin nostrils, and a straight perpendicular plate of the ethmoid (PPE), and possibly a deviated nose[12].

Surgeons wishing to preserve the nasal dorsum must consider some indications[13] before proceeding.

1. Natural dorsal projection (tension nose); septum located in the middle of the nose.
2. Normal radix position and short nasal bones with a cartilaginous hump.
3. Aesthetically straight dorsal lines that veer off-center.
4. Ancient people who had a dorsal hump and a paper-thin skin envelope.

Relevant symptoms[13]:

1. A non-central caudal septum.
2. Septal deviation.
3. Convex profile and a deep radix.
4. Widespread nasal dorsum.

Contraindications

Low radix, dorsal nasal abnormalities, an ANSA lower than the rhinion, and a broad middle 1-3 are contraindications. Furthermore, the key stigmas are a hump in the middle third of the nose, a saddling of the supratip area, and a very low radix. In addition to the radix shape, weak cartilages, a long nasal bone, a deviated PPE, and an obsessive patient are all potential problems with this method. Our research led us to the conclusion that this method is highly effective for some types of noses, but caution is needed due to the potential for stigmas to arise[12].

Soft Tissue Envelope (STE)

The sub-SMAS plane is typically used to elevate the soft tissue envelope since it is less invasive and has fewer blood vessels than the traditional subcutaneous plane. However, considerable postoperative edema, numbness, protracted scar remodeling, and induration are still linked to sub-SMAS dissection. Tardy raised the issue of the STE gradually narrowing over time, and Toriumi[14] has lately provided evidence in this regard. In order to reduce both immediate and future issues, the STE must be lifted as a single sheet. The nasal ligaments can be saved and even restored in some cases; this includes Pitanguy's, the scroll ligament complex, and the intercrural ligament. It is possible to preserve the integrity of the scroll ligament complex when closing the subperichondrial dissection spaces between the alar and upper lateral cartilages. After the operation, it is reattached to the underlying soft tissue, which has three different benefits: (i) it creates a distinct surface aesthetic line, (ii) it closes dead space, and (iii) it stabilizes the internal valve. Pitanguy's ligament, when left intact or repaired, enhances supratip break[2,15], improves tip projection, and reduces the intralobular curve.

Dorsal Preservation (DP)

Saban only performs the Cottle surgery on post-traumatic patients who have severe septal abnormalities and cannot undergo a subdorsal strip excision. The Cottle method's longer surgical time and increased difficulty in dorsal placement are its two main drawbacks. Dr. Finocchi has renamed a variation of the Cottle method

"Simplified Preservation Quick Rhinoplasty" (SPQR)[16]. Before adopting the Cottle technique, he had completed 150 DP procedures using the Saban method. The necessity of addressing significant bone septal irregularities was the impetus for the modification. When compared to the standard Cottle, Finocchi's approach has the following advantages[2]: (1) the vertical cut in the septum is an incision rather than the necessary excision of a vertical strip; (2) the location of the vertical strip is not dictated by the "quadrangular-PPE junction" but rather by the desired dorsal pivot point in the keystone area; and (3) para septal medial osteotomies are not necessary to separate the nasal bones from the septum and each other. Finocchi has used this method on over a hundred patients in a row, and he has found it to be both adaptable and helpful when dealing with situations of a deviated nose. Current evidence[2] suggests (1) "a developmental deviation of the nose where the ideal dorsum is merely displaced off the midline" and (2) "significant septal deviations". The impaction of the osseocartilaginous vault, rotation of the bony dorsum, and a swinging door septoplasty with cartilaginous repositioning are all under the surgeon's control; this method has a wide range of applications. In contrast, the osseocartilaginous vault is impacted, and any rotation is of the full vault "without separation of the bony and cartilaginous components"[2] when using the high septal strip approach with two vectors of movement. Therefore, the patient's deformity is taken into account when deciding between the many procedures available.

Alar Cartilage Preservation

Maintaining projection and reducing the number of tip abnormalities were just some of the intermediate-term benefits of employing tip suturing and structural support with various columellar struts, septal extension grafts, and tongue-in-groove treatments. Nonetheless, PR is a step forward in tip surgery since it preserves nearly all alar cartilage, improving function and lessening complications. Subperichondrial exposure, ligament preservation, and total alar cartilage preservation are revolutionary steps forward in tip surgery[2].

Regalado-Briz and Byrd[17] method involves a columellar strut and tip suturing to create a symmetrical unified tip complex without removing the cephalic lateral crus. He stated that scarring, structural deformation, and functional consequences are all reasons to avoid alar excision. He did, however, remove some cartilage from the mid portion. The following are the main components of the method: a) end-to-end or side-to-side attachment of a septal extension graft to the caudal septum, b) domal creation sutures to define the tip, and c) lateral crural steal to shorten and tighten the lateral crus. A rigid tip complex is produced by tensioning the three legs of the tripod in these three stages. No cephalic or paradoxical alar cartilages are removed, and no transactions are performed like they are so often in the middle crus[2,17].

The steps of Ozman et al[18] incise and slide method entails four stages and are as follows: (1) cephalic trimming, leaving at least an 8 mm rim strip; (2) undermining the lateral crura; (3) suturing the cephalic island under the surviving lateral crura; and (4) reattaching the vertical scroll ligament.

Cartilaginous Push-Down and Preservation of the Bony Cap

More than a century ago, Joseph[19] outlined a method for reducing a nasal hump by partially resecting the nose's bones and cartilage. Two upper lateral cartilages (ULCs) and the septal cartilage form a single unit that makes up the cartilaginous component of the hump. These three structures join at the top and shape the letter M[20]. This structure is cut into three sections during hump reduction in traditional rhinoplasty, which is the leading cause of long-term abnormalities like shadows and pinching. Furthermore, the angle and relationship between the septal cartilage and the ULCs are diminished, which may impair the internal nasal valve's performance. Different writers have described techniques that prevent these complications while treating the nasal hump effectively. Cottle's[21] push-down was the first description. Huizing's[22] and Drumheller's[23] modifications tried to improve the procedure. Ishida's[24] "cartilaginous push-down" was the last modification used in modern rhinoplasty approaches to preserve the dorsum. The first two reduce the hump holistically without damaging the dorsal or sagittal planes or the area around the keystone. These methods are typically recommended for patients with minor bumps, minimal or no nasal abnormalities, and a narrow nose shape[1,25-27].

Cartilage can be saved using the method outlined by Ishida[24]. Initially, this method was only

applied to relatively flat humps of varying sizes. However, after a thorough understanding of the keystone region's anatomy, massive and/or deviated humps[25] became the primary signal for the cartilaginous preservation approach.

The cartilaginous push-down method for treating a nasal hump involves adjusting the septal cartilage without breaking the M-shaped link between the lateral crus (ULCs) and the posterior septal cartilage[24]. The nasal dorsum is undermined in a sub-superficial musculoaponeurotic system plane, and the posterior septum is undermined in a sub-perichondral plane on both sides, whether the procedure is performed using an open or closed approach. The ethmoid bone's perpendicular plate is undercut, and a corresponding sliver of septal cartilage is excised from the dorsum of the nose. Most septum deviations occur towards its base, close to the palatal crest. Hence, this resection should focus on that area. When there is minimal septal deviation, the optimal resection site is about 3-4 mm below the dorsum. The caudal portion of the septal cartilage is preserved by the high septal strip, which may be helpful when dealing with stubborn nasal tips. A Freer dissector is used to separate the ULCs from the nasal bones. Special care must be taken since this cartilage extends as far as 9 mm under the nasal bones and is considerably softer than the tissues above it.

Begin by separating the ULCs from the nasal bones in the keystone region. The depth of the dorsal reduction is determined by the lateral extent of this dissection. In order to move the hump, the septal cartilage must be fully dissociated from the ethmoid's perpendicular plate. When reshaping the nose's keystone, two osteotomies are made to the nasal bones, one on each side. These osteotomies begin just below the nose's broadest point in the middle third (dorsal aesthetic lines) and meet in the center of the nose, making up around half to two-thirds of the nose's length. This keystone cap of bone will be reduced in height alongside the hump's cartilaginous top. To avoid the thicker region of the nasal bones and to minimize the necessity for ethmoid osteotomies, the bony cap should not be extended past the midpoint of the nasal bones. The amount the dorsum lowered is determined by the lateral length of dissection between the ULCs and the osseous pyriform aperture; nasal deviations can be rectified without the dorsum being lowered. As the dissection progresses, the cartilaginous dorsum is depressed, and the ULCs are released in stages, moving from the midline to the sides. The middle third of the nose is held in place and secured by the sesamoids and the lateral osteotomies, which are both parts of the fibrous connective tissue that attaches the ULCs to the nasal bones. The cartilage at the nose's tip continues to function independently of the nose's central region. Even in more prominent noses, the bony cap articulates with the cartilage, straightening the osteocartilaginous transition, so it only needs to be cut smaller. Then, a rasp is used to get rid of the last of the bony bump on the side. The cartilaginous hump is held in place because of the lateral osteotomies performed[25].

Preservation rhinoplasty techniques are safer, especially in dorsal deformities without tip problems (Figures 1 and 2).

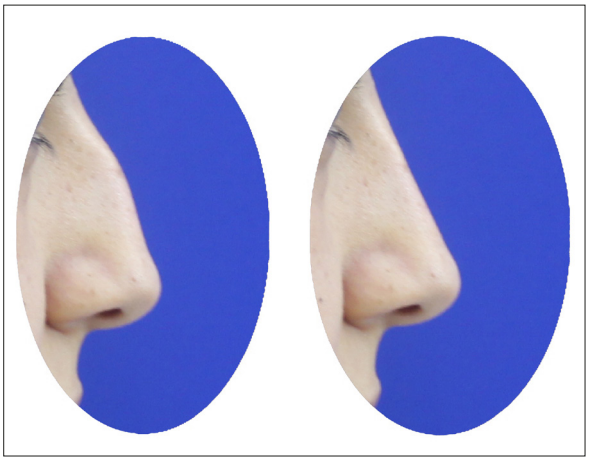

Figure 1. Preservation rhinoplasty case 1 (preoperative and postoperative view).

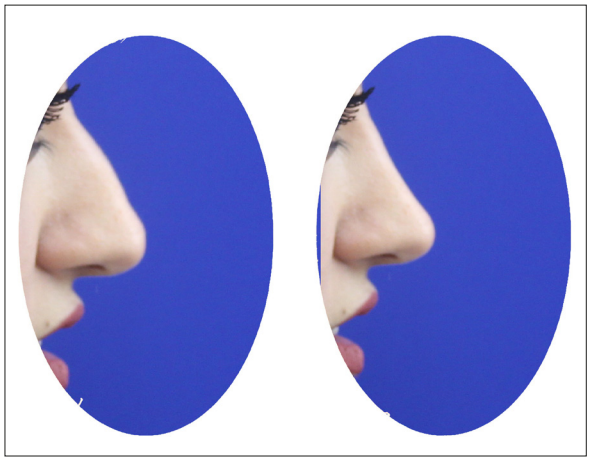

Figure 2. Preservation rhinoplasty case 2 (preoperative and postoperative view).

Conclusions

The advent of preservation rhinoplasty (PR)[28] marked a radical shift in perspective on the surgical reshaping of the nose[29-31]. Daniel coined this phrase in the current year. To achieve the appropriate form with sutures, PR involves three essential elements: elevating a sleeve of skin from the subperichondrial-subperiosteal plane, preserving the osteocartilaginous dorsum, and preserving the alar cartilages with minimal excision[32,33].

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