Microdebrider-Assisted Versus Radiofrequency-Assisted Inferior Turbinoplasty

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Objectives: The study aimed to evaluate the long-term efficacy of microdebrider-assisted inferior turbinoplasty (MAIT) compared to radiofrequency-assisted inferior turbinoplasty (RAIT) for hypertrophic inferior turbinates.

Study Design: Surgical outcomes were evaluated using the visual analogue scale, anterior rhinomanometry, and saccharin test results.

Methods: From January 2001 to December 2006 inclusively, 120 patients with persistent allergic rhinitis, chronic nasal obstruction, and hypertrophic inferior turbinates were enrolled in this study, randomly classified, and underwent either MAIT (n = 60) or RAIT. Ten patients who did not have any nasal discomfort served as normal controls. Assessments (visual analogue scale, anterior rhinomanometry, and saccharin test) were conducted prior to surgery and 6 months, 1, 2, and 3 years subsequent to surgery.

Results: Compared to preoperative values, the symptom scores (nasal obstruction, sneezing, rhinorrhea, and snoring), mean total nasal resistance, and mean saccharin transit time all improved significantly at 6 months, 1, 2, and 3 years after surgery in MAIT group (P < .05 for all). The same holds true for the RAIT group from 6 months up to 1 year (P < .05 for all), but no improvements from 2 to 3 years after were noted. The parameters between the two groups did not significantly differ 6 months after surgery, but was noted after 1 to 3 years (P < .05 for all).

Conclusion: MAIT is more effective than RAIT at relieving nasal symptoms and decreasing total nasal resistance and saccharin transit time 1 to 3 years postoperatively in patients with persistent allergic rhinitis and who have substantial nasal obstruction.

Key Words: Microdebrider, radiofrequency, inferior turbinoplasty.

INTRODUCTION

Inferior turbinate hypertrophy is a frequent cause of chronic nasal obstruction.1 The hypertrophy of the inferior turbinates may be due to various causes including allergic reaction, vasomotor rhinitis or drug-induced rhinitis.2,3 Although chronic nasal obstruction is not life threatening, it drastically affects patients’ quality of life. A surgical approach to enlarged inferior turbinates becomes necessary when medications fail.

The surgical techniques for treatment of enlarged inferior turbinates include total or partial turbinectomy, cryotherapy, submucosal diathermy, laser turbinoplasty, and inferior turbinoplasty.3,4 Most of these procedures are destructive, to varying extents, to the respiratory epithelium on the turbinate surface. The main goal of 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.5

Recently, the advent of microdebrider and radiofrequency for the surgical treatment of hypertrophic inferior turbinates appear to offer some advantages over traditional techniques with regard to postoperative complications and mucosal preservation.5,6 According to the literature, rhino-sinus physiological mechanisms required about 2 years for restoration after surgery in this region. There is no study comparing postoperative results for more than 2 years for these two methods. We compared postoperative results of microdebrider-assisted inferior turbinoplasty (MAIT) and radiofrequency-assisted inferior turbinoplasty (RAIT) for 3 years in patients with persistent allergic rhinitis.

MATERIALS AND METHODS

From January 2001 to December 2006, inclusively, 120 patients (63 men and 57 women) with chronic nasal obstruction and rhinitis were enrolled. Their ages ranged from 18 to 59...
years (mean: 37.5 years). All patients had documented clinical histories of persistent allergic rhinitis and a high titer of anti-Dermatophagoides fahrbene-specific and anti-Dermatophagoides pteronyssinus-specific IgE antibodies. All of the patients presented symptoms and signs of nasal obstruction 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, nasal polyps or tumors, and chronic sinusitis were also 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 conchial hypertrophy or conchial bullosa, were also excluded from the study.7 The 120 patients selected for this study were randomly assigned to undergo RAIT (n = 60), or MAIT (n = 60). Ten patients (five 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 53 years (mean: 34.8 years). The study was approved by the Bioethical Committee of the hospital, and written informed consent for participation in the study was provided by all the participants.

All surgical procedures were performed by the same surgeon. RAIT was performed under local anesthesia. We used the ENTe Coblator Plasma Surgery System (Arthrocare Corp., Sunnyvale, Calif.) with a voltage range of 96 to 312 voltages and root-mean-square (Vrms) at 100 kHz and the ENTe Hummingbird wand. The wand was damped with 9% normal saline to permit the plasma field to form during insertion. 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, Taipe, Taiwan), the needle of the probe was inserted submucosally at the anterior head of inferior turbinate and extended to the posterior portion of the inferior (two entries per turbinate, one at the medial surface of inferior turbinate, one at the turbinate surface facing the inferior meatus and parallel to the nasal floor). Then, the inferior turbinate was ablated with an output power level of four (168–182 Vrms) in the posterior to anterior direction. The wand was kept in position for 15 seconds unless the whitening of the overlying mucosa of the applied region was noted. The withdrawal was performed at coagulation mode. Great care was taken not to injure the mucosa of inferior turbinate. No nasal packing was used after the operation.

The MAIT 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 was made with a scalpel in the inferior and lateral aspects of the turbinate head. A turbinate blade (3.5 mm tip with a serrated blade, Medtronic Xomed, Jacksonville, Fla.) was then inserted into the anterior face of the inferior turbinate just medial to the mucocutaneous junction. A submucosal pocket was dissected by tunneling with the elevator in an anterior to posterior and superior to inferior sweeping motion. A 2.9 mm diameter microdebrider tip (Medtronic Xomed, Jacksonville, Fla.), rotating continuously in a circular fashion and set at 3,000 rpm while using suction irrigation, was applied through the incision to remove all the stromal tissue possible from inside of 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 mid-portions of the inferior turbinate to gain better access to treat the “mulberry-tip” of the inferior turbinate. The nasal passages were packed with a piece of Merocel (Medtronic Xomed, Jacksonville, Fla.) for a one day.

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 patients were evaluated prior to surgery and at 6 months, 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 1 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. They were requested not to use oral or topical steroids, antihistamines or vasoconstrictors 2 weeks before each visit.

A standard visual analogue scale ranging from zero (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 using a rhinomanometer (Rhino 4000, Homoth, Hamburg, Germany) in all groups, including the control group.5 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. The mean total nasal resistance of the 10 normal patients served as the control value for this test.

Nasal mucociliary transport was evaluated in all patients and controls using the saccharin test.9 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 analysed using repeated-measures analysis of variance (ANOVA). Then, a post hoc multiple comparison was performed using Bonferroni t test (alpha = .05).

RESULTS

Of the 60 patients enrolled in each group, all were monitored 1 year after surgery. Three patients in the MAIT group and five patients in the RAIT group dropped out at the 2-year postoperative visit. Four patients in the MAIT group and seven patients in RAIT group dropped out at the 3-year follow-up visit.

None of the patients in either of the surgical groups developed active bleeding during or after surgery. While mucosal tears were noted in the MAIT group (11.7%, 7/60) and not in the RAIT group, there was no loss of mucosa in either group. Postoperative crusting and synchia developed in the MAIT group (7/60 and 0/60 patients, respectively) and not in the RAIT group (0/60 and 0/60 patients, respectively). While one of the 60 patients experienced nasal dryness after surgery in MAIT group, none in RAIT group experienced nasal dryness. 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 6 months to 3 years after surgery in the MAIT group compared to their preoperative values (P < .05 for all, Table I). Although all the symptom scores of the
RAFT groups significantly improved 6 months to 1 year postoperatively compared to their preoperative levels ($P < .05$, both), no improvement of nasal symptoms from 2 to 3 years postoperatively was noted ($P > .05$, both). The nasal symptom scores for nasal obstruction, sneezing, rhinorrhea, and sneezing between the MAIT and RAIT groups did not significantly differ 6 months after surgery ($P > .05$), but not from 1 to 3 years after surgery ($P < .05$ for all). The mean number of visits of our clinic for nasal allergy between RAIT (0.10 $\pm$ 0.30) and MAIT (0.08 $\pm$ 0.28) did not significantly differ ($P > .05$) 6 months after surgery. Nonetheless, the mean number of visits of our clinic for nasal allergy in RAIT group was significantly higher than that in MAIT group from 1 to 3 years after surgery (1.05 $\pm$ 1.02 vs. 0.15 $\pm$ 0.36, 2.58 $\pm$ 0.63 vs. 0.30 $\pm$ 0.46, 2.91 $\pm$ 0.77 vs .48 $\pm$ .50, respectively) ($P < .05$ for all).

The mean total nasal resistance for the normal controls was 0.15 $\pm$ 0.05 Pa/mL/sec. The MAIT group showed significant decreases in rhinomanometric test results at 6 months, 1 year, 2 years, and 3 years postoperatively compared to preoperative values ($P < .05$ for all), (Table II). Although the mean total nasal resistance for the RAIT group significantly improved from 6 months to 1 year postoperatively compared to their preoperative levels ($P < .05$, both), no further improvement in mean total nasal resistance was noted for postoperative years 2 and 3 ($P > .05$, both). The mean total nasal resistance between the MAIT and RAIT groups did not significantly differ 6 months after surgery ($P > .05$), but not from 1 year to 3 years after surgery ($P < .05$ for all).

The mean saccharin transit time was 14.70 $\pm$ 4.52 minutes for the normal control group. Compared to preoperative values, the mean saccharin transit times for

### Table I

<table>
<thead>
<tr>
<th>Nasal Obstruction</th>
<th>Pre-op</th>
<th>Post-op 6 months</th>
<th>Post-op 1 year</th>
<th>Post-op 2 years</th>
<th>Post-op 3 years</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAIT group</td>
<td>8.53 $\pm$ 1.03</td>
<td>1.45 $\pm$ 0.65$^1$</td>
<td>4.53 $\pm$ 2.23$^1$</td>
<td>8.04 $\pm$ 1.35</td>
<td>8.30 $\pm$ 1.37</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>MAIT group</td>
<td>8.68 $\pm$ 1.05</td>
<td>1.43 $\pm$ 0.65$^1$</td>
<td>1.43 $\pm$ 0.65$^1$</td>
<td>1.49 $\pm$ 0.66$^1$</td>
<td>1.55 $\pm$ 0.81$^1$</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Sneezing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAIT group</td>
<td>5.95 $\pm$ 1.17</td>
<td>1.78 $\pm$ 0.69$^1$</td>
<td>2.92 $\pm$ 0.94$^1$</td>
<td>5.51 $\pm$ 1.15</td>
<td>5.57 $\pm$ 1.32</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>MAIT group</td>
<td>6.15 $\pm$ 1.02</td>
<td>1.65 $\pm$ 1.07$^1$</td>
<td>1.65 $\pm$ 1.07$^1$</td>
<td>1.84 $\pm$ 1.10$^1$</td>
<td>1.88 $\pm$ 1.06$^1$</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Rhinorrhea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAIT group</td>
<td>6.63 $\pm$ 1.52</td>
<td>1.68 $\pm$ 0.87$^1$</td>
<td>3.08 $\pm$ 1.53$^1$</td>
<td>6.07 $\pm$ 1.30</td>
<td>6.49 $\pm$ 1.40</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>MAIT group</td>
<td>6.97 $\pm$ 0.96</td>
<td>1.63 $\pm$ 0.92$^1$</td>
<td>1.63 $\pm$ 0.92$^1$</td>
<td>1.65 $\pm$ 0.99$^1$</td>
<td>1.68 $\pm$ 0.99$^1$</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Snoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAIT group</td>
<td>6.55 $\pm$ 1.17</td>
<td>1.58 $\pm$ 0.67$^1$</td>
<td>3.67 $\pm$ 1.41$^1$</td>
<td>6.05 $\pm$ 1.51</td>
<td>6.15 $\pm$ 1.35</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>MAIT group</td>
<td>6.70 $\pm$ 1.06</td>
<td>1.55 $\pm$ 0.70$^1$</td>
<td>1.58 $\pm$ 0.72$^1$</td>
<td>1.65 $\pm$ 0.77$^1$</td>
<td>1.77 $\pm$ 0.83$^1$</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

SD = standard deviation; RAIT = radiofrequency-assisted inferior turbinoplasty; MAIT = microdebrider-assisted inferior turbinoplasty.

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

The score was significantly different compared with preoperative value (Bonferroni t test).

### Table II

<table>
<thead>
<tr>
<th>The Mean Total Nasal Resistance and Mean Saccharin Transit Time (Mean ± SD) Before and After Surgery Between RAIT and MAIT.</th>
<th>Control</th>
<th>RAIT</th>
<th>MAIT</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean total nasal resistance (Pa/mL/sec)</td>
<td>.15 ± .05</td>
<td>.31 ± .06</td>
<td>.32 ± .08</td>
<td>&gt;.05</td>
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<tr>
<td>Postoperative (6 months)</td>
<td>.15 ± .06$^1$</td>
<td>.15 ± .05$^1$</td>
<td></td>
<td>&gt;.05</td>
</tr>
<tr>
<td>Postoperative (1 year)</td>
<td>.18 ± .09$^1$</td>
<td>.15 ± .05$^1$</td>
<td></td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Postoperative (2 years)</td>
<td>.29 ± .06</td>
<td>.15 ± .04$^1$</td>
<td></td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Postoperative (3 years)</td>
<td>.31 ± .06</td>
<td>.16 ± .04$^1$</td>
<td></td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Mean saccharin transit time (minutes)</td>
<td>14.70 ± 4.52</td>
<td>20.52 ± 7.41</td>
<td>21.33 ± 8.23</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>Postoperative (6 months)</td>
<td>15.23 ± 6.95$^1$</td>
<td>14.87 ± 6.00$^1$</td>
<td></td>
<td>&gt;.05</td>
</tr>
<tr>
<td>Postoperative (1 year)</td>
<td>17.62 ± 6.82$^1$</td>
<td>14.98 ± 5.93$^1$</td>
<td></td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Postoperative (2 years)</td>
<td>19.45 ± 6.28</td>
<td>15.05 ± 5.75$^1$</td>
<td></td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Postoperative (3 years)</td>
<td>19.79 ± 6.28</td>
<td>15.21 ± 4.81$^1$</td>
<td></td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

SD = standard deviation; RAIT = radiofrequency-assisted inferior turbinoplasty; MAIT = microdebrider-assisted inferior turbinoplasty.

*The score in MAIT group was significantly different compared with its analog in RAIT group (Bonferroni t test).

The score was significantly different compared with pre-operative value (Bonferroni t test).
the MAIT group significantly decreased and returned to normal at 6 months to 3 years after surgery (P < .05 for all; Table II). Although the mean saccharin transit time for RAIT group significantly improved from 6 months to 1 year postoperatively compared to their preoperative levels (P < 0.05, both), no improvement in the mean saccharin transit time from 2 to 3 years postoperatively was noted (P > .05, both). The mean saccharin transit time between the MAIT and RAIT groups did not significantly differ 6 months after surgery (P > .05), but not from 1 to 3 years after surgery (P < .05 for all).

DISCUSSION

Two mucosa-preservation techniques, MAIT and radiofrequency inferior turbinoplasty, are widely used for treatment of hypertrophic inferior turbinates. The microdebrider provides real-time suction with the ability to resect inferior turbinate tissue precisely. Radiofrequency tissue reduction is also safe and effective for tissue reduction of hypertrophic inferior turbinates. The technique is based on local submucosal delivery of low-frequency energy by means of a specifically adapted electrode. This energy induces ion agitation within the tissue, which increases the local temperature and causes a thermal lesion to occur in the deep mucosa, without damaging the mucosal surface. The healing process induces fibrosis, with wound contraction leading to tissue volume reduction. Because surgery is more invasive than medical treatment, it is important that surgery result in sustained improvements in the patient’s quality of life. Thus, we compared the long-term efficacies of the two surgical techniques. Ideal turbinate surgery, in which there is an attempt to reduce submucosal tissue with minimal violation of the mucosa, can be achieved with endoscopy-guided microdebrider-assisted or radiofrequency-assisted techniques. Thus, we enrolled only patients with mucosal hypertrophy of the inferior turbinates and excluded patients with bony hypertrophy of the inferior turbinates in our study.

In the MAIT group, nasal obstruction, rhinorrhea, sneezing, and snoring significantly improved 6 months to 3 years postoperatively compared to their preoperative levels (P < .05, all). Although all the symptom scores of the RAIT group significantly improved 6 months to 1 year postoperatively compared to their preoperative levels (P < .05, all), no further improvement occurred at 2 and 3 years postoperatively (P > .05). MAIT achieved effects similar to those of MAIT at 6 months postoperatively (P > .05), but not at 1, 2, and 3 years postoperatively (P < .05). This result could be explained by the fact that thermal injury and fibrosis or shrinkage of the submucosal turbinate tissue, especially the anterior head of the inferior turbinate, could be insufficient in patients with prolonged hypertrophy, leading to unsatisfactory volume reduction at 1, 2, and 3 years postoperatively in the RAIT group. Because MAIT removed submucosal tissue more thoroughly than RAIT, including reducing the numbers of inflammatory cells and damage to the postnasal nerve branch, it is reasonable that MAIT improved patients’ long-term symptoms more effectively than RAIT.

Although the correlation between nasal obstruction symptoms and total nasal resistance remains controversial, rhinomanometry is an objective method for evaluating the relative level of nasal patency. Cavaliere et al. reported that rhinomanometric measurements demonstrated a significant decreases of nasal resistance at the 3-month postoperative visit in their 25 patients who underwent radiofrequency turbinoplasty. Huang and Cheng reported that the improvement of nasal resistance was observed 1 year after endoscopic MAIT.

We rhinomanometrically assessed nasal resistance to air passage, which significantly improved at 6 months to 3 years after surgery in the MAIT group. The mean total nasal resistance for the RAIT group significantly improved at 6 months to 1 year postoperatively compared to the preoperative levels, while no improvement at the 2nd and 3rd years postoperatively was found. Therefore, the improvement in nasal resistance is consistent 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. Back et al. reported that the mean saccharin transit times were better 6 months to 1 year postoperatively than before receiving radiofrequency inferior turbino-plasty in their 20 patients with hypertrophic inferior turbinates. The nasal mucociliary transport time remained within the normal range from the end of the 1st week to 3 months after surgery in patients who underwent MAIT. In our study, the mean saccharin transit time decreased significantly compared to the preoperative times from 6 months to 3 years after surgery in the MAIT group (P < .05, all). The mean saccharin transit time decreased significantly compared to the preoperative time 6 months to 1 year after surgery in the RAIT group, which is in line with the report by Beck et al. Nonetheless, the mean saccharin transit time did not significantly differ at 2 and 3 years postoperatively compared to preoperative values for the RAIT group. Thus, MAIT results in better long-term nasal mucociliary transport than does RAIT.

The limitations of the current study include the lack of a control group with patients on medical treatment only. Nonetheless, patients in our study surgically treated with MAIT or RAIT for hypertrophic inferior showed reliable results by subjective and objective means of assessing restoration of nasal physiological mechanisms after surgery and long-term postsurgical follow-up for 3 years.

CONCLUSION

MAIT is more effective than RAIT for relieving nasal symptoms and decreasing total nasal resistance and saccharin transit time 1 to 3 years postoperatively in patients with persistent allergic rhinitis who have substantial nasal obstruction.
BIBLIOGRAPHY


