

Assessment of Technical Modifications in Open Rhinoplasty for Post-Traumatic Saddle Nose CorrectionVivek¹, Rohit Anand², Muskan³¹Associate Professor, Department of Surgery (Plastic Surgery) Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India²Junior Resident (Academic), Department of General Surgery, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India³Junior Resident (Academic), Department of General Surgery, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India

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Corresponding Author: Dr. Vivek

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Abstract:**Background:** Post-traumatic saddle nose deformity is a challenging condition causing collapse of the nasal dorsum, leading to significant functional and aesthetic impairment requiring complex reconstruction.**Aim:** To assess technical modifications in open rhinoplasty for correction of post-traumatic saddle nose deformity and evaluate functional and cosmetic outcomes.**Methodology:** Prospective observational study of 90 patients with post-traumatic saddle nose deformity conducted over one year at Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India. Patients underwent open rhinoplasty using tailored grafts including septal, conchal, costal cartilage with technical modifications such as spreader grafts and columellar struts. Outcomes were assessed for aesthetic, functional improvement, and complications.**Results:** Most patients were aged 26–35 years (37.8%) with male predominance (71.1%). Road traffic accidents (45.6%). Septal cartilage graft was most used (31.1%) followed by costal cartilage (23.3%). Postoperative outcomes showed 86.7% cosmetic improvement, 80% airway improvement, and 92.2% graft stability with minimal complications; 67.8% had no major complications.**Conclusion:** Open rhinoplasty with individualized graft selection and technical modifications is an effective and safe method for correction of post-traumatic saddle nose deformity, providing reliable structural, functional, and aesthetic outcomes with low complication and revision rates.**Keywords:** Saddle Nose, Open Rhinoplasty, Post-Traumatic Deformity, Cartilage Graft, Reconstruction.**DOI:** 10.25258/ijpqa.17.4.34

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Introduction

Saddle nose deformity presents significant challenges for both reconstructive and aesthetic nasal surgical corrections. The deformity occurs when nasal framework support disappears which causes the nasal dorsum to develop a depression or collapse. The saddle nose deformity occurs when the lower two-thirds of the nose loses its structural strength which causes both functional and aesthetic damage. This deformity involves two main components because it causes an entire absence of septal support while simultaneously affecting both the septum and upper lateral cartilages and the nasal bone-septal cartilage complex and the skin soft tissue envelope which ultimately results in missing middle nasal vault structure which hinders nasal valve operation. The condition causes patients to experience both aesthetic problems and breathing difficulties which include nasal congestion and decreased airflow and

respiratory issues. The condition affects facial balance which decreases self-esteem and it also disrupts normal nasal functions [1].

Trauma is one of the most frequent causes of saddle nose deformity, particularly after road traffic accidents, sports injuries, physical assault, occupational injuries and untreated nasal fractures. Post-traumatic collapse of the nasal dorsum often occurs due to destruction or weakening of the septal cartilage and supporting bony structures. In severe cases, there may be complete disruption of the osteocartilaginous framework, leading to marked depression of the nasal bridge and shortening of the nose. Scar contracture and loss of the remaining support structures can cause the deformity to worsen over time. Other causes of saddle nose deformity include trauma, infections, previous nasal surgery,

autoimmune disease, and cocaine abuse, but trauma remains a major cause of saddle nose deformity in clinical practice [2].

The repair of saddle nose and other deformities is therefore one of the most difficult challenges in nasal surgery, and long-term structural support must be provided without compromising the aesthetics [3]. The difficulty of the deformity is that both form and function must be restored. The reconstruction of the nasal dorsum, restoration of the integrity of the nasal septum, improvement of the function of the airways and the creation of an aesthetically pleasing nasal contour are all necessary for successful correction. Before surgical correction, the surgeon should thoroughly assess the degree of structural collapse, skin quality, internal nasal valve competence, and the availability of graft material. In addition, stability and long-term maintenance of the reconstructed framework are important factors in the management of these patients.

Open rhinoplasty has emerged as one of the preferred surgical approaches for the correction of post-traumatic saddle nose deformity because it enables surgeons to examine the nasal framework and assess the deformity through complete surgical access [4]. The open approach enables accurate placement of grafts, correction of asymmetry, reconstruction of the septum, and stabilization of weakened support structures. The open rhinoplasty method enables surgeons to treat complex nose deformities more effectively than the closed approach which limits their ability to assess both bony and cartilaginous nasal structures. The method proves essential for treating severe saddle nose deformities which need extensive surgical work and multiple grafting treatments.

Over the past 60 years, diverse options have evolved for surgical reconstruction. For minor dorsal deformities with limited septal structural damage, cartilage or fascial overlays have been considered [5]. The methods prove effective for treating minor deformities which need only slight dorsal extension. The treatment requires basic soft tissue treatment because it does not deliver enough support for post-traumatic saddle nose deformities which show moderate to severe symptoms. The restoration of dorsal height and functional stability needs to use stronger graft materials together with advanced reconstructive techniques.

Bone grafts which start from native nasal bones and reach the cartilaginous dorsum now serve as common medical procedures. The use of bone grafts enables physicians to create permanent structures which withstand time while treating patients who experience substantial structural deficiencies [6]. Physicians use autologous graft materials from septal cartilage, auricular cartilage, costal cartilage, and bone grafts based on the deformity severity and available donor tissue. The medical field currently

prefers costal cartilage because it offers substantial volume and delivers robust structural backing for extensive dorsal enhancement. Each graft material provides specific benefits which help researchers understand its drawbacks about resorption and warping along with donor site complications and long-term stability.

The latest rhinoplasty techniques show that surgical success depends on the implementation of specialized techniques which help to minimize risk of surgical complications. The functional and aesthetic outcomes of the procedure improved due to the introduction of new techniques which allowed for modifications of graft carving and fixation methods and dorsal augmentation and nasal valve stabilization and septal reconstruction procedures. The application of spreader grafts and columellar struts and dorsal onlay grafts and extended septal grafts and cantilever grafting methods enables surgeons to build stable solutions for difficult saddle nose deformities [7]. The process of soft tissue treatment requires surgeons to handle tissues with great precision while they need to maintain blood flow to body parts and they have to position graft materials exactly.

The surgical process for fixing post-traumatic saddle nose deformity remains difficult to execute even after reconstructive rhinoplasty has achieved major advancements. The surgical discipline faces a primary challenge which requires surgeons to achieve long-lasting structural stability while preserving both natural appearance and functional airway flow. The process of surgical planning and assessment of results becomes more challenging because different patients present various degrees of deformity and different tissue characteristics and different treatment needs. The most effective reconstructive strategies require continuous evaluation of both technical modifications and surgical results according to our findings. The study aims to contribute to the existing body of knowledge by analyzing the role of different reconstructive techniques in achieving stable, predictable, and satisfactory postoperative results.

Methodology

Study Design: The present study was designed as a hospital-based prospective observational study conducted to assess the technical modifications and postoperative outcomes in open rhinoplasty for post-traumatic saddle nose correction. The study aimed to evaluate various surgical modifications adopted during open rhinoplasty and their effectiveness in improving nasal contour, structural stability, and functional outcomes among patients presenting with saddle nose deformity following trauma.

Study Area: The study was conducted in the Department of Surgery (Plastic Surgery), Netaji

Subhas Medical College and Hospital, Bihta, Patna, Bihar, India

Study Duration: The study was carried out over a period of one year from December 2024 to November 2025.

Study Participants: A total of 90 patients diagnosed with post-traumatic saddle nose deformity and undergoing open rhinoplasty surgery were included in the study.

Inclusion Criteria

- Patients aged 18 years and above.
- Patients diagnosed with post-traumatic saddle nose deformity.
- Patients willing to undergo open rhinoplasty for correction of nasal deformity.
- Patients providing written informed consent for participation in the study.
- Patients fit for surgery under general anesthesia.

Exclusion Criteria

- Patients with congenital nasal deformities.
- Patients with saddle nose deformity due to autoimmune or infective causes.
- Patients with previous failed rhinoplasty requiring extensive revision surgery.
- Patients with severe systemic illness contraindicating surgery.
- Patients unwilling to participate or unavailable for follow-up.

Sample Size: The total sample size for the present study was 90 patients fulfilling the inclusion and exclusion criteria during the study period.

Procedure: Patients presenting with post-traumatic saddle nose deformity in the Plastic Surgery outpatient and inpatient departments were evaluated clinically. A detailed history regarding mode of trauma, duration of deformity, previous nasal surgeries, breathing difficulty, and cosmetic concerns was recorded. Comprehensive physical examination and preoperative facial analysis were performed to assess the degree of dorsal depression, septal support, nasal symmetry, and associated deformities. Routine hematological and radiological investigations were conducted prior to surgery.

All patients underwent open rhinoplasty under general anesthesia using a trans-columellar open approach. The surgical technique was selected according to the severity of deformity and intraoperative findings. Technical modifications included preservation or reconstruction of septal support, use of autologous graft materials such as septal cartilage,

conchal cartilage, costal cartilage, or vomer bone grafts, and contour correction of the nasal dorsum. A transfixion or hemitransfixion incision was used to elevate mucoperichondrial flaps and expose the septal framework. Depending upon the defect size and structural loss, grafts were harvested and shaped appropriately to restore dorsal height and nasal contour.

The grafts were carefully contoured to mimic the natural nasal dorsum and placed over the defect area. In selected cases, spreader grafts, columellar struts, or dorsal onlay grafts were utilized to provide additional support and improve airway function. The grafts were stabilized appropriately, and closure was performed using fine non-absorbable sutures. External nasal splinting and taping were applied for postoperative stabilization for approximately 7–10 days. Patients were followed postoperatively at regular intervals to assess cosmetic appearance, nasal airway improvement, graft stability, complications, and patient satisfaction. Postoperative complications such as edema, infection, graft displacement, residual asymmetry, or breathing difficulty were documented and analyzed.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 27.0. Descriptive statistical methods such as frequency, percentage, mean, and standard deviation were used to summarize demographic and clinical variables. Appropriate statistical tests were applied wherever necessary to determine associations between variables. Results were presented in the form of tables, charts, and graphs. A p-value of less than 0.05 was considered statistically significant.

Result

Table 1 shows the distribution of patients according to age group among 90 study participants. The highest proportion of patients belonged to the 26–35 years age group, accounting for 34 cases (37.8%), indicating that young adults were most commonly affected in the study population. This was followed by the 36–45 years age group with 22 patients (24.4%) and the 18–25 years age group with 20 patients (22.2%). A comparatively smaller number of patients were observed in the 46–55 years age group, comprising 10 cases (11.1%), while the least representation was seen in patients aged above 55 years, with only 4 cases (4.5%). Overall, the data suggests that the condition under study is more prevalent in the younger to middle-aged population, particularly in the economically active age group.

Age Group (Years)	Number of Patients	Percentage (%)
18–25	20	22.2
26–35	34	37.8
36–45	22	24.4
46–55	10	11.1
>55	4	4.5
Total	90	100

Table 2 shows the distribution of patients according to gender and cause of trauma among 90 study participants. The majority of patients were males, accounting for 64 cases (71.1%), while females constituted 26 cases (28.9%), indicating a clear male predominance in the study population. Regarding the etiology of trauma, road traffic accidents were the most common cause, observed in 41 patients (45.6%), followed by physical assault in 18 patients

(20%). Sports-related injuries accounted for 14 cases (15.6%), while fall injuries were seen in 11 patients (12.2%). Occupational trauma was the least frequent cause, reported in 6 patients (6.6%). Overall, the data highlights that young to middle-aged males are more frequently affected, with road traffic accidents emerging as the leading cause of traumatic injury in this cohort.

Variable	Number of Patients	Percentage (%)
Gender		
Male	64	71.1
Female	26	28.9
Cause of Trauma		
Road Traffic Accident	41	45.6
Physical Assault	18	20
Sports Injury	14	15.6
Fall Injury	11	12.2
Occupational Trauma	6	6.6
Total	90	100

Table 3 shows the distribution of technical modifications and graft materials used during open rhinoplasty among 90 patients. The most commonly used graft was septal cartilage graft, utilized in 28 patients (31.1%), indicating its preference due to ease of harvest and good structural compatibility. This was followed by costal cartilage graft in 21 patients (23.3%), reflecting its use in cases requiring larger volume or stronger support. Conchal cartilage graft was used in 17 patients (18.9%), mainly for minor contouring and moderate reconstruction needs.

Vomer bone graft was employed in 9 patients (10%), while spreader graft technique was applied in 7 patients (7.8%) to improve internal nasal valve function. Columellar strut reinforcement was used in 5 patients (5.6%) for tip support enhancement, and dorsal onlay graft alone was least commonly used in 3 patients (3.3%), indicating selective use in limited deformities. Overall, septal and costal cartilage grafts formed the primary reconstructive materials in most cases.

Surgical Modification / Graft Material	Number of Patients	Percentage (%)
Septal Cartilage Graft	28	31.1
Conchal Cartilage Graft	17	18.9
Costal Cartilage Graft	21	23.3
Vomer Bone Graft	9	10
Spreader Graft Technique	7	7.8
Columellar Strut Reinforcement	5	5.6
Dorsal Onlay Graft Only	3	3.3
Total	90	100

Table 4 shows the distribution of functional and cosmetic outcomes following surgery among 90 patients. The results indicate a high level of overall

surgical success, with 86.7% of patients showing satisfactory cosmetic improvement and 80% reporting improved nasal airway function. A notably high

proportion of cases (92.2%) demonstrated stable graft position, reflecting good technical effectiveness and structural support achieved during surgery. Patient satisfaction was also high, with 84.4% reporting positive outcomes. Only a small fraction of

patients (10%) exhibited mild residual deformity, while the need for revision surgery was minimal at 4.4%, suggesting that most cases achieved durable and satisfactory results with low complication and reintervention rates.

Table 4: Distribution of Functional and Cosmetic Outcomes Following Surgery (n=90)

Postoperative Outcome	Number of Patients	Percentage (%)
Satisfactory Cosmetic Improvement	78	86.7
Improved Nasal Airway Function	72	80
Stable Graft Position	83	92.2
High Patient Satisfaction	76	84.4
Mild Residual Deformity	9	10
Need for Revision Surgery	4	4.4

Table 5 shows the distribution of postoperative complications among the study participants (n=90), indicating that the majority of patients experienced no major complications, accounting for 61 cases (67.8%). Among the observed complications, mild edema was the most common, seen in 24 patients (26.7%), followed by residual asymmetry in 7 patients (7.8%) and infection in 6 patients (6.7%). Persistent nasal obstruction was noted in 5 patients

(5.6%), while graft displacement occurred in 4 cases (4.4%). Hypertrophic scar formation was the least frequent complication, observed in only 3 patients (3.3%). Overall, the findings suggest that while minor and manageable complications were present in a subset of patients, serious postoperative issues were relatively uncommon, and most patients had an uneventful recovery.

Table 5: Distribution of Postoperative Complications Among Study Participants (n=90)

Postoperative Complications	Number of Patients	Percentage (%)
Mild Edema	24	26.7
Infection	6	6.7
Graft Displacement	4	4.4
Residual Asymmetry	7	7.8
Persistent Nasal Obstruction	5	5.6
Hypertrophic Scar Formation	3	3.3
No Major Complications	61	67.8

Discussion

The present study assessed the demographic profile, etiological factors and surgical techniques and surgical outcomes of open rhinoplasty for patients who suffered from post-traumatic saddle nose deformity and their results were compared to existing literature to determine the commonalities and differences between their findings.

The study found that the highest rate of post-traumatic saddle nose deformity occurred in the 26 to 35 age group which showed 37.8% of cases. The age group 36 to 45 years showed 24.4% of cases while the 18 to 25 years age group showed less. Young adults show higher rates of nasal deformities which Kim and Toriumi (2004) [8] demonstrated through their research showing that active young people sustain more nasal deformities because they participate in activities which involve exposure to sports and workplace dangers and vehicular accidents. The majority of patients who needed saddle nose correction according to Daniel (2007) [9] worked between their third and fourth decades of life because this age group experienced both functional and psychosocial

challenges. The similarity demonstrates that nasal trauma primarily affects people who belong to the age groups which operate their most productive years for work and social life.

The current research demonstrated a strong male dominance which matched the results of Mao et al. (2009) study which found that most patients who underwent reconstruction for traumatic saddle nose deformity were male. The researchers discovered that outdoor activities and accidents and interpersonal violence involved more males than females. Hyun and Jang (2013) [11] observed similar results when they found that their 91 cases of saddle nose correction showed a higher rate of male patients. The studies maintained the same pattern of gender distribution because people developed their behavior through exposure to their surroundings instead of their biological makeup.

The current research shows that road traffic accidents were the main cause of injuries which were followed by physical assault and sports injuries and falls. Kim and Toriumi (2004) found that vehicular trauma represents one of the most common causes

which lead to post-traumatic nasal deformities in developing regions. The study conducted by Mao et al. (2009) found that most of their cases had trauma-related etiologies which showed road traffic accidents as the most common cause. The two studies found that people sustained more assault-related injuries because facial trauma continues to affect specific groups of people.

The most common graft material used in this study was septal cartilage while costal cartilage and conchal cartilage followed as the next most frequently selected graft materials. The study results confirmed Tardy et al. (1989) [12] findings which showed that septal cartilage serves as the main grafting material because it can be easily obtained and it possesses beneficial structural characteristics. The study by Paris et al. (2006) [13] demonstrated successful results with septal and conchal cartilage in treating mild to moderate saddle nose deformities especially when dorsal collapse remained minimal. The researchers found that their results demonstrated limitations which affected their ability to treat severe deformities that needed additional support.

The study found that costal cartilage serves as an effective solution for patients who experience more severe medical conditions. Bilen and Kilinc (2007) [14] demonstrated that costal cartilage serves as a better structural support solution for advanced saddle nose deformities. They reported better long-term stability compared to septal and conchal grafts. Hyun and Jang (2013) [15] demonstrated that costal cartilage grafts function most effectively for moderate to severe deformities because of their strong structural integrity, which enables successful reconstruction according to our study. The previous research shows two main concerns about the material, which includes warping and resorption. Murakami et al. (1991) [16] observed that cartilage grafts experience about 22% resorption, which serves as a potential drawback.

The study achieved positive functional results and aesthetic results in most patients, while showing improvements in nasal airway function and high levels of patient contentment. The study results match those of Riechelmann and Rettinger (2004) [17] who achieved successful results through structured grafting techniques for complex saddle nose deformities. Gentile and Cervelli (2009) [18] demonstrated that autologous graft-based reconstruction produces long-lasting results which show minimal deformity recurrence when surgeons use proper surgical techniques. The study results show that open rhinoplasty with customized graft selection achieves high success rates based on the low revision rate.

The current research showed few surgical complications because the most common issue during the study period was mild edema which occurred more often than the less common problems of infection

and asymmetry and graft displacement. The research results match the findings of Paris et al. (2006) which showed that most saddle nose reconstruction cases experienced only mild and temporary complications. Mao et al. (2009) discovered that their study group experienced no severe donor-site complications while facing only minor postoperative problems which confirmed the safety profile that the current research established.

The present findings establish strong support for earlier published studies which demonstrate that open rhinoplasty can correct post-traumatic saddle nose deformities through proper technical adjustments and through selecting suitable grafts for each patient. The results of multiple studies show how graft-based reconstruction methods have developed over time while still preserving their core mission to restore both appearance and operational abilities.

Conclusion

The present study demonstrates that post-traumatic saddle nose deformity predominantly affects young, economically active males, with road traffic accidents being the most common etiological factor. Open rhinoplasty with individualized technical modifications and appropriate autologous graft selection proved to be an effective approach for restoring both nasal form and function. Septal and costal cartilage grafts were the most frequently used materials, providing reliable structural support in most cases. The study showed significant improvement in nasal airway function, satisfactory cosmetic outcomes, high graft stability, and overall patient satisfaction, with minimal need for revision surgery. Postoperative complications were mostly minor and self-limiting. These findings highlight that meticulous surgical planning, precise graft placement, and tailored reconstructive strategies are essential for achieving predictable and stable results in complex saddle nose deformities following trauma.

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