Paparella: Volume IV: Plastic and Reconstructive Surgery and Interrelated Disciplines

Section 1: Plastic and Reconstructive Surgery

Chapter 6: Aesthetic Surgery of the Nose

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Surgical Philosophy and Principles of Rhinoplasty

Rhinoplasty surgery is considered by even the most renowned and capable surgeons to be the most challenging, exciting, and vexing of all plastic surgery procedures. Nasal anatomy and proportions ar marvelously varied, demanding careful individualized approaches tailored to each patient's anatomic and functional needs. Since even minute postoperative irregularities and asymmetries are openly visible or palpable (and in a sense represent microcomplications), extreme demands for near-perfection are placed on rhinoplastic surgeons. They must not only learn to control the operative event, but also become skilled at manipulating and controlling the dynamics of the postoperative healing period for optimal aesthetic results.

Such skills are not developed rapidly but are the product of years of accumulated study an experience as the surgeon witnesses, analyzes, and modifies the surgical outcomes.

The final result of any rhinoplasty procedure is the consequence of the individual patient's anatomy as much as of the surgeon's skill. No two noses are ever quite alike; it follows 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 the achievement of consistently outstanding results.

The best candidates for ideal surgical results are almost always those with relatively minimal deformities (a small hump, a minimally bulbous tip, a slightly overwide or overlong nose). However, this group of patients expects and even demands perfection because of the minimal nature of the problem. In patients who demonstrate significant departures from the aesthetic ideal (a large lump, an elongated dropping nose, a twisted nose), more dramatic surgical results are possible. This latter group may tolerate possible minor imperfections, since the overall improvement is indeed a significant one. 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 limitation (or possibilities) inherent in each individual nose.

Misguided attempts to create more than the condition of the nasal tissues will allow (overoperating) inevitably lead to the all-too-frequent complications seen after overaggressive rhinoplasty.

Patient Evaluation

From the outset of the evaluation process, patient motivations, expectations, and surgical possibilities must be analyzed by developing open and easy communication with the patient. Clearly the motivations and expectations of a teenager may be substantially different from those of the older patient in middle life, since the latter's well-developed body image is not shared by the former. If the surgical possibilities are limited by anatomy or the surgeon's understanding of the problem, rhinoplasty probably is best not undertaken. In general, older patients, particularly males, must be evaluated with greater care to fully understand and appreciate the motivational factors that have led to a request for appearance-changing surgery.

Anatomic Assessment

Every patient examination should be characterized by an orderly and compulsive evaluation of the nose and the surrounding facial feature proportions. Although it is admittedly the pleasant differences in anatomy that characterize the attractive faces seen in various cultures, appreciation for and understanding of the "ideal normal" will provide the surgeon with a baseline from which to interpret his findings. Careful interpretation of the variations in anatomy characterizes the experienced surgeon, progressively planning during the physical and visual examination what can and what cannot be reasonably accomplished.

Balance and harmony of proportionate facial features have changed little since Da Vinci established his timeless standards. A useful method of evaluating nasal proportions derives from conceiving the nose as being compose of a series of interrelated nasal anatomic components, which include the covering epithelium, the bony pyramid (the maxillary ascending process, nasal bones, and bony septum), the cartilaginous pyramid (the quadrangular cartilage and attached upper lateral cartilages), and the mobile nasal tip (paired alar cartilages and surrounding soft tissues). Subunits within the nasal tip or base include the infratip lobule, the alar side walls, and the columella.

The quality of the skin is an essential indicator of the surgical outcome an plays a significant role in preoperative planning. Extremely thick skin, rich in sebaceous glands and subcutaneous tissue, is the least ideal skin 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".

Extremely thin skin, often pale, freckled, and nearly translucent, must also be recognize and respected for its inherent limitations. Although ideal for achieving critical definition, thin skin with sparse subcutaneous tissue provides almost no cushion to hide 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 a 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.

In every patient it is essential to evaluate the critical factor relating to the inherent strength and support of the nasal tip, referred to as the *tip recoil.* Finger depression of the tip toward the upper lip provides a quick and reliable test of the ability of the mobile tip structures to spring back into position. The tip that possesses weak, somewhat flail alar cartilages does not tolerate an extensive sacrifice of tissue well, and may require the addition of supportive struts to improve its long-term stable support. These weak tips are often accompanied by thin alar side walls and thin skin. If the recoil is instantaneous and vigorous and the tip cartilage is resistive to deforming influences of the finger, more definitive tip surgery may usually be performed without fear of substantial support loss. The size, shape, attitude, and resilience of the alar cartilages may be estimated also by palpation or ballottement of the lateral crus between two fingers surrounding its cephalic and caudal margins. During this assessment the surgeon makes the all-important decision about the need 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.

During the course of this examination the tip cartilages should be evaluate for any apparent bifidity, and the width and breadth of the "dome" segment bridging the medial and lateral crus estimated.

In a continuing systematic fashion the anterior septal angle and the relationship of the supratip dorsum to the tip projection are noted.

The magnitude and supporting strength of the upper lateral cartilage are palpated to determine whether they adequately resist inward retraction upon quiet and vigorous inspiration. If a nasal hump exists, an estimate should be made of the bony versus the cartilaginous extent of the hump.

The length of the nasal bones may be palpably determined with relative ease; this assumes particular importance in patients with abnormally short nasal bones whose nose is predominantly cartilaginous.

Within tolerances of 1 to 2 mm the external topography of the nasal skeleton can then be palpably mapped and evaluated for future surgical reorientation. Commonly the most excellent rhinoplastic result is that in which the anatomic components have simply been rearranged and reoriented, rather than substantially reduced or sacrificed.

Larger noses with proportionate harmony, almost without exception, are aesthetically more attractive than overreduced small noses.

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 may be discovered that may significantly influence the final functional and aesthetic appearance.

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 a 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 whether its length is adequate. It is also important to ascertain whether the central skeletal component of the nose (the quadrangular cartilage) is overlong and might interfere with satisfactory tip rotation; also, the size and position of the nasal spine and its related caudal septal angle must 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 may be responsible for airway blockade after infracture of the bony side walls during an osteotomy, may easily be overlooked in a casual inspection. Internal examination confirms the condition of the internal nasal valves and their associate upper lateral cartilages, and determines whether the turbinates require repair or relocation to improve the 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. In particular, facial asymmetries (which are present more often than not) and the relationship of the chin projection to the nose should be documented, 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, reinforce 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.

Photographic Assessment

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 audiograms to the otologist and x-rays to the bone specialist. They are important guides to operative

planning and execution, definitive records for evaluation by the surgeon and patient, invaluable teaching tools, and vital medical and legal records.

No better method of continuing medical education in rhinoplasty exists than the dispassionate critical evaluation of long-term uniform postoperative photographs. Successes can be noted and useful techniques reinforced; errors in judgment or technique can be identified and discarded from the surgical repertoire. Useful information can be learned about the progression of healing and its influence, positive or negative, on the evolving nasal appearance.

At the outset of his career the rhinoplasty surgeon should establish a standardized approach to obtaining uniform patient photographs, either by taking them personally or by arranging for a compulsive assistant (or professional photographer) to fill this critical role. Since all facial surgery is highly visual in character, it behooves the surgeon to develop personal expertise in photography. Viewed through the sharp camera lens, vital additional diagnostic information may often be added to the analysis of facial features.

35-mm color slides using Kodachrome 25 or 64 in the six standardized head positions are preferred. If prints are desired, they are available in 60 seconds from one of the slide-to-print Polaroid copiers. Slides are easily stored, retain their color quality for many years, are most useful for teaching, and provide an ideal comparative reference of the patient's features when projected larger than life size in the operating room during surgery.

Standard views in rhinoplasty photography include full frontal, basal, right and left lateral, and right and left oblique views. Employing a 105-mm portrait lens with dual flash strobe units and an overhead slave "key" flash, standardized, shadow-free, accurate representations of facial features may easily be recorded from sitting to sitting. A background complimentary to skin tones (light blue, light green, or gray) serves best; a pure white, black, or cluttered background should be avoided.

Precision photography in facial aesthetic surgery should be viewed with the same compulsion as that devoted to exacting surgical procedures.

Preparation for Surgery

Establishment of Communication

Critical to the successful outcome of any aesthetic operation is the development of easy and thorough communication between surgeon and patient. This establishment of a mutual trust and confidence may not come easily and may require more than one encounter and discussion. The surgeon must be assured that the patient's expectations are in fact realistic, that the motivations expressed are appropriate, and that the patient's anatomy presented is of a nature amenable to the desired changes. The patient, understandably anxious, is in need of confidence that his chosen surgeon is sympathetic to his stated wishes, agreeing with or counseling him clearly about the aesthetic changes requested, and that the operation can be accomplished in a tidy, organized, and essentially painless manner, resulting in an improved but "natural" appearance change.

All candidates for aesthetic surgery require an initial investment of consultation time that may be substantial. The number of interview periods required before surgery varies from patient to patient and is a matter of acquired surgical judgment. The teenage girl who is familiar with the surgeon's work through her operated classmates benefits little from repeated preoperative office visits, usually being anxious to schedule and complete her operation quickly and comfortably. Older patients may take solid reassurance from multiple visits, each one building psychologically upon the next. The initial consultation serves as an exacting diagnostic session to assess expectations and realistic surgical goals, educating uninformed patients about the details and "mysteries" of nasal surgery. Verbal and written educational materials not only serve to inform and reassure patients, but allow them to form a knowledge base from which may spring important questions in later sessions. Hesitant, insecure people who require repeated visits for redundant reassurance should be viewed cautiously, since their expectations may never be met, no matter how thorough the preoperative preparation or excellent the surgical outcome.

Patients arriving for consultation for plastic surgery are understandably anxious and even embarrassed about the initial interview discussion. The surgeon's responsibility is to put them at ease through skilled interview techniques, drawing out wishes, expectations, fears, and presurgical prejudices or biases. It is vital to encourage patients to express themselves fully, a requirement often difficult for the most loquacious of individuals. Relevant questions about medical history, allergies, and medicines in current use are often useful "ice breakers", particularly when phrased in the context of ensuring that any contemplated elective operative procedure be made as safe as possible.

Open-ended questions are useful in encouraging specific patient responses; for example, "What can I do for you today?", "How can I help you?", "Tell me and show me what you don't like about your nose", or "Does your nose bother you in some way?". We insist that patients point out with one finger, in front of a three-way mirror, *exactly* what concerns them about the nose and other facial feature characteristics. What each patient finds pleasant or disconcentrating is also important to elicit and document. It is always surprising how commonly patients find difficulty in pinpointing precise anatomic concerns, and here more specific questions pose by the surgeon are helpful. The use of a common Q-tip to point specifically to different anatomic components of the nose is effective and safe.

Once patients' concerns and expectations are elicited as fully as possible, an entire nasal and facial analysis, employing the three-way mirror, is carried out by the surgeon.

Once patient and surgeon come to the mutual understanding that corrective surgery is desirable and that it is possible that realistic expectations can be met, the patient is introduced to the surgical nurse, who in effect becomes the patient's ombudsman, professional counselor, and "best friend" during the perioperative period. A detailed description of the operation and its ramifications is given. Specific details are emphasized, including method of anesthesia, financial aspects, timing and frequency of postoperative visits, an specific postoperative instructions. Concerns or desires not expressed to the surgeon often surface in this interview encounter, as patients find discussions with the nurse less threatening and pleasantly anticipatory. This second dialogue is a vital part of the initial patient evaluation process and is regarded as of equal importance to the surgeon's interview.

As the final phase of the initial interview, the patient and surgeon sit down in a comfortable, nonclinical setting to review the details, ramifications, potential complications, and limitations of surgery. All questions are encouraged and answered as fully as possible.

If considered useful, second opinions from other surgeons are encouraged to further reassure the patient. The viewing by the patient of a photographic catalog of the surgeon's previous surgical result is regarded as inappropriate and undignified, unless by doing so the patient's understanding of the correction of an unusual surgical problem may be significantly enhanced. Examples include chin augmentation, cleft lip-nose abnormalities, and more complex nasal reconstructions.

This three-part initial patient interview technique is an extremely valuable one, creating in most cases an essential communication bond among patient, surgeon, and office staff.

Anesthesia and Analgesia

Each of the surgical steps in the correction of the nose is interrelated and interdependent. The success of each step depends in no little measure on the preceding ones. Since the administration of anesthesia is the initial surgical step in rhinoplasty, a well planned and executed technique calculate to avoid 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 varied approaches to nasal anesthesia. Our experience suggests that a combination of monitored intravenous analgesia with local topical an infiltration anesthesia is ideal for rhinoplasty. This is a fundamental, safe, and reliable method for achieving the goals of nasal anesthesia: (1) a comfortable, relaxed, and responsive patient; (2) a bloodless operative field; and (3) minimal distortion of the nose.

Surgical Planes

To minimize scarring and reduce surgical trauma, it is important to identify and use the surgical tissue planes of the nose correctly. The importance of anatomic planes is stressed throughout surgical training, since dissection within these planes facilitates surgery, inducing minimal bleeding and postoperative scarring. Although rarely mentioned, proper dissection planes do exist in the nose, and too much emphasis cannot be placed on surgical dissection within these planes.

Three distinct dissection planes of value during rhinoplasty may be identified within the nose. There is an extraperiosteal plane lateral and medial to the ascending process of the maxilla along the intended course of the lateral osteotomies. Infiltration of local anesthetic on both sides of the ascending process aids remarkably in eliminating or reducing bleeding after lateral osteotomy. There is a second plane in the submucoperichondrial spaces flanking

the nasal septum. Infiltration of local anesthetic into this plane results in a hydraulic elevation of the septal flap, facilitating elevation with little bleeding. Of greatest importance is the surgical plane occupying the immediate supraperichondrial and subperiosteal regions over the lower and upper lateral cartilages and nasal bones existing just below the subcutaneous layer. This plane over the osseocartilaginous dorsum is entered in all rhinoplasty operations and produces a virtually bloodless field to ensure delicate precision surgery. Preserving the thickest possible subcutaneous tissue-muscle-epithelium covering layer during rhinoplasty facilitates cushioning of the newly aligned dorsum, camouflaging any slight irregularities that develop during or after surgery.

When the anesthetic is injected into proper planes, it diffuses readily, and only small amounts, usually 3.5 to 5 mL, are needed 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 distorting effect that leads to inaccurate judgment. Thus, by identifying and utilizing the proper dissection planes, only small amounts of anesthetic are needed to achieve maximal anesthesia and vasoconstriction with minimal nasal distortion. Further, the avoidance of dissection injury to the continuous muscular and fascial layer found just superficial to the desired tissue plane over the nasal dorsum improves healing contours and smoothness.

Premedication and Intravenous Analgesia

After the patient has been sedated with premedication and intravenous analgesia, local anesthesia is administered. It is important that the patient not receive a great many different families of drugs before and during surgery. Combinations of drugs, particularly when intermingled with the intravenous medication given during surgery, are often unpredictable in their individual and combined effectiveness. Any potential drug reaction from the use of multiple families of pharmacologic agents is confusing to treat and may be impossible to counteract intelligently.

Close cooperation between 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 potent narcotic and phenothiazine, has been found safe and reliable for inducing a state of relaxed sedation. It must be administered in small titrated increments by an experienced anesthesiologist, and never infused as a large bolus. In 20 years of practice the senior author has never experienced a single serious problem in many thousands of patients given Innovar sedation by sensitive, experienced anesthesiologists. The powerful antiemetic effect of droperidol has largely eliminated the problem of nausea.

The patient is maintained in the reverse Trendelenburg position with the head elevated, since this position is invariably more comfortable. It enhances vasoconstriction and facilitate venous and lymphatic drainage.

Topical Anesthesia

Before the infiltration of local anesthetic, the nasal mucous membranes are anesthetized with 4 per cent cocaine. The cocaine is color coded to guard against the possibility of solution confusion with inadvertent injection of cocaine. The cocaine is deposited in each nasal fossa on a single neurosurgical Cottonoid, which is well wrung out to prevent any excess absorption of the drug. It is unnecessary to cocainize precise nerves in the nose with multiple cumbersome pledgets or cotton-tipped wires, an exercise more traditional than useful. The placement of Cottonoids is simple and achieves the desired anesthesia and vasoconstriction.

The Cottonoids further act as excellent tampons, preventing the flow of blood and nasal secretion into the pharynx. The strings attached represent 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 the final dressings are placed.

Infiltration Anesthesia

One per cent lidocaine with a 1:100.000 to 1:50.000 dilution of epinephrine is preferred for infiltration anesthesia. The weaker solution is used in older patients or in those with possible 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 per cent 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 5.5 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. Again, no effort is made to block specific nerves. If septal reconstruction is required, an additional 3 to 4 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-gauge 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. Any sensation of the needlestick may be masqueraded by bluntly pinching the skin elsewhere in 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. If the nose becomes distorted during this maneuver, the needle is not in the proper plane, and infiltration should stop until

the plane is located. Alternately rotating the needle slightly, laterally and medially over the dorsum, 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. Using this method, only two injections are needed 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 just beyond the left alar fascial junction. Infiltration occurs as the needle is withdrawn to the columella. Without removal the needle is rotated and advanced to the columella. Again, a small amount of anesthetic is deposited as the needle is withdrawn. Sparing the patient an additional stick, the needle is rotated into the right nasal base, which is anesthetized in a similar fashion.

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 lateral cartilage is exposed and everted by pressure above the nostril. The solution is deposited along the course of the proposed incision and beneath the perichondrium, minimally ballooning the vestibular skin and perichondrium. Surgical elevation and preservation of an intact vestibular skin flap are thereby facilitated. If delivery of the alar cartilage is contemplated, the anesthetic is infiltrated along the extent of the planned incision at the caudal margin of the cartilage.

The anesthetic may now be deposited along the course of the lateral osteotomies, or if desired this may be deferred until later in the operation. This delay adds a safety measure to the procedure by allowing the patient to metabolize the initial lidocaine and epinephrine before more solution is added. 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 and then medial to the ascending process of the maxilla along the intended path of the lateral osteotomies, 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.

Up to this point, the amount of infiltrated local anesthetic should be only 3.5 to 5 mL. Every effort is expended to place the solution into the proper planes and to avoid tissue distortion, particularly avoiding spurious tip projection from infiltration edema, a condition that may lead to errors in judgment in establishing tip projection and attitude. If no septal reconstruction is planned, infiltration anesthesia has been completed.

When septal reconstruction is planned, anesthesia of the already cocainized septum is now 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. It allows for an avascular flap elevation and may help to dissect synechiae from areas of old fractures.

The Cottonoids are removed temporarily, and with the bevel down, the needle is inserted into the mucous membrane on the side of the intended mucoperichondrial flap. The needle is advanced to the plane between the quadrangular cartilage and perichondrium, and with infiltration a hydraulic elevation is created. This is repeated at several other sites along the mucous membrane. The needle is then inserted beneath the muco-periosteum overlying the bony septum on both sides, and anesthetic is infiltrated. 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.

After the infiltration anesthesia has been accomplished, it is critical that the surgeon wait 10 to 15 minutes before making any incisions. This allows the vasoconstriction to reach its maximal effectiveness and thus helps to minimize bleeding.

This combination of monitored intravenous anesthesia and local topical and infiltration anesthesia has been repeated successfully several thousand times over the past 20 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 avoids tissue distortion. In the vast majority of operations, little if any bleeding occurs during the procedure, and postoperative ecchymosis is minimal or nonexistent. All these factors help to permit the precise, bloodless dissection of the nasal structures that is essential for a carefully controlled rhinoplasty operation.

Surgical Landmarks

It is ordinarily possible to locate and draw the topography of the nasal skeleton, as well as certain key landmarks, on the external skin of the nose. Accurate within 1 to 2 mm, marking the nose in this fashion preoperatively is especially helpful for the less experienced surgeon. It further provides a thoughtful preview, by means of palpation and inspection, of the location and size of the individual nasal components to be modified. Critical decisions about planned tissue excisions, augmentations, and reorientation of nasal structures thereby may be supported by visual illustration of the nose itself.

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 lateral crural incisions. The caudal margins of the nasal bones and edges of the maxillary process are indicated and the estimated extent of profile realignment and osteotomy pathways are indicated by dotted lines. Once skin elevation has been accomplished during uncovering of the nasal framework, many of the external markings assume less accuracy as the dynamics of nasal surgery unfold.

Surgery of the Nasal Tip

Philosophy of Tip Sculpture

Sculpture of the nasal tip is properly regarded as the most exacting aspect of nasal plastic surgery. The surgeon is challenged by nasal anatomic components essentially bilateral (demanding symmetric surgical techniques and healing), animate, and mobile, which may require reduction, enhancement, or simply preservation of existing projection. Since no single

surgical technique may be successfully employed in correction of the endless anatomic tip variations encountered, the surgeon must analyze each anatomic situation and make a reasoned judgment about which approaches and tip modification techniques will result in a predictably natural appearance. Factored into this judgment decision must be consideration of, inter alia, the strength, thickness, and attitude of the alar cartilages; the degree of tip projection; the tip skin and subcutaneous thickness; the columellar length; the length of the nose; the width of the tip; and the tip-lip angulation and relationship.

It remains a fundamental principle of tip surgery that normal or ideal anatomic features of the tip should be preserved and if possible remain undisturbed by surgical dissection, while abnormal features must be analyzed, exposed, reanalyzed, and corrected by reduction, augmentation, or shape modification.

Surgeons have gradually come to understand that radical excision and extensive sacrifice of alar cartilages and other tip support mechanisms all too frequently result in eventual unnatural or "surgical" tips. What appears pleasant and natural in the very early postoperative period may come to heal poorly owing to overaggressive attempts to modify the anatomy more extensively than the tissues will allow. Rhinoplasty is, after all, a compromise operation, in which tissue sacrifices are made in order to achieve a more favorable appearance. It therefore becomes judicious to developed a reasoned planned approach to the nasal tip based entirely on the anatomy encountered coupled with the final result intended. A philosophy of a *graduated incremental anatomic approach* to tip surgery is highly useful to achieve consistently natural results. Conservative reduction of the volume of the cephalic margin of the lateral crus, preserving a substantial complete, undisturbed strip of residual alar cartilage, is preferable in individuals in whom nasal tip changes are intended to be modest. As the tip deformity encountered becomes more profound, more aggressive techniques are required, from weakened complete strip techniques to significant interruption of the residual complete strip and profound alteration in the alar cartilage size, attitude, and anatomy.

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) (Table 1). 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 nasal tip support mechanisms.

In most patients the major tip support mechanisms consist of (1) the size, shape, and resilience of the medial and lateral crura; (2) the wrap-around attachment of the medial crura 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. Compensatory reestablishment of major tip support should be considered if during the operation any or all of these major tip support mechanisms are compromised in any fashion.

The minor tip support mechanisms, which in certain anatomic configurations may assume major support importance, include (1) the dorsal cartilaginous septum, (2) the interdomal ligament, (3) the membranous septum, (4) the nasal spine, (5) the surrounding skin and soft tissues, and (6) the alar side walls.

Tip projection in every rhinoplasty operation is inevitably enhanced, reduced, or preserved in its original state. Anatomic situations in which each of these outcomes is desirable and intended are regularly encountered in a diverse rhinoplasty practice. The desirable surgical goal in every operation is preservation of the projection already existent, if, as is true in most rhinoplasty patients, preoperative projection of the tip is satisfactory. Other 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; these 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.

Table 1. Tip Support Mechanisms

Major

1. Size, shape, and resilience of medial and lateral crura.
2. Medial crura footplate attachment to caudal border of quadrangular cartilage.
3. Attachment of upper lateral cartilages (caudal border) to alar cartilages (cephalic border).

Minor

1. Ligamentous sling spanning paired domes of alar cartilages.
2. Cartilaginous septal dorsum.
3. Sesamoid complex extending support of lateral crura to piriform aperture.
4. Attachment of alar cartilages to overlying skin and musculature.
5. Nasal spine.
6. Membranous septum.

Successful achievement of these diverse surgical results requires an understanding of, and a healthy respect for, the major and minor tip support mechanisms, seasoned by recognition of the intraoperative surgical tip dynamic principles that interact in every tip operation. It clearly follows that *the appropriate tip incisions and approaches should be planned to preserve as many tip supports as possible.* Alar cartilage sculpturing similarly should 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.

The surgeon should differentiate clearly 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, operating the alar cartilages without removing them from their anatomic beds. Sculpturing *techniques* are defined as surgical modifications: excision, reconstruction, or orientation of the alar cartilages calculated to result in significant changes in the definition, size, orientation, and projection of the nasal tip. Because of the amazing complexity of anatomic configurations encountered in nasal tip surgery, further modifications are frequently employed to ensure stable refinements.

It is important to assess several factors before the appropriate tip procedure is selected. In planning tip remodeling, the surgeon must determine whether 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 subsequent increase in the columellar inclination (nasolabial angle).

Ideally, conservative reduction of the volume of the cephalic margin of the lateral crus, preserving most of the crus while maintaining a complete (uninterrupted) strip of alar cartilage, is preferred. 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 needed. The philosophy of a graduated incremental anatomic approach to nasal tip surgery, referred to above, has proved useful. This implies that no routine tip procedure is ever used; instead *the appropriate incisions, approaches, and tip-sculpturing techniques are selected entirely on the basis of an analysis of the varying anatomy encountered* (Table 2). 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.

Surgical Approaches to the Tip

Nondelivery Approaches

In anatomic situations in which the nasal tip anatomy is favorable, conservative refinements only are necessary, and nondelivery approaches possess great value. Less dissection and disturbance of the tip anatomy is necessary, thereby reducing the risks of asymmetry, error, and unfavorable healing. Properly executed non-delivery approaches therefore allow the surgeon to control the healing process more accurately than when more radical approaches and techniques are chosen.

The transcartilaginous approach is preferred because of its simplicity and ease of employment; exactly the same tip refinements may be accomplished, however, through the retrograde approach. These approaches are chosen in patients whose tip anatomy is fundamentally satisfactory, requiring only volume reduction to accomplish a thinning sculpture of the cephalic or medial margin of the lateral crus. When tip projection is to be enhanced by the use of cartilage tip grafts, nondelivery approaches are preferred, since precise recipient pockets may be more accurately created in the infratip lobule, undisturbed by the minimal dissection inherent in nondelivery approaches.

Delivery Approaches

Delivery of the alar cartilages as individual bipedicle chondrocutaneous flaps through intercartilaginous and marginal incisions is the preferred approach when the nasal tip anatomy is more abnormal, or when more dramatic tip refinement is necessary. Significant modifications in the alar cartilage shape, attitude, and orientation are more predictably attained when the cartilages are delivered. The base photograph is usually helpful in determining which patients may best be approached in this manner. If the triangularity of the tip from below is satisfactory and only modest volume reduction of the lateral crus appears necessary, the non-delivery approach serves well. However, if on base and frontal view the alar

cartilages flare unpleasantly, if tip triangularity is unsatisfactory, or if the tip appears too amorphous and bulbous, a delivery approach is chosen in order to correct these aesthetic deficiencies more thoroughly. Transcartilaginous suture narrowing of broad domes, an effective and preferred technique, is effected via the delivery approach. In similar fashion, interrupted strip techniques for more radical tip refinement and cephalic rotation are more efficiently accomplished when the cartilages are delivered. The increased surgical exposure obtained provides the surgeon with an improved binocular view of the tip anatomy and affords the added ease of surgical bimanual modifications.

Open (External) Approach

The external or open approach to the nasal tip is in reality a more aggressive form of the delivery approach and is chosen with discretion in very specific nasal tip deformities. When the nasal tip is highly asymmetric, markedly overprojected, severely underprojected, or anatomically confusing in its form (as in certain secondary revision cases), the open approach is considered. The transcolumellar scar is of negligible importance in this decision, since it routinely heals inconspicuously. The anatomic view is unparalleled through this approach, affording the surgeon diagnostic information unavailable via traditional closed approaches. These technical virtues must be balanced against the potential disadvantages of an enlarged scar bed, slightly delayed healing with some prolongation of tip edema, and increased operating time. Clearly, when subtle and conservative tip surgery is indicated by the existing anatomy, the open approach is unnecessary.

Alar Cartilage Sculpturing Techniques

The choice of technique to modify the alar cartilages and the relationship of the nasal tip to the remaining nasal structures should be based entirely on the anatomy encountered and the predicted result desired, as defined in relation to the known dynamics of long-term healing. The astounding diversity of tip anatomic situations encountered demands a broad diversification of surgical planning and execution by the experienced surgeon.

Three broad categories of nasal tip sculpturing procedures may be identified. Although there are additional subtle technical variations, the three primary categories include:

1. Volume reduction with residual complete strip.

2. Volume reduction with weakened residual complete strip.

3. Volume reduction with interrupted strip.

Preserving intact the major portion of the residual complete strip of the alar cartilage is always preferable when the anatomy of the alar cartilages and their surrounding soft tissue investments allows. This preservative approach retains the supportive advantage of the intact cartilage strip (thus mimicking nature), discourages cephalic rotation when it is undesirable, eliminates many of the potential hazards of more radical techniques, and tends to produce a more natural final result.

Techniques involving a weakened (or reoriented) residual complete strip possess all the positive virtues noted above, while also allowing the surgeon to effect reorientation of the attitude of the dome, projection modification, and narrowing refinement so desirable in the ideal postoperative appearance. The control of favorable healing is enhanced by these techniques, and the risk of complication is considerably diminished.

Despite a laudable desire to preserve the integrity of the residual complete strip whenever possible, anatomic situations are regularly encountered in which the shape, breadth, and orientation of the alar cartilages must be changed more radically by interrupting the complete strip in a vertical fashion somewhere along its extent, in order to refine severe anatomic deficits. When significant cephalic rotation is indicated, interrupted strip techniques serve well. The risks of asymmetric healing are higher when the alar cartilages are divided, however, and initial loss of tip support occurs immediately. The latter problem must be recognized and countermeasures taken during surgery to ensure that sufficient tip support is reconstituted. Shoring struts in the columella, infratip lobule cartilage grafts, and transdomal suturing constitute the most commonly used tip support adjuncts.

Tip Projection and Cartilage Tip Grafts

In addition to the creation of narrowing refinement and symmetry of the nasal tip, most evident in the frontal view, appropriate projection must be preserved or newly created to result in the most natural appearance possible. Clearly the most attractive and elegant noses are those in which anterior projection is sufficient to set the tip subtly but distinctly apart from the nasal supratip areas, lending strength and character to the entire face. Ptotic or poorly projected tips produce a snubbed and indistinct appearance typical of unskillful rhinoplasty.

Ideally, on profile view, the nasal tip should be slightly elevated above the cartilaginous dorsum by 1 to 2 mm, blending gently rather than abruptly into the supratip. If the preoperative projection of the tip is normal and adequate, lowering the cartilaginous dorsum into proper alignment will achieve a satisfactory aesthetic appearance, provided that no loss of tip support occurs during the operative or postoperative period. Preserving the major and minor tip support structures increases this likelihood, whereas their sacrifice without compensatory reestablishment of support inevitably leads to eventual tip ptosis. If preoperative tip projection is inadequate, attempts to overreduce the supratip cartilaginous dorsum in order to produce pseudoprojection of the tip are inadvisable, and lead to apparent flattening or widening of the middle third of the nose.

If tip projection is inadequate, several reliable methods may be employed singly or in tandem to establish permanent improvement. All involve reorientation of the alar cartilages or the addition of autogenous cartilage grafts to strengthen or sculpture the projection and/or the attitude of the tip and infratip lobule.

Since the long-term viability and stability of cartilage tip grafts is well established, their use is regularly employed with success if the surgical modification of existing alar cartilage configuration is inadequate to produce the desired degree of projection. (In revision rhinoplasty in particular, tip cartilage grafts are irreplaceable in skeletal reconstruction beneath scarred skin and asymmetric topography.)

Two distinct varieties of tip grafts are preferred: those that directly overlay the dome profile of the alar cartilage, and those that redefine and contour the skeletal anatomy of the infratip lobule. Since these grafts (single or laminated) lie in intimate subcutaneous pockets, exacting sculpture of their size and shape is mandatory. Harvested from septal or auricular cartilage, they are ideally inserted without suture fixation into small pockets dissected to accommodate exactly the dimensions of the graft(s). Bilateral marginal incisions beneath the anatomic dome area facilitate the careful pocket creation, and render final positioning and stabilization of the graft easier than if only one incision is used. Suture fixation of the graft may be necessary if undermining is widely developed in a primary delivery or open approach method, disallowing the creation of a stable, defined pocket. Edges of the grafts must be beveled or softened to avoid visible contour irregularities or offset deformities. Carved in triangular, trapezoidal, or shieldlike shapes, tip grafts may accentuate favorable tip-defining points and highlights while imparting a more natural appearance to tips with congenital or postsurgical inadequacies.

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 are effective in establishing permanent projection. "Plumping" grafts of cartilage fragments, introduced into the base of the columella through a low lateral columellar incision, 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 tentpole 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.

Tip Rotation

In many patient undergoing rhinoplasty, cephalic rotation of the nasal tip complex (alar cartilages, columella, and nasal base) assumes a major importance in the surgical event, while in other individuals the *prevention* of upward rotation is vital. Certain well-defined and reliable principles may be involved by the nasal surgeon to essentially calibrate the degree of tip rotation (or prevention thereof). The dynamics of healing play a critical role in tip rotation principles; it is the control of these postoperative healing changes that distinguishes rhinoplasty from less elegant procedures. In the past, overrotation of the nasal tip created an unhealthy stigma for the rhinoplasty procedure. Most individuals recognize and prefer the aesthetic advantages of the stronger nose possessed of sufficient length to impart character and suitable proportions of the face.

The planned degree of tip rotation is dependent on a variety of factors, which often include:

1. The length of the nose.
2. The length of the face.
3. The length of the upper lip.
4. Facial balance and proportions.
5. The aesthetic desires of the patient.
6. The surgeon's aesthetic judgment.

An important distinction must be drawn between *tip rotation* and *tip projection.* Certain tip rotation techniques may result in desirable increases in tip projection, but the converse is not true. Tip rotation and projection are in fact complementary to each other, and their proper achievement in individual patients is constantly interrelated. A classic example of this interdependent relationship is illustrated by the almost inevitable loss of tip projection when interrupted strip techniques are chosen in order to enhance cephalic rotation; steps must be planned to restore adequate longterm tip projection by one of the several methods recommended.

Finally, distinction must be drawn between *true* tip rotation and the *illusion* of tip rotation achieved by contouring cartilage grafts placed in the infratip lobule, columella, and nasolabial angle. Favorable modifications in the tip-lip-complex profile area with autogenous implants may obviate entirely the need for any actual tip rotation at all, thus preserving a long and at times more desirable nasal appearance. Reduction of the nasal profile, particularly the supratip cartilaginous pyramid, may also impart the illusion of rotation and a shortened nose, albeit occasionally at the expense of a strong and narrow dorsum.

Nasal tip rotation results fundamentally from planned surgical modifications of the alar cartilages, but increments of rotation may also be realized from additional adjunctive procedures upon nasal structures adjacent to the alar cartilages that exert a favorable influence upon calibrated tip rotation methods. Shortening of the caudal septum, excision of overlong caudal upper lateral cartilages, and septal shortening with a high transfixion incision are regularly employed to enhance the effects of a planned degree of tip rotation.

Since tip rotation is only one of the many objectives desirable in rhinoplasty, decisions regarding rotation must be interrelated with planning for tip volume reduction, alar cartilage thinning reduction, and modifications in the attitude and angulation of the alar cartilages.

The techniques and healing dynamics described are not absolute but are reasonably predictable. The overwhelming majority of tip rotation techniques may be incorporated in an organizational scheme that consists of three procedures to preserve a complete, intact strip of alar cartilage, and three additional procedures involving interrupted strip techniques. Unique anatomic situations are regularly encountered that require modifications of this scheme in order to achieve a more refined result, but the fundamental principles elaborated remain a constant. In addition, the thickness and strength of the alar cartilages, along with the character of their enveloping soft tissue and skin, dictate, to a degree, which techniques may safely and predictably be employed in each anatomic situation.

Complete strip techniques are always preferable tip procedures when the nasal anatomy permits and the goals of the surgical procedure may be met without resorting to the less predictable interrupted strip procedures. Preserving a complete, uninterrupted segment of alar cartilage remnant contributes to a more stable and better supported nasal tip that tends to *resist* cephalic rotation during healing.

Interrupted strip techniques combined with volume reduction of excessive alar cartilage tend to result in a more substantial degree of cephalic rotation of the tip complex. Once the complete strip of residual alar cartilage is divided (interrupted), a relative instability of the nasal tip results, upon which the forces of upward scar contraction create a variable degree

of cephalic rotation. This underscores the principle that during scar contracture tissues are generally moved from areas of instability (in this case the unstable nasal tip cartilages) toward areas of stability (the bony-cartilaginous nasal pyramid).

Tip Rotation with Complete Strip Techniques

Volume reduction of the alar cartilage results in a tissue deficit of minimal, moderate, or maximal proportions, depending on the degree of cartilage removal indicated or desirable. Essentially no cephalic tip rotation results from minimal volume reduction alone, while the greater tissue void resulting from moderate to maximal volume reduction tends to create progressively greater degrees of *minimal* tip rotation. Indeed, preservation of the complete strip is regularly indicated and preferred in order to resist the forces of upward rotation when the preoperative nasal length is to be maintained.

Substantial planned tip rotation when complete strip techniques are employed therefore depends on the addition of adjunctive procedures to achieve cephalic elevation of the tip. These include caudal septal reduction, septal shortening with high septal transfixion incisions, shortening of the upper lateral cartilages, or designing illusions of tip rotation by the use of cartilage battens, struts, or plumping implants.

Tip Rotation with Interrupted Strip Techniques

When the integrity and spring of the alar cartilage are broken, cephalic rotation is fostered by virtue of upward scar contracture forces acting inexorably upon alar cartilage segments that are now more flail and less well supported. These techniques are particularly useful when the attitude of the alar cartilages is one of profound downward inclination, imparting a depressed or snarl-like appearance to the nose. Caution must constantly be exercised in the use of interrupted strips in patients with thin skin or more delicate cartilages, since the absence of good tip-supporting structures sets the stage for loss of projection, alar collapse, notching, pinching, and asymmetry.

Lateral Interruption Techniques. In anatomic situations in which cephalic rotation is desirable and the anatomy of the bridge between the medial and lateral crus (the "dome") is aesthetically pleasing, lateral interruptions of the residual complete strip possesses virtues. Avoiding interruption of the strip medially fosters symmetric healing and reduces the likelihood of uneven tip-defining points becoming evident months after surgery. The lateral interruption allows the reduced alar cartilage to be pulled moderately upward by scar tissue during healing, but because the dividing cut is sited more laterally and therefore more deeply in the soft tissues of the tip, notching, pinching, and other asymmetries are essentially prevented. If modification of the dome is necessary, transdomal suture techniques to narrow, refine, and even slightly project the tip may be favorably combined with lateral interruption.

Medial Interruption Techniques. Many different methods of interruption of the residual complete strip at or near the dome have been described; each predictably leads to some degree of cephalic rotation, and the complete strip is converted to two or more segments of flail cartilage. Planned rotation with this approach is reserved for patients with thicker skin and supporting structures, in order to minimize undesirable consequences of asymmetric healing and even overrotation. Elevation of the medial nostril margin is more common with

medial strip interruption, an onerous stigma of nasal surgery.

It is worthy of reemphasis that medial interruption techniques almost always result in a moderate to major loss of tip projection, requiring adjunctive procedures to restore or augment tip projection and avoid tip ptosis.

Lateral Interruption Techniques With Suture Rotation. An ideal method for significant tip rotation would combine lateral strip interruption to preserve the integrity of the strip medially with a calibrated triangular excision of cartilage laterally, and stabilization of the cut cartilage edges with suture fixation. The degree of rotation realized here is controllable by the surgeon, essentially eliminates most of the undesirable sequelae of interrupted strip techniques, and changes in a predictable and permanent way the attitude of the alar cartilages. The suture fixation helps to diminish the loss of tip support inherent in most interrupted strip techniques. In individuals with thin or moderately thin skin and more delicate cartilages, this method is highly predictable and desirable.

As with the rotation concepts discussed above with regard to complete strip techniques, the same adjunctive techniques for enhancing tip rotation may be useful to combine with interrupted strip techniques. Included among these adjunctive techniques are (1) shortening of the caudal septum, (2) shortening of the caudal upper lateral cartilage, (3) high septal transfixion incision with wedge excision of septum, and (4) reduction of over-convex medial crura (caudal margin).

However, overrotation must be religiously avoided, since correction of this undesirable postoperative situation is often difficult or impossible.

Correction of the Overprojecting Tip

Profound facial and nasal disharmony may result from the anatomic facial feature variant termed "the overprojecting nose". Since the entire nose, and especially the normal nasal tip, is composed of distinct and interrelated anatomic components, any one or a combination of several of these components may be responsible for the tip that projects unpleasantly too far forward of the anterior plane of the face. Goode accurately characterized the guidelines for determining appropriate and inappropriate tip projection. When a large number of patients with overprojecting tips are analyzed, it becomes apparent that no single anatomic component of the nose is constantly responsible for overprojection; it clearly follows that no single surgical technique is uniformly useful in correcting all the problems responsible for the various overprojection deformities.

Accurate anatomic diagnosis allows for preoperative development of a logical individualized strategy for correction and tip retropositioning. In almost every instance, *weakening or reducing of normal tip support mechanisms is required* to achieve normality, supplemented by reduction of the overdeveloped components. The following anatomic variants are commonly responsible individually or collectively for overprojection of the nasal tip.

Overdevelopment of the alar cartilages, commonly associated with thin skin and large nostrils, is frequently encountered in the overprojecting nose. The junction between the medial and lateral crura may form an overlarge dome of significant convexity, or the anatomic dome

area may be sharply angulated, twisted, or even buckled, often demonstrating significant asymmetry of the entire tip and its tip-defining points. The hypertrophied cartilages must be delivered, their abnormalities clearly diagnosed, and overall volume reduction of both the lateral and medial crura accomplished. Portions of the medial crus may require resection in order to retroposition the nasal tip satisfactorily.

A second common cause of excess nasal tip projection is an overlarge nasal bony spine that seemingly imparts an upward thrust of the tip components, which otherwise may be of normal dimensions. Compounding this abnormal appearance is often a coexistent blunting of the nasolabial angle, which may appear full, webbed, and excessively obtuse, with no obvious demarcation between the tip and columella. The upper lip may appear short, tethered, and tense, often exposing excessive gingiva in facial repose as well as in animation. Rongeur or osteotome reduction of the overlarge spine and associated caudal quadrangular cartilage and soft tissue is a surgical prerequisite to tip retrodisplacement.

A similar deformity of overprojection and obliteration of a definitive nasolabial angle may be the result of overdevelopment of the caudal quadrangular cartilage. The nasal spine may in fact be of normal size, but if even slightly overlarge, it compounds the problem of overprojection. In effecting repair, the caudal septal margin abutting the nasal spine should always be inspected and shave reduced to normal proportions before any of the nasal spine is sacrificed.

A high anterior septal angle due to an overdeveloped quadrangular cartilage component may spuriously elevate the tip to an abnormally forward-projecting position, even when associated with otherwise perfectly normal tip anatomy. This condition tends to "tent" the tip away from the face and "tether" the upper lip, producing an indefinite nasolabial angle and sometimes creating abnormal exposure of the maxillary gingiva, particularly upon smiling. Correction demands a departure from the normal operative sequence of correcting the tip first. The initial surgical steps are planned to lower the cartilaginous profile first, releasing the tip from an abnormal overprojected influence. Further tip refinement measures can then be carried out as desired and as indicated by the alar cartilage anatomy.

Tip overprojection may occur as the result of an overlong columella associated with excessively long medial crura. In this deformity the infratip lobule is commonly insufficient, creating the effect of extremely large and disproportionate nostrils. This deformity suggests the use of an external approach to the nasal tip in order to shorten the columellar length as well as that of the medial crura.

Various combinations of the above hypertrophic anatomic problems may contribute to the overprojecting tip problem. In preoperative analysis, each nasal component must be compulsively identified and analyzed; only then can a definitive plan for natural correction be conceived. In general, a combination of weakening of the major tip support mechanisms and reduction of the components responsible for the tip overprojection is carried out incrementally, and as conservatively as possible, to achieve in a progressive fashion the desired normal final result. The various components capable of creating or contributing to overprojection of the nose are shown in Table 3.

Table 3. Etiologies of Overprojecting Tip

Alar cartilage overdevelopment
Nasal spine overdevelopment
Caudal septum overdevelopment
Dorsal septum overdevelopment
Elongated columella and medial crura
Combined overdevelopment abormalities
Iatrogenic overprojecting tip.

Iatrogenic overprojection may occur when those surgeons intent on profoundly increasing tip projection produce an unnaturally sharp and projected tip configuration (often associated with overrotation of the tip). These misadventures commonly result from overaggressive tip surgery in which portions of the lateral crus are borrowed and rotated medially to increase medial crus projection. If this form of interrupted strip technique is carried out in thin-skinned patients, unpredictable healing may lead to a sharp, narrowed, asymmetric, and overprojected tip with potential collapse of the alar side walls early or even late in the postoperative period. Correction requires exploration of the residual nasal tip cartilages through a delivery approach to determine the residual anatomy and the precise cause of the deformity. The overprojecting cartilages (usually the medial crura) are trimmed to a proper position, and when indicated autogenous cartilage grafts are inserted between the tip skin and the residual alar cartilages to soften and sculpture the tip contours.

Alar Base Reduction

Appropriate reduction of the overprojecting nose typically requires that the various major and minor tip support mechanisms be diminished in order to retroposition the tip closer to the face. A concomitant reduction of the alar component length and lateral flare (occasioned by tip retropositioning) is usually required to improve nasal balance and harmony. Alar wedge excisions of various geometric designs and dimensions are necessary to balance alar length and position. These excisions are determined by the present and intended shape of the nostril aperture, the degree and attitude of the lateral alar flare, the width and shape of the nostril sill, and the thickness of the alae. It is axiomatic that the surgeon creating alar reduction by excision of alar or nostril floor tissue should always err on the side of conservatism and strive for symmetric repair, since overaggressive and asymmetric tissue resection leads to an almost irreversible situation of disharmony and even nostril stenosis.

Profile Alignment

Three anatomic nasal components are responsible for the preoperative profile appearance: the nasal bones, cartilaginous septum, and alar cartilages. Generally, all three must undergo modification to create a pleasing and natural profile alignment. If the nose is too large with a convex profile, reduction of the three segments is required. Less commonly (except in revision rhinoplasty), profile augmentation with autograft materials must be carried out.

The ultimate intended profile is visualized in the mind's eye of the surgeon, extending from the naso-frontal angle to the tip-defining point, and then on around the infratip lobule

and columella to the nasolabial angle. The extent of reduction of bone, cartilage, and soft tissue always depends on and is guided by stable tip projection; thus, positioning the projection of the tip at the outset of the operative procedure is beneficial. Since the thickness of the investing soft tissues and skin varies at different areas of the profile and from patient to patient, dissimilar portions of cartilage and bone must be removed to result ultimately in a straight or slightly concave profile line. Strong, high profiles generally suit the patient best in the long term, contributing to a more elegant nose on profile and oblique views, while also rendering a more narrow nasal appearance on frontal view. Overreduced profiles result in a washed-out, indefinite, and widened appearance from the front, separating the eyes inadequately and reflecting desired light reflexes poorly.

In planning profile alignment, the two stable reference points are the existing (or planned) nasofrontal angle and the tip-defining point. Aesthetics are generally best served when profile reduction results in a high, straight-line profile in males, with the leading edge of the tip just slightly higher in females. A gentle slope of no more than 2 to 3 mm should exist between the caudal part of the cartilaginous dorsum and the most anteriorly projecting aspect of the nasal tip. Reversal of the usual preoperative tip-supratip relationship is required to achieve this aesthetic ideal.

The degree and angulation of the "hump removal" depends on a variety of factors, the most important of which are the size of the various involved anatomic components and the surgeon's confidence in the stability of postoperative tip projection. These must be balanced with a personal preference for profile appearance combined with the surgeon's value judgment of facial aesthetics.

Surgical access to the nasal dorsum is gained through the transcartilaginous or intercartilaginous incision, depending on which approach was employed during tip refinement. Commonly the incision is extended around the anterior septal angle and into the membranous septum for a distance of 5 to 8 mm to provide full visualization of the nasal skeleton. Complete transfixion incisions for exposure are unnecessary and may compromise tip support by sacrificing the attachment of the medial crural footplates to the caudal septum.

The plane of tissue elevation over the nasal dorsum is important for several reasons. A relatively avascular potential plane exists just intimate to the perichondrium of the cartilaginous vault and just below the periosteum of the bony vault. Elevating the tissue flap in this important plan preserves the thickest possible ultimate epithelium-soft tissue covering to cushion the newly formed bony and cartilaginous profile. Generally, only sufficient skin is elevated to gain access to the bony and cartilaginous profile; thus, wide undermining is unnecessary in the typical rhinoplasty. In older patients with redundant and less elastic skin, or when access is needed for major autograft augmentation, wider undermining is carried out. Even in the latter instance the periosteum-soft tissue layer over the intended site of the low lateral osteotomies is preserved intact to help stabilize the antral bony pyramid after infracture osteotomy maneuvers.

The soft tissues over the cartilaginous dorsum are elevated by means of scalpel dissection with a No. 15 blade, while the periosteum over the bony pyramid is lifted from its stable bony attachment with the Joseph elevator. Since the periosteum inserts into the internasal suture line in the midline, the periosteum is lifted on either side of this suture and

the space then brought into continuity with the sharp scissors. Little or no bleeding should ensue during uncovering of the nasal skeleton in these important planes, allowing direct vision assessment of the anatomy encountered.

Either of two methods of profile alignment is preferred: incremental or en bloc. In the former the cartilaginous dorsum is reduced by incrementally shaving the cartilaginous dorsum until an ideal tip-supratip relationship is established, followed by sharp osteotome removal of the residual bony hump. If only minimal hump removal is contemplated, the knife is positioned at the osseocartilaginous junction and plunged through this area, then advanced caudally to and around the anterior septal angle of the caudal septum (In large cartilaginous reductions, a portion of the upper lateral cartilage attachment to the quadrangular cartilage is of necessity removed with the dorsal septum, leaving these two cartilaginous components attached, however, by the underlying mucoperichondrial bridge.) A sharp Rubin osteotome (honed to razor sharpness at the operating table), seated in the opening made by the knife at the osseocartilaginous junction, is advanced cephalically to remove the desired degree of bony hump in continuity with the cartilaginous hump.

Any irregularities remaining are corrected under direct vision with a knife or tungsten-carbide rasp. Palpating the skin of the dorsum with the examining finger moistened with peroxide often provides clues to unseen irregularities, as does intranasal palpation of the profile with the noncutting edge of the No. 15 blade.

Except in very large or severely twisted noses, it is unnecessary and potentially harmful to separate the upper lateral cartilages from the septum by cutting through the mucoperichondrial bridge of tissue connecting them at the nasal valve.

Any redundant soft tissue around the anterior septal angle may be trimmed away to achieve improve tip-supratip definition. The caudal septum, assessed by stretching the partial transfixion incision posteriorward, lies now exposed for geometric shortening or repositioning.

In patients in whom the nasofrontal angle is poorly defined or in need of repositioning, weakening of the bone in the desired area is accomplished prior to bony hump removal. At the exact site in the midline where the nasofrontal angle is desired, a 2-mm osteotome is plunged transcutaneously into the midline of the nasal bone. By angulating this small osteotome laterally on either side, the exact cephalic extent of bony hump removal may be controlled by scoring the bone in a horizontal line. During the bony hump removal phase of profile alignment, then, the nasal bones fracture cephalically where this weakening maneuver has established a bony dehiscence, allowing the surgeon some additional control over the ultimate site of the nasofrontal angle. Creating a more caudally placed angle provides the illusion of a shorter nose without actual shortening; establishing a more cephalically placed angle creates the appearance of a longer nose.

In patients in whom the nasofrontal angle is too deep, augmentation with residual septal cartilage or remnants of the excised alar cartilages provides a beneficial aesthetic refinement.

Further profile enhancements may be favorably developed with contouring cartilage grafts positioned along the dorsum, supratip area, infratip lobule, columella, and nasolabial

angle. In the latter site, "plumping" grafts are commonly employed to open an otherwise acute or unsatisfactory nasolabial angle and thereby contribute to improved profile appearance. The illusion of tip rotation and nasal shortening is created by this maneuver, reducing the degree of actual shortening required, and preserving a longer and often more elegant nose.

Bony Pyramid Narrowing and Alignment

Significant advances have been developed over the past two decades in the reduction of osteotomy trauma in rhinoplasty surgery. Osteotomies, the most traumatic of all surgical maneuvers during nasal surgery, are best delayed until the final step in the planned surgical sequence, when vasoconstriction exerts its maximal influence and the nasal splint may be promptly positioned. This furthers the surgeon's quest to avoid excessive trauma, swelling, and ecchymosis.

Profile alignment in the typical reduction rhinoplasty inevitably results in an excessive, plateau-like width to the nasal dorsum, requiring narrowing of the bony and cartilaginous pyramids to restore a natural and more narrow frontal appearance to the operated nose. The lateral bony side walls (consisting of the nasal bones and maxillary ascending processes) must be completely mobilized by nongreenstick fractures and moved medialward (exceptions may exist in older patients with more fragile bones in whom greenstick fractures may be acceptable or even preferable). The upper lateral cartilages are also moved medially because of their stable attachment cephalically to the undersurface of the nasal bones.

To facilitate atraumatic low lateral osteotomy execution, medial-oblique osteotomies angled laterally 15 to 20 degrees from the vertical midline are preferred. By creating an osteotomy dehiscence at the intended cephalic apex of the lateral osteotomy, the surgeon exerts added control of the exact site of back-fracture in the lateral bony side wall. A 2- to 3-mm sharp micro-osteotome is positioned intranasally at the cephalic extent of the removal of the bony hump (if no hump removal has been necessary, the site of positioning is at the caudal extent of the nasal bones in the midline). The osteome is advanced cephalo-obliquely to its intended apex at an angle of 15 to 20 degrees, depending on the shape of the nasal bony side wall. Little trauma results from medial-oblique osteotomies, which avoid the ever-present possibility of eccentric or asymmetric surgical fractures developing when lateral osteotomies alone are performed. In addition, bony infracture occurs without strong manual pressure exerted on the nasal bones, a traditional but unnecessary traumatic maneuver.

Trauma may be significantly reduced in lateral osteotomies if 2- or 3-mm micro-osteotomies are employed to accomplish a controlled fracture of the bony side walls. There is no need for elevation of the periosteum along the pathway of the lateral fractures, since the small osteotomies 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 vestibular skin to encounter the margin of the piriform aperture at or just above the inferior turbinate. This preserves the bony side wall 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 osteotome then progresses toward the base 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 side wall is thus created, allowing infracture without excessive traumatic pressure. 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 micro-osteotomies, since the soft tissues embracing the bony side walls remain essentially undamaged.

In most rhinoplasty procedures, controlled nasal fractures as the result of osteotomy should result in slight mobility of the bony side walls stabilized by the internal and external periosteum that bridges the nasal fragments on either side of the osteotome pathways. Large guarded osteotomies destroy this vial periosteal sling, potentially rendering the bony fragments unstable and susceptible to eccentric or asymmetric healing. In addition, trauma from the large osteotomies inevitably produces increased bleeding, edema, and ecchymosis in an unacceptably large number of patients.

In deviated noses characterized by essentially convex or concave bony asymmetries and excessively wide or extremely thick bones (including revision rhinoplasty), double lateral osteotomies may be considered for improved mobilization and regularization. This decision is best determined preoperatively to allow the higher osteotomy to be accomplished before the low lateral osteotomy. Reversing this order necessitates attempting the higher osteotomy on an already mobilized lateral bony side wall, a more difficult task.

Upon completion of satisfactory osteotomies and suitable aesthetic nasal narrowing, the profile line is finally inspected and palpated for irregularities or inadequate alignment. Since the upper lateral cartilages move medialward with the bony side walls after osteotomies, their dorsal margins should be trimmed to sit flush with, or slightly lower than, the cartilaginous profile line. Excess soft tissue, it present, is excised, and the new nasal dorsum is inspected for and cleaned of any debris. Any desired profile grafts to improve the ultimate intended profile line are now scalpel sculptured to size and placed accordingly. If limited undermining of the overlying dorsal epithelium has occurred, grafts may be placed with no requirement for suture fixation. If a large subcutaneous pocket exists, however, transcutaneous pull-out 5-0 mild chromic catgut sutures are employed to fix the grafts into the intended site. The sutures, cut flush with the skin at 5 to 7 days, retract into the subcutaneous space and are absorbed.

Final subtle nasal refinements are now completed; these may include caudal septal reduction, resection of excessive vestibular skin and mucous membrane, trimming of the caudal margins of the upper lateral cartilages (only if too long or projecting into the vestibule), columellar narrowing, and bilateral alar reduction. These final maneuvers are carried out with the assistant maintaining constant finger pressure over the lateral osteotomy sites to prevent even minimal oozing and intraoperative swelling. All incisions are closed completely with 5-0 chromic catgut suture. No permanent sutures are used.

Nasal dressings are now applied. No intranasal dressing or packing is necessary in routine rhinoplasty. If septoplasty has been an integral part of the operation, a folded strip of Telfa is placed into each nostril along the floor of the nose to absorb any drainage. The previously placed transseptal quilting mattress suture acts as the sole internal nasal splint for the septum, completely obliterating the submucoperichondrial dead spaces and fixing the septal elements in place during healing. The external splint consists of a layer of compressed

Gelfoam placed along the dorsum and stabilized in place with flesh-colored micropore tape, extending over and laterally beyond the lateral osteotomy sites. A small aluminum and Velcro (Denver) splint applied firmly over the nasal dorsum completes the operation.

Postsurgical Considerations

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

Whether patients are discharged the afternoon of or the morning after surgery, all intranasal dressings are removed from the nose before they leave. A detailed list of instructions is supplied for patients or accompanying family members (Table 4); the important aspects of these "do's" and "don't's" 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.

Table 4. Patient Instructions Following Nasal Plastic Surgery

A. Introduction

Please read and familiarize yourself with these instructions both 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 Kleenex, if necessary.
2. Change dressing under nose (if present) as needed.
3. The nasal 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 intercourse.
6. Brush teeth gently with a soft toothbrush only. Avoid manipulation of upper lip to keep nose at rest.
7. Avoid excess or prolonged telephone conversations and social activities for at least 10-14 days.
8. You may wash your face - carefully avoid dressing. Take tub baths until dressings are removed.
9. Avoid smiling, grinning, and excess facial movements for 1 week.
10. Do not wash hair for 1 week unless you have someone do it for you. DO NOT GET NASAL DRESSINGS WET.
11. Wear 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 nose to swell.
13. Don't swim for 1 month, since injuries are common during swimming.
14. Don't be concerned if, following removing of dressing, the nose, eyes, and upper lip show some swelling and discoloration - this usually clears in 2-3 weeks. In certain patients it may require 6 months for all swelling to completely subside.
15. Take only medications prescribed by your doctor(s).
16. Do not wear regular glasses or sunglasses which rest on bridge of nose for at least 4 weeks. We will instruct you in method of taping glasses to your forehead to avoid pressure on nose.
17. Contact lenses may be worn within 2-3 days after surgery.
18. After the doctor removes your nasal cast, skin of 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 312-472-7559.

M. E. Tardy, Jr, MD.

The external splint is removed by the surgeon or surgical nurse 5 to 7 days after surgery. An important consideration should be 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 disturbances of the newly forming subcutaneous fibroblastic layer over the nasal dorsum, with additional unwanted scarring and even abrupt hematoma.