

# Osteotomy Techniques to Correct Posttraumatic Deviation of the Nasal Pyramid: A Technical Note

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## Abstract:

**Background and Objectives.** Correction of the deviated nasal pyramid is frequently incomplete and may result in a sub-optimal surgical outcome. Precise anatomic analysis of the deformity and a thorough understanding of available techniques improve the surgical osteotomy.

**Methods and Materials.** The advantages and disadvantages of the various osteotomy techniques are analyzed, based on the cadaver studies and clinical experience of the authors. The cadaver studies demonstrate the anatomic results when various osteotomes are used in specified ways. Clinical outcomes in the treatment of posttraumatic nose deviations correlate well with these results.

**Results and/or Conclusions.** A thorough understanding of the advantages and disadvantages of various osteotomy techniques enables the surgeon to apply them to specific anatomical deformities in posttraumatic nose deviations more precisely. In general, perforating osteotomies preserve more soft tissue support than the linear osteotomies. Sequential osteotomies, occasionally combined with intermediate osteotomies, are useful in straightening the extremely deviated nasal pyramid.

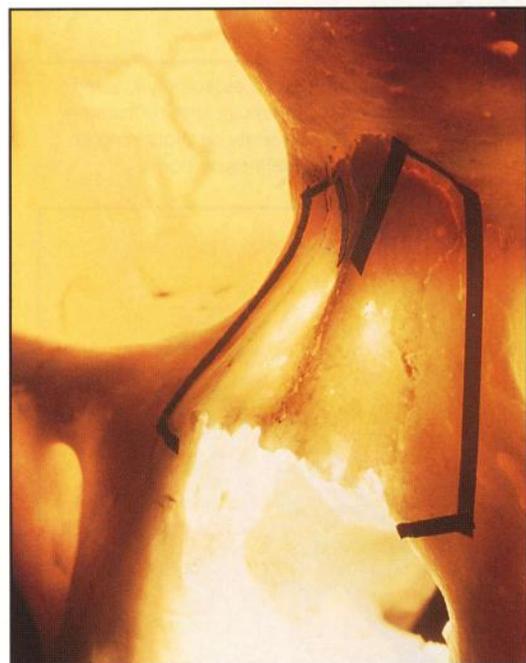
**Key Words:** Nasal pyramid, posttraumatic deviation, osteotomy.

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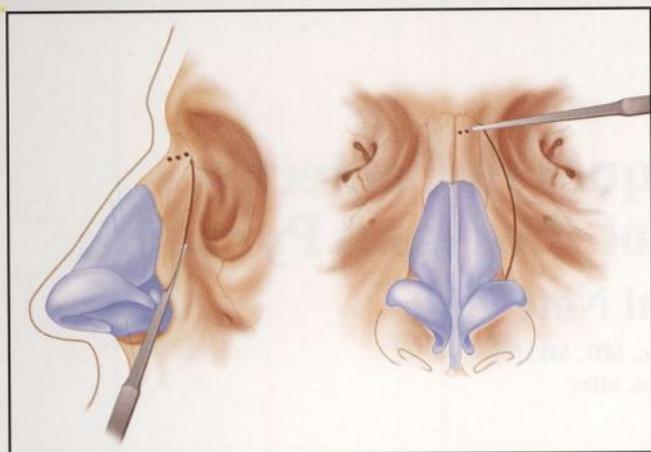
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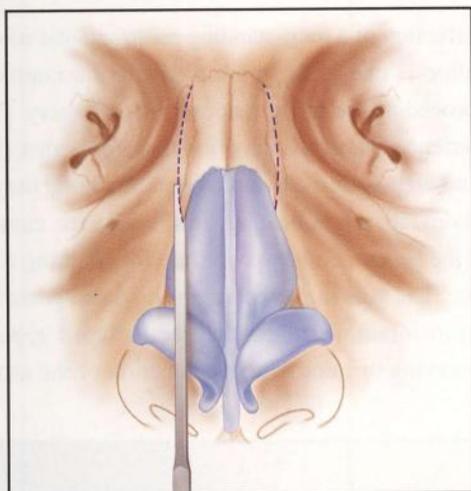
Correction of a long-standing posttraumatic nasal deviation is one of the more difficult and unpredictable procedures in facial reconstructive surgery. Even the most experienced surgeons may find that a nose that appeared straight and well-corrected on the operating table may subsequently redeviate while healing. In these cases, camouflage grafts are the best secondary procedure for attaining a straight appearance. The goal in correcting the deviated posttraumatic nose is to maintain a straight and well-shaped appearance, while preserving or improving the function of the airway.



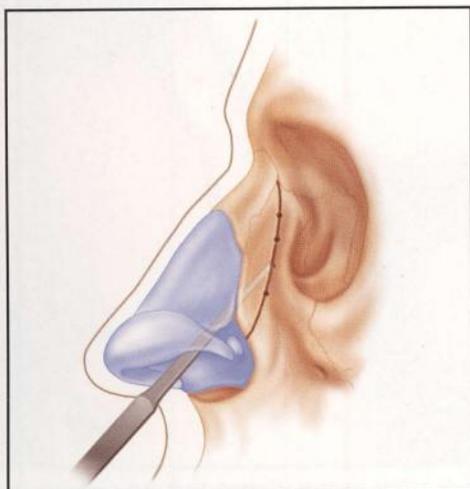
**Figure 1.** The transilluminated skull demonstrates the thin naseotomy is best performed on the right side. This generally follows the high-low-high configuration. If the osteotomy is carried too far superiorly, as depicted on the left, a "rocker" deformity can result.



**Figure 2.** The high-low-high osteotomy helps to preserve the airway after a lateral osteotomy. A transcutaneous perforating osteotomy may be added superiorly as necessary to complete the infrafracture.



**Figure 3.** The intermediate osteotomy is used in specific situations. These include reducing a marked nasal bone convexity or shortening an extremely long asymmetric nasal bone.



**Figure 4.** "Push Out" perforating osteotomy is performed by creating a small number of perforations, directing the osteotome from intranasally to outwards.

## HISTORICAL BACKGROUND

The surgical objective of nasal osteotomies is to: 1) close an open nasal vault, 2) straighten a deviated nasal dorsum, or 3) narrow the nasal sidewalls. Since the nose and the nasal airway of each patient are anatomically unique, the osteotomies may need to perform these tasks either alone or in combination. Jacques Joseph was the one of the first surgeons to promote osteotomies using osteotomy saws.<sup>1-3</sup> The path of his lateral osteotomy traversed from the inferior piriform aperture up into the nasal process of the frontal bone. Other surgeons in the early years of rhinoplastic surgery simply fractured the nasal walls inward or began using chisels or osteotomes to mobilize the nasal wall.<sup>4-8</sup> Nasal airway compromise secondary to overaggressive surgical narrowing of the lateral nasal walls was a common postoperative complication. Cottle used both — a Joseph saw and a chisel — for his lateral osteotomies and preserved the nasal airway with his "push-down" technique.<sup>9</sup> Others recognized that preservation of the periosteum and the attachments of the lateral suspensory ligaments of the lower lateral cartilage helped to prevent postoperative airway obstruction.<sup>10-15</sup> Performing lateral osteotomies using a perforating technique was also advocated in order to preserve lateral nasal wall periosteal support.<sup>16-19</sup>

The nasal bones are relatively thin, when compared to the nasion (Figure 1). The correct position for the osteotomies is shown on the figure's right, demonstrating that the osteotomies are performed through the thinner transilluminated bone. The average thickness of the nasal bones along the path of the osteotomy is 2.5 mm. An attempt to cut into the more superior thickened bone would be difficult and could result in a rocker formation, in which infrafracture of the nasal bone results in protrusion at the more superior fracture site.<sup>20</sup>

Numerous osteotomes are currently available to correct nasal deformities. In general, the most delicate osteotome that will suffice to perform a given task should be selected. For a perforating osteotomy, the 2-mm osteotome will function quite well and will not leave a visible external scar. Numerous other customized osteotomes are available. A common variation is to customize the straight osteotome (Neivert, Stortz, St. Louis, MO) by smoothing the guard and making the cutting blade slightly narrower. Based on the thickness of the nasal bones, a 3-mm or slightly larger osteotome is optimal for a linear osteotomy and a 2-mm osteotome for a perforating osteotomy.

Commonly used osteotomy techniques include the lateral osteotomy, performed either with a perforation or linear technique; the intermediate osteotomy; the medial osteotomy; the superior osteotomy; and what we have termed the "push out" perforating lateral osteotomy. The lateral osteotomy in the high-low-high fashion is widely accepted by most surgeons as

the standard lateral procedure (Figure 2). This procedure may be performed either by a linear osteotomy with one of the above-mentioned osteotomes or by creating a series of small perforations along the nasal bone, using a 2-mm osteotome, either transcutaneously or intranasally. A small triangle of bone is left at the initiation of the osteotomy to preserve the lateral and nasal suspensory ligament attachments to the piriform aperture. This helps to prevent secondary nasal obstruction. The superior back fracture may be created either by manual pressure or by creating a transcutaneous perforating superior osteotomy site. The perforation is generally performed by making a small cutaneous puncture midway between the nasal dorsum and the medial canthal area with a 2-mm osteotome. The osteotome is used through this single skin incision to create three or four small postage-stamp perforations. This procedure will allow the nasal bone to be mobilized as much as required, while preserving the support of the overlying periosteum.

Medial osteotomies, if utilized, are performed in an angulated fashion between the nasal bone and the septum and are carried superiorly to meet the superior osteotomy site or back fractured site. The use of medial osteotomies is essential when straightening the extremely deviated nose or narrowing the exceptionally wide nose. In cases where less correction is required, medial osteotomies are not always essential; in some cases they may actually cause irregularities and postoperative deformities of their own.

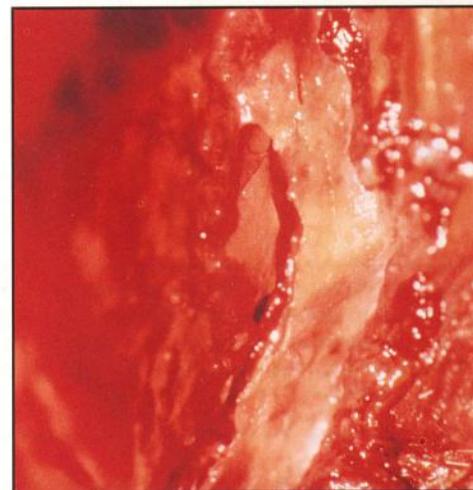
The intermediate osteotomy is used in special clinical circumstances.<sup>21,22</sup> We prefer to use a 3-mm straight osteotome through an intercartilaginous incision to create a discrete osteotomy site from the inferior aspect of the nasal bone to meet the superior fracture site (Figure 3). The intermediate osteotomy may be performed in various positions along the lateral nasal wall, depending on the anatomy and surgical goals. When the nasal walls (bones) are markedly unequal in height, an intermediate osteotomy, performed closer to the nasal facial groove, helps to equalize the height of the bones and obtain a straighter nose. In other cases, a marked irregularity or convexity of a posttraumatic nasal bone may be cut with the intermediate osteotomy to flatten the area.

The "push out" perforating osteotomy is used when the nasal bones have been fractured medially, and the objective is to move them laterally (Figure 4). In the posttraumatic case, a unilateral osteotomy is frequently utilized. The surgeon creates intranasal perforations from along the nasal facial groove or from the previous fracture site. These procedures help to lateralize the nasal bones and render them more symmetric.<sup>23</sup>

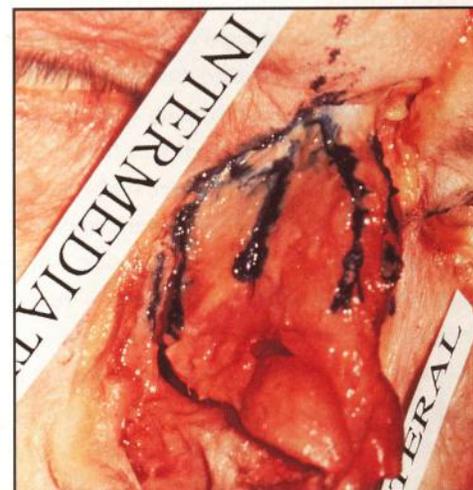
In a study of osteotomy techniques in fresh cadavers, 60 fresh frozen cadaver specimens were used by the authors to perform various osteotomies with different techniques, and



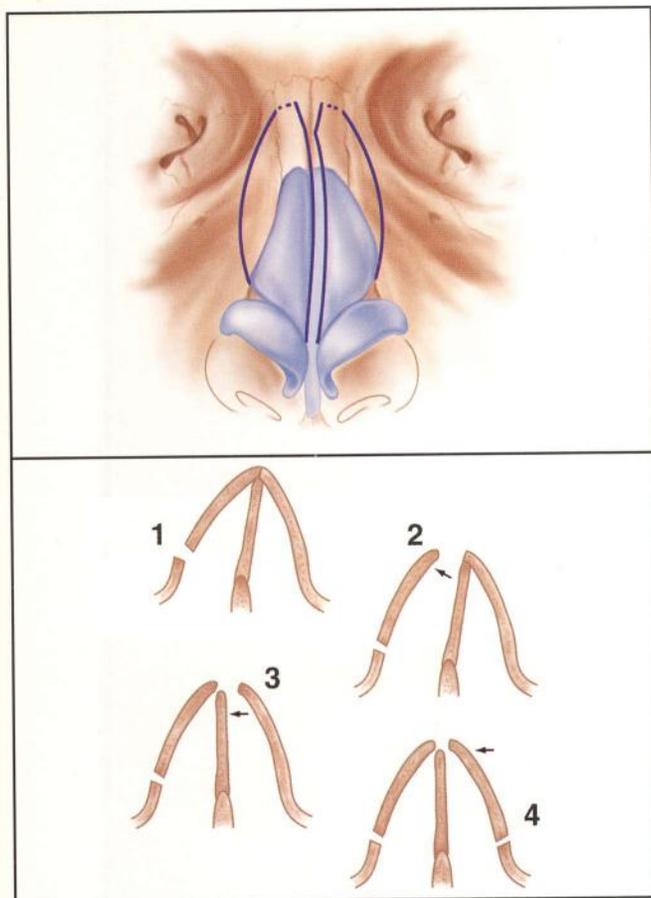
**Figure 5.** This lateral osteotomy was performed with a Neivert osteotome in a linear fashion using the high-low-high technique.



**Figure 6.** This lateral perforating osteotomy is performed in the same configuration as Figure 5, but demonstrates increased soft tissue preservation and support.



**Figure 7.** An intermediate osteotomy, performed on a fresh cadaver, demonstrates a precise osteotomy site with no comminution.



**Figure 8.** Sequential osteotomies. The nose deviated significantly to one side can best be approached with a series of osteotomies, performed as if opening a book. In this example, a space for the deviated left nasal bone to move is created by moving the septum and right nasal bone first.

the anatomic results were evaluated.<sup>16</sup> As seen in Figure 5, a lateral linear osteotomy creates a precise cut but leaves very little soft tissue support. A similar osteotomy is demonstrated, performed with the perforating technique where considerably more periosteal support remains intact (Figure 6). A subsequent study by Rohrich<sup>19</sup> compared these two techniques to an endoscopic evaluation. It confirmed the findings of the cadaver study and noted less intranasal trauma with the perforating technique, when compared to the linear technique. All the intermediate osteotomies in our cadaver study resulted in precise osteotomy sites (Figure 7). There were no comminutions or other displacements. To obtain this precise cut, the intermediate osteotomy must be performed first — before the lateral and medial osteotomies destabilize the nose.

These osteotomies may be combined to correct any given anatomic deformity. The extremely deviated nose is one of these instances. In this case, the osteotomies are performed sequentially from one side of the nose to the other, creating a space in which to move the far-lateralized nasal bone. The technique is similar to turning the pages of an open book, the nasal walls and septum simulating the pages (Figure 8).



**Figure 9A. Case 1.** Preoperative frontal view of a female patient with a fractured nose and significant displacement. **9B.** Postoperative view after performing nasal reconstruction that included perforating osteotomies, performed with a 2-mm osteotome.

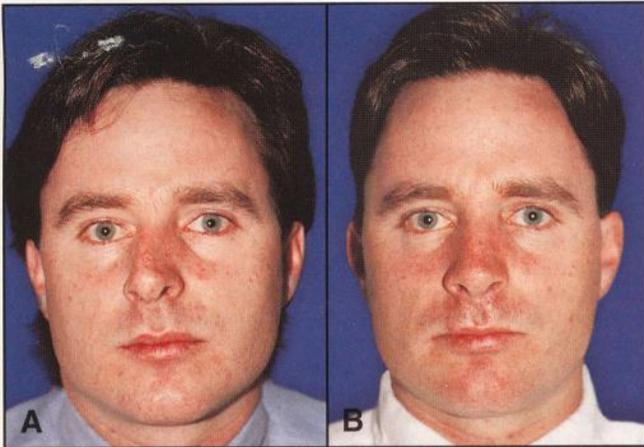
## CASE REPORTS

### Case 1

A 45-year-old woman presented for the initial consultation 6 months after sustaining a nasal fracture in a motor vehicle (truck) accident (Figure 9A). The immediate nasal bleeding and mobile nasal bones had been treated by the family physician. There was no acute reduction of the fracture. Physical examination at 6 months postinjury revealed a broad nasal dorsum with irregularities and inadequate tip support. An open reduction of the nasal fracture was performed. At the time of surgery, only minimal cartilage was present in the septum. Therefore, with the consent of the patient, an ear cartilage graft was used to reconstruct the cartilaginous framework of the nose. A strut tip graft and left lateral crural grafts were fashioned and placed precisely over the lower third of the nose. An onlay graft of auricular cartilage was placed over the left upper lateral cartilage at its junction with the septum. The bony dorsum was treated with sequential osteotomies, beginning on the patient's left, performing left lateral, left medial, right medial, and then right lateral osteotomies. The lateral osteotomies were created with a perforating technique using a 2-mm osteotome. The medial osteotomies were performed with a straight 3-mm osteotome. Postoperatively, the patient healed uneventfully, with an excellent airway and straight nasal bones (Figure 9B).

### Case 2

A 31-year-old male patient presented with a traumatic nasal and septal deformity, caused by multiple sports-related injuries (Figure 10A). He complained of severe nasal obstruction with reduced tolerance of exercise. The examination revealed a severe deviation of external nose and internal septum. The nasal tip support was inadequate, with excessive columellar show. A septorhinoplasty was performed, along with a septoplasty and



**Figure 10A.** Case 2. Preoperative frontal view of a male patient with a severe nasoseptal deviation, caused by multiple trauma. **10B.** Postoperative frontal view, demonstrating correction of the nasoseptal deformity.

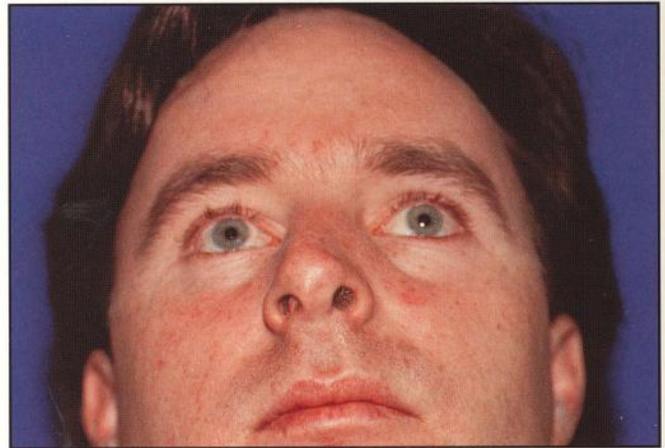
medial and lateral osteotomies to reduce the patient's nose to the midline. A left intermediate osteotomy was performed subsequently to compensate for the longer left nasal wall and to improve the symmetry. A percutaneous columellar strut, made of septal cartilage, was placed between the medial crura of the lower lateral cartilages to improve nasal tip support (Figure 10B). The pre- and postoperative base views are presented as well (Figures 11 and 12). The postoperative healing was uneventful. The airway of the patient was dramatically improved — the nose demonstrated correction of the nasal-septal deformity and improved symmetry, with reduced columellar show.

## CONCLUSION

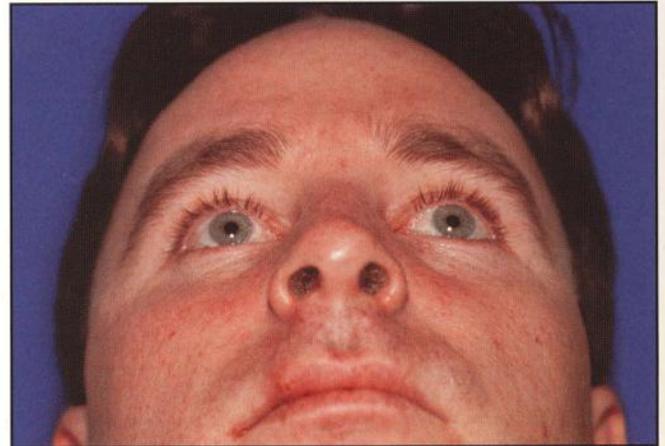
Craniofacial surgeons should be aware of the wide variety of nasal osteotomy techniques, as well as the indications for each of their applications. In order to achieve optimal results, it is important to use the proper osteotomy, based on the preoperative assessment, and to preserve periosteal support as much as possible. Recognition of these factors helps to achieve favorable and stable rhinoplasty results and prevents postoperative iatrogenic nasal airway obstruction.

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**Figure 11.** Preoperative base view of a male patient with a severe nasoseptal deviation, caused by multiple trauma.



**Figure 12.** Postoperative base view of the final result.

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