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REVIEW ARTICLE

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Functional nasal surgery in the office-based setting

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Abstract

Objective: Nasal obstruction is a very common problem often addressed by functional nasal surgery. Increasingly, these procedures are being performed in the office setting secondary to decreased down time, cost, and obviation of general anesthesia. Our goal with this review is to discuss how to appropriately select patients for office–based procedures, what procedures may be considered, and current outcomes with in–office functional nasal surgery.

Data Sources: PubMed, Scopus, Google Scholar.

Methods: Research databases were searched for articles discussing techniques for performing functional nasal surgery in an office setting, and outcomes of various in–office functional nasal procedures.

Results: Studies found and included in this review discuss many aspects of office–based functional nasal surgery, including practical points on patient selection and office set–up, what procedures can safely be performed, and outcomes of different techniques to address specific problems. Broadly, procedures amenable to performance in the office address the internal and external nasal valves, the nasal septum, and the inferior turbinates.

Conclusion: A wide range of techniques to aaddress the nasal valves, septum, and inferior turbinates can be performed in a safe and effective manner without the need for an operative suite.

KEYWORDS

nasal obstruction, nasal surgical procedures, office surgery, reconstructive surgery

Highlights

- This review demonstrates that procedures for nasal obstruction, including septoplasty, inferior turbinate reduction, and nasal valve surgery, can be performed in an office-based setting in select patients.
- Given the increased demand for office-based procedure, this review gives providers a resource to appropriately choose patients and procedures to perform in office for nasal obstruction.

INTRODUCTION

Nasal obstruction is an extremely prevalent problem, with an estimated one-third of the population seeking medical attention for their nasal obstruction.[1] The etiology of nasal obstruction varies, often including multiple and overlapping causes with contributions from inflammatory and structural conditions.[1] The end result, however, is reduced airflow through the nasal valves and nasal cavity. Careful history and physical examination are essential to evaluate the cause of a patient's nasal obstruction and ultimately provide the appropriate intervention. While many cases may be treated medically, patients with a significant anatomical component of their nasal obstruction may benefit from procedural intervention.[2] Broadly, structural contributors to nasal obstruction include nasal valve dysfunction, septal deviation, and inferior turbinate hypertrophy or some combination thereof.[3] Prior studies demonstrate that surgery to correct anatomic causes of nasal obstruction can decrease symptoms and improve patient quality of life.[4] Historically, these problems would be addressed in the operating room. However, in-office procedures have become dramatically more popular in recent years due to factors such as patient preference and changes in insurance and reimbursement patterns.[5] When considering office-based procedures for nasal obstruction, a thorough understanding of what surgical options are available and how to select appropriate patients is essential.

NASAL ANATOMY AND STRUCTURAL ETIOLOGIES OF NASAL OBSTRUCTION

Nasal anatomy is complex, and patients often have multiple areas of structural abnormality contributing to symptoms of nasal obstruction. During normal inspiration, airflow proceeds from the nasal vestibule, through the nasal valve and nasal cavity, and continues through the nasopharynx. Anatomic structures within the nose contribute to airflow resistance and create nonlaminar flow, which is helpful for warming and humidifying air. However, excessive resistance within the nose will create symptoms of nasal obstruction, and increased resistance can be due to a number of anatomic variations.[1]

The internal nasal valve is the narrowest segment of the nasal airway. The boundaries of the internal valve are the septum, upper lateral cartilage, and inferior turbinate. This region is responsible for two-thirds of total nasal airway resistance. Poiseille's law states that airflow resistance is related to the inverse of the radius to the fourth power, so even minimal narrowing of the internal valve can contribute significantly to nasal obstruction symptoms.[6] The external nasal valve is anterior to the internal valve and bounded by the septum, alar rim, and nasal sill. The external valve region may experience dynamic collapse with inspiration; a small amount of collapse may be normal, but a weak lateral wall leading to more significant valve collapse may contribute to nasal obstruction.[7] Naturally malpositioned or weak lower lateral cartilages may also lead to increased obstruction in the valve region (Figure 1).[8]

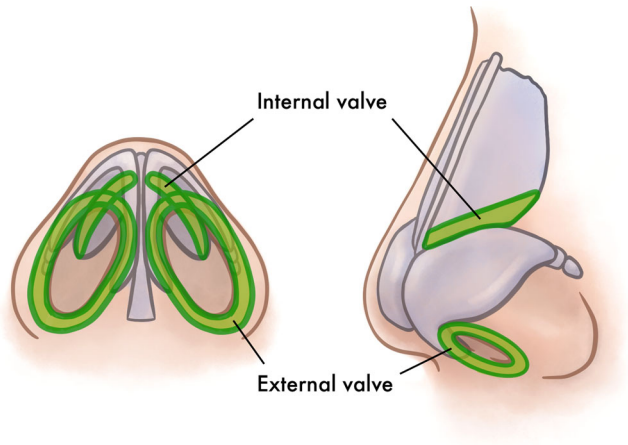

FIGURE 1 Nasal valve.

The nasal septum consists of membranous, cartilaginous, and osseous components.[1] A deviated septum is the most common cause of nasal obstruction.[9] However, not all patients with deviated septums will experience symptoms of obstruction. Deviations in the septum appear to be more common than not: a large international study found that 89% of patients undergoing nasal endoscopy in otolaryngology clinics had some degree of septal deviation.[10]

The inferior turbinate is a bony structure with overlying mucosa that has a rich vascular supply, and functions to regulate nasal airflow.[11] It is situated at the boundary of the internal nasal valve, and consequently, hypertrophy of the turbinate can decrease the valve cross-sectional area leading to obstruction.[7] Hypertrophy of the inferior turbinate may be bony, soft tissue, or mixed. Most cases of inferior turbinate hypertrophy are due to soft tissue hypertrophy, commonly caused by chronic rhinitis.[12]

While internal and external valves, nasal septum, and inferior turbinate abnormalities are the most commonly cited causes of nasal obstruction, a myriad of anatomic variations exist that may contribute to patient symptoms. Nasal polyps or masses, synechiae, adenoid hypertrophy, concha bullosa, subtleties of nasal cartilage shape, and many more structural causes of obstruction may be found, and care should be taken on physical exam, endoscopy, and image review to identify these less common contributors to nasal obstruction.

PATIENT EVALUATION AND DIAGNOSIS

Given the prevalence of nasal obstruction and the many possible underlying causes of symptoms, careful patient evaluation is critical to determine who may benefit from procedural interventions. A full history, including characterization of obstruction, associated symptoms such as nasal congestion or rhinorrhea, timing and severity of symptoms, aggravating and relieving factors, and prior treatment/response, is necessary. Symptom severity can be assessed using validated surveys, such as the Nasal Obstruction Symptom Evaluation (NOSE) scale.[13] A full physical exam should include at least anterior

rhinoscopy and nasal endoscopy if indicated to visualize the septum, inferior turbinates and evaluate for sinonasal pathology. The internal and external nasal valve should be observed during gentle and deep inspiration and may be evaluated using the Cottle and modified Cottle maneuvers. Care should be taken to note if anatomic abnormalities correspond to symptoms—for example, if septal deviation corresponds to the side the patient feels is obstructed. If not, other etiologies should be considered. If symptoms and anatomic evaluation are concerning for a more inflammatory rather than structural cause of nasal obstruction, patients should be managed medically rather than surgically and may benefit from further work-up such as allergy testing. Imaging, such as maxillofacial computed tomography, may not be necessary but should be considered, particularly if there is any concern for pathologic masses or other unusual anatomic contributors to nasal obstruction.

SELECTING PATIENTS FOR OFFICE-BASED PROCEDURES

Once a patient has been fully evaluated and it is determined that procedural intervention is warranted, a decision should be made regarding the patient's candidacy for an in-office procedure.

Not all structural problems are appropriate to address in-office: patients who will require an extensive septorhinoplasty with osteotomies, for example, should be managed in the operating room. Similarly, certain patients may not be well-suited to office-based procedures. Ideally, patients should be comfortable with minimal or oral sedation and should not have excessive anxiety or fear of needles and injections.[5] Attention should be paid to patient medical comorbidities that may require a more monitored setting with an anesthesiologist, such as significant systemic illness and cardio-pulmonary conditions that may make in-office procedures less safe. Finally, insurance coverage of in-office procedures varies greatly, and if the procedure is denied, patients may be responsible for the cost, which should be discussed upfront.

In determining whether to pursue in-office procedures, patients should be counseled that complication rates for in-office nasal procedures appear to be low: one recent series of 315 patients undergoing office-based nasal procedures found that 2.5% of procedures were stopped early due to complications such as pain, bleeding, or vasovagal response, 2.5% of patients had postoperative complications including infection and bleeding, and 11% of procedures eventually required a revision procedure.[14]

SET-UP FOR OFFICE-BASED PROCEDURES AND PATIENT PREPARATION

To perform office-based nasal procedures efficiently and safely, thought must be given to set-up and equipment. The room where procedures are performed should have a comfortable chair that can be reclined, and enough space around it for a surgeon and assistant to work effectively. Good overhead lighting is essential, and a headlight may be useful. An endoscope tower and endoscopes may be helpful in certain cases, though are generally not essential. Electrocautery may also be useful. Emergency equipment should also be available, particularly if sedatives are used. This should include a cardiac monitor with electrocardiogram and pulse oximetry, an automated external defibrillator, oxygen, an intravenous set-up, and emergency medications such as epinephrine and naloxone.

For effective nasal anesthesia, both topical and injected anesthetic agents should be used. Procedures may be performed using local anesthetics only, or sedating medications may be additionally used. Topical preparation of the nose should include an anesthetic and a vasoconstrictive agent, such as lidocaine and phenylephrine, or cocaine. Local injection is then performed, typically with lidocaine and diluted epinephrine. Postoperatively, patients should be observed for 30 min to ensure recovery from the procedure.

NASAL VALVE

If dynamic or static obstruction at the nasal valve is determined to contribute to patients' symptoms, particularly if a Cottle or modified Cottle maneuver improves symptoms, then there are multiple procedures that can be performed in an office setting to mitigate valve collapse. Recent technological advances have increased office-based options: bioabsorbable implants have become popular, and radiofrequency remodeling is another novel method used to manage obstruction. While traditional open septorhinoplasty techniques may not be appropriate for the office setting, more targeted vestibular skin and cartilage procedures are possible and may improve obstructive symptoms.

Bioabsorbable implant

The Latera bioabsorbable implant (Stryker, Inc.) was recently developed to reduce nasal obstruction in patients with significant nasal valve collapse. The implant is designed to support the upper and lower lateral cartilages, and thus reduce lateral nasal wall collapse. It is composed of a 70:30 blend of poly-L-lactide and poly-D-lactide and absorbs over approximately 18 months; after absorption, the surrounding nasal sidewall tissue is left stiffer than preimplant.[15] Latera placement may be performed as an isolated procedure, or in conjunction with septoplasty or inferior turbinate reduction, depending on the individual patient needs.

Before implant placement, careful examination should be performed to assess for the area of maximal valve collapse to target implant placement location. It should sit over the nasal bones at its cephalic extent and over the lateral crura of the lower lateral cartilages caudally. When placement is planned, ensure the inferior end of the placement will not extend caudally onto the ala, where it may be visible (Figure 2). If the patient regularly uses glasses, placement should be lateral enough to not cause discomfort when glasses are worn. If no other procedures are being performed,

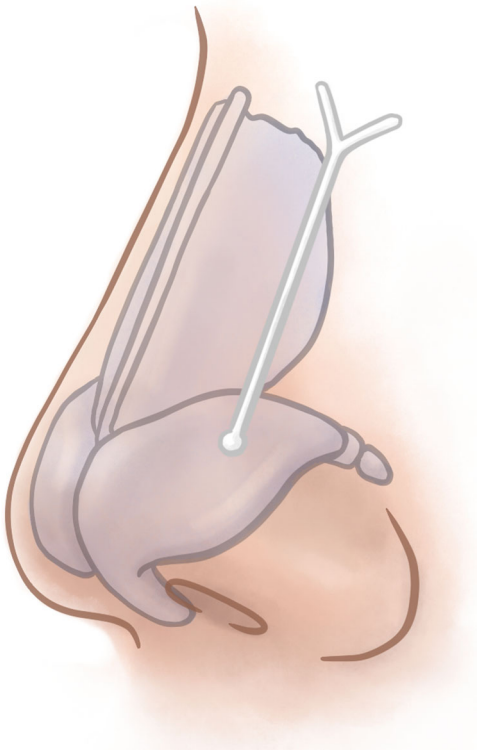

FIGURE 2 Bioabsorbable implant.

intranasal topicalization is generally not needed for bioabsorbable implant placement. Local anesthetic should be injected at the alar rim injection site and along the planned implant trajectory. After allowing 10–15 min for the anesthetic to take effect, the implant is placed. Using a double-prong skin hook, downward traction is applied to the alar rim. The implant delivery cannula is introduced intranasally close to the alar rim and then advanced over the lateral cartilages to the frontal process of the maxilla to the planned placement site. The implant is then deployed and the delivery cannula is removed.

Outcome data on bioabsorbable implant placement is generally favorable. A 2020 meta-analysis including 396 patients who underwent Latera placement found that NOSE scores were significantly improved at 3, 6, and 12 months postprocedure, and the rate of removal was 6%.[16] A 2019 prospective randomized control trial comparing sham surgery and Latera placement also found that implant placement significantly improved NOSE scores.[17] Whether the Latera can be as effective as traditional rhinoplasty techniques are unclear; a 2020 cadaver study comparing placement of the Latera versus butterfly or spreader graft found that the bioabsorbable implant was least effective at improving nasal airflow, but this was limited to static rather than dynamic analysis.[18] Conversely, a 2021 comparison of rhinoplasty techniques compared to Latera placement with or without septoplasty and inferior turbinate reduction found equivalent improvement in NOSE scores between the two groups.[19] Overall, Latera appears to be a reasonable minimally invasive option to improve nasal obstruction symptoms in patients with valve collapse, but further study is needed.

Radiofrequency remodeling

Temperature-controlled radiofrequency treatment is a novel minimally invasive option for treating nasal obstruction due to lateral wall collapse at the junction of the upper and lower lateral cartilages. Radiofrequency energy can induce cartilage reshaping, and the VivAer device (Aerin Medical) is a bipolar stylus that applies radiofrequency energy to the internal nasal valve to induce mechanical deformation of the cartilage of the lateral nasal wall, which can help stabilize and tissue—and perhaps widen the nasal valve—and prevent collapse.[20,21] The VivAer was designed to be used in an office-based setting under local anesthetic.

Before radiofrequency treatment, the nose should be topicalized, as the VivAer device is used intranasally. Next, intranasal local anesthetic injection around the upper lateral cartilage should be performed. Once a patient is sufficiently anesthetized, the VivAer stylus is placed over the caudal edge of the upper lateral cartilage, and the overlying mucosa is treated. In clinical trials, settings of 60°C and 4 watts were used, and three to four nonoverlapping sites were treated.[21–23]

Multiple single-arm trials have found significantly improved NOSE scores in patients undergoing radiofrequency remodeling, with effects lasting at least 2 years.[24,25] One randomized control trial from 2021 comparing VivAer treatment to a sham procedure found significantly greater improvement in NOSE scores for patients in the active treatment arm compared to the control group.[23] Another 2021 paper found improvement in both NOSE and quality of life scores in patients who underwent radiofrequency remodeling at 2 years postop.[22] As this is a relatively new technique, more outcomes data is needed, but radiofrequency remodeling appears to be a promising office-based procedure for valve collapse.

Rhinoplasty: Skin and cartilage procedures

A number of traditional procedures to improve valve collapse may be performed under local anesthesia, including excision of excess skin and cartilage, lateral crural J-flap, Z plasty, or even more extensive primary and revision septorhinoplasties. If osteotomies or any bony work are needed, these cases are likely not appropriate for the office setting, but skin and cartilage work may be performed. The lateral crural J-flap, as described by O'Halloran, frees the lateral edge of the lower lateral cartilage and excises excess skin and cartilage—this is most appropriate for patients whose obstructive symptoms appear due to external valve collapse.[26] A 2017 case series reported office-based performance of 34 rhinoplasties using a lateral crural J-flap and four septorhinoplasties using an external approach with septal cartilage used for grafting; patients tolerated these procedures well. None of the septorhinoplasties and 12% of the rhinoplasties required revision.[14]

Z-plasties can similarly be used to correct narrowed or stenotic external valves, and are well-tolerated under local anesthesia (Figure 3).[27] Traditional rhinoplasty techniques such as alar batten

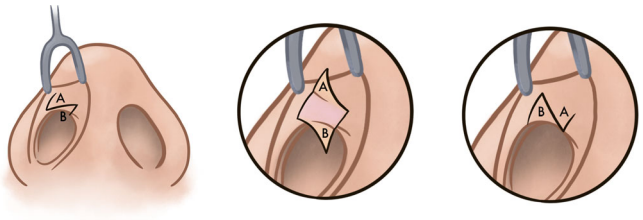

FIGURE 3 Nasal valve Z plasty.

grafts may also be performed in the office setting. Patients who have undergone previous rhinoplasties may develop new obstruction, or have insufficient improvement in prior obstruction: many revision procedures can be performed under local anesthesia, including shaving down a graft or previously discussed skin and cartilage techniques to improve the nasal airway. While the literature on office-based functional rhinoplasty is relatively limited, many traditional techniques are likely to translate well to an in-office setting, and an added benefit is the ability to assess the subjective sense of airflow mid-procedure in an awake patient.

SEPTOPLASTY

Office-based septoplasties may be performed in patients with fairly limited deviations or localized spurs. If bony deviations are present, or more extensive work is needed, patient discomfort may necessitate general anesthesia. Septoplasty can be performed either using an open or endoscopic approach. The key to either method is good topical and injected anesthetic. The actual procedure follows the same steps as in the operating room. Typically, a standard submucous resection should be performed, and any septal burr use should be limited as it can cause more significant patient discomfort. A prior case series of in-office septoplasties, open and endoscopic, demonstrates good patient tolerance, and an 11% revision rate.[14]

INFERIOR TURBINATE

The inferior turbinates may hypertrophy and contribute to nasal obstruction. Hypertrophy is often primarily due to chronic inflammation, and medical treatment for allergic or nonallergic rhinitis should be trialed before surgical intervention.[12] However, procedures to reduce the inferior turbinates may be very helpful to patients who do not improve with medical therapy, either alone or in concert with other nasal procedures. A number of turbinoplasty techniques, which preserve overlying mucosa and thus allow for normal mucociliary clearance, exist which can be performed in an office-based environment.[28] Broadly, turbinoplasty approaches can be categorized as submucosal ablation and submucosal bone resection. These techniques tend to be very well tolerated by patients and generally do not require any sedation.[5]

Inferior turbinate submucosal ablation

Myriad methods of submucosal ablation exist cautery, radiofrequency, coblation, and others. Choice of method will depend on surgeon comfort with a given approach and factors such as cost and ease of set-up.

Bipolar cautery is a cost-effective method of inferior turbinate reduction. A 2020 case series of 60 patients undergoing inferior turbinate reduction with bipolar cautery found significant improvement in SNOT scores at 1-year postprocedure; 10% of patients had vasovagal responses during the procedure.[29]

Radiofrequency devices can be used to reduce submucosal tissue. These devices allow for precisely targeted application of radiofrequency current. Prior research has shown a significant reduction in nasal obstruction scores and good patient tolerance of radiofrequency ablation, with no significant difference in outcomes compared to microdebrider resection.[30,31]

Coblation uses radiofrequency energy applied through a conductive solution such as saline, creating a plasma field that ablates tissue and generates less thermal energy than other methods of ablation.[32] The coblator has been found to be as effective as microdebrider resection at reducing symptoms of nasal obstruction, with significantly less postoperative pain.[33]

Inferior turbinate submucosal bone resection

Submucosal bone resection can be performed using a microdebrider in an office environment, in a similar fashion to in the operating room with submucosal resection of the inferior turbinate bone. Compared to bipolar cautery, microdebridement appears to have better improvement in obstructive symptoms.[34] A 2015 meta-analysis compared the microdebrider to radiofrequency ablation, and found both improved nasal obstruction symptoms, with no significant difference in outcomes.[31]

SUMMARY

Functional nasal surgery may be performed safely and effectively in the office setting. A wide range of procedures can be performed in the office, for a variety of structural causes of nasal obstruction. Surgeons should be prepared with thoughtful set-up and patient preparation, and a good understanding of what problems can be addressed under local anesthesia. In the right patient, office-based procedures provide a cost-effective way to improve symptoms of nasal obstruction.

AUTHOR CONTRIBUTIONS

The authors have nothing to report.

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CONFLICTS OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

The authors have nothing to report.

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