Superior Rhinoplasty Outcomes with Precise Nasal Osteotomy: An Individualized Approach for Maintaining Function and Achieving Aesthetic Goals

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Abstract

Background: Although frequently performed in rhinoplasty, nasal osteotomies have been unpredictable in consistently controlling postoperative alterations in bony morphology in many patients. Consequently, a detailed algorithm for an individualized approach to osteotomy is needed to achieve superior aesthetic and functional outcomes.

Objectives: The authors aimed to propose a component-oriented and individualized approach for nasal osteotomy in rhinoplasty.

Methods: Clinical outcomes were reviewed for 150 consecutive patients who underwent rhinoplasty. Type and frequency of specific osteotomy procedures and preoperative and postoperative photographs were examined.

Results: A total of 97 cases with at least 12 months of follow-up data were evaluated. In 92 of 97 patients (95%), a lateralized medial oblique osteotomy was performed; 70 (72%) required bilateral intermediate osteotomy, and 21 (22%) required unilateral osteotomy. Forty-one patients (42%) underwent bilateral base osteotomy and 24 (25%) underwent unilateral base osteotomy. No base osteotomy was performed in 32 patients (33%) who had aesthetically pleasing lateral wall width and no convexity of the posterior portion of the lateral bony wall.

Conclusions: The osteocartilaginous vault is asymmetric in the majority of patients undergoing rhinoplasty. Anatomic variations in the height, length, and/or width of the bony vault can significantly influence its shape and symmetry. Various principles and techniques for nasal osteotomy increase predictability of outcomes while improving nasal aesthetics and function.

Level of Evidence: 4

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For decades, nasal osteotomy has been an essential component of aesthetic, functional, and reconstructive rhinoplasty procedures. However, problems remain in consistently controlling alterations in bony morphology after osteotomy, particularly in 3 specific groups: patients needing correction of significant bony convexity, patients with significant preexisting nasal pyramid asymmetry, and patients requiring medialization at the apex of the open roof after nasal dorsal reduction.

The proximal one-third to one-half of the nose comprises the bony vault, which consists of the ascending process of the maxilla and a paired nasal bone. The ascending process of the maxilla extends in the cephalic direction from the piriform aperture to the lacrimal crest. In other words, the anatomic composition of the lateral wall of the bony pyramid of the nose includes the ascending process

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of the maxilla at the level of the piriform aperture extending superiorly to the level of lacrimal and frontal bones. However, the nasal bony pyramid at the level of the medial canthal region includes both the ascending process of the maxilla and the nasal bones (Figure 1). These bones are relatively thick and narrow above the canthal level, which is why osteotomy is rarely indicated at this location.

Osteotomies were first implemented to narrow the open roof that followed a major hump reduction and initially consisted of a lateral osteotomy placed in the nasofacial groove. Subsequently, a medial osteotomy that paralleled the septum was added to ensure total mobilization of the lateral wall. The surgeon would conduct both osteotomies, then push the lateral wall outward (outfracturing) from the medial bony cut with an instrument, and finally push the lateral wall inward (infracturing) from the lateral bony cut. Although total mobilization was achieved, this procedure frequently led to instability and descent of the bones into the pyriform aperture. With the introduction of the spreader graft by Sheen, it became possible to close the open roof without recourse to the osteotomies. Therefore, the indication for lateral osteotomy became narrowing of the base bony width (x-point) rather than closing the open roof. Parkes et al. introduced the concept of the double lateral osteotomy as a means of correcting the convex lateral wall, and later Rohrich et al. and Gunter et al. stressed the importance of the dorsal lines in assessing the postoperative dorsum. Gruber et al. noted that narrowing the dorsal lines can involve narrowing the broad bone cephalic to the apex of the open roof by means of medial oblique osteotomy.

**Osteotomy Types**

**Medial and Transverse Osteotomies**

Medial osteotomy is performed when a bony cut is created in the nasal bone, thereby separating it laterally from the upper bony vault and medially from the bony septum. Depending on the anatomic features, the surgeon can avoid extending the medial osteotomy to the frontal bone by fading it laterally. Based on its angle, the medial osteotomy has been characterized as paramedial, oblique paramedian, medial oblique, or transverse. This type of osteotomy is commonly combined with lateral osteotomy and/or green-stick fracture to reduce the width or thickness of the nasal bone or lateral wall. In rare cases, increased bony width above the infraorbital rim can be reduced using this type of osteotomy. Medial osteotomies are not typically needed when there is an open roof deformity after removal of a large dorsal hump.

**Midlevel or Intermediate Osteotomy**

Intermediate or midlevel osteotomy is performed unilaterally or bilaterally between the level of the medial and lateral osteotomies. This type of osteotomy is indicated when there are significant lateral nasal wall asymmetries or the degree of the bony vault convexity or deviation is too severe to be corrected and contoured with a standard single-level osteotomy alone. Typically, the more medial, or upper nasal, osteotomy is performed first along the naso-maxillary suture line. Then the more lateral, or lower nasal, osteotomy is performed using the low-to-low technique. After undergoing intermediate osteotomy, these patients also commonly require lateral osteotomy.

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**Figure 1.** Normal anatomy of the OC region of the nose: (A) anteroposterior and (B) profile views. Note the anatomic relationship of upper lateral cartilage, lower lateral cartilage, septum and bony framework. MCL, medial canthal ligament.
Lateral or Base Osteotomy

Lateral osteotomies were first implemented to close an open roof deformity, narrow the bony base or lateral walls of the bony pyramid, and straighten and correct asymmetric or deviated bony framework.

Lateral osteotomies are completed in either a low-to-low or low-to-high fashion. Regardless of the type performed, it is important to preserve a triangular area of the caudal aspect of the frontal process of the maxilla near the internal valve (Webster’s triangle), thereby avoiding nasal valve collapse and obstruction.

Lateral osteotomies are typically initiated from the lateral point of the piriform aperture anterior to the attachment of the inferior turbinate (usually 3 mm to 4 mm above the base of the piriform aperture) and are most frequently continued superiorly to at least 12 months of follow-up data.

Osteotomies narrow and change bony structures. The etiology of the open roof is modification of the cartilaginous vault. In other words, there is no open roof into the mucosal space until the cartilaginous vault is incised or excised. Thus, the paradigm for closing of the open roof is not osteotomy now, but rather “spreader flaps first and spreader grafts if need be.” Spreader flaps can be utilized by separating the upper lateral cartilage and preserving its height. After reduction of the excessive projection of the septal component, spreader flaps are created and sutured to the septum, thereby closing the open roof. Spreader grafts, typically harvested from the septum, are chosen when additional width is desired in one or both sides of the dorsum. These grafts are also useful when there is significant deviation of the dorsal septum. Further details on the indications and technical nuances of spreader grafts and flaps are beyond the scope of this article. The open roof is purely a cartilage vault phenomenon and is the subject of a second paper by the current authors on individual dorsal reduction.

Over the past decade, we have found it necessary to evolve from classic standardized osteotomy techniques to a more selective approach for individualized management of each patient. Based on the results of medial oblique and lateral osteotomies we have performed over the past 2 decades, we recognized a lack of optimal consistency due to several factors: (1) obstacles at the apex of the open roof that prevent medialization; (2) disproportion between medial movement of the lateral wall and closure of the open roof (anterior and posterior aspects of the lateral wall); (3) inability to correct convexity of the lateral wall; and (4) persistent asymmetry. Thus, we reassessed the aesthetic goals and indications for nasal osteotomy. Currently, we perform osteotomy to modify the aesthetics of the bony vault by altering the shape and width of the dorsal aesthetic lines, changing the width of the nasal base (x-point), or modifying the shape and convexity of the lateral nasal wall. In the majority of cases, the dorsum is reduced, which results in widening of both the anatomic dorsum and the dorsal surface aesthetic lines. Consequently, there is a frequent need for dorsal narrowing. In >85% of our cases, particularly women, the base bony width is too wide aesthetically and must be narrowed. In addition, a high percentage of cases demonstrate convex lateral walls, which further accentuate the width of the nose. Over several years, we developed various surgical techniques to address some of these problems.

METHODS

One hundred fifty consecutive patients who underwent rhinoplasty at private clinics between 2009–2011 were included in this study. Patient charts, pre- and postoperative photographs, taken 1 year apart, and clinical data were retrospectively reviewed in detail. Informed consent was obtained from all patients, and no institutional board review was required for the standard rhinoplasty procedures. Exclusion criteria included patients that did not have at least 12 months of follow-up data.

Osteotomy Techniques

Hump Reduction and the Open Roof

The principle author’s technique for reducing the osteocartilaginous (OC) hump was a 2-step approach involving precise bony hump disarticulation and removal with a 3-mm osteotome, and preservation of the “underlap” portion of the upper lateral cartilage, which not only filled the open roof but also amplified the spring function of the spreader flap. This maneuver was followed by osteotomy. Notably, meticulous removal of the bony hump preserved the integrity of the cartilaginous vault, avoiding the creation of a true open roof (Figures 1–6). A temporary open roof occurred when the upper lateral cartilage was detached to allow lowering of the dorsal septum. It was then closed with the spreader flaps.

Narrowing the Anterior Portion of the Lateral Bony Wall and Bony Dorsum

From an aesthetic standpoint, the purpose of narrowing the bony dorsum was to establish narrow parallel dorsal lines. The preoperative bony dorsal width was often excessive and worsened by dorsal hump reduction. The remedy involved a 2-step procedure: a lateralized medial oblique osteotomy with an osteotome or saw and narrowing of the dorsal edge by an intermediate osteotomy. In the past, medial and medial oblique osteotomies were performed to facilitate medialization of the lateral walls after lateral osteotomy. In contrast, we performed a lateralized medial
oblique osteotomy to narrow the bony dorsum regardless of lateral wall width. The technique was essentially the same as that proposed by Gruber et al, with the osteotome or saw placed 2 mm to 3 mm lateral to the apex of the open roof and fading 15° off the midline (Figure 7). A true medial oblique osteotomy is performed at the apex of the open roof and fades about 15° off the midline to avoid solid bone centrally. Once the lateralized medial oblique osteotomy was completed, the bones were compressed to narrow the dorsum.

For dorsal reshaping, an intermediate osteotomy at 3 mm to 5 mm off the midline was needed in some cases in addition to the lateralized medial oblique osteotomy. These two osteotomies were then connected with an external osteotomy. The intermediate osteotomy was required to separate the osseous union and allow the dorsal edges to narrow. When performing intermediate osteotomies with an electric saw, it is necessary to preserve the external branch of the anterior ethmoidal nerve by not extending laterally beyond the typical 5 mm off midline.

Narrowing of the dorsum preceded lateral wall narrowing in our operating sequence. When nasal bones were vertically oriented, were concave in morphology, and had appropriate width, further narrowing was not needed. In such cases, only lateralized medial oblique and intermediate osteotomies were performed. This allowed closure of the open roof and improved aesthetics without the need for lateral osteotomy, and prevented unwanted additional medialization and subsequent narrowing of the entire base of the nasal bones.

**Anterior vs Posterior Osteotomies**

We considered the nasal pyramid as 2 different entities. The anterior portion and convexity of the pyramid were...
corrected with oblique and midlevel osteotomy, whereas the posterior part and the excess base width were corrected with lateral or base osteotomy.

**Correction of Lateral Wall Convexity**

Parkes et al. addressed the problem of lateral nasal walls that are convex in the anteroposterior plane by introducing the double lateral osteotomy, which consisted of intermediate and lateral osteotomies. The authors emphasized that the intermediate osteotomy was “found to approximate the suture line between the maxilla and nasal bone.”

The reason for emphasizing this clinical problem is because the intermediate osteotomy has 2 functional purposes: narrowing the dorsum and correcting lateral wall convexity (Figure 8). In both cases, the intermediate osteotomy is completed before the lateral osteotomy.

**Narrowing the Base Width**

The primary indication for a lateral osteotomy is excessive bony base width of the nose. Our preferred method was to narrow the base width while preserving nasal function. The primary focus was to correct the convexity of the posterior portion of the lateral bony wall, and a critical procedural element was to identify the so-called “turning point,” which typically falls on the ascending segment of base osteotomy. The turning point is the point where the curves of the cephalic aspect of the lateral bony wall meet the convexity of the caudal portion of the lateral bony wall concavity. The markings comprised the x-point at the greatest width of the bony base, an extended Webster’s triangle, and the cephalic continuation and any transverse component.

Lateral osteotomy was completed with a percutaneous 2-mm straight osteotome. As modified from the procedure
described by Tebbetts, the osteotome was punched through the skin at the level of the x-point high on the lateral wall and then dragged down to the nasofrontal groove, thereby minimizing damage to the vessels. A subsequent 3-step lateral osteotomy was performed, consisting of the following: (1) a descending component that defined the extended Webster’s triangle; (2) a classic lateral osteotomy that passed upward in the nasofrontal groove toward the medial canthus and...
slightly anterior to the widest point of the nose (x-point); and (3) an ascending transverse component that approached the previous osteotomies (Figure 9). Actual narrowing of the lateral nasal wall was easily accomplished and rarely required significant digital manipulation. Notably, there was no need for base osteotomy in patients in whom the width of the x-point was aesthetically pleasing and the posterior part of the lateral bony wall was not convex.

RESULTS

Of the 150 consecutive patients in our study who underwent rhinoplasty, 97 had at least 12 months of follow-up data available. There were 86 women and 11 men, with a mean overall age of 24 years (range, 17-48 years), and mean follow-up of 14 months. Table 1 is a summary of the specific types and frequencies of nasal osteotomies performed. Representative clinical results are pictured in Figures 10–12.

In 92 of 97 patients, lateralized medial oblique osteotomy was performed; 70 patients required bilateral intermediate osteotomy and 21 patients required unilateral osteotomy. With regard to base osteotomies, 41 patients (42%) underwent bilateral base osteotomy and 24 patients (25%) underwent unilateral base osteotomy. Base osteotomy was not performed in 32 patients (33%) who had aesthetically pleasing lateral wall width (x-point) and no convexity of the posterior part of the lateral bony wall.

DISCUSSION

Osteotomies are no longer an automatic step in rhinoplasty, nor are they completed in a uniform manner. The evolution of our approach to nasal osteotomy occurred over several years. The most important factor necessitating a reformed approach was less than ideal results after standard osteotomies. An in-depth analysis was conducted in cadaver studies. In addition, preoperative and postoperative computed tomography scans of rhinoplasty patients were analyzed. Based on these investigations and the incorporation...
of techniques from other surgeons, we were able to develop a more individualized approach to nasal osteotomy.

Osteotomies and their various sequences must be determined on an individualized basis on each side of the nose. At our institution, we complete a 4-step analysis of each OC vault. First, we assess the desired dorsal width after dorsal reduction and locate the widest point on the dorsal lines. This data determines whether there is a need for lateralized medial oblique osteotomy to narrow dorsal width. Second, lateral wall convexity is addressed, which indicates the need for an intermediate osteotomy. Third, base bony width is analyzed in relation to intercanthal width, which establishes the need for a lateral osteotomy. Fourth, each side of the nose is analyzed independently due to the asymmetry that exists in every nose.

### Functional Consequences

**Nasal Osteotomy and Its Effect on Nasal Breathing**

Nasal osteotomy can lead to medialization of the inferior turbinate if the anterior portion of the inferior turbinate is anterior to the plane of the osteotomy. In these situations, nasal obstruction secondary to reduction of airway width at the level of the inferior turbinate occurs. This has been measured intraoperatively as a reduction of the distance between the inferior turbinate and septum. It can be avoided if the lateral osteotomy is performed in a high-low-high fashion, maintaining an intact segment of attachment of the inferior turbinate by leaving the Webster triangle undisturbed.21-23

**Dorsal Hump Reduction**

In the majority of rhinoplasty procedures, osteotomies are completed after hump reduction to close the open roof. Consequently, the extent of hump reduction in 3 directions—vertical, caudal, and cephalic—will influence the type and location of the osteotomies. The osteotomies can be planned preoperatively, but the actual procedures must be decided intraoperatively after hump reduction. As the reduction extends downward in the anteroposterior plane, changes occur aesthetically and anatomically. In particular, the dorsal lines become wider and the reduction occurs entirely in the substance of the nasal bones, thus reducing their percentage of the lateral nasal wall. Similarly, the rhinion point at the OC junction is higher in the midline than laterally. As a result, the effective lateral dorsal edge of the nasal bone is more caudal than the preoperative midline rhinion. In this case, the major variable is cephalic extension of the hump.

### Table 1. Type and Frequency of Nasal Osteotomies Performed

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. of Cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical cases with ≥12 mo follow-up data</td>
<td>97</td>
</tr>
<tr>
<td>Lateralized medial oblique osteotomy</td>
<td>92 (94.8)</td>
</tr>
<tr>
<td>Bilateral intermediate</td>
<td>70</td>
</tr>
<tr>
<td>Unilateral</td>
<td>21</td>
</tr>
<tr>
<td>No lateralized medial oblique osteotomy</td>
<td>5 (5.2)</td>
</tr>
<tr>
<td>Base osteotomy</td>
<td>65 (67.0)</td>
</tr>
<tr>
<td>Bilateral</td>
<td>41</td>
</tr>
<tr>
<td>Unilateral</td>
<td>24</td>
</tr>
<tr>
<td>No base osteotomy performed</td>
<td>32 (33.0)</td>
</tr>
</tbody>
</table>

**Figure 10.** This 18-year-old woman presented for rhinoplasty to achieve significant aesthetic change in her nose. She requested a more feminine, narrower nose. The patient is shown preoperatively (A, C) and at 15 months postoperatively (B, D). After incremental dorsal reduction, lateralized medial oblique and intermediate osteotomies were performed. Because of the asymmetry of the ascending process of the maxilla, a low-to-high osteotomy with bilateral spreader flaps was performed on the left side with no base osteotomy on the right side. After tip suturing, a single layer onlay graft was placed over the domes to increase definition. Genial osteotomy and advancement was completed as well.
reduction. Thus, it is appropriate to review the relationship between the anatomic nasofrontal suture line and the aesthetic nasion. During Joseph’s era, dorsal hump reduction was often massive and extended well into the radix area. In the case of an open roof extending to the nasofrontal suture line, the question becomes how to connect down to the lateral fracture line. Initially, the solution was to add transverse percutaneous osteotomies. Currently, the extent of hump reduction rarely extends higher than the level of the medial canthus in the majority of aesthetic rhinoplasty procedures.

Lateralized Medial Oblique Osteotomy

The need for medial osteotomies is most closely related to excision of the bony hump. Lateral osteotomies mobilize the lateral wall sufficiently to close the open roof. Thus, the challenge of how to mobilize the lateral wall from the open roof to the lateral osteotomy in the nasofacial groove arose. Initially, a true medial osteotomy paralleling the septum was selected. The problem was that the outfracture often produced a “rocker” formation. Anatomic studies revealed that the bone was solid centrally. This led to the development of medial oblique osteotomy, which is characterized by the following 3 factors: the osteotome is placed at the apex of the

Figure 11. This 19-year-old woman presented for rhinoplasty to improve her facial/nasal asymmetry, nasal deviation, and nasal obstruction. She exhibited significant asymmetry of the facial and nasal bones (ascending process of maxilla) as well as significant nasal pyramid deviation. To achieve symmetry, a lateralized medial oblique osteotomy was performed on the right side. On the left side, lateralized medial oblique, midlevel intermediate, and low-to-high base osteotomies were performed to correct asymmetry and convexity. In addition to dorsal reduction, bilateral spreader grafts, bilateral spreader flaps, a columellar strut, and domal onlay grafts were placed. The patient is shown preoperatively (A, C) and at 12 months postoperatively (B, D), demonstrating improvement of nasal deviation and asymmetry.

Figure 12. This 25-year-old woman of Persian descent presented requesting improvement of her nasal and facial appearance. She was noted to have bilateral convexity of the nasal bones and vertical orientation of the left ascending process of the maxilla. After slight dorsal reduction, bilateral oblique, bilateral midlevel, and bilateral base (low-to-high) osteotomies were performed. The extended Webster’s triangle was left intact bilaterally to prevent weakening of the nasal valves and subsequent nasal obstruction. Tip suturing and domal onlay grafts improved nasal tip aesthetics. The patient also underwent fat transfer to the periorbital and facial regions. The patient is shown preoperatively (A, C) and at 12 months postoperatively (B, D).
open roof, the osteotome fades 15° to 25° off the midline, and the lateral wall compresses against the septum.

Consequently, Gruber et al.20 introduced lateralized medial oblique osteotomy, whereby the osteotome is placed at the lateral border of the open roof (2 mm-3 mm lateral to the apex), the osteotome fades 25° to 35° off the midline, and the lateral wall slides underneath the intact central dorsum. The essential differences are the preservation of dorsal width at the intercanthal line and the sliding lateral wall underneath the intact dorsal bone.

In the past, surgeons frequently found the need to add an extra osteotomy to modify the lateral bony wall in patients with a broad bony base or with posttraumatic deformities. Parkes et al.10 introduced the double lateral osteotomy, consisting of anterior-superior and posterior-inferior lateral osteotomies and referring to all osteotomies between the medial and lateral osteotomies as intermediate osteotomies. Based on rhinoplasty procedures performed in fresh cadavers, they demonstrated that the intermediate osteotomy effectively approximated the suture line between the maxilla and nasal bone. In additional cadaver studies, it became apparent that the lateral bony nasal wall was composed of the nasal bones and the frontal process of maxilla to varying degrees. At the intercanthal line, the composition is roughly 50:50, whereas at the pyriform aperture, it is approximately 33:67, with the majority coming from the frontal process of the maxilla. When a signification lateral osteotomy is roughly 50:50, whereas at the pyriform aperture, it is approximately 33:67, with the majority coming from the frontal process of maxilla and nasal bone. In additional cadaver studies, they demonstrated that the intermediate osteotomy effectively approximated the suture line between the maxilla and nasal bone. In additional cadaver studies, it became apparent that the lateral bony nasal wall was composed of the nasal bones and the frontal process of maxilla to varying degrees. At the intercanthal line, the composition is roughly 50:50, whereas at the pyriform aperture, it is approximately 33:67, with the majority coming from the frontal process of maxilla and nasal bone. In additional cadaver studies, it became apparent that the lateral bony nasal wall was composed of the nasal bones and the frontal process of maxilla to varying degrees. At the intercanthal line, the composition is roughly 50:50, whereas at the pyriform aperture, it is approximately 33:67, with the majority coming from the frontal process of maxilla and nasal bone. In additional cadaver studies, it became apparent that the lateral bony nasal wall was composed of the nasal bones and the frontal process of maxilla to varying degrees.

It is important to note that this suture line is not midlevel, but rather closer to one-third to two-thirds of the lateral bony wall and certainly caudal. Also, as the hump reduction is conducted, the nasal bone component of the lateral wall is reduced, thus decreasing the percentage of the lateral wall attributed to the nasal bone and making it less of a midlevel osteotomy.

We have noted that the greater the dorsal bony length, the longer the bony component of the OC part will be. Therefore, reduction of the cartilaginous dorsal hump increases the width of the OC vault. We have also noticed that the most objective method is to define the dorsal line width above, at, and below the medial canthal ligament (MCL).

We complete intermediate osteotomies for 2 reasons: to assist in narrowing the dorsum when necessary and to reduce the convexity of the lateral wall (Figure 8). When narrowing the dorsal lines, we routinely perform a lateralized medial oblique osteotomy followed by an intermediate osteotomy with a 2-mm osteotome. We then typically perform an external osteotomy to connect the 2 previous osteotomies and narrow the dorsum. The second indication for intermediate osteotomies is when the lateral walls are convex in the anteroposterior plane. Once the hump reduction and lateralized medial oblique osteotomy are completed, the intermediate osteotomy is conducted. It always precedes the lateral osteotomy.

Originally, lateral osteotomies were completed with a saw that cut along the frontal process of the maxilla along the nasofacial groove. Osteotomes replaced saws, which led to significant changes in direction (low vs high), approach (internal vs external), and purpose. Within a 2-year period, textbooks reflected this shift from saws (Converse) to osteotomes and saws (Rees), and then to osteotomes alone (Sheen).1,3

Lateral osteotomies were originally conceived as a means of closing the open roof and were implemented routinely. In 1982, Daniel2 emphasized an application for narrowing the base bony width or x-point and noted that osteotomies were not necessary in at least 10% of cases. Selection of Sheen’s1 technique low-to-high or low-to-low osteotomy was based on the preexisting bony width and the desired amount of medial movement (Figure 9).

The starting point for all osteotomies varies. The lateralized medial oblique osteotomy begins at the apex of bony hump removal (+8 mm to 10 mm above the original bone-cartilage junction), whereas the intermediate osteotomy begins high along the pyriform aperture but below the original bone-cartilage junction (~2 mm to 4 mm).

In addition, there is a distinct difference between the junction point of bone/cartilage before hump reduction and the bony open roof when the cartilage vault is intact, and then the defined bony open roof once the cartilage vault is reduced. This junction point becomes more caudal as reduction of the dorsum is conducted, and the distance between the ends of the bones is wider. In addition, the dorsal line width is greater after reduction of the vault.

One of the problems with the published literature is the depiction of osteotomies on conventional lateral walls and the drawing of osteotomies before dorsal reduction. We studied the effect of dorsal reduction on the starting points of osteotomies after the hump reduction. As an example, lateralized medial oblique osteotomy narrows the dorsal lines irrespective of lateral base osteotomy. Gruber19,20 previously stated that he performs the medial oblique osteotomy to access the lateral low-to-low osteotomy. However, the dorsal lines are only affected if the medial oblique osteotomy is performed in combination with lateral osteotomy and fairly posteriorly.

We propose that all nasal osteotomies should involve component-oriented and individualized approaches. As
noted, each lateral osteotomy can be conducted differently to overcome inherent asymmetry between the right and left sides of the nose. In addition, because the asymmetric lateral wall remains asymmetric after a lateral osteotomy (the simple act of medialization does not change the intrinsic morphologic asymmetry), individualized osteotomy techniques may be needed to improve symmetry.

The convexity of the lateral nasal wall can be present in 2 different planes: the cephalocaudal direction and the anteroposterior direction. The "turning point" we refer to is the point at which the curvature of the ascending process of the maxilla changes from a concave to a convex morphology as the plane traverses in the cephalocaudal direction. It is worth emphasizing that osteotomy of the ascending segment should be along this line. It is important to avoid extending too far superior while performing this osteotomy because doing so can cause the concave portion to fracture.

CONCLUSIONS

Every OC vault is asymmetric, and thus each osteotomy must be individualized for each patient and for each side of the nose. Anatomic variations in the bony vault (height, length, and width) can significantly influence the shape as well as the degree of asymmetry. Furthermore, changes occur after hump reduction. Because of its cantilever effect, when the dorsum of the nose is reduced significantly, the relationship of the upper lateral cartilage and septum as well as muscular balance can be disturbed. This may lead to suboptimal functional and aesthetic outcomes. Extension of the Webster’s triangle should be considered to preserve the stability of the piriform ligament, thereby preventing nasal valve collapse and airway obstruction. A rhinoplasty surgeon can effectively utilize spreader flaps in closure of the cartilaginous open roof.

Lateralized medial oblique osteotomies can control the width of the nasal dorsum and dorsal aesthetic lines independently of lateral or intermediate osteotomies. The width and convexity of the nasal bones should be considered independently and addressed individually. Lastly, after dorsal reduction, the anatomic and morphologic composition of the lateral wall (frontal processes of maxilla vs nasal bones at different levels) should be evaluated intraoperatively (caudally at the pyriform aperture vs cephalically at the MCL level) to increase precision of individualized osteotomies.

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