# Chapter 47: Rhinoplasty

**M. Eugene Tardy, Jr.**

## Surgical Philosophy

Aesthetic and reconstructive rhinoplasty, universally acknowledged as the most elegant but most difficult of all plastic surgical procedures, soon approaches the one-hundredth anniversary of its modern development. Although certain refinements in technique gained progressive acceptance during the first three-quarters of the twentieth century, the fundamental operation remained a primarily *tissue reduction* procedure, characterized by various degrees of excision (often rather profound) of the fundamental nasal anatomic components.

In the past 15 years a striking revolution has occurred in the fine points of analysis and technique, guided by surgeons devoted to tissue reorientation and augmentation rather than resection, individualization of technique rather than a lock-step approach, and atraumatic tissue dissection in proper nasal cleavage planes. A more thorough understanding of and respect for the long-term surgical outcome now dominates and guides the selection of the surgical technique because surgeons no longer are content with satisfactory short-term results at the expense of risking future visual and functional misadventures. Thus all modifications to nasal structures must factor in the dynamic effects each maneuver exerts upon the immediate overall nasal appearance, in the nasal airway, and the anticipated control of the vagaries of healing nasal tissues. Clearly the surgically altered nose continues to be modified by the healing process and certain inexorable aging phenomena during the lifetime of the patient. This it is seldom possible to designate a "final result" following nasal surgery.

The philosophy, approaches, and graduated techniques presented in this chapter seek to document and validate the long-term virtues of accurate detailed analysis and planning, atraumatic and conservative surgical techniques devoted to tissue repositioning and reorientation, and methods of exercising the highest control over the healing process.

## Preoperative Patient Assessment

### Anatomic evaluation

The final result of any rhinoplasty procedure is the consequence of the individual patient's anatomy (Fig. 47-1 and Plates 7 and 8) as much as the surgeon's skill. No two noses are ever quite alike; it follows then that no single, standard procedure suffices to reconstruct every nose pleasingly. The ability to diagnose the possibilities and limitations inherent in each patient is an absolute prerequisite to achieving outstanding results. Patients with relatively minimal deformities (a small hump, a minimally bulbous tip, a slightly overwide nose) almost always are the best candidates for near-perfect surgical results (Fig. 47-2). Because the initial problem is minimal, this group of patients often expects and even demands perfection. More dramatic surgical results

are possible in patients who demonstrate significant departures from an aesthetic ideal (a large hump; an elongated, drooping nose; a twisted nose); these patients might tolerate possible minor imperfections that result, since the overall improvement is indeed dramatic (Fig. 47-3). **It is the fundamental responsibility of the surgeon to balance the wishes and desires of the patient with what is realistically possible given the anatomic limitations (or possibilities) inherent in each individual nose.**

The quality of the skin is an essential indicator of the surgical outcome and plays a significant role in preoperative planning. Extremely thick skin, rich in sebaceous glands and subcutaneous tissue, is the least ideal skin type for achieving desirable refinement and definition. Care must be taken not to overreduce the bony-cartilaginous skeleton in thick-skinned patients in a futile attempt to produce a much smaller nose. Failure of thick skin to contract favorably in this situation may lead to excess soft-tissue scar, an amorphous nasal appearance, and even the dreaded soft-tissue "pollybeak" (Fig. 47-4).

Extremely thin skin, often pale, freckled, and nearly translucent, must also be recognized and respected for its inherent limitations. Although ideal for achieving critical definition, thin skin with sparse subcutaneous tissue provides almost no cushion to cover even the most minute of skeletal irregularities or contour imperfections, and therefore demands near-perfect surgery to achieve the desired natural result. Occasionally patients with this anatomic condition demonstrate an undesirable progressive skin retraction and unattractive shrinkage over several years, rendering the nose unnatural and angular.

The ideal skin type falls somewhere between these two extremes, being neither too thick and oily nor too thin and delicate. It possesses enough subcutaneous tissue to provide satisfactory cushion over the nasal skeleton but still allows critical definition to become apparent in a relatively short time after surgery. Evaluation of skin type is made by inspection and palpation - rolling the skin over the nasal skeleton and gently pinching it between the examining fingers.

A critical factor in assessing the candidate for rhinoplasty is the inherent strength and support of the nasal tip, referred to as the *tip recoil.* Finger depression of the tip toward the upper lid provides a quick and reliable test of the ability of the mobile tip's structures to spring back into position (Fig. 47-5). The tip that possesses weak, somewhat flail alar cartilages does not tolerate an extensive sacrifice of tissue well and may in fact require the addition of supportive struts to improve its long-term stable support. These weak tips are often accompanied by thin alar sidewalls and thin skin (Fig. 47-6). If the recoil is instantaneous and vigorous, and the tip cartilages resist the deforming influence of the finger, more definitive tip surgery may usually be performed without fear of substantial loss. The size, shape, attitude, and resilience of the alar cartilages may be estimated by palpation or "ballottement" of lateral crus between two fingers surrounding its cephalic and caudal margins. During this assessment the surgeon makes the all-important decision about whether to enhance, reduce, or carefully preserve the tip projection that exists preoperatively. Any asymmetry of the alar cartilages must be carefully noted for later correction.

A surprising amount of diagnostic information may be gained by palpating the internal vestibules of the nose with the thumb and forefinger surrounding the columella. Otherwise undetected twists and angulations of the nasal septum, which may significantly influence the final functional and aesthetic appearance, may be discovered. The width and length of the columella and the medial crura it contains are determined. Short medial crura will probably require supportive cartilaginous struts to lengthen the columella and aid in rotation, if desirable; extremely flaring or overlong medial crura invite reduction in width and length as well as retropositioning. Information about the potential of the tip to undergo desirable cephalic rotation is gained by the exploring fingers, which determine whether the tip-lip complex is tethered by muscle and its inadequate length. It is also important to determine whether the central skeletal component of the nose (the quadrangular cartilage) is overlong and might interfere with satisfactory tip rotation (Fig. 47-7). The size and position of the nasal spine and its related caudal septal angle must also be evaluated.

The experienced surgeon accomplishes these visual and palpatory diagnostic exercises with precision and facility, often while eliciting further history from the patient. Detecting the minute but critical structural distinguishing characteristics of each individual's nasal anatomy is the first and most important step toward a splendid surgical result.

Careful examination of the nasal cavities before and after shrinkage of the mucosa and turbinates is an essential component of the initial examination. An overt, symptomatic deviation of the nasal septum is easily diagnosed; the deflected ethmoid plate, which may appear innocent but in fact be responsible for airway blockade after infraction of the bony sidewalls during an osteotomy (Fig. 47-8) may be easily overlooked by casual inspection. Internal examination confirms the condition of the internal nasal valves and their associated upper lateral cartilages and discovers whether the turbinates require repair or relocation to improve overall nasal function. If a septal perforation exists, its size and location may significantly influence the planned extent of the surgical procedure, particularly if substantial hump removal is planned.

Finally, the position and inclination of the nasofrontal and nasolabial angles, the shape and size of the alae, the overall width of the middle and upper thirds of the nose, and the relationship of the nose to the remainder of the facial features and landmarks are evaluated (Fig. 47-9). In particular, facial asymmetries (which are present more often than not) and the relationship of the chin projection to the nose should be documented (Fig. 47-10), particularly for the patient who is unaware of their existence. The routine use of a three-way mirror and facial photographs catalyze this vitally important communication process between the expectant patient and the cautious surgeon. This is the time, reinforced by later discussions, to make the patient aware of any and all limitations that the existent anatomy imposes on the desired surgical outcome. Realistic expectations and thoroughly informed consent are the keystones on which the most important surgical outcome - a happy patient - is achieved.

## Photography

Standard and uniform color photographs of the rhinoplasty patient, recorded before and serially after the surgical event, are as important to the rhinoplasty surgeon as radiographs are to the bone specialist and ECGs are to the cardiologist. They are important guides to operative planning and execution, definitive records for evaluation by the surgeon and patient, invaluable teaching tools, and vital medicolegal records. Reliable methods of making standardized, consistently uniform photographs have been described in Fig. 47-11. All rhinoplasty surgeons must either become expert in keeping uniform photographs or arrange uncompromisingly for their provision by a medical photographer or knowledgeable assistant. Life-sized projection of the 35-mm color transparency in the operating theater during surgery is an invaluable aid to precision surgery (Fig. 47-12).

## Laboratory evaluation

The extent of indicated laboratory evaluations performed in the preoperative period depends on the needs of the individual patient. Routinely ordered is an automated biochemical survey (SMA-12), a complete blood count, a urinalysis, and a bleeding and coagulation survey (routinely consisting of a complete blood count, platelet count, bleeding and clotting time, and partial thromboplastin time). This information is augmented by a thorough history of any personal or familiar bleeding disorder. Of particular importance is any history of recent ingestion of aspirin or aspirin-containing drugs, which must be stopped at least 2 weeks before the scheduled surgery.

Routine sinus radiographs are requested only if nasal and sinus disease is suspected; radiographs of the nasal skeleton usually provide little useful information that cannot be better obtained from minute inspection and palpation. When nasal implants or foreign bodies are suspected to exist, xeroradiograms may be invaluable in pinpointing their position, composition, and extent.

## Anesthesia and analgesia

Successful rhinoplasty depends on a careful preoperative evaluation, an exacting operative technique, and postoperative healing.

Each surgical step in the correction of the nose is interrelated and interdependent on the other steps. The success of each step depends in no small measure on the preceding ones. Since the administration of anesthesia is the initial surgical step in rhinoplasty, a well-planned and well-executed technique that avoids tissue distortion is necessary for a successfully controlled procedure.

Improper administration of anesthesia results in an uncomfortable, agitated patient and a bloody operative field, which at best hinders surgery. Correct anesthetic administration commonly results in a comfortable, relaxed patient and a relatively bloodless operative field, permitting

precise anatomic dissection.

Just as there are a multitude of rhinoplasty techniques, so there are various approaches to nasal anesthesia. Experience suggests that a combination of monitored intravenous analgesia with local topical and infiltration anesthesia is ideal for rhinoplasty. General endotracheal anesthesia is less often employed for routine nasal surgery and is chosen only when concerns regarding patient cooperation arise.

### *Surgical planes*

To achieve goals of anesthesia fully, it is important to appreciate, identify, and correctly utilize the surgical planes of the nose. The importance of anatomic tissue planes is stressed throughout surgical training, since dissection within these planes facilitates surgery with minimal bleeding and postoperative scarring.

Within the nose three distinct dissection planes can be identified. An extraperiosteal plane exists lateral and medial to the ascending process of the maxilla along the intended course of the lateral osteotomies. Infiltration of the local anesthetic on both sides of the ascending process aids remarkably in eliminating or reducing bleeding after a lateral osteotomy (Fig. 47-13). A second plane exists in the submucoperichondrial and submucoperiosteal spaces flanking the nasal septum. Infiltration of the local anesthetic into this plane results in a hydraulic elevation of the septal flap, facilitating elevation and preservation of flap integrity (Fig. 47-14). Of greatest importance is the surgical plane occupying the immediate supraperichondrial and supraperiosteal regions over the lower and upper cartilages and nasal bones that exist just below the subcutaneous tissue layer (see Fig. 39-43). It is entered in all rhinoplasty operations. Infiltrating and operating in this plane produces a virtually bloodless field for delicate precision surgery.

A paucity of vascular and neural structures exists in these planes; anesthetic infiltration into these planes misses the vessels and nerves that lie more superficial in the subcutaneous tissue and dermis. When the anesthetic is injected into the proper planes, it diffuses more readily and requires only small amounts (usually 3.5-5 mL) to obtain the desired anesthetic and vasoconstrictive effects. If the infiltration is placed in the subcutaneous tissue or epithelium overlying these planes, larger quantities are needed to obtain these effects, and there is a tendency to distort and "balloon" the nose, creating a distortion that leads to inaccurate judgment. By identifying and using the proper dissection planes, only small amounts of anesthetic are needed to achieve maximal anesthesia and vasoconstriction with consequent minimal nasal distortion.

### *Preoperative medication and intravenous analgesia*

Local infiltration anesthesia is administered after the patient has been sedated with preoperative medication and intravenous analgesia. It is important that the patient not receive a great many different families of drugs before and during surgery. Combinations of drugs, particularly when they are intermingled with intravenous medications given during surgery, are often unpredictable in their individual and combined effectiveness. Any drug reaction that may

arise from the use of multiple families of pharmacologic agents is confusing to treat and may be impossible to counteract intelligently.

Close cooperation between the surgeon and anesthesiologist is important at this time as well as throughout the operation. Each is responsible for the patient's safety and well-being, and each catalyzes the operative process by a healthy respect for the other's responsibilities.

Innovar, a combination of droperidol and fentanyl citrate, has been found to be safe and reliable for inducing a state of relaxed sedation. It is best administered in small titrated increments by an experienced anesthesiologist and should never be infused as a large bolus. The powerful antiemetic effect of droperidol has largely eliminated the problem of nausea. In excessively anxious patients, Versed (midazolam) added to the intravenous regimen effectively reduces anxiety and promotes amnesia.

For increased comfort the patient is maintained in the reverse Trendelenburg position with the head elevated. This enhances vasoconstriction and facilitates venous and lymphatic drainage.

### *Topical anesthesia*

Before infiltration of the local anesthetic, the nasal mucous membranes are anesthetized with a 4% cocaine solution, color-coded to prevent the possibility of solution confusion and the inadvertent injection of cocaine. The cocaine is deposited in each nasal fossa on a single neurosurgical cottonoid, which is wrung out to prevent any excess absorption of the drug (Fig. 47-15). It is unnecessary to anesthetize specifically precise nerves in the nose with multiple cumbersome pledgets or cotton-tipped wires, a more traditional than useful exercise.

The cottonoids further act as excellent tampons that prevent the flow of blood and nasal secretions into the pharynx. The strings attached to the cottonoids are a safety factor. They allow for ease of retrieval, prevent any accidental aspiration during the procedure, and act as an infallible reminder to remove the packing before placing the final dressing.

### *Infiltration anesthesia*

For infiltration anesthesia 1% lidocaine with a 1:100.000 or 1:50.000 dilution of epinephrine is preferred. The weaker solution is used in older patients or in those with any question of cardiovascular or peripheral vascular disease. Both concentrations of epinephrine produce profound vasoconstriction if incisions are delayed for 10 to 15 minutes after the final injection. The concentration of 1% lidocaine is sufficient to produce excellent anesthesia and has an effective duration of 1.5 to 2 hours.

Except in unusual cases, a total of 3.5 to 5 mL of the solution, sparingly injected into the proper surgical planes, is sufficient to produce profound vasoconstriction and complete nasal anesthesia with no significant tissue distortion. No effort is made to block specific nerves. If septal reconstruction is required, an additional 2 to 3 mL of the anesthetic is injected into the

septal mucoperichondrial and mucoperiosteal planes to aid in the hydraulic dissection of the septal flap.

The infiltration of the local anesthetic is initiated by retracting the ala cephalically with thumb and forefinger, exposing the caudal edge of the upper lateral cartilage (specula or retractors are unnecessary and redundant at this point). A long 27-range needle is placed parallel to the long axis of the exposed upper lateral cartilage, and with a quick stabbing motion the needle penetrates the epithelium, usually with minimal sensation to the patient (Fig. 47-16, A). Any sensation of the needle stick may be masqueraded by simultaneous blunt pinching of the skin elsewhere on the nose or face, a concept referred to as *lateral inhibition.*

The needle is advanced along the lateral wall of the dorsum, hugging the perichondrium of the upper lateral cartilages and the periosteum of the nasal bones, thus remaining in the proper plane. Identification of this plane is enhanced by lifting the soft tissues overlying the nasal dorsum with thumb and forefinger.

A minimal quantity, usually less than 0.5 mL, is deposited into this plane as the needle is withdrawn to but not beyond the point of initial penetration (Fig. 47-16, B). If the nose becomes distorted during this maneuver, the needle is not in the proper plane, and the infiltration stops until the plane is located. With alternate slight rotation of the needle laterally and medially over the dorsum (Fig. 47-16, C and D), the procedure is repeated until the anesthetic is deposited in the proper plane over the area to be dissected. The procedure is repeated on the opposite side. With this method only two injection penetrations are sufficient to anesthetize the nasal dorsum.

Anesthesia of the base of the nose and columella is accomplished next. The needle penetrates the skin at the junction of the floor of the right nostril and columella and is advanced to a point just beyond the left alar facial junction (Fig. 47-16, E). Infiltration occurs as the needle is withdrawn to the columella. Without removal the needle is rotated and advanced into the columella. Again, a small amount of anesthetic is deposited as the needle is withdrawn. Sparing the patient an additional needle prick, the needle is rotated into the right nasal base, which is anesthetized in a similar fashion (Fig. 47-16, F).

The technique of nasal tip anesthetic infiltration depends on the type of planned nasal tip incision. If a transcartilaginous incision is intended, the vestibular skin on the undersurface of the lower cartilage is exposed and everted by pressure above the nostril. The solution is deposited along the course of the proposed incision in the natural plane beneath the perichondrium. Surgical elevation and preservation of an intact vestibular skin flap is thereby facilitated. If delivery of the alar cartilage is contemplated, the anesthetic is infiltrated in the soft tissue along the extent of the planned incision at the caudal margin of the cartilage.

The anesthetic may then be deposited along the course of the lateral osteotomies (Fig. 47-16, A and B), or if desired this may be deferred until later in the operation. This delays adds a safety measure to the procedure by allowing the patient to metabolize the initial lidocaine and epinephrine before adding any further solution. The margin of the piriform aperture just above

the leading anterior edge of the inferior turbinate is brought into sharp relief by surrounding it with the blades of a small nasal speculum. The needle is inserted at this site, and a small amount of medication is injected. The needle is advanced lateral to and then medial to the ascending process of the maxilla along the intended path of the lateral osteotomies (Fig. 47-16, G), and as the needle is withdrawn, solution is deposited. Thus the path of the lateral osteotomies is surrounded by local vasoconstrictive anesthesia, a valuable adjunct to bloodless osteotomies and patient comfort. Postoperative ecchymosis is reduced to a minimum or eliminated by the latter maneuver combined with a gentle operative procedure.

When septal reconstruction is planned, anesthesia of the already anesthetized (with cocaine) septum is accomplished. Unlike the preceding steps, infiltration of a generous amount of solution into the proper septal plane is preferred. This quantity results in hydraulic dissection of the mucoperichondrium and mucoperiosteum from the cartilaginous and bony septum (Fig. 47-14). It allows for an avascular flap elevation and may help to dissect synechiae from areas of old fractures.

With nasal shrinkage intense at this point, the cottonoids are removed temporarily. The needle is inserted with the bevel down into the mucous membrane on the side of intended mucoperichondrial flap elevation. The needle is advanced to the plane between the quadrangular cartilage and perichondrium, and with anesthetic infiltration hydraulic elevation is created. This is repeated at several other sites along the mucous membrane. The needle is then inserted beneath the mucoperiosteum overlying the bony septum on both sides, and the anesthetic is infiltrated there. Small amounts of solution are also deposited on both sides of the base of the septum at the maxillary crest-quadrangular cartilage junction. After completion of the septal anesthesia, the cottonoids are reinserted. If surgery is deliberately delayed 10 to 15 minutes, vasoconstriction will reach its maximal effectiveness and bleeding will be minimized.

This combination of monitored intravenous anesthesia and local topical-infiltration anesthesia has been repeated successfully several thousand times over the past 15 years with no serious sequelae. It ensures patient comfort, provides for constant patient monitoring, limits the number of needle penetrations, minimizes the amount of anesthetic, and prevents tissue distortion. In the vast majority of operations little if any bleeding occurs during the procedure, and postoperative ecchymosis is minimal or nonexistent. All of these factors help to permit the precise and bloodless dissection of the nasal structures, which is essential for a carefully controlled rhinoplasty operation.

## Surgical landmarks

Although not strictly necessary, it can be helpful to the neophyte as well as the experienced surgeon to indicate on the external skin surface the anatomic surgical landmarks with a marking pen. These external manifestations of the nose skeleton and framework may ordinarily be judged within tolerances of 1 to 2 mm, allowing the development of critical, measured judgments about planned excisions, augmentations, and reorientation of nasal structures (Fig. 47-17). It may be helpful (particularly in a teaching environment) to mark the margins of the alar

cartilages and their precise tip-defining points, as well as the preplanned amount of cephalic reduction required for refinement and definition. The caudal margins of the nasal bones and maxillary ascending processes are indicated, and the estimated extent of the bony-cartilaginous hump removal and the planned osteotomy pathways may be indicated by dotted lines. A plus (+) mark on contour depressions serves to remind the surgeon of the need for intended augmentation, since small depressions may later be obscured by anesthetic infiltration and surgical edema. Skin markings are of course only general guidelines to the intended surgical maneuvers, but may be useful in guiding the thought processes by which precise surgery is executed.

## Surgery of the Nasal Tip

Because it is mobile and animate, the nasal tip is approached as a rather distinctive and separate portion of the rhinoplasty operation. It is helpful, although not mandatory, to operate on the nasal tip first, since it is usually technically more efficient to align and reconstruct the remainder of the nose to dimensions dictated, to a substantial degree, by the projection, size, and attitude of the tip.

The objective of tip surgery is to construct a defined, stable, properly projecting nasal tip, which is roughly triangular on the base view and blends harmoniously with the remainder of the nasal anatomy. Cephalic rotation of the tip during rhinoplasty is usually desirable. In the past, strong emphasis was placed on tissue excision and more radical division of the tip cartilages and supporting structures. Gradually surgeons have come to realize that improved long-term results occur when the supporting structures of the tip are preserved and more conservative reconstructive techniques of tip sculpture are employed.

The surgical anatomy of the nasal tip is extraordinarily varied, a fact that makes tip sculpture difficult but also exciting and challenging. Fig. 47-1 and Plates 7 and 8 show this pertinent surgical anatomy and the terms applied to it.

Tip sculpture cannot be successfully undertaken, let alone mastered, until the major and minor tip-support mechanisms are appreciated, respected, and preserved (or, when indicated, reconstructed). Loss of tip support and projection in the postoperative healing period is one of the most common surgical errors in rhinoplasty. This "tip ptosis" is usually the inevitable result of the sacrifice of tip supports (Fig. 47-18).

The major tip support mechanisms consist of (1) the size, shape, and resiliency of the medial and lateral crura; (2) the wrap-around attachment of the medical crural footplates to the caudal end of the quadrangular cartilage; and (3) the soft-tissue attachment of the caudal margin of the upper lateral cartilage to the cephalic margin of the alar cartilage (Fig. 47-19). If any or all of these major tip supports are compromised in any fashion during the operation, compensatory reestablishment of major tip support should be considered.

The minor tip-support mechanisms (Fig. 47-19), which in certain anatomic configurations may assume major support importance, include (1) the dorsal cartilaginous septum, (2) the

interdomal ligaments, (3) the membranous septum, (4) the nasal spine, (5) the surrounding skin and soft tissues, and (6) the alar sidewalls.

In every rhinoplasty operation the procedure inevitably results in either preservation of the existing tip projection, reduction of projection, or, frequently, enhancement of tip projection. Anatomic situations in which each of these outcomes is desirable and intended are regularly encountered in a diverse rhinoplasty practice. Preservation of the projection already existent is the desirable surgical goal, if, as is true in the majority of rhinoplasty patients, preoperative projection of the tip is satisfactory. Certain patients require an increase in the projection of the tip relative to the intended new profile line. A predictable variety of reliable operative methods exist for creating or augmenting tip projection; they are discussed later in this chapter. Finally, in a limited but clearly definable group of patients with overprojecting tips, a calculated intentional reduction of excessive tip projection is desirable.

Successfully achieving these diverse surgical results requires an understanding of and a healthy respect for the major and minor tip-support mechanisms, seasoned by the recognition of the intraoperative surgical tip dynamic principles that interact in every tip operation. It clearly follows then that the *appropriate tip incisions and approaches should be planned to preserve as many tip supports as possible.* Alar cartilage sculpturing should similarly respect this principle by conserving the volume and integrity of the lateral crus and avoiding, in all but the most extreme anatomic situations, radical excision and sacrifice of tip cartilage.

To understand healing dynamics clearly and to assess and compare results accurately, surgeons should differentiate between *incisions, approaches,* and *techniques.* Incisions are simply methods of gaining access to the underlying supportive structures of the nose, and by themselves have little importance. Approaches to the nasal tip provide important exposure to the skeletal structures and consist of procedures either to deliver the tip cartilages or to avoid complete delivery. Sculpturing techniques, then, are defined as surgical modifications: excision, reconstruction, or reorientation of the alar cartilages calculated to result in significant changes in the definition, size, orientation, and projection of the nasal tip. The principal incisions, approaches, and techniques employed in nasal tip surgery are listed in Fig. 47-20 and Table 47-1. Because of the amazing complexity of anatomic configurations encountered in nasal tip surgery, further modifications are frequently employed to ensure further stable refinements.

In assessing the need for tip remodeling, the surgeon must determine whether or not the tip requires (1) a reduction in the volume of the alar cartilages, (2) a change in the attitude and orientation of the alar cartilages, (3) a change in the projection of the tip, and (4) a cephalic rotation with a consequent increase in the columellar inclination (nasolabial angle). Once these factors are accurately assessed, the most favorable incisions, the approach, and the tip-sculpture technique may be chosen.

Ideally, conservative reduction of the volume of the cephalic margin of the lateral crus, preserving the majority of the crus while maintaining a complete (uninterrupted) strip of alar cartilage, is preferred (Fig. 47-21). This procedure is quite satisfactory and appropriately safe

when minimal conservational tip refinement and rotation are required. As the tip deformity increases in size and complexity, more aggressive techniques are required. A philosophy of a graduated incremental anatomic approach to tip surgery is recommended. This implies that no routine tip procedure is ever used; instead *the appropriate incision(s), approach, and tip-sculpting technique is selected based entirely on an analysis of the varying anatomy encountered.* Whenever possible a complete strip operation is employed, reserving more risky interrupted strip techniques for anatomic situations in which more profound refinement changes and significant rotation are desirable.

**Table 47-1.** Classification of surgical terms

| | |
|---|---|
| Incisions | Transcartilaginous |
| | Intercartilaginous |
| | Marginal |
| Approaches | Delivery |
| | Nondelivery |
| | Cartilage-splitting |
| | Retrograde |
| | External (open) |
| Techniques | Volume reduction with |
| | Complete strip |
| | Weakened complete strip |
| | Interrupted strip. |

### Nondelivery approaches

When the anatomic situation requires only conservative or minimal tip refinement and rotation, a *nondelivery* (cartilage-splitting or retrograde-eversion) approach is preferred (Fig. 47-22). The majority of the lateral crus is left intact as a complete strip, with resection of only a few millimeters of the medial-cephalic portion of the lateral crus to effect refinement. This operation is useful in many patients because it tends to "mimic nature", disturbs very little of the normal anatomy of the tip, and therefore consistently heals predictably, with symmetry and minimal scarring (Figs. 47-23 and 47-24).

### Delivery approaches

As the tip anatomy becomes more abnormal or asymmetric, more complex surgical techniques are gradually employed. In these patients, a delivery approach is recommended, allowing visual presentation of the alar cartilages as bipedicle chondrocutaneous flaps for further analysis and reconstruction (Fig. 47-25). Under direct vision surgical modifications of varying designs can then be executed symmetrically. Greater volume reduction of the medial portion of the lateral crus is usually necessary, still maintaining a complete strip at least 5 mm wide (Figs. 47-26 and 47-27). If judged necessary, further refinement in the tip may be created by weakening the complete strip convexity with conservative crosshatching, gentle morselization, or incomplete

noncoalescent dome incisions (Figs. 47-28). In patients with extremely thin skin, delicate alar sidewalls, and bulbous cartilage, predictable narrowing refinement may be achieved by transdomal suturing of the complete strips with a horizontal mattress suture of 4-0 clear nylon (Figs. 47-29 and 47-30). Narrowing refinement is accomplished, vital tip supports are preserved, and symmetric healing is facilitated (Fig. 47-31). Delivery approaches are indicated almost exclusively when significant defatting or scar resection is required.

In more severe tip deformities, and particularly when more significant cephalic tip rotation is indicated to improve the tip relationship to the face and nose, the surgeon must consider interrupted strip techniques for maximal results (Figs. 47-32 and 47-33). Here the residual complete strip, after volume reduction of varying degrees, is divided somewhere along its course (usually at or near the angle), excessive portions of the lateral and occasionally the medial crus are removed, and the cartilages are reconstructed so that their cut ends about or overlap. Inherent dangers (asymmetric healing and scarring) exist whenever the complete strip is interrupted, and some tip support is almost always sacrificed, which may be compensated for by placement of a shoring cartilage strut in the columellar compartment. Interrupted strip techniques tend to foster cephalic tip rotation but are a decided liability if rotation of the tip is contraindicated. Tip rotation may be further accentuated by shortening of the caudal septum and even placement of cartilage plumping grafts to efface the nasolabial angle further.

In cleft lip and nose deformities, severely asymmetric tips, and some markedly overprojecting tips with eccentric anatomy, an open (external) approach to the tip may be helpful (Fig. 47-34), particularly when the variant anatomy is not clear preoperatively. Although more operative edema and scarring result from this approach, the advantages of precise direct-vision diagnosis, bimanual surgery, and extraordinary exposure render this approach useful in selected cases (Fig. 47-35).

## Tip projection

A final critical decision in undertaking nasal tip surgery involves the need for preservation, enhancement, or reduction of existing tip projection. Since the majority of patients undergoing a rhinoplasty demonstrate satisfactory projection, it becomes the surgeon's responsibility to ensure that the major and minor tip supports are left largely intact (or reconstructed) to prevent an eventual loss of projection. Complete strip techniques are therefore recommended whenever feasible, avoiding the complete transfixion incision, which destroys the vital support provided by the medial crural overlap of the caudal septum (Fig. 47-36). If additional projection is required, it may be achieved in a variety of ways. Autogenous cartilage struts positioned below and/or between the medial crura (Figs. 47-37 and 47-38) are effective in establishing permanent projection. Plumping grafts of cartilage fragments, introduced into the base of the columella through a low lateral columellar incision (Fig. 47-39), provide an additional platform for the tip projection resulting from the strut. Cartilage struts should be shaped with a gentle curve to match the anatomy of the curved columella, at times aiding in the creation of a distinct "double break", but should never extend to the apex of the tip skin lest a visible tent-pole appearance develop. If the medial crural footplates diverge in a widely splayed fashion, further

tip projection may be gained by resecting excessive intercrural soft tissue and suturing the medial crura together. Height and contour may be added to the tip by the use of autogenous cartilage grafts from the nasal septum or auricular cartilage (Fig. 47-40). Since these grafts lie immediately subcutaneously, intimately adjacent to the skin, great care must be taken in their positioning. An exacting "pocket preparation" becomes a basic prerequisite for their use; that is, a pocket is fashioned into which the graft fits as precisely as a hand in a glove. Carved in a triangular, trapezoidal, or shieldlike shape, tip grafts may accentuate favorable tip-defining points and highlights and can succeed in giving a more normal appearance to tips with congenital or post-surgical inadequacies (Fig. 47-41).

Cephalic rotation of the tip may increase projection by advancing the lateral crura medially and suturing them to lie above the cut ends of the medial crura. Transdomal sutures properly positioned between two complete alar cartilage strips may result in additional projection of the tip.

It should be appreciated then that nasal tip surgery is a compromise in which the surgeon gives away something to achieve a narrower, more defined, and stable tip component of the nose. Years of experience are required to understand and master tip surgery techniques thoroughly. Along with this invaluable insight, emphasis should always be placed on conserving tip anatomic structures and avoiding both radical excision and sacrifice of tip tissue. Compulsive long-term follow-up and evaluation of patients both by frequent examination and by review of standardized, uniform photographs facilitates the development of expertise in nasal tip surgical refinement.

## Surgery of the Cartilaginous Vault

The dorsal surface of the quadrangular cartilage and its related upper lateral cartilages comprise the cartilaginous vault. Ordinarily a new relationship must be established between the tip and profile line. Reduction of the supratip area to a level that allows the leading edge of the tip to exist 1 to 2 mm above the cartilaginous profile is the usual aesthetic goal. Making this new relationship permanent requires that tip projection, whether preexistent or the consequence of tip surgery, be stable and lasting. Tip surgery then is usually performed at the outset of the operation, unless a significant overgrowth of the dorsal septum has created an anatomic variant in which this normally minor tip-support mechanism is giving greater support thrust to the tip projection. In this later circumstance, reduction alignment of the supratip area precedes tip surgery to eliminate this spurious support, thereby allowing more accurate evaluation of the true magnitude of normal tip-support mechanisms.

Aesthetics are best served when reduction in both the cartilaginous and bony vaults results in a relatively strong, high, and straight-line profile in the male (Fig. 47-42), with the leading edge of the tip just slightly higher in the female (Fig. 47-43). In the latter circumstance a gentle slope of about 2 to 3 mm should exist between the tip-defining point and the lower extent of the cartilaginous profile. In planning a profile alignment, the two stable reference points are the nasofrontal angle (located ideally at the level of the upper eyelid) and the tip-defining point. Reversal of the usual tip-supratip relationship (in which the supratip cartilaginous dorsum lies

variably higher than the tip) is required to achieve this aesthetic ideal.

It can be appreciated then that the degree and angulation of "hump removal" depend on a variety of factors, some of which are under the control of the surgeon and some of which are not. These factors include skin thickness, the amount of bony hump relative to cartilaginous hump, the relative width of the nose, the inclination of the nasal tip, and, equally important, the patient's wishes regarding the desired nasal profile. In the final analysis, it is the surgeon's ability to visualize the final appearance of the nose after approximately 12 to 18 months of healing that allows exact and precise profile alignment.

Because the thickness of the overlying skin differs from that of soft tissues (thinner overlying the rhinion and thicker in the supratip area), it follows that a straight-line removal of both cartilaginous and bony hump may result in over-reduction and an unsatisfactory final profile. To accommodate this tissue thickness differential, an initial controlled incremental reduction of the cartilaginous dorsum under direct vision is preferred.

Access to the nasal skeleton is gained by elevation of the soft tissues over the cartilaginous vault by knife dissection in the precise tissue plane that is intimate to the perichondrium enveloping the upper lateral cartilages and the cartilaginous dorsum (Fig. 47-44). Respecting and utilizing this tissue plane prevents unnecessary trauma to the more superficially located blood vessels and sensory nerves, resulting in significantly less bleeding and a reduction in healing scar. Access to the bony vault is continued by elevation of the periosteum over the nasal bones with the Joseph elevator (Fig. 47-44, B), thereby exposing the entire bony-cartilaginous skeleton of the nose for inspection and direct-vision surgery. Excellent exposure may be gained during these technical maneuvers simply by carrying the medial extent of the transcartilaginous or intercartilaginous incision 4 to 6 mm around the anterior septal angle - the partial transfixion incision. The vital support relationship of the medial crural attachment to the caudal margin of the septum is thereby preserved by avoiding the more traditional complete transfixion incision.

With the Converse retractor in place, excellent exposure of the nasal dorsum is achieved, visualized with intense fiberoptic headlighting. The stage is thus set for incremental cartilaginous profile alignment. A knife is positioned at the osseocartilaginous junction and drawn lightly down to the anterior septal angle to allow any remaining soft-tissue fibers to fall laterally, exposing the blue-white underlying cartilage clearly. Under direct vision, with the knife blade at precise right angles to the cartilaginous dorsum (quadrangular cartilage and upper lateral cartilages combined) are shaved away smoothly (Fig. 47-45). How thick a strip (1-3 mm) depends on the amount of supratip reduction required to establish the new satisfactory tip-supratip relationship. After each increment is removed, the profile is inspected and palpated to ensure smoothness and a properly developing relationship to the tip. It may be helpful to depress the tip toward the lip from time to time to determine the precise degree of cartilaginous reduction. Failure to reduce this supratip in relation to the ultimate tip projection is a common error, leading to a displeasing tip-supratip relationship, or worse, a cartilaginous "pollybeak" deformity requiring revision surgery (Fig. 47-46).

In the typical rhinoplasty procedure the upper lateral cartilages are involved in surgical reduction only as a consequence of their intimate attachment as the wings of the quadrangular cartilage. As this reduction progresses, the underlying bridge of mucoperichondrium stabilizing the upper laterals to the septum may be exposed. This vital portion of the nasal lining contributes significantly to the internal nasal valve and is best left undisturbed and undivided. By gently teasing the mucoperichondrium away from the cartilages, further cartilaginous reduction may be accomplished, if necessary, without jeopardizing the mucoperichondrium to be preserved. Occasionally the caudal margin of the upper lateral cartilage, in its anatomic relationship to the cephalic margin of the alar cartilage, demonstrates a scroll-like appearance. If this redundance of cartilage contributes to excessive thickness in the middle third of the nose on frontal and oblique views, it may be resected. Except in the abnormally long, drooping nose, the length of the upper lateral cartilages plays a small role in overall nasal length and ordinarily requires no significant shortening. Of vital importance, however, is the underlapping attachment of the upper lateral cartilages to the undersurface of the nasal bones. If this critical supportive relationship is avulsed by surgical or nonsurgical trauma, repair is extremely difficult, a typical depressed-contour deformity results, and the ipsilateral airway may be compromised. Repair is often best effected by an onlay cartilage autograft (Fig. 47-47).

Alignment of the cartilaginous profile initially generates several significant advantages. The tip-supratip relationship is established with precision (Fig. 47-48), undesirable over- or underreduction is more easily prevented, and the exact amount of bony hump to be removed or reduced is clearly apparent.

## Surgery of the Bony Vault

### Bony profile reduction

With the tip-supratip relationship satisfactorily established, the exact degree of bony hump excess is readily apparent (Fig. 47-48). If minimal bone requires removal to establish the predetermined desired profile, the sharp tungsten-carbide down-cutting rasp facilitates a rapid and minimally traumatic reduction. Even less trauma is created from initial hump removal by the small Rubin osteotome, sharpened to razor edge; a sharpening stone is kept on the operating table setup, allowing the critical edge on each osteotome to be honed just before its use.

As previously described, only enough periosteum to allow removal of the bony hump is elevated over the bony dorsum. Preserving the periosteum and soft-tissue attachment overlying the nasal bones and maxillary ascending processes laterally reduces trauma and bleeding and, more important, stabilizes the mobile bony sidewalls after all infractions are complete - an internal splint.

The Rubin osteotome is seated at the caudal end of the bony hump and aligned and positioned to effect removal of only that amount of bone desired to leave a high, strong profile line (Fig. 47-49). Conservation is most important here, since any further bony refinement may be further accomplished with the rasp. Progressive taps with the sound-deadened mallet forces

the sharp osteotome precisely through the thick nasal bones as guided by the surgeon. The vertical fin located on the handle of the Rubin osteotome serves admirably to allow exact surgical control in aligning the instrument.

The detached bony fragment is then removed and inspected for asymmetries, which can provide the surgeon with clues about the need for further selective bony reduction. If irregularities of bone persist, several methods may be useful for achieving absolute smoothness. If one cut edge of nasal bone requires further reduction, it may be lowered by shaving with the sharp, thin osteotome, trimmed under direct vision with the strong double-action Becker scissors, or smoothed with the down-cutting rasp.

Before final finishing and smoothing of the bony dorsum is carried out with the rasp, it is useful to inspect the relative height of the upper lateral cartilages, trimming then under direct vision to lie at the same level or just below the level of the cartilaginous dorsum. This step is considered to be important at this stage of the procedure, since upper laterals that remain too high above the cartilaginous dorsum may be caught in the teeth of the rasp, risking avulsion or displacement, a difficult complication to repair.

The nasal profile must then be critically assessed by the surgeon. The final profile must be not only aesthetically pleasing but absolutely smooth and free of irregularities. Otherwise, displeasing contour irregularities may develop months and even several years later, particularly in the relatively thin-skinned patient. Several techniques are helpful in assessing profile smoothness before completing the bony profile alignment with a finishing rasp. Palpation of the dorsum through the skin with a wet finger reveals irregularities not otherwise detectable with routine palpation. Tensing the skin over the dorsum during palpation facilitates evaluation. During internal visualization of the bony-cartilaginous dorsum, palpating the dorsum with the noncutting edge of the No. 15 Bard-Parker knife blade often allows discovery of minute irregularities that are frequently inapparent to the most critical eye. If redundant soft tissue exists beneath the skin either medially or laterally, it may be conservatively excised at this point.

Final finishing of the bony dorsum is effected with the delicate tungsten-carbide rasp, an instrument that retains its extreme sharpness for long periods without significant detectable dulling. The down-cutting rasp is preferred, preventing trauma to the soft tissues in the nasofrontal area. The rasp should be pulled firmly and obliquely down the bony dorsum, cutting bone with each stroke and eliminating excessive, overly traumatic to-and-fro motions. All the products of rasping (bone fragments and "sawdust") must be removed by suction to prevent later irregularities.

Should overaggressive hump removal occur as the result of a maldirected osteotome, several remedies are available. The excised bony hump may be replaced after reduction in size and removal of all attached mucosa (after Skoog). Splinted in place, this bone graft can be used to reconstruct an over-reduced dorsum satisfactorily. More delicate realignment of the dorsum's irregularities (bony or cartilaginous) can be satisfactorily reconstructed with autogenous cartilage grafts from the septum, alar cartilage remnants, or auricular cartilage autografts. Reconstruction

with alloplastic implants is not always recommended, since autogenous tissues are always preferable in the nose.

## Narrowing the nose: osteotomies

Profile alignment in the typical reduction rhinoplasty inevitably results in an excessive plateaulike width of the nasal dorsum, which requires narrowing of the bony vault for a normal, natural appearance when the patient is viewed from the front. To accomplish this narrowing, the lateral bony sidewalls (consisting of the nasal bones and the maxillary ascending processes) must be mobilized and moved medially. The upper lateral cartilages also are moved medially because of their stable attachment to the undersurface of the nasal bones.

The stage is set for precision narrowing by medial-oblique osteotomies. A 2- to 3-mm delicate, sharp microosteotome is seated at the superior extent of the bony hump removal on either side of the bony septum and advanced cephalically and obliquely at an angle of 15 to 20 degrees outward (Fig. 47-50). Little trauma results from these medial-oblique osteotomies, which create a predetermined weakness or dehiscence at which the ultimate back-fracture occurs from the lateral osteotomies. This represents a safety factor in the osteotomy procedure, preventing the ever-present possibility of eccentric or asymmetric surgical fractures developing when only lateral osteotomies are performed. In addition, bony narrowing occurs without necessitating strong pressure to be exerted on the nasal bones to accomplish infraction, a traditional but unnecessarily traumatic maneuver.

Lateral osteotomies are reserved for last in a rhinoplasty, since they may be more traumatic than these steps previously accomplished. Additional tip refinement, septal reconstruction, or alar base reduction surgery - if indicated - is completed before the lateral osteotomies are initiated.

Trauma may be significantly reduced in lateral osteotomies if 2- or 3-mm microosteotomes are employed to accomplish a controlled fracture of the bony sidewalls (Fig. 47-51). No need exists for elevation of the periosteum along the pathway of the lateral fractures, since the small osteotomes require little space for their cephalic progression. Appropriately, the intact periosteum stabilizes and internally splints the complete fractures, facilitating stable and precise healing. The low-curved lateral osteotomy is initiated by pressing the sharp osteotome through the vestibule skin to encounter the margin of the piriform aperture at or just above the inferior turbinate (Fig. 47-52). This preserves the bony sidewall along the floor of the nose (where narrowing would achieve no favorable aesthetic improvement) but might compromise the lower nasal airway without purpose. The pathway of the osteotomy then progresses toward the face of the maxilla, curving next up along the nasomaxillary junction to encounter the previously created small medial-oblique osteotomy. A complete, controlled, and atraumatic fracture of the bony sidewall is thus created, allowing infraction without excessively traumatic pressure (Fig. 47-53). Immediate finger pressure is applied bilaterally over the lateral osteotomy sites to forestall further any extravasation of blood into the soft tissues. In reality, little or no bleeding occurs during microosteotomies because the soft tissues embracing the bony sidewalls remain essentially

undamaged.

After infraction the dorsum is again palpated and inspected for any irregularities; if they exist, they are corrected under direct vision. The upper lateral cartilages are viewed to ensure that their relationship to the height of the septum is appropriate.

The fracture line of the lateral osteotomy should be as low as possible to allow a large lateral wall for infraction and to prevent the palpable step deformity that results when osteotomies are positioned too high on the nasal sidewall (nearer the dorsum). The bones must ideally be freely mobile but splinted by the undisturbed periosteum and soft tissues that remain attached to the bony fragments.

When the nasal bony sidewalls are twisted, asymmetric, or markedly irregular, further osteotomies may be required higher on the ascending process to achieve correction (Figs. 47-54 and 47-55).

## Graphic Record-Keeping and Self-Education

Invaluable feedback and learning about the effectiveness of various techniques is based on studying the surgical records. When the ultimate postoperative appearance is compared side by side with a detailed graphic record of the operation, a great deal of information surfaces. There is no better method for reducing the often arduous "learning curve" between inexperience and experience, which is a vital ingredient for successful rhinoplasty surgery.

After each operation, a detailed visual record of the operative event is prepared, and routine as well as unique procedures are recorded in color (Fig. 47-56). This information, if desired, may be ultimately transferred to the more stylized Gunter graphic for teaching purposes (Fig. 47-57).

## Postsurgical Considerations

The care of the postrhinoplasty patient is directed toward patient comfort, reduction of swelling and edema, patency of the nasal airway, and compression-stabilization of the nose.

Whether discharged the afternoon of or the morning after surgery, *all* intranasal dressings are removed from the nose before the patient leaves. A detailed list of instructions is supplied for the patient or accompanying family member (see box on p. 855); the important aspects of these "do's" and "don'ts" are emphasized. Prevention of trauma to the nose is clearly the most important consideration. Oral decongestant therapy is helpful, but the value of corticosteroids and antibiotics in a routine rhinoplasty is conjectural.

The external splint is removed by the surgeon or surgical nurse 5 to 7 days after surgery. An important consideration should be the gentle removal of the tape and splint by bluntly dissecting the nasal skin from the overlying splint with a dull instrument, without disturbing or

tenting up the healing skin. Failure to follow this policy may lead to disturbance of the newly forming subcutaneous fibroblastic layer over the nasal dorsum with additional unwanted scarring and even abrupt hematoma. After cleansing of the skin with an adhesive solvent, immediate frontal and lateral photographs are taken to document the early postoperative surgical result (these early photographs may assume vital medicolegal importance if the patient's surgical result is compromised by trauma in the immediate future). Thereafter it is to the surgeon's educational advantage and the patient's best interest to arrange for visits at 1, 3, 6, 9, 12, and 24 months after the operation. After that, yearly visits are helpful to review the subtle changes in nasal appearance that inevitably occur. Observing these changes, favorable as well as unfavorable, allows the surgeon to refine his technique both to anticipate and to control these long-term healing characteristics.

## Patient instructions following nasal plastic surgery

### *A. Introduction*

Please read and familiarize yourself with these instructions *before* and *after* surgery. By following them carefully you will assist in obtaining the best possible result from your surgery. If questions arise, do not hesitate to communicate with me and discuss your questions at any time. Take this list to the hospital with you, and begin observing these directions on the day of surgery.

### *B. Instructions*

1. Do not blow nose until instructed. Wipe or dab nose gently with tissues, if necessary.

2. Change dressing (if it is present) under nose as needed.

3. The nasal plaster cast will remain in place for approximately 1 week and will be removed in the office. Do *not* disturb it; keep it dry.

4. Avoid foods that require prolonged chewing. Otherwise, your diet has no restrictions.

5. Avoid extreme physical activity. Obtain more rest than you usually get and avoid exertion, including athletic activities and sexual intercourse.

6. Brush teeth gently with a soft toothbrush only. Avoid manipulation of upper lip to keep nose at rest.

7. Avoid prolonged telephone conversations and excessive social activities for at least 10 to 14 days.

8. You may wash your face, but carefully avoid the dressing. Take tub baths until the dressings are removed.

9. Avoid smiling, grinning, and excessive facial movements for 1 week.

10. Do not wash hair for 1 week unless you have someone to do it for you. *Do not get nasal dressings wet.*

11. Avoid clothing that fastens in front or back for 1 week. Avoid slipover sweaters, T-shirts, and turtlenecks.

12. Absolutely avoid sun or sun lamps for 6 weeks after surgery. Heat may cause the nose to swell.

13. Don't swim for 1 month.

14. Don't be concerned if, after removal of dressing, the nose, eyes, and upper lip show some swelling and discoloration; this usually clears in 2 or 3 weeks. In certain patients it may require 6 months for all swelling to subside completely.

15. Take only medications prescribed by your physician(s).

16. Do not wear regular glasses or sunglasses that rest on the bridge of the nose for at least 4 weeks. We will instruct you in the method of taping the glasses to your forehead to prevent pressure on the nose.

17. Contact lenses may be worn within 2 or 3 days after surgery.

18. After the physician removes your nasal plaster cast, the skin of the nose may be cleansed gently with a mild soap or Vaseline Intensive Care lotion. *Be gentle.* Makeup may be used as soon as bandages are removed. To cover discoloration, you may use Erase by Max Factor, Cover Away by Adrien Arpel, or On Your Mark by Kenneth.

19. *Don't take chances!* If you are concerned about anything you consider significant, call me at (insert physician's phone number).