

Rhinoplasty: A Essential Technique

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Published by: SM Online Scientific Resources LLC

Published Date: July 10, 2016

Online Edition available at <http://www.smgebooks.com>

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PREFACE

The primary objective of rhinoplasty is to create predictable changes in nasal contour while maximizing nasal function. Reproducible, consistent outcomes in rhinoplasty come with the surgeon's ability to create a stable nasal structure and predict the effects of scar contracture on this structure. In complex cases, endonasal approaches may not provide the exposure needed to execute complex grafting. The external approach allows maximal exposure of the cartilaginous nasal structures, bony vault, and septum. The surgeon is thus able to directly visualize the repositioning, alteration, and augmentation of the nasal structures.

Standard closed techniques usually offer a satisfactory approach for simple deformities such as dorsal humps and bony deviation. This form of traditional closed rhinoplasty technique is essentially a reductive process where cartilaginous and bony elements of the nasal skeleton are resected, with little effort being made to recreate structural integrity of the nose other than re-positioning the nasal septum and nasal bones. While for many patients this reduction and mobilisation approach is appropriate, others who have complex deformities of the nasal tip, septum, middle third and who require augmentation are often better served using an open approach.

PRINCIPLES AND PHILOSOPHY OF RHINOPLASTY

Aesthetic and functional surgery of the nose is considered to be the most challenging, rewarding, and humbling of all facial plastic procedures. Rhinoplasty is a continually evolving operation, but the fundamental philosophy and principles have not changed dramatically over recent years. Advances have been made in the refinement of rhinoplasty through a better understanding of nasal analysis, anatomy, function, and long-term postoperative healing. Every rhinoplasty operation presents the surgeon with a diversity of nasal anatomy, contours, and proportions, requiring a series of organized and interrelated surgical maneuvers tailored to each patient's anatomical and functional needs.

Patients should be given perioperative information and guides about the nasal surgery and care.

INDICATIONS

While there are no absolute indications to external rhinoplasty, there are certain problems which are best corrected through techniques requiring wide exposure. In general these methods involve extensive rearrangement of existing structures or addition of structural grafts. Indications include:

- Extensive revision surgery.
- Severe deformity of the external nose and/or septum.
- Congenital cleft lip nose deformities.
- Tip rhinoplasty, especially where graft augmentation is deemed necessary or complex suturing is required.
- Deformities of the middle third of the nose including saddle deformity.
- Certain cases of nasal valve collapse.

A good rule to follow for all indications is to wait until the patient is skeletally mature and longitudinal growth is complete. Exceptions are functional disorders in children that would compromise normal development.

The highest priority in mid facial cosmetic surgery is to create a trusting relationship between doctor and patient. This relationship is almost always established by an attentive, patient, and honest counseling process. If not, the physician should not hesitate in referring the patient to a different rhino surgeon.

CONTRAINDICATIONS

A relative contraindication to the external approach for rhinoplasty is the presence of severely damaged or thinned skin. Such conditions may occur following multiple previous operations, particularly in thin skinned individuals. The presence of acquired cutaneous telangiectasias, purple or blue discoloration of the nasal skin with cold temperature, and visible irregularities are signs of such a condition. In these cases, an endonasal approach with limited soft tissue elevation may reduce the risk of further cutaneous compromise. Others contraindications are:

- Intranasal substance abuse (eg, cocaine).
- Psychological or psychiatric instability.
- SIMON (single, immature, male, overly expectant, narcissistic) personality traits.
- Comorbid medical conditions that preclude surgical clearance.
- Preoperative diagnosis of nasal dysfunction (with or without aesthetic deformity) that may be better treated with a closed approach (ie, septoplasty for airway obstruction) or medical management.
- Patient refusal of external scar.
- Very thick nasal skin in which postoperative edema can be permanent.

ALTERNATIVES TECHNIQUES

Although there are no absolute contraindications to the external approach during rhinoplasty, an endonasal approach may be a reasonable alternative in cases in which minimal changes are required.

Nondelivery approaches have the advantage of preserving all major tip support mechanisms of the nose. Access may be gained through a cartilage-splitting or retrograde approach. The main disadvantage of these approaches is the limited exposure of the tip cartilages. While the delivery approach provides greater exposure than nondelivery approaches, it does so at the cost of compromising tip support. Specifically, the inter-cartilaginous incision disrupts the attachment of the Upper Lateral Cartilages (**ULCs**) and Lower Lateral Cartilages (**LLCs**). Although the lower lateral crura are widely exposed with this method, the chondrocutaneous flap is delivered in a nonanatomical orientation, creating potential difficulty for the inexperienced surgeon.

INFORMED CONSENT

Every surgical procedure constitutes a punishable bodily injury under the law, and only informed consent by the patient exempts the surgeon from liability. Informed consent, then, is a key legal concern for physicians. The requirements for informed consent are more rigorous for a medically unnecessary cosmetic procedure than for a medically indicated intervention.

We use a standard information sheet that covers all potential risks and complications. These sheets are given to patients following their initial interview with the surgeon. This gives patients the opportunity to read about the operation and review its potential risks and complications even while at home.

Approximately 1-2 weeks before the operation, the patient is scheduled for a second counseling and disclosure session with the surgeon and is given a customized information sheet (e.g., with a diagram showing where the incisions will be made). The possibility of an unsuccessful outcome should always be disclosed, especially in purely cosmetic operations.

Years of informed experience in rhinosurgery are a key factor in achieving a high degree of patient satisfaction. But even very experienced rhinosurgeons will have patients who, for understandable reasons, are dissatisfied with the postoperative result. Even in cases of this kind, it is easier and less complicated to work with a patient who is well informed.

Postoperative and Post hospital Instructions: Patients are routinely furnished with postoperative and post hospital instructions. We routinely give the instructions twice, especially at the time of discharge. Necessary precautions regarding exposure to sunlight, sports activities, nasal hygiene, etc. are reviewed with the patient

Postoperative Course: Patients dissatisfied with their appearance will often enter recovery with a critical attitude. We therefore describe postoperative healing in realistic terms and, when in doubt, may even exaggerate potential discomforts to help our patients cope with the normal healing process. Healing after rhinoplastic surgery takes 6 to 12 months, and the healing process may vary significantly from one patient to the next. Figures 1-3 show patient photographs taken preoperatively, several weeks postoperatively, and at one year.

STRUCTURAL ANATOMY OF THE NOSE

Rhinoplasty surgery requires a robust understanding of the surgical anatomy and physiology of the nose and nasal airway. An understanding of the anatomy of the nose is obviously quite crucial for the rhinoplasty surgeon. The underlying structural framework of the nose consists of the paired nasal bones superiorly and the five major nasal cartilages caudally.

SEPTUM

The nasal septum is composed primarily of the quadrangular cartilage, vomer (bone), and perpendicular plate of the ethmoid bone. The septum rests on the nasal spine and the nasal crest of the maxillary and palatine bones inferiorly in a 'tongue-and-groove' fashion.

The membranous septum is the area between the caudal border of the cartilaginous septum and the medial crura. It contains important dense fibrous attachments between the septum and tip cartilages (Figure 1). Dorsally, the cartilaginous septum joins the upper lateral cartilages, and harbors the critical attachment to the nasal bone at the rhinion. The perpendicular plate of the ethmoid attaches rostrally to the nasal bones, cribriform plate, and sphenoid sinus. The vomer also fuses with the sphenoid sinus rostrally.

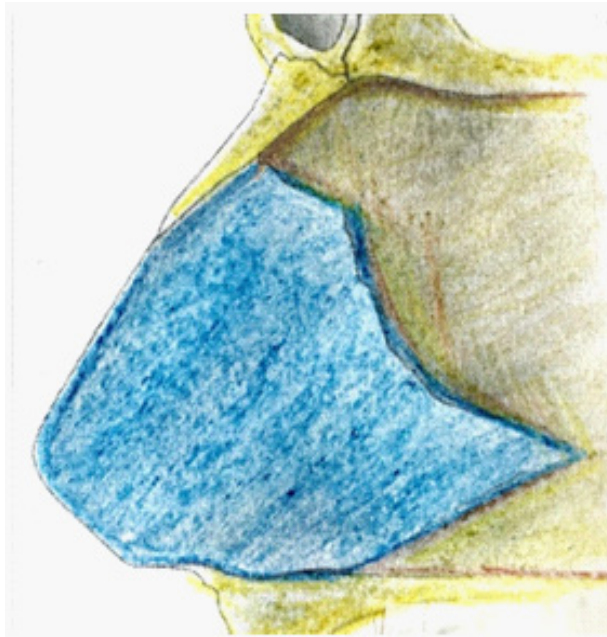


Figure 1: Nasal septum composed by the quadrangular cartilage, vomer (bone), and perpendicular plate of the ethmoid bone.

Septal cartilage is often harvested for grafting during rhinoplasty. During harvest, an adequate dorsal and caudal strut of at least 1 cm must be preserved, leaving an adequate vector of support between the nasal spine and the keystone area, which in turn prevents saddling of the middle vault.

NASAL BONES

The paired rectangular-shaped nasal bones are thin and of variable length. The naso-frontal suture line is usually slightly higher than the radix and should not be disrupted in osteotomies. The lateral suture line with the maxillary bone is slightly medial and up on the nasal sidewall. Lateral osteotomies typically extend lateral to this suture line, onto the frontal process of the maxilla. Asians tend to have shorter and flatter nasal bones. The upper lateral cartilages are firmly attached to the medial-inferior border of the nasal bones by a dense, tight connection.

UPPER THIRD OF THE NOSE

The nasal bone fuses in the midline with the contralateral nasal bone and bony septum, superiorly with the frontal bones at the frontonasal suture, and laterally with the frontal processes of the maxilla. Lateral to the frontal process of the maxilla is the lacrimal bone. The fossa of the lacrimal bone contains the lacrimal sac, which continues inferiorly as the lacrimal duct (Figure 2).



Figure 2: Upper thir of the nose.

UPPER LATERAL CARTILAGE (ULC)

This paired, triangular-shaped cartilage is situated caudal to the inferior margin of the nasal bone. Its dorsal margin is thicker and is continuous with the dorsal septum. Its cranial margin is attached to the nasal bone. The caudal border helps support the lateral crus via the scroll. Laterally, it has a dense fibrous layer extending to the bony pyriform aperture. The nasal valve refers to areas of the airway that are narrow and rate limiting (Figure 3).



Figure 3: Upper lateral cartilage.

The internal nasal valve is the narrowest area, bounded by the dorsal nasal septum medially, the ULC laterally, and the head of the inferior turbinate, infero-laterally. The normal angle between the septum and ULC is roughly 12 degrees. Narrowing in this area can occur from a number of causes, including previous reduction rhinoplasty, dorsal septal deviation, and trauma. Many ethnic noses have a broader internal nasal valve (e.g. Asians and African Americans; In comparison to Caucasian nasal bones, those of Asian patients are smaller, thinner and less projected).

The external nasal valve represents the area within the nasal vestibule, bounded medially by the columella, inferiorly by the nasal sill, and supero-laterally by the alar lobule. It can also be the source of obstruction from collapse or scarring.

The intervalve area is the space between the external and internal nasal valves. It is the most common site for lateral obstruction and collapse. Anatomically, it represents the lateral aspect of the lateral crus, where 'recurvature' often occurs. Externally, it corresponds to the supra-alar crease. A deep crease is suggestive of recurvature and potential lateral wall collapse with nasal obstruction.

THE LACRIMAL SYSTEM

The Medial Canthal Tendon (**MCT**) and lacrimal system can be injured during lateral osteotomy. The MCT is a complex structure that extends from the medial canthus, as a continuation of the orbicularis oculi muscle and tarsal plates, and has a tripartite fibrous attachment medially.

The anterior and superior fibrous attachments insert into the frontal process of the maxilla while the posterior attachment inserts into the posterior lacrimal crest. These fibrous attachments are important for maintaining a normal intercanthal distance.

The Horner's muscle is the medial continuation of the deep head of the pre-tarsal orbicularis oculi. It inserts just posterior to the posterior attachment of the MCT onto the posterior lacrimal crest. Contraction of Horner's muscle pulls the medial canthus in a medial direction. The deep insertion of the preseptal portion of the orbicularis oculi muscle inserts into the superficial lacrimal sac fascia. Contraction of this muscle displaces the lacrimal sac wall laterally.

During blinking, contraction of these two muscles acts in opposing directions, causing a shortening of the canaliculi and opening of the lacrimal sac; this closes the puncta. Tears in the ampulla of the canaliculi are entrained into the lacrimal sac in a syphon action. Gravitational pull then results in an antegrade flow of tears from the sac into the lacrimal duct. This process is known as the lacrimal pump! mechanism and is important to normal lacrimation.

Care must be taken to avoid injury to the MCT, lacrimal duct, lacrimal sac and lacrimal pump mechanism during lateral osteotomies (see section on lateral osteotomy).

MIDDLE NASAL VAULT

The middle nasal vault is composed of the dorsal septum and ULCs. Variations in these cartilaginous structures will give rise to surface deformities such as twisting, pinching, humps, etc. The ULCs are firmly attached to the dorsal septum and represent the internal nasal valve. The dorsal strut must be rigid enough to provide support; insufficient integrity will lead to collapse and a saddle nose deformity. It must be at least 1 cm in height and have firm attachments to the dorsal bony septum, known as the ‘keystone’ area.

There is a physiologic widening to the dorsal septal cartilage that functions to flare the ULCs slightly and act as natural spreader grafts. Separation of this articulation can occur during hump resection and failed reconstruction may then lead to subsequent collapse of the ULCs, pinching of the middle vault, and airway obstruction. The caudal border of the ULCs is part of the scroll with the cephalic border of the lateral crura. This lends some support to the lateral wall and valve areas. Resection through a cephalic trim can risk lateral wall collapse.

LOWER THIRDS OF THE NOSE

The cartilaginous nasal framework contributes important factors to nasal appearance and function. Intrinsic to the anatomic description of the cartilaginous framework of the nose is the description of the tip support mechanisms (Table 1).

Table1: Major and Minor Tip Support Mechanisms.

MajorTip Support Mechanisms
1. Size, shape, and resiliency of the Lower Lateral Cartilages (LLCs)
2. Fibrous attachments of the medial crurato the caudal septum
3. Scroll, a fibrous recurvature attaching the cephalic border of the LLC, to the caudal border of the Upper Lateral Cartilages (ULCs)
Minor Nasal Tip Support Mechanisms
1. Dorsal cartilaginous septum (anterior septal angle)
2. Interdomalligament.
3. Membranous (caudal) septum
4. Nasal spine
5. Sesamoid complex
6. Attachment of LLC to the skin and soft tissue envelope

Three major tip support mechanisms have been described: (1) the size, shape, and resiliency of the LLCs, (2) the fibrous attachments of the medial crura to the caudal septum, and (3) the scroll, a fibrous recurvature attaching the cephalic border of the LLCs to the caudal border of the ULCs. Six minor nasal tip support mechanisms have been described: (1) dorsal cartilaginous septum (anterior septal angle), (2) interdomal ligament, (3) membranous (caudal) septum, (4) nasal spine, (5) sesamoid complex, and (6) LLC’s attachment to the Septum.

The LLC contributes, in a great degree, to the characteristics of the size and shape of the lower third of the nose. In the area of the nasal domes, its caudal margin courses just under the level of the skin. The LLC can be followed posteriorly, superiorly, and laterally into the middle third of the nose. As the LLC is followed laterally, the caudal edge of the LLC will curve away from the nasal alar rim. In the frontal view, the LLCs will flare out at an angle not usually more acute than 40 degrees from the midline. The ULCs form a significant part of the middle third of the nose, also known as the middle vault.

Their attachment to the LLC through the recurvature between them (also known as the scroll) will be responsible for part of the degree of upper and lower mobility of the LLC. The internal nasal valve is composed of the angle created between the ULC and the cartilaginous septum. Weakness of the ULC, short nasal bones, and/or an overly aggressive resection of the cartilaginous dorsal hump without reconstruction using spreader graft placement can predispose this area to collapse. The LLCs have been described as a tripod where their medial crura correspond to the base of the tripod. Modification of the length of the tripod's leg length and support can affect the nasal structure, shape, function, and appearance.

LOWER LATERAL CARTILAGE: GREATER ALAR CARTILAGE

The greater or major alar cartilages form the underlying structure of the nostrils. In addition, they are the main components of the nasal tip. Each alar cartilage is composed of a medial, intermediate (middle), and lateral crus that are curved around the naris. The medial crus are attached by fibrous tissue with the antero-caudal part of the septal cartilage, thus forming a part of the columella. The lateral crus usually overlap the lower margin of the ULC. The alar scroll area is the interval structure between the lower and upper lateral cartilages.

It is of great importance as it supports and gives form to the tip of the nose and provides rigidity to the internal nasal valve, thus playing an important role in the nasal function. The posterior border of the lateral crus is anchored to the frontal process of the maxilla by dense fibrous tissue and contains several small minor alar cartilages. Because the lateral crus is too short to support completely the lower lateral part of the ala nasi, fibroareolar tissue fills the gap.

Alar Base

The alar base refers to the area where the alar side wall attaches to the face. This includes parts of the nasal sill, alar lobule and alar facial groove. Ideal aesthetic proportions in this anatomical area will first be discussed.

- **Frontal view:** Nasal base should not occupy more than 1/5 of the total horizontal face width.
- **Basal view:** The lines drawn connecting the alar facial grooves and nasal tip should form an isosceles triangle. The tip-lobule-to-columella ratio should be 1:2. The long axis of the nostrils should be about 45 degrees to the axis of the columella. The ideal nostril appearance is pear-

shaped and the nostrils should be symmetrical. The degree of alar flaring can be objectively quantified by measuring the amount of alar side wall extending lateral to a vertical line drawn through the alar facial groove.

- **Profile view:** The Alar-Columella Relationship (**ACR**) is evaluated through a profile view. Normally, 2-3 mm of columellar show should exist. When excessive, it may result from a hanging columella or a retracted alar lobule, or both.

Skin Anatomy, SMAS, SSTE, Vascular and Nerve Supply

- The overlying Skin and Soft Tissue Envelope (**SSTE**) varies in thickness from the radix to the nasal tip. The skin overlying the upper third of the nasal pyramid is thicker before it thins out over the cartilaginous dorsum. The skin thickness then increases over the lower third as a result of the more sebaceous nature of the skin in the nasal tip. Below the skin is the superficial fatty layer.

- The nasal muscles consist of four main groups: the elevators, the depressors, the compressor, and the dilators. The elevators include the procerus and levator labii superioris alaeque nasi. The depressors consist of the alar nasalis and depressor septi nasi. The compressor of the nose is the transverse nasalis, whereas the dilators are the dilator naris anterior and posterior. The muscles are interconnected by an aponeurosis termed the nasal Superficial Musculo Aponeurotic System (**SMAS**). This layer is continuous with the SMAS that envelops the rest of the face and neck. Major vessels that supply the external nose pass through the SMAS and superficial fatty layer which makes the ideal plane of dissection deep to this SMAS.

- The internal nasal lining consists of squamous epithelium in the nasal vault. This merges with pseudostratified ciliated columnar respiratory epithelium harboring abundant seromucinous glands within the nose.

- The arterial supply to the external nose is divided into branches from the internal carotid, namely the branches of the dorsal nasal from the ophthalmic artery, and branches from the external carotid, namely the facial artery which branches into the superior labial, and angular arteries. The superior labial artery forms the columellar branch and the angular artery gives off the lateral nasal artery.

- Veins of the nose essentially follow the arterial pattern. They are unique in that they communicate with the cavernous sinus and lack valves. These features potentiate the risk of intracranial spread of infection.

- Sensation to the nose is derived from the branches of the trigeminal nerve. The ophthalmic division (V1) supplies the dorsum and most of the tip while the maxillary division (V2) innervates the lateral nasal region. The ophthalmic nerve from V1 gives off the nasociliary nerve which branches out as the anterior ethmoidal nerve within the orbit, and divides into a septal and a lateral branch. The lateral branch eventually exits the nasal cavity between the upper lateral

cartilage and the nasal bone to supply the nasal skin from rhinion to tip. This nerve is called the external nasal branch of the anterior ethmoidal nerve. The other minor contributions to sensation over the dorsum are derived from branches of the supraorbital and supratrochlear nerves (all from V1). The infraorbital nerve (V2) supplies the alar rim.

FACIAL ANALYSIS OF THE RHINOPLASTY PATIENT

Effective nasal aesthetic assessment requires an understanding of nasal anatomy, patient aspirations, available techniques, and cultural and race-specific facial aesthetics. The face can be analysed with respect to measurable parameters. If a line is drawn from the upper limit of the external auditory meatus to the lower orbital rim, the line perpendicular to this passing through the root of the nose is the facial plane.

The nose projects forward from this, and is separated into thirds: the bony dorsum, the middle third and the tip. The aesthetics of the nose should not be judged in isolation but rather seen in the context of the overall facial structure for that individual. This analysis should include:

- Assessment of facial aesthetic and symmetry including:
 - Vertical fifths,
 - Horizontal thirds and
 - Alignment
- Projection of nasion, bony dorsum, middle third and tip (Figure 4).
- Width; bony base, bony dorsum, middle third and tip.
- Rotation of columella with philtrum (naso-labial angle) and of dorsum with forehead (fronto-nasal angle).
- Analysis of symmetry and shape of the tip viewed from the base.
- Analysis of symmetry of zygomatic eminence.

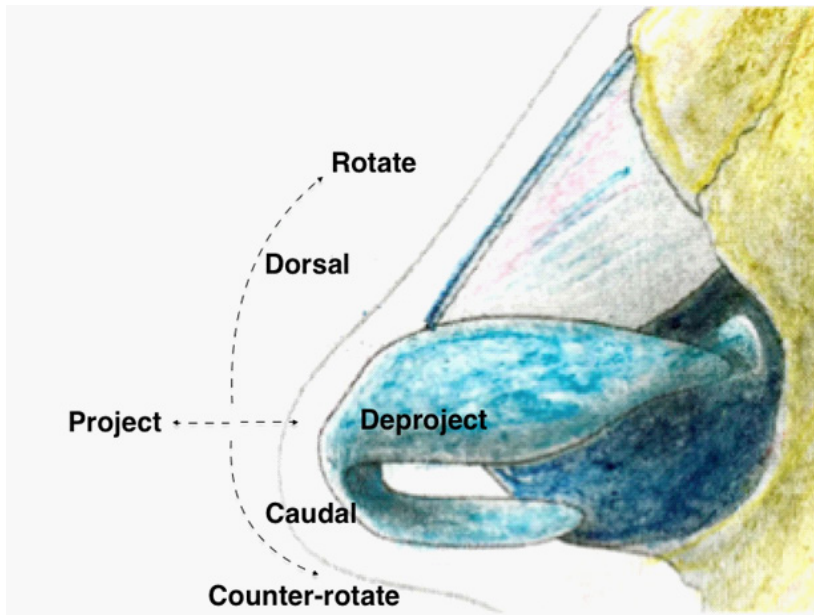


Figure 4: Projection and rotation of nasion, bony dorsum, middle third and tip.

A brief description of commonly used terms and landmarks used in rhinoplasty and facial plastic surgery is listed below. This facilitates instruction during the dissection as well as during clinical practice.

- Trichion – the point where the hairline meets the midpoint of the forehead.
- Glabella – the most prominent point of the forehead located in the mid saggital plane between the eyebrows.
- Radix – root of the nose. It is the most narrow and least projected area of the nose. It is a region rather than a point.
- Nasion – frontonasal suture line in midline. The ‘ideal’ vertical position of the nasion in Caucasians is the supra- tarsal crease of the upper eyelid, whereas in Asians, who do not have this crease, it is the mid-pupillary point.
- Orbitale – the palpable point of the lowest margin of the inferior orbital rim
- Endocanthion – the point of the medial canthus where the upper and lower lids join.
- Rhinion – midline point of junction of nasal bones and upper lateral cartilage/dorsal septum; the bony cartilagi- nous junction of the dorsum.
- Subnasale – the deepest point at the junction of the base of the columella and the upper lip in the mid line.
- Philtrum – a midline groove between the nose and the upper lip.

- Pogonion – most anterior point of the chin.
- Menton (or mentum) – lowest point of the mandibular symphysis
- Supratip – the area just cranial to the tip of the nose, often overlying the anterior septal angle. Often a subtle supratip break is desirable. When over-projected, it is referred to as a ‘pollybeak’ deformity.
- Pronasale – the most prominent point of the nasal tip.
- Infratip lobule – the lower-most portion of the nasal tip, formed by the intermediate crura. It creates a ‘double break’ to the columella.
- Tip-defining points – surface landmarks that react the anterior-most point of the domes.
- Nasolabial angle – the angle formed between the columella and upper lip. It is between 90° and 100° in men and 95° and 105° in women.
- Nasofrontal angle – the angle formed between the nasal bridge and the forehead. Ideally, the apex (or nasal starting point) is situated at the level of the superior eyelash line. Typical angles are 130° in men and 135° in women.

PREOPERATIVE PLAN

Analysis should then continue with a systematic assessment of each view of the nose. While analysis of the patient is done in the office setting, quality preoperative photographs allow for more detailed study at a later time (Figure 5). On the frontal view, symmetry and width should be assessed in each of the vertical thirds of the nose. The brow-tip esthetic lines should follow a gentle, unbroken curve following the relative normal variation of nasal width: slightly wider cephalad at the brow/nasal root transition, narrower in the middle vault, and wider again at the tip. If the brow-tip esthetic lines are irregular or asymmetrical, the anatomical cause of the problem should be noted. Bony and cartilaginous vault irregularities are easily discernable with a single light source placed above the patient to enhance shadowing. The general tip shape should be determined from the frontal and base views (e.g., bulbous, deviated, wide, amorphous, asymmetrical). The base view also provides information about the shape and size of the columella, alarbase, nostrils, and lobule. In general, the frontal and base views should reveal a triangular shape of the nose in which the nasalbase (interface of nose and face) is wider than the tip and dorsal line. The triangularity of the tip depends on the presence of an unbroken line from the nasal tip-defining points to the lateral alar margin. Poor structural support in this area will manifest as alar pinching or concavity of the alar margins on frontal and base views. In cases of variant anatomy in which the base is excessively narrow or the tip too wide, the correct relationship must be restored.

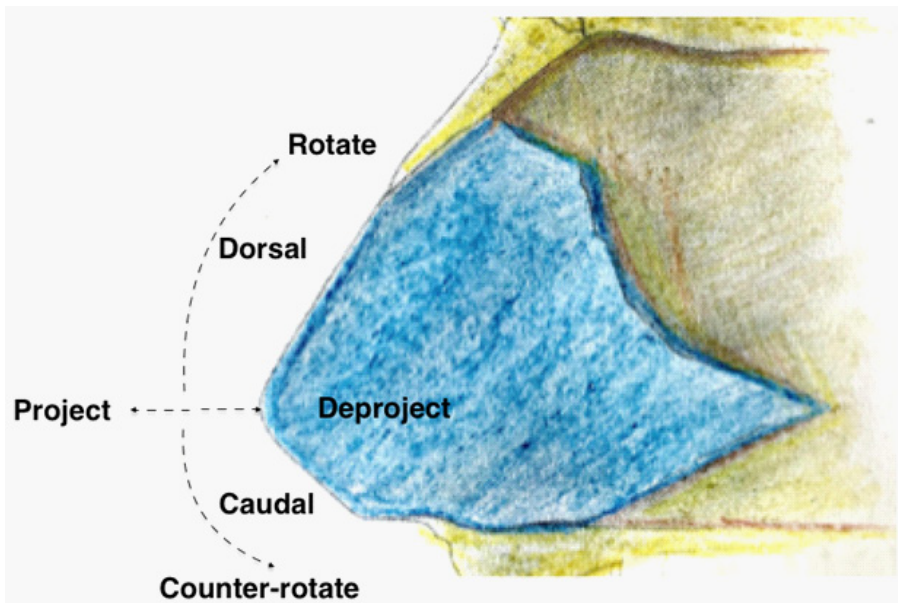


Figure 5: Preoperative standard form Template of nasal anatomy. (Copyright® Thieme, Inc. for Michael S. Godin, MD 2011.)

On the lateral view, the nasofrontal angle should be approximately 120° . This angle is measured at the nasal starting point and is determined by the height of the radix and the angle of the forehead. A deep nasofrontal angle creates an illusion of a shorter nose, independent of the actual vertical position of the nasal starting point. Conversely, a shallow angle creates an appearance of a longer nose. The dorsum is assessed for smoothness, convexity or concavity, and presence of a supratip break. In the lower third, the overall projection and rotation of the nasal tip must be assessed. Using Goode's method, the nasal tip projection as defined from the alar crease to the tip-defining point, should be just over half the length of the nose. The nasolabial angle in men should be between 90° and 95° and in women between 95° and 105° . This angle can be affected by variations in the size and shape of the upper lip and premaxillary bone. Therefore, the nasolabial angle does not always reflect the degree of tip rotation. The alar-columellar relationship and degree of infra tip break should also be noted.

There are universally accepted differences between the male and female nose. Both should be symmetrical. The bony dorsum should be very slightly projected anterior to the nasion. The tip should be projected slightly anterior to the middle third. The tip defining points (the caudal maximum convexity of the tip) should be readily defined and not bulbous. The nasolabial angle should be 90 - 95 degrees in the male and 95 to 100 degrees in the female (Figure 6).

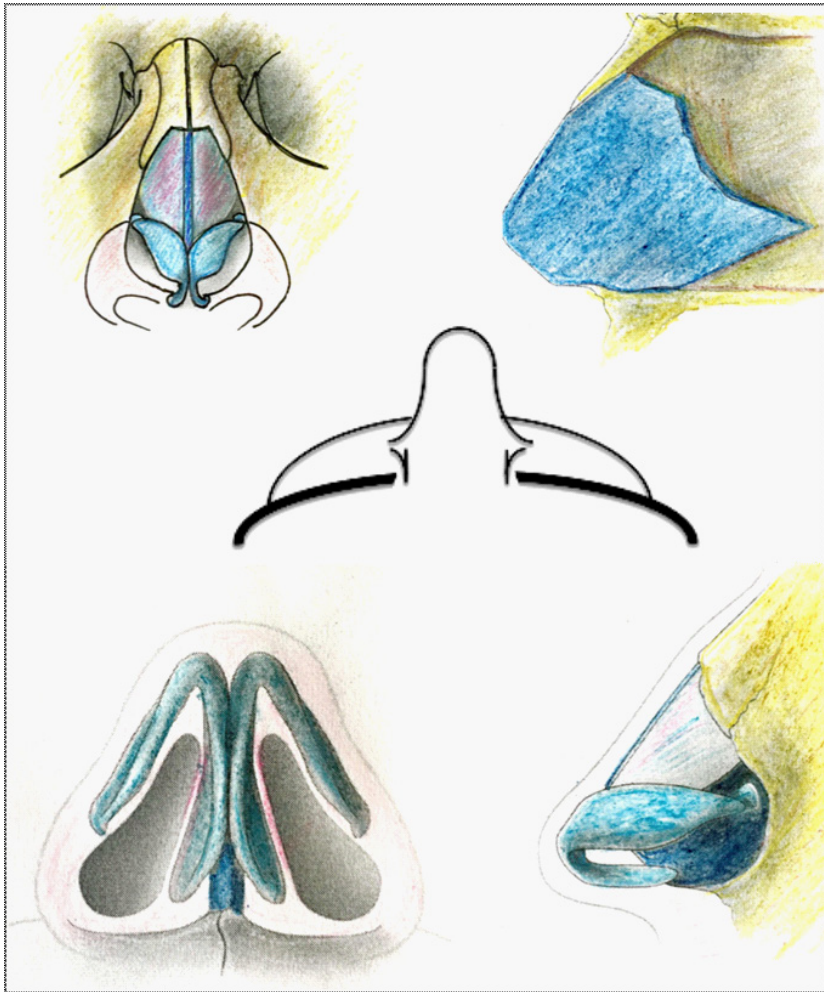


Figure 6: Nasal analysis.

The tip should be rotated upwards at the second columella break. The facial plane should be visualised in profile and the projection of the nose in relation to forehead and chin analysed. The malar arch projection should be assessed (Figure 7 and 8).



Figure 7: Nasofrontal and nasolabial angles.

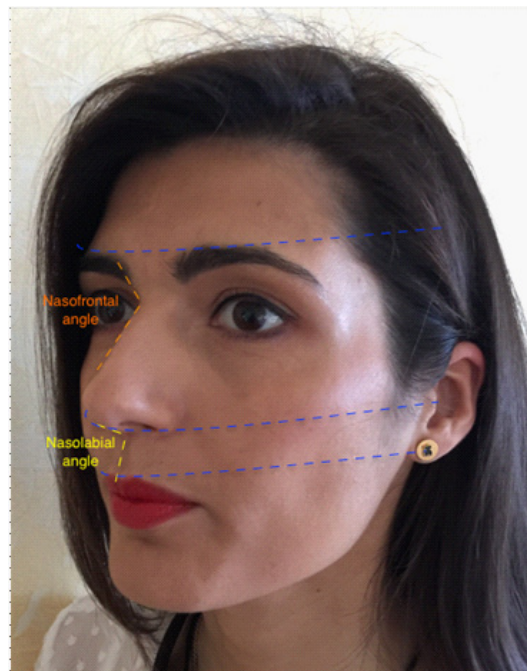


Figure 8: Malar arch or zygomatic eminence analysis.

It is important that attention be given to the skin type, colour, thickness, and age. In anterior view, the alignment should be assessed; looking at the bony and cartilaginous dorsum separately, noting any angulation between them. In basal view, the base should approximate the form of an equilateral triangle with nostril comprising two-thirds of the height, oval in shape and in an oblique position (Figure 9 and 10).



Figure 9: Facial analysis.



Figure 10: Facial analysis, depressor of septanassi.

SURGICAL TECHNIQUE

The operation of open septo rhinoplasty is generally performed under general per-oral endotracheal or laryngeal mask anaesthesia with the tube/mask fixed in the midline to prevent distortion of the upper lip. The operating table is placed in 15° of head up tilt to reduce bleeding. Further vasoconstriction is achieved following induction, when the nasal cavities are packed lightly with 1/1000 adrenaline soaked pledgets, and the septum and proposed skin wound lines are injected lightly with 1/80000 adrenaline with 2% lidocaine. Care is taken not to distort the soft tissue by over-injection. The nasal vibrissae are trimmed with ne blunt pointed scissors.

Planning and correct placement of incisions is of paramount importance and the skin flap should be raised in the SMAS layer as close to the cartilage and bone layer as is possible. This maximises the thickness of the overlying skin envelope and reduces bleeding. Elevation of the skin ap is normally straightforward but in secondary revision procedures with extensive scarring of the columella, foreshortened columella and deformed columella this can be extremely challenging.

The advantage of a standard operation is that the operative sequence is largely predetermined. The basic operation is a relatively standard sequence is:

1. Local injection followed by preparation – wait 10-15 min
2. Remove intranasal nasal pack and shave vibrissae
3. Open approach using transcolumellar incisions
4. Elevation of skin envelope
5. Septal exposure: by the open approach
6. Reassess operative plan based on alar and septal anatomy
7. Creation of symmetrical alar rim strips
8. Incremental hump reduction – rasp: bone, scissors: cartilage
9. Caudal septum/ANS excision (Optional)
10. Septal harvest/septoplasty

11. Osteotomies
12. Graft preparation
13. Spreader grafts (Optional)
14. Columellar strut or septal extension graft and suture
15. Tip sutures with optional add-on grafts (excised alar cartilage)
16. Closure
17. Alar base modification (optional)
18. Alar Rim Grafts (**ARS**) (optional)
19. Doyle splints, external cast, and nasal block

INCISION

The trans-columellar incision can be an inverted 'V' or 'Z'. Make this at the middle of the columella anterior to the feet of the medial crura. Our preference is a inverted 'V' incision in primary rhinoplasties as it offers a wider area to redistribute the forces of contraction. Sometimes, the columella is so distorted that you need to imagine the final shape of the columella and plan your incision accordingly.

The medial marginal columella incision is made 1-2 mm from the columella edge and begins from the transcolumellar incision where it forms a right angle and extends about 10 mm up into the domal recess of the vestibule but avoiding the soft triangle (Figure 11).



Figure 11: Trans-columellar incision: inverted 'V'.

The domal incision is made using three point retraction and the plane of dissection to the domes is made by elevating the soft tissue off the medial surface of the medial crura as far as the intermediate crus. Palpation of the margins of the lower lateral cartilage at this point will offer a guide to the position of the alar crural incision which hugs the caudal edge of the lateral crura (Figure 12).

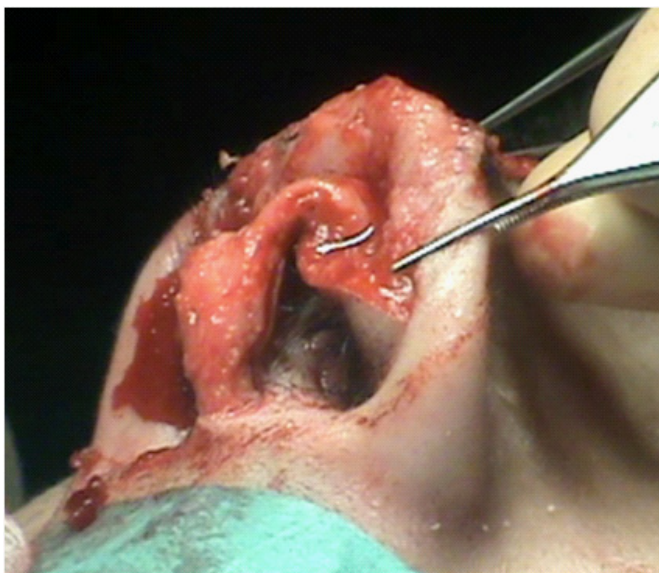


Figure 12: Dissection of the domes.

Elevation of the soft-tissue envelope then proceeds cephalad toward the domes. Three-point retraction greatly aids in the development of the correct plane of dissection. A fine double-prong skin hook retracts the superior flap of the columella cephalically, another fine skin hook is placed at the under surface of the medial crus in order to retract the intermediate crus and dome inferolaterally, and a third wide double prong skin hook is placed at the alar rim margin to expose the marginal incision. Dissection is performed with Converse scissors in a plane immediately superficial to the perichondrium.

The scissors should be slightly angled downward toward the cartilage and the plane developed with fine cuts using the tips of the scissors rather than through a spreading motion. A cotton-tip applicator may be used as a blunt dissector to further develop the plane. As the dissection plane is developed cephalad, the vestibular skin is incised flush with the caudal border of the lateral crura (previously scored). The second fine double-prong skin hook may be advanced laterally on the lateral crus as dissection continues cephalad and laterally.

Dissection should be taken to the lateral 25% of the lateral crus in order to gain enough exposure for work in the upper two thirds of the nose. Dissection too far laterally may result in destabilizing the ligamentous lateral support of the LLCs.

Once both lateral crura are exposed, dissection may be continued cephalad over the middle vault. Dissection below the muscle is critical to avoid thinning the overlying skin soft tissue envelope. Dissection of the soft-tissue envelope over the upper third should be elevated in a subperiosteal plane. Starting at the rhinion, a Joseph elevator is used to incise the periosteum. Dissection proceeds cephalad in this plane. The size of the subperiosteal pocket depends on the planned surgical maneuvers. If significant reduction or rasping of the bony dorsum is needed, a wider area of dissection may be required. If elevation of the radix is planned, a narrow pocket may be preferred for better fixation of the radix graft.

SEPTOPLASTY

The septal cartilage together with the conjoined upper laterals forms the foundation tripod, which provides the primary structural support for the nasal lobule.

The integrity of this foundation tripod is dependent upon adequate tensile strength of these cartilages and rigid fixation at the 'keystone' area and the nasal spine. In septoplasty, it is necessary to preserve the dorsal and the caudal / inferior strips of the quadrangular cartilage so that the foundation tripod remains intact. Without this, nasal valve function and support to the tip and supra-tip areas will be compromised.

While it may be possible to refashion or disarticulate these structural elements, it is essential that in the end they are reconstituted or otherwise a poor result with nasal collapse will follow. So long as integrity of the anterior region of the quadrangular cartilage incorporating the struts is preserved, then the remaining posterior area of the quadrangular cartilage is available as a source of donor cartilage for grafting.

The open approach, achieved by gaining access between the separated the lower lateral cartilages (Figure 13 and 14). If extended access is needed then the upper laterals can be separated from the dorsal septum. This will be necessary if spreader grafts are to be used, but should not be performed as a routine as it makes reconstruction of the foundation tripod necessary. Mucoperichondrial flaps are elevated either unilaterally or bilaterally depending on the surgical requirement. In all but the most minor of deformities, the next step is mobilisation of the cartilaginous septum from the vomer and the perpendicular plate of the ethmoid, while preserving the attachment at the keystone area. This separation is accompanied by a localised removal of bone from the perpendicular plate to ensure there are no deforming stresses transmitted to the cartilage. Once this is achieved, an assessment can then be made of the resting position of the cartilage, and a decision made about what further interventions may be required to further improve septal position.



Figure 13: Septoplasty by external approach.



Figure 14: Septoplasty by external approach.

Methods of correcting deformity are:

- Removal of the deformed section. This is useful for a localised spur or fracture line.
- Correcting the curve (see section on biomechanics).
- Detachment and reattachment to nasal spine / vomer. This can be useful if the septum is sitting

to one side of the nasal spine or vomer. Mobilizing it to the opposite side and reattaching is known as the 'doorstep technique'.

- Removal and replacement of structurally sensitive area of cartilage. This involves grafting of either the dorsal or caudal struts of the nasal septum (sometimes both). It is essential that these areas are reattached at completion (see above).
- Septal extension graft. Used if the existing septum is deficient caudally and/or anteriorly.

SURGERY FOR THE MIDDLE THIRD OF THE NOSE

The middle third of the nose is an area sometimes underappreciated in rhinoplasty. Deformity here can have significant effects on both form and function, and is rarely corrected by septoplasty alone. The middle third is the meeting point of the solid (bony) and soft (cartilaginous) nasal structures and incorporates the structural tripod of the upper laterals, nasal septum and the union of these cartilages with the nasal bones, bony septum and frontal process of the maxilla. As discussed previously, this structurally vital union of bone and cartilage is known as the keystone area. Deformity of the cartilage occurs readily. Since it is fixed to bone at either end, the multi-directional tensions occurring as a result of growth and trauma can give rise to warping. Functionally, the middle third forms a major contribution to the internal valve, which has the narrowest cross-sectional area within the nasal cavity. As the valve walls are not rigid, the contribution of the upper laterals to the valve is affected by changes in airflow and lateral pressure. Surgery on the cartilage and bone of the middle third should aim not only for the ideal aesthetic structure but also the best nasal valve function.

Common Deformities of the Middle Third are:

- Those with nasal bone deviation.
- Those without nasal bone deviation:
 - Vertical tension leading to 'C' or 'S' profiles to the cartilage – upper
 - Laterals will need release and septum trimmed or replaced to the bony aperture
 - Total septal deviation – often has deviation of the keystone area
 - Internally
 - Lateral view deformities – these are dealt with in the dorsal grafting section
 - Narrow middle third or inverted 'V' deformity – a pinched appearance to the dorsum, reduces function. Spreader grafts required
 - Polly beak / tension nose from overly strong and long septum / upper lateral complex – leads to tall, thin internal valve. Septal and upper lateral reduction, possibly with spreader grafts, will be required.

Skin flap retraction at this point can be achieved either with a blunt nasal retractor or an Aufricht retractor in place. Reduction of the cartilaginous hump is performed with a scalpel under direct vision. The cartilaginous vault should be incised by a through-and-through incision (No. 15 blade) along the planned resection line of the hump (composite reduction). Using this cartilage incision as a guideline, the osteotome is introduced into the opening created rather like ash's mouth, then mobilisation of the bony part of the hump is completed with an osteotome.

Depending on the length of the hump, the upper laterals may have been separated from the septum by the composite hump reduction and should be reattached to the septum with a 4-0 seda suture.

Alternatively, the cartilaginous hump can be removed as a component reduction. This is achieved by separating the upper laterals from the nasal septum, and reducing the septal dorsum with the scalpel blade or scissors. The bony hump can then be reduced with an osteotome. Finally, the upper laterals are trimmed with the scalpel to the desired height, or placed over the dorsal septum to prevent internal valve collapse. The septum generally needs to be lower if the upper laterals are going to be placed over the dorsum. 4-0 seda is then used to secure the upper laterals to the septum. A (medium fine) tungsten carbide or diamond rasp is now used to smooth the bony surface and edges of the osteotomy if they are irregular (Figure 15). If necessary, some extra shaving of the cartilage with a scalpel is performed under direct vision to obtain the desired supratip height. In the case of the very small hump, it may be better to perform a series of cartilage shavings with a scalpel followed by rasping to avoid over reduction of the hump. On occasion, this may negate the need for osteotomies.



Figure 15: Rasp is used to smooth the bony surface and edges of the osteotomy because they are irregular.

Internal Medial Osteotomy (Optional)

The osteotome can be placed under direct vision taking care not to traumatise the skin as the osteotome is inserted. It is safer to use a large osteotome (8 mm) to reduce the risk of skull base penetration, should the osteotome slip posteriorly. It is accepted that with the larger osteotome, the internal mucosal trauma may be greater. Care must be taken not to penetrate the dorsal skin envelope. On nearing the nasofrontal suture, the osteotomy should be curved laterally (faded) taking care that the bone cut does not extend more cephalic than the inter-canthal line. In this way, the thick bone of the radix nasi is avoided. The use of a slightly curved osteotome will facilitate this lateral curvature.

Internal Lateral Osteotomy (Optional)

A narrow 4-mm guarded curved osteotome is inserted through a mini-incision made in the soft tissue of the lateral wall of the pyriform aperture. A good landmark for the appropriate level is the superior margin of the inferior turbinate. A notch is created in the pyriform aperture at the ascending process of the maxilla. Position of the osteotomy will depend on the deformity, but in general terms it should start low, slowly bending from lateral to medial as far as the inter-canthal line where the medial osteotomy was carried out.

SURGERY OF MIDDLE VAULT

The middle vault has significant functional and cosmetic implications for the nose. Functionally, the internal nasal valve area is partly dependent on the relationship of the ULC and the dorsal septum. Excessive narrowing of the angle between these structures will lead to obstruction at the internal valve. Previous surgery causing destabilization of this area will result in inferomedial collapse of the ULC into the airway. In particular, patients with short nasal bones and long ULCs are at risk of lateral collapse. Cosmetically, the width and symmetry of the front view of the nose depends on symmetrical reconstruction of the ULC and septum.

Spreader grafts are long rectangular cartilaginous grafts placed between the dorsal cartilaginous septum and ULC. grafts are useful for correcting functional and cosmetic problems related to a narrow or asymmetrical middle vault (Figure 16). In addition, these grafts should be used in primary rhinoplasty to prevent middle vault collapse in high-risk patients. In particular, when reduction of a cartilaginous dorsal hump leads to excision of the horizontal articulation of the dorsal septum and ULCs, spreader grafts will stabilize the middle vault and help restore appropriate horizontal width.



Figure 16: Spreader grafts for correcting functional and cosmetic problems related to a narrow or asymmetrical middle vault.

The dimensions of spreader grafts will vary depending on specific needs and anatomy, but range from 6-12 mm in length, 3-5 mm in height, and 2-4 mm in thickness. More than one graft may be needed depending on available grafting material and the deformities. In general the

thicker aspect of the spreader graft is beveled and then positioned cephalad at the rhinion in order to create the normal appearance of slightly increased width in this area. The grafts may be placed from a dorsal approach after the ULCs are freed from the septum. Muco perichondrial flaps must first be elevated from the junction of the ULC and septum in order to prevent injury to the mucosal lining and subsequent cicatrix. Two 4-0 seda sutures placed through the ULC, spreaders, and septum should be used for stabilization. The caudal ULC should be pulled caudally during the suture stabilization in order to straighten any redundancy or curvature.

The dorsal profile of the spreader grafts, ULC, and septum should be coplanar and smooth. In situ trimming of the grafts may be needed to ensure an even dorsal surface.

An alternative method of placing spreader grafts is through a tight sub perichondrial tunnel at the junction of the ULC and dorsal septum. In this method, elevation of the septal flaps must not include the dorsal aspect of the quadrilateral cartilage. A mucoperichondrial incision is made high on the septum just caudal to the junction of the ULC and septum. An arrow dissection instrument, such as a Cottle dissector, is then used to create a long, tight pocket just beneath the dorsal junction between the ULC and septum. Snug placement of a spreader graft into this tunnel will cantilever the ULC away from the dorsal septum, effecting additional widening of the internal nasal valve, as compared to placing spreaders through an open dorsal approach. In the latter, the ULC is lateralized, but the absolute angle between the septum and ULC does not change. The precise pocket spreader graft creates lateralization and mild flaring of the ULC, leading to increased width and angulation. This effect is achieved because of the bulk of the spreader graft placed below the intact connection between the dorsal margin of the septum and the ULC. This translates to additional airway improvement. This method should be considered in patients with severe obstruction referable to the internal valve. A drawback to this method is the additional width that is incurred. Careful patient selection is therefore required. Other methods to modify middle vault width have been described in the literature and include flaring sutures, suspension sutures, and butterfly grafts.

When in the situation where the projection of the entire middle and upper thirds of the dorsum is inadequate, dorsal grafting is required. This often needs to be more than a single layer of cartilage to give the required improvement. Using one of residual septal cartilage, costal cartilage, septal bone, fashion a laminate of grafts. It should be suitable to run the length of the dorsum from the nasium to the anterior septal angle and be as is appropriate to create dorsal aesthetic lines. The graft should be smooth, bevelled to resect the dorsal pro le, and have the suture knots buried.

The graft should then be placed in the dorsal pocket, and reduced as necessary if still too long. Renements should be made and the profile checked by replacing the skin and applying some posterior traction on the dorsal skin. If extra soft tissue thickness is needed perichondrium or temporalis fascia can be placed as an overlay to prevent irregularities in the cartilage showing. Stabilisation of the grafts is often advisable, and is achieved either by suturing the graft to the septum and upper laterals, or by using a percutaneous vicryl suture.

LATERAL OSTEOTOMIES

The purpose of lateral osteotomies is to narrow the base bony width of the nose as measured at its widest point; not merely to close the open dorsal roof. The two most common methods are the low-to-high and low-to-low osteotomies which differ in their direction, degree of bony fracture, and movement.

The low-to-high osteotomy begins at the pyriform aperture on the nasal process of maxilla and passes tangentially across it to the nasal bone suture line at the level of the medial canthus. Next, digital pressure on the lateral wall results in a greenstick fracture of the transverse portion and a gentle tilt of the lateral nasal wall. In contrast, the low-to-low osteotomy is done in two steps. A small speculum is inserted vertically in the nostril and straddles the pyriform aperture. A transverse cut is made in the mucosa using a cautery. The osteotome is inserted with the guard outward to facilitate palpation. The surgeon holds the curved osteotome in the dominant hand and palpates the guard with the other hand. The lateral osteotomy continues to the level of the medial canthus or the base of the previous transverse osteotomy. For a low-to-high osteotomy, the osteotome is withdrawn and digital pressure is used to create a transverse greenstick fracture which produces the desired tilt. For a low-to-low osteotomy, the straight osteotome is rotated 90° with the blade pushing against the maxilla which forces the lateral nasal wall inward.

A transverse percutaneous osteotomy is done with a 2 mm osteotome placed through a small vertical stab incision just above the medial canthus. The osteotome is gently tapped to insure a complete vertical osteotomy in the lateral nasal wall. Second, a low-to-low lateral osteotomy is done using a straight osteotome. It begins at the pyriform aperture on the nasal process of the maxilla and passes straight up the lateral wall to end at the level of the medial canthus. Digital pressure produces complete mobilization of the lateral wall and definite narrowing of the nose. The primary difference is that a low-to-high osteotomy preserves bony contact at the transverse greenstick fracture which limits movement. In contrast, the low-to-low osteotomy incorporates a complete osteotomy transversely allowing total movement of lateral nasal wall.

LOWER THIRD OF THE NOSE

Surgery on the lower third has been considered by many to be the most challenging aspect of rhinoplasty, never to be mastered. It is not only technically difficult but also the least predictable. With the external approach, however, the exposure and surgical maneuvers have been greatly enhanced. Precise surgical steps are more easily performed and afford a greater control over the tip in general. There are numerous techniques to control and modify the nasal tip and the surgeon should have excellent command of them all. The aim for tip modification are correct tip height asymmetry with medial crural xation sutures, narrow the tip and increase tip projection with domal and interdomal sutures, reduce tip volume by cephalic trim of lateral crus of the alar cartilages and to decrease the projection increase cephalic rotation with lateral crural overlap.

Many maneuvers involve multiple actions and the primary and secondary effects must be considered during rhinoplasty planning. Worthy of mention is that illusions can be created by each maneuver. For example, a plumping graft blunts the nasolabial angle and creates the illusion of cephalic tip rotation.

To create a specific change to the external shape, there are usually several options that must be considered. For example, tip definition with projection can be achieved with a dome-binding suture or cap graft. Tip definition with deprojection could be accomplished through a dome division or cephalic trim.

Skin over the nasal tip can be exceptionally thin and thick. The significance of this anatomic distinction cannot be overstated. Thin skin will invariably reveal all corners and edges to grafts. As such, great care must be observed for sufficient camouflage of all cartilage edges. Conversely, thick skin will blunt significantly any alteration that is performed to the cartilaginous framework. It has a more limited ability to contract, and improving tip definition may require grafting and increased projection.

The lower lateral cartilages are the primary structural framework of the tip. The caudal septum, including both the anterior and posterior septal angles, is also contributory. Deviation of the anterior septal angle can twist the tip. Alterations of the posterior septal angle, especially when sitting off the nasal spine, will distort the medial crura, which will in turn create a deviated columella.

Asymmetric domes may require two different surgical maneuvers for each side. Support to tip projection comes from the size and strength of the lower lateral cartilages. Additional contributions come from the caudal septum, anterior nasal spine, interdomal ligament, membranous septum, scroll between the lower lateral and upper lateral cartilages, and the skin thickness.

The intermediate crus are primarily responsible for the shape of the tip, including tip definition. Many rhinoplasty maneuvers are thus directed at this region.

Tip Suturing Techniques

- **Medial Crural Fixation Suture:** Expose the lower lateral cartilages by dissecting in the SMAS and remove any overlying scar tissues. Any asymmetry in tip height is addressed with skin hooks and the position of the new tip secured with a small hypodermic needle. The posterior superior free border of both the medial crus is then sutured with a simple 4-0 seda suture. The suture goes ‘outside in’ starting at the posterior-superior margin of the medial crus starting from one side staying just below the intermediate segment and going through the other side from ‘inside out’ at the posterior-superior margin of the medial crus. A single knot is tied and is buried between the two crura. The knot brings the two medial crura together and also establishes symmetrical tip height.

• **Medial Crural Flare Control Suture:** This is a vertical mattress suture that is placed along the length of the medial crus to control there of the medial crus, thus narrowing the width of the columella. This suture begins at the lower end of the medial crural footplate on the medial surface and comes out superiorly and goes similarly on the other side starting superiorly and coming out inferiorly and the knot buried in between. The tightness and the location of the suture determine the width of the columella. Beware using the suture close to the free border of the medial crus which will give a cosmetically unacceptable pencil-thin columella.

• **Inter-Domal Suture:** Practise this bilateral dome suture with a 5-0 ethilon suture. This suture brings the two domes together, thus narrowing the width and controlling the bi dity of the tip. This can be either a simple suture (Fig. 52) or a horizontal mattress suture passing through both the domes around 2 mm above the caudal / medial border of the intermediate crura at the most divergent point, thus helping to approximate the domes. Take care to cut the knots very close and not to narrow the tip and give an unsightly 'unicorn' tip.

• **Trans-Domal Suture or Dome Spanning:** Expose the domes adequately, dissect all the scar tissue away, so that the bare cartilage is seen. Practise a unilateral transdomal suturerst. This is a unilateral horizontal mattress suture starting in the axial plane with a 4-0 seda suture entering the medial crus about 2 mm below the intermediate crus and coming out into the lateral crus at the desired point. Now, take the needle out and follow the path back from outside in and exiting the medial crus and secure the knot medial to the medial crus. Keep the entry point and exit points in the medial and lateral crus between 2-3 mm. This suture can also be done bilaterally with a figure-of-8 suture going through both domes and securing the knot between the domes. There is no need to dissect the underlying vestibular mucosa at the tip region.

• **Lateral Crural Flare Control Suture:** Expose the alar cartilages, dissect the scar tissue away. Practice this horizontal mattress suture between the two lateral crura to reduce lateral alar ballooning. This suture helps in the medial and upward movement of the lateral crus, thus reducing the lateral alar ballooning. The suture should be placed in the lateral crus at the level of the alar ballooning as far laterally as possible, starting from 'inside out/outside in on the right side' and goes 'inside out and outside in on the left side'. The knot is placed internally in the middle between the two domes. Always replace the overlying skin ap and check for alar pinching and unwanted under-rotation of the tip before tightening the knot.

• **Cephalic Rim Excision of Lateral Crus:** Adequately expose both lateral crus including the cephalic border through an open approach. Remove any overlying scar tissue. The amount of the lateral crus to remain (5-7 mm) is measured from the caudal edge of the cartilage. Then, with a No. 15 blade knife, the cartilage is incised taking care not to include underlying vestibular skin. Next, with a sharp curved scissors using a technique of 'small snips and big spreads', the cephalic portion of the cartilage is separated from the underlying mucosa and excised.

- The cephalic excision line should be parallel to the caudal border with a gentle convexity leading to the intermediate segment staying 2 mm lateral to the dome. When nearing the dome, it is advisable to gently curve the line of excision to prevent unwanted alteration in the tip dynamics. Remember to leave a minimum of 5 mm in females and 7 mm in males of lateral crural cartilage to prevent external nasal valve collapse and alar pinching. Sometimes, the cephalic border is readily de nable due to rolling scrolling of the cephalic border. Care must be taken to excise this ‘rolled in’ cephalic border to achieve tip de nition and symmetry.

- Lateral Crural Overlap: After adequate exposure an incision is made across the mid portion of the lateral crus, after separating the vestibular mucosa (Fig. 56). Then, the medial segment is elevated and overlapped on the lateral segment with vertical mattress sutures up to a maximum of 4 mm. The excess vestibular skin underneath will settle over time. Where to incise and how much to overlap depends on individual patient need, but as a general rule of thumb, the maximum advancement should be no more than 4 mm to avoid distortion.

Grafts Techniques

Tip / Shield Graft (with Buttress Graft): A firm graft placed at the junction of the intermediate and medial crura is aimed at improving tip definition, projection, and derotation. Autologous cartilage from the septum, rib, or occasionally ear is used. It is suture-secured to the medial crura and a columellar strut may be needed. It will reduce the double break at the infra-tip lobule segment.

Cap (Peck) Graft: A firm graft placed immediately over the tip defining points. It increases definition and projection without rotation. It is very powerful for individuals with a broad and amorphous tip and thick skin. Precise symmetry and suture fixation is imperative. The platform should be form and a columellar strut is occasionally needed.

Lateral Crural Strut Grafts: Firm strut grafts placed along the undersurface of the lateral crus, between the cartilage and vestibular mucosa. The lateral crural strut graft is designed to straighten the convexity of the crus, thus diminishing lateral tip bulbosity. It can also be used to reposition the lateral crus in a caudal direction. Furthermore, the increased rigidity will enhance lateral wall support, decreasing dynamic collapse and improving the nasal airway.

Alar Rim Grafts: Alar rim grafts are narrow grafts placed in a pocket along the alar rim, often spanning from the tip, through the soft tissue triangle, towards the alar base. They are used for small degrees of alar retraction and/or collapse at the junction between the tip and alar lobules. They improve support along the rim and provide a better transition from the tip to the ala, which can decrease the illusion of tip bulbosity. Septal or ear cartilage is often used.

ALAR BASE SURGERY

Alar base surgery is usually performed as a final step in the rhinoplasty sequence. Modification to the dorsum and tip will impact the alar base width, both objectively as well as through the deliberate creation of illusions.

A simultaneous wedge and sill incision can be performed if reductions of the nasal base, alar flaring and nostril size are all required. The design of the excision must preserve the curved portion of the nostril.

After resection, a 'figure-of-eight' suture can be passed to further narrow and pinch the base. The needle is passed from the right side of the incision, through the pre-maxillary soft tissue to the contra lateral side. The suture then catches the subcutaneous tissue of the cut alar edge before being passed back through the premaxillary soft tissue in reverse direction. The needle is then passed through the subcutaneous tissue of the right alar before being tied. The knot should not be tied too tight to avoid bunching of tissues.

The columellar strut is a reliable technique which may be used to stabilize the nasal base. This technique is useful in cases in which major tip alterations are not needed. The columellar strut is a rectangular graft that provides structural support to the nasal tip and improves nasal projection. Dissect an area vertically between medial crura, following the path of medial crura to create a pocket towards the nasal spine.

The strut should be rectangular and may vary from 5-12 mm in length, 3-6 mm in width, and 1-3 mm thick. The strut is placed in a pocket between the medial crura and sutured to the medial crura in a horizontal mattress fashion. Because the strut does not extend to the nasal spine, it cannot push the tip beyond its existing projection. Thus, while the floating columellar strut will provide some support to the medial crura, such struts may not be adequate for patients with a deficient nasal base.

As a columellar strut extends closer to the nasal spine, a theoretical increase in tip support is gained. The strut, however, must be strong enough to withstand the downward tension of the tip, particularly if it is designed to push the tip beyond its current projection. This is the concept of the extended columellar strut. This technique aims to create a significant increase in projection in patients with a major deficiency of tip support. The non-Caucasian patient and the patient with a congenital nasal deformity often exhibit this scenario. Other anatomical findings indicative of a patient with a deficient nasal base include aptotic or under projected nasal tip, and then a solabial angle may be overly acute. The graft is typically harvested from costal cartilage in order to impart sufficient strength to the nasal base and tip. The strut is suture fixated to the periosteum of the nasal spine. A notch in the under surface of the strut may be made to articulate with the spine and prevent migration from the midline. Alternatively, the graft maybe incorporated with a separate premaxillary graft in a tongue in-groove manner. This may be necessary in patients with an exceptional degree of premaxillary deficiency. As in the other techniques, the medial crura are sutured to the extended columellar strut to achieve the desired projection.

The caudal extension graft relies on the same principle as the previous technique. The difference is that the caudal septum is effectively lengthened with a cartilage graft so that the medial crura may be readily sutured to it. Patients with a relative caudal septal deficiency may present with

columellar retraction and an under projected, over rotated tip. This technique is often employed in secondary rhinoplasty after previous excessive shortening of the septum. The graft should overlap the existing caudal septum and be suture stabilized with at least two horizontal mattress sutures. The caudal aspect of the graft should be in the midline so that the medial crura may be stabilized in a midline position. Both the caudal septal stabilization technique and the caudal extension graft allow for changes in projection, rotation, nasolabial angle, and columellar show by variably positioning the medial crura onto the septum or caudal extension graft. The latter technique has the potential for a greater degree of tip alteration as the shape and orientation of the effective caudal septal margin may be altered. For instance, if the caudal extension graft is longer anteriorly toward the tip, counter rotation may be achieved.

If the graft is longer posteriorly near the nasal spine, the nasolabial angle may be opened with a resultant appearance of increased tip rotation. These techniques rely on the stability of the septum to stabilize the tip. Therefore, the caudal septum itself must be structurally intact and securely attached to the nasal spine and maxillary crest in order to stabilization.

CLOSURE, CAST, AND POST-OP MANAGEMENT

All incisions are sutured. First, the transcolumellar incision, the midline suture at the apex of the V for alignment; second, the lateral corner sutures to insure redraping of the skin; and third, the columellar pillar sutures. Additional interrupted sutures of 4-0 seda are added as indicated. The transfixion incision is closed with 2-3 polysorb sutures.

Merocel® inside a glove finger is used as a nasal packing for 24 - 48 hours.

The nose is then taped with 0.5 inches wide Steri-strips which compress the skin envelope, reduce edema, and model the tip. The tapes are applied in the following sequence: (1) three slightly overlapping transverse tapes on the bridge from radix to supratip, (2) two longitudinal tapes placed along the edges of the bridge of the nose and then pinched together to both narrow the tip and support it, and (3) another transverse tape to compress the supratip skin. A small piece of Telfa gauze (4 × 1 cm) is placed along the dorsum which will facilitate subsequent removal of the nasal splint. The aluminium splint is placed to molded over the bony portion of the nose.

The surgeon immediately dictates the operative report and fills out the operative flow sheet and diagrams. The smoothness of the postoperative course is directly proportional to the amount of time spent at the preoperative visit explaining to the patient what to expect.

The post-op medications are confirmed, antibiotics are given for at least 10 days postoperatively. A first-generation cephalosporin is used for simple primary cases in order to cover skin and intranasal flora. In complex secondary cases, particularly if ear cartilage is harvested, a quinolone such as ciprofloxacin or levofloxacin is used in order to add antipseudomonal coverage). The patient is also instructed to clean the nasal lining with hydrogen peroxide on a cotton-tipped applicator and apply Bacitracin ointment over the incisions. The patient is instructed to avoid salt in his/her diet, exertion, and overheating, all of which may induce increased edema.

The patient should return on the first postoperative day for a general check. If significant bleeding has not occurred since surgery, the nasal packing may be removed. If turbinate surgery was performed, the packing may remain for an additional day. The sutures, tape, cast, and ear bolsters are removed between the seventh postoperative days.

After this point, frequency of follow-up depends on the complexity of the surgery and the individual postoperative course. On average, patients are seen three times within the first month, five to ten more times over the next 12 months, and at least yearly after that. Frequent follow-up is crucial in order to detect these abnormalities as early as possible and to correct them through the methods described. Long-term visits are important as the nose continues to change for many years after surgery. Photographs should be taken throughout the postoperative course in order to follow these changes. Only through repeated follow-ups, study of photographs, correlation to operative worksheets, and ongoing analysis will the rhinoplasty surgeon learn from previous mistakes and gain better surgical results.

COMPLICATIONS

Bleeding is the earliest common postoperative complication following rhinoplasty. The placement of packing will help to prevent bleeding, but does not guarantee against it. Larger packs should be used in cases in which intraoperative blood loss was greater than normal. For patients with questionable hemostasis, the packing should remain for an additional one to two days beyond the standard 24 hours. At this period, the packing should be extracted partially to assess for bleeding around it before completely removing it. If slow oozing persists after pack removal, topical decongestants may be sprayed intranasally.

Often, the vasoconstrictive effect will control such a problem. More severe bleeding may require replacing the packing material for another few days.

Rarely, bleeding continues beyond several days after surgery. In such cases, a careful intranasal examination with a rigid endoscope and suction may be required to identify the source of bleeding. Chemical cautery and repeat packing may address the problem.

In some cases, an exam and electrocautery or suture control is required under anesthesia. In these cases, it may be an exposed vessel on the inferior turbinate or septum or granulation tissue around the septal splint which may be the source of the bleeding.

Postoperative infection is rare and is characterized by increased pain, swelling, and erythema. It must be determined if the patient has been compliant with the antibiotic regimen. If not, the appropriate antibiotics should be resumed. Nausea and dysphagia are two common reasons for failing to take oral medications. Antiemetics, liquid medicines, or i. v. administration of the antibiotics may therefore be needed. If infection has occurred despite taking antibiotics, a broader spectrum agent may be considered. If infection progresses despite these measures or if fluctuance develops, the intranasal incisions may need to be opened to allow drainage and irrigation. The presence of infection is compounded in the presence of multiple grafts or alloplastic materials. As stated previously, these complications are avoidable through stabilization of these structures and avoidance of over resection during primary surgery. These types of problems may not become apparent for several years after surgery. If severe, revision surgery to reconstruct the deficient areas may be required.

CONCLUSION

Rhinoplasty is considered to be the most challenging, rewarding, and humbling of all otorhinolaryngist procedures and is a continually evolving operation, but the fundamental philosophy and principles knowledge is required. Every rhinoplasty operation presents the surgeon with a diversity of nasal anatomy, contours, and proportions, requiring a series of organized and interrelated surgical maneuvers tailored to each patient's anatomical and functional needs. Advances have been made in the refinement of rhinoplasty through a better understanding of nasal analysis, anatomy, function, and long-term postoperative healing. Novel surgical maneuvers and techniques have also been developed that improve the long-term results of rhinoplasty from both aesthetic and functional stand points.