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Reduction Structured Rhinoplasty

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The philosophy of corrective and aesthetic surgery of the external nose has evolved over the last several decades. Historically, facial plastic surgeons had a limited understanding of nasal structure and of the long-term effects of wound healing. Often, immediate postoperative results were cosmetically pleasing, but the structural integrity of the nose was lost. In some cases, structurally compromised noses collapsed on inspiration, leading to nasal blockage. During the healing process, the skin tightened and often buckled this weakened framework, leading to asymmetries and deformities. Over the last few decades facial plastic surgeons have leveraged advancements in the understanding of wound healing and nasal structure to develop improved tissue rearrangement techniques. When coupled with structural reinforcement, these new techniques can be performed to maintain or improve nasal respiratory function, ensure long-lasting structural stability, and achieve an aesthetically pleasing cosmetic result. This discussion describes some of the new techniques.

History

Rhinoplasty is considered one of the most challenging of all plastic surgery procedures. When the procedure is properly performed, the surgeon repositions the nasal framework to alter aesthetic contours and to maintain or improve respiratory function. In the 1930s the most popular type of rhinoplasty was the Joseph reductive rhinoplasty. Although this technique typically produced cosmetically favorable immediate postoperative results, it often damaged the structural integrity of the nose and caused patients to develop functional disturbances years later. In addition, during the healing process, as the tissues contracted over this weakened nasal structure, patients frequently developed cosmetic deformities and asymmetries. Despite these issues, this model of the reductive rhinoplasty technique continues to be performed in many centers as the preferred method even to this day.

As surgeons began to recognize adverse effects in some of their patients, surgical strategies were developed to prevent these outcomes. A particularly significant development in the 1970s was Jack Sheen's introduction of the first shield tip graft to address the problem of an overresected nasal tip. This technique marked a departure from previous norms in its integration of more advanced nasal structure knowledge. It has since been adopted for application in some primary cases as a means of increasing the projection and definition of the nasal tip. Other structural support techniques that have become more popular include columellar struts, dorsal onlay grafts, batten grafts, and spreader grafts. A few of these techniques are described in the following sections.

Preoperative evaluation

When evaluating a patient interested in aesthetic facial surgery, a thorough history and physical

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examination are essential. In the initial evaluation, discussion should begin by focusing on the patient's motivation for and goals of aesthetic facial surgery. The surgeon should help the patient develop realistic expectations with a frank discussion of the limitations of the proposed procedures. Adverse outcomes should also be discussed and the patient should demonstrate an understanding of these risks.

Patient history

The surgeon should focus on the chief complaint to develop a clear understanding of the patient's concerns. The patient should begin by describing what aesthetic characteristics are the most concerning, often with the help of a mirror or specially designed computer imaging software. A history of nasal symptoms should be discussed including the presence of right, left, or bilateral obstruction; fixed or changing obstruction; rhinorrhea; epistaxis; or sinusitis. Any history of trauma should be further explored. Any prior nasal procedures, especially septoplasty, should be known before surgery because this information may guide surgical planning.

In addition to a full exploration of the patient's past medical history, any personal or family history of bleeding should be noted and may require further laboratory investigation. In patients who smoke, the surgeon should insist that they refrain before surgery to achieve the best results. The risks of smoking on postoperative wound healing should be clearly stated and the patient must demonstrate an understanding of these risks. A history of drug use, especially cocaine, should be noted. A history of collagen vascular diseases, though rare, should be known before surgery because it may impact the expected results.

All medication taken by the patient should be documented, especially topical nasals sprays, systemic decongestants, antihistamines, steroids, and anticoagulants. If a patient takes aspirin, ibuprofen, or high-dose vitamin E he or she should discuss discontinuing these medications with his or her primary care physician before surgery. The surgeon should inquire as to the use of herbal medications, especially the ''four G's'' (ginseng, garlic, Ginkgo biloba, and ginger), which are known to produce an anticoagulant effect.

Physical examination

An overall evaluation of the face emphasizes balance and symmetry and begins with a frontal facial evaluation. The nose should be seen as one of many aesthetic facial subunits that must interrelate with the other subunits in a balanced and harmonious manner [1].

To aide in examining the symmetry and balance of the face, the face should be divided into thirds. Each third should be roughly equal in vertical dimension, as shown in Fig. 1. The face should also be divided horizontally into fifths. Each fifth should ideally be the width of the eye, and any deviations from this may indicate asymmetries or altered proportions (Fig. 2) [2].

The nose commands a prominent position in the center of the face and has major influence on the aesthetics of the face. On profile, the vertical height of the nose (from the nasion to the nasal root) should be 43% of the distance from the nasion to the menton (Fig. 3).

Lines and angles created by the nose can be used to analyze further the position and orientation of the nose. The nasofrontal angle should be 125 to 135 degrees (Fig. 4). The nasolabial angle should be about 90 degrees in men and between 95 and 105 degrees in women (Fig. 5). This is the major determinant of tip rotation or ''attitude'' of the tip. Shorter people can tolerate more tip rotation than taller people.

On lateral view there should be at most 4 mm of columella visible and on frontal view the infratip lobule and ala should create a line similar to a ''gull in flight.'' The nasal width should be equal to one intercanthal width at the alar base. The basal view of the nose should approximate an equilateral triangle with a columella to lobule height of 2:1. The ideal tip width is 70% to 75% of the base width.

The projection of the nose is a description of how far anteriorly the tip of the nose projects from the face. It is evaluated on profile by measuring the distance on a horizontal line drawn through the alar crease perpendicular to the Frankfurt plane. The

Fig. 1. Horizontal frontal thirds.

Fig. 2. Vertical fifths.

length of a horizontal line drawn from the nasal tip to the alar line divided by the length of a line drawn from the nasion to the nasal tip should be between 0.55 and 0.60 (Fig. 6).

The skin quality of the nose should be examined and may guide the surgical planning. Thick skin is rich in sebaceous glands. Surgeons should avoid the temptation to overreduce this type of nose to achieve a small, well-defined nose, because more often this produces a small, poorly defined ''bag of potatoes'' nose. Thin-skinned noses can also be quite challenging. Although it is easier to achieve good definition with thin skin, minor imperfections are more visible. In addition, thin skin is prone to increased postoperative contractions leading to an unnatural, ''shrink-wrapped'' appearance. Medium thickness skin is ideal and likely to produce the best aesthetic results.

Fig. 3. Nasal height.

Fig. 5. Nasolabial angle.

Fig. 4. Nasofrontal angle.

The nose should be examined by inspection and palpation. Any wrinkles, dryness, or sun damage should be noted. An internal nasal examination should include direct inspection with a nasal speculum and possibly fiberoptic nasal examination when warranted. The position of the caudal border of septum should be noted. The surgeon should examine the quality of the mucosa and the size, color, and position of the turbinates. Palpation of the septum helps elucidate structural support. Any septal scar tissue should be noted and may indicate prior surgery.

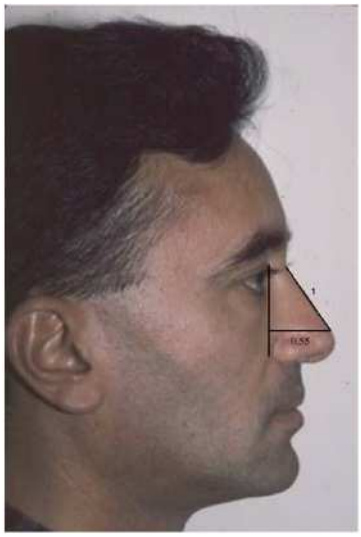

Fig. 6. Nasal projection.

A septal perforation, if found, should be evaluated in size, location, and etiology.

The nasal tip support should be evaluated by palpation. Depressing the nasal tip and watching for ''tip recoil'' helps assess the underlying cartilaginous framework and may guide the extent of cartilage resection. The strength of the alar cartilage should also be evaluated by palpation. Ballottement of the ala helps assess structural integrity and may guide the extent of resection or indicate a need for structural reinforcement. These examinations may also indicate the need for structural reinforcement.

Nasal respiratory function should be evaluated using the cottle test both before and after decongestion with a topical spray. A small spatula is used to support the nasal valve and the patient is instructed to obstruct the opposite nostril and inhale. The patient rates the nasal patency with and without the support of the spatula. This is done to evaluate the internal and external nasal valve and repeated on the opposite side. The patient is then fully decongested and is asked to rate the patency of each side. This examination helps evaluate for nasal valve collapse and may indicate the need for structural reinforcement. In patients with nasal obstruction responsive only to decongestion, a turbinectomy should be considered.

The external nasal bones should be evaluated by inspection and palpation. Asymmetries should be noted as should the width and projection. The internal nasal bones should be examined by palpation. Any deviation of the perpendicular plate of the ethmoid should be noted.

Clinical photography

Standardized preoperative and postoperative photodocumentation is essential both in analysis and evaluation of results. This can be done by a medical doctor or qualified medical photographer and should include four views: the anterior full face at mid-neck including the outline of the hair, right and left profile, and basal view. At least one photograph should be taken with the patient smiling. Should the patient have significant asymmetry, a close-up basal view is recommended. Standard photographic technique includes use of adequate lighting without excessive shadowing. The patient should be at least 1 m from the camera and at least 1 m from a dark background. Photodocumentation of this type contributes to the continued refinement in surgical planning and technique of even the most experienced plastic surgeon. Photodocumentation can also form a teaching file in an academic setting and can become a part of the medical and medicolegal record.

Radiologic and laboratory evaluation

Radiography is indicated when the history suggests recurrent or chronic sinus disease or as other-wise warranted. Typical preoperative laboratory investigation includes SMA-7, complete blood count, urinalysis, prothrombin time and partial thromboplastin time, and in patients over the age of 45 or with significant cardiac history a chest radiograph and ECG.

Preoperative discussion

It is imperative that the surgeon clearly delineates the limitations of the proposed procedure. One of the most common reasons for dissatisfaction among facial plastic surgery patients occurs when there is discordance between the expectations of the patient and surgeon. The Step Theory may facilitate this discussion (Fig. 7). In this theory a patient can rate his or her preoperative appearance on a scale of 1 to 5 with a 1 being perfection and a 5 being a monstrosity. A reasonable expectation is to improve by one level, at most two levels. The surgeon must stress that perfection is not a realistic goal and only leads to disappointment.

The surgeon should provide an overview of the healing process including a timeline. Sample photographs can aide in this discussion. By adequately preparing for the process, patients often feel more in

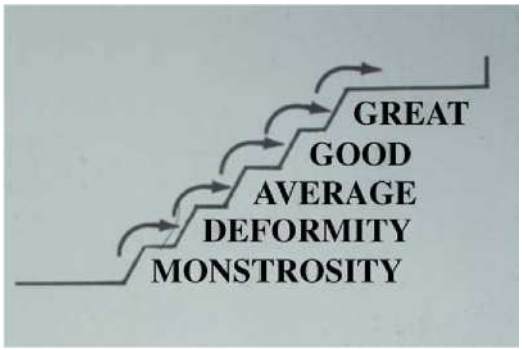

Fig. 7. The step theory.

control during the healing period. Immediately after the surgery the patient has puffy eyes and they may be black and blue. There is a bandage over the nasal bridge and there may be packing inside the nose. This packing is removed either after the patient fully awakes from anesthesia or the following day. When the packing is in place the patient is not able to breathe through his or her nose. Self-care should be explained including the use of cold-compresses across the nasal bridge. Various stages of healing should be explained including when the final post-operative results can be evaluated.

Potential complications should be described in a balanced, accurate, and appropriately descriptive manner. Risks of both minor and more significant postoperative bleeding should be explained including the patient's role in preventing or stopping the bleeding at home. Depending on the procedure, the risks of visible intranasal or external scarring should be explained. The use of cosmetic products in this situation can be explained. Should the patient require scar revision, this should also be described. Risks of nasal obstruction or valve collapse should be addressed and possible revision procedures can be explained at this point. More serious adverse outcomes including cerebrospinal fluid leak, meningitis, and death should be mentioned, appropriately weighted by their relative rarity.

Beyond revision surgery for adverse outcomes, the possibility of further touch-up surgery for minor imperfections may be warranted. The fee, if any, should be disclosed. The surgeon should consider having a patient write out the risks of surgery in his or her own words. This facilitates further discussion, helps verify understanding, and may provide medicolegal protection for the surgeon.

The surgeon should give the patient a list of anticoagulants that should not be taken for 2 weeks before surgery. Prescriptions for postoperative medications should be given at this visit and explained. The patient should shampoo with a hexachlorophene detergent cleanser (pHisoHex) the evening before surgery.

Surgical planning

The surgical planning for each case should be tailored to the unique deformities and functional problems presented. The surgeon should consider the aesthetic goals of the patient, including cultural, social, and ethnic aspects that may influence the desired outcome. General goals should include the improvement of nasal respiratory function; preservation or augmentation of the nasal support structures; maximal esthetic improvement; and avoidance of septal perforation, stenosis, and scarring.

The surgeon should study all the patient information and should fully describe the problems. The anatomic cause of each of these problems should then be deciphered. The appropriate surgical maneuvers should then be decided on and the sequence of events should be planned. Typically, a surgeon visualizes this procedure five times on a given patient: (1) in the office while examining the patient, (2) during preoperative planning, (3) during the actual procedure, (4) during immediate postoperative care, and (5) when evaluating the results at 6 months. It must be remembered that a surgeon cannot judge the results at a given time, but rather should see the results as an evolving process that changes throughout the patient's life.

Anesthesia

Rhinoplasty can be performed effectively under either local or general anesthesia. Regardless of the type chosen, successful anesthesia relies on close cooperation between the anesthesiologist and surgeon. Just as the surgeon expects to be updated on significant changes in the cardiovascular status of a patient, so does the anesthesiologist expect to be informed of what concentration and volume of epinephrine is being injected, or if the endotracheal tube is being adjusted.

Local anesthesia combined with premedication or light sedation has been successfully used by many facial plastic surgeons, but should be used only in a motivated patient able to cooperate during this moderately uncomfortable procedure. Patients benefit from this choice of anesthesia by a hastened recovery and reduced cost. There are some drawbacks, how-

ever, to this technique. When sedated, an uncomfortable patient may become so restless that the procedure must be aborted or converted to general anesthesia. In addition, this technique does not provide airway protection and puts the patient at risk for aspiration when under sedation. Some surgeons advocate general anesthesia with an endotracheal tube. Although this does provide good airway protection, it irritates the glottis, leaving a patient with a sore throat and often hoarse voice after surgery. The best anesthetic choice, then, for many patients is sedation and placement of a laryngeal mask tube. Although some authors believe that the laryngeal mask tube obscures the view of the patient profile and interferes with access to the base of the nose, the authors' experience has shown that if the tube is not taped, then it can easily be positioned to provide access to and visualization of these areas.

Surgical technique

Immediately preoperatively the patient should be examined while awake and sitting up. At this time the surgeon should mentally visualize the procedure based on the predetermined plan, verifying the physical examination.

Once in the room, the patient should be positioned supine on the operating table. Preoperative photos should be arranged for easy access throughout the procedure. Surgical landmarks should be noted by palpation and labeled with a surgical marking pen. These may include the margins of the upper and lower lateral cartilage, the tip defining point, any planned cephalic reduction, the extent of any bony cartilaginous hump reduction, and intended sites of osteotomy.

Local anesthesia should be given, even with general, to allow for a lighter plane of anesthesia. Neurosurgical cottonoids soaked with Neosynephine hydrochloride or color-coded 4% cocaine should be placed intranasally. Many texts describe discrete anatomic sites to target specific nerves, but this concept is purely academic in nature and not of practical use.

For the injectable agent the authors prefer 1% lidocaine with 1:100,000 epinephrine. The authors consider 1:500,000 epinephrine for an elderly patient with cardiac disease. In general, approximately 5 to 8 mL should be sufficient to anesthetize the nose. Keep in mind that the maximum dose of lidocaine is 7 mg per kg or 500 mg in an average adult. This is approximately 50 mL of 1% lidocaine. When injecting an anesthetic agent it is essential to avoid anatomic distortion. Use a long 27-gauge needle, taking care to inject into the proper plane. This produces hydrodissection, lifting up the tissue within the plane, allowing for ease of surgical dissection. Injecting into the proper plane also more effectively reduces bleeding and allows the surgeon to use less anesthetic agent. This minimizes distortion of tissues and exposes the patient to less medication. Forceful injections should be made in the submucoperichondrial and submucoperiosteal planes on septum producing a hydraulic elevation of the flap. Injections should also be made along the hemitransfixion and rim incision sites. The nasal apex should be injected, and between the domes and the inferior turbinates. The surgeon should next inject the supraperichondrial space of the upper and lower lateral cartilage, the supraperiosteal space over nasal bones, and the extraperiosteal planes on maxilla along the proposed osteotomy sites. Following the injection, the surgeon should wait 10 to 15 minutes before making incisions to allow for maximal effect of the epinephrine.

If during the course of the procedure bleeding becomes excessive or uncontrollable the nose should be packed with sponges soaked in a vasoconstricting agent and the surgeon should wait 5 to 10 minutes. The blood pressure should be checked. If it is found to be elevated, appropriate treatment should be instituted. Any bleeders should be identified and cauterized. A bleeding site can be injected with lidocaine and epinephrine or treated with a cottonoid soaked with a vasoconstrictor. If the bleeding continues, microfibrillar collagen, also known as ''witch's hair,'' can be used, although this makes it more difficult to continue the procedure. If all these efforts fail, the surgeon should consider placing a formal pack and aborting the procedure.

The septum should be addressed first. A full transfixion incision is made for septal harvesting (Fig. 8). After raising the mucoperichondrial flap on

Fig. 8. Full transfixion incision.

Fig. 9. Harvesting the nasal septum.

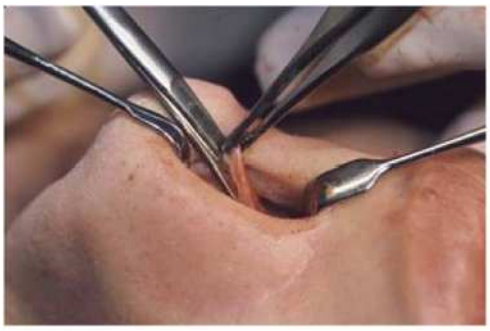

Fig. 11. Resection of caudal septum mucoperichondrium

one side of the nasal septum, an incision is made through the septum posterior to the anterior septal angle to form the anterior septal strut. This incision continues to the floor of the nose and this window of cartilage is removed and placed aside in saline (Fig. 9) [3].

The nose can then be shortened by reducing the caudal septum (Fig. 10). This also corrects the septal angle and should be accompanied by an adequate resection of mucoperichondrium (Fig. 11). This resection may include a portion of the bony nasal spine, which can be taken using a rasp or an osteotome. After completion of the septal work the transfixion incision is closed.

The external approach is most commonly used and begins with degloving the nasal tip and dorsum. An inverted V incision is made at the columella and continued laterally as the standard ''gullwing'' (Fig. 12). This incision continues along the marginal inferior edge of the lower lateral cartilage. Care should be taken to elevate the soft tissue over the cartilaginous dorsum. Using tip scissors, the skin flap is elevated off the lower lateral cartilage, then the upper lateral cartilage. This can also be done sharply with a scalpel. This flap should be elevated laterally just enough to provide access to that particular nose. Elevation continues to the nasal bones where the periosteum is incised. The periosteum is then elevated off the nasal bones using a Joseph elevator [4].

Attention should then be directed to the dorsal hump. The dorsum should be reduced to a line predetermined by the preoperative analysis. To facilitate dissection and modeling of the cartilaginous dorsum, the upper lateral cartilages are separated from the septum. This can be done by creating a submucosal tunnel and, with an Aufricht retractor in place, a number 11 scalpel is used to incise upward, cutting the connections between the upper lateral cartilage and the septum. Care should be taken to avoid penetrating the nasal mucosa during this step. Separating the upper lateral cartilages from the septum can also be accomplished using the ''squeeze down'' technique where a scissor is used to resect the cartilaginous dorsum. Once the upper lateral cartilages are

Fig. 10. Resection of the caudal septum.

Fig. 12. Dorsal view of gullwing incision.