Rhinoplasty Dissection Manual
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Illustrated by Devin M. Cunning, M.D.
To my ever supportive wife, Colleen, and our two daughters, Hannah and Olivia, and to my parents who gave me encouragement to practice medicine.

Dean M. Toriumi, M.D.

With special appreciation and love for my family—my parents Bill and Merle, and my brothers and sisters-in-law, Richard and Rachel, Paul, Sam, and Jen.

Daniel G. Becker, M.D.
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Excellent surgical outcomes in rhinoplasty derive from two interrelated factors: (1) a detailed understanding of the multiple nasal anatomic variants encountered, and (2) an acquired knowledge of the ultimate long-term effects of surgical alterations of these anatomic components—the evolution of healing.

The first skill can be learned by detailed observation, enhanced by cadaver dissection; the second skill only by careful follow-up of operated patients over time.

The general concepts of nasal anatomy have been fundamentally clear for centuries, but only in recent decades have surgeons appreciated the finely detailed nuances of nasal anatomic dynamics that influence the surgical creation of a natural, pleasing rhinoplasty result, free of surgical stigmata. A detailed comprehension of nasal anatomy must therefore transcend knowledge of basic anatomic relationships. The surgeon must judge, by inspection and palpation, the character of the skin and subcutaneous tissues as they vary from nasal region to region, the influences of facial mimetic musculature, the relative strength and support of the cartilaginous and bony framework and substructure, and the limitations imposed by the interrelationship of all these structures upon the ultimate favorable result. As important as the evaluation of what can reasonably be accomplished during rhinoplasty is the acquired knowledge and skill to assess what cannot be accomplished.

This judgment is largely predicated on the critical analysis of each patient's individual anatomy, coupled with technical refinements guided by experience, and generally requires years of personal surgical result evaluation to become keen.

In this dissection manual, Drs. Becker and Toriumi have created a unique study guide and cadaver dissection manual dedicated to guiding the learner in a disciplined manner. They admirably extend the tradition of the University of Illinois Department of Otolaryngology's leadership in teaching anatomy and surgery in rhinoplasty. Cadaver dissection constitutes a privilege not available to all, and, as such, this precious material must be wisely and conservatively approached. Experience teaches that a disciplined, structured approach to dissection of the nose produces the best educational outcome.

An important favorable development in contemporary rhinoplasty is the appropriate concern for conservative and subtle anatomic changes that by definition derives from a preservation attitude toward nasal tissues. Commonly, rather than excisional sacrifice of large segments of cartilage or bone, a philosophy of preservation and restoration of tissues is developing that precludes creation of unnecessary tissue voids which may heal and scar un-
predictably. Wise surgeons recognize that even a larger nose, well balanced to the surrounding facial features, is always aesthetically preferable to a nose made over-small by radical surgery. Conservation surgery thereby further extends the surgeon's control over the final surgical result, as an appropriate equilibrium between the corrected nasal skeleton and soft tissue covering is more reliably achieved. Conservative sculpture and volume reduction of the alar cartilages clearly produce more favorable results, generally avoiding major resections and vertical interruption of the intact residual strip of lateral and medial crus. Notching, pinching, alar cephalic retraction, over-rotation, and asymmetries are all almost entirely eliminated in long-term healing when this conservative philosophy is embraced. A further striking example of conservatism is the preservation of a strong, high profile in many patients, a distinct contrast to the dramatic *retroussé* profiles created in decades past by sacrifice of over-generous segments of nasal bony humps.

Finally, thoughtful nasal surgeons, through accurate anatomic diagnosis, discern which portions of the nasal anatomy are pleasing and satisfactory, striving to avoid disturbing these structures and areas when correcting (or gaining access to) anatomic components in need of correction. This philosophy further extends the surgeon's favorable control over ultimate healing. Thoughtful cadaver dissection provides the learner with visual pathways to gain access to structures to be modified, while preserving normal tissues and relationships. Important tissue planes, vital in live surgery, can be appreciated best when viewed at leisure in the dissection laboratory.

This well-conceived work, properly employed, contributes substantially to shortening the steep learning curve characteristic of rhinoplasty.

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Preface

The successful rhinoplasty surgeon’s operative plan is based on a clear understanding of the patient’s desired changes, a careful and accurate diagnosis of the patient’s anatomy, and a wide armamentarium of surgical techniques. Prior techniques and the surgeon’s personal experiences with the array of surgical techniques are also primary factors in the decision for a particular operative approach. The successful surgeon’s application of surgical techniques is designed to accommodate differences in anatomy and to account for variant anatomy. For example, noses with thin skin and noses with thick skin each present specific problems that must be considered when choosing techniques for altering nasal structure. Also, the effects of scar contracture vary from patient to patient and can significantly affect the ultimate aesthetic and functional outcome. The rhinoplasty surgeon must recognize that the healing process may distort the changes made at the time of surgery, however expertly they were accomplished. The surgeon’s only recourse is to build a structurally sound nasal architecture that can withstand the forces of scar contracture and provide an acceptable success rate.

The importance of experience in rhinoplasty cannot be overemphasized. The experienced rhinoplasty surgeon can anticipate the likelihood of a favorable outcome based on his or her experience using certain techniques with a specific deformity. Selection of the proper technique for each circumstance should provide the opportunity for a high success rate.

The purpose of this dissection manual is to provide practical information about a wide range of surgical techniques in rhinoplasty. The dissection manual guides the reader through a step-by-step dissection. It focuses on the execution of basic and advanced rhinoplasty techniques and seeks to provide practical information that can be readily applied in surgery. The text is intended to be a procedurally oriented dissection manual and is organized to allow easy reference to a wide array of basic and advanced rhinoplasty techniques. Illustrations and intraoperative photographs, along with detailed text, guide the reader through the step-by-step dissection. Important technical and clinical “pearls” are highlighted in each section. A programmatic cadaver dissection videotape accompanies the text.

Before beginning the nasal dissection, review the chapter on nasal anatomy (Chapter 1) and the chapter on pre-operative rhinoplasty analysis (Chapter 2). Chapter 3 outlines local anesthesia injection techniques; the dissector is instructed to practice the injections prior to commencing the programmatic dissection.

The dissection manual guides you through the following dissections: septoplasty, trans-
cartilaginous or inter-cartilaginous approach, delivery approach and an external rhinoplasty approach. The remainder of the programmatic nasal dissection details a number of rhinoplasty techniques and addresses a number of specific rhinoplasty problems. The manual focuses primarily on the external rhinoplasty approach; however, all approaches are covered and can be performed sequentially, or the disector may choose to focus on a specific approach. Appropriate targeted references for further reading are also provided.

We recommend that the disector proceed with Chapters 1–6 with the skin-soft tissue envelope intact. For the remaining chapters, the disector may wish to split the skin down the midline for better exposure. In this fashion, the dissection can be performed without an assistant, and (except for a complete septoplasty) without a headlight.

The cadaver laboratory is the place to sharpen one’s surgical skills. This manual seeks to provide the disector with the opportunity to obtain maximum benefit from performing this complex operation on cadaver specimens. The dissection manual was “field tested” at the University of Pennsylvania Rhinoplasty Course: Aesthetic & Functional Rhinoplasty. Participants, many of whom professed relatively limited rhinoplasty experience, undertook the stepwise, programmatic dissection and worked through the manual (with the exception of rib or clavaria bone harvest) in a single five-hour period.

Rhinoplasty is an operation that requires constant thought, assimilation of information, and reaction to unexpected findings. With this in mind, the authors strongly recommend involvement in as many advanced teaching encounters as possible. This may involve reading timely literature, attending advanced rhinoplasty courses, observing other experienced surgeons, or sharpening one’s skills in the cadaver laboratory. We hope that use of this dissection manual will stimulate thought and incite both the enthusiasm of the beginner as well as experienced rhinoplasty surgeons seeking to broaden their surgical armamentarium.

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Rhinoplasty Dissection Manual
Although the anatomy of the nose has been fundamentally understood for many years, only relatively recently has there been an increased understanding of the long-term effects of surgical changes on the function and appearance of the nose. A detailed understanding of nasal anatomy is critical for successful rhinoplasty. This chapter reviews the surface and structural anatomy of the nose, with an emphasis on important surgical anatomy.

Accurate assessment of the anatomic variations presented by a patient allows the surgeon to develop a rational and realistic surgical plan. Furthermore, recognizing variant or aberrant anatomy is critical to preventing functional compromise or untoward aesthetic results. This chapter presents a limited diagrammatic overview of nasal anatomy. More detailed study of nasal and facial anatomy is recommended (1) (Figs. 1-10).
Figure 1. Surface anatomy of the nose: Frontal view. 1, Glabella; 2, nasion; 3, tip-defining points; 4, alar-sidewall; 5, supraalar crease; 6, philtrum.

Figure 2. Surface anatomy of the nose: Base. 1, Infratip lobule; 2, columella; 3, alar sidewall; 4, facet or soft-tissue triangle; 5, nostril sill; 6, columella–labial angle or junction; 7, alar–facial groove or junction; 8, tip-defining points.

Figure 3. Surface anatomy of the nose: Lateral. 1, Glabella; 2, nasion, nasofrontal angle; 3, rhinion (osseocartilaginous junction); 4, supratip; 5, tip-defining points; 6, infratip lobule; 7, columella; 8, columella–labial angle or junction; 9, alar–facial groove or junction.
Figure 4. Surface anatomy of the nose: Oblique. 1, Glabella; 2, nasion, nasofrontal angle; 3, rhinion; 4, alar sidewall; 5, alar–facial groove or junction; 6, supratip; 7, tip-defining points; 8, philtrum.

Figure 5. Nasal anatomy: Oblique. 1, Nasal bone; 2, nasion (nasofrontal suture line); 3, internasal suture line; 4, nasomaxillary suture line; 5, ascending process of maxilla; 6, rhinion (osseocartilaginous junction); 7, upper lateral cartilage; 8, caudal edge of upper lateral cartilage; 9, anterior septal angle; 10, lower lateral cartilage, lateral crus; 11, medial crural footplate; 12, intermediate crus; 13, sesamoid cartilage; 14, pyriform aperture.

Figure 6. Nasal anatomy: Lateral (rotated slightly obliquely). 1, Nasal bone; 2, nasion (nasofrontal suture line); 3, internasal suture line; 4, nasomaxillary suture line; 5, ascending process of maxilla; 6, rhinion (osseocartilaginous junction); 7, upper lateral cartilage; 8, caudal edge of upper lateral cartilage; 9, anterior septal angle; 10, lower lateral cartilage, lateral crus; 13, medial crural footplate; 12, intermediate crus; 13, sesamoid cartilage; 14, pyriform aperture.

Figure 7. Nasal anatomy: Base. 1, Tip-defining point; 2, intermediate crus; 3, medial crus; 4, medial crural footplate; 5, caudal septum; 6, lateral crus; 7, naris; 8, nostril floor; 9, nostril sill; 10, alar lobule; 11, alar–facial groove or junction; 12, nasal spine.
Figure 8. Nasal septum. 1, Quadrangular cartilage; 2, nasal spine; 3, posterior septal angle; 4, middle septal angle; 5, anterior septal angle; 6, vomer; 7, perpendicular plate of ethmoid bone; 8, maxillary crest, maxillary component; 9, maxillary crest, palatine component.


Figure 10. Nasal vasculature. 1, Dorsal nasal artery; 2, lateral nasal artery; 3, angular vessels; 4, columellar artery.
PEARLS

- The nose may be thought of in anatomic thirds. The upper third roughly corresponds to the bony dorsum; the middle third roughly corresponds to the cartilaginous dorsum; and the lower third generally corresponds to the tip.
- When describing relationships of one structure to another in the nose, use the well-defined *anterior/posterior* or *caudal/cephalic*. (Fig. 11).
- The nasal bones are usually small; the ascending process of the maxilla provides a significant contribution to the bony anatomy of the nose.
- The alar lobule contains fat and fibrous connective tissue, but it contains no cartilage. The lateral crus of the lower lateral cartilage takes on a more cephalic position as it extends laterally and is not found in the alar lobule.
- The lobule, alar lobule, and the infratip lobule are terms that designate three distinct anatomic areas of the nose. The lower third of the nose may be referred to as the *lobule* or *tip*. The *alar lobule* is a fibrofatty nasal subunit that is devoid of cartilage and composes a portion of the lateral nasal sidewall. The infratip lobule
should comprise one third of the vertical length of the nose on base view (i.e., 2:1 columnellar/lobule ratio).

- The nasal valve area includes the cross-sectional area described by the nasal valve and is affected by the inferior turbinate, the caudal septum, and the tissues surrounding the pyriform aperture. The nasal valve proper is bounded by the nasal septum, the caudal margin of the upper lateral cartilage, and the floor of the nose, and is considered to be the location of the least cross-sectional area in the nose. In lateral osteotomies, care is taken to preserve a small triangle of bone at the pyriform aperture to prevent medialization of the inferior turbinate, which can compromise the cross-sectional area of the nasal valve area.

- Scroll region: The upper lateral cartilages and lower lateral cartilages interrelate in three different configurations. Most commonly, the cephalic edge of the lower lateral cartilage overlaps the caudal edge of the upper lateral cartilage in the scroll region. Less commonly, the cephalic edge of the lower lateral cartilage abuts the caudal edge of the upper lateral cartilage. Rarely the cephalic edge of the lower lateral cartilage is overlapped by the caudal edge of the upper lateral cartilage.

- Internasal suture line: The nasal bones are fused in the midline at the internasal suture. When elevating the skin-soft tissue envelope, decussating fibers must be divided (typically with scissors) from their attachment at the midline internasal suture to achieve the desired exposure.

- The caudal margin of the nasal septum has a defined posterior septal angle, a middle septal angle, and an anterior septal angle. This anatomy plays a significant role in the shape of the nasal tip, including the infratip lobule, double-break, and supratip region. The surgeon attempting to create or allow for tip rotation by conservative excision of a superiorly based triangle of caudal septum must be aware of this anatomy.

- The septum is composed of contributions from a number of anatomic structures (see Fig. 8).

- In performing septoplasty, great care must be taken to preserve a generous L-strut to maintain support for the lower two thirds of the nose. Generally, it is recommended that at least 15 mm caudally and 15 mm dorsally (after accounting for any removal of dorsal hump) be preserved.

- Rhinion versus sellion: The rhinion is the soft-tissue correlate of the osseocartilaginous junction of the nasal dorsum. The sellion corresponds to the osseocartilaginous junction of the nasal dorsum.

- Osteotomies should not extend into the hard nasofrontal bone. When osteotomies extend too far cephalically into this thick, hard bone, a rocker deformity may result. In a rocker deformity, infracture of the bone may displace this excessive cephalic portion laterally.

- Vascular supply and lymphatics are found superficial to the nasal musculature (2). The soft-tissue layers in the nose are epidermis, dermis, subcutaneous [this plane contains blood vessels and lymphatics, and also a (typically) thin layer of fat], muscle and fascia (musculoaponeurotic) plane, areolar tissue plane, and perichondrium/periosteum. Dissection during rhinoplasty in the proper tissue planes [areolar tissue plane (i.e., submusculoaponeurotic)] preserves nasal blood supply and minimizes postoperative edema.

- The astute surgeon will be able to anticipate the contour of the upper and lower lateral cartilages by studying the surface topography of the nose.
Anatomy

Figure 11. Nasal relationships.

REFERENCES

Rhinoplasty Analysis

Development of an operative plan that will achieve the desired outcome requires an understanding of the patient's wishes and selection of appropriate surgical maneuvers to effect the proposed changes. The surgeon must be able to identify anatomic constraints that will limit the ability to change contour (thick skin, weak cartilages, etc.). Experience with rhinoplasty over time has shown that detailed anatomic analysis of the nose is an essential first step in achieving a successful outcome. Failure to recognize a particular anatomic point preoperatively will often lead to a less than ideal long-term result.

After you have identified the various anatomic landmarks in Chapter 1, undertake a preoperative rhinoplasty analysis of your patient (cadaver specimen). In this programmatic dissection, you will perform a number of incisions, approaches, and surgical techniques, but it is also important to develop your skills in rhinoplasty analysis. Repeated practice of rhinoplasty-analysis skills will improve your preoperative diagnostic ability. Therefore, in this exercise, determine what the best approach and techniques would be in your specimen. Follow the simplified rhinoplasty-analysis algorithm provided as you examine the face and nose.

Also provided is a more detailed description of terms and a more detailed review of rhinoplasty analysis.

LANDMARKS FOR ANALYSIS (FIG. 1) (Appendix C)

Points

Trichion: Anterior hairline in the midline
Glabella: Most prominent midline point of forehead, well appreciated on lateral view
Nasion: Most posterior midline point of forehead, typically corresponds to nasofrontal suture
Rhinion: Soft-tissue correlate of osseocartilaginous junction of nasal dorsum
Sellion: Osseocartilaginous junction of nasal dorsum
Supratip: Point cephalic to the tip
Tip: Ideally, most anteriorly projected aspect of the nose
Subnasale: Junction of columella and upper lip
Figure 1. Nasal analysis: Landmarks.

- Trichion
- Glabella
- Nasion
- Rhinion
- Supratip
- Tip
- Subnasale
- Labrale superius
- Stomion
- Menton

A

B

C

Cervical Point

Gnathion

Menton
**Rhinoplasty Analysis**

Labrale superius: Border of upper lip  
Stomion: Central portion of interlabial gap  
Stomion superius: Lowest point of upper-lip vermilion  
Stomion inferius: Highest point of lower-lip vermilion  
Mentolabial sulcus: Most posterior midline point between lower lip and chin  
Pogonion: Most anterior midline soft-tissue point of chin  
Menton: Most inferior point on chin  
Cervical point: Point of intersection between line tangent to neck and line tangent to submental region  
Gnathion: Point of intersection between line from subnasale to pogonion and line from cervical point to menton

**LAB EXERCISE: NASAL ANALYSIS**

**General**

*Skin quality:* Thin, medium, or thick  
*Primary descriptor* (i.e., why is the patient here): For example, “big,” “twisted,” “large hump”

**Frontal View**

*Twisted or straight:* Follow brow-tip aesthetic lines  
*Width:* Narrow, wide, normal, “wide–narrow–wide”  
*Tip:* Deviated, bulbous, asymmetric, amorphous, other

**Base View**

*Triangularity:* Good versus trapezoidal  
*Tip:* Deviated, wide, bulbous, bifid, asymmetric  
*Base:* Wide, narrow, or normal. Inspect for caudal septal deflection  
*Columella:* Columella/labial ratio (normal is 2:1 ratio); status of medial crural footplates

**Lateral View**

*Nasofrontal angle:* Shallow or deep  
*Nasal starting point:* High or low  
*Dorsum:* Straight, concavity, or convexity; bony, bony–cartilaginous, or cartilaginous (i.e., is convexity primarily bony, cartilaginous, or both)  
*Nasal length:* Normal, short, long  
*Tip projection:* Normal, decreased, or increased  
*Alar–columellar relationship:* Normal or abnormal  
*Naso–labial angle:* Obtuse or acute

**Oblique View**

Does it add anything, or does it confirm the other views?  
Many other points of analysis can be made on each view, but these are some of the vital points of commentary.
SURFACE ANGLES, PLANES, AND MEASUREMENTS: DEFINITIONS (FIG. 2) (1–5) (Appendix D)

Facial thirds
Upper third: Trichion to glabella
Middle third: Glabella to subnasale
Lower third: Subnasale to menton (Fig. 2A)

Horizontal fifths: Five equally divided vertical segments of the face (Fig. 2B)

Frankfort plane: Plane defined by a line from the most superior point of auditory canal to most inferior point of infraorbital rim (Fig. 2C)

Nasofrontal angle: Angle defined by glabella-to-nasion line intersecting with nasion-to-tip line. Normal, 115 to 130 degrees (within this range, more-obtuse angle more favorable in female, and more acute angle in male patients; Fig. 2D)

Nasofacial angle: Angle defined by glabella-to-pogonion line intersecting with nasion-to-tip line. Normal, 30 to 40 degrees (Fig. 2E)

Figure 2. Surface angles, planes, and measurements. A: Horizontal facial thirds. B: Vertical facial fifths.
Figure 2, continued. C: Frankfort plane. D: Nasofrontal angle.

Figure 2, continued. E: Nasofacial angle. F: Nasomental angle.
Figure 2, continued. G: Relationship of lips to subnasale-to-pogonion line. H: Relationship of lips to nasomental line.

Figure 2, continued. I: Mentocervical angle. J: Legan's angle of facial convexity.
Rhinoplasty Analysis

K

Figure 2, continued. K: Nasolabial angle. L: Nasal projection: method of Goode.

**PEARL**

Normal projection with a "3-4-5" triangle described by Crumley (see later) gives a nasofacial angle of 36 degrees.

Nasomental angle: Angle defined by nasion-to-tip line intersecting with tip-to-pogonion line. Normal, 120 to 132 degrees (Fig. 2F)

Relationship of lips
- To nasomental line: Upper lip, 4 mm behind; lower lip, 2 mm behind line from nasal tip to menton (Fig. 2H)
- To subnasale-to-pogonion line: Upper lip, 3.5 mm anterior; lower lip, 2.2 mm anterior (Fig. 2G)

Mentocervical angle: Angle defined by glabella-to-pogonion line intersecting with menton-to-cervical point line (Fig. 2I)

Legan facial-convexity angle: Angle defined by glabella-to-subnasale line intersecting with subnasale-to-pogonion line; normal, 8 to 16 degree (Fig. 2J)

**PEARL**

Useful in assessing chin deficiency, candidacy for chin implant, chin advancement, or other chin alteration

Nasolabial angle: Angle defined by columellar point-to-subnasale line intersecting with subnasale-to-labrale superius line; normal, 90 to 120 degrees (within this range, more obtuse angle more favorable in female, and more acute in male patients; Fig. 2K)

Columellar show: Alar-columellar relationship as noted on profile view; 2 to 4 mm of columellar show is normal
Nasal projection: Anterior protrusion of nasal tip from face (Fig. 2L)

Goode's method: A line is drawn through the alar crease, perpendicular to the Frankfurt plane. The length of a horizontal line drawn from the nasal tip to the alar line (alar point-to-nasal tip line) divided by the length of the nasion-to-nasal tip line. Normal, 0.55 to 0.60 (2,3)

Crumley's method: The nose with normal projection forms a 3-4-5 triangle [i.e., alar point-to-nasal tip line (3), alar point-to-nasion line (4), nasion-to-nasal tip line (5)] (4).

Byrd's method: Tip projection is two-thirds (0.67) the planned postoperative (or the ideal) nasal length. Ideal nasal length in this approach is two-thirds (0.67) the midfacial height (5)

POWELL AND HUMPHRIES "AESTHETIC TRIANGLE"

Nasofrontal: 115 to 130 degrees
Nasofacial: 30 to 40 degrees
Nasomental: 120 to 132 degrees
Mentocervical: 80 to 95 degrees (3)

RHINOPLASTY ANALYSIS

A thorough physical examination and accurate preoperative analysis are critical to achieving the desired long-term postoperative rhinoplasty result. Some degree of mental organization assists in the execution of the physical examination. Visual examination and finger palpation are equally important in the nasal evaluation. Throughout the evaluation, a mental image of the potential outcome and surgical limitations inherent in every individual should be visualized. In effect, the potential rhinoplasty operation is rehearsed even as the physical examination proceeds (1,6).

Study of the standard preoperative photographic images for rhinoplasty (frontal, base, lateral, oblique) allows a systematic, detailed anatomic analysis that complements the physical examination process. This chapter focuses on analysis of the four standard rhinoplasty photographic views (frontal, base, lateral, oblique). Emphasis is placed on anatomic descriptions of structures and their relationships to other structures.

Analysis begins by examining all four views and making an assessment of the overall stature of the patient, the facial skin quality, and the symmetry of the face. The principle of dividing the face into horizontal thirds and vertical fifths is a useful tool to obtain a general sense of any incongruent areas of the face that may play a key role in nasal appearance and the outcome of nasal surgery. It is essential that these incongruent areas or asymmetries be recognized and discussed with the patient. Thickness and quality of the facial skin—subcutaneous tissue complex must be determined, as it plays a critical role in dictating the limitations of what can and cannot be accomplished with aesthetic nasal surgery (1,6,7).

After completing the general assessment, note and highlight the most striking characteristics of the nose. These are typically the characteristics that bring the patient for rhinoplasty, such as excessive size, deviation, or a dorsal hump. These primary patient concerns must be recognized, highlighted, and addressed above all else.

As the surgeon reviews each photographic image, the major aesthetic and technical points that can be evaluated on a given view are noted first. Subtleties in analysis are then addressed. It is important to recognize both the characteristics of greatest concern to the patient and the more subtle findings. The patient may not notice these other subtle abnormalities if they are left unaddressed by the surgeon. Postoperatively, the scrutinizing patient may notice and point out these abnormalities. Stepwise, methodical analysis of the patient and the photographic views allows the well-trained surgeon to identify significant anatomic and aesthetic points.
Frontal View

On frontal view, the observant surgeon first notes nasal width, any deviation from the midline, and characteristics of the nasal tip. Nasal width can be assessed in the upper, middle, and lower third of the nose. It is important to recognize that a saddle deformity of the bony or cartilaginous dorsum will contribute to the appearance of an overwide dorsum on frontal view, whereas a hump will give the impression of a narrow dorsum. Similarly, a low bony dorsum will create an illusion of a relatively wide upper third of the nose and wide intercanthal distance or pseudohypertelorism (7). This appearance can be significantly improved by augmenting the nasal dorsum. The width of the nasal base on frontal view should approximate the intercanthal distance.

The contour of the curved aesthetic lines that follow the eyebrows, traverse the radix, and continue down along the lateral nasal dorsum to end at the tip-defining points (the brow–tip aesthetic lines) should be followed, and any asymmetries, twists, or deviations noted. These brow–tip aesthetic lines should be smooth, unbroken, gently curved, and symmetric (1,6).

The nasal tip should be characterized on frontal view with regard to symmetry and definition. Concavity or other anatomic findings of the alar sidewall are noted. Vertical and horizontal aspects of bulbosity should be recognized when present. Bifidity of the nasal tip may be visible on this view (but is typically best appreciated on base view). The gentle “gull-in-flight” relationship of the nasal alae to the infratip lobule should be followed, and any asymmetry should be noted. Exaggeration of this curve is suggestive of alar retraction and/or a dependent infratip lobule. If the columella is not visible (“hidden columella”) on frontal view, this also may indicate a retracted columella. The vertical position and symmetry of the alar insertions should be described on the frontal view.

Base View

On base view, special attention should be given to triangularity, symmetry, columella/lobule ratio, and width and insertion of the alar base. The nasal base should be configured as an isosceles triangle with a gently rounded apex at the nasal tip and subtle flaring of the alar sidewalls (Fig. 3) (4,8,9). Poor triangularity or trapezoidal configuration with broad domal angles may suggest abnormal divergence of the intermediate crura. The presence of asymmetry of the tip may best be appreciated on this view. Often one can visualize the outline of

Figure 3. Nasal analysis: Base view. Give special attention to triangularity, symmetry, columella/lobule ratio, and width and insertion of the alar base.
the lower lateral cartilages beneath the thin skin of the columella and alar rim, and asym­metries or buckling can be noted. Overlong or short medial crura may be apparent; a wide columella and flaring of the medial crural footplates should be noted when present. One should look into the nasal vestibule to identify possible recurvature of the lateral aspect of the lower lateral cartilage (lateral crura), which on occasion contributes to nasal obstruction or correlates with an alar concavity seen on frontal view. This recurvature of the lateral crura can be accentuated with application of dome-binding sutures (transdomal sutures, etc.), resulting in nasal airway obstruction. The caudal septum may be seen protruding into a nos­tril. Asymmetric nostrils or protruding medial crural footplates may be a clue of subtle cau­dal septal deviation or asymmetry. Asymmetric orientation of the nostril apices may be indicative of underlying abnormalities of the domal region of the lower lateral cartilages.

The width of the alar base should be noted, with normal width generally being within a vertical line dropped from the medial canthi. Variations in the appearance of width on the base view may be due to the variation in horizontal position of the alar insertions on the face or in the flare of the alar sidewalls. The alar sidewalls themselves are characterized with regard to thickness and flare. Alar base insertions are described by degree of recurva­ture, with straight insertions going directly into the face (i.e., no nostril sill), and extremely recurved alae inserting directly into the columella (4,8,9).

The ratio of the columella to lobule should approximate a 2:1 ratio, and the beginning of the flare of the medial crural footplates should divide the alar base into halves. The nostrils are commonly oriented 30 to 45 degrees toward the midline and are pear-shaped and elongated. The facets or external soft-tissue triangles are attractive when they are well defined but can detract if they are overly conspicuous (4,8,9).

**Lateral View**

The lateral view offers important information on tip projection, nasal length, dorsal profile, and alar–columellar relationship.

The nasal tip should ideally project strongly from the the face and gracefully lead the supratip dorsum, creating a modest supratip break. An identifiable but not overly exagger­ated columellar double break typically marks the junction of the medial and intermediate crus. Nasal tip projection is consistently assessed by using the method described by Goode (see Fig. 2) (2,3). If the length of a line drawn from the tip-defining point perpendicular to a tangent to the alar–facial junction is greater than 0.55 to 0.60 of the line drawn from the nasion to tip-defining point, then the nose may be overprojected. However, when assessing tip projection, relationships between the nose and other aesthetic facial features (chin pro­jection, forehead contour, ethnic background, etc.) must be considered.

Nasal length is complicated to define. The nasal length is compared with the horizontal thirds of the face and the overall stature of the patient to determine whether the nose is of appropriate length. However, the factors contributing to the appearance of nasal length are complex. The nose can be considered to have three lengths, with nasion to tip being the central length, and nasion to alar margin being the lateral lengths. A short or long lateral length may reflect a retracted or hooded ala, respectively, whereas a short or long central length may reflect an obtuse or acute nasolabial (columellar–labial) angle, respectively. Furthermore, a deep nasofrontal angle contributes to the illusion of a short nose, and a shallow nasofrontal angle adds apparent length to the nose (10). In Fig. 4A, three diagrams identical except for the nasofrontal angle illustrate the effect of the nasofrontal angle on the appear­ance of nasal length. Another three diagrams (Fig. 4B), identical except for the nasolabial angle, illustrate the effect of the nasolabial angle on the appearance of length.

The nature of the columellar–labial confluence and columellar–lobular angle (double break) also must be assessed. Webbing or tenting of the columellar–labial confluence should be noted. An overly obtuse columellar–labial angle and/or an exaggerated double break will make the nose appear short, whereas the converse (acute columellar–labial angle and/or absent double break) will add apparent length. A posteriorly inclining lip or de­ficiency of the premaxilla may confound accurate measurement of the columellar–labial
A deep nasofrontal angle and/or an obtuse nasolabial angle contributes to the appearance of a short nose, whereas a shallow nasofrontal angle and/or an acute nasolabial angle adds apparent length. In the first three line drawings (A), the nasolabial angle is the same, whereas the nasofrontal angle is altered to illustrate the effect of the nasofrontal angle on the appearance of nasal length. In the next three drawings (B), the nasofrontal angle is constant, whereas the nasolabial angle varies.

Figure 4. A deep nasofrontal angle and/or an obtuse nasolabial angle contributes to the appearance of a short nose, whereas a shallow nasofrontal angle and/or an acute nasolabial angle adds apparent length. In the first three line drawings (A), the nasolabial angle is the same, whereas the nasofrontal angle is altered to illustrate the effect of the nasofrontal angle on the appearance of nasal length. In the next three drawings (B), the nasofrontal angle is constant, whereas the nasolabial angle varies.

The relationship of the nose to other facial structures also will influence nasal length; for example, a flat forehead will give the illusion of increased nasal length (10).

Byrd (5) described a useful method for determining appropriate aesthetic proportions for tip projection, nasal length, and radix projection. "Ideal" nasal length is two thirds of the midfacial height and is equal to chin vertical. Tip projection is ideally two thirds of this planned or ideal nasal length. Radix projection may be measured from the junction of the nasal bones with the orbit and ideally should be one third of the calculated nasal length.
Byrd recommended the plane of the cornea surface as a preferred reference point for radix projection; from this starting point, the radix projects 0.28 times the ideal nasal length. In Byrd’s report, the radix projected 9 to 14 mm from the plane of the cornea surface (5).

One should be familiar with the aesthetic angles applied in facial analysis as general guidelines for standards of facial aesthetics and facial harmony. Powell and Humphreys aesthetic triangle (nasofacial, nasofrontal, nasomental, and mentocervical angles) and the nasolabial angle or confluence are a few of the more commonly cited measurements (3).

Assessment of the dorsal contour should identify any concavity, convexity, or irregularity. A high dorsum with a slight concavity at the rhinion is generally considered the aesthetic ideal in the white female nose. A high dorsum that is straight or with a small hump is ideal in a white male nose. Other notable components of the dorsum include the nasal starting point, which is ideally positioned at the level of the superior palpebral fold, and the tip–supratip relationship, as previously mentioned.

The ala is analyzed in detail on the lateral view. Insertion of the ala on the face 2 to 3 mm above the columella in the horizontal plane, as described by Crumley (4), is judged to be normal. The contour of the alar rim in profile ideally approximates a “lazy S” shape: one should note if this is normal, exaggerated, or straight. The size of the alar lobule is classified as small, normal, or large. The alar–columellar relationship should be precisely described. The range of normal columellar show is generally considered to be 2 to 4 mm. The complexities of the alar–columellar relationship were categorized by Gunther et al. (11), who identified abnormal positioning of the ala and the columella in relationship to a line drawn through the long axis of the nostril. All patients have a hanging, normal, or retracted ala and a hanging, normal, or retracted columella. Thus nine possible anatomic combinations make up the alar–columellar relationship (Fig. 5).

On lateral view, the long axis of the nostril should rise at approximately 10 to 30 degrees from a plane horizontal to the Frankfurt plane. This is a reliable determinant of the need for operative rotation of the nasal tip (7).

Oblique View

Although it offers the least amount of objective data, this is an important aesthetic view because the nose is most often seen at oblique angles. Several aspects of nasal contour are highlighted on this view and should be assessed. The brow–tip aesthetic lines and the soft-tissue facets are especially prominent and should be carefully assessed, as irregularities may be highlighted on this view. Furthermore, abnormalities of the lateral aspect of the nasal bones, nasal length, dorsal height, and tip projection also may be highlighted on the oblique view.

Overview

There is no “standard” rhinoplasty. Each operation is unique in that it must be tailored to the specific anatomic components involved and the desires of the patient. By developing a consistent, meticulous routine in which the patient’s nose is analyzed with regard to its anatomic components and their complex interrelationships, the surgeon can select the best incisions, approaches, and techniques to achieve the desired surgical outcome.

PEARLS

- The soft-tissue point correlating to the osseocartilaginous junction of the nasal dorsum is the rhinion. The skin at this location is relatively thin compared with the thicker skin of the nasion. This is important to recognize when planning dorsal hump reduction. After hump reduction, this area must be very smooth to avoid visible or palpable irregularities (see Appendix G).
- The nasal starting point typically corresponds to the nasiion. In female patients, it is ideally situated at the same level as the superior palpebral fold.
Figure 5. Nine possible anatomic combinations making up the alar–columellar relationship.
PEARLS, continued

- The nasal tip should be the most anteriorly projecting portion of the nose. The nasal tip should ideally lead the supratip dorsum, creating a modest supratip break.
- A “pollybeak” is a postoperative situation in which the supratip leads the tip. Causes for a pollybeak include underresection of cartilaginous dorsum at the anterior septal angle, excessive scar tissue formation, and inadequate support of the tip, causing postoperative loss of tip projection.
- An identifiable but not overly exaggerated columnellar double break usually marks the junction of the medial and intermediate crus.
- Nasal-tip projection may be consistently assessed by using the method described by Goode. If the length of a line drawn from the tip-defining point perpendicular to a tangent to the alar–facial junction is greater than 0.55 to 0.60 of the line drawn from the nasion to tip-defining point, then the nose may appear overprojected.
- Thickness and quality of the facial skin–subcutaneous tissue complex must be determined, as it plays a critical role in dictating the limitations of what can and cannot be accomplished with nasal surgery.
- Thin skin, strong cartilages, and bifidity: an important anatomic triad. The surgeon must recognize the need to approximate the tip-defining points to improve tip triangularity. The surgeon must recognize the risk of bossa formation if excessive lateral crura is excised (see Appendix G).
- Facial analysis can describe vertical facial thirds: trichion-to-glabella, glabella-to-subnasale, and subnasale-to-menton. However, the hairline is variable, and at times the glabella is not always precisely identifiable. Another method considers the lower two thirds of the face from the nasion to the menton. The nasion-to-subnasale distance is 47% of the total, whereas subnasale to menton is 53% (Fig. 6).
- The astute surgeon will be able to anticipate the contour of the lower lateral cartilages by studying surface topography of the nasal tip.
- The basal view provides information about the shape of the lower lateral cartilages. A trapezoidal nasal base indicates a wide domal angle and indicates the need for a tip technique that will create a more acute dome angle (dome-binding suture, etc.).
- Cephalic positioning of the lateral crura is indicated by the “parenthesis” deformity and lack of lateral wall support.
- The “narrow nose syndrome” is noted in patients with a projecting nose, short nasal bones, and long upper lateral cartilages. These patients are at high risk for inferomedial collapse of the upper lateral cartilages after dorsal-hump excision. These patients frequently need spreader grafts. The contour of the caudal margin of the medial and intermediate crura can frequently be assessed by close examination of the nasal base.

ILLUSIONS IN RHINOPLASTY

- A dorsal convexity or hump frequently gives the appearance of narrowness on frontal view. It also provides the illusion of relative decreased projection. That is, changing the relationship between the dorsum and tip can improve the appearance of projection.
- A low dorsum gives the appearance of increased nasal width due to less shadowing along the lateral nasal wall.
- A saddle deformity of the bony or cartilaginous dorsum will contribute to the appearance of an overwide dorsum on frontal view, whereas a hump will give the impression of a narrow dorsum. Similarly, a low dorsum will create an illusion of a relatively wide upper third of the nose or pseudohypertelorism. This appearance can be significantly altered by augmenting the nasal dorsum.
- A deep nasofrontal angle lends the appearance of a short nose, as does an obtuse nasolabial angle or an accentuated double break.
Rhinoplasty Analysis

Figure 6. Relationship of the lower two-thirds of the face.

REFERENCES

INJECTIVE ANESTHESIA TECHNIQUE

Proper local anesthesia is critical to allow atraumatic dissection with minimal bleeding and edema. A total volume of less than 3 ml of 1% lidocaine with 1:100,000 epinephrine is typically used to attain anesthesia for rhinoplasty alone. When performing septorhinoplasty, as much as 10 ml of local anesthetic may be used. The anesthetic is allowed to take effect for at least 15 minutes to maximize the vasoconstrictive effect of the epinephrine.

To become familiar with a method of injection of local anesthetic agent, saline can be injected with a 5-ml syringe and 27 gauge (1.5 cm) needle along the site of injection in your cadaver specimen. Injection varies in some respects, based on the surgical approach selected; for example, the subdermal columellar injection may be omitted in an endonasal approach. A generalized approach to injection is described below. For a septrhplasty, multiple 0.5-ml to 1.0 ml injections are made in the subperichondrial and subperiosteal plane along the entire area of anticipated dissection. Injections also should be placed along the site of the proposed incision (Killian, hemitransfixion, etc.). Both sides of the septum should be injected if the surgeon plans to elevate mucosa bilaterally. The injection will aid in the dissection if placed in the subperichondrial plane. It is helpful to place an injection on the posterosuperior septum bilaterally to minimize bleeding from the sphenopalatine blood vessels.

Inject local anesthetic into the subdermal plane in the midline of the columella from tip-defining points to the nasal spine in preparation for the external approach (Fig. 1). This injection is limited to <0.3 ml to prevent distortion of the columella or nasal base. For either endonasal or external approach, inject <0.3 ml of local anesthesia into the soft-tissue between and around the domes of the lower lateral cartilages (Fig. 2). The injection extends up to the region of the anterior septal angle. After completing this injection, gently massage the domal region between the thumb and index finger of both hands to disperse the anesthetic throughout the tip region. Place multiple injections of 0.1 ml of local anesthetic along the caudal margin of the lateral and intermediate crura (along the planned marginal incision; Fig. 3). Overinjection will result in distortion of the nostril rim and soft-tissue triangle. Inject <0.1 ml to raise a small bleb in the vestibular skin along the lateral aspect of the
Figure 1. Inject <0.3 ml of local anesthetic into the subdermal plane in the midline of the columella from tip-defining points to the nasal spine in preparation for the external approach. This injection of the columella is necessary for the external approach but may not be necessary for most endonasal approaches.

Figure 2. Inject <0.3 ml of local anesthetic into the soft tissue between the domes of the lower lateral cartilages. Injection of the supratip is illustrated here as a percutaneous injection but also may be performed endonasally.

Figure 3. Place multiple injections of 0.1 ml of local anesthetic along the caudal margin of the lateral and intermediate crura (along the planned marginal incision).
medial crura, at the planned incision site for the columellar flap of the external rhinoplasty approach (Fig. 4).

For an intercartilaginous, transcartilaginous, or delivery approach, place similar injections of 0.1 ml intranasally along the respective incision sites (Fig. 5).

After inserting the needle between the upper and lower lateral cartilages (intercartilaginous), inject local anesthetic along the lateral wall of the nose approximately 1 cm off the midline (Fig. 6). The line of injection is along the lateral aspect of the nose and extends from the nasofrontal suture line to the cephalic margin of the lateral crura. Use <0.5 ml for this injection to prevent distortion of the tissues. Perform no injections along the dorsum of the nose to prevent distortion of the soft tissue that may inhibit accurate evaluation of the contour of the dorsum. In preparation for lateral osteotomies, inject on the outside and inside of the nasal bones just above the periosseum. After completing these injections, massage the injection sites to help disperse the local anesthetic and prevent tissue distortion.

PEARLS

- Subperichondrial and subperiosteal injections of local anesthetic will make dissection of the septal flap easier by hydrodissecting the flap. This is particularly...
Figure 5. For an intercartilaginous, transcartilaginous, or delivery approach, place injections of 0.1 ml intranasally along the incision site.

PEARLS, continued

- Helpful when dissecting over fractures in the cartilage, bone, or along the maxillary crest.
- Injection of the osteotomy sites should be performed on the inside and outside of the ascending process of the maxilla.
- Avoid excessive injection of local anesthetic into the columella; otherwise the relation between the ala and columella may be altered.
- In cases in which dorsal hump excision must extend into the region of the nasofrontal angle, additional injections of local anesthetic can be placed along the path of the supratrochlear artery and just medial to the medial canthus.
- If the surgeon plans to use lateral crural strut grafts, injections of local anesthetic can be placed in the vestibular skin on the undersurface of the lateral crura where the vestibular skin will be dissected.
Figure 6. A. Injection of local anesthetic along the lateral wall of the nose. B. Injection for lateral osteotomies.

REFERENCES

Septoplasty

NASAL DISSECTION: SEPTOPLASTY WITH CARTILAGE HARVEST

Hemitransfixion Incision with Anterior Septal Tunnels

1. Retract the columella with a small nasal speculum, multitoothed Brown–Adson forceps, large two-prong hook, or another suitable instrument. This maneuver exposes the caudal margin of the septum (1,2).

2. Make a hemitransfixion incision along the caudal border of the cartilaginous septum with a no. 15 blade or no. 15-C blade. In this exercise, a hemitransfixion incision extending from the anterior septal angle to the posterior septal angle is used to gain access to the caudal septum. A Killian incision can be used if access to the caudal septum is not necessary (Fig. 1A).

3. In rare cases, the nasal spine should be exposed.

4. With a no. 15 blade, small, sharp-pointed scissors, or other suitable instrument, incise the perichondrium of the septum adjacent to the caudal septum on one side.

5. Perform a subperichondrial dissection along the lower half of the septum to allow harvesting of septal cartilage. Do not extend this dissection too high, so that later in the dissection a precise pocket tunnel can be made to place a spreader graft via an endonasal approach.

6. Repeat maneuver 5 on the opposite side of the septum.

7. If the septum needs any shortening, now may be a good time to perform selective excision of the caudal aspect of the septum (Fig. 1B–D). If rotation of the nasal tip is necessary, a superiorly based triangle of caudal septum can be excised (Appendix F). For an obtuse nasolabial angle, the posterior septal angle can be trimmed. For a tension nose deformity (3) or hanging-columella deformity, the entire caudal septum may need to be trimmed. Instead of resection, an overly long midline caudal septum can be sutured between the medial crura to provide support, increase projection, and set tip-rotation and alar–columellar relation.
Figure 1. A: A hemitransfixion incision (short dotted lines) or a Killian incision (longer dotted lines) may be used to perform septoplasty. B: Conservative excision in an overlong septum of a thin wedge of caudal septum to decrease columellar show or shorten the nose. C: Excision of a wedge of caudal septum with the base of the excised wedge anterior, for increased rotation. D: Excision of excessive septum at the posterior septal angle to decrease fullness of the nasolabial angle.
Sepal Surgery with Harvesting of Cartilage

Carry out a routine septoplasty or submucous-resection operation. To harvest septal cartilage, disarticulate the cartilaginous septum from its bony attachment (osseocartilaginous junction), leaving an ample attachment superiorly (dorsally) at the “Keystone” area. Incise the cartilage dorsally and caudally, preserving ≥15 mm anteriorly to support the nasal tip, and being sure that ≥15 mm will remain dorsally after hump removal (Fig. 2). Preserve this harvested septal cartilage for use as struts or grafts later on in this exercise. If inadequate septal cartilage is available, plan to harvest auricular cartilage for grafting purposes.

Note: We have described septoplasty via a hemitransfixion or a Killian’s incision. A viable alternative is to approach the caudal septum directly by performing an external rhinoplasty approach and separating the medial crura, thereby coming upon the caudal septum (Fig. 3). Septoplasty may then proceed as described earlier. Although this approach avoids the need for a septal mucosal incision, it is a more complex approach and carries with it a higher risk of loss of tip support if appropriate supportive maneuvers (e.g., columellar strut, caudal extension graft) are not undertaken. This approach is ideal in patients who have an overly long midline caudal septum (tension nose deformity). In these cases, the medial crura can be dropped back and sutured to the midline caudal septum. This maneuver will allow shortening of the nose, deprediction of the nasal tip, or correction of the hanging columella deformity.

PEARLS

- Special care must be taken to be sure the dissection is in the subperichondrial plane. If there is any blood-tinged tissue over the surface of the cartilage, there may be a layer of perichondrium left on the cartilage.
- To correct a spur along the floor, a subperistosteal tunnel can be dissected along the floor and connected to the dissection above the junction of the septum and maxillary crest. This method of dissection will minimize the chance of tearing the mucosal flap along the maxillary crest.
- If the surgeon plans to apply spreader grafts into precise submucosal tunnels, a bridge of mucosa should be left on the dorsal septum. This will allow the surgeon to create tunnels under the junction of the upper lateral cartilages and septum to accept the grafts.
- If the surgeon plans to approach the caudal margin of the septum to correct defor-
Figure 3. To perform septrhinoplasty, a viable approach to the septum is to perform an external rhinoplasty approach and separate the medial crura, thereby coming upon the caudal septum, and then proceeding with elevation of mucoperichondrial and mucoperiosteal flaps in standard fashion. Before dissection, local anesthetic should be injected between the medial crura and into the vestibular skin caudal to the caudal septum. While an assistant holds the lower lateral cartilages laterally (A), the surgeon dissects between the medial crura (B) until the caudal septum is identified (C). Special care must be taken to remain in the proper plane between the crura. The mucoperichondrial flaps are next further developed with an elevator (D). The dorsal septum can be divided from the upper lateral cartilages in an anteriorto-posterior direction (E) after both mucoperichondrial flaps have been elevated to the junction of the upper lateral cartilage and septum (extramucosal dissection). This will allow preservation of continuity of the intranasal mucosa while dividing the upper lateral cartilages from the dorsal septum. Bilateral mucoperichondrial flaps are developed for wide access to the septum (F). Appropriate supportive maneuvers (e.g., columellar strut, caudal extension graft) are undertaken because of the risk of loss of tip support. With an overly long caudal septum, the medial crura can be sutured back on a midline caudal septum to provide support and set tip position.
PEARSLS, continued

mity or to shorten the septum, the septum can be approached through the external rhinoplasty approach.

- After dissecting between the medial crura to approach the septum, the medial can be dropped back and sutured to an overly long midline caudal septum. This maneuver will create a more rigid nasal tip without normal tip recoil.
- If significant bleeding is noted, the surgeon can reinject the mucosal flaps and place neurosurgical pledgets bilaterally to compress the mucosal flaps.

REFERENCES

Incisions and Approaches

Incisions are methods of gaining access to the bony and cartilaginous structures of the nose and include transcortilaginous, intercartilaginous, marginal, and transcolumnellar incisions. Approaches provide surgical exposure of the nasal structures including the nasal tip and include cartilage-splitting (transcartilaginous incision), retrograde (intercartilaginous incision with retrograde dissection), delivery approach (intercartilaginous, marginal incisions), and external (transcolumnellar and marginal incisions). Based on an analysis of the individual patient's anatomy, appropriate incisions, approaches, and tip-sculpturing techniques are selected (1) (Appendix E).

In this section, a transcortilaginous incision is performed on one side. Then an intercartilaginous and marginal incision is made on the other side to deliver that cartilage. Next, proceed with the external rhinoplasty approach. Following these instructions will allow an experience with several incisions and approaches in a single specimen.

TRANSCARTILAGINOUS INCISION OR CARTILAGE-SPLITTING APPROACH

As demonstrated in the accompanying figures, use a two-prong retractor and the middle finger of the nondominant hand to expose the lower lateral cartilage (LLC).

Locate the caudal and cephalic margins of the lateral crus. (The surgeon must identify the cephalically positioned lateral crus when it is present before executing this incision.) Make an incision through vestibular skin only 5 mm to 8 mm cephalic to the caudal margin of the lateral crus of the LLC incision. Figure 1 illustrates the site of a transcortilaginous incision and the more cephalic location of an intercartilaginous incision. With scissors, dissect free the vestibular skin in a cephalic direction to just beyond the cephalic edge of the lateral crus (Fig. 2). Then incise the lateral crural cartilage and free the cephalic portion (to be removed) from its remaining soft-tissue attachments by dissecting superficial to it in the supraperichondrial plane. Use a skin hook to retract the caudal vestibular skin and another skin hook to retract the nostril margin. An assistant may hold the skin hook that retracts the nostril margin, while the surgeon grasps the cartilage to be removed and completes the excision by dividing any last soft-tissue attachments with scissors (Fig. 3) (1,2).
Figure 1. Retraction with a wide two-prong retractor and the middle finger of the nondomi­nant hand exposes the transcortilaginous incision site and also the more cephalically lo­cated intercartilaginous incision site.

Figure 2. In a cartilage-splitting approach, dissect the vestibular skin in a cephalic direction to just beyond the cephalic edge of the lateral crus. Then assess how much lateral crus should be removed, and incise the lateral crural cartilage. Be sure to leave $\geq 7\,\text{mm}$ to $9\,\text{mm}$ of intact strip.
Figure 3. A: Use a skin hook to retract the caudal vestibular skin and the nostril margin. Free the cephalic portion (to be removed) from its remaining soft-tissue attachments by dissecting superficial to it in the supraperichondrial plane. Grasp the cartilage to be removed, and complete the excision by dividing any last soft-tissue attachments with scissors. B: The cartilage incision must come far enough medially to include the cephalic lateral crus at the dome region, or else supratip fullness may persist. However, it is important not to incise too far inferomedially, or the cartilage (which is typically narrow at this region) may be excessively weakened or divided. C: A 30-gauge needle placed percutaneously at the dome can help guide the medial aspect of the transcartilaginous incision in selected cases.
DELIVERY APPROACH (PERFORM ON SIDE OPPOSITE CARTILAGE-SPLITTING APPROACH)

Intercartilaginous Incision

By using a two-prong retractor, evert the caudal margin of the nostril and, by applying pressure with the middle finger of the nondominant hand, reveal the gap between the caudal margin of the upper lateral and the cephalic margin of the lower lateral cartilages. With a scalpel, make an intercartilaginous incision in this location (Fig. 4) (1, 2).

Figure 4. A–C: Intercartilaginous incision. D: For an intercartilaginous approach, bilateral intercartilaginous incisions are connected in the midline over the anterior septal angle, and the incision extends anterior to the caudal septum as a high partial-transfixion incision. Exposure of the middle and upper nasal vault proceed as described in the text. E: After completion of the intercartilaginous approach, a Converse retractor (or other appropriate retractor) may be inserted through the incisions, beneath the skin/soft-tissue envelope, to provide exposure of the upper two thirds of the nose.
Marginal Incision

By using a two-prong retractor, evert the caudal margin of the nostril in which an intercartilaginous incision was made and, by applying pressure with the middle finger of the nondominant hand, define the caudal margin of the lower lateral cartilage. Pressing cephalad on the nasal dome will cause the caudal margin to appear laterally. Remember that the non-hair-bearing area is a guide to the caudal margin of the lateral crus. Furthermore, palpation of the cartilage edge with the handle of the scalpel can be helpful before cutting. By using the two-prong retractor to obtain proper exposure, make the marginal incision just caudal to the caudal edge of the lower lateral cartilage (Fig. 5). Great care must be taken as the lateral incision nears the midline. Make sure that the incision follows the cartilage edge and does not take a “short-cut” along the alar rim, which can damage the facet area. Great care must be taken not to cut across a narrow dome or intermediate crus (1,2).

Delivery of lower lateral cartilages

At this stage, an intercartilaginous incision and marginal incision on one side and a transcartilaginous incision on the other side have been made. Reinsert the two-prong retractor into the nostril with the intercartilaginous and marginal incisions and present the caudal margin of the lower lateral cartilage with the aid of pressure from the third finger of the nondominant hand.

Use a slightly curved, fine-pointed dissecting scissors to lift and dissect the soft tissues from the surface of the lower lateral cartilage (Fig. 6). Perform this dissection by inserting scissors into the marginal incision laterally and then separate the perichondrium of the lower lateral from the overlying external skin and soft tissue with a spreading motion. If this is difficult, caudal traction on the vestibular skin underlying the lower lateral cartilage, with a fine two-prong hook, will facilitate this maneuver (Fig. 7) by pulling the lateral crus into the vestibule and thus opening up the potential dissecting plane. Avoid damaging the overlying muscle and nasal vasculature (1,2).

Figure 5. Marginal incision. The nondominant hand is critical to obtain proper exposure.
Figure 6. Dissect the soft tissues from the superficial surface of the lower lateral cartilage.

Do not work too far laterally. The lateral one fourth of the lower lateral cartilage should be avoided by the surgeon in nearly all cases.

Place the hook end of a Nievert retractor through the intercartilaginous incision and draw the now-free lateral crus down, like a visor, until it appears outside of the vestibule. It can be held in this position by the Nievert or by another suitable instrument (Fig. 8).

Examine the lower lateral cartilages for unique anatomic features and asymmetries.

Figure 7. Caudal traction on the vestibular skin underlying the lower lateral cartilage with a fine two-prong hook pulls the lateral crus into the vestibule and opens the potential dissecting plane.
THE EXTERNAL (OPEN) RHINOPLASTY APPROACH

Background

The external rhinoplasty approach to the nose provides maximal exposure of the lower lateral cartilages, upper lateral cartilages (ULCs), middle nasal vault, and bony nasal vault. These supportive structures can be manipulated in a precise and symmetric fashion. The increased exposure facilitates accurate suture placement and fixation of cartilage grafts. The external rhinoplasty approach also facilitates diagnostic capability and is a tremendous aid in teaching rhinoplasty (3-10) (Appendix K).

The incisions used in this approach include a transcolumellar incision connected to bilateral marginal incisions. The actual configuration of the transcolumellar incision is not as critical as the placement of the incision. The incision should be made at the level of the midcolumella where the caudal margins of the medial crura lie close to the skin and can support the incision to help prevent a depressed scar. An inverted-V incision, or some other broken-line incision, is used to break up the scar and lengthen it to minimize scar contracture. The surgical dissection must be performed in the proper areolar tissue planes to minimize tissue damage and scarring, maintain hemostasis, and maximize redraping of the skin/soft-tissue envelope. Dissection in proper tissue planes will help preserve vascular structures of the flap, ensure flap viability, and minimize bleeding, postoperative edema, and scarring (11).

NASAL DISSECTION: EXTERNAL (OPEN) RHINOPLASTY APPROACH

Marking the Transcolumellar Incision

Begin the dissection by outlining the transcolumellar incision used in the external rhinoplasty approach with a marking pen. Mark an inverted-V transcolumellar incision at the level of the midcolumella (Fig. 9). The midcolumellar incision should be marked midway between the top of the nostril and the base of the columella, where the caudal margin of the medial crura lie just beneath the skin, to provide support for the incision. The midcolumellar incision will be connected to bilateral marginal incisions, which are placed just caudal to the caudal margin of the lateral crura (Fig. 10). The marginal incision should not be made along the rim of the nostril (rim incision). The marginal incision may be marked with a marking pen as well.
Figure 9. A–C: Inverted-V incision on the midcolumella, at a level where the margin of the medial crura lies just beneath the skin.

Figure 10. A, B: Marginal incisions are placed just caudal to the caudal margin of the intermediate and lateral crura.
Midcolumellar Incision

By using a no. 11 blade with a "sawing" motion, follow the midcolumellar markings to complete the midcolumellar incision (Fig. 11). Proceed medial to lateral on one side of the columnella and then the other. Take special care to keep the blade perpendicular to the skin edges, thereby preventing beveling of the skin edges. (Beveling of the skin edges may lead to a "trapdoor" deformity with eventual unacceptable scar). While incising laterally, be careful to stay superficial to avoid damage to the caudal margin of the medial crura. Use a no. 15 blade to make the columellar extension of the marginal incision on both sides of the columnella, 1 to 2 mm behind the leading edge of the columnella (Fig. 12). This incision is made along the caudal margin of the medial and intermediate crura. By minimizing the dissection over the medial crus, damage to this cartilage can be avoided.

Figure 11. A–C: Midcolumellar incision made by using a no. 11 blade with a sawing motion. Keep the blade perpendicular to the skin edges, and stay superficial to avoid damage to the caudal margin of the medial crura.
Marginal Incision

Beginning laterally, make a light incision through vestibular skin 1 to 2 mm caudal to the caudal margin of the lateral crura. Follow the caudal margin of the lateral crura as the incision is extended medially. (The dissector has already made the marginal incision on one side; here simply make a marginal incision on the other side.)

Define the Columellar Flap

By using angled Converse scissors, or another suitable dissecting scissors, elevate the thin vestibular skin of the flap that covers the medial crura. Insert the scissors beneath the columellar extension of the marginal incision and dissect medially in the correct plane of dissection, below the musculoaponeurotic layer (Fig. 13). The scissors should then pass superficial to the caudal margin of the ipsilateral and then contralateral medial crus (Fig. 14). Guide the scissors through the opposing columellar extension of the marginal incision (Fig. 15). During this dissection, take special care to avoid damaging the flap or the caudal margin of the medial crura. Use the scissors to spread the tissues in the plane of dissection (Fig. 16). If not positioned properly, the dissector may cut through the caudal margin of the medial crura. To avoid this, the dissector must remain caudal to the medial crura and dissect very carefully.

Flap Elevation

Use the Converse scissors to complete the midcolumellar incision without beveling the incision or damaging the medial crura (Fig. 17). Take special care to avoid beveling this incision. Use a narrow double-prong hook to retract the flap. The paired columellar arteries may be seen, and typically must be cauterized with bipolar cautery.

Figure 13. To elevate the thin vestibular skin of the flap that covers the medial crura, insert the scissors beneath the columellar extension of the marginal incision and dissect medially in the correct plane of dissection, below the musculoaponeurotic layer. If one meets resistance, they can alternate dissection to the contralateral side of the columella.
Figure 14. The scissors pass superficial to the caudal margin of the ipsilateral and then contralateral medial crus.

Figure 15. Guide the scissors through the opposing columellar extension of the marginal incision.
Figure 16. A, B: Spread the tissues in the plane of dissection.

Figure 17. A, B: Complete the midcolumellar incision. Do not bevel the skin edges, or an unacceptable scar (due to a trapdoor deformity) may result.
Three-Point Countertraction

To elevate the skin/soft-tissue envelope over the nasal tip, (a) place a wide double-prong hook along the margin of the nostril rim caudal to the lateral crus, (b) place a small double-prong hook on the columellar flap, and (c) place a small double-prong hook on the vestibular skin side of the intermediate crus (Fig. 18). Then use Converse scissors to dissect the columellar flap from the caudal margin of the medial and intermediate crus, as the countertraction acts to expose the areolar tissue plane. The scissors are used to expose the caudal aspect of the lateral crus as well. Then the dissection advances cephalically over the surface of the lateral crus. As the dissection continues along the surface of the lateral crus, soft tissue is elevated, leaving only perichondrium on the cartilage. As dissection proceeds laterally along the lateral crus, cut the vestibular skin along the caudal margin of the lateral crus, thereby completing the marginal incision. Make small, calibrated cuts under direct vision to avoid inadvertently cutting through the lateral crus. Limit dissection of the lateral crus to the areolar tissue plane deep to the muscle. A cotton-tip applicator can be used to complete the dissection of the lateral crus once the deep areolar tissue plane has been identified. A portion of the dissection on the opposite side was performed with the cartilage delivery approach; nevertheless, repeat these maneuvers on the opposite side to complete elevation of the skin/soft-tissue envelope over the nasal tip.

[An alternative approach to this dissection is to begin dissection through the marginal incisions (retrograde dissection) (12).] In this approach, identify the proper tissue plane, and elevate the skin/soft-tissue envelope off the lateral crus. Then proceed medially with scissor dissection toward the domes and intermediate crura. This maneuver is performed bilaterally to achieve elevation of the skin/soft-tissue envelope.

This retrograde dissection is helpful if the surgeon is having difficulty following the caudal margin of the intermediate and lateral crus. This is not unusual in cases in which there is buckling of the intermediate crus or domes. Retrograde dissection generally is not the approach of choice for secondary rhinoplasty, as the lateral crura may have been excised or previously dissected.

[Examine the lateral crus on the side of a transcartilaginous incision and cephalic trim. Evaluate the excision of cephalic cartilage. Was it stopped too short, leaving cephalic lateral crus at the dome region? Did the incision go too far; was the dome inadvertently divided? Was too much cartilage taken? Measure the amount of lateral crus remaining; there should be at least 7 mm to 9 mm.]

Figure 18.
Incisions and Approaches

Figure 18. A, B: With three-point countertraction exposing the areolar tissue plane, use Converse scissors to dissect soft tissue from the caudal margin of the intermediate and lateral crus. Dissection of the skin/soft-tissue envelope proceeds in the deep areolar plane below the muscle, leaving only perichondrium on the cartilage. C: As dissection proceeds laterally, follow the caudal edge of the lateral crus and cut the marginal incision. Make only a very small cut at a time, and take great care to avoid cutting the cartilage. D: As dissection continues laterally, the marginal incision is extended laterally as described above. E: When dissecting the proper tissue plane, a cotton-tip applicator can be used to sweep soft tissue off of the lateral crus. F: Completed exposure of the left lateral crus via the external approach. G: Dissection has been completed of both the left and right lateral crus, and attention will now be directed toward the midline.
Midline Dorsal Dissection

Divide fibrous connections in the midline near the surface of the domes to release the flap and allow dissection cranially (Fig. 19). Do not dissect tissue from between the domes; otherwise a midline band of tissue may be left on the flap. Shift the dissection to the midline, where the anterior septal angle is identified with a spreading action of the Converse scissors or other suitable dissecting scissors. Once the blue hue of the cartilaginous middle third of the nose has been identified, create a midline tunnel over the cartilaginous middle vault. Then use a cotton-tip applicator to dissect bluntly the soft-tissue envelope cranially and laterally (Fig. 20). This maneuver will frequently expose sizable blood vessels that can be spared, as they are dissected laterally. Depending on the degree of exposure that is needed, some fibrous connections may need to be cut near their attachment to the cartilaginous nasal vault (Fig. 21). Muscle and vessels can be spared by dividing tissues close to the surface of the cartilages.
Incisions and Approaches

Figure 19. A–C: Shift the dissection to the midline, and divide fibrous connections in the midline near the surface of the domes to release the flap and allow dissection cranially. Do not dissect tissue from between the domes; otherwise, a midline band of tissue will be left on the flap. With a spreading action of the Converse scissors or other suitable dissecting scissors (D, E), identify the blue hue of the cartilaginous middle third of the nose, and create a midline tunnel over the cartilaginous middle vault (F).

Figure 20. A: If dissection proceeds in the proper tissue plane, a cotton-tip applicator can assist in the exposure. B: Divide the decussating fibers (apply bipolar cautery first) to connect the dissected spaces over the middle vault and lateral crura.
Exposure of Cartilaginous and Bony Dorsum

**Exposure of the Cartilaginous Vault**

The cartilaginous vault, typically corresponding to the middle third of the nose, can be exposed as described earlier. Alternatively, as with a cartilage-splitting, retrograde, or delivery approach, the skin/soft-tissue envelope can be exposed either by using sharp scalpel dissection or by scissor dissection in the supraperichondrial plane.

Use a scalpel (no. 15 blade) or long, slightly curved dissecting scissors to elevate the soft tissues in the midline, working up toward and just beyond the rhinion, inserting and opening, but not cutting, with the blades under the skin.

Lay bare the perichondrium of the ULC in the midline but do not extend too far laterally at this stage. Take special care not to follow the ULC below the caudal margin of the nasal bones. Such a maneuver may result in disarticulation of the ULCs from the nasal bones.

**Elevation of Periosteum/Exposure of Bony Vault**

Under direct vision by using an Aufricht or Converse retractor, use a Joseph periosteal elevator or other appropriate instrument to cut through the periosteum 2 mm cephalad and parallel to the caudal margin of the nasal bones (Fig. 22).

Alternatively, palpate the junction between the nasal bone and ULCs with the Joseph elevator beneath the skin/soft-tissue envelope by gently allowing the Joseph to "fall" off the nasal bone onto the ULCs as it is withdrawn. The Joseph elevator can then be seated 2 mm above this junction with certainty, and the periosteum incised. Elevate the periosteum off the bony nasal vault up to the nasion. Then elevate in the subperiosteal plane over the bony dorsum toward the midline and laterally (Fig. 23). Execute these maneuvers bilaterally (Fig. 24). Do not extensively undermine over the side walls of the bony nasal pyramid at
Incisions and Approaches

Figure 22. Subperiosteal dissection over bony nasal vault up to the nasion.

Figure 23. Cross section at level of nasal bones, illustrating dissection in subperiosteal plane. Lateral and medial motion of the elevator achieves this elevation in the subperiosteal plane.

Figure 24. After bilateral elevation, the midline decussating fibers remain undivided. These generally are severed with scissors.
this stage. Next, sever the midline internasal suture attachments; this can be accomplished with scissors or sharp elevator. Make sure that the nasal skeleton is completely freed from the overlying skin. Pass an elevator or similar instrument from side to side over the bony-cartilaginous dorsum. This completes the execution of the external rhinoplasty approach.

[The disector now has exposure via the external rhinoplasty approach. When achieving exposure via an endonasal approach, the intercartilaginous or transcartilaginous incisions are typically connected caudally in the midline and continue over the caudal septum as a high partial-transfixion incision, as described previously (see Fig. 4D and E). Direct visualization of the nasal dorsum is thus achieved with the aid of an Aufricht or Converse retractor inserted through the intercartilaginous or transcartilaginous incision.

[Note: If the disector wishes to place spreader grafts via a precise pocket endonasal approach, it should be undertaken now. The technical steps are described in Chapter 8. Later, after hump removal (Chapter 6) and osteotomies (Chapter 7), the disector will place spreader grafts via the external rhinoplasty approach.

**PEASES**

- If the surgeon plans to place a dorsal graft or radix graft, a precise pocket can be made over the upper dorsum and/or radix. This will allow the surgeon to place the graft into a precise pocket and minimize the chance of graft migration.
- If the surgeon plans to place an alar batten graft, the lateral extent of the dissection should be minimized.
- During the external rhinoplasty approach, elevation of the skin/soft-tissue envelope from the underlying supportive structures of the nose results in disruption of the minor tip-support mechanism provided by the attachment of the skin/soft-tissue envelope to the lower lateral cartilages. To help offset this loss of tip support, a columnellar strut cartilage graft can be sutured in a pocket between the medial crura. Such a strut is used to support the medial crura to preserve tip projection and not necessarily to increase tip projection (Appendix F).
- The columnellar extension of the marginal incision should be placed only 1 to 2 mm behind the face of the columnella to minimize dissection of vestibular skin and to avoid damage to the caudal margin of the medial crura.
- When advancing the converse scissors across the columnella to the opposite marginal incision, special care should be taken to remain caudal to the medial crura.
- Dissect in the tissue plane just above the perichondrium. Avoid violating the muscle layer.
- During dissection, follow the caudal margin of the lower lateral cartilages. If the caudal margin is lost sight of, move laterally to pick up the lateral crus, and dissect retrograde to avoid cutting across a buckled intermediate crus or deformed dome.
- Precise closure of the midcolumnellar incision, with meticulous alignment of the skin edges, is critical to prevent an unsightly scar. Principles of skin-edge eversion and tension-free closure will also help prevent a visible scar. Vertical mattress-suture closure aids in skin-edge eversion.

**REFERENCES**


Removal of Bony–Cartilaginous Hump

In this exercise, the cartilaginous and bony hump are removed en bloc. Be conservative! Plan to take a small amount of the hump off at first and thereby avoid incising the mucoperichondrium, which provides important support. Later, after the bony–cartilaginous hump has been removed, be prepared to make multiple fine adjustments of both the septum and dorsal margins of the upper lateral cartilages. When lowering the dorsal septum, keep in mind the importance of allowing for the thicker skin over the lower one third of the nose. Also, recognize that inadequate resection at the supratip may result in a polly-beak deformity. (Appendix G)

[Note: The dissector may wish to incise the skin/soft-tissue envelope down the midline either now or subsequent to this chapter. The hump excision may be done first, and then split the skin to examine the result and allow easy exposure for subsequent maneuvers. If the dissector intends to augment the dorsum with a cartilage graft, this may be done first, and then split the skin for easy exposure during the remaining dissection. The skin in the midline can be sutured back together as desired at any time.]

Expose the cartilaginous dorsum with a Converse retractor, and use a no. 15 blade to incise lightly any remaining soft tissue overlying the cartilaginous dorsum. Reflect this tissue laterally on both sides. Next, beginning at the osseocartilaginous junction and proceeding caudally, incise the cartilaginous dorsum at the planned level of initial excision (Figs. 1 and 2). Try to keep this incision even on both sides, but remember that there will be additional “fine-tuning” modifications after initial hump excision.

Under direct vision, place an osteotome against the bony hump at the osseocartilaginous junction (Fig. 3). Use the incised but attached cartilaginous dorsum to help seat the osteotome at this location. With a gentle, controlled two-tap technique, incise the bony hump with the osteotome (Fig. 4). Take care not to overresect the bony hump, as the osteotome will tend to cut deeper into the bone. Remove the hump with a hemostat or similar instrument, and examine its features (1,2).

When executing hump excision, preserve the underlying nasal mucoperichondrium. The nasal mucoperichondrium provides support to the upper lateral cartilages and helps decrease the risk of inferomedial collapse of the upper lateral cartilages after hump excision (Fig. 5). (Inferomedial collapse of the upper lateral cartilages and inadequate infracture of
Figure 1. Beginning at the osseocartilaginous junction and proceeding caudally, incise the cartilaginous dorsum at the planned level of initial excision. This amount of excision is larger than normally performed. Most patients would require smaller dorsal hump excisions.

Figure 2. At this stage, the cartilage remains attached at the osseocartilaginous junction.

Figure 3. Under direct vision, insinuate an osteotome against the bony hump at the osseocartilaginous junction. Use the incised but attached cartilaginous dorsum to help seat the osteotome at this location.

Figure 4. A,B: With a gentle, controlled, two-tap technique, incise the bony hump with the osteotome. Careful examination of the excised hump can help guide additional calibrated excision of remnant cartilage or bone. Assess whether the nasal mucoperichondrium was successfully avoided. C,D: Patient underwent dorsal hump excision and application of radix graft. E,F: Conservative dorsal hump excision leaving high profile.
Figure 5. Cross-section at the level of the cartilaginous vault (A). The nasal mucoperichondrium provides support to the upper lateral cartilages and helps decrease the risk of inferomedial collapse of the upper lateral cartilages after hump excision (B, C). When the nasal mucoperichondrium is violated, inferomedial collapse of the upper lateral cartilages may occur (D, E).

the nasal bones can lead to an “inverted V deformity,” in which the upper lateral cartilages collapse inferomedially, and the caudal edges of the nasal bones are visible in broad relief, creating an unacceptable appearance. (3,4) (Appendix G)

Now make additional fine-tuning modifications to the cartilaginous dorsum as indicated. Examination of the excised hump may guide any additional excision. Trim the anterior (dorsal) margins of the upper lateral cartilages such that they lie on a level with or just below that of the trimmed border of the septum. Additional modification of the bony dorsum also may be required.

An “open roof” may be created by hump removal. The bony margins should now be smoothed with a rasp by using few but firm strokes (Fig. 6). Any bony fragments should be removed, making sure that all obvious particles are removed from under the skin/soft-tissue envelope.

An alternative to the manual rasp is a powered reciprocating rasp or sheathed burr (Figs. 7 and 8) (5). These instruments can be used wherever a manual rasp would be used, but with less soft-tissue trauma. The site to be treated can be directly visualized. The powered instruments are especially useful to smooth the bony margins of the open roof. They also are useful to correct isolated bony irregularities that may be encountered, for example, in secondary rhinoplasty. It appears that a more reproducible result can be obtained with a lower incidence of visible or palpable bony dorsal irregularities. After rasping or burring, bone particles should be irrigated from the surgical site.
Figure 6. Smooth the bony margins with a rasp by using few but firm strokes, cutting only on the downstroke.

Figure 7. The powered reciprocating rasp is an alternative to the manual rasp.
Figure 8. The powered sheathed suction bur is an alternative to the manual rasp.

[Note: This is one approach to hump excision. Another approach is described here. In some cases, the surgeon may wish first to separate the upper lateral cartilages from the dorsal septum. This is accomplished in the submucoperichondrial plane and can be readily accomplished through the hemitransfixion incision or external rhinoplasty approach (Fig. 9). Then rather than excising the entire cartilaginous hump, only a strip of dorsal septum is excised. The remainder of the hump excision proceeds as described earlier; the upper lateral cartilages are then shaved down individually so that they are at the same level as the dorsal septum.] This method is good for excision of large dorsal humps where preservation of mucosal continuity may be otherwise difficult.

**PEARLS**

- Two-tap technique: Overzealous force on the osteotome may lead to loss of control and undesired under- or overresection of the dorsal hump. A controlled excision of the bony dorsum is best achieved with a careful, repeated two-tap technique designed to advance the osteotome only a short distance at a time.
- The surgeon should be sure that the osteotomes are sharp to allow precise bone cuts.
- In cases with large dorsal humps, an extramucosal reduction can be performed by dissecting mucosa off the undersurface of the middle and upper vaults.
- The beginning surgeon may wish to premark the proposed hump excision on the nasal skin.
- If the surgeon feels uncomfortable using an osteotome for dorsal-hump removal, a sharp rasp will be effective with less risk of overresection.
- The periosteum must be cleared from the bone prior to rasping to insure effective lowering of the bone.
- Most dorsal humps are primarily cartilaginous. Therefore, the dissector should limit excision of the bony vault.
Figure 9. A–E: Division of the upper lateral cartilages from their attachment to the dorsal septum in the submucoperichondrial plane. Great care should be taken to preserve an intact mucoperichondrium.
Figure 9, continued. 

F: Division of the upper lateral cartilage from the attachment to the dorsal septum, with dissection of a submucoperichondrial flap, may be accomplished from above, as shown here via the external rhinoplasty approach. 

G: This dissection begins at the anterior septal angle, and then subperichondrial dissection is performed. Completed division of upper lateral cartilages from septum.

REFERENCES

MEDIAL OSTEOTOMIES

To perform medial osteotomies, insert the osteotome at the junction between the nasal bone and septum. With the two-tap technique, advance the cutting edge cephalad and fade laterally as the frontal bone is reached (Fig. 1). Control the sharp leading edge of the chisel, as it moves under the skin, with the forefinger of the nondominant hand. This fading medial osteotomy avoids the thick frontal bone. Medial osteotomies are usually not necessary in cases in which large dorsal humps are excised, leaving an open-roof deformity.

LATERAL OSTEOTOMIES AND INFRACTURE

[Note: The dissector may wish to mark the site of the proposed osteotomy on the skin before proceeding. Perform the lateral osteotomy on one side, and then reflect the skin/soft-tissue envelope laterally to examine it. Is it in proper position? Is the periosteum intact, or has it been violated? Is the mucoperiosteum intact?

After assessing the first lateral osteotomy, the skin of the opposite side may be reflected before the osteotomy. This will allow observation of the osteotomy under direct vision.]

The lateral osteotomies run from the most lateral point of the pyriform aperture to a point medial to the inner canthus of the eye, taking a high to low to high path. In practice, this means a starting point 3 mm to 4 mm above the base of the pyriform aperture and adjacent to the head of the inferior turbinate. The high-to-low lateral osteotomy preserves a small triangle of bone at the base of the pyriform aperture (Fig. 2). Use a 2-mm (guarded) or 3-mm (guarded or unguarded) curved or flat osteotome. Use a guarded or unguarded osteotome based on preference.

Make a small incision near the base of the pyriform aperture. Although it is not essential, many surgeons create a short subperiosteal tunnel along the path of the proposed lateral osteotomy. Scat the osteotome on the bone 3 mm to 4 mm above the base of the pyriform aperture, and use a gentle two-tap technique to advance the osteotome gradually. Angle the osteotome in a posterior and cephalic direction initially, and then adjust the osteotome so that the cutting edge travels toward a point medial to the inner canthus of the eye. This creates the typical high-to-low-to-high lateral osteotomy. Control the cutting edge by palpation with the thumb or fingers of the nondominant hand as the osteotome travels toward the inner canthus. When the osteotome approaches the level of the inner canthus,
Figure 1. Fading medial osteotomies. Place an osteotome flat against the septum with the edge facing laterally. Control the sharp leading edge of the chisel, as it moves under the skin, with the forefinger of the nondominant hand. Avoid the thick frontal bone.

Figure 2. Lateral osteotomies should be started from a point 3 mm to 4 mm above the base of the pyriform aperture to a point adjacent to the inner canthus of the eye. Some rhinoplasty surgeons find it helpful to mark the proposed line of the osteotomy on the skin before executing this maneuver.

rotate the osteotome clockwise on the patient’s right side and counterclockwise on the left side. This will normally fracture the nasal bone inward creating a controlled backfracture. It may be necessary to complete the fracture with thumb pressure.

INTERMEDIATE OSTEOTOMIES

An osteotomy between the medial and lateral osteotomies is occasionally indicated. Specific indications include the abnormally contoured nasal bone that is either excessively convex or concave. Intermediate osteotomies are most effective for decreasing the curvature of an excessively convex nasal bone. The intermediate osteotomy allows recontouring of the nasal bone for correction of the severely deviated bony vault. This osteotomy is performed before the lateral osteotomy. A 2-mm transcutaneous osteotomy performed midway up the nasal bone is typically used to complete the intermediate osteotomy.

PEARLS

- Medial osteotomies are performed to control the backfracture of the nasal bones after lateral osteotomies. If a large dorsal-hump removal was performed, leaving an open roof, it may not be necessary to perform medial osteotomies.
- High-to-low-to-high lateral osteotomies are performed to leave a small triangle of bone at the base of the pyriform aperture and prevent medialization of the inferior turbinate.
- The dorsal nasal septum at the level of the bony vault must be midline to allow symmetric medialization of the nasal bones. If there is difficulty medializing the nasal bones, a blade handle can be used to shift the bony septum to the midline with the nasal bones.
- If a greenstick fracture is noted, a transcutaneous 2-mm osteotome can be used to complete the backfracture and infracture the nasal bone.
- Greenstick fractures are acceptable in older patients.
REFERENCES

Spreader Grafts

Spreader grafts may be placed endonasally or via the external rhinoplasty approach. If endonasal placement of spreader grafts is done in this dissection, undertake this before hump reduction and osteotomies.

Through a small (5-mm) mucosal incision near the anterior septal angle, develop a precise subperichondrial pocket along the length of the cartilaginous dorsum near the junction of the dorsal septum and upper lateral cartilage (Fig. 1). A Cottle or Freer elevator can be used to elevate the subperichondrial tunnels. Special care must be taken to get into the subperichondrial plane; otherwise, the mucosa may tear. Additionally, avoid pushing the elevator through the septum to the other side. Fashion rectangular spreader grafts that extend from the osseocartilaginous junction to the internal nasal valve where the upper lateral cartilage meets the dorsal septum. Appropriate thickness can be determined to achieve the desired functional effect without causing excessive widening, usually 1 mm to 3 mm in thickness. Experience is required to develop reliable surgical judgment regarding the appropriate width and length of spreader grafts. Insert the grafts into the precise subperichondrial tunnels, taking great care to preserve the mucosa (see Fig. 1).

[Note: After placing endonasal spreader grafts, return to Chapter 6 and perform hump excision and then osteotomies. To examine the precise pocket that was made before hump removal, separate the upper lateral cartilage from the septum, as described below and illustrated in Fig. 2.]

Division of the upper lateral cartilages from their attachment to the dorsal septum is undertaken in the submucoperichondrial plane (see Fig. 2). This may be done before hump excision, or in cases in which no hump excision is necessary. Alternatively, this maneuver may be undertaken after hump excision. Again, great care should be taken to preserve an intact mucoperichondrium.

The accompanying figures (Figs. 2 through 6) illustrate placement of spreader grafts through the external rhinoplasty approach. At this point, the dissector should have undertaken hump reduction and osteotomies. (If hump removal has not been completed, return to Chapter 6). Spreader grafts are placed into pockets between upper lateral cartilage and dorsal septum (Figs. 3 and 4). A typical graft extends from the osseocartilaginous junction to the anterior septal angle. The spreader grafts are secured with absorbable suture [we recommend 5-0 polydioxanone suture (PDS), Monacryl, or other similar suture]. The spreader
Figure 1. A-D: Placement of spreader grafts via endonasal approach. A: Mucoperichondrial incision down to the cartilage. B: Careful elevation of subperichondrial tunnel. C: Spreader grafts. D: Insertion of spreader grafts.
Figure 2. Division of the upper lateral cartilages from their attachment to the dorsal septum in the submucoperichondrial plane. Great care should be taken to preserve an intact mucoperichondrium.
Figure 3. A: Spreader grafts are placed into a pocket between upper lateral cartilage and dorsal septum. A typical graft extends from the osseocartilaginous junction to the anterior septal angle. B, C: A spreader graft has been carved and is positioned between the dorsal septum and upper lateral cartilage.

Figure 4. A–C: Bilateral spreader grafts in submucoperichondrial pocket between upper lateral cartilage and septum.
Figure 5. Spreader grafts may be secured first with absorbable suture to the septum to stabilize them in position. (We recommend 5-0 PDS, or other similar suture).

Figure 6. Spreader grafts sutured into position. Several horizontal mattress sutures secure the spreader grafts and upper lateral cartilages. A needle of adequate size (such as a PS-2) facilitates engaging all structures (upper lateral cartilage-to-spreader graft-to-septum-to-spreader graft-to-upper lateral cartilage) in a single pass. Note how this suture passes through the dorsal edge of the upper lateral cartilage.

Spreader Grafts may be secured first to the septum to stabilize them in position (Fig. 5). Alternatively (and commonly), simply engage all structures (upper lateral cartilage-to-spreader graft-to-septum-to-spreader graft-to-upper lateral cartilage) with a single mattress suture (Fig. 6). An additional horizontal mattress suture may be necessary to secure the spreader grafts and upper lateral cartilages in position. A needle of adequate size (such as a PS-2) facilitates engaging all structures in a single pass (Fig. 6). Do not cinch down the mattress sutures too tightly or inferiorly, or else the upper lateral cartilages may actually be forced medially.

SPREADER GRAFTS

In the absence of other causes of nasal obstruction, the nasal valve and nasal valve area constitute the flow-limiting segment of the nose. The nasal valve is bounded by the caudal border of the upper lateral cartilage and the nasal septum, which join at an angle of 9 degrees to 15 degrees in the normal Caucasian nose (Fig. 7). A valve fulfills the definition of a movable structure that regulates the flow of gas or fluid. The nasal valve area includes the cross-sectional area described by the nasal valve and is affected by the inferior turbinate, the caudal septum, and the tissues surrounding the pyriform aperture (Fig. 7). The nasal valve area is considered to be the location of the least cross-sectional area in the nose and is believed to regulate significantly both nasal airflow and resistance and the velocity and shape of the air stream. The nasal valve area is the major flow-resistant segment of the nasal airway (1).

An overnarrow nose in the middle third, whether congenital or (more commonly) the consequence of previous surgery or trauma, requires cartilage graft augmentation to improve the airway and restore aesthetic balance. Examination may reveal an overnarrow an-
Figure 7. Nasal valve and nasal valve area.

Figure at the nasal valve area, medial collapse of the valve on even modest inspiration, or collapse of the upper lateral cartilage against the septal wall, effectively compromising the airway. Spreader grafts act as spacers between the upper lateral cartilage and septum, correcting an overnarrow middle vault and internal nasal valve or preventing excessive narrowing in the high-risk patient (2-10).

A submucoperichondrial tunnel on one or both sides of the dorsal aspect of the septum may be prepared by elevating the mucoperichondrium bridging the upper lateral cartilages to the septum. This dissection provides a space to be filled by a cartilage graft insinuated into the pocket, lateralizing the upper lateral cartilage(s), improving the airway and effectively widening, when indicated, the appearance of the middle third of the nose. In our experience, spreader grafts are more effective when the fibrous connections between the dorsal septum and upper lateral cartilage are left intact. Application of the spreader grafts creates a cantilever effect and aids in lateralizing the upper lateral cartilage to provide maximal airway improvement.

Whereas spreader grafts may be comfortably carried out through traditional endonasal techniques (2), in more complex reconstructions, particularly complicated by multiple abnormalities, an external rhinoplasty approach may facilitate accurate dissection and graft suture fixation (6).

When the T-shaped configuration (horizontal extension) of the nasal septum is resected with dorsal-hump removal, narrowing of the middle nasal vault may be problematic in the high-risk patient. Identifying the high-risk patient during initial preoperative analysis is essential to the prevention of excessive narrowing of the middle nasal vault with internal nasal valve collapse. An anatomic variant referred to as the "narrow-nose syndrome" has been described (2,6). Short nasal bones, long weak upper lateral cartilages, thin skin, and a narrow projecting nose predispose to middle vault collapse. A large en bloc hump removal should be avoided, as the T-shaped horizontal support of the nasal septum is eliminated and the intranasal mucosa (which provides support to the upper lateral cartilage) is at risk of injury. Regardless of the approach to the middle vault, keeping the intranasal mucosa intact with execution of profile alignment (dorsal-hump removal) helps maintain important support of the upper lateral cartilages (see Chapter 6, Fig. 5). This can be achieved by dissecting submucosal tunnels and freeing the upper lateral cartilages from the septum before cartilaginous hump removal. Alternatively, conservative hump excision followed by millimeter-by-millimeter shaving of the upper laterals under direct vision preserves the intranasal mucosa.

Collapse of the middle nasal vault may highlight the caudal edges of the nasal bones to produce the characteristic "inverted V" deformity (Appendix G).

When the dorsal hump has been taken down and the upper lateral cartilages appear destabilized, such as in the high-risk patient, suturing the upper lateral cartilages back to the septum can be helpful to prevent middle nasal vault collapse. Spreader grafts applied between
the nasal septum and upper lateral cartilages prevent excessive narrowing of the nose and preserve an adequate nasal valve. An external rhinoplasty approach may facilitate accurate graft-suture fixation in this setting. These precautionary maneuvers are not necessary in all cases but may prevent problems in the high-risk patient (6).

Commonly performed surgical maneuvers can result in loss of support to the middle vault. Cephalic trim (volume reduction) of the lateral crura disrupts the scroll (recurvature) and frees the caudal margin of the upper lateral cartilage. Lateral osteotomies may further mediate the upper lateral cartilages. The upper lateral cartilages can fall toward the narrowed dorsal septal edge, producing narrowing of the middle vault and internal valvular collapse. In the majority of patients, the combination of these maneuvers will not result in a problem; however, in high-risk patients (narrow-nose syndrome), this combination of maneuvers may contribute to excessive narrowing of the middle vault with internal valve collapse.

When spreader grafts are used, appropriate spreader-graft thickness will achieve the desired functional effect without causing overwidening. Great care should be taken to avoid overwidening if possible. Experience is required to develop reliable surgical judgment regarding the appropriate width and length of spreader grafts. Careful palpation of both upper lateral cartilages can aid in verifying symmetry of the middle nasal vaults.

Spreader grafts are usually 1 mm to 3 mm in thickness. It is generally better to use thinner spreader grafts because if the middle vault is too wide, revision surgery will be necessary. After spreader grafts are secured in position via the external approach, or if they are placed endonasally after dissection of the soft-tissue envelope, the middle-vault width can be assessed by inspection and palpation. The middle vault should be no wider than the bony vault and narrower than the nasal tip. If excessive width or asymmetry is noted, the grafts should be repositioned or narrowed. Over time, this area of the nose tends to narrow as edema resolves and scar contracture pulls the upper lateral cartilages medially.

Asymmetry of the middle nasal vault may at times be addressed with the placement of a unilateral spreader graft, or alternatively, with the placement of spreader grafts of unequal thickness (Fig. 8) (10). In most cases, we prefer to use bilateral spreader grafts to splint deviations of the dorsal septum and prevent worsening of the dorsal septal deviation.

A variety of other maneuvers are at the surgeon’s disposal in addressing the middle nasal vault. Onlay cartilage wafer grafts, derived from the septum or ear, effectively efface and improve middle-third depressions, but may be used to improve aesthetics only when airway blockage does not exist as a consequence of middle-vault collapse. Careful preoperative analysis should determine the need for other supportive and reconstructive

Figure 8. Spreader grafts may be applied unilaterally or asymmetrically to camouflage asymmetry of the middle nasal vault.
Figure 9. Coronal sinus computed tomography scan in a patient with nasal obstruction, illustrating obstructing concha bullosa.

maneuvers, such as conchal cartilage grafts to restore support to a collapsed lateral nasal wall. External valve collapse and the potential need for alar batten grafts also should be evaluated.

PEARLS

- If there is difficulty in spreader-graft placement by using an external approach, check the exposure. A common mistake is a failure to carry the marginal incision and dissection over the lateral crura laterally enough, limiting exposure. Extending this incision and dissection appropriately will improve exposure of the middle nasal vault and greatly facilitate spreader-graft placement.
- Double check middle-vault width and symmetry after applying spreader grafts. Careful palpation will allow precise assessment of middle-vault width.
- Spreader grafts applied into precise submucosal tunnels introduce bulk under the intact connection between the upper lateral cartilage and dorsal septum. The spreader graft creates a cantilever effect and effectively lateralizes the collapsed upper lateral cartilage.
- When securing spreader grafts via suture fixation, gently stretch the upper lateral cartilage toward the anterior septal angle to ensure that they are not buckled. The suture will place gentle traction on the upper lateral cartilages to prevent buckling. After completing suture fixation, inspect the upper lateral cartilages to be sure that they are not buckled (6).
- In considering nasal obstruction, a complete evaluation is critical. Causes of nasal obstruction include allergic rhinitis, chronic sinusitis, rhinitis medicamentosa, nasal polyps, deviated septum, internal and external nasal-valve collapse, and others. One commonly overlooked cause of nasal obstruction is a concha bullosa, or aerated middle turbinate (Fig. 9), which can be most easily recognized on nasal endoscopy or coronal computed tomography scan.

REFERENCES

Surgery of the Nasal Tip

EXERCISES (Appendix F)

Placement of Columellar Strut

The placement of a rectangular cartilage strut between the medial crura can improve tip support and augment tip projection. A columellar strut also can be used to correct buckled medial or intermediate crura or to increase columellar show. The strut may be placed by using the external approach or into a precise pocket via the endonasal approach.

Placement of Columellar Strut via an External Rhinoplasty Approach

The area between the medial crura is dissected to create a pocket to place the strut. The rectangular cartilage strut typically measures 8 mm to 12 mm in length, 3 mm to 4 mm in width, and 1 mm to 2 mm in thickness. The strut is most typically fashioned from harvested septal cartilage, but also, when necessary, from auricular cartilage, and at times from rib cartilage. The strut is positioned so that it sits above (without extending to) the nasal spine (Fig. 1). It is preferable to leave a small soft-tissue pad between the strut and the nasal spine. The strut should not extend above the intermediate crura. It is secured to the medial crura with several absorbable mattress sutures (e.g., 4-0 plain gut, Keith needle) placed through the vestibular skin. Asymmetries of the lower lateral cartilage (LLC) may be improved with placement of the strut (Fig. 2). Asymmetry of the tip may be created if the medial crura are asymmetrically sutured to the strut (Fig. 3), or if an overlong strut extending beyond the nasal spine shifts to the side of the nasal spine, thereby causing a deviated nasal tip (Fig. 3) (1,2).

Placement of Columellar Strut via an Endonasal Approach

A small incision is made through the vestibular skin and ipsilateral medial crus (Fig. 4). Scissor dissection creates a precise pocket through this small incision (Fig. 5). The col-
Figure 1. Placement of columellar strut. A, B: The strut sits above (without extending to) the nasal spine, and it should not extend above the intermediate crura. C–F: A columellar strut may be placed via the external rhinoplasty approach. With proper exposure achieved (C), dissection of a pocket between the medial crura is undertaken (D). The carved columellar strut is placed in the pocket, as described earlier (E) and secured with interrupted 4-0 plain gut on a straight septal (Keith) needle (F).
Figure 2. A–D: Asymmetries of the lower lateral cartilage may be improved with placement of the strut.

Figure 3. Asymmetry may be created if the medial crura are asymmetrically attached to the strut (A), or if an overlong strut extending beyond the nasal spine “slips” to the side of the nasal spine, thereby causing a deviated nasal tip (B).

Figure 4. Placement of columellar strut via an endonasal approach. First, an incision is made through the vestibular skin and ipsilateral medial crus.
Identify the Dome

Identify the dome and approximate the lateral and medial crura at the dome with a pair of multitoothed Brown-Adson forceps. The line of the dome should be at approximately 30 degrees to the sagittal plane.
Reduce the Crural Volume and Rigidity: Complete Strip

Identify the scroll region, the cephalic border of the LLC (Fig. 8). Excise the cephalic portion of the LLC by making an incision parallel to the caudal margin with the 15 blade and then peeling off the cephalic portion, leaving the vestibular skin behind. The line of incision parallels the caudal margin of the LLC. Leave at least 7 mm to 9 mm of intact cartilage. This preserves an intact strip of cartilage from the feet of the medial crus to the most lateral part of the lateral crus. This will produce conservative narrowing of the nasal tip.

Figure 8. Cephalic resection of lateral crura of lower lateral cartilages.
Accentuate the Tip

Now apply domal/transdomal sutures as outlined.

**Place Individual Horizontal Mattress Domal Sutures**

For domal sutures (Fig. 9), a mattress suture of 5-0 polydioxanone suture (PDS) or other appropriate suture is passed through each dome, and the knot of each mattress suture is tied between the domes. As the sutures are secured, narrowing of the tip is accomplished. An interdomal suture sets the width between the domes. If stiff nasal-tip cartilages are encountered, the surgeon should use 5-0 clear nylon instead of PDS (4–6).

**Place Single Transdomal Suture**

Alternatively, a single transdomal suture that traverses both domes may be placed, in lieu of two individual domal sutures and an interdomal suture (Fig. 10) (1–3). The caudal pass should be slightly longer than the cephalic pass of the mattress suture. When the mattress suture is placed in this fashion, the caudal edge will tend to lead the cephalic edge as the suture is tightened. This creates a more favorable tip–supratip relation. If the cephalic edge leads the caudal edge of the lateral crus despite proper placement of the domal suture, a small cephalic wedge of the cartilage may be excised and the edges sutured, which repositions the cephalic edge lower in relation to the caudal edge (Fig. 11).

*Figure 9. Individual horizontal mattress domal sutures. The caudal pass is slightly longer than the cephalic pass of the mattress suture. As the sutures are secured, narrowing of the tip is accomplished. An interdomal suture is placed between the two domes, securing the interdomal distance.*
Figure 10. A, B: A single transdomal suture may be placed in lieu of two individual domal sutures and an interdomal suture. C–J: Patient with trapezoidal tip and broad domal angles. Transdomal suture techniques were used to improve the patient's tip triangularity as seen in preoperative (G, E, G, I) and postoperative (D, F, H, J) photographs. K–Z: Patient with trapezoidal asymmetric nasal tip. Columellar strut and transdomal suture techniques were useful to improve tip symmetry and triangularity. K, L: Preoperative frontal and base view. M, N: Graphic operative worksheet (Gunter diagram). O–Q: Intraoperative photographs illustrating placement of columellar strut and suture techniques. R–Y: Preoperative (R, T, V, X) and postoperative (S, U, W, Y) photographs.
Figure 10, continued.
Figure 10, continued.
Figure 10, continued.
Figure 11. If the cephalic edge leads the caudal edge of the lateral crus despite proper placement of domal suture, a small cephalic wedge of the cartilage may be excised, and the edges sutured, which repositions the cephalic edge lower in relation to the caudal edge. In this figure, one lower lateral cartilage illustrates the wedge excised, and the other illustrates the edges resutured (A). B: The effect of this maneuver on the relationship between the cephalic and caudal edge is illustrated.
Figure 12. A, B: Lateral crural steal. When the horizontal mattress domal sutures take a larger bite of lateral crus, a portion of the lateral crus is "borrowed" by the medial crus. The "medial crural" leg of the tripod is lengthened, whereas the "lateral crural" legs of the tripod are shortened (see Appendices A and F). This results in increased projection and rotation. Tip refinement also is achieved, as with a standard domal suture. C–F: Rotation of this patient's nasal tip was achieved by using the lateral crural steal technique and by suturing medial crura back on overly-long midline caudal septum.
**Lateral Crural Steal**

Lateral crural steal (Fig. 12) is an effective method for increasing tip projection and rotation (7). When the horizontal mattress domal sutures take a larger bite of lateral crus, a portion of the lateral crus is shifted medially. The “medial crural” leg of the tripod is lengthened, whereas the “lateral crural” legs of the tripod are shortened (see Appendices A and F); the result is increased projection and rotation. Tip refinement also is achieved, as with a standard domal suture.

**Further Refinement with Dome Division with Intact Vestibular Skin and Suture Reconstitution**

We rarely divide the domes, but when this technique is performed, it is usually in the thick-skinned patient. In most cases, we use some form of dome-binding suture to change tip contour (8).

Remove the transdomal sutures to perform this maneuver. Dividing the dome by vertical incision allows further narrowing of the nasal lobule. Projection also can be altered by removal of a superiorly based triangle of cartilage lateral or medial to the vertical incision. By excising a larger amount of cartilage along the cephalic margin of the lateral crus, the cephalic dome can be positioned below the caudal dome (Fig. 13).

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**Figure 13.** Divide the dome by vertical incision. Reapproximate the divided cartilages with suture (e.g., 6-0 PDS) to secure the position of the cartilage and reconstitute the intact strip.
Reapproximate the divided cartilages with 6-0 PDS suture (Fig. 14). The placement of sutures to reapproximate the divided cartilages after dome division secures the position of the cartilage and contributes to increased tip stability. Simple interrupted sutures are preferred to a mattress suture, because a mattress suture may excessively narrow the tip (Fig. 14).

Note: We rarely perform dome division because we find less-aggressive techniques (dome-binding suture) very effective for modifying tip contour. We try to avoid dome division in patients with thin skin.

Lateral Crural Overlay

When the patient's anatomy calls for rotation and deprojection, lateral crural overlay is one possible technique (Fig. 15) (7,9). The lateral crura are incised lateral to the domes. The vestibular mucosa is elevated from the undersurface of the lateral crus, and the medial portion is overlapped over the lateral and secured in place with sutures. When undertaking this maneuver, great care must be taken to perform it symmetrically.
Figure 15. (left and above) A–J: Lateral crural overlay. Great care must be taken to perform this technique symmetrically.
Tip Graft

Sutured in place, shield-shaped tip grafts typically are used to increase tip projection and change tip contour (1,2). They also can be used to camouflage tip asymmetries. Tip grafts should be avoided in patients with thin skin.

Carve a shield-shaped tip graft from the harvested septal cartilage. The width generally varies from 8 mm to 12 mm at the leading edge. The length varies from 8 mm to 15 mm, and thickness typically varies from 1 mm to 3 mm (Fig. 16). The graft is thicker at the leading edge and thinner at the base. One may consider cutting the graft larger at the leading edge to allow in situ carving once the graft is secured in position. The graft is sutured to the caudal margins of the medial/intermediate crura that have been stabilized by the sutured-in-place columellar strut. An excessively thick tip graft will increase fullness in the infratip lobule.

Secure the tip graft with 6-0 PDS or Monacryl sutures (Fig. 17). Four to six sutures are usually applied. Place the lower sutures first.

Figure 16. A–E: Tip graft width generally varies from 8 mm to 12 mm at the leading edge. The length varies from 8 mm to 15 mm, and thickness typically varies from 1 mm to 3 mm.
Figure 17. A: The tip graft is sutured to the caudal margins of the medial/intermediate crura. Four to six 6-0 PDS sutures are typically placed. Place the middle sutures first. B, C: Intraoperative photographs illustrating placement of tip graft.
Figure 17, continued. D–K: Preoperative (D, F, H, J) and postoperative (E, G, I, K) photographs of a patient who underwent application of a tip graft. The tip graft was used to increase tip projection and provide a bidomal shape to the nasal tip. Please refer to text for a more detailed discussion of tip grafts.
When placing a tip graft in a patient whose domes have been divided (and suture reconstructed), apply the tip graft so that it camouflages the caudal aspect of the cut domes (Fig. 18), decreasing the risk that this point will be palpable or visible after surgery.

Figure 17, continued.

Figure 18. If a tip graft is applied in a patient with divided domes, the caudal aspect of the cut domes should be hidden behind the tip graft to decrease the risk of a palpable or visible point after surgery.
Cap or Buttress Graft

Typically, a tip graft should be projected 1 mm to 2 mm above the existing domes. In patients with thick skin and an underprojected tip, a longer tip graft can be projected 2 mm to 4 mm above the existing domes. In these and other appropriate cases, a cap or buttress graft placed behind the leading edge of the tip graft may be useful to support the graft (particularly softer, pliable auricular cartilage tip grafts) and to prevent excessive cephalic rotation of the graft under the tension of closure of the skin/soft-tissue envelope. Buttress grafts are sutured to the tip graft and both domes by using 6-0 PDS or Monacryl suture (Fig. 19). The buttress grafts should create a smooth transition from the edge of the tip graft to the caudal margin of the lateral crura (2).

Figure 19: A–D: Buttress or cap graft.
Figure 19, continued. E–L: Preoperative (E, G, I, K) and postoperative (F, H, J, L) photographs of two patients who had tip grafts with cap-graft placement. Cap grafts were placed to support the leading edge of the grafts, prevent cephalic rotation of the graft, and ensure a smooth transition from the edge of the graft to lateral crus.
Figure 19, continued.
Alar Batten Graft

The external nasal valve is composed of the cutaneous and skeletal support of the mobile alar side-wall. Overaggressive resection of the lateral crura during rhinoplasty and the subsequent postoperative soft-tissue contraction may lead to internal and/or external nasal valve compromise. Cephalic positioning of the lateral crura also will leave suboptimal structural support in the mobile alar side-wall (external valve collapse).

Alar batten grafts, typically of curved septal or auricular cartilage, placed to support the alar rim, can correct internal or external nasal-valve collapse (Fig. 20) (10-12).

Create a precise pocket for an alar batten graft. The graft is typically placed caudal to the lateral crura at the point of maximal lateral nasal wall collapse. Fashion a graft from harvested auricular or septal cartilage, and insert it into the precise pocket. The pocket is subcutaneous and is placed at the point of maximal supraalar collapse. Auricular cartilage is preferred because of the curvature of the cartilage. The convex side of the graft is oriented laterally to correct the supraalar pinching. If this pocket is too superficial, the graft may be palpable or visible. When placed via an external rhinoplasty approach, secure the graft with a suture applied medially from the graft to adjacent soft tissue or lateral crus.
Figure 20. A: Alar batten graft.

Figure 20, continued. B, C: Intraoperative photographs illustrate location of alar batten graft placement, centered around the point of greatest weakness and concavity of the alar sidewall. The alar batten graft in this case has been fashioned with autogenous auricular cartilage.

Figure 20, continued. D, E: Alar batten grafts may be placed via a precise pocket endonasal rhinoplasty approach.
Figure 20, continued. F–T: Primary rhinoplasty patient with cephalic positioning of the lateral crura requiring alar batten grafts. Preoperative photographs (F–I).
Figure 20, continued. The rhinoplasty worksheet (K–L) illustrates that this patient underwent septrhinooplasty with cartilage harvest. She underwent conservative cephalic resection. She received a columellar strut, plumping grafts, dorsal onlay grafts, spreader grafts, and alar batten grafts. Preoperative (M, O, Q, S) and postoperative (N, P, R, T) photographs are seen here. Note the improvement in the nasal valve, best seen on base view.
Lateral Crural Grafts

Lateral crural grafts are anatomic grafts that replace excessively reduced or deformed lateral crura. These grafts are shaped like lateral crura and measure approximately 5 mm in vertical height. Auricular cartilage has the ideal curvature for lateral crural grafts. The grafts are sutured to the vestibular skin and medial or intermediate crura. Care is taken so the caudal margins of the grafts are placed symmetrically; otherwise, there may be asymmetry of the alar rims. Grafts that are too large or curved may create a bulbous tip (2) (Fig. 21).

Figure 21. Intraoperative photograph illustrating lateral crural grafts and a shield graft. The grafts are sutured to the vestibular skin and medial or intermediate crura.

**PEARLS**

*Complete Strip*

- Although many surgeons perform cephalic trim of the lateral crura as a routine maneuver during rhinoplasty, some patients have flat or concave lateral crura that do not contribute to tip bulbosity. Many of these patients do not need to undergo cephalic trim of the lateral crura. Cephalic trim should be performed when there is fullness (bulbosity) in the supratip or supraalar region due to protrusion of the cephalic margin of the lateral crura.

- The surgeon should leave 7 mm to 9 mm of lateral crus. This determination is made on a patient-to-patient basis. The strength of the lateral crura and alar sidewalls should be considered. With strong cartilages, more cartilage can be excised, and with weak cartilages, more cartilage should be preserved.

- Complete strip is illustrated here via the external rhinoplasty approach but was illustrated earlier in this text via the cartilage-splitting approach (Chapter 5, Figs. 1–3). In a cartilage-splitting approach, the attachments of the lateral crura to the skin/soft-tissue envelope are undisturbed, and a complete strip of 6 mm to 8 mm should be preserved. Cephalic resection of lateral crus may also be accomplished via the retrograde dissection approach and via the delivery approach.

- Minimize lateral resection of the cephalic margin of the lateral crura. Change in tip contour is primarily effected by medial excision, and lateral excision can contribute to valve collapse and supraalar pinching.

- Thin skin, strong cartilages, and bifidity is a common triad that should be recognized. These patients are at higher risk for bossa formation if excessive cartilage is excised from the cephalic margin of the lateral crura (Appendix G).
**Surgery of the Nasal Tip**

**PEARLS, continued**

**Transdomal Sutures**

- Transdomal suture placement can create excessive fullness in the infratip lobule. The infratip lobule should be assessed after transdomal suture placement. Additionally, the lateral aspect of the lateral crura may medialize into the airway with placement of a transdomal suture. If this occurs, it may be necessary to apply lateral crural strut grafts to straighten the lateral crura. On rare occasions, the lateralmost aspects of the lateral crura may need to be trimmed.
- Separate dome binding sutures are better able to correct asymmetric domes.

**Tip Grafts**

- Before closure, all edges of the tip graft should be rounded off to prevent visibility of the edges of the graft.
- Excessively stiff tip grafts should be crosshatched on the caudal surface to allow cephalic bending and a good double break.
- Surgeons tend to make shield grafts too narrow. Most grafts should be approximately 8 mm to 10 mm in width at the leading edge. In male patients, the tip grafts are generally wider, and typically measure 10 mm to 12 mm in width at the leading edge.
- Most cadaver specimens have thin, atrophic skin, so the tip graft will tend to be more noticeable. Indeed, we try to avoid the use of tip grafts in patients with thin skin.
- Tip grafts are ideal for camouflaging subtle tip asymmetries.

**Alar Batten Grafts**

- Alar batten grafts may be placed via an external rhinoplasty approach or into a precise pocket made through an endonasal incision. This graft is nonanatomic and is typically placed caudal to the lateral crura where there is maximal collapse of the lateral nasal wall and supraalar pinching.
- If alar batten grafts are placed too far cephalic, excessive fullness over the middle vault will be noted.
- Patients should be told that there will be temporary fullness in the area of the graft. This fullness will typically decrease over a 2- to 3-month period.
- For maximal support, the alar batten graft should extend over the bone of the pyriform aperture.

**REFERENCES**

Follow the accompanying figures and text to perform alar base resections (1,2).

The site of incisions and the amount, degree, and geometry of alar reductions depend on a host of anatomic variations predetermined before and during surgery. Although the surgeon’s aesthetic judgment will ultimately determine the site and degree of resection, a more precise surgical approach may be determined if several anatomic guidelines are assessed and integrated. Conservatism is mandatory to avoid overreduction and asymmetry, conditions that are difficult to correct satisfactorily.

As the need for reduction increases, both the incision and excision become more extensive. Alar reduction is a compromise operation, in which greater reductions exact the penalty of a larger scar. The surgeon must balance this compromise with experienced aesthetic judgment and proven scar-camouflage techniques.

Skin sutures placed across the alar–facial junction often lead to permanent suture marks. Effective camouflage at the alar–facial junction may be facilitated by positioning incisions 1 mm to 2 mm above the alar–facial junction. Skin closure can be performed with a cyanoacrylate adhesive (octyl-2-cyanoacrylate, Dermabond; Ethicon, Somerville, NJ, U.S.A.).

INTERNAL NOSTRIL FLOOR REDUCTION

In patients requiring minimal alar reduction, excision of a wedge of epithelium and soft tissue from the nostril floor only (Fig. 1) will slightly reduce the alar flare by reducing the dimension of the internal (medial) border. Although the outward curve of the ala is altered, no medial repositioning of the alar–facial junction is effected. The scar is effectively hidden within the nostril floor if the nostril sill is not violated. At times, the shape of the nostril sill will determine whether this approach is appropriate. Subtle, conservative, but effective improvements are possible with this approach. The dimension of the lateral alar border remains unchanged.
Figure 1. Internal nostril floor reduction will slightly reduce alar flare.

WEDGE EXCISION OF NOSTRIL FLOOR AND SILL

Further reduction of alar flare is accomplished by carrying the incision across the sill into the alar–facial junction 1 mm to 2 mm above the alar–facial crease. Reduction of flare as well as slight reduction of the alar bulk is effected (Fig. 2).

ALAR WEDGE EXCISION

If the alar development is excessive and bulbous, excision of a wedge of ala at the alar–facial junction 1 mm to 2 mm above the alar–facial crease will reduce the overall bulkiness of the alar anatomy (Fig. 3). Some medial repositioning of the alae may be effected with this maneuver. Reduction of the overall length of the alar sidewalls occurs when generous wedges are excised, ideal in the reduction of the alar flare created when correcting the overprojecting tip.

SLIDING ALAR FLAP

More substantial alar reduction with medial repositioning is effected with a generous incision above the alar–facial junction with various degrees of alar excision (Fig. 4). Reduction of the volume, curve, and flare of both the internal and external alar margins will result from this procedure, the extent of each dependent on the angulation of the alar incision. A backcut placed 2 mm above the alar–facial junction allows the alar flap to slide medially, narrowing the alar base significantly.

Figure 2. Wedge excision of nostril floor and sill conservatively reduces flare as well as alar bulk.
Figure 3. Excision of a wedge of ala at the alar-facial junction 1 mm to 2 mm above the alar-facial crease will reduce the overall bulkiness of the alar anatomy. Some medial reposi­tionning of the alae may be effected with this maneuver.

Figure 4. Sliding alar flap typically incorporates a backcut to allow the alar sidewall to ad­vance medially.

**PEARLS**

- When performing alar base reduction, the surgeon should err on undercorrecting the deformity to prevent resection of excessive tissue. Once too much tissue is ex­cised, it is very difficult to correct; be particularly conservative in male patients.
- Internal alar base excision can significantly decrease the internal diameter of the nostril and should be performed in a conservative manner. When performed, usually <2 mm of tissue is removed.
- If an incision is made on the lateral surface of the ala, the incision should be made above the alar crease to minimize scarring. A cyanoacrylate adhesive (Der­mabond; Ethicon, Somerville, NJ, U.S.A.) can be used to close the lateral alar in­cision.
- In the incision, the skin edges can be favorably beveled to maximize skin-edge eversion and avoid a depressed scar.

**REFERENCES**

Other Maneuvers

PLUMPING GRAFTS

Plumping grafts may be used to open up an acute nasolabial angle, improve a retracted columella, and support a deficient nasal base. Dissect a midcolumellar precise pocket to just above the nasal spine. Place multiple small pieces of cartilage (1 mm to 2 mm), harvested from the septum or ear, in the pocket. These grafts will augment the deficient area (Fig. 1) (1,2). Plumping grafts placed below the medial crural footplates will increase support of the nasal base (Appendix F).
CAUDAL EXTENSION GRAFTS

Caudal extension grafts have been described for use in correcting a retracted columella, overrotated tip, short nose, or to increase tip support and projection (3) (Appendix F). This graft is sutured to the caudal margin of the nasal septum and is secured between the medial crura in the midline with 5-0 buried polydioxanone suture (PDS) (Fig. 2). When suturing the caudal extension graft to the caudal septum, the caudal margin of the graft must be in the precise midline. Deviation off the midline will result in a deviation of the nasal base or tip. It is critical to assess nasal projection, length, tip rotation, and alar/columellar relation when positioning a caudal extension graft. Patients should be told preoperatively that their nasal tip will be stiffer, with loss of the normal tip recoil.
Other Maneuvers

Figure 2. A caudal extension graft may at times be useful to correct retraction of the columella (A). In this patient example (preoperative, B–E; postoperative, F–I), a caudal extension graft, harvested from the patient’s posterior septal cartilage, was used to address the retracted columella.
Figure 2, continued. This intraoperative sequence illustrates placement of the graft, extending beyond the caudal septum (J, K). The caudal septum in this patient was deviated toward his left, so the graft was placed to take advantage of the slight curvature of the graft to achieve a midline position.
Other Maneuvers

Figure 2, continued. With the graft in place (L), the medial crura were secured to the caudal aspect of the graft to achieve proper tip projection and to address the retracted columella (M). Special care was taken to set appropriate projection, rotation, length, and columellar show. It is critical that the caudal extension grafts be placed in the precise midline.
DEVIATED CAUDAL SEPTUM

A number of maneuvers are at the surgeon's disposal in the treatment of a caudal septal deviation (4,5). Traditional approaches include scoring the septal cartilage on the concave side, thereby relaxing the "spring" of the cartilage. This may be done as a solitary maneuver, or in conjunction with a so-called "swinging door maneuver." As illustrated in Fig. 3, a wedge of cartilage excised along the maxillary crest releases the caudal septal attachments and allows the septum to swing to the midline. The midline position may be secured with a 4-0 PDS attached to the periosteum adjacent to the opposite side of the nasal spine.

Ethmoid bone splinting grafts or sandwich grafts also may be of benefit in this situation (6). A straight piece of bone is harvested; a large straight Keith needle may be used as a delicate hand-held drill to make holes in the bone graft. The deviated portion of cartilaginous septum may be addressed by scoring on the concave side, and the bone graft or grafts may then be used to splint the septum in a straighter orientation. However, use of the ethmoid bone graft in this location thickens the caudal septum and can contribute to nasal obstruction. The ethmoid bone sandwich grafts may be used to address a deviation of the dorsal septum, where the additional septal thickness caused by this graft is well tolerated (Fig. 4).

In cases of a severely deviated caudal and dorsal septum, the offending portion may be excised and replaced with a straight piece of cartilage, typically harvested from the septum more posteriorly (Fig. 5) (4). Suture fixation to a stable segment of cartilage attached at the osseocartilaginous junction and nasal spine will allow reconstruction of an intact L-strut to support the lower third of the nose. The reconstructed caudal segments can be sutured between the medial crura to set nasal length, projection, rotation, and the alar/columellar relation.

Figure 3. Deviated caudal septum, "swinging door" maneuver.

Figure 5. A, B: Septal replacement for severe cases of deviated caudal and dorsal septum. C–T: In the first case example (preoperative photographs, C–F), a segment of caudal septum is removed (G, H) and replaced with a straight piece of septal cartilage harvested posteriorly (I, J).
Figure 4. A splinting graft of ethmoid bone may help maintain the septum in a straighter orientation.
Figure 5, continued.
Figure 5, continued. As illustrated, the replacement cartilage is extended caudally and secured between the medial crura as well (K). In this case, a tip graft also was applied (L).
Figure 5, continued.
Figure 5, continued. Preoperative (M, O, Q, S) and postoperative (N, P, R, T) comparison.

**U–BB:** This series of intraoperative photographs illustrates total replacement of the severely deviated caudal septum.
Figure 5, continued.
Figure 5, continued. The severely deviated component (U–W) is removed, along with posterior septum (X). The deviated septum is replaced with straight septal cartilage (Y–Z) harvested posteriorly. A tip graft also was applied (AA).
RIB CARTILAGE GRAFT RECONSTRUCTION OF SADDLE DEFORMITY:
INTEGRATED DORSAL GRAFT/COLUMELLAR STRUT

The severe saddle-nose deformity may be treated by using autogenous rib cartilage (8,9). Harvest of rib is described later. The rib graft is carved into a dorsal graft and a columellar strut, which are interdigitated to recreate an intact L-strut (Fig. 6). This type of structural reconstruction is particularly useful when there is complete loss of septal support. If an intact nasal septal L-strut is present, onlay dorsal grafting will be sufficient to correct the deformity. Great care must be taken to adhere to the principle of “balanced cross-sectional carving” to minimize the risk of graft warping. Once in position, the domes can be sutured over the graft with a transdomal suture. An external rhinoplasty approach allows exposure for facile placement of these grafts. A tip graft allows improved tip projection and definition.

Figure 6. A, B: Severe saddle-nose deformity. Rib graft is fashioned into a columellar strut (secured to the medial crura) and a dorsal onlay graft that interdigitates with the columellar strut. C–EE: (slides) Preoperative (C–F) photographs of a patient with a severe saddle-nose deformity. She underwent application of an iliac bone graft to her nasal dorsum in the past. Lack of an intact L-strut and inadequate middle vault support resulted in descent of the graft, airway obstruction, and referral to our office for reconstruction. Base view reveals the bone graft in the left nostril and a widened columellar scar.
Figure 6, continued.
Figure 6, continued. Graphic operative worksheet (G, H) illustrates the surgical high points. Rib graft was harvested (I, J), and exposure was achieved via the external rhinoplasty approach (K, L). A sutured-in-place columellar strut fashioned from rib graft was secured between the medial crura (M, N). A dorsal-onlay graft was carefully carved (O, P) with a notch, allowing it to interdigitate with the columellar strut.
Other Maneuvers

Figure 6, continued.
Figure 6, continued.
Figure 6, continued. The dorsal graft was placed and secured (Q–T). Example from another patient illustrating interdigitation of strut and dorsal onlay graft (U). A tip graft was placed and covered with a layer of perichondrium to camouflage and soften the leading edge of the tip graft. (V, W)
Figure 6, continued.
Figure 6, continued. Preoperative (X, Z, BB, DD) and postoperative (Y, AA, CC, EE) side-by-side comparison.
PEARLS

- When placing plumping grafts, the surgeon should overcorrect because the grafts tend to settle over time. Additionally, the pocket can be gently irrigated with an antibiotic solution to minimize the incidence of infection.

- When performing a caudal extension graft, the surgeon must take special care to set appropriate tip projection, rotation, length, and alar/columnar relation. Additionally, the caudal margin of the graft must be in the precise midline.

- The inferior border of the caudal extension graft should be stabilized on the posterior septal angle, soft tissue, or other supporting tissues to avoid postoperative counterrotation of the extension graft.

- Deviations of the caudal septum can usually be corrected by crosshatching the cartilage and other conservative maneuvers described in the text. Many cases can be corrected by accounting for excessive length of the L-strut. In rare cases, subtotal septal replacement may be necessary.

- When using an integrated columnar strut/dorsal graft, the surgeon must take special care to stabilize the columnar strut in the midline to avoid shifting or tilting of the columnella. Placement of the dorsal graft into a precise dorsal pocket or suture fixation of the dorsal graft to the middle nasal vault will minimize the chance of the graft shifting to one side.

- Symmetric carving of the costal cartilage graft will minimize the chance of the graft warping over time.

REFERENCES

Harvest of Autogenous Tissue

HARVESTING CONCHAL CARTILAGE: ANTERIOR APPROACH

Auricular cartilage can be harvested using the anterior or posterior approach (1–6). In most cases, we prefer the anterior approach because we believe it is less traumatic, and the incision heals well if vertical mattress closure is used. If smaller cartilage grafts are needed, then we use the posterior approach.

With a marking pen, outline an incision that follows the outer edge of the cavum and cymba concha. This incision should be placed along the portion of the concha that is vertically oriented in relation to the lateral aspect of the skull (Fig. 1). Use a syringe with 1% lidocaine (Xylocaine) solution with 1:100,000 epinephrine (or for the lab demonstration, water) to "hydrodissect" the skin of the concha cavum and cymba from the underlying cartilage.

Make the incision with a no. 15 blade, and elevate the skin and perichondrium from the underlying cartilage. Dissection proceeds by using appropriate scissors, and also bluntly with cotton-tip applicators. Care should be taken not to damage the soft auricular cartilage, which can tear. The dissection should stop short of the cartilage of the external auditory canal. The radix helicis should be preserved if preservation of ear position is critical. If the entire conchal bowl is excised, the auricle will usually settle closer to the head.

Dissect out the desired piece of cartilage, and leave the underlying muscle behind (perichondrium will remain adherent to the posterior surface of the cartilage). Avoiding deep dissection into the soft tissue minimizes bleeding.

Suture the circumferential incision with a 6-0 nylon running mattress suture. Alternatively, the incision may be closed with interrupted vertical mattress sutures. Special care must be taken to avoid overlap of the skin edges. Place a bolster dressing of Telfa, dental roll, or other suitable material into the concha, and suture it into position to decrease the risk of hematoma. No residual deformity of the pinna is expected with this approach.
Figure 1.
Harvest of Autogenous Tissue

Figure 1, continued. A–T: Injection hydrodissects the skin of the concha cavum and cymba from the underlying cartilage (A). The incision follows the outer edge of the cavum and cymba concha and is placed along the portion of the concha that is vertically oriented in relation to the lateral aspect of the skull (B, C). Dissection proceeds by using appropriate scissors, and also bluntly with cotton-tip applicators (D–G). The dissection stops short of the cartilage of the external auditory canal. Incise the cartilage (H, I) and dissect out the desired piece of cartilage (J, K). Achieve perfect hemostasis before closure (L). The cartilage should be handled gently to avoid tearing or damaging the soft auricular cartilage.
Harvesting Ethmoid Bone

The perpendicular plate of the ethmoid bone and/or the vomer may be used as a splinting graft in the treatment of a deviated cartilaginous septum. Ethmoid bone may be harvested via a standard septoplasty approach.

Harvesting Rib Graft

Cartilage is typically harvested (Fig. 2) from the eighth and ninth ribs or the confluence. If additional cartilage is required, the tenth rib also may be harvested. Bone may be harvested with the ninth rib if desired.

Figure 2. Rib cartilage harvest. Cartilage is typically harvested from the eighth and ninth ribs. A 4 cm to 6 cm incision overlying the eighth rib allows adequate exposure (see also Chapter 11, Fig. 6). Dissection proceeds to and then through the rib perichondrium. Dissection around the rib is undertaken subperichondrially; the pleura is typically closely adherent to the perichondrium. With the donor rib completely separated from surrounding soft tissue, the graft is incised and delivered under direct vision. The surgeon may place a malleable retractor beneath the rib as it is incised.

Figure 1, continued. Suture of the circumferential incision is shown here with a 6-0 nylon running vertical mattress suture (M–P). Alternatively, one may close the incision with interrupted mattress sutures. Place a bolster dressing of Telfa, dental roll, or other suitable material into the concha and suture it into position (Q–T) to decrease the risk of hematoma.
A 4-cm to 6-cm incision overlying the eighth rib allows adequate exposure. Dissection proceeds to and then through the rib perichondrium. The muscle fibers can be separated instead of cut to minimize postoperative pain. Dissection around the rib is undertaken sub-perichondrially; the pleura is typically closely adherent to the perichondrium. With the graft completely separated from surrounding soft tissue, the graft is incised and delivered under direct vision. The surgeon may elect to place a malleable retractor beneath the rib as it is incised. Saline is placed in the surgical site and Valsalva or positive pressure applied to check for a pleural leak. If a pleural tear is identified, a pursestring suture closure is undertaken around a red-rubber suction catheter. The surgeon then requests a "Valsalva" from the anesthesiologist. The red rubber is then removed and the suture tightened. Saline may be placed in the wound and another Valsalva undertaken while the surgeon carefully inspects for air bubbles. A standard, layered soft-tissue closure without a drain is accomplished. Skin edge eversion can be accomplished with evertting subcutaneous sutures.

A chest radiograph is obtained in all patients after rib harvest. In the rare instance of a difficulty, the surgeon may wish to consult the appropriate surgical colleague.

**HARVESTING CALVARIAL BONE**

Parietal bone may be harvested (Fig. 3) through a horizontal incision (typically, 4 cm to 6 cm) superior to the temporal line. Typically the nondominant side is chosen. Incision to and through the periosteum, followed by subperiosteal undermining, provides proper exposure. A drill is used to outline the proposed graft (typical graft size, 1 cm to 1.5 cm by 4 cm to 4.5 cm). A trough is drilled through the outer table to the diploe; this allows the proper angle for application of a chisel or powered oscillating saw to harvest the grafts carefully. Short controlled taps on a sharp osteotome allow increased precision and help decrease the risk of inner-table penetration and dural tear.

Patients must be cautioned preoperatively of the risk of possible dural tear and possible brain injury. Any dural entry should elicit an immediate neurosurgical consultation.

The donor site can be contoured with hydroxyapatite cement or any other biocompatible bone substitute material. The incision is typically closed in a multilayer fashion.
Figure 3. Calvarial bone harvest. Parietal bone may be harvested through a horizontal incision (typically, 4 cm to 6 cm) superior to the temporal line. Typically the nondominant side is chosen (A). A drill is used to outline the proposed graft (typical graft size, 1 cm to 1.5 cm by 4 cm to 4.5 cm). A trough is drilled through the outer table to the diploe (B, D, E). A chisel or powered oscillating saw may be used to harvest the grafts carefully (C, F–I). Narrower grafts are safer and easier to harvest.
Figure 3, continued. Short, controlled taps on a sharp osteotome (H) allow increased precision and help decrease the risk of inner table penetration and dural tear.

PEARLS

- When harvesting auricular cartilage, the surgeon can simplify the dissection by performing local anesthetic injections in the subperichondrial plane. This will act to hydrodissect the flap and allow blunt dissection to elevate the flap.
- Special care must be taken to evert the skin edges when performing the skin closure. There will be a tendency for the dissected flap to overlap the skin on the side that was not dissected. Vertical mattress sutures are most effective for aligning the skin edges.
- If lateral ear position is a concern, the radix helicis can be left intact to support the auricle and preserve lateral ear position.
- Perichondrium can be dissected off the posterior surface of the cartilage and used as tissue for camouflage or to cushion a tip graft.
- If small cartilage grafts are needed, the posterior approach can be used to harvest ear cartilage.
- If the patient has one ear that protrudes more than the other, then the cartilage should be harvested from that side. If the patient sleeps on one side of the head, then the cartilage should be removed from the contralateral side.
PEARLS, continued

Harvesting Costal Cartilage

- Palpate appropriate-shaped cartilage, and place the incision over the rib to be harvested. In female patients, the incision should be placed in the proximity of the inframammary crease.
- Postoperative pain can be minimized by cutting as little muscle as possible when dissecting over the costal cartilage. The muscle fibers can be bluntly dissected to expose the costal cartilage and then retracted to perform the dissection.
- Postoperative pain can be significantly decreased by keeping the inferior ribs intact to support the rib cage. With the inferior ribs intact, the patient will have much less pain on inspiration.
- Dissect perichondrium off cartilage, taking special care to elevate perichondrium off the inferior surface of the costal cartilage. By leaving the perichondrium intact over the pleura, there will be minimal chance of pneumothorax.
- The incision should be closed in multiple layers. After closing the muscle, fascia, and subcutaneous tissues, evert the dermal sutures (4-0 polydioxanone suture (PDS)) to provide prolonged support to the skin edges. The wound will remain everted for several months; however, the scar camouflage will be excellent. Patients should be informed of the temporary excess eversion of the skin edges.
- With costal cartilage for grafting, symmetric carving is essential to avoid postoperative warping.

Harvesting Ethmoid Bone

- Avoid resecting ethmoid bone high near the cribriform plate to prevent cerebrospinal fluid leak. Use atraumatic instruments and techniques when removing the bone.
- The bone graft can be shaped with a burr.

Harvesting Calvarial Bone

- Examine the curvature of the skull to determine the most favorable shape to the bone to harvest the bone graft. The parietal or occipital areas are the most common areas where calvarial bone grafts are harvested.
- Create a bone trough down to the diploic layer to allow a curved osteotome to elevate the external table gently off an intact inner table. Generous irrigation is necessary to avoid damage to the bone.
- Narrower 1 cm to 2 cm strips of bone are easier to elevate off the inner table.
- The bone defect can be filled with a bone substitute material.

REFERENCES

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Incision Closure, Nasal Splint, Postoperative Considerations

CLOSURE OF THE MIDCOLUMELLAR INCISION

A single, subcutaneous 6-0 polydioxanone suture (PDS) can be positioned in the dermal tissues to enhance skin-edge eversion and take tension off of the closure (Fig. 1). This suture should provide skin-edge alignment and slight eversion. Excessive eversion will create a deformity that may require many months to resolve. The level of the skin edges must be precisely aligned with this suture; otherwise, an unsightly scar may result. If there is no tension on the closure, a subcutaneous suture may not be necessary.

To close the skin, five 7-0 nylon vertical mattress sutures are used. The first suture lines up the apex of the inverted V. The next two sutures are angled from medial on the lower flap to lateral on the upper flap to align the closure properly. A 6-0 chronic suture is used to line up the vestibular skin at the corner of the columellar flap. This corner suture is important because aberrant healing of this corner can result in a visible notch defect.
Figure 1. A–D: Closure of external columellar incision. Note how the two sutures placed just off the midline are angled from medial on the lower flap to lateral on the upper flap. This will recruit redundant skin medially and prevent lateral notching of the columellar incision. Intraoperative photographs (E, F) highlight proper suture placement. When the columellar flap is elevated properly, and then closed meticulously, it should be inconspicuous, as illustrated in this preoperative (G) and postoperative (H) base view.
CLOSED OF THE MARGINAL, INTERCARTILAGINOUS, OR TRANSCARTILAGINOUS INCISION

This incision is closed with one or two 5-0 chromic sutures located laterally that act to advance the lateral crura slightly toward the domes (Fig. 2). This suture advancement will negate the need for an additional suture placed in the region of the domes. All sutures used to close the marginal incision must be examined to make sure there is no distortion of the nostril rim or domal region. If the nostril rim is notched, then the suture should be replaced, taking a smaller bite.

PLACEMENT OF INTRANASAL PACKS, NASAL SPLINT

Intranasal Pack

When extensive septoplasty is undertaken, or when partial turbinectomy or turbinoplasty is performed, the surgeon may wish to place a temporary intranasal pack. The goal is to provide some compression of the septal flaps and, in the case of turbinate surgery, to decrease the risk of postoperative bleeding. There are a number of commercially available packs. An intranasal pack is typically left in place at most overnight and removed the next morning.

External Splint

A great variety of splints are commercially available. In general, after placement of an appropriate adhesive, a small rectangular strip of Telfa is placed over the nasal dorsum to facilitate removal of the splint in 5 to 7 days. Tape is applied over the dorsum and the nasal tip. A splint is carefully applied.

POSTOPERATIVE CARE

The sutures should be removed from the columellar incision after 5 days. At that point, the incision may be supported with flesh-colored steri-strips for several weeks to act as antitension taping. Persistent postoperative supratip edema can be treated with subdermal in-
PEARLS

Closure of external rhinoplasty incisions.

- If there is any tension on the closure, a midline 6-0 PDS suture can be applied to evert the skin edges. Special care must be taken to align the skin edges properly. If the subcutaneous suture is not placed properly, the result will likely be a visible scar.

- The columellar incision is closed with the first 7-0 nylon vertical mattress suture placed in the precise midline. The next two sutures are placed just off midline and are angled from medial on the lower flap to lateral on the upper flap. This maneuver will minimize the chances of creating a notch at the lateral aspect of the columellar flap.

- After closing the marginal incision, the surgeon should check the alar margin to ensure that there is no notching of the margin. This occurs if too much mucosa is taken and acts to deform the alar rim.

- The surgeon should examine the columellar extension of the columellar incision. In most cases, no suture is needed in this region because the vestibular skin is adequately aligned. In some cases, the vestibular skin is not aligned properly, and a 6-0 chromic suture should be used to align the incision properly.

Application of the Cast

- A strip of Telfa can be applied over the dorsum to allow the cast and tape to be removed without lifting the dorsal skin off the underlying nasal skeleton, with resulting edema.

- The nose should be loosely taped to avoid vascular compromise. The tissues will become edematous, and if taped too tight, the tissues may become compromised.

- An Aquaplast cast can be loosely applied to the nose and left in place for 5 days. At the time of cast removal, adhesive remover applied through the holes in the cast will loosen the tape. A blunt instrument can be used to lift the cast and tape carefully off the nose.

Postoperative Care

- At the time of cast removal, the tape should be loosened with adhesive remover that is applied through the holes in the Aquaplast cast and allowed to work for 5 to 10 minutes.

- Digital exercises can be used in the patient who has a deviated nose. These patients can perform digital exercises on the nasal bones to avoid postoperative shifting of the bony nasal vault. This must be done within 10 days after surgery; otherwise, the bones will have started to fixate.

- Postoperative steroid injections can be used to correct subtle asymmetries of the nose. Triamcinolone acetonide (Kenalog; 10 mg/ml) can be injected into the subdermal region where excessive asymmetric edema is noted.

REFERENCES

Appendix A: Tripod Concept

TRIPOD CONCEPT

When considering the effect of surgical techniques on the nose, one may think of the tip as a tripod, with each lateral crus composing one leg of the tripod, and the paired medial crura composing the third leg (1,2). Shortening the two "lateral crural" legs will cause the tripod to fall in that direction, thereby "rotating and deprojecting" the tripod. Weakening these two legs (as with cephalic resection) is also said to have the same effect (although less so), as the healing forces applied to these weakened legs of the tripod will cause the tip to rotate and deproject slightly over time. Similarly, a columellar strut will strengthen the "medial crural" leg of the tripod. Use of a columellar strut to correct buckled medial or intermediate crura may increase tip projection and rotation. Even though the tripod concept oversimplifies the dynamics of the nasal tip, it provides those with little experience in rhinoplasty with a method of predicting the effects of specific techniques.

REFERENCES

Appendix B:
Guide to Nasal Analysis

NASAL ANALYSIS

General

Skin quality: Thin, medium, or thick
Primary descriptor (i.e., why is the patient here): For example, "big," "twisted," "large hump"

Frontal View

Twisted or straight: Follow brow-tip aesthetic lines
Width: Narrow, wide, normal, "wide-narrow-wide"
Tip: Deviated, bulbous, asymmetric, amorphous, other

Base View

Triangularity: Good versus trapezoidal
Tip: Deviated, wide, bulbous, bifid, asymmetric
Base: Wide, narrow, or normal. Inspect for caudal septal deflection
Columella: Columellar/lobule ratio (normal is 2:1 ratio); status of medial crural footplates.

Lateral View

Nasofrontal angle: Shallow or deep
Nasal starting point: High or low
Dorsum: Straight, concavity, or convexity; bony, bony-cartilaginous, or cartilaginous (i.e., is convexity primarily bony, cartilaginous, or both)
Nasal length: Normal, short, long
Tip projection: Normal, decreased, or increased
Alar-columellar relationship: Normal or abnormal
Naso-labial angle: Obtuse or acute

Oblique View

Does it add anything, or does it confirm the other views?
Many other points of analysis can be made on each view, but these are some of the vital points of commentary.
Appendix C:
Aesthetic Analysis

LANDMARKS FOR ANALYSIS: POINTS

See figures on page 10.

Trichion: Anterior hairline in the midline
Glabella: Most prominent midline point of forehead, well appreciated on lateral view
Nasion: Most posterior midline point of forehead, typically corresponds to nasofrontal suture
Rhinion: Soft-tissue correlate of osseocartilaginous junction of nasal dorsum
Sellion: Osseocartilaginous junction of nasal dorsum
Supratip: Point cephalic to the tip
Tip: Ideally, most anteriorly projected aspect of the nose
Subnasale: Junction of columella and upper lip
Labrale superius: Border of upper lip
Stomion: Central portion of interlabial gap
  Stomion superius: Lowest point of upper-lip vermilion
  Stomion inferius: Highest point of lower-lip vermilion
Mentolabial sulcus: Most posterior midline point between lower lip and chin
Pogonion: Most anterior midline soft-tissue point of chin
Menton: Most inferior point on chin
Cervical point: Point of intersection between line tangent to neck and line tangent to submental region
Gnathion: Point of intersection between line from subnasale to pogonion and line from cervical to menton
Appendix D: Surface Angles, Planes, and Measurements: Definitions

Facial thirds
- Upper third: Trichion to glabella
- Middle third: Glabella to subnasale
- Lower third: Subnasale to menton

Horizontal fifths: Five equally divided vertical segments of the face

Frankfort plane: Plane defined by a line from the most superior point of auditory canal to most inferior point of infraorbital rim

Nasofrontal angle: Angle defined by glabella-to-nasion line intersecting with nasion-to-tip line. Normal, 115 to 130 degrees (within this range, more-obtuse angle more favorable in female, and more acute angle in male patients)

Nasofacial angle: Angle defined by glabella-to-pogonion line intersecting with nasion-to-tip line. Normal, 30 to 40 degrees

**PEARL**
Normal projection with a “3-4-5” triangle described by Crumley (see below) gives a nasofacial angle of 36 degrees.

Nasomental angle: Angle defined by nasion-to-tip line intersecting with tip-to-pogonion line. Normal, 120 to 132 degrees

Relationship of lips
- To nasomental line: Upper lip, 4 mm behind; lower lip, 2 mm behind line from nasal tip to menton
- To subnasale-to-pogonion line: Upper lip, 3.5 mm anterior; lower lip, 2.2 mm anterior

Mentocervical angle: Angle defined by glabella-to-pogonion line intersecting with menton-to-cervical point line

Legan facial-convexity angle: Angle defined by glabella-to-subnasale line intersecting with subnasale-to-pogonion line; normal, 8 to 16 degrees

**PEARL**
Useful in assessing chin deficiency, candidacy for chin implant, chin advancement, or other chin alteration

Nasolabial angle: Angle defined by columellar point-to-subnasale line intersecting with subnasale-to-labrale superius line; normal, 90 to 120 degrees (within this range, more obtuse angle more favorable in female, and more acute in male patients)

Columellar show: Alar-columellar relationship as noted on profile view; 2 to 4 mm of columnellar show is normal
Nasal projection: Anterior protrusion of nasal tip from face

Goode’s method: A line drawn through the alar crease, perpendicular to the Frankfurt plane. The length of a horizontal line drawn from the nasal tip to the alar line divided by the length of the nasion-to-nasal tip line. Normal, 0.55 to 0.60 (2,3)

Crumley’s method: The nose with normal projection forms a 3-4-5 triangle (i.e., alar point-to-nasal tip line (3), alar point-to-nasion line (4), nasion-to-nasal tip line (5) (4).

Byrd’s method: Tip projection is two-thirds (0.67) the planned postoperative (or the ideal) nasal length. Ideal nasal length in this approach is two-thirds (0.67) the midfacial height (5)

Powell and Humphries “Aesthetic Triangle”:
- Nasofrontal: 115 to 130 degrees
- Nasofacial: 30 to 40 degrees
- Nasomental: 120 to 132 degrees
- Mentocervical: 80 to 95 degrees

REFERENCES
Appendix E: Tip Support, Incisions, and Approaches

MAJOR TIP-SUPPORT MECHANISMS

1. Size, shape, and strength of lower lateral cartilages
2. Medial crural footplate attachment to caudal septum
3. Attachment of caudal border of upper lateral cartilages to cephalic border of lower lateral cartilages

[Nasal septum also is considered a major support mechanism of the nose.]

MINOR TIP-SUPPORT MECHANISMS

1. Ligamentous sling spanning the domes of the lower lateral cartilages (i.e., interdomal ligament)
2. Cartilaginous dorsal septum
3. Sesamoid complex of lower lateral cartilages
4. Attachment of lower lateral cartilages to overlying skin/soft-tissue envelope
5. Nasal spine
6. Membranous septum

INCISIONS: METHODS OF GAINING ACCESS

1. Intercartilaginous
2. Transcartilaginous
3. Marginal (NOT to be confused with rim incision)
4. Transcolumellar

APPROACHES: PROVIDE SURGICAL EXPOSURE

1. Cartilage-splitting
2. Retrograde
3. Delivery: Marginal + intercartilaginous incision
4. External approach: Marginal + transcolumellar incision

SCULPTING TECHNIQUES: SURGICAL MODIFICATIONS

1. Complete strip (i.e., cephalic resection) or volume reduction of lateral crura
2. Incomplete strip (dome division)
3. Transdomal/domal sutures
4. Augmentation grafting
5. Tip graft
6. Other

REFERENCES

Appendix F:
Achieving Surgical Goals: Selected Options

INCREASE ROTATION

Lateral crural steal
Transdomal suture that recruits lateral crura medially
Base-up resection of caudal septum (variable effect)
Cephalic resection (variable effect)
Lateral crural overlay
Columnellar strut (variable effect)
Plumping grafts (variable effect)
Illusions of rotation: increased double break, plumping grafts (blunting nasolabial angle)

DECREASE ROTATION (COUNTERROTATE)

Full transfixion incision
Double-layer tip graft
Shorten medial crura
Caudal extension graft
Reconstruct L-strut, as in rib graft reconstruction (integrated dorsal graft/columnellar strut)

INCREASE PROJECTION

Lateral crural steal (increased projection, increased rotation)
Tip graft
Plumping grafts
Premaxillary graft
Septocolumellar sutures (buried)
Columnellar strut (variable effect)
Caudal extension graft

DECREASE PROJECTION

High partial, or full transfixion incision
Lateral crural overlay (decreased projection, increased rotation)
Nasal spine reduction
Vertical dome division with excision of excess medial crura, with suture reattachment

INCREASE LENGTH

Caudal extension graft
Radix graft
Double-layer tip graft
Reconstruct L-strut
DECREASE LENGTH

See increase rotation
Also, deepen nasofrontal angle
Set-back and suture medial crura to midline caudal septum

TIP REFINEMENT

Cephalic resection (volume reduction)
Dome-binding sutures
Vertical dome division, with suture reconstitution
Tip graft

REFERENCES

Appendix G:
Selected Complications
of Rhinoplasty

**Bossae:** A knuckling of lower lateral cartilage at the nasal tip caused by contractural healing forces acting on weakened cartilages. Patients with thin skin, strong cartilages, and nasal-tip bifidity are especially at risk. Excessive resection of lateral crus and failure to eliminate excessive interdomal width may play some role in bossae formation.

**Polly beak:** Postoperative fullness of the supratip, with an abnormal tip-supratip relation. This has several etiologies: Failure to maintain adequate tip support (postoperative loss of tip projection), inadequate cartilaginous hump (anterior septal angle) removal, and/or supratip dead space/scar formation.

Treatment depends on anatomic cause. If the cartilaginous hump was underresected, then resect additional dorsal septum. One also must ensure adequate tip support. Maneuvers such as placement of a columellar strut may be of benefit. If the bony hump was overresected, consider a graft to augment the bony dorsum. If a polly-beak is from excessive scar formation, consider triamcinolone (Kenalog) injection or skin taping in the early postoperative period, before any consideration of surgical revision.

**Inverted V deformity:** Inadequate support of the upper lateral cartilages after dorsal-hump removal can lead to inferomedial collapse of the upper lateral cartilages and an "inverted V deformity." In this deformity, the caudal edges of the nasal bones are visible in broad relief. Inadequate infracture of the nasal bones is also a frequent cause. When executing hump excision, it is helpful to preserve the underlying nasal mucoperichondrium (extramucosal dissection), which provides significant support to the upper lateral cartilages and helps decrease the risk of inferomedial collapse of the upper lateral cartilages after hump excision. When undertaking osteotomies after hump excision, appropriate infracture and narrowing of the bony vault must be achieved.

**Rocker deformity:** If osteotomies are taken too high, into the thick frontal bone, the superior aspect of the osteotomized nasal bone may project or "rock" laterally when the bone is infractured. This is a "rocker" deformity. A 2-mm osteotome may be used percutaneously to create a more appropriate superior fracture line and correct the rocker deformity.

**Dorsal irregularities:** After creation of an "open roof" by hump removal, the bony margins should be smoothed with a rasp. Any bony fragments should be removed, making sure that all obvious particles are removed from under the skin/soft-tissue envelope. Failure to remove all fragments may lead to a visible and/or palpable dorsal irregularity.

**Nasal valve collapse:** The surgeon should recognize the existence of the internal and external nasal valve. The internal nasal valve area is bounded by the caudal margin of the upper lateral cartilage, septum, and floor of the nose. The external nasal valve refers to the area delineated by the cutaneous and skeletal support of the mobile alar wall. Excessive narrowness in either of these locations may cause nasal obstruction. Weakness at either of these locations may result in collapse with the negative pressure of inspiration, resulting in nasal airway obstruction. Nasal valve collapse is seen most often as a sequela of overresection of lateral crura or middle vault collapse. Overaggressive resection of the lateral crura and the subsequent postoperative soft-tissue contraction frequently leads to nasal valve compromise.
REFERENCES

Appendix H:
Adjunctive Procedures

Chin implant (Fig. 1)

Figure 1. Chin augmentation can be a useful adjunctive procedure to create facial balance in the patient with an underdeveloped chin. In this illustration, only the chin differs between these two line drawings.
Submental lipectomy (Fig. 2)

Figure 2. In the selected patient seeking nasal surgery, submental lipectomy is another useful adjunctive procedure to create facial balance.

REFERENCE

Appendix I: Cleft Lip Nasal Deformity

UNILATERAL CLEFT (Fig. 3)

Nasal tip:
Medial crus of LLC shorter on cleft side
Lateral crus of LLC longer on cleft side (total length of cleft and noncleft side LLC are the same)
Tip-defining point on cleft side is flat and laterally displaced
Columella:
Short on cleft side
Columellar base directed to noncleft side (unopposed orbicularis muscle)
Nasal base:
Horizontal orientation on cleft side
Alar base:
Laterally, inferiorly, and posteriorly displaced on cleft side
Nasal floor:
Usually absent
Septum:
Caudal deflection to noncleft side
Posterior deflection to cleft side

BILATERAL CLEFT

Figure 3. Cleft-lip nasal deformity. Typical anatomic findings characteristic of unilateral cleft-lip nasal deformities.
Nasal tip:
- Medial crura short bilaterally
- Lateral crura short bilaterally, caudally displaced
- Tip-defining points poorly defined and widely separated
Columella:
- Short, with a wide base
Nostrils:
- Horizontal orientation bilaterally
Alar base:
- Laterally, inferiorly, and posteriorly displaced bilaterally
Nasal floor:
- Usually absent bilaterally

REFERENCE

Appendix J: Photography Setup (1) (Fig. A-4)

Camera: 35-mm SLR (single light reflex camera) with 105-mm macro lens
Lighting: dual electronic flash units; overhead kicker light adds a backlighting effect that improves picture quality and softens or eliminates background shadows
Background: Nassau blue no. 25
Film: Kodak Ektachrome ASA 100

STANDARD RHINOPLASTY VIEWS

1:7, frontal, base, lateral, oblique
1:5 and 1:3, close-up, base view

REFERENCE

Appendix K: Indications For External Rhinoplasty Approach

Asymmetric nasal tip
Crooked-nose deformity (lower two thirds of nose)
Saddle-nose deformity
Cleft-lip nasal deformity
Secondary rhinoplasty requiring complex structural grafting
Septal-perforation repair

REFERENCES

Appendix L: Suggested Surgical Instruments for Rhinoplasty

1. Needle holder
2. Bayonet forceps
3. Mallet
4. Takahashi forceps
5. Siegel retractor
6. Converse retractor
7. Hemostat (curved)
8. Hemostat (straight)
9. Small nasal speculum
10. Large nasal speculum
11. Small single skin hook
12. Small double skin hook
13. Small double skin hook
14. Medium double skin hook
15. Wide double skin hook
16. Freer/Cottle elevator
17. Joseph elevator
18. Converse scissors
19. Fomon scissors
20. Straight Stevens scissors
21. Curved Stevens scissors
22. Curved Iris scissors
23. Scalpel handle
24. Scalpel handle
25. Brown–Adson forceps
26. Brown–Adson forceps
27. Bishop–Harmon forceps
28. Bishop–Harmon forceps
29. 2.0-mm unguarded osteotome
30. 3.0-mm straight unguarded osteotome
31. 3.0-mm straight guarded osteotome
32. 2.5-mm straight guarded osteotome
33. Medical grade sharpening stone
34. Dorsal (Rubin) osteotomes: small, medium, large
35. Rasp with tungsten-carbide inserts: 1/2, 3/4, 5/6
36. Aiache cartilage crusher
37. No. 10 Frazier tip suction
Appendix M: List of Selected Companies with Address/Phone Numbers

RHINOPLASTY INSTRUMENT SETS

Anthony Products, Inc., Indianapolis, IN 800 428-1610
Ellis Instruments, Inc., Madison, NJ 800 218-9082
Instruments Unlimited, Quakertown, PA 800 818-0094
Invotec, Jacksonville, FL 800 998-8580
Lorenz Surgical, Jacksonville, FL 800 874-7711
MicroFrance, St. Aubin, France 800-874-5797
Smith-Nephew-Richards, Madison, WI 888 395-8060
Snowden Pencer, Tucker, GA 800 843-8600
Storz Instruments, St. Louis, MO 800 325-9500
Xomed Surgical Products, Jacksonville, FL 800 874-5797

ALLOPLASTIC CHIN IMPLANTS

Allied Biomedical, Paso Robles, CA 800 276-1322
Hanson Medical, Inc., Kingston, WA 800 771-2215
Invotec, Jacksonville, FL 800 998-8580
Porex Surgical, Inc., College Park, GA 800 521-8145
W. L. Gore & Associates, Inc., Flagstaff, AZ 800 528-8763
Xomed Surgical Products, Jacksonville, FL 800 874-5797

ALLODERM

LifeCell Corporation, The Woodlands, TX 800 367-5737

DERMABOND (OCTYL-2-CYANOACRYLATE)

Ethicon, Somerville, NJ 800 888-9234

RHINOPLASTY POWER INSTRUMENTATION

Linvatec/Hall Surgical Products Group, Largo, FL 800 925-4255
United American Medical, McMinnville, TN 800 521-5002
Xomed Surgical Products, Jacksonville, FL 800 874-5797

NASAL SPLINTS

Invotec, Jacksonville, FL 800 998-8580
Shippert Medical Technologies (Denver Splints), Englewood, CO 800 888-8663
Vision Medical (Thermoplast), Peoria, AZ 800 874-5797
Xomed Surgical Products, Jacksonville, FL 800 874-5797

INTRANASAL PACKS

Invotec, Jacksonville, FL 800 998-8580
Xomed Surgical Products, Jacksonville, FL 800 874-5797
Appendix N: Selected Recommended Literature


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