

Case Series

Evaluating the types of osteotomies performed in rhinoplasty

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ABSTRACT

Nasal bone osteotomies are essential in rhinoplasty, particularly in the context of India where rhinoplasty is a prevalent aesthetic procedure. These osteotomies serve various purposes, from widening a narrow nasal bony pyramid to correcting deviations or width issues. Beyond routine cases, congenital, traumatic, or developmental deformities may require unique approaches to address nasal bone structure. However, consensus on the optimal osteotomy technique remains elusive. The ideal technique should be precise, reproducible, safe, and minimize postoperative complications like bruising and swelling. This study focuses on identifying the most commonly used osteotomy technique in rhinoplasty that yields favorable results. This retrospective study spanned from January 2021 to July 2023 and included 60 patients undergoing rhinoplasty. Preoperative data were documented, intraoperative methods were recorded, and postoperatively, the prevalence of different osteotomy types was statistically analyzed. Among the 60 patients, 70% (42 patients) underwent combined medial and lateral osteotomies. Within this group, 12 patients had lateral osteotomies using the high-to-high method, 5 patients had the low-to-low method, and 25 patients had the high-to-low lateral osteotomy. This study underscores the critical role of osteotomy in rhinoplasty. A retrospective analysis of 60 rhinoplasty cases revealed that the lateral osteotomy high-to-low method is the most commonly employed technique. This finding suggests that this particular approach is favored by surgeons for its effectiveness in achieving the desired outcomes in rhinoplasty procedures.

Keywords: Osteotomy, Rhinoplasty, High to low osteotomy, Rocker deformity, Step deformity

INTRODUCTION

Rhinoplasty presents a formidable challenge, standing as an aesthetic endeavor wherein both the patient and their social circles continually evaluate the outcome crafted by the plastic surgeon. Amidst this complex landscape, osteotomy emerges as a pivotal maneuver, indispensable for achieving favorable results and narrowing nasal width. However, the intricate nature of osteotomy adds a layer of complexity to rhinoplasty, demanding precision and meticulousness. The choice of osteotomy type is typically determined pre-operatively, with the pivotal factor lying in the extent of lateral nasal wall movement required to attain the desired reduction in bony base

width. Substantial movement necessitates complete osteotomies with bony separation, whereas more modest adjustments can be achieved through a greenstick fracture. Variations of osteotomy techniques can be synergistically employed to achieve the desired width reduction, yet the movement and stability of lateral walls remain paramount in the decision-making process.¹

Lateral osteotomies

Lateral osteotomies, done low-to-low or low-to-high, must preserve the triangular area of the maxilla's frontal process (Webster's triangle) to prevent nasal valve collapse and obstruction.²

Low to low osteotomy

Involves a straight osteotome driven along the base of the frontal process of the maxilla in a horizontal trajectory. Low-to-low osteotomy is widely used to correct a large open roof and excessively wide nasal base due to its effectiveness in achieving greater medial movement of the nasal bone.³

Low to high osteotomy

The low-to-high osteotomy starts at the piriform aperture, moves towards the intercanthal line, and ends high on the nasal dorsum. This technique is less frequently used and is favored for correcting a minor roof opening or mobilizing a moderately wide nasal base.³

High to high osteotomy

From the pyriform aperture at the level of the inferior turbinate and proceeds deep in the maxillary groove curving superiorly to nasofrontal suture line.³

Transverse osteotomies

Commences with a vertical stab incision just above the medial canthus, utilizing a 2 mm osteotome to completely fracture the lateral wall transversely, originating slightly above the medial canthus and progressing upward. This is generally followed by a low-to-low osteotomy.¹

Medial oblique osteotomies

Medial osteotomy involves making a bony cut in the nasal bone, which separates it laterally from the upper bony vault and medially from the bony septum.⁴ Positioning a curved osteotome at the cephalic end of the open roof, it is driven downward toward the medial canthus. This approach is tailored to refine a broad bony dorsum and is usually coupled with a low-to-low lateral osteotomy.¹ Depending on its angle, the medial osteotomy is classified as paramedial, oblique paramedian, medial oblique, or transverse. This osteotomy type is often used in conjunction with lateral osteotomy and/or greenstick fracture to decrease the width or thickness of the nasal bone or lateral wall.²

Double level osteotomies

Involves an osteotomy along the inferior border of the nasal bone, parallel to and conjoined with a low-to-low osteotomy. The objective is to diminish the convexity of the lateral wall.¹

Micro osteotomies

Executed using a 2 mm osteotome, these micro-adjustments rectify asymmetries or inherent irregularities in the bones. Osteotomy is generally performed to narrow the bony vault, address open roof deformities, instill

symmetry, and widen the bony vault through lateral displacement of nasal bones. Osteotomy becomes especially critical for patients with short nasal bones, elderly individuals with delicate nasal structures, or those who wear heavy eyeglasses.¹

Complications of osteotomy are either operative trauma or cosmetic. Complications stemming from osteotomy encompass both operative trauma and cosmetic concerns. Operative Trauma complications include hemorrhage, edema, nasal cyst formation, anosmia, arteriovenous fistula, epiphora, canalicular bleed. Cosmetic complications include nasal bone asymmetry, Infections like abscess or granuloma, excessive narrowing, insufficient mobilization, unstable bony pyramid.⁴

Lateral osteotomies typically start near the lateral edge of the piriform aperture, about 3-4 mm above its base, and extend upwards to the level of the medial canthus of the eye. If performed above the nasofrontal suture, this osteotomy can cause protrusion at the superior fracture site, resulting in a "rocker" deformity.² In this study, we shall focus on the different types of osteotomies used to obtain the patient's desired results and tabulate them. Based on the data gathered, we would be concluding the most common type of osteotomy used for the desired outcome in a cohort of 60 patients.

CASE SERIES

According to the study, the age group commonly consenting to an elective rhinoplasty lies between the age group of 31-45 years constituting 48% of the study while the least percentage of study subjects lie amongst the age group of 46-60 years of age.

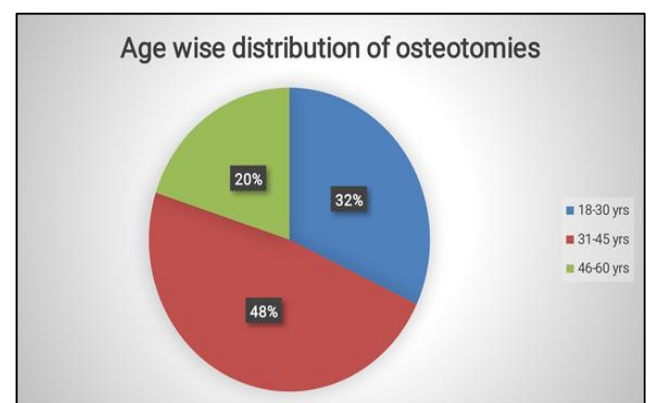


Figure 1: Age distribution of osteotomy subjects.

The subjects of the study were divided based on gender to reveal that the prevalence of osteotomies amongst men are more common than in women despite the common consensus of body image consciousness bring prevalent more commonly among women.

There were 19 females in the study constituting 45.2% of the study subjects while 23 male subjects contributing to

54.8% of the study (Figure 1). Based on the study, figure 2 represents the count of each type of osteotomy in the study population of 60 patients. The counts for each osteotomy type are as HIGH TO LOW OSTEOTOMY: 25 occurrences (42%), HIGH TO HIGH OSTEOTOMY: 12 occurrences (20%), LOW TO LOW OSTEOTOMY: 5 occurrences (8%), PARAMEDIAN: 11 occurrences (18%), INTERMEDIATE: 7 occurrences (12%).

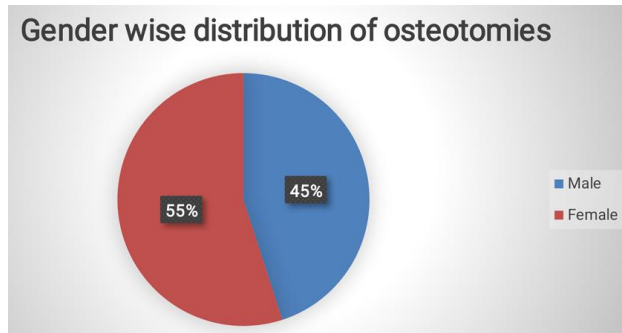


Figure 2: Gender distribution of osteotomy subjects.

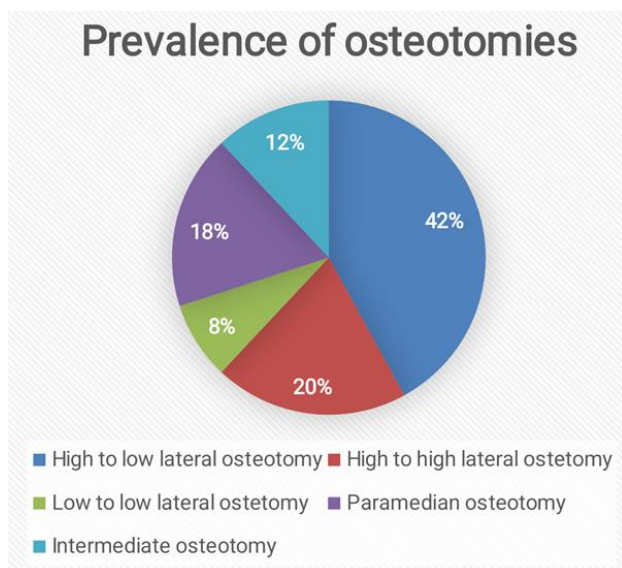


Figure 3: Prevalence of different types of osteotomies.

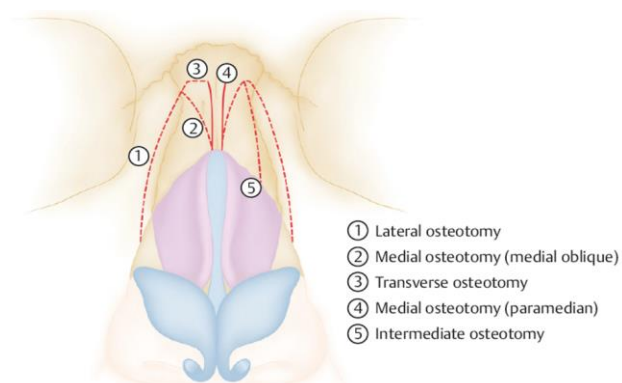


Figure 4: Pictographic representation of different types of osteotomies.

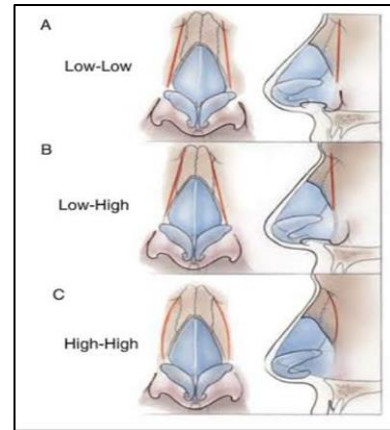


Figure 5: Types of lateral osteotomies.

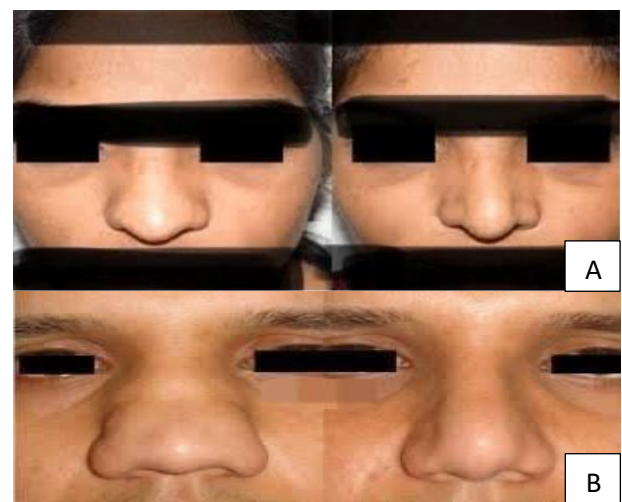


Figure 6 (A and B): Preoperative and postoperative photographs after performing osteotomies in rhinoplasty.

Figure 3, clearly displays the 'HIGH TO LOW OSTEOTOMY' type having the highest prevalence and 'LOW TO LOW OSTEOTOMY' having the lowest prevalence in this study. In this study however combined lateral and medial osteotomy has been employed with different lateral osteotomy techniques. A retrospective analysis of 60 rhinoplasty cases revealed that the lateral osteotomy high-to-low method is the most commonly employed technique.

Table 1: Complications of osteotomies.

Operative trauma	Cosmetic
Haemorrhage	Nasal bone asymmetry
Edema	Infections: abscess, granuloma, cellulitis.
Nasal cyst formation	Excessive narrowing
Anosmia	Insufficient mobilization
Arteriovenous fistula	Unstable bony pyramid
Epiphora	Rocker deformity
Canalicular bleeding	Stair step deformity

DISCUSSION

An osteotomy rhinoplasty involves a surgical technique where the nose is intentionally "broken" using an osteotome, a tool designed to cut through bone.⁵ The bony structure of the nasal vault presents as a complex three-dimensional arrangement. This procedure aids surgeons in determining the appropriate modifications for nasal osteotomies.⁶

In 2007, Gruber et al conducted a study which concluded that narrowing the nasal dorsal width can be achieved through a medial oblique osteotomy when positioned at the lateral aspect of the open roof's apex.⁷ A study by Simsek et al in 2014 found that rhinoplasty, with or without osteotomy, effectively alleviated nasal obstruction symptoms, with the addition of osteotomy enhancing patient satisfaction in selected cases.

In this study it was noted that in specific instances, incorporating the osteotomy procedure extended the duration of the surgery and notably improved patient contentment.⁵ In 2016, a study done by Devasamudra et al concluded that to attain favorable aesthetic outcomes we must perform intermediate osteotomies before lateral ones.⁸ Likewise, a 2018 research by Jang et al on the safety of osteotomy in aesthetic rhinoplasty among East Asian patients established the efficacy of paramedian oblique and percutaneous lateral osteotomy in reducing broad nasal bones, offering a stable framework and reliable approach when simultaneous silicone augmentation is conducted.⁹ According a 2019 study by Mowlavi et al, the results suggested that maintaining a substantial triangular strut within the maxillary component of the piriform aperture poses no risk of collapsing into the nasomaxillary suture line.

Thus, performing controlled lateral osteotomies can be done safely to achieve aesthetic improvements without compromising midvault stability.¹⁰ A 2020 study conducted by Ismail et al assessed various osteotomy types in rhinoplasty patients, revealing that lateral greenstick osteotomy, without median osteotomy, resulted in the fewest complications.¹ In light of the range of osteotomy approaches, it becomes imperative to pinpoint the specific type of osteotomy that yields optimal clinical outcomes. This study aims to delineate the most commonly practiced osteotomy to achieve the desirable results with least number of complications.

Nasal osteotomies are controlled fractures of the nasal bones and adjacent maxillary processes. Osteotomies were originally used to narrow the open roof that resulted from significant hump reduction, starting with a lateral osteotomy in the naso facial groove. Later, a medial osteotomy running parallel to the septum was introduced to achieve full mobilization of the lateral wall. The surgeon would perform both osteotomies, first pushing the lateral wall outward (out fracturing) from the medial cut, then inward (in fracturing) from the lateral cut.

Despite achieving complete mobilization, this method often caused instability and the bones to descend into the pyriform aperture.² The nasal bone structure consists of two nasal bones that connect at the top with the frontal bone and on the sides with the frontal process of the maxillary bones. These combined elements - the ascending maxilla and the nasal bones - create the bony nasal vault, which makes up the upper third of the nose and provides support for the cartilaginous structures forming the rest of the nose.¹⁰ The dorsal width represents the width created by each nasal bone as it moves horizontally from the midline before curving toward the face. The ventral width results from the nasal bone and nasal process of the maxilla descending to meet the maxilla's horizontal face.

The type and location of osteotomies depend on the desired aesthetic goal, considering the nasal bone dynamics modeled by the pyramidal frustum. The bony support structure of the nose comprises nasal bones attaching to the frontal bone and laterally to the frontal process of the maxillary bones. This, along with the ascending maxilla, forms the bony nasal vault supporting the cartilaginous structures. Osteotomy mobilization of this bony support is a standard part of rhinoplasty, with lateral osteotomy being key to rectifying nasal pyramid deformities by adjusting its width or projection.¹⁰ Medial osteotomies initiate bony framework correction. After humpectomy, the upper end of the open roof deformity becomes the starting point for medial osteotomy. The osteotomy line takes a "C" shape and ends at the medial canthus level. Intermediate osteotomies, parallel to lateral osteotomies, can be done with precision in open rhinoplasty.

They are performed before lateral osteotomies since intermediate cuts are challenging once the bone is mobilized. The lateral osteotomy involved making a small incision at the pyriform aperture, slightly above the attachment level of the inferior turbinate. Avoiding osteotomy below the attachment of the inferior turbinate was crucial to prevent long-term medialization of the turbinate, which could lead to nasal obstruction. Additionally, it aimed to prevent damage to the Webster's bony triangle, which could alter the shape of the nasal vestibule.¹¹

In this study, we can see that out of 60 patients that 70% use the combined medial and lateral osteotomy technique for the desired results of which lateral osteotomy three techniques were used. In this study we were able to isolate the most common osteotomy used to be high to low lateral osteotomy to provide the desired results however it was used in conjunction with medial osteotomy as a combined approach.

CONCLUSION

In this study, we can see that out of 60 patients that 70% use the combined medial and lateral osteotomy technique

for the desired results of which lateral osteotomy three techniques were used. Osteotomy is one of the most crucial steps in rhinoplasty. We concluded that lateral osteotomy with or without median osteotomy is the safest osteotomy and high-to-low osteotomy is the safest one with the least complications.

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