# Rhinoplastic Considerations in Post Traumatic Patients

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**Introduction**: Trauma to the face usually involves nose and perinasal structures due to anatomic position. Treating injuries caused by trauma to these structures is hard for maxillofacial surgeon, especially if secondary rhinoplasty is being considered. **Materials and Methods**: In this article, after a short introduction to anatomy and diagnosis process, secondary rhinoplasty is discussed. **Results:** A total of 13 articles is used for available articles between 1967 to 2014. **Conclusion**: there are different types of deformities caused by trauma which are treated by secondary rhinoplasty, there are different method for treating these deformities and a rhinoplastic surgeon should have proper knowledge and expertise to be able to use these methods.

**Keywords**: Nasal trauma; Septoplasty; Rhinoplasty

## Introduction

The nose and perinasal tissues have an important role in respiration, humidification, speech production and the sense of smell. On the other hand, it is needless to say that the nose is a key aspect of facial appearance, a very recognizable feature of the face and perhaps the most prominent part of facial aesthetics. However, this important position can increase the chance for trauma (1,2). Nasal fractures has known as the commonest bony traumas related to the craniofacial area and the third commonest fracture in the whole adult human skeleton (3). The most common mechanism of injury is blunt trauma due to motor vehicle accidents, damages caused by sports, and altercations (2).

Precise diagnosis, as well as proper surgery are crucial to manage nasal fractures since a mild nasal bone or cartilage deformity results in an external nose abnormality and obstruction. Several techniques and instructions have been developed for refining and optimizing acute nose injury. Closed reduction/ monitoring with consecutive follow-ups has been used as the commonest therapy. However, even using the most appropriate therapy instructions, suboptimal functional and aesthetic outcomes are possible. Several factors, like length of operation, edema, unrecognized former nasal abnormality, septal deviation, and many related damages can affect the total outcomes (2, 3, 4). However, not all fractures have corrective control. For unfavorable outcomes of a closed reduction, open reduction or secondary rhinoplasty are regarded. In cases without reduction in an optimal time (10 days from the injury), greater bone healing and fibrotic alterations limit the decrease and enhances the possible requirement to osteotomy. Hence, several investigators underwent a delayed surgery at least 6 months following the injury, as soon as achieving stability at the fracture point. Posttraumatic nose deformities that need further rhinoplasty/ septorhinoplasty account for 50% of the patients (2, 4, 5).

Nasal deformity after injury is as the commonest causes for septorhinoplasty. The performance and cosmetic defects following trauma can make people seeking for treatment who did not considered for operation. Rhinoplasty after trauma is frequently done and is hard to perform as an aesthetic facial surgery. Because the cases' satisfaction is a crucial factor to assess the rhinoplasty outcomes and such patients may have expectations different from cosmetic rhinoplasty cases. Thus, the surgeon should have armamentarium methods for properly treating and correcting the abnormalities in an injured nose (3, 6, 7).

This review aimed to discuss different available modalities for treatment of nasal trauma. Howevre, an emphasis has been given on post traumatic septorhinoplasty. We will also discuss some of the specific post traumatic deformities of the nose.

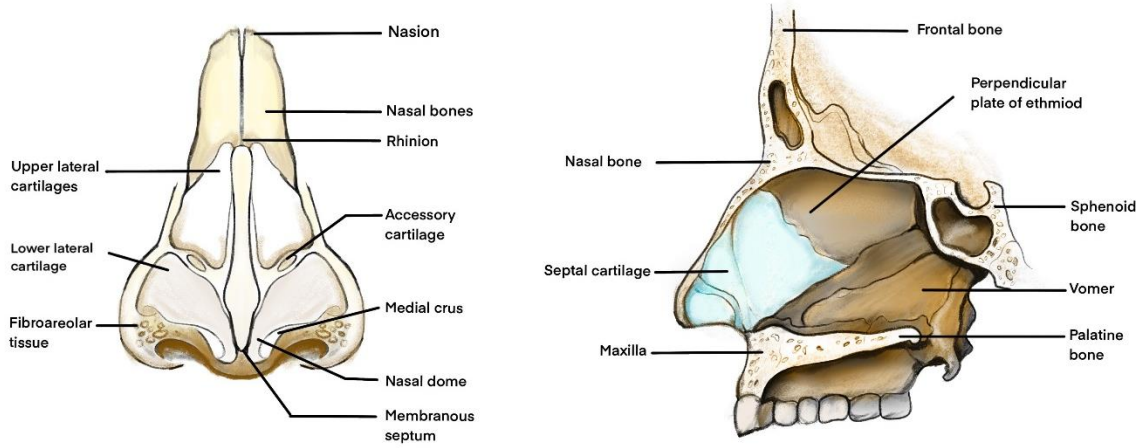


**Figure 1**. Dorsal nasal and septal anatomy

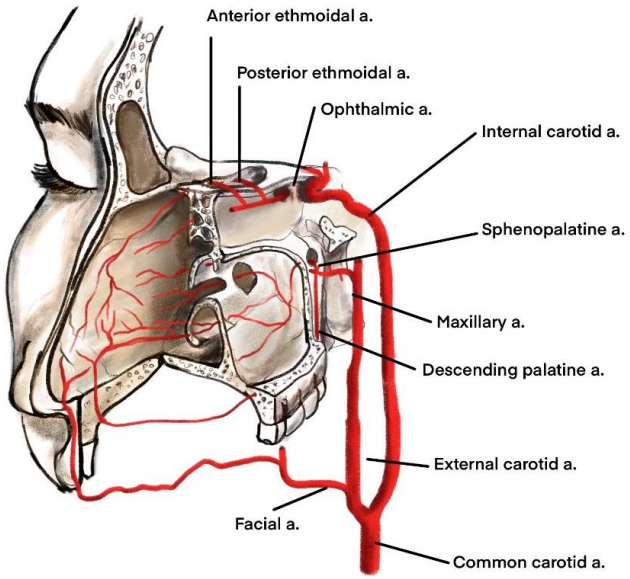


**Figure 2**. Anatomy of blood suply to nasal structures

## Materials and Methods

A total of 13 articles is used for available articles between 1967 to 2014.

## Results and Discussion

### *Anatomic considerations*

The nasal pyramid has thin bones placed in the center of the face (4). The nasal skeleton has the frontal process of the maxilla, the frontal bone process, the ethmoid, vomer, and the nose bones. The nose bones fractures are more distal and are broader and thinner. Considerable energy is needed for fracturing the more proximal nose bones that trauma expansion toward the frontal process of the maxilla and frontal bone is possible. The cartilage has two lower and upper lateral and a central septal cartilages. Surrounding bony matrix dorsally and laterally by cartilage leads to a soft structure allowing force waste with no constant abnormality. Generally, Considerable energy is needed to cause a cartilaginous trauma (1, 2, 8) (Figure 1).

The rich blood supply of the nose put the patient at risk of epistaxis in nose injury. They are classified as anterior or posterior, according to the bleeding origin. The commonest place is anterior epistaxis, in the Kiesselbach's plexus in the anteroinferior septum. Posterior epistaxis usually comes from branches of the sphenopalatine as well as anterior ethmoidal arteries and s also lesser observed compared with anterior bleeding, however, is more frequently leads to serious hemorrhage (2, 9) (Figure 2).

The ophthalmic and maxillary branches of the trigeminal nerve provide nasal sensation. The infratrochlear nerve supplies sensation toward the upper nasal dorsum and sidewalls skin and the anterior ethmoidal provides the lower dorsum and tip.

Identifying the nasal septum anatomy can provide appropriate management of the nose fractures. The septum has quadrilateral cartilage, the perpendicular plate of the ethmoid bone, the vomer, and the maxillary crest. The septum caudal center is quite thin and is a thicker posterior septal cartilage providing the initial aid to the dorsum and crucial for recognizing the septum as a certain facial growth part. In many

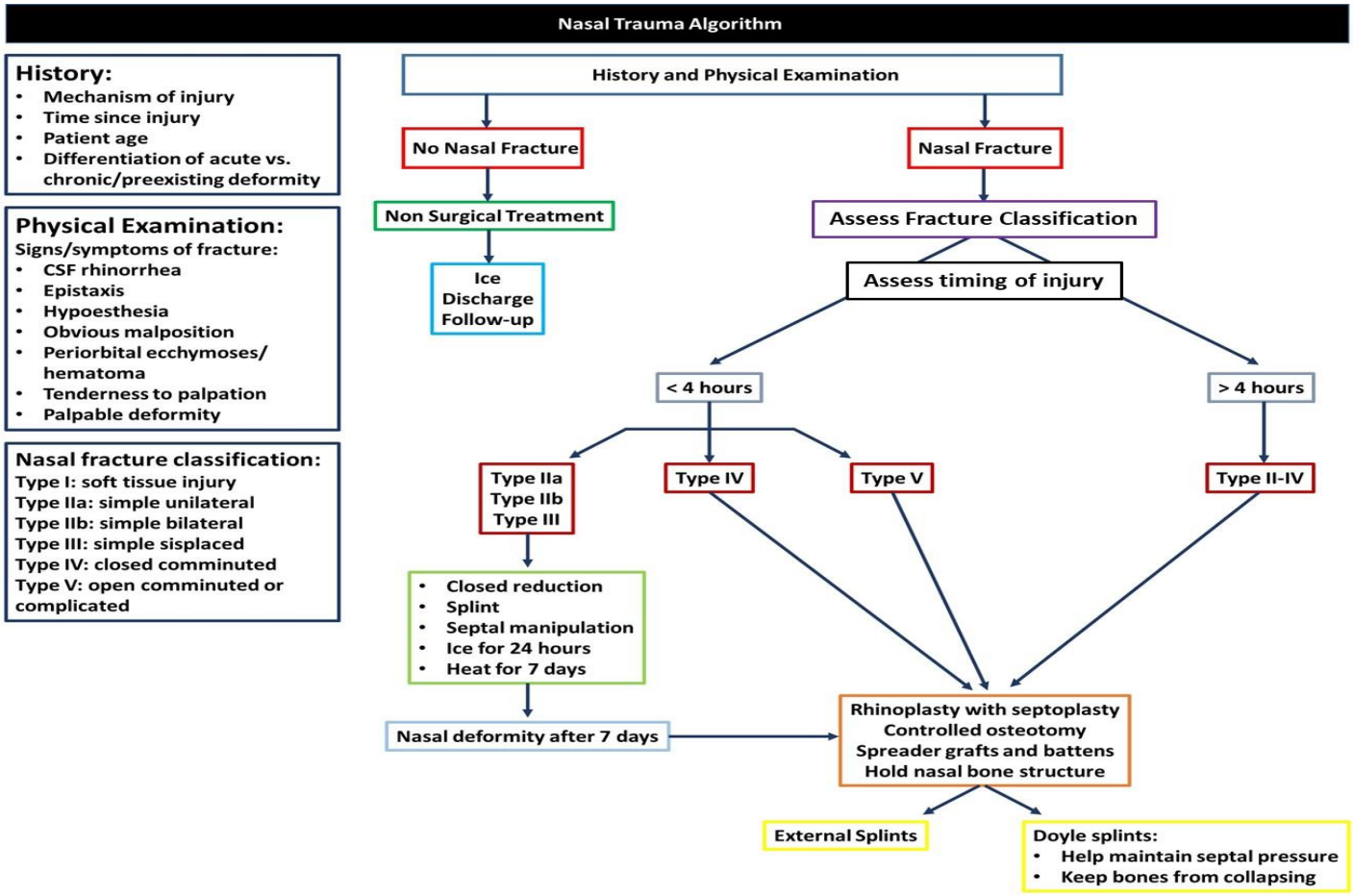


**Figure 3**. Algorithm provided by higuera *et al.* for managing nasal fractures

cases, this area experiences a growth to the age of nearly 12-13 years. Considerable septal injury affects negatively midfacial growth (2, 10).

## *Diagnosis of nasal traumatic injuries*

### History and physical examination

A detailed history including the mechanism and time of the injury, age of the patient and preexisting nasal deformity is essential for treatment planning.

Regarding the trauma mechanism, the force vector and size are important. For example the generally observed "aggravated assault" mostly leads to a comparatively lateral blow with low energy, leading to an infracture of the ipsilateral nose bone as well as an outfracture on the contralateral direction. Such trauma is frequently correlated with the shift of the nose septum. Also, with initial low-velocity trauma, the nasal tip alone can become malpositioned. Typically, the lower portion of the fracture rotates inward and the upper portion is pushed upward and outward. This causes a supratip depression and a small more cephalic hump. With increasing force, the cartilaginous and bony dorsum becomes fractured (1, 2, 11).

Time is also an important factor in decision making for treatment of nasal traumatic injury. Through the first hours following trauma, prior to substantial swelling, deformity is possible to be completely visualized that lets the surgeon performing a closed reduction. Following this time, swelling can obscure the nose appearance, and intervention is needed to be postponed until resolving. Ideally, nasal mucosal swelling as well as inflammation should have resolved. Also, the deformities of the osteocartilaginous structures completely apparent by resolution of cutaneous edema. The surgical axiom of 6-12 months after the injury is often quoted (2, 11).

Children have a diagnosis and control difficulty due to their nose bones plasticity and smaller size than adults. Fracture caused by trauma is more likely in pediatrics; however, septal traumas are mostly missed in children. In subacute or mild

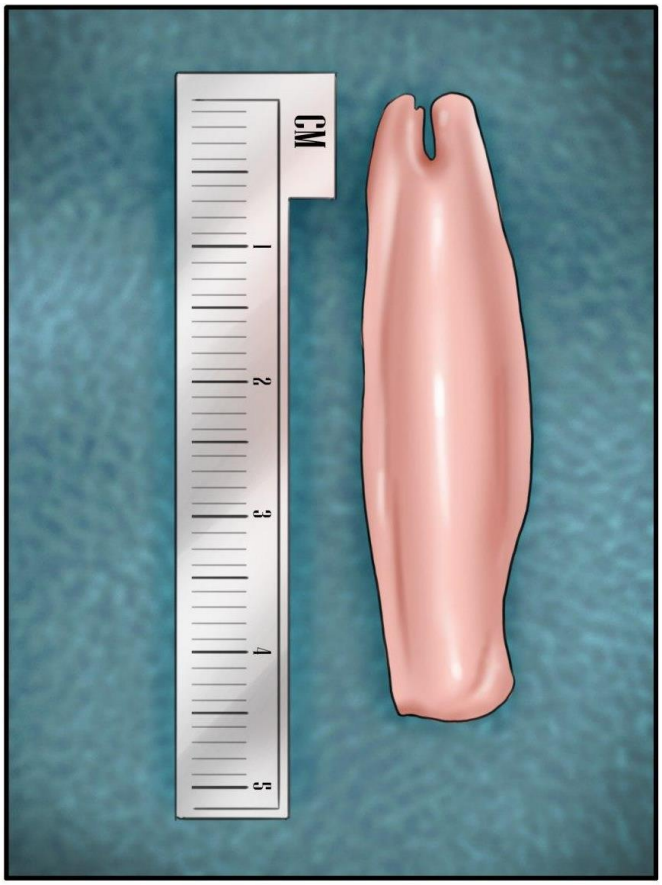


**Figure 4**. An integrated collumellar strut

injury, the septum is possibly deviated, providing an area to form a hematoma. When it is not treated, the septal trauma can proceed to localized septal necrosis and/or developmental centers disruption that can finally result in a more substantial abnormality. This process can explain several nasal abnormalities among adults.

Patients' nasal malformation is possibly caused after a former nasal trauma; therefore, its history and results are crucial. Managing acute nose fracture along with a previous nose injury (untreated or undertreated) has shown complicated since the nose owns its an inconceivable mechanism to return to its original deformed condition (2).

After obtaining a complete history, physical examination of the nose begins. In general, signs of acute fracture include Cerebrospinal fluid rhinorrhea, Epistaxis, Hypoesthesia, Obvious malposition, Periorbital ecchymoses/hematoma, Tenderness on palpation, Palpable deformity, septal deviation and hematoma. For post traumatic rhinoplasty, the physical examination will focus on symmetry, depression of nasal saddle, airway evaluation, nasal skin scars and internal changes (10, 11).

***Radiographic evaluation***

After a history and thorough examination, radiographic assessment is often helpful to exclude other facial fractures and better plan any bony surgery. Plain X-rays may be adequate to assess the extent and displacement of nasal bone fractures when no other injuries are suspected, however, they are not very useful in primary and late nasal fracture repair. Anatomic assessment of the internal nasal airway are not simply provided. Computed tomographic scans are the most helpful and considered a gold standard in this regard and their axial and coronal slices provide the most complete view of the internal nasal airway, but they are not particularly helpful for evaluation of external nasal morphology (1, 2, 11, 12).

***Nasal trauma classification and management***

Higuera *et al.* (2) believed that adequate managing of nose injury needs considering four vital tips:-trauma seriousness;-time; - using local vs. general anesthesia; and-when the decision is made for reducing the nose fracture, performing a closed vs. an open reduction can result in more favorable results.

The algorithm proposed by Higuera *et al.* (2) which is based on murrey *et al.* (13) classification of nasal fractures, provides an adequate guideline for management of acute nasal fractures (Figure 3).

Based on murray *et al.* (13) works, type I trauma is described as soft tissue trauma with no concomitant trauma to the nasal underlying structures; type IIa as a simple one-sided nondisplaced fracture while type IIb affects simple one-sided displaced fracture; and type III is defined as simple displaced fracture while type IV as closed comminuted fracture. The open comminuted fracture or the mentioned types with concomitant cerebrospinal fluid rhinorrhea, severe displacement, septal hematoma, crush injuries, airway blockage, or related nasoorbito-ethmoid midface fractures include type V traumas.

Closed reduction has known as the simple, safe, and easy technique compared with others due to minimum possible morbidness and the possibility of most acute isolated nose fractures with minimum bony as well as septal trauma through nearly 10 days of trauma. It also can be failed for properly addressing abnormalities of the cartilaginous structure and nose septum. Nasal septum deviation leads to stress on the nose bones resulting in displacing following reduction. The prevalence of postreduction deformities following closed reduction leading to secondary rhinoplasty is 14% - 50%. Performing open/closed reduction is associated with the septum status and the need for preserving the link among the septum, upper lateral cartilages, and nose bones. Early complete septorhinoplasty has shown for avoiding undesirable results from closed reduction as several cases would be unwilling experiencing a secondary process (14, 15).

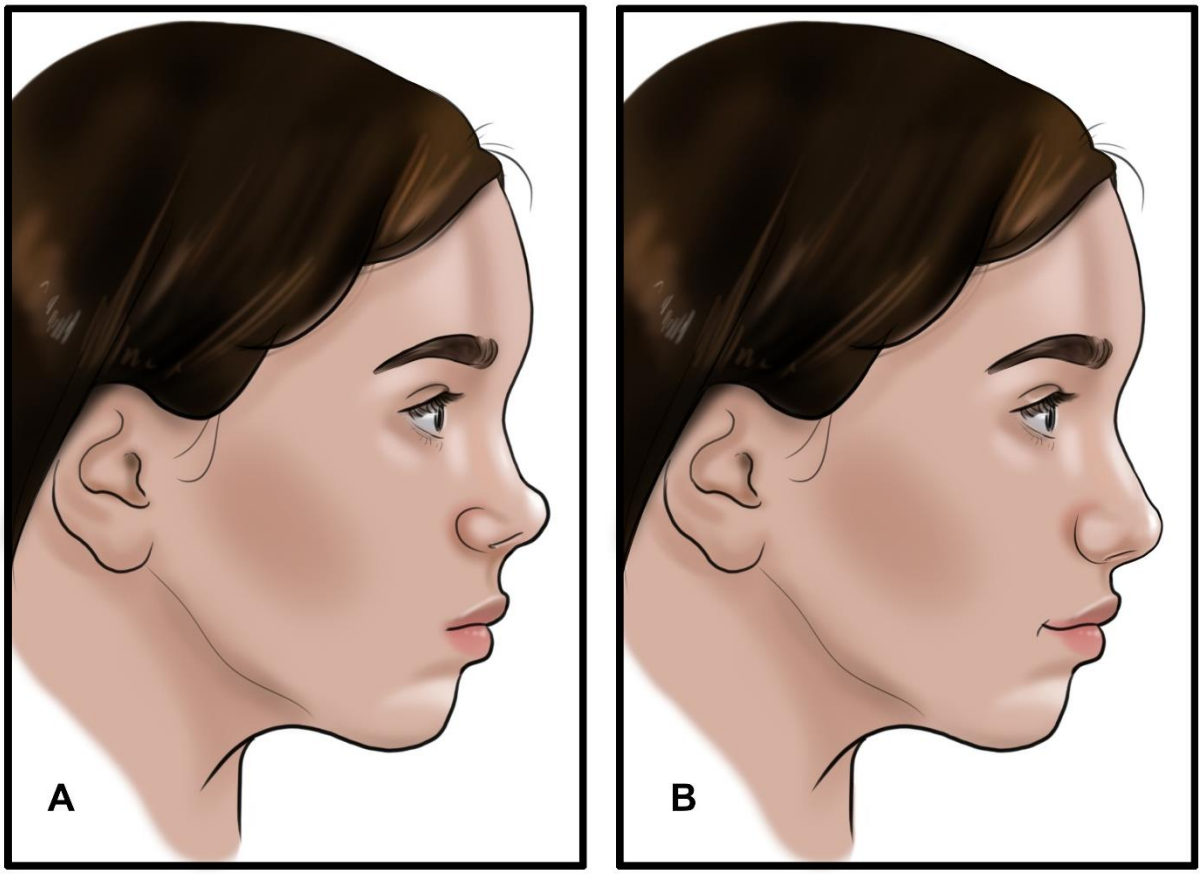


**Figure 5**. Saddle nose deformity

Our emphasis is on post traumatic septorhinoplasty and according to the algorithm provided previously, the additional indications for this approach are: type V and IV fractures, type IIa, IIb and III fractures when more than 4 hours have elapsed since trauma and finally, type IIa, IIb and III fractures which have been reduced but still have deformities 7 days after the initial trauma.

The remainder of this article is dedicated to discussing different nasal deformities resulting from trauma and their management.

***Post traumatic septo rhinoplasty***

While traumatic nasal rearrangement can produce a wide variation of deformities, a pattern of nasal dysmorphologies can be identified. These include the expected alterations which can occur with any projected tripod structure: loss of height, deviation, asymmetries. Most traumatized noses have a component of all of them. The anatomic contribution to each component must be understood if an ideal correction is to be achieved (11).

***Saddle nose***

The saddle nasal malformation has found as serious consequences of nose injury Caused by a septal hematoma that has not treated turning infected and leading to an abscess as well as septal cartilage resorption (6). A saddle nose deformity leaves the patient with a lack of structure in the nasal dorsum, either of bone and/or cartilage. This defect leads to a scooped-out appearance from the lateral view and an appearance of a flattened nasal bridge from the frontal view. An illusion of tip rotation accompanies the depression and in some cases in which significant middle vault collapse has occurred, this may be real as well. Loss of height leads to this illusion (6, 11).

Assessing a case with a saddle nasal malformation should consider aesthetic feature and function, as well. It is essential to analyze the lateral view for quantifying and localizing regions of insufficient cartilage. The bony dorsal and tip status must consider as guides for determining the proper place for lying mid-dorsal projection. Intranasal evaluation can be helpful for checking the existence of septal pereforation as well as assessing the internal valve area condition. The content and status of rest

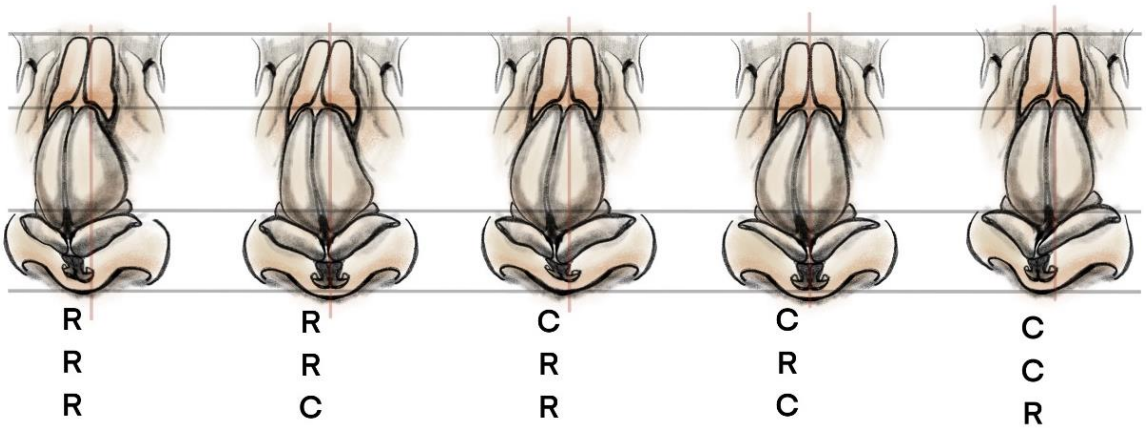


**Figure 6.** Different types of deviation (10)

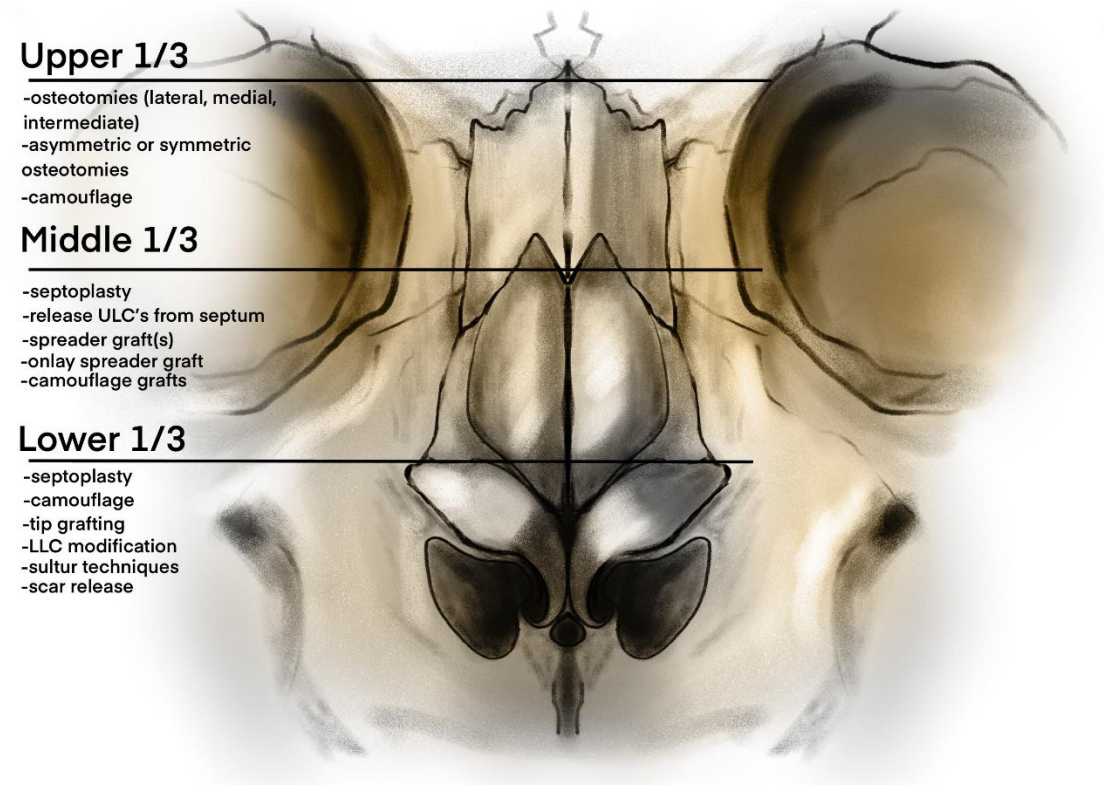


**Figure 7**. Treatment algorithm for deviations (10)

of septal cartilage should be recorded. The integrity and protection resulted from the remained septum should be gauged via slight touch at the nose dorsum and tip. Minimum persistence or recoil for downwarding digital pressure shows a considerable compromise for supporting and must warn the surgeon about inadequate simple onlay grafting alone. Those suffering lack of caudal septal protection and scar contracture often have foreshortened noses needing structural grafting for correction of the nasal length. Correcting such deformities needs dorsal augmentation as well as reconstitution of tip support. An unified dorsal graft/columellar strut provides such goals (Figure 4).

Less serious saddle abnormalities characterized by strong dorsal and caudal septal protection have open airway and soft tissue limitations are not treatable using dorsal onlay grafts. Onlay cartilage grafting toward the dorsum is achievable by endonasal and external rhinoplasty techniques. The grafting

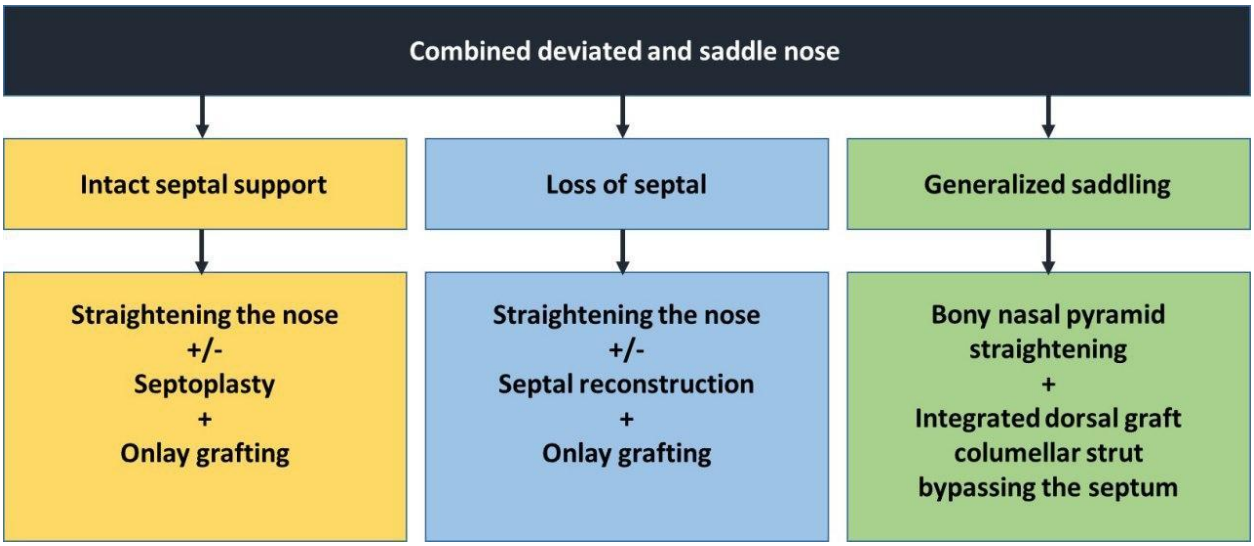


**Figure 8**. Algorithm for management of combined deviated and saddle nose defformity

agents' type is associated with the deficiency level due to the saddle. When dorsal projection of smaller than 3 to 4 mm is needed, septal or auricular cartilage is applied. The former is more appropriate since it is straighter, firmer, and less sensitive to abnormality. Regrettably, septal cartilage is commonly compromised or defective in several saddle noses. In patients with inadequately thick septal or auricular cartilage for correcting a relatively larger dorsal insufficiency, costal cartilage is used and carved into a peoper onlay graft.

Autogenous bone grafts offer the advantage of greater support and augmentation that may be required in larger defects. The most common donor sites are rib, iliac crest and calvarium. Although bone grafts result a material to reconstruct the saddle nose, a high risk of absorption causes them less desirable compared with rib cartilage (6, 11) (Figure 5).

***Deviated nose:***

Blunt trauma from a lateral direction may cause the nasal dorsum or tip to become deviated. This is seen as a portion or the entire nose being deviated off a straight line drawn from the glabella down through the central aspect of the Cupid's bow. This is common due to displacement of one or both nasal bones, however; may extend down through the structures of the middle vault. (11) While evaluating the deviated nose, determining the factors associated with the external deviation is crucial. It can isolate bony or cartilaginous abnormalities, however, the bony and cartilaginous vaults have known as the pathophysiologic reason to confirm the deviation (5).

The surgeon must indicate the structural concerns: 1-the bony section, 2-upper lateral cartilages and 3-lower lateral cartilages. Determining which deviations can be modified by osteotomies and which ones via cartilage grafting or rearrangement is crucial (10) (Figure 6).

The following image summarizes treatment modalities for deviation of each nasal third (Figure 7).

*Osteotomy*

For the upper third, usually osteotomies are performed to correct the position of nasal bones. Osteotomies aim at creating mobile bony parts returnable to a desirable anatomic status and direction. (6) If the bony rhinion is diverged from the midline, it can translocate the dorsal septum as well as upper lateral cartilages (5). Osteotomies aim at straightening a diverged nasal dorsum, narrowing the nose sidewalls, and closing an opening nasal vault. Lateral, medial, and intermediate osteotomies are used as common methods. The lateral osteotomy has been mostly conducted in a "high-low-high" method, keeping the lateral and nasal suspensory protection (10, 11).

Following repositioning the bony pyramid to achieve satisfactory results, supportive external tape and casting are needed to maintain at least one week. When the nasal bones tend to be medialized promptly, internal splints is useful for providing outward protection for the lateral nasal bones (10).

***Septoplasty:***

The nasal septum functions as the backbone of the nose and has a tremendous effect on the appearance of the dorsum. Deflections of the septum can make both the middle as well as the lower third of the nose appear deviated The ULCs and lower lateral cartilages are bonded to the septum via strong fibrous adhesion, dorsal and caudal septal divergences can be appeared as external nasal asymmetry. Thus, for the traumatic

crooked nose, the adage "as the septum goes, so goes the nose" is particularly appropriate. The traumatized noses most frequently presents as an S-shaped or reverse S-shaped anteroposterior deformity due to buckling and fracture of the septum from oblique forces.

The correction technique is associated with the areas affected and deformity seriousness. For example, for major deflections in which the caudal septum remains deviated, spreader grafts should be utilized with the upper lateral cartilage contrary to the deviated direction sewn different from the spreader graft-septal composite for pulling it toward the midline. Combined maneuvers, such as cartilage scoring, positioning of batten grafts of bone, cartilage, or alloplastic compounds, or cartilage resection are applied for straightening the septum. Serious caudal septal deviations, like deviations characterized by complicated septal fractures extending toward the dorsal border of the septum need more aggressive therapy. These abnormalities can lead to one-sided nasal obstruction as well as columella and nasal tip deviations. Uncomplicated camouflaging or repositioning methods can lead to incomplete correction among such patients. The most appropriate method for these abnormalities is removing the deviated part of caudal septum by replacing a straight autologous cartilaginous graft (5, 6, 10, 11).

***Mined deviation and saddle nose deformity***

Diverged nose modification along with saddling result in specific concerns to the surgeon. Grafting for improving the saddling is commonly challenged with the instable structural protection due to the pre-existing anatomic changes and the maneuvers for correcting the divergence. Therefore, desirable modification of saddling or more augmentation in deviated nose is constructing a straight and stable septum (16). Won *et al.* (16) simplified the management of this type of deformity, in an algorithm provided in Figure 8.

## Conclusion

There are many different types of deformity which require specific treatment planning, however the discussion of said deformities is beyond the scope of the present article.

Conflict of Interest: 'None declared'.

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