Title

In-Office Functional Nasal Surgery

Authors

Richard Kao, MD
richkao@iupui.edu
Department of Otolaryngology – Head & Neck Surgery
Indiana University School of Medicine

Cyrus C. Rabbani, MD
crabbani@iupui.edu
Department of Otolaryngology – Head & Neck Surgery
Indiana University School of Medicine

Jonathan Y. Ting, MD
joting@iupui.edu
Division of Rhinology
Department of Otolaryngology – Head & Neck Surgery
Indiana University School of Medicine

Taha Z. Shipchandler, MD FACS
Corresponding Author
tshipcha@iupui.edu
Division of Facial Plastic, Aesthetic & Reconstructive Surgery
Department of Otolaryngology – Head & Neck Surgery
Indiana University School of Medicine

Disclosures

Dr. Shipchandler is a member of the Speaker’s Bureau for the Spirox Latera lateral nasal implant.

Synopsis

Nasal airway obstruction is a common complaint encountered by the otolaryngologist. In-office nasal procedures are becoming increasingly popular, and should be considered for patients desiring immediate treatment without the adverse effects of general anesthesia, operating room costs or scheduling delays. In this paper, we discuss the factors in patient selection, room set-up, and other considerations. We discuss the options available for in-office treatment for nasal valve repair including turbinoplasty, septoplasty, and nasal valve repair/functional rhinoplasty-type techniques described in our literature.

Keywords

Nasal surgery, functional rhinoplasty, nasal valve, in-office, local anesthesia

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Key Points

- In-office nasal surgery should be considered for patients desiring immediate treatment without the adverse effects of general anesthesia, operating room costs or scheduling delays
- In office nasal valve procedures are becoming more popular with more recent options available
- Patient selection, pre-procedure counseling, and effective local anesthesia are critical to ensuring patient satisfaction and outcomes
- In-office inferior turbinoplasty using microdebrider, radiofrequency, ionized field ablation, and laser have all demonstrated effectiveness in the treatment of turbinate hypertrophy
- In-office septoplasty may be considered in those with limited septal deflection, or with bony or cartilaginous spur

Introduction

Nasal airway obstruction is a common symptom encountered by the otolaryngologist. The investigation, diagnosis, and treatment of nasal airflow obstruction takes time and patience. Numerous structural, immunologic, and disease processes have been associated with these symptoms. Septal deformity, nasal valve collapse/stenosis, and inferior turbinate hypertrophy top the list among anatomic and structural causes of nasal obstruction. Inevitably, the evaluation requires both a thorough patient history as well as an objective examination by the clinician.

Static and dynamic structural weaknesses contribute to obstruction of the nasal airway. External nasal valve collapse takes place at the nasal ala and nostril, usually precipitated by deep inhalation. The internal nasal valve is described as the narrowest segment of the nasal airway with the highest contribution to overall nasal airway resistance. The valve boundaries are the anterior head of the inferior turbinate, septum, and caudal edge of the upper lateral cartilages. This narrow passage makes the internal valve vulnerable to multiple factors that may contribute to airway resistance and obstruction (e.g. allergic rhinitis, septal deviation, valve collapse)[1].

Ultimately, persistent nasal airway obstruction, despite medical and conservative therapy, generally prompts a discussion about surgical intervention. Effective surgical management is guided by patient symptoms, physical exam findings and patient selection.

Diagnosis

The introduction and improvements in nasal endoscopy have allowed thorough in office evaluation. An evaluation of the nasal airway by endoscopy includes decongestion followed by investigation for valve narrowing, septal deviations, polyps, synechiae, tumors, and foreign bodies.

Though patients may find many ways to describe a symptom, one of the more common terms to relay nasal obstruction is nasal congestion. Medical treatment is the primary route of care for these patients, though when ineffective, surgical options exist including in-office procedures.

Septal deviations generally contribute to nasal obstruction, but this may not always be a major factor. Constantian et al. revealed 54% of patients with subjectively obstructed nasal airway with the septum deviated to the other side. In these cases, the nasal valve may be the major contributor to obstruction. The nasal valve must be examined by both observed and forced breathing. External nasal valve collapse can be diagnosed by observing the nostril margin (basal view) to determine the degree of alar collapse on moderate to deep inspiration through the nose. The cottle and modified cottle maneuver are well described techniques for evaluating specific locations of valve collapse amenable to surgical therapy (See Figure 1). Other methods of objective assessment may include peak nasal inspiratory flow (PNIF), acoustic rhinometry (AR), and rhinometry (RM). The utilization of these tests in the clinical setting is somewhat lacking given the time required. Surveys for symptoms are commonly utilized for assessment of nasal obstruction. The Nasal Obstruction Symptom Evaluation (NOSE) survey is a quality of life survey supported by the AAO Consensus Statement[2]. The visual analog scale (VAS) may also be used as a surrogate for rhinomanometry with adequate reliability[3].

Considerations

Nasal obstruction can take a heavy toll on a patient's overall quality of life and daily productivity. In office surgical procedures to address nasal airway obstruction generally avoid delays and recovery time by using minimally invasive techniques to achieve the goal of improved nasal airflow. Typically, patients drive themselves home or to work after such a procedure without any decrease in productivity.

Scott et al. described a series of 315 in office rhinologic procedures with an overall complication rate of 2.5%[4].These complications included pain, vasovagal episodes, bleeding, infection, and a swallowed pledget. An overall revision surgery rate of 11.7% was found for procedures including turbinoplasty, endoscopic sinus surgery, septoplasty, rhinoplasty, and septorhinoplasty. Vasovagal responses to in office procedures ranged from 0.16-0.6%. Many of these patients completed their procedure following a short recovery period[4, 5].

Patient Selection

In office surgical procedures are not well suited for every patient, thus determining who is a good candidate is critical. The nature and extent of the obstruction must be addressed. It is important that the patient's understanding and desires from intervention are well understood. There are patients who may elect a limited in office procedure over a more extensive surgery in an operating room with general anesthesia despite a limited outcome.

Specifically, for in office turbinate, nasal valve and septum procedures, consider those patients who are medically unfit to undergo elective procedures due to the risks of general anesthesia. Coagulopathies and local anesthetic allergies should be known prior to initiating any office procedure. Patients on anti-platelet therapy may need to hold these medications if allowed by their cardiologist or other medical practitioners. The cardiovascular risks associated with holding anti-platelet or anti-coagulant medications should be thoroughly discussed both with the surgeon and the cardiologist. Generally, aspirin is acceptable to continue while clopidogrel or ticagrelor should be held at least 5 days prior.

Patients must be aware of the cost of the procedure. There are large variations in insurance coverage when it comes to elective functional office nasal surgery. In office nasal procedures may be denied in which case the patient is expected to cover the procedural cost upfront. These charges should be honestly and openly discussed upfront, prior to any intervention.

Room Set Up and Patient Preparation

The room in which these procedures are performed should be equipped with appropriate surgical equipment and lighting. Specifically, a headlight is often helpful for in office nasal valve repair. Instruments should be laid accessible to both the assistant and surgeon along with supplementary anesthetic and topical vasoconstrictors. An electrocautery machine with appropriate tips may be stored within the office if necessary.

To improve patient comfort, the senior author (TZS) has speakers set up to play calming music at the patient's discretion. A low dose anxiolytic such as diazepam, alprazolam, or lorazepam may be provided for mild sedation depending on the patient. The patient should be made sure that the position they remain in throughout the procedure is not only tolerable but comfortable. Patient's typically are reclined to 45 degrees for these procedures with a pillow under their knees and behind their head in the standard otolaryngology office exam chair. Local anesthetic of the nasal cavity requires a combination of topical and local injections. Topical agents generally contain an anesthetic and vasoconstriction component to achieve improved visualization and operative space. Topical spray with 1% phenylephrine and 4% lidocaine may be applied to start. Nasal pledgets may then be placed, soaked with one or more of the following: lidocaine, epinephrine, tetracaine. Planned sites of incision and dissection are subsequently injected with lidocaine and diluted epinephrine with a 25-gauge needle (See Figure 2). The patient may generally be observed for 30 minutes following the procedure to ensure recovery and hemostasis.

Rhinoplasty and Nasal Valve Repair

Evaluation of the nasal valve comes down to distinguishing static and dynamic obstruction from either the upper or lower lateral cartilages. Bernoulli's principle states that as air velocity increases the outward pressure decreases leading to collapse from the sides of the nose. Weak lateral cartilage of the nose makes this collapse even more evident. The internal nasal valve accounts for nearly 2/3 of the total nasal airway resistance, and with even a slight decrease in the cross-sectional area, symptomatic obstruction may arise[6]. On the other hand, static obstruction from nasal valve stenosis tends to remain at baseline regardless of the passage of air.

Worth noting are non-surgical options for treatment of valve obstruction. Common commercial devices for nasal dilation include external nasal dilator strips, nasal stents, nasal clips, and septal stimulators. Limited data is available to support their use. A systematic review by Kiyohara et al. found that external nasal dilators and nasal clips are the best studied and appear to be potential alternatives to surgical intervention[7]. A reduction in nasal airway resistance was found with external nasal dilators (Breathe-Right Device); and nose cones (Max-Air) were found to increase nasal airflow[1, 8].

Bioabsorbable Implant

As far as in office treatment of nasal valve stenosis, few options exist that have gained significant popularity with more wide-spread use. One such implant is the Latera Bioabsorbable implant (Stryker Corp., Kalamazoo, MI; see photo of Top placement guide and bottom two Latera stents in the package not yet removed, also see additional photo of delivery device). Latera has been available for over 3 years now with data showing effectiveness 18 months from the procedure date with improved NOSE scores. Latera can be placed either in the office using local anesthetic or in the operating room. The implant is bioabsorbable (poly-L-lactide and poly-D-lactide) thus resorbs on average 18 months after placement. The process the body undergoes to breakdown the implant leads to intrinsic stiffening of the nasal sidewall thus giving a long-lasting positive effect for the valve collapse even when the implant is no longer present. Latera is designed to serve as a sidewall and internal nasal valve support strut anchored caudally by the lateral crura of the lower lateral cartilage and cephalically by the sidewalls of the nasal bones. The implant is designed to rest in a plane just superficial to these structures in the sub-SMAS plan of the nose and subperiosteally or just superperiosteally on the nasal bones. This strut then supports and may even lateralize the sidewall of the nose resulting in improved nasal breathing via decreased internal nasal valve collapse.

Latera comes pre-packaged with two implants, a placement guide and a delivery device (see photo XX noted previously). The placement guide is used to mark an area on the side of the nose where the perceived collapse is occurring (photo of placement guide on right side of nose). Great care must be taken to have the inferior edge of the implant cephalic to the alar-sidewall groove of the nose, otherwise the impression of the implant may be visible and too close to the overlying dermis causing potential inflammation or irritation. The implant is placed with relative ease under sterile conditions into the delivery device (photo of implant in extended delivery device).

The senior author (TZS) has performed over 170 Latera procedures with over 30 in office under local anesthesia. It is a well-tolerated procedure and generally takes 15 minutes to complete the procedure after a small room setup. Once the local anesthetic has been allowed to sit for 10 minutes, a double skin hook is used to apply traction downward on the nasal ala with the two hooks being placed in line on either side of where the intended implant will be placed (see photo of double skin hook in place with cannula through the skin hook). Next, the implant is placed taking great care to maintain the appropriate plane noted above (see photo). Once the implant is in the nose, a finger is placed gently on the nasal bone while pulling out the delivery device (see photo). This gentle finger pressure may aid in preventing the implant from coming back out with the delivery device.

The Latera device is among the earliest attempts to address the nasal valve while utilizing a minimally invasive approach. It is recommended that a surgeon perform several procedures of this kind in the operating room before attempting this procedure in the office. In the author's experience, thin-skinned individuals in the nasal bone region may show an impression of a visible implant though this typically disappears within 4-6 weeks. Extrusion of the implant through the skin is very rare and has not been experienced by the senior author though it has been reported anecdotally. Typically this has been due to the implant being deployed too superficially. Other possible complications include no improvement from implant placement or retrieval of the implant from the nostril. Typically a retrieval may occur early on when a surgeon is just gaining experience with the procedure.

The use of Latera is a suitable alternative for a patient who does not want the downtime of going to sleep for surgery or is medically unfit to receive a general anesthetic. Certainly if a patient has severe septal deviation and turbinate hypertrophy, Latera still may provide some improvement, but optimally the patient would be treated in the operating room with a septoplasty and/or turbinate reduction.

When evaluating a patient for Latera, it is important to note the skin thickness of the patient's nose in the nasal bone region. As otolaryngologists we typically do not examine this area of skin. Very thin or crepe like older skin in this area may show the impression of the implant which may not be acceptable to a patient. In addition, if a patient wears glasses regularly then the nose pieces of the glasses may rest on the superior edge of the Latera implant and cause some discomfort for the first several weeks after placement. It is important to discuss these issues with patient ahead of time.

Vestibular Skin Procedures

For the external nasal valve, a well described rhinoplasty technique that may be suitable for an office setting is the lateral crural J-flap; this involves an incision over the lateral crus with excision of excess cartilage and vestibular skin[4, 9, 10]. An intranasal z-plasty may be offered for internal/external nasal valve collapse; this is performed by removing portion of the vestibular skin with a skin z-plasty performed at the site of valve collapse[11] (See Figure 4). In addition, Dolan et al. describe a well-tolerated excision of 2 millimeters of mucosa, fibrous tissue, and caudal upper lateral cartilage with primary closure[12].

In an older patient with significant tip droop, weakened cartilages and alar collapse, consider a “rhinolift”. This procedure has been described as 1) an excision of redundant skin overlying the nasofrontal angle[13], and 2) a skin excision at the supratip crease with subsequent suspension of the lower lateral cartilages on the upper lateral cartilages[14]. Scott et al. describes four septorhinoplasties performed with an external approach and septal cartilage grafting[4]. Osteotomies have not been well described in the clinic setting likely attributable to poor patient tolerance; however, closed nasal reduction following fracture may be suitable if addressed in a timely fashion.

Radiofrequency Remodeling

Recently, the Vivaer (Aerin Medical, Sunnyvale, CA) tissue remodeling device was introduced as a low frequency, non-ablative, tissue remodeling device designed to address obstruction in the nasal valve region. The procedure is performed quickly in the office with injectable and/or topical anesthetic in the mucosal region of narrow inside the nose. The device has showed promise to address an area not easily treated previously, specifically, the area just posterior to the nasal skin vestibule where the lateral wall is collapsing. Applying the tip of the device leads to remodeling and stiffening of the submucosal tissue and cartilage thus opening the nasal airway.

Inferior Turbinate Hypertrophy

The inferior turbinates play a key role in respiratory function and nasal physiology. Not only do they humidify, warm, and cleanse the air that is inspired through the nose, they also contribute to inspiratory resistance, nasal defense system, and mucociliary transport[15]. Nasal obstruction is often caused by hypertrophic inferior turbinates, which may be caused by allergic or non-allergic rhinitis[16]. Upon examination, these patients most commonly present with pathologic mucosal inflammation[17]. Medical management is the first-line treatment, which includes the use of steroid sprays, anti-histamines, decongestants, nasal saline sprays, and even immunotherapy in recalcitrant cases. In cases where medical management has failed, surgery may be indicated.

Surgical reduction of the inferior turbinates was introduced by Hartmann in the 1890s[18]. Total or partial turbinate resection was originally preferred, which had an increased risk of empty nose syndrome and atrophic rhinitis[19]. Submucous electrocautery was introduced for its quick and relatively bloodless method, but produced temporary relief only, along with unwanted nasal dryness and edema. Similarly, cryotherapy offered a quick and bloodless option, but caused diffuse mucosal injury due to the high surface area in contact with liquid hydrogen.

Over time turbinoplasty as described by Mabry has become a preferred surgical technique[20]. The goal of this surgery is to alleviate the patient's symptoms while preserving the mucosa and mucociliary function. As such, the turbinoplasty approach is characterized by raising a submucosal flap and resecting the hypertrophic submucosal tissues. The procedure is frequently supplemented with outward fracturing of the inferior turbinates, which is somewhat limited in the clinic setting due to comfort. Over time, multiple technologies have been introduced, each with their own strengths and weaknesses. Regardless of the method, multiple studies have demonstrated that the turbinoplasty approach provides the most lasting improvement in airway resistance[21, 22].

Radiofrequency-Assisted Turbinoplasty

Radiofrequency assisted turbinoplasty is a surgical procedure that uses radiofrequency (RF) heating to cause submucosal tissue destruction. Radiofrequency has been used to reduce soft tissue volume in the soft palate and base of tongue in addition to the inferior turbinates. The device delivering this technology includes the Celon System (Olympus America, NY, USA), which delivers 50 to 70 joules with a frequency of 470 Hz at a power setting of 15 [22]. The Celon device has a bipolar probe needle measuring 1.3 mm in diameter with a protected tip, which aims to deliver the radiofrequency current to only its immediate vicinity. A previously described device in the literature of similar function is the Somnus (Somnus Medical Technologies, Inc)[21].

After application of topical anesthetic spray into the nasal cavity and local anesthetic injection into the turbinate, the tip is inserted into the head of the inferior turbinate under endoscopic visualization with a zero-degree endoscope. The tip is advanced posteriorly in the submucosal plane, parallel to turbinate's bony structure without exiting the turbinate. The instrument is then retracted anteriorly while using the coagulation setting so that a single continuous submucosal thermal lesion is created along the length of the inferior turbinate. The coagulation typically occurs over the span of 60 to 90 seconds for each turbinate. Scar contraction occurs over the next three weeks, ultimately resulting in the decreased size of the inferior turbinates (Celon, Olympus Medical Systems Europe and MEA).

This method of turbinate reduction offers a relatively easy setup and preparation. Patients are typically able to return to normal activity levels after the procedure, and typically have high patient comfort and satisfaction.

Ionized Field Ablation-Assisted Turbinoplasty

The concept of ionized field ablation centers on its use of a radiofrequency-activated plasma to resect tissue. Its electrodes are configured in a specific fashion to create a plasma field of ionized sodium molecules, which ablate tissues while dispersing minimal excess heat energy in that process. The most commonly used device delivering this technique is aptly named Coblation (Smith Nephew, TX, USA) after its so-called “cold ablation”. The thermal effect of the process is approximately 45 to 85 degrees Celsius, significantly lower than traditional RF techniques. It has numerous applications in the head and neck, including ablation and resection of tissues in the oral cavity, oropharynx, and nasopharynx, airway, and paranasal sinuses.

The more recently developed Turbinator wand (Smith Nephew, TX, USA) used with coblation technology incorporates suction into the handpiece, which provides a more visible removal of submucosal tissue intra-operatively. Though the wand is significantly larger at 2.9 mm in width, it removes tissue more aggressively and provides improved hemostasis than older coblation techniques. A preliminary study reveals good outcomes, not inferior to microdebrider-assisted methods[23].

Microdebrider-Assisted Turbinoplasty

Microdebrider-assisted turibnoplasty has emerged as a popular technique due to the familiarity with the technology, which is frequently used in endoscopic sinus surgery. The inferior turbinate blade (See Figure 2) uses an elevated, rotating, oscillating tip that removes obstructive tissue in a “cold steel” fashion.

Saline irrigation and suction is incorporated into this device to clear the tip of debris and actively extract the tissue excised from the surgical site.

To provide access to the turbinate, a stab incision is often made at the head of the turbinate and a submucosal plane is developed. The turbinate blade can then be advanced through this plane with ease to begin resecting tissue. The blade may be rotated to address different areas of obstruction, while care is taken to not perforate through the posterior turbinate mucosa. A more invasive extension of this technique employs a submucosal resection of some portion of the turbinate bone in addition to its soft tissue[19].

The use of microdebrider requires a comparably more involved setup, which includes saline irrigation and suction simultaneously. As a result, proper function relies upon these constituents working correctly as well. Due to the cold blade resection, there is increased risk for postoperative bleeding than with thermoablative techniques.

A meta-analysis of 1523 cases from 26 studies comparing the above methods showed that all the above methods (RF and coblation grouped together versus microdebrider) produced significant symptomatic relief, with no significant difference in the visual analog scale or rhinomanometry postoperatively[21]. There was insufficient data to conclude whether concurrent out-fracturing provided any additional benefit. It is important to note that two high-quality prospective and randomized studies included in this analysis revealed that microdebrider-assisted turbinoplasty was statistically favored in providing symptom relief[16], and providing longer-lasting effects over 6 months postoperatively[24].

Septoplasty

In-office septoplasty can be performed under local anesthetic in a similar fashion to that in the operating room. The ideal patient for this procedure is one with limited cartilaginous deviation or an isolated spur, such that precise surgical resection can greatly improve the patient’s symptoms[25]. In the instance of septal deviation, the procedure follows the standard operation performed in the operating room using open or endoscopic visualization. Special attention is given to properly anesthetize all the intended areas of resection along the septum as well as the hemitransfixion site.   Ensuring patient comfort during in-office septoplasty is an utmost consideration, especially because the comfortable patient is more likely to stay still during the procedure.

Conclusion

Surgical procedures in the office require a prepared clinician and patient. There are a growing number of techniques to treat patients for nasal airway obstruction. While not all patients are suited for an in office functional nasal airway procedure, there are many potentially favorable candidates. Beyond the cost saving benefits, consider performing in office functional nasal surgery in patients with desire for limited surgical interventions or those that are medically unfit for general anesthesia.

References

1. Portugal LG, Mehta RH, Smith BE et al. Objective assessment of the breathe-right device during exercise in adult males. *Am J Rhinol* 1997; **11**: 393-7.
2. Stewart MG, Smith TL, Weaver EM et al. Outcomes after nasal septoplasty: results from the Nasal Obstruction Septoplasty Effectiveness (NOSE) study. *Otolaryngol Head Neck Surg* 2004; **130**: 283-90.
3. Ciprandi G, Mora F, Cassano M et al. Visual analog scale (VAS) and nasal obstruction in persistent allergic rhinitis. *Otolaryngol Head Neck Surg* 2009; **141**: 527-9.
4. Scott JR, Sowerby LJ, Rotenberg BW. Office-based rhinologic surgery: A modern experience with operative techniques under local anesthetic. *Am J Rhinol Allergy* 2017; **31**: 135-8.
5. Radvansky BM, Husain Q, Cherla DV et al. In-office vasovagal response after rhinologic manipulation. *Int Forum Allergy Rhinol* 2013; **3**: 510-4.
6. Haight JS, Cole P. The site and function of the nasal valve. *Laryngoscope* 1983; **93**: 49-55.
7. Kiyohara N, Badger C, Tjoa T, Wong B. A Comparison of Over-the-Counter Mechanical Nasal Dilators: A Systematic Review. *JAMA Facial Plast Surg* 2016; **18**: 385-9.
8. Raudenbush B. Stenting the nasal airway for maximizing inspiratory airflow: internal Max-Air Nose Cones versus external Breathe Right strip. *Am J Rhinol Allergy* 2011; **25**: 249-51.
9. O'Halloran LR. The lateral crural J-flap repair of nasal valve collapse. *Otolaryngol Head Neck Surg* 2003; **128**: 640-9.
10. Tan S, Rotenberg B. Functional outcomes after lateral crural J-flap repair of external nasal valve collapse. *Ann Otol Rhinol Laryngol* 2012; **121**: 16-20.
11. Dutton JM, Neidich MJ. Intranasal Z-plasty for internal nasal valve collapse. *Arch Facial Plast Surg* 2008; **10**: 164-8.
12. Dolan RW, Catalano PJ, Innis W, Wanees E. In-office surgical repair of nasal valve stenosis. *Am J Rhinol Allergy* 2009; **23**: 111-4.
13. Kabaker SS. An adjunctive technique to rhinoplasty of the aging nose. *Head Neck Surg* 1980; **2**: 276-81.
14. Hu M. External Approach for the Treatment of the Aging Nasal Tip. *International Journal of Head and Neck Surgery* 2016; **7**: 165-7.
15. Lee KC, Hwang, P. H., Kingdom, T. T. Surgical Management of Inferior Turbinate Hypertrophy in the Office: Three Mucosal Sparing Techniques. *Operative Techniques in Otolaryngology-Head and Neck Surgery* 2001; **12**: 107-11.
16. Liu CM, Tan CD, Lee FP et al. Microdebrider-assisted versus radiofrequency-assisted inferior turbinoplasty. *Laryngoscope* 2009; **119**: 414-8.
17. Siegel GJ, Seiberling KA, Haines KG et al. Office CO2 laser turbinoplasty. *Ear Nose Throat J* 2008; **87**: 386-90.
18. Maskell S, Eze N, Patel P, Hosni A. Laser inferior turbinectomy under local anaesthetic: a well tolerated out-patient procedure. *J Laryngol Otol* 2007; **121**: 957-61.
19. Janda P, Sroka R, Baumgartner R et al. Laser treatment of hyperplastic inferior nasal turbinates: a review. *Lasers Surg Med* 2001; **28**: 404-13.
20. Veit JA, Nordmann M, Dietz B et al. Three different turbinoplasty techniques combined with septoplasty: Prospective randomized trial. *Laryngoscope* 2017; **127**: 303-8.
21. Acevedo JL, Camacho M, Brietzke SE. Radiofrequency Ablation Turbinoplasty versus Microdebrider-Assisted Turbinoplasty: A Systematic Review and Meta-analysis. *Otolaryngol Head Neck Surg* 2015; **153**: 951-6.

22. Gouveris H, Nousia C, Giatromanolaki A et al. Inferior nasal turbinate wound healing after submucosal radiofrequency tissue ablation and monopolar electrocautery: histologic study in a sheep model. *Laryngoscope* 2010; **120**: 1453-9.
23. Khong GC, Lazarova L, Bartolo A, Leong SC. Introducing the new Coblation Turbinator turbinate reduction wand: Our initial experience of twenty-two patients requiring surgery for nasal obstruction. *Clin Otolaryngol* 2018; **43**: 382-5.
24. Lee JY, Lee JD. Comparative study on the long-term effectiveness between coblation- and microdebrider-assisted partial turbinoplasty. *Laryngoscope* 2006; **116**: 729-34.
25. Thamboo A, Patel ZM. Office Procedures in Refractory Chronic Rhinosinusitis. *Otolaryngol Clin North Am* 2017; **50**: 113-28.