

# Orthognathic Surgery and Rhinoplasty: Simultaneous or Staged?

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**Background:** Orthognathic surgery can significantly impact the nasolabial envelope, and at times requires an adjunctive rhinoplasty. The purpose of this study was to evaluate nasal morphology in orthognathic patients, focusing on predictive variables, and the need for and timing of definitive rhinoplasty. Based on these data, an algorithm for the implementation of adjunctive rhinoplasty is proposed.

**Methods:** A review of cases over a 3-year period was completed. Information regarding demographic, diagnostic, and operative details; nasal morphology; and use of rhinoplasty was compiled. Three-dimensional images were used to quantify anatomical variables.

**Results:** Over 589 patients were reviewed during this period. Of these, 163 fulfilled inclusion criteria for this study. The mean age was 23.3 years. In total, 41.7 percent of orthognathic cases underwent adjunctive rhinoplasty. Of these, 82.4 percent were staged and 17.6 percent were simultaneous. The average time between staged procedures was 208 days. When simultaneous, 16.7 percent of the orthognathic procedures had significant maxillary movement (advancement >4 to 5 mm, impaction >2 mm, alar base excisions); in comparison, 92.9 percent of staged cases had significant maxillary movement ( $p < 0.0001$ ). All patients had self-reported satisfaction with functional and aesthetic results during the follow-up period.

**Conclusions:** Nasal and jaw deformities are intricately interlinked. In this series, the authors identified patterns requiring adjunctive rhinoplasty in the setting of orthognathic surgery. The authors present an algorithm to extensively treat the nasomaxillofacial relationship using orthognathic surgery alone, orthognathic surgery in concert with rhinoplasty, or orthognathic surgery followed by staged rhinoplasty. (*Plast. Reconstr. Surg.* 141: 322, 2018.)

Orthognathic surgery is a powerful tool to improve facial aesthetics and function. When performed well, the altered bony position has a positive impact on the facial soft-tissue structure and support. However, certain untoward effects may at times be encountered. In particular, the Le Fort I osteotomy can alter the nose and can result in base widening, tip changes, reduced nasofrontal angle, and shortened nasal length.<sup>1,2</sup> These changes are caused primarily by changes in the skeletal support, which impacts the overlying nasal tissues and vault.<sup>3</sup> Subperiosteal dissection and wide surgical exposure and release

also impact the nasal base.<sup>3</sup> We previously characterized Le Fort–induced nasolabial changes using three-dimensional photogrammetry.<sup>4–7</sup> These changes can either improve or worsen the postorthognathic nasal appearance, depending on the preexisting nasal morphology.

The most favorable scenario is when the nasal appearance is improved following Le Fort osteotomy. However, a postoperative nasal deformity can occur when (1) an intrinsic deformity fails to improve (or worsens) after a Le Fort I procedure; or (2) a well-balanced nose is altered, and deformed, because of the impact of orthognathic surgery. Measures are taken to avoid this latter scenario, but some degree of deformity may be created regardless of mitigation attempts.

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In these settings, the nasal deformity is best addressed using definitive rhinoplasty. Temporally, the rhinoplasty can be performed concurrent with jaw surgery, or in a delayed/staged fashion.<sup>8,9</sup> The purpose of this study was to evaluate nasal deformity in the setting of orthognathic surgery, characterize predictive variables, and describe an algorithm for timing and management.<sup>8</sup> Emphasis is placed on (1) predicting the need for rhinoplasty and (2) analyzing the management and outcomes of a large cohort of patients.

## PATIENTS AND METHODS

This is an institutional review board–approved retrospective review of orthognathic subjects treated over a 3-year period by the senior author (D.M.S.). Patients were excluded for lack of follow-up (<1.5 years) or incomplete documentation. Demographic, diagnostic, and operative details were compiled. Presence or absence and timing of rhinoplasty was also recorded. Groups were then subdivided into the following: (1) orthognathic procedure and simultaneous rhinoplasty, (2) orthognathic procedure and staged rhinoplasty, and (3) orthognathic procedure alone where the nose was aesthetic postoperatively. Three-dimensional photographs were assessed at standardized time points using the Vectra 3D Imaging system (Canfield Scientific, Parsippany, N.J.). Diagnostic, morphologic, and treatment variables were stratified as an algorithmic approach. Statistics were performed in IBM SPSS Version 23 (IBM Corp., Armonk, N.Y.). Tests were two-tailed, with an alpha of 0.05.

## RESULTS

During this period, 362 rhinoplasties and 227 orthognathic procedures were performed. Of these, 262 rhinoplasty and 163 orthognathic patients fulfilled criteria of having 1.5 years of follow-up (Table 1). The mean age was found to be 23.3 years, and 65.6 percent of patients were female patients. In total, 68 patients underwent both orthognathic surgery and rhinoplasty in either a simultaneous or a staged fashion. Of the 95 patients who had no rhinoplasty, there was no intrinsic deformity, and orthognathic surgery either did not change the nose appreciably or improved the nasal form. These changes included an improved dorsal hump, forward projection of the nasal tip, improved supratip break, wider alar base, increased nasolabial angle, and wider nostrils. Of the 68 patients who underwent adjunctive rhinoplasty, 17.6 percent underwent procedures

**Table 1. Number of Orthognathic Procedures with and without Adjunctive Rhinoplasty**

All Orthognathic	No Adjunctive Rhinoplasty	Simultaneous Rhinoplasty	Staged Rhinoplasty
163	95	12	56

performed simultaneously and the other 82.4 percent underwent procedures performed in a staged fashion. The average time between staged procedures was 208 days. In the patients who underwent Le Fort I osteotomy and required rhinoplasty, few procedures were performed simultaneously (3.7 percent), compared with the 96.3 percent that were performed in a staged fashion. In comparison, all patients who underwent genioplasty who needed adjunctive rhinoplasty had the procedures performed simultaneously. For patients who underwent a combination of genioplasty and Le Fort I osteotomy and/or bilateral sagittal split osteotomy, 90.7 percent underwent a staged procedure when adjunctive rhinoplasty was necessary. Of simultaneous procedures performed, 75.0 percent were in patients who underwent genioplasty with bilateral sagittal split osteotomy alone with no maxillary movements.

Of all patients, when the orthognathic procedure and the rhinoplasty were performed simultaneously, only 16.7 percent of the orthognathic procedures had significant maxillary movement; this is in comparison to the staged rhinoplasty group, where 92.9 percent of patients had significant maxillary movement ( $p < 0.0001$ ). For orthognathic surgery involving the maxilla, a simultaneous rhinoplasty was typically performed only in situations of minimal advancement (<4 to 5 mm), minimal impaction (<2 mm), and in the absence of alar base excisions. Of the 82.4 percent of rhinoplasty patients who underwent staged procedures, the most common reasons were if the maxilla was involved and large movements or rotations were introduced by the orthognathic surgery, if the deformity was directly attributable to the Le Fort osteotomy, or if there was intrinsic nasal deformity. During the 1.5-year follow-up period, no patients required a revision procedure, and all patients self-reported being satisfied with their functional and aesthetic results.

## DISCUSSION

### Orthognathic Surgery and the Nasolabial Envelope

Orthognathic surgery can dramatically alter the nasolabial envelope, and several of



**Fig. 1.** Staged rhinoplasty for nasal deformity worsened by orthognathic surgery. Patient is shown preoperatively (*left*); after orthognathic surgery (*center*); and after rhinoplasty (*right*).

these changes have been well-characterized in previous studies.<sup>5-7</sup> These changes include an increase in the nasolabial angle leading to increased tip rotation, an absolute increase (but relative decrease) in nasal tip projection, a widened alar base, more horizontal nostrils, and reduced columellar height. These alterations

are predictable to some degree and may be desirable in patients with intrinsic nasal deformity, such as a narrow alar base or underrotated nasal tip before surgery.<sup>3</sup> In fact, over 60 percent of patients undergoing orthognathic surgery have been found to have concurrent nasal deformity before surgery.<sup>10</sup>

**Table 2. Surgery-Induced Deformity and Management**

Deformity	Cause	Maneuvers/Solutions
Underprojected tip	Loss of tip support, decrease in projection	Tip suturing, columellar strut, CSEG, tip grafting
Wide alar base	Intrinsic; widening from Le Fort advancement, impaction, widening, CCW	Increase tip projection, alar base and/or sill excisions
Short, wide, flat nostrils	Intrinsic, alar base widening in context of loss of tip support	Increase tip projection, increase infralobular height alar base and/or sill excisions
Overrotated tip	Increase NL angle with Le Fort advancement	Separate UCL from scroll, CSEG, infralobular tip grafting, dorsal onlay
Excess nostril display (lateral)	Alar retraction, buckled columella, overrotated tip	Tongue-in-groove medial crural cephalic positioning, derotate tip, lateral crural support
Midvault narrowing	Intrinsic, perspective against widened alar base	Spreader grafts, spreader flaps
Prominent dorsum	Intrinsic	Dorsal reduction
Flat dorsum	Intrinsic, worsened from Le Fort advancement	Dorsal augmentation, rib or septal cartilage
Deep supratip break	Worsened from Le Fort advancement	Tip repositioning, caudal midvault augmentation

CSEG, caudal septal extension graft; CCW, counter-clockwise; NL, nasolabial; UCL, upper lateral cartilage.



**Fig. 2.** Staged rhinoplasty for intrinsic nasal deformity not corrected by orthognathic surgery. Patient is shown preoperatively (left); after orthognathic surgery (center); and after rhinoplasty (right).

In other cases, however, the orthognathic procedure itself can induce a nasal deformity (Fig. 1). The iatrogenic nasal aberration needs to be anticipated and recognized, and will typically require a concurrent or a staged rhinoplasty to fully correct the nasal and facial deformities. In this series of patients, the most common findings after orthognathic surgery included a widened alar base, reduced tip projection, broader tip-defining points, and horizontal nares. To target these postsurgical changes, several maneuvers can be performed in an adjunctive rhinoplasty (Table 2). In some cases of a wide alar base, narrowing can be accomplished by increasing tip projection alone.<sup>11</sup> If the alar base cannot be sufficiently narrowed by altering tip projection, sill or alar wedge excisions can be performed in addition to increasing the tip projection.<sup>12</sup>

Finally, there can be the persistence of intrinsic nasal deformities after orthognathic surgery (Figs. 2 and 3). This would then include nasal changes from surgery along with any intrinsic deviation, curvature, septal deviation, asymmetry, constriction, or collapse. In this series, 58.3 percent of patients did not require rhinoplasty, or the orthognathic surgery

was able to improve the nasal deformity. In the rest, orthognathic surgery induced, maintained, or worsened the nasal deformity; these were corrected by rhinoplasty, which was conducted in a staged fashion in a majority of patients.

### Sequence of Orthognathic Surgery and Rhinoplasty

If at all possible, our preference is to avoid performing rhinoplasty before orthognathic surgery; instead, rhinoplasty should be a definitive procedure to finalize nasal aesthetics and function at the time of orthognathic surgery or afterward. This does not deny, however, that circumstances exist in which rhinoplasty may be required for severe nasal symptoms or morphology, such as in cleft patients, trauma, and airway obstruction. In such cases, the rhinoplasty may be required before an orthognathic procedure can be performed. These patients were all excluded from this study.

Sometimes, a rhinoplasty can be performed first if the planned orthognathic procedure does not involve maxillary repositioning (no Le Fort I osteotomy or bilateral sagittal split osteotomy and/or



**Fig. 3.** Staged rhinoplasty for intrinsic nasal deformity not corrected by orthognathic surgery. Patient is shown preoperatively (left); after orthognathic surgery (center); and after rhinoplasty (right).

genioplasty only). In this series, one patient underwent a rhinoplasty several months before genioplasty, but this was an exception; no Le Fort I osteotomy was performed to alter the nasomaxillary envelope. Only a minority of our orthognathic patients underwent mandibular and chin surgery only.

In addition, there are situations where orthognathic patients undergo a rhinoplasty or septoplasty performed by a provider who did not recognize the dentofacial deformity, or before the dentofacial deformity had fully developed. In addition to orthognathic surgery, a secondary or repeated rhinoplasty may be necessary in these cases. Such situations frequently occur when procedures are performed for nasal cosmesis or nasal functional deficits without anticipating present or future need for orthognathic surgery. When possible, rhinoplasty should be performed concurrently or staged after the orthognathic procedure; if concurrent, rhinoplasty should be the second procedure performed.

#### Simultaneous versus Staged Rhinoplasty

The decision on timing of rhinoplasty in conjunction with orthognathic surgery has yet to be

studied in a large cohort of patients. Several factors should be considered, including a risk-to-benefit ratio, when deciding between a simultaneous or a staged rhinoplasty (Table 3). A simultaneous procedure allows for all components of the nasomaxillofacial tissues to be manipulated in concert (Fig. 4). This reduces the number of procedures a patient has to undergo, and may be associated with higher patient satisfaction.<sup>10,13</sup> Technically, a simultaneous procedure allows for better hemostasis, visualization, and access during the rhinoplasty.<sup>14</sup> After the orthognathic procedure is complete, the posterior septal angle is secured to the anterior nasal spine. The Le Fort incision can be left partially open during the open rhinoplasty, which allows for better access to the caudal septum, anterior nasal spine, inferior turbinates, and piriform rim.<sup>10,14</sup> However, to preserve the nasal mucosal floor, turbinates are managed endonasally. In addition, degloving of the maxilla and sidewall dissection during the orthognathic procedure may allow for better hemostasis for the rhinoplasty.

A disadvantage of performing a simultaneous procedure is the need for a tube exchange from

a nasal endotracheal tube to an oral tube, and greater potential for postoperative airway difficulties. Postoperatively, we use Doyle splints instead of nasal packing, and guiding elastics instead of wiring for intermaxillary fixation. Another

disadvantage is that the edema, degloving, and subperiosteal release during the orthognathic procedure may make the final form unpredictable, which can make it difficult to accurately gauge the nasal tip and alar base positions.<sup>15</sup> Despite these disadvantages, the simultaneous approach does not necessarily result in greater functional or aesthetic complication when performed judiciously.<sup>10</sup> For the simultaneous approach, the most common rhinoplasty maneuvers performed included tip refinement, increasing tip projection and rotation, septoplasty, midvault widening (with spreader or autospreader grafts), and turbinate ablation or resection. Alar base and sill excisions are not ideally performed as a part of concurrent rhinoplasty with orthognathic procedures.

The staged rhinoplasty, in contrast, is ideal for significant intrinsic nasal deformities, especially for asymmetry or deviation that would largely remain following orthognathic surgery. We favor a staged/interval rhinoplasty as well

**Table 3. Advantages and Disadvantages of Simultaneous versus Staged Rhinoplasty**

Simultaneous rhinoplasty	
Advantages	
Operative visibility	
Single anesthesia event	
Disadvantages	
Predictability	
Postoperative airway challenges	
Staged rhinoplasty	
Advantages	
Predictability	
Allows for fine-tuning	
No tube change, shorter procedure lengths	
Disadvantages	
Requires second procedure	
Avoids piriform plate	



**Fig. 4.** Simultaneous orthognathic surgery and rhinoplasty. Preoperative (left) and postoperative (right) images.

for surgery-induced nasal deformity. Cases with specific types and magnitudes of maxillary repositioning, such as counterclockwise rotation, impaction, large advancements, or changes in yaw or rotation, may make it more difficult to predict the final position of the nasal base. A staged rhinoplasty allows for the soft tissue to stabilize after the orthognathic procedure and may allow for greater predictability of rhinoplasty results. For instance, after a period of healing from orthognathic surgery, the alar facial crease or alar base points will stabilize in their final positions along the piriform aperture. This more stable and finalized soft-tissue backdrop will provide the reference against which to plan tip projection, position, and alar base and/or sill-narrowing procedures. In a staged rhinoplasty, any maneuver may be used to alter the tip, midvault, base, dorsum, or septum. Common maneuvers performed during a staged rhinoplasty include introducing spreader grafts, increasing the tip projection and definition, modification of the alar base and/or sill, and turbinate modification (especially following significant impaction) (Table 2). Of the patients in our series who underwent rhinoplasty, 82.4 percent of them underwent the rhinoplasty in a staged fashion.

### An Algorithm for Management

Given the findings and assessment of nasal morphology in this series, we propose the following algorithm for the use of adjunctive rhinoplasty with orthognathic surgery:

1. For no nasal deformity or intrinsic nasal deformity improved by the orthognathic procedure: no rhinoplasty needed.
2. For nasal deformity created by the orthognathic procedure: staged rhinoplasty.
3. For intrinsic deformity that is maintained or worsened by the orthognathic procedure: simultaneous or staged rhinoplasty based on the considerations below.

When a rhinoplasty is required, it can be performed in a simultaneous versus a staged fashion (Table 3). A simultaneous rhinoplasty can be performed when (1) intrinsic nasal deformities are present and are expected to worsen or not improve; (2) for symmetric, nondeviated nasal morphology; (3) in the setting of orthognathic procedures not involving the maxilla (mandibular movements only); and (4), if the maxilla is involved, a Le Fort osteotomy that involves lesser magnitudes of movement (<4 to 5 mm). Repositioning of the mandible does not affect nasal shape to a significant degree,

but it does affect the spatial relationship of the nose and the chin.<sup>16</sup> Therefore, a rhinoplasty can be performed concurrently with mandibular advancement with or without genioplasty. In all other situations, an adjunctive rhinoplasty should be staged.

## CONCLUSIONS

Nasal deformity can occur concurrently with maxillofacial dysmorphology, or as a consequence of orthognathic surgery. There has been a paucity of literature, however, discussing how nasal changes following orthognathic surgery predict the need for rhinoplasty, or comparing simultaneous versus staged rhinoplasty in these cohorts. In this series, we demonstrated that there is a reproducible pattern of patient abnormalities that can be comprehensively addressed, and that there are specific situations for the use of adjunctive rhinoplasty in either a simultaneous or a staged fashion that can best leverage the advantages of either approach. We present an algorithm to extensively treat the nasomaxillofacial relationship using orthognathic surgery alone, orthognathic surgery in concert with rhinoplasty, or orthognathic surgery followed by staged rhinoplasty. Through the use of this algorithm, patients have reported satisfaction in results and no revisions have been necessary in the first 1.5 years of follow-up. Long-term outcomes have yet to be assessed, and future studies will seek to quantitatively evaluate patient satisfaction and photogrammetric outcomes of both approaches.

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## PATIENT CONSENT

*Patients and parents or guardians provided written consent for use of patients' images.*

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