

42 Surgery of the Bony Nasal Vault

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An important challenge to the surgeon wishing to master modern rhinoplasty is the consideration of nasal function in addition to traditional aesthetic concerns. The importance of nasal function is evidenced by the proposition that the distinguishing features of the human nose arose in *Homo erectus* in response to the need for more moisture conservation.¹ Recognition of nasal function is particularly important to the surgeon manipulating the bony skeleton of the nose. Although suboptimal aesthetic results may occur with either inadequate or inappropriate mobilization of the nasal bony–cartilaginous framework, significant reduction of the nasal airway may also occur. Several techniques are available to appropriately mobilize and reposition the bony nasal vault. Herein we review our experience with a variety of techniques and consider some special situations.

Anatomy

External Landmarks and Soft Tissue Components

Requisite to the use of the techniques described below is an understanding of the bony anatomy of the nose and its relation to the external nasal contour. The external contour of the upper third of the nose is defined by the two side-walls, the dorsum, and the nasofrontal angle.^{2,3} The nasion is the bony junction between the frontal and nasal bones. The nasofrontal angle is the external landmark identifying the deepest or most posterior portion of the nasal dorsum and may lie several millimeters inferior to the nasion. The rhinion is the osseocartilaginous junction of the nasal bones to the superior edge of the upper lateral cartilages.

The external appearance of the nose is affected by both the bony–cartilaginous framework and the shape and consistency of components of the overlying soft tissue envelope. This soft tissue varies in thickness over the nasal bones. As shown in **Fig. 42.1**, the nasal skin is thicker superiorly and inferiorly and quite thin over the central nasal rhinion.² Thus surgery on the nasal profile must compensate for this to avoid a saddle nose appearance. For example, a slight hump must be left at the bony rhinion if a straight soft tissue profile is desired.

Bony and Cartilaginous Framework

The nasal bones are paired structures that attach superiorly to the frontal bone and laterally to the nasal process

of the maxillary bones. These structures together form the bony nasal vault. The keystone area is the junction of the perpendicular plate of the ethmoid with the nasal bones at their inferior edge in the midline. This is an important area as destabilization here in the setting of aggressive septoplasty can lead to a saddle nose deformity. The side-walls are formed by the nasal bones themselves and the frontal process of the maxilla. The nasal bones are thin inferiorly and become thick superiorly.^{2,4} This is demonstrated by transillumination of the skull (**Fig. 42.2**). The variable thickness of the bony structures of the nose has implications for osteotomy placement, as discussed later in the chapter.

The septum supports the nose below the inferior edge of the nasal bones. The septum and upper lateral cartilage complex provides the skeletal component of the lower nasal dorsal profile. Preservation of adequate (>1 cm) dorsal and caudal struts of septum during septoplasty is paramount in the preservation of this profile. In the setting of dorsal hump reduction, the amount of septum to be removed during hump reduction must be taken into account. For this reason, the authors regularly perform hump reduction and medial osteotomies prior to removal of any septal cartilage, if septoplasty is being performed concurrently.

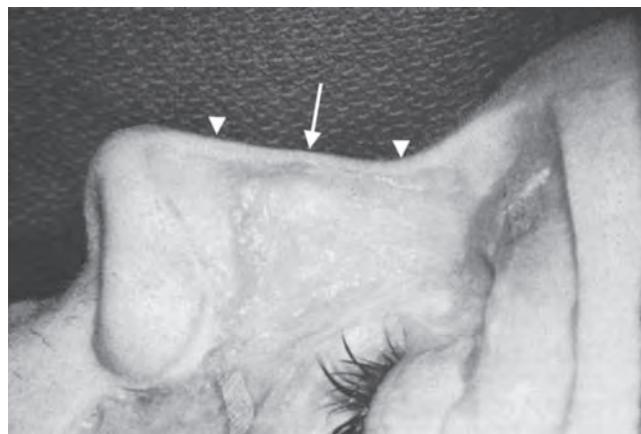


Fig. 42.1 Skin thickness of the nasal dorsum. The nasal thickness varies greatly from patient to patient but in general is thicker in the supratip and nasion areas (*arrowheads*). Reduction of the bony–cartilaginous framework in rhinoplasty must allow for variations in the thickness of the soft tissue–skin envelope. To maintain a straight soft tissue profile, the framework must maintain a slight hump at the rhinion (*arrow*). (Adapted from Larrabee WF Jr., Makielski KH. *Surgical Anatomy of the Face*. New York: Raven; 1993:164.)



Fig. 42.2 Transillumination of the skull reveals the thinner aspect of the nasal bones, which are mobilized with osteotomies in rhinoplasty (*arrow*). Osteotomies that are carried into the thicker bone of the maxilla or frontal bone are ineffective or result in inappropriate fracture sites.

Surgical Techniques

Hump Reduction

The soft tissue envelope is elevated from the bony-cartilaginous framework up to the level of the nasofrontal angle (via incisions described elsewhere in this text). Care is taken to undermine conservatively and yet widely enough to permit adequate hump reduction and subsequent skin redraping (**Fig. 42.3**). Although adequate exposure is obtained to perform the desired reduction or refinement of the profile, as much soft tissue support is preserved as possible. Either an osteotome or a rasp can be used to lower the dorsum, depending on the surgeon's experience and preference. In general, an osteotome may be used for larger humps and a rasp for smaller reductions and refinements. To remove larger humps, a conservative correction is performed with a double-guarded osteotome (**Fig. 42.4**). Refinements are then made with a tungsten carbide pull rasp. The rasp is angled slightly obliquely off the midline to avoid avulsing the upper lateral cartilages from the undersurface of the nasal bones. Removal of a dorsal hump creates a so-called open roof deformity, necessitating osteotomies for closure (**Fig. 42.5**).

Osteotomies

Jacques Joseph was one of the first surgeons to promote osteotomy.⁵ The path of his osteotomy extended from the inferior piriform aperture up into the nasal process of the frontal bone. The mobilization of the nasal bones by

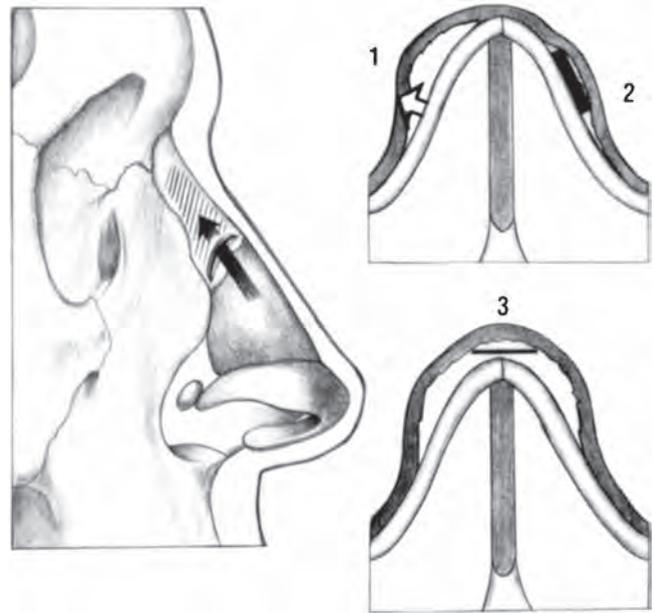


Fig. 42.3 Elevation of the periosteal flap begins with (1) sharp dissection a few millimeters above the caudal end of the nasal bones, followed by the development of pockets bilaterally (2) and the connection of these pockets in the midline with sharp dissection (3). (Adapted from Larrabee WF Jr. *Open rhinoplasty and the upper third of the nose*. *Facial Plast Surg Clin North Am*, Elsevier, 1993;1(1):26.)

Joseph and other early rhinoplastic surgeons resulted in a high rate of nasal airway compromise postoperatively. The recognition that preservation of the periosteum and lateral

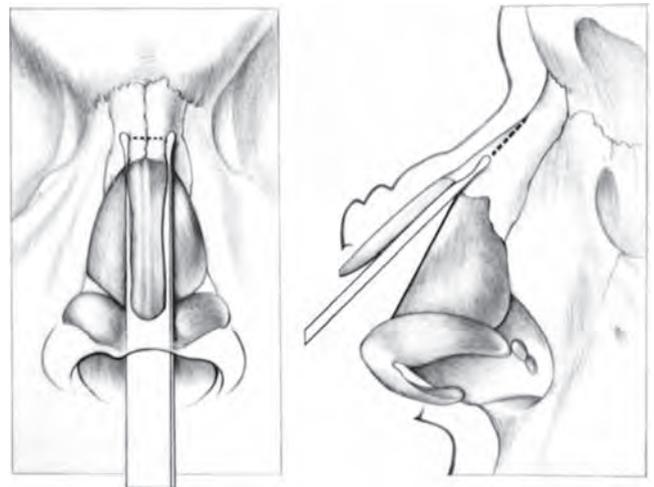


Fig. 42.4 The cartilaginous dorsum to be removed is incised sharply and left attached to the nasal bones. After elevating the periosteum, a double-guarded osteotome is then used to complete the hump removal. Care is used to follow the planned profile superiorly to the nasion and to avoid canting the osteotome to the right or left. The hump removal is done conservatively with fine adjustments made with the rasp. (Adapted from Larrabee, WF Jr. *Open rhinoplasty and the upper third of the nose*. *Facial Plast Surg Clin North Am*, Elsevier, 1993;1(1):28.)



Fig. 42.5 An open roof deformity is created after removal of a bony and cartilaginous dorsal hump, as demonstrated in this cadaver dissection. The flattened nasal dorsum is the external manifestation of an open roof (*arrowheads*). Osteotomies are performed to close the open roof (see text).

suspensory ligaments of the lower lateral cartilage helped to lower the incidence of postoperative airway compromise has been an important positive technical modification.⁶⁻⁸ Thus modern techniques of osteotomy have evolved to take into account the effects of bony repositioning on functional as well as aesthetic outcome.

The indications for performing osteotomies are: (1) to close an open nasal vault (see Fig. 42.5); (2) to straighten a deviated nasal dorsum; or (3) to narrow the nasal sidewalls. From a functional standpoint, the surgeon must consider the possible effects of the osteotomy on the patient's nasal airway. Each patient's nasal architecture is unique. In general, an osteotomy should be limited to the thinner aspect of the nasal sidewall. The average thickness of the nasal sidewall along the osteotomy path is 2.5 mm.⁹ Commonly used osteotomy techniques include the lateral osteotomy, performed either with a perforation or linear technique; the medial osteotomy; the superior osteotomy; and the intermediate osteotomy.

The Lateral Osteotomy

Lateral osteotomies are performed to close an open dorsum (open roof) and to narrow or straighten the nasal pyramid. There are two basic techniques: the linear (single-cut) technique and the perforating technique. With the linear technique, the osteotome is used to make a bony cut along the nasal facial groove (Fig. 42.6). The most widely accepted path of the osteotomy follows a high (anterior), low (posterior), high (anterior) pathway. The course of the lateral osteotomy begins just at or

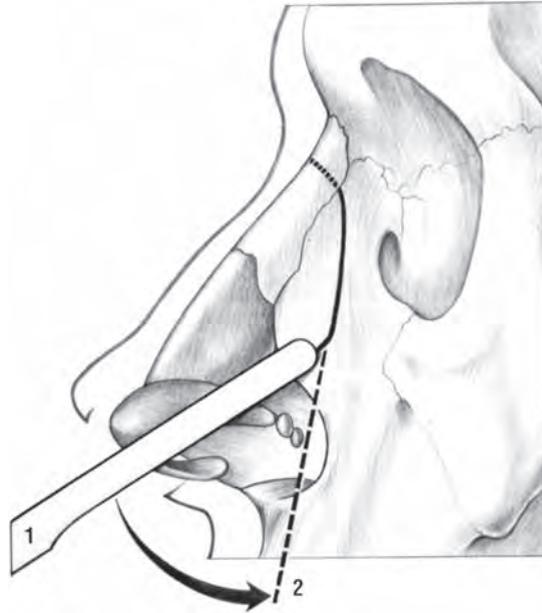


Fig. 42.6 The lateral osteotomy is begun at the anterior end of the inferior turbinate and is first made perpendicular to the face of the pyriform aperture (position 1). After this cut, the osteotomy is carried in a curved fashion toward the medial canthal area (position 2). (Adapted from Larrabee, WF Jr. *Open rhinoplasty and the upper third of the nose*. *Facial Plast Surg Clin North Am*, Elsevier, 1993;1(1):30.)

slightly above the level of the attachment of the inferior turbinate (Fig. 42.7A). A small triangle of bone at the pyriform aperture is left intact to preserve the lateral attachments of the suspensory ligaments. This helps to preserve the nasal airway. Next, the osteotomy is continued along the nasal facial groove until it curves superiorly and anteriorly into the thinner aspect of the nasal bone at the level of the inferior orbit (Fig. 42.7B). The cut is then terminated at the level of the medial canthus. If it is carried higher into the thicker bone of the nasofrontal suture a rocker deformity may result, in which in-fracture of the nasal bone results in protrusion at the superior fracture site.¹⁰

The superior back-fracture can be created by turning the osteotome, applying digital pressure, or using a percutaneous transverse superior osteotomy. In the latter technique, a small cutaneous puncture is created with a 2-mm osteotome midway between the nasal dorsum and the medial canthal region. Through this site, the same osteotome is used to create three or four small perforations, allowing mobilization of the nasal bone without disrupting the overlying periosteal support.

The perforating technique can also be used to create a lateral osteotomy. A small series of perforations are placed along the desired fracture site using a transnasal or transcutaneous approach (Fig. 42.8). The perforating intranasal osteotomy can also be used to "push out" the nasal bones



A



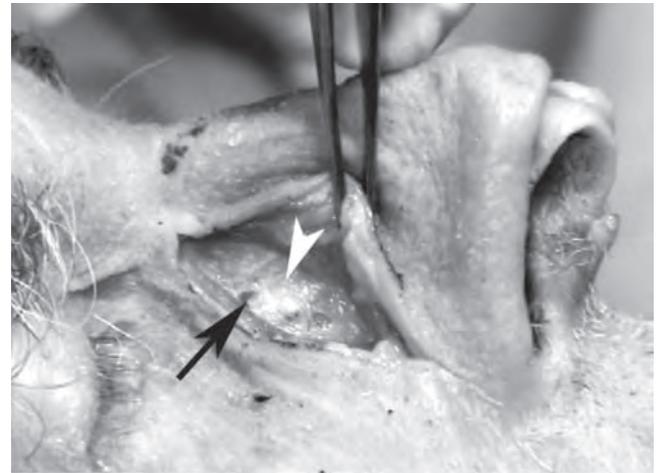
B

Fig. 42.7 Lateral osteotomy technique demonstration. (A) The osteotome is placed just above the level of attachment of the inferior turbinate, thus preserving lateral suspensory ligamentous attachments. (B) As the cut progresses superiorly, note the change in angle of the osteotome and the switch from an underhand to overhand grip on the instrument.

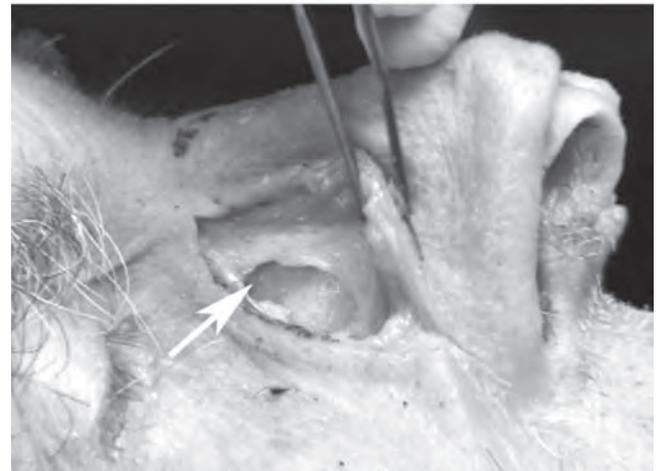


Fig. 42.8 External perforating lateral osteotomy technique. Using a sharp 2-mm straight osteotome, multiple postage-stamp osteotomies are made through one or two external incisions.

that have been medially displaced by previous trauma or surgery.¹¹ The objective is to move the nasal sidewall laterally. Although the perforating osteotomy is often preferred in difficult cases, such as revision rhinoplasty or posttraumatic nasal surgery, it is becoming more popular for performing osteotomies for the traditional indications. One reason for this is the ability to more directly visualize the path of the desired osteotomy, and another is the preservation of periosteal attachments to the nasal bones (**Fig. 42.9**). Cadaveric studies have demonstrated preservation of considerably more periosteal support with the perforating technique in comparison with the linear technique.^{12,13} Noses that are extremely deviated or those that have thick nasal sidewalls are more appropriately treated with a linear osteotomy.¹⁴



A



B

Fig. 42.9 Preservation of the periosteum using the perforating technique. (A) Dissection of periosteum after perforating osteotomy in this cadaver demonstrates an intact periosteum, still attached to the underlying (but mobilized) bone (*white arrowhead*). Black arrow indicates a postage-stamp periosteal and corresponding bony cut. (B) After incision of the periosteum, the bony sidewall falls into the nasal cavity (*white arrow*), demonstrating the importance of periosteal attachments in preventing flail segments during osteotomy.

The Medial Osteotomy

The indications for medial osteotomies are: (1) when mobilization of the entire nasal sidewall is required; (2) to help prevent uncontrolled or irregular back-fracture from the upper portion of a lateral osteotomy; and (3) to widen an overly narrowed bony nasal vault. The medial oblique osteotomy technique is used for the former two indications, the medial vertical technique for the latter. The medial oblique osteotomy can be performed linearly or percutaneously. Linear medial osteotomies are performed in an angulated fashion between the nasal bone and septum and are carried superiorly to meet the superior osteotomy site or back-fractured site (**Fig. 42.10**). They are often used to correct the deviated nose or to narrow the wide nose without a hump. In the severely deviated or wide nose, medial osteotomies can be considered essential. However, in cases where less correction is required, they may actually cause bony irregularities and should be used judiciously.

The medial vertical osteotomy is performed to separate the septum from the bony nasal vault. It is often used alone (without lateral osteotomy) to widen the nasal vault that is natively or iatrogenically narrowed. After separation of the upper lateral cartilages from the septum, a straight osteotome is placed between the septum

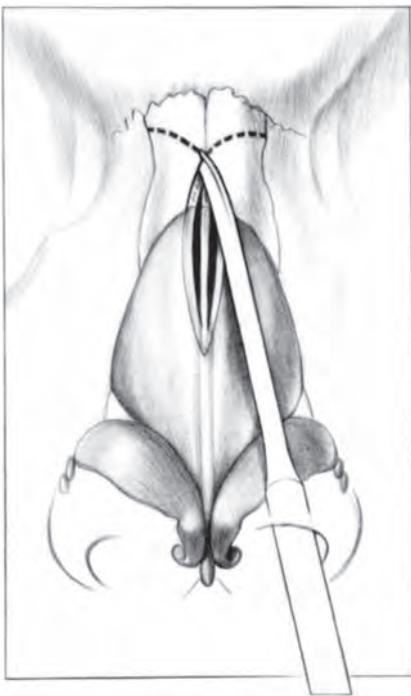


Fig. 42.10 Medial osteotomies are not done routinely but are performed when necessary, such as in the extremely wide or deviated nose. Either a straight or a curved osteotome creates a controlled cut at the transition to the thicker frontal bone. (Adapted from Larrabee WF Jr. Open rhinoplasty and the upper third of the nose. *Facial Plast Surg Clin North Am*, Elsevier, 1993;1(1):29.)

and inferior edge of the nasal bone. A vertical cut is performed, with care taken not to extend into the frontal bone. Care must also be taken during initiation of medial osteotomies in the keystone area, as destabilization of the septum can result, especially in the setting of prior septoplasty. A slight twisting motion at the end of the cut provides the 1 mm or so of space required for placement of a spreader graft.

The Intermediate Osteotomy

The primary uses of the intermediate osteotomy are: (1) to narrow the extremely wide nose that has good height (bilateral osteotomy); (2) to correct the deviated nose with one sidewall much longer than the other; and (3) to straighten a markedly convex nasal bone.^{14,15} The intermediate osteotomy is made parallel to the lateral osteotomy somewhere along the midportion of the nasal sidewall. The exact medial/lateral placement of the osteotomy along the lateral nasal wall may vary depending on the surgical goals. In a closed rhinoplasty, it is usually performed via an intercartilaginous incision with a small osteotome (e.g., 3 mm) and carried cephalad to the superior fracture site. Through the open rhinoplasty approach it can be performed with more precision. The intermediate osteotomy is performed before the lateral osteotomy, as the intermediate cut cannot be made easily after the bone is mobilized laterally. Soft tissue should be left attached to the nasal bone for added support.

Postoperative Care

Osteotomy causes mild to moderate soft tissue swelling and, in addition, may cause ecchymosis and periorbital edema. Postoperative edema can be greatly reduced by the application of cold compresses and by elevation of the head to 30 degrees during the first 24 hours after surgery. Perioperative antibiotics may be used. Nasal packing, if used, is removed in 24 hours, and nasal casts or surgical splints are removed after 1 week. Some surgeons encourage nasal exercises, in which the patient places a finger on either side of the nose and exerts moderate inward pressure to prevent displacement of the newly medialized osteotomized bony pyramid.

Special Considerations

The Extremely Deviated Nose

The previous osteotomies may be used in combination to correct any given anatomical deformity of the bony nasal pyramid. For example, in the posttraumatic or longstanding

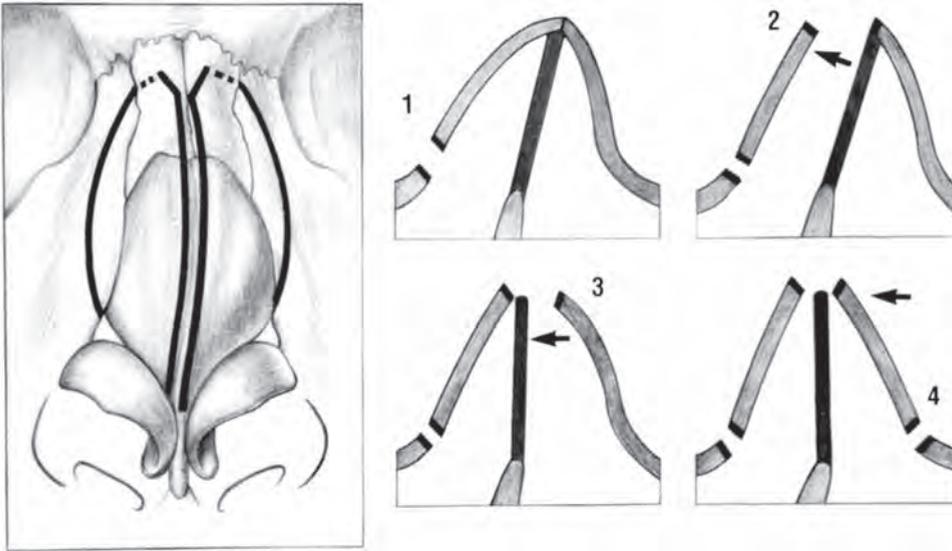


Fig. 42.11 To correct a deviated nose, sequential osteotomies are performed in a fashion similar to opening a book. (Adapted from Larrabee WF Jr. Open rhinoplasty and the upper third of the nose. *Facial Plast Surg Clin North Am*, Elsevier, 1993;1(1):33.)

severely crooked nose, it is important to completely mobilize the segments of the bony pyramid to avoid persistent postoperative deviations. In this situation, the osteotomies are performed sequentially beginning on the side opposite the deviation (e.g., for a pyramid displaced to the left, begin with the right lateral osteotomy). Note that this is similar to turning the pages of an open book, with the nasal walls and septum simulating the pages (**Fig. 42.11**). This allows creation of a space in which to realign the deviation.

Wide Nose

Removal of a significant hump from the wide nose may result in a wide open dorsum. Standard osteotomies may allow the nasal bones to be moved to close the open roof. Debris or residual wedges of bone or cartilage may persist at the junction of the nasal bone and septum. This must be removed prior to closure. In some cases, when nasal height is appropriate and the nasal bones are extremely wide or convex, bilateral intermediate osteotomies may be necessary to obtain adequate narrowing.¹⁴

Short Nasal Bones

Preoperative evaluation of the patient should include assessment of the length of the nasal bones and the composition of the nasal hump (bone versus cartilage). Patients with short nasal bones, as determined by palpation, often have a primarily cartilaginous hump. In this

case, the surgeon must avoid both overmobilization of the nasal bones with osteotomies and over-resection of the dorsal nasal bones with a rasp or osteotome. The dorsal hump can sometimes be lowered without osteotomies. A perforating osteotomy may be used to preserve maximal soft tissue support. In these cases, a greenstick fracture superiorly is desirable as it also avoids overmobilization of the delicate, short nasal bones.

Summary

A systematic approach must be used when addressing the deviated nasal pyramid. This includes precise preoperative and intraoperative anatomical analysis of the bony deformity. A thorough understanding of the various techniques available to address these deformities allows the surgeon to address the deviated pyramid most appropriately and with optimal postoperative outcome.

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