

Efficacy of Intra- and Extratubinal Microdebrider Turbinoplasty in Perennial Allergic Rhinitis

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Objectives/Hypothesis: Microdebrider-assisted inferior turbinoplasty (MAIT) has become a popular method for relieving symptoms of allergic rhinitis and can be performed intratubinally or extratubinally. The objective of this study was to evaluate and compare the long-term efficacy of these two methods.

Study Design: Prospective randomized study.

Methods: Sixty patients diagnosed with perennial allergic rhinitis were selected. Thirty patients were treated with intratubinal MAIT (group 1) and 30 patients were treated with extratubinal MAIT (group 2). Postoperative changes in nasal obstruction, rhinorrhea, sneezing, nasal itching, and postnasal drip were evaluated 3, 6, and 12 months postoperatively. The cross-sectional area of the second notch and nasal cavity volume were compared at 12 months. The operation time, duration of crust formation, and postoperative bleeding were also compared.

Results: All symptoms improved significantly in both groups at 3, 6, and 12 months. However, when improvement of rhinorrhea, sneezing, and nasal itching was compared, improvement was statistically significant in group 2 at 12 months. Acoustic rhinometry demonstrated a significant increase in the cross-sectional area of the second notch and nasal cavity volume in both groups, which did not differ significantly between the two groups at 12 months. The operation time and duration of crust formation were longer in groups 1 and 2, respectively. The incidence of postoperative bleeding was higher in group 2.

Conclusion: Although both methods showed significant improvement, extratubinal MAIT seemed more effective for long-term relief of allergic symptoms. However, the advantages and disadvantages of each method should be considered before choosing the surgical technique.

Key Words: Turbinoplasty, microdebrider, intratubinal, extratubinal, perennial allergic rhinitis, symptom.

Level of Evidence: 1b.

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INTRODUCTION

Chronic nasal obstruction is one of the most common medical complaints and interferes with quality of life. It can result either from nasal and septal deformities or from mucosal disease associated with inferior turbinate hypertrophy. Perennial allergic rhinitis and other forms of rhinitis can cause mucosal hypertrophy of the inferior turbinate, and chronic nasal obstruction often accompanies the disease. Watery rhinorrhea, sneezing, and itching sensations of the nose and eyes are also common symptoms of allergic rhinitis. When appropriate medical treatment fails to improve the patient's symptoms, surgical treatment on the inferior turbinate can be attempted to relieve the discomfort and to improve the quality of life. Various techniques are currently performed to reduce the volume of the mucosal

and bony tissues of the inferior turbinate. These include cryosurgery, electrocautery, total or partial turbinectomy, turbinoplasty, and submucosal turbinectomy.^{1–3} Recently microdebriders have been increasingly used, and favorable long-term results have been reported.^{4–7}

Microdebrider-assisted inferior turbinoplasty (MAIT) may be performed intratubinally (removal of submucosal tissue via a submucosal pocket) or extratubinally (trimming of the turbinate's mucosal surface) according to the volume of the submucosal tissue and surgeon's preference.^{5,6,8,9} However, these surgical techniques are mainly focused on mucosal volume reduction of the inferior turbinate to relieve the nasal obstruction. In patients with allergic rhinitis a possibility exists that other symptoms such as rhinorrhea, sneezing, itching, and postnasal drip may persist after the procedure. Although several studies have reported that turbinate surgery using a microdebrider can reduce allergic symptoms other than nasal obstruction,^{5–7} this matter needs further evaluation. Furthermore, postoperative results between the intratubinal and extratubinal methods have not been compared. Therefore, objectives of the present study were to evaluate the efficacy of MAIT in patients with perennial allergic rhinitis and to determine which method (intratubinal vs. extratubinal MAIT) is more effective in relieving the symptoms associated with allergic rhinitis.

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MATERIALS AND METHODS

Patients

A prospective clinical study was conducted from July 2008 to December 2010 with 60 patients diagnosed with perennial allergic rhinitis accompanying chronic turbinate hypertrophy. All patients had typical symptoms of allergic rhinitis, positive reactions to *Dermatophagoides farinae* and *D. pteryonyssinus* in an allergic skin prick test, and a high titer of anti-*D. farinae*-specific and anti-*D. pteryonyssinus*-specific immunoglobulin E antibodies. All patients had symptoms of nasal obstruction and stuffiness related to congested turbinate mucosa that had not responded to 3 months of medical treatments. None of the patients had a prior history of sinus or nasal surgery. Patients with systemic disease, septal deviation, sinusitis, nasal polyps, tumors, or other forms of rhinitis were excluded. Patients with prominent mucosal hypertrophy were selected based on a decongestion test using a Bosmin cotton pledget and the results of acoustic rhinometry because patients with bony hypertrophy, that is, covered with a thin layer of mucosa, are not good candidates for MAIT. The patients underwent a complete nasal airway evaluation, including a thorough past medical history, nasal endoscopic examination, and radiologic study.

The 60 patients were randomly assigned into two groups of 30 patients each. Randomization was performed according to the randomized list, which was constructed using a statistical random number table. The male-to-female ratio was 16:14 (mean age, 32.3 years; range, 17–59 years) and 18:12 (mean age, 29.8 years; range, 15–61 years) in group 1 (intratubinal MAIT) and group 2 (extratubinal MAIT), respectively. Patients who dropped out of the study before the 12-month postoperative follow-up were also excluded.

Informed consent was obtained from all patients and the study was approved by the Institutional Review Board of the College of Medicine, Soonchunhyang University.

Surgical Procedures

All surgical procedures were performed by the same surgeon (J.Y.L.). In most cases, the surgical interventions were carried out under local anesthesia. General anesthesia was used for some nervous patients. Procedures were performed under the direct vision of a 4-mm-diameter 0° endoscope (Karl Storz, Germany).

In group 1, a mucosal incision was made with a blade on the anterior aspect of the turbinate after infiltration with a combination of 2% lidocaine and 1:100,000 epinephrine. The submucosal tissue was dissected from the medial surface and inferior edge of the bone via the mucosal incision, and a submucosal pocket was created with a sharp elevator in an anterior-to-posterior direction. A 3.5-mm-diameter straight microdebrider tip (Stryker Instruments, Kalamazoo, MI) was inserted through the incision into the submucosal pocket. Redundant submucosal tissue was removed in an oscillating fashion at 3,000 rpm. Great care was taken not to damage the surface of the turbinate mucosa. After surgery, the nasal cavity was packed with Merocel (Medtronic Xomed, Jacksonville, FL) for 2 days to obliterate the dead space created during operation.

In group 2, after infiltration of a combination of 2% lidocaine and 1:100,000 epinephrine, the mucosal surfaces of the inferomedial side, lateral aspect, and anterior head region of the inferior turbinate were trimmed conservatively with a microdebrider (Stryker Instruments, Kalamazoo, MI). The same

tip was used at a speed of 3,000 rpm, and packing was also performed with Merocel for the same period.

Evaluations

Subjective symptoms were measured using a standard 10-point visual analogue scale (VAS). The questionnaire included the degree of nasal obstruction, rhinorrhea, sneezing, nasal itching, and postnasal drip. A score of 0 indicated no symptoms or disturbances, and a score of 10 indicated the most bothersome and unremitting state. The questionnaire was administered before the procedure and at 3, 6, and 12 months after the operation. Preoperative VAS scores were compared with those recorded at 3, 6, and 12 months postsurgery respectively and the degree of improvement was evaluated. The operation time, duration of crust formation, and postoperative bleeding were also compared between the two groups. Patients visited the office once a week for 4 weeks after the operation. The duration of crust formation was estimated as the period from the operation to the point of disappearance or detachment of the major crust from the turbinate. Postoperative bleeding was defined as a condition that required temporary nasal packing with Vaseline gauze, Bosmin, or Merocel, except for bleeding control immediately after packing removal.

Acoustic Rhinometry

Acoustic rhinometry (Model SRE 2000; Interacoustics, Denmark) was performed preoperatively and 12 months postoperatively. Statistical significance was compared in terms of the increase in the cross-sectional area of the second notch and volume of the nasal cavity within each group and between the two groups. The average value of both nasal cavities was used for the analysis.

Statistics

Postoperative improvement in each group was evaluated using Wilcoxon signed rank test. The degree of improvement, operation time, and duration of crust formation between the two groups were analyzed using the Mann-Whitney test. The number of patients with postoperative bleeding was compared using Fisher's exact test. Statistical analyses were conducted using SPSS version 11.0 (SPSS Inc., Chicago, IL), and statistical significance was defined as $P < .05$.

RESULTS

Improvement of Subjective Symptoms

No patients had dropped out of the study at the 12-month follow-up, and all completed the questionnaire. Table I lists VAS scores for each symptom, and the results of the statistical analyses within each group and between the groups preoperatively and at 3, 6, and 12 months after the procedure. All symptoms included in the questionnaire improved significantly at 3, 6, and 12 months after the procedure in both groups. When group 1 and group 2 were compared, improvement did not differ significantly in any symptoms at 3 and 6 months. However, improvement of rhinorrhea, sneezing, and nasal itching was statistically significant in group 2 compared with group 1 at 12 months. The scores for nasal obstruction and postnasal drip did not differ significantly between the two groups 12 months after the operation.

TABLE I.
Comparison of Visual Analogue Scale Scores.

		IMAIT	EMAIT	P Value
Nasal obstruction	Preoperative	7.27 ± 1.20	7.20 ± 1.13	P = .813 (NS)
	At 3 months	1.40 ± 0.67*	1.41 ± 0.72*	P = 1.000 (NS)
	At 6 months	2.33 ± 0.66*	1.93 ± 0.73*	P = .076 (NS)
	At 12 months	2.50 ± 0.73*	2.47 ± 0.57*	P = .845 (NS)
Watery rhinorrhea	Preoperative	6.20 ± 1.37	6.40 ± 1.30	P = .522 (NS)
	At 3 months	1.47 ± 0.86*	1.67 ± 0.96*	P = .375 (NS)
	At 6 months	2.40 ± 0.77*	2.47 ± 0.78*	P = .738 (NS)
	At 12 months	3.27 ± 0.83*	2.73 ± 0.91*	P = .011†
Sneezing	Preoperative	5.57 ± 1.55	5.37 ± 1.22	P = .517 (NS)
	At 3 months	1.90 ± 0.88*	1.60 ± 0.77*	P = .213 (NS)
	At 6 months	2.60 ± 0.89*	2.40 ± 0.67*	P = .312 (NS)
	At 12 months	3.37 ± 0.93*	2.53 ± 0.63*	P = .001†
Nasal itching	Preoperative	5.23 ± 1.45	5.13 ± 1.27	P = .766 (NS)
	At 3 months	1.80 ± 0.97*	1.57 ± 0.97*	P = .371 (NS)
	At 6 months	2.70 ± 0.91*	2.43 ± 0.86*	P = .234 (NS)
	At 12 months	3.83 ± 1.26*	2.73 ± 0.98*	P = .001†
Postnasal drip	Preoperative	4.50 ± 1.33	4.70 ± 1.66	P = .565 (NS)
	At 3 months	1.83 ± 1.08*	2.01 ± 0.74*	P = .420 (NS)
	At 6 months	2.57 ± 0.73*	2.71 ± 0.91*	P = .526 (NS)
	At 12 months	2.70 ± 0.75*	2.92 ± 0.92*	P = .396 (NS)

Data are given as mean ± standard deviation.

*Statistically different from preoperative values ($P < .001$).

†Statistically different between IMAIT and EMAIT groups 12 months postoperatively, which was better in the EMAIT group.

IMAIT = intratubal microdebrider-assisted inferior turbinoplasty; EMAIT = extratubal microdebrider-assisted inferior turbinoplasty; NS = statistically not significant.

Operation Time, Duration of Crust Formation, and Postoperative Bleeding

The operation time (minutes) was longer in group 1 and the duration of crust formation (weeks) was longer in group 2 with statistical significance, respectively. The incidence of postoperative bleeding was higher in group 2, but without statistical significance (Table II). Two patients in group 1 and 5 patients in group 2 had postoperative bleeding, but this was easily controlled with Bosmin-soaked cotton pledgets.

Acoustic Rhinometry

In both groups, the cross-sectional area of the second notch and volume of the nasal cavity increased significantly 12 months after the operation. When the two groups were compared, the increases in these values did not differ significantly (Table II).

DISCUSSION

Microdebrider is generally regarded as an essential instrument in the rhinology field. It has also been introduced in turbinate surgery, and satisfactory results have been reported on the MAIT.^{4-7,10} This instrument can be used intratubally as well as on the external turbinate surface, often in combination with an endoscope. Endoscope-guided MAIT permits precise removal of redundant soft tissue of the inferior turbinate. Some surgeons use the microdebrider intratubally,^{5,6} while

others resect parts from the external surface of the turbinate.^{8,9} Each method has its own advantages and disadvantages. Intratubal MAIT usually does not injure the mucosal surface, with the exception of the incision

TABLE II.
Comparison of Acoustic Rhinometry, Operation Time, Duration of Crust Formation, and Postoperative Bleeding.

	IMAIT	EMAIT	P Value
CSA of 2nd notch (cm ²)			
Preoperative	0.58 ± 0.02	0.60 ± 0.04	P = .240 (NS)
At 12 months	0.66 ± 0.02*	0.67 ± 0.03*	P = .818 (NS)
Nasal cavity volume (cm ³)			
Preoperative	5.48 ± 0.56	5.51 ± 0.76	P = .312 (NS)
At 12 months	6.63 ± 0.32*	6.60 ± 0.30*	P = .577 (NS)
Operation time (minute)	14.13 ± 2.22	6.12 ± 0.97	P < .001
Duration of crust formation (week)	1.63 ± 0.67	2.23 ± 0.63	P = .010
Postoperative bleeding	2/30	5/30	P = .424 (NS)

IMAIT = intratubal microdebrider-assisted inferior turbinoplasty; EMAIT = extratubal microdebrider-assisted inferior turbinoplasty; CSA = cross sectional area; NS = statistically not significant.

Data are given as mean ± standard deviation.

*Statistically different from preoperative values ($P < .001$).

site. However, perforation or damage of the mucosal surface may occur when the operation is performed with the tip toward the medial surface of the turbinate. Incision and creation of a submucosal pocket can prolong surgery time, and excessive submucosal tissue may be removed. In contrast, extratubinal MAIT can precisely remove the hypertrophied portion of the mucosa under direct endoscopic visualization. However, damage to the mucosal surface cannot be avoided and may lead to delayed healing. More bleeding during and after the operation and interference of mucociliary function may be induced.

Several reports have demonstrated the long-term efficacy of intratubinal MAIT and radiofrequency ablation in patients with perennial allergic rhinitis.^{5-7,11,12} However, to date no researchers have studied on the efficacy of extratubinal MAIT or conducted comparative clinical trials between intratubinal and extratubinal methods in patients with allergic rhinitis. Therefore, the objective of this study was to evaluate and compare the long-term efficacy of these two methods. In terms of improvement in subjective symptom scores, both groups showed statistically significant improvement at 3, 6, and 12 months after the procedure compared with preoperative values. Symptom improvement did not differ significantly between the groups until 6 months. Symptom scores for rhinorrhea, sneezing, and nasal itching were significantly better in group 2 at 12 months, while symptom scores for nasal obstruction and postnasal drip did not differ significantly between the groups. Improvement in typical allergic rhinitis symptoms such as rhinorrhea, sneezing, and nasal itching after the operation may be associated with reduction of the turbinate surface area, which contacts foreign allergens, and also associated with decreases in the submucosal vessels and secretory glands.⁵⁻⁷ Destruction of various inflammatory or allergy-affected cells and the autonomic or sensory nervous system on the surface and within the inferior turbinate may also be a cause of symptom improvement.^{5-7,13}

Although the reason for more substantial improvement in rhinorrhea, sneezing, and nasal itching in group 2 is not clear, it may have occurred secondary to fibrosis of the mucosal surface and destruction of allergy-affected cells, submucosal vessels, and the nervous system by direct trimming of the mucosal surface and submucosal superficial layer simultaneously. Intratubinal MAIT can also induce similar effects, but the efficacy may be better when removing surface and submucosal tissue simultaneously than removing submucosal tissue only. Worse scores were predicted for postnasal drip in group 2 because of damage to the mucosal surface. However, the scores did not differ significantly between the groups, and it may be postulated that minimal mucosal injury with the microdebrider did not significantly interfere with mucociliary clearance. It also appears that the inferior turbinate is not the only site responsible for mucociliary clearance; the whole respiratory epithelium of the nasal cavity instead functions in ciliary activity. Although additional examinations were not performed in this study, saccharine test, measurement of ciliary beat rate, or biopsy of the turbinate

tissue at 12 months after the procedure would be helpful to confirm the suggested hypotheses.

As mentioned above, intratubinal and extratubinal methods have their own advantages and disadvantages. As expected, the operation time was significantly longer in group 1, and the creation of a submucosal pocket with the elevator and other instruments is presumably the reason for this. However, the duration of crust formation was longer in group 2 with statistical significance because extratubinal MAIT causes damage to the mucosal surface of the turbinate. Postoperative bleeding was more frequent in group 2, but it did not differ significantly from that in group 1. Although 2 patients in group 1 and 5 patients in group 2 had postoperative bleeding after the procedure, it was easily controlled by temporary packing with Bosmin-soaked cotton pledgets. Acoustic rhinometry revealed a significant increase in the cross-sectional area of the second notch and volume of the nasal cavity in both groups, but these parameters did not differ significantly between the groups 12 months postoperatively. This finding indicates that both methods have similar long-term effectiveness in relieving nasal obstruction in patients with perennial allergic rhinitis.

More reports on the efficacy of MAIT have been published during the past few years. We expect that the use of microdebriders in turbinate surgery will become more popular, and that satisfactory results and the safety of the procedure will be reported and confirmed by further studies.

CONCLUSION

Groups 1 and 2 exhibited significant improvement in all symptoms included in the questionnaire, as well as increased cross-sectional area of the second notch and volume of the nasal cavity. However, rhinorrhea, sneezing, and nasal itching were significantly improved in group 2 compared with group 1 at 12 months postoperatively. We found that extratubinal MAIT seemed to be more effective for long-term relief of allergic rhinitis symptoms compared with the intratubinal method. However, the advantages and disadvantages of each method, such as the operation time, crust formation, and postoperative bleeding, should be considered before choosing a surgical technique. A longer follow-up period with a larger number of subjects will be necessary to confirm our results.

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