

Long-Term Efficacy of Microdebrider-Assisted Inferior Turbinoplasty With Lateralization for Hypertrophic Inferior Turbinates in Patients With Perennial Allergic Rhinitis

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Objectives: The aim of the study was to evaluate the long-term efficacy of microdebrider-assisted inferior turbinoplasty with lateralization (MAITL) compared to submucosal resection for hypertrophic inferior turbinates.

Study Design: Surgical outcomes were evaluated with respect to visual analogue scale, anterior rhinomanometry, and saccharin test results.

Methods: From January 2002 to December 2006 inclusively, 160 patients with perennial allergic rhinitis and hypertrophic inferior turbinates were enrolled into this study. The patients, all suffering from chronic nasal obstruction, were randomly classified into two groups, MAITL group or SR group, each comprised of 80 patients. Ten patients who did not display any nasal discomfort served as normal controls. For the submucosal resection group, patients underwent submucosal resection of the inferior turbinate, whereas patients in the MAITL group underwent microdebrider-assisted inferior turbinoplasty with lateralization. Assessments (visual analogue scale, anterior rhinomanometry, and saccharin test) were conducted prior to the surgery and 1, 2, and 3 years after completion of surgery.

Results: Compared to preoperative values, subjective complaints including nasal obstruction, sneezing, rhinorrhea, and snoring improved significantly in both groups at 1, 2, and 3 years after surgery in both groups ($P < .05$ for all). Rhinomanometric assessment also showed significant improvement at 1, 2, and 3 years postoperatively in both groups ($P < .05$ for all). Saccharin transit time was significantly decreased ($P < .05$ for all)

compared to preoperative values 1, 2, and 3 years after surgery in both groups.

Conclusion: Microdebrider-assisted inferior turbinoplasty with lateralization appears to be as effective as submucosal resection at relieving nasal symptoms and decreasing total nasal resistance and saccharin transit times for more than 3 years in patients with perennial allergic rhinitis who have had substantial nasal obstruction.

Key Words: Microdebrider, inferior turbinoplasty, submucosal resection.

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INTRODUCTION

Inferior turbinate hypertrophy is the main cause of symptomatic nasal obstruction.¹ Perennial allergic and non-allergic rhinitis are the most common noninfectious causes of inferior turbinate hypertrophy.² Patients suffering from chronic nasal obstruction and hypertrophic turbinates often benefit from turbinate reduction when other medical treatment fails.³

Various methods have been proposed and are available for the surgical treatment of hypertrophic inferior turbinates, including cryotherapy, submucosal diathermy, laser turbinoplasty, submucosal turbinectomy, and partial and total turbinectomy.^{4–9} Because surgery is more invasive than other types of treatment such as medication, it is important that the surgery results in sustained improvement in the patient's quality of life.

The main goal of the turbinate surgery is to relieve the patient's symptoms of chronic nasal congestion while preserving mucosal surfaces with reduction of the submucosal and bony tissue.¹⁰ The aim of our study was to compare the long-term efficacy of microdebrider-assisted inferior turbinoplasty with lateralization and submucosal resection in patients with perennial allergic rhinitis.

MATERIALS AND METHODS

From January 2002 to December 2006, inclusively, 160 patients (84 men and 76 women) with chronic nasal obstruction and rhinitis were enrolled in the study. Their ages ranged from 19 to

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61 years (mean: 39.2 y). All patients had documented clinical histories of perennial allergic rhinitis and a high titer of anti-*Dermatophagoides fabrinae*-specific and anti-*Dermatophagoides pteryonyssinus*-specific immunoglobulin E antibodies. All patients presented symptoms and signs of nasal obstruction and stuffiness related to hypertrophy of the inferior turbinates that had not responded to various medical treatments (topical corticosteroids, antihistamines) during the preceding 3 months. None of the patients had a prior history of sinus or nasal surgery. Patients with nasal septal deviation or sinusitis were excluded. The effect of topical decongestion on nasal resistance was also evaluated. Patients with less than a 35% decrease in unilateral nasal resistance on rhinomanometry, indicating a structural abnormality such as conchal hypertrophy or conchal bullosa, were also excluded from the study.¹¹ The 160 patients selected for this study were randomly assigned to undergo submucosal resection of the inferior turbinate (n = 80), or microdebrider-assisted inferior turbinoplasty with lateralization (n = 80). Ten patients (six men) who had no evidence of nasal obstruction or rhinitis were recruited as normal controls. The age of the control subjects ranged from 18 to 63 years (mean: 36.4 y). Written informed consent for participation in the study was provided by all participants.

All surgical procedures were performed by the same surgeon. Submucosal resection was performed under local anesthesia. All surgical procedures were performed under 30° endoscopic guidance. After infiltration of the inferior turbinate with combined 2% Xylocaine and 1:100,000 epinephrine (AstraZeneca AB, Taipei, Taiwan), a 3 to 4-mm mucosal incision was made on the head of the inferior turbinate. The submucosal tissue was dissected from the medial surface and the inferior edge of the bone via the mucosal incision, and assisted with the use of an elevator (Explorent Surgical Instruments, Tuttlingen, Germany). The excess cavernous tissue was then resected using Hartmann forceps (329001 Hartmann nasal cutting forceps, size 1, working length 11 cm, Explorent Surgical Instruments). After surgery, the nasal cavity was packed with Vaseline-coated gauze for 2 days.

The MAITL procedure was performed under local anesthesia, and under 30° endoscopic guidance. After infiltration of the inferior turbinate with combined 2% Xylocaine and 1:100,000 epinephrine, an incision in the inferior and lateral aspects of the turbinate head was made with a scalpel. A turbinate blade (3.5-mm tip with a serrated blade, Medtronic Xomed, Jacksonville, FL) was then inserted into the anterior face of the inferior turbinate just medial to the mucocutaneous junction. A submucosal pocket was dissected by tunnelling with the elevator in an anterior to posterior and superior to inferior sweeping motion. A 2.9-mm diameter microdebrider tip (Medtronic Xomed, Jacksonville, FL) rotating continuously in a circular fashion and set at 3,000 rpm, while using suction irrigation, was applied through the incision to remove all of the stromal tissue possible from inside the turbinate. Particular attention was paid to preserve the mucosal flap during this removal process. For patients with very hypertrophic turbinate tails, the same procedure was performed from a second entry point made at the midportion of the inferior turbinate to gain better access to treat the "mulberry-tip" of the inferior turbinate. The osseous portion of the inferior turbinate was then out-fractured, allowing extra lateralization of the turbinate. The nasal passages were packed with a piece of Mero-cel (Medtronic Xomed, Jacksonville, FL) for a 1-day period.

The surgical outcomes for both procedures were evaluated with respect to three distinct parameters: visual analogue scale, active anterior rhinomanometry, and saccharin testing. The three parameters were used to assess subjective patient complaints (nasal obstruction, rhinorrhea, sneezing, and snoring), total nasal resistance, and nasal mucociliary transport, respectively. All pa-

tients were evaluated prior to surgery and at 1, 2, and 3 years after surgery. Patients were permitted to use intranasal inhalation of fluticasone propionate, when the symptoms of nasal allergy occurred within a year after surgery in both groups. One year after surgery, patients were treated with an oral antihistamine or intranasal steroid spray, or both, to relieve symptoms of nasal allergy on appropriate days. Patients were asked not to use oral or topical steroids, antihistamines, or vasoconstrictors for 2 weeks before each visit.

A standard visual analogue scale ranging from 0 (no symptoms) to 10 (the most-severe symptoms) was used to assess subjective patient complaints, including nasal obstruction, sneezing, rhinorrhea, and snoring.

Active anterior rhinomanometry was performed in all patients in the surgical groups and in the control group using a rhinomanometer (Rhino 4000, Homoth, Hamberg, Germany). Using a value of 75 pascals as the reference point, the total nasal resistance was evaluated both before and after surgery in both study groups.¹²

Nasal mucociliary transport was evaluated in all patients and controls using the saccharin test.¹³ With the patient in an upright, seated position, a saccharin granule was placed on the septal mucosa corresponding to the antero-inferior tip of the middle turbinate, and the time required for the subject to experience a sweet taste was determined. If no such gustatory sensation was reported by the patient, the result was recorded as being greater than 60 minutes and treated as 60 minutes for the purposes of statistical analysis. The mean saccharin transit time of the 10 normal patients served as the control value for this test.

Data were analyzed using repeated-measure analysis of variance (ANOVA), and then a post hoc multiple comparison was performed using Sidak's *t* test ($\alpha = 0.05$).

RESULTS

Of the 80 patients enrolled in each group, all were monitored for 1 year after surgery. Six patients in the MAITL group and nine patients in the submucosal resection group dropped out by the 2-year postoperative visit. Four patients in the MAITL group and eight patients in the submucosal resection group dropped out by the 3-year follow-up visit. The reason given by those patients who dropped out at the second and third year postoperative follow-up visits was due to their busy lives.

None of the patients in either of the surgical groups developed active bleeding during or after surgery. However, mucosa tear was noted in the MAITL group and in the submucosal resection group, 10% (8 of 80) and 40% (32 of 80), respectively, but there was no loss of mucosa in either group. Postoperative crusting and synechia developed more frequently in the submucosal resection group (8 of 80 and 2 of 80 patients, respectively) compared to those of the MAITL group (0 of 80 and 0 of 80 patients, respectively). Two of the 80 patients in each group experienced nasal dryness after surgery. None of the patients in either of the two groups experienced atrophic rhinitis during the postoperative follow-up period.

The typical symptoms related to nasal obstruction (sneezing, rhinorrhea, snoring) decreased significantly from 1 to 3 years after surgery in both surgical groups compared to their preoperative values, respectively ($P < .05$ for both, Table I). No significant differences were noted between the MAITL and submucosal resection groups at each postoperative visit ($P > .05$ for all).

TABLE I.
Nasal Subjective Symptoms (Mean $\pm$ Standard Deviation).*

	Pre-Op	Post-Op 1 Year	Post-Op 2 Year	Post-Op 3 Year	P†
Nasal obstruction					
SR group	8.54 $\pm$ 1.03	1.45 $\pm$ 0.63‡	1.48 $\pm$ 0.63‡	1.50 $\pm$ 0.71‡	<.0001
MAITL group	8.69 $\pm$ 1.05	1.46 $\pm$ 0.65‡	1.47 $\pm$ 0.65‡	1.53 $\pm$ 0.77‡	<.0001
Sneezing					
SR group	5.95 $\pm$ 1.17	1.79 $\pm$ 0.69‡	1.80 $\pm$ 0.71‡	1.85 $\pm$ 0.78‡	<.0001
MAITL group	6.15 $\pm$ 1.02	1.65 $\pm$ 1.07‡	1.80 $\pm$ 1.09‡	1.82 $\pm$ 1.07‡	<.0001
Rhinorrhea					
SR group	6.69 $\pm$ 1.38	1.66 $\pm$ 0.84‡	1.69 $\pm$ 0.82‡	1.71 $\pm$ 0.83‡	<.0001
MAITL group	6.96 $\pm$ 0.95	1.61 $\pm$ 0.92‡	1.64 $\pm$ 0.99‡	1.64 $\pm$ 0.98‡	<.0001
Snoring					
SR group	6.55 $\pm$ 1.17	1.58 $\pm$ 0.67‡	1.59 $\pm$ 0.67‡	1.61 $\pm$ 0.70‡	<.0001
MAITL group	6.70 $\pm$ 1.10	1.51 $\pm$ 0.69‡	1.54 $\pm$ 0.69‡	1.58 $\pm$ 0.74‡	<.0001

SR = submucosal resection; MAITL = microdebrider assisted inferior turbinoplasty with lateralization; Post-op = post operative.

*Visual analogue scale (VAS) ranging from 0 (no symptoms) to 10 (the most severe symptoms) was used to determine the degree of the subjective symptoms.

†Overall significance by repeated measures of analysis of variance (ANOVA).

‡The score was significantly different compared with pre-operative value (Sidak's *t* test).

The total mean nasal resistance for the normal controls was 0.18 ± 0.06 Pa/mL/second. Rhinomanometric testing showed significant decreases in both surgical groups at 1, 2, and 3 years postoperatively compare to preoperative values ($P < .05$ for both), Figure 1. No significant differences were noted between the MAITL and submucosal resection groups at each of the three postoperative visits ($P > .05$ for all).

The mean nasal mucociliary transport time was 14.82 ± 6.32 minutes for the normal control group. Compared to preoperative values, the nasal mucociliary transport time values for both of the groups significantly decreased and had returned to normal at the first year postoperative follow-up visit, and remained normal for years 2 and 3 after surgery ($P < .05$ for both groups; Fig. 2). Although the mean nasal mucociliary transport time did not differ significantly between the MAITL and submucosal resection groups ($P > .05$ for all), the nasal mu-

ciliary transport time in the MAITL group was lower than that of the submucosal resection group at each post-operative visit.

DISCUSSION

The microdebrider, which has been widely used in inferior turbinate surgery for the past decade, is supposed to provide real-time suction with the ability of precise tissue resection.^{10,14,15} Passali et al.¹⁶ indicated that submucosal resection was superior to various forms of surgery at relieving nasal obstruction, rhinorrhea, sneezing, and postnasal dripping postoperatively. Thus, we used submucosal resection as the controls in our study. Ideal turbinate surgery, in which there is an attempt to reduce submucosal tissue with minimal violation of the mucosa, could be achieved using an endoscopy-guided microdebrider-assisted technique. However, patients with bony hypertrophy covered with a thin layer of mucosa are not good

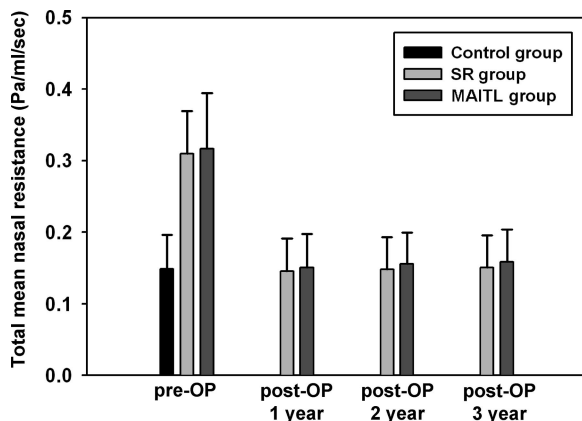


Fig. 1. Total mean nasal resistance measured before and after operation.

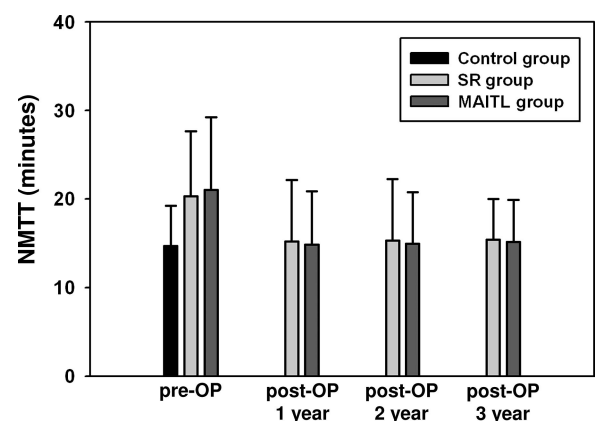


Fig. 2. Nasal mucociliary transport time (NMTT) measured before and after operation.

candidates for microdebrider turbinoplasty because the thick, calcified bony turbinates make the debridement difficult and might predispose the turbinates to mucosal tears. Thus, we studied only patients with mucosal hypertrophy of the inferior turbinates.

In the MAITL group, nasal obstruction, rhinorrhea, sneezing, and snoring significantly improved 1 to 3 years postoperatively compared to their preoperative levels ($P < .05$, all). The MAITL group achieved effects similar to those of submucosal resection 1, 2, and 3 years postoperatively ($P > .05$, all). Submucosal resection is effective in reducing not only nasal congestion, but also sneezing and rhinorrhea in patients with perennial allergic rhinitis via a reduction in the number of various inflammatory or allergy-affected cells in the turbinates.^{17,18} In addition, submucosal resection also damages the branch of the post-nasal nerve which plays a role in causing sneezing and hypersecretion.¹⁸ Because MAITL removes submucosal tissue as effectively as submucosal resection, including reducing the numbers of inflammatory cells and damaging the postnasal nerve branch, it is reasonable that MAITL could improve patients' long-term symptoms as effectively as submucosal resection.

Rhinomanometry is proposed as an objective method for evaluating the relative level of nasal patency.¹⁹ McCaffrey and Kern¹⁹ reported positive correlation between nasal-obstruction symptoms and nasal resistance to air passage in a sample of 1,000 patients with chronic rhinitis. Huang and Cheng²⁰ reported that the improvement of nasal resistance was observed 1 year after endoscopic microdebrider-assisted inferior turbinoplasty. We rhinomanometrically assessed the level of nasal resistance to air passage, which significantly improved from the end of the first to the third years after surgery in both groups. These findings are in agreement with a study by Kim et al.²¹ Therefore, the improvement of nasal resistance is consistence with patients' subjective interpretations of long-term results and satisfaction.

The saccharin test is a useful method to evaluate the relative effectiveness of nasal mucociliary transport due to the technique's relative simplicity and reproducibility.¹³ Passali et al.¹⁶ reported that the nasal mucociliary transport time returned to normal by 1 year after submucosal resection. In our earlier report, the nasal mucociliary transport time significantly increased at the end of the first week after surgery and returned to normal at 1 month after surgery in patients who underwent submucosal resection. However, the nasal mucociliary transport time remained within the normal range from the end of the first week to 3 months after surgery in patients who underwent MAITL.²² In this study, the mean nasal mucociliary transport time decreased significantly compared to preoperative times from the end of the first year to the third year after surgery in both groups ($P < .05$, all). Although the mean nasal mucociliary transport time did not differ significantly between the groups ($P > .05$, all), the nasal mucociliary transport time in the MAITL group was lower than that of the submucosal resection group. Mucociliary transport in the nasal mucosa remained within the normal range from 1 to 3 years after surgery in the patients who underwent submucosal resection or

MAITL. Nonetheless, we suggest that the MAITL technique is superior to submucosal resection with regard to preserving mucociliary transport of the nasal mucosa after turbinate surgery because of its advantage of preservation of the nasal mucosa during manipulation.

According to the literature,^{23–25} rhino-sinus physiological mechanisms required about 2 years for restoration after surgery in this region. Thus, in our study, patients surgically treated with MAITL or submucosal resection for hypertrophic inferior turbinates showed reliable results after 3 years of postsurgical follow-up.

CONCLUSION

MAITL is equally effective as submucosal resection at relieving nasal symptoms and decreasing total nasal resistance and saccharin transit time for more than 3 years in patients with perennial allergic rhinitis who have substantial nasal obstruction.

BIBLIOGRAPHY

1. Bridger GP, Proctor DF. Maximum nasal inspiratory flow and nasal resistance. *Ann Otol Rhinol Laryngol* 1970;79:481–488.
2. Passali DP, Passali FM, Damiani V, Passali GC, Bellussi L. Treatment of inferior turbinate hypertrophy: a randomized clinical trial. *Ann Otol Rhinol Laryngol* 2003;112:683–688.
3. Moore GF, Freeman TJ, Ogren FP, Yonkers AJ. Extended follow-up of inferior turbinate resection for relief of chronic nasal obstruction. *Laryngoscope* 1985;95:1095–1099.
4. Lippert BM, Werner JA. CO2 laser surgery of hypertrophied turbinates. *Rhinology* 1997;35:33–36.
5. Rakover Y, Rosen G. A comparison of partial turbinectomy and cryosurgery for hypertrophic inferior turbinates. *J Laryngol Otol* 1996;110:8732–8735.
6. Talaat M, Subawy EI, Bakay FA, Raheem AA. Submucosal diathermy of the inferior turbinates in chronic hypertrophic rhinitis. *J Laryngol Otol* 1987;101:452–460.
7. Lippert BM, Werner JA. Comparison of carbon dioxide and neodymium: yttrium-aluminum-garnet lasers in surgery of the inferior turbinate. *Ann Otol Rhinol Laryngol* 1997;106:1036–1042.
8. Martinez SA, Nissen AJ, Stock CR, Tesmer T. Nasal turbinate reduction for relief of nasal obstruction. *Laryngoscope* 1983;93:871–875.
9. Fanous N. A new surgical approach to turbinate hypertrophy: a review of 220 cases. *Arch Otolaryngol Head Neck Surg* 1986;112:850–852.
10. Davis WE, Nishioka GJ. Endoscopic partial inferior turbinectomy using a power microcutting instrument. *Ear Nose Throat J* 1996;75:49–50.
11. McCaffrey TV. Nasal function and evaluation. In: Bailey BJ, ed. *Head and Neck Surgery-Otolaryngology*. 3rd edition. Philadelphia, PA: Lippincott Williams & Wilkins; 2001: 261–171.
12. Clement PAR. Committee report on the standardization of rhinomanometry. *Rhinology* 1984;22:151–155.
13. Sakakura Y, Majima Y, Harada T, Hattori M, Ukai K. Nasal mucociliary transport of chronic sinusitis in children. *Arch Otolaryngol Head Neck Surg* 1992;118:1234–1237.
14. Michael F, Hasan T, Jessica L, Roy L, David C. A safe, alternative technique for inferior turbinate reduction. *Laryngoscope* 1999;109:1834–1837.
15. Yanez C. New technique for turbinate reduction in chronic hypertrophic rhinitis: intratubinate stroma removal using the microdebrider. *Oper Tech Otolaryngol Head Neck Surg* 1998;9:135–137.
16. Passali D, Lauriello M, Bellussi L. Treatment of hypertrophy of the inferior turbinate. Long-term results in 382 patients randomly assigned to therapy. *Otol Rhinol Laryngol* 1999;108:569–575.

17. Mori S, Fujieda S, Igarashi M, Fan GK, Saito H. Submucosal turbinectomy decrease not only nasal stuffness but also sneezing and rhinorrhea in patients with perennial allergic rhinitis. *Clin Exp Allergy* 1999;29:1542–1548.
18. Mori S, Fujieda S, Yamada T, Kimura Y, Takahashi N, Saito H. Long-term effect of submucosal turbinectomy in patients with perennial allergic rhinitis. *Laryngoscope* 2002; 112:865–869.
19. McCaffrey TV, Kern EB. Clinical evaluation of nasal obstruction. *Arch Otolaryngol* 1979;105:542–545.
20. Huang TW, Cheng PW. Changes in nasal resistance and quality of life after endoscopic microdebrider assisted inferior turbinoplasty in patients with perennial allergic rhinitis. *Arch Otolaryngol Head Neck Surg* 2006;132:990–993.
21. Kim CS, Moon BK, Jung DH, et al. Correlation between nasal obstruction symptoms and objective parameters of acoustic rhinometry and rhinomanometry. *Auris Nasus Larynx* 1998;25:45–48.
22. Chen YL, Liu CM, Huang HM. Comparison of microdebrider-assisted inferior turbinoplasty with submucosal resection in children with hypertrophic inferior turbinates. *Int J Pediatr Otorhinolaryngol* 2007;71:921–927.
23. Hol MK, Huizing EH. Treatment of inferior turbinate pathology: a review and critical evaluation of the different technique. *Rhinology* 2000;38:157–166.
24. Bergler WF, Sadick H, Hammerschmitt N, Oulmi J, Hormann K. Long-term results of inferior turbinate reduction with argon plasma coagulation. *Laryngoscope* 2001;111: 1593–1598.
25. Lagerholm S, Harsten G, Engard P, Olsson B. Laser-turbinectomy: long-term results. *J Laryngol Otol* 1999;113: 529–531.