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Functional and Olfactory Outcomes of Inferior Turbinate Hypertrophy Reduction with Laser, Radiofrequency, and Bipolar

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ABSTRACT

Objective: This study aims to compare the effects of bipolar cauterization, radiofrequency ablation, and laser reduction methods, which are frequently used for turbinate reduction, on recovery times and olfactory functions in the early postoperative period.
Materials and Methods: The olfactory functions of all patients were preoperatively evaluated with the Sniffin' Sticks test. To assess the effects on olfactory functions, olfactory tests were repeated in the third month after the operation. The patients were examined weekly, and the resolving time of the crusts was recorded.
Results: The endoscopic turbinate reduction was performed with bipolar cautery in 50 patients, with radiofrequency ablation in 50 patients, and with laser ablation in 50 patients. There was no statistically significant difference between the techniques used regarding the severity of the olfactory function loss in the third month (p=0.546). It was observed that the resolving time of the crusts was the shortest in the group treated with the Holmium-YAG laser and the longest in the patients who underwent bipolar cautery (p<0.001). Parosmia persisted in only 9 patients in the postoperative third month (BP:7, RF:2, L:0) (p=0.049). In addition, it was determined that nasal dryness and pain (as assessed by visual analog score) were the most in the bipolar group (p=0.001 and p=0.005, respectively), and there was no significant difference between the laser and radiofrequency groups in terms of these symptoms (p=0.53 and P=0.96, respectively).
Conclusion: Patients who underwent Holmium laser turbinate ablation had less crusting and less olfactory function loss in the early period compared to those who underwent radiofrequency and bipolar turbinate reduction.

Keywords: Smell disorder, inferior turbinate surgery, sniffin sticks, turbinate

INTRODUCTION

The nose is the first organ of the respiratory system and provides humidification and heating of the inhaled air to the lungs (1). In addition, the olfactory function, one of our five senses, is the most important function of the nose (2). Olfactory cells are located on the roof of the nose at the level of the middle turbinate, where odor molecules reach here by diffusion (2). Intranasal pathologies such as septum deviation, turbinate hypertrophy, and sinus polyps are the most important causes of nasal congestion (1). Allergic rhinitis and non-allergic rhinitis-related mucosal hypertrophy play an important role in the etiology of turbinate hypertrophy, which we frequently encounter in otolaryngology practice (3). Although non-surgical methods such as topical nasal sprays and saline irrigation are used in the treatment, their effectiveness is more limited (4,5). For this reason, surgical turbinate reduction continues to be performed increasingly today. Various surgical techniques have been described for the reduction of the hypertrophic inferior turbinate. However, there is no clear consensus in the literature about the most appropriate surgical method and the effectiveness of surgical treatment (5). The primary purpose of surgical treatment is to provide optimum volumetric shrinkage of the turbinate to reduce nasal congestion while not harming the functions of the nose and minimizing possible complications. The crusting that occurs during the healing period after turbinate reduction causes temporary congestion,

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decreased olfactory functions, a bad smell in the nose, and adversely affects the quality of life (3). However, in the long term, it is known that the improvement in nasal congestion and the increase in air circulation within the nose positively affect the patients' olfactory functions (3).

This study aims to compare the effects of bipolar cauterization, radiofrequency ablation, and laser reduction methods, which are currently frequently used in the treatment of turbinate reduction, on early crusting times and olfactory functions.

MATERIAL AND METHODS

This study included patients who were admitted to the otorhinolaryngology outpatient clinics of Ulus Liv Hospital between June 2020 and June 2022 for nasal obstruction and had inferior turbinate reduction for turbinate hypertrophy. The study was approved by the Medical Ethics Committee of Istinye University (Date: 17.11.2021, No: 2/2021.K-84). Informed consent forms were signed by the patients beforehand, and those who voluntarily agreed to participate in the study were included. The study was conducted in accordance with the Declaration of Helsinki. Each patient was first evaluated with nasal endoscopy by an otolaryngologist. Patients who had previous turbinate reduction due to nasal obstruction, known olfactory disorders, allergic rhinitis, chronic sinusitis, or septum deviation were not included in the study. In addition, patients with any known systemic and chronic diseases (diabetes, MS, Alzheimer's, etc.) were excluded.

Methods were explained to the patients, and turbinate reduction was planned according to patient selection. Skin prick test was performed on all patients, and negative test results patients were included in the study. The patients in the first group underwent turbinate reduction with bipolar cautery, the second group underwent ablation with radiofrequency, and the third group underwent laser. The baseline olfactory functions of all patients were evaluated with Sniffin' Sticks before surgery. The same surgeon performed all operations. After the surgery, a nasal humidifier and rinsing with physiological saline were recommended for all patients. Controls were performed by another doctor who did not know which method was used. The patients were examined weekly for nasal crusting. The olfactory functions of the patients were assessed on the 1st week, 1st month, and 3rd month postoperatively.

A visual analog scale was performed once preoperatively and weekly after the operation to measure nasal dryness and postoperative pain sensation.

Olfactory Tests

Psychophysical testing of olfactory function was performed with the validated Sniffin' Sticks (Burghart, Wedel) test, in which odorants were adsorbed into commercially available felt-tip pens. First, the cap of the pen was opened by the experimenter before starting the test, then the experimenter waited for 3 seconds so that the scent was exposed, and then the tip of the pen was placed approximately 1-2 cm in front of the nostrils. The test consisted of one threshold and two suprathreshold subtests. That is, it consisted of a test for PEA thresholds, a test for odor discrimination (16 triplets with two different odors), and a test for odor identification (16 common odors presented in four) (alternative, forced selection procedure). The maximum score for each subtest is 16, and the maximum composite score is 48 (TDI - threshold, discrimination, and identification score). TDI composite scores higher than 30.3 were considered normosmia, scores lower than 16.5 were considered functional anosmia, and scores between 16.5 and 30.3 were considered hyposmia.

Parosmia Assessment Scale

Parosmia was quantified in 4 degrees (0 to 3) with these factors: frequency of occurrence: daily=1 point, otherwise=0 points, intensity: very strong=1 point, otherwise=0 points, social effects (e.g., weight loss, significant change of habits): yes=1 point, no=0 points. The total score represents the degree of the disorder.

Turbinate Reduction Methods

Bipolar cauterization: After the patient was anesthetized with the help of LMA, cauterization was performed submucosally into the concha using a 0-degree endoscope. Ellman Surgitron® Dual EMC 90 Energy Source Bipolar mode (1.7 MHz and 15 Watt) and Ellman Surgitron® Bipolar Forceps Cushing were used during the procedure.

Radiofrequency Ablation: After the patient was anesthetized with the help of LMA, the radiofrequency ablation probe was applied submucosally using a 0-degree endoscope. Olympus Celon® Elite instrument (15 Watts, Fine RFITT mode) and Celon® ProBreath probe were used during the procedure.

Laser Ablation: After the patient was placed under anesthesia with the help of LMA, the submucosal application was performed with a 0-degree endoscope. During the procedure, Medilas® H Solvo Holmium: Yag Laser was applied at 400 nm wavelength, 0.8 watts, and 6 Hz.

Statistical analysis

Statistical analysis was performed using the IBM SPSS version 21.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean and standard deviation (SD), median (min-max), or number and frequency. The Kruskal-Wallis test was used to compare continuous variables. A p-value of <0.05 was considered statistically significant.

RESULTS

150 people were included in the study, of which 82 were female, and 68 were male. The mean age of the patients included in the study was 34.1 years (18-47). The patients were divided into three groups, and endoscopic turbinate reduction was performed in 50 patients using bipolar cautery, 50 patients using RF, and 50 patients using a laser. The mean preoperative TDI score of the patients in the bipolar cautery

ablation group was calculated as 26.775. This value was found to be 20.425 in the postoperative 1st week, 22.575 in the postoperative 1st month (T=13 D=11 I=12), and 31.075 in the postoperative 3rd month. The nasal crusting duration was 35.3 days. The mean preoperative TDI score of the patients in the radiofrequency ablation group was 26.425. The mean TDI of the patients in this group was 20.025 in the postoperative 1st week, 24.675 in the postoperative 1st month, and 31.925 in the postoperative 3rd month. The mean duration of nasal crusting in this group was 22.3 days. The mean preoperative TDI score in the holmium-YAG laser ablation group was 26.3. The postoperative 1^{st}-week, 1^{st}-month, and 3rd-month values were recorded as 19.575, 26.425, and 31.975, respectively. In this group, the duration of nasal crusting was 12.6 days. All three techniques used in turbinate reduction caused a decrease in olfactory functions in the 1st postoperative week. There was no statistically significant difference between the groups regarding the severity of the decrease in olfactory functions (p=0.546). When olfactory functions were assessed at the end of the first month, it was observed that the deterioration was most common in patients who underwent bipolar cautery and the least in patients who underwent Holmium-YAG laser, and the difference between these two groups was statistically significant (p=0.003). On the other hand, there was no statistically significant difference between the groups in terms of olfactory functions after three months (p=0.045). The crusting durations were the shortest in the Holmium-YAG laser group and the longest in the bipolar cautery group. The difference between these two groups regarding crusting durations was significant (p<0.001). Preoperatively, none of the patients had a complaint of parosmia. In the first postoperative week, 46 patients had parosmia (BP:23, RF:18, L:5) (p=0.005). While parosmia persisted in 22 patients at postoperative 1 month (BP:15, RF:7, L:0) (p=0.005), only 9 patients had parosmia after 3 months (BP:7, RF:2, L:0) (p=0.049) (Table 1). The preoperative VAS scores for nasal dryness were 1.4 +/- 0.69 in the laser group, 1.6 +/- 1.07 in the radiofrequency group, and 1.3 +/- 1.05 in the bipolar cautery group. No significant difference was observed between these three groups regarding preoperative nasal dryness VAS scores. In the postoperative 3rd month follow-up, these scores were 2.6 +/- 0.51 in the laser-treated group, 3.1 +/- 1.19 in the radiofrequency group, and 5.4 +/- 0.84 in the bipolar cautery group. In the postoperative 3rd month, nasal dryness was found to be significantly more severe in the bipolar cautery group (p=0.001), while no statistically significant difference was observed between the radiofrequency and laser groups (p=0.53).

It was determined that the VAS scores for postoperative pain were highest in the bipolar group and lowest in the laser-applied group, but the difference between these two groups was not significant (P=0.96).

DISCUSSION

Nasal obstruction due to turbinate hypertrophy is an important health problem that otolaryngologists frequently encounter in their daily practice and significantly affects patients' quality of life. Surgical reduction of the turbinates is an easy and effective treatment modality (3,5,6). Crusting, which occurs due to the deterioration of mucosal ciliary activity on the turbinates in the early postoperative period, both affects the psycho-social lives of the patients due to bad odor and causes nasal congestion to continue for a while (6). Today, with the Covid-19 infection, which continues as a pandemic, elective surgical interventions continue in a controlled manner, similar to all activities worldwide. Olfactory dysfunction is one of the typical findings of COVID-19 infection (7), and the occurrence of anosmia/hyposmia and malodor during the crusting process after turbinate reduction leads to COVID-19 concerns in patients. In addition, the resulting bad odor affects the daily social life of the patients. For these reasons, turbinate reduction operations are aimed at the improvement of nasal congestion (5), improvement in olfactory functions as a result of increased nasal airflow (8), and early resolution of crusting and thus of bad odor (9,10).

In the study of Harju et al., it was reported that the crusting duration after concha reduction with radiofrequency was longer than the patients in the diode laser group, and in some cases, crust formation continued for up to three months (11).

Table 1: TDI, Parosmia, Nasal Dryness scores at beginning,1 week, 1 Month, 3 Months after Treatment; Nasal Crusting Time (NCT) (days)

Technique	Beginning			1st Week		1st Month		3rd Month			
	TDI	Parosmia	Nasal Dryness	TDI	Parosmia	TDI	Parosmia	TDI	Parosmia	Nasal Dryness	NCT(days)
BP	26.775	0	1.34/-1.05	20.425	23	22.575	15	31.075	7	5.4+/0.84	35.3
RF	26.425	0	1.6+/-1.07	20.025	18	24.675	7	31.925	2	3.1+/1.19	22.3
L	26.3	0	1.4+/-0.69	19.575	5	26.425	0	31.975	0	2.6+/0.51	12.6
Total (Patients)		0			46		22		9		
p	0.54	1		0.69	0.005	0.003	0.005	0.045	0.049		<0.001

(BP: Bipolar, RF: Radiofrequency, L: Laser)

In a study by Janda et al., moderate-to-severe nasal congestion, crusting, and nasal discharge were observed in patients during the first four weeks following diode laser treatment (12). In this current study, we found that patients who underwent the radiofrequency method had a shorter crusting time compared to bipolar cauterization; however, the shortest crusting time was observed in patients who underwent Holmium laser.

There is no study in the literature evaluating the effects on olfactory functions in the early postoperative period. However, Garzaro et al. (8) showed improvement in olfactory functions after radiofrequency, and Back et al. (13) after submucosal bipolar cauterization. According to our observations in this study, a decrease in olfactory functions was observed in the 1st week after turbinate reduction, regardless of the technique used. Olfactory functions tended to improve earlier in patients who underwent laser reduction. In the 3rd month after the operation, olfactory functions improved in all groups, and no difference was found between the olfactory scores. Similarly, the mean TDI scores increased in all three groups.

Nasal dryness occurs due to thermal damage after turbinate reduction. It has also been shown that nasal dryness affects the quality of the nasal microbiome in patients, thus causing a decrease in olfactory functions (14). Especially during the application of bipolar cautery, submucosal damage caused by the temperature reaching 400 °C causes scar development. The resulting mucous gland damage eventually leads to reduced mucus and nasal dryness (15). In our study, the group in which nasal dryness was mildest was the laser group.

The highest mean VAS score for intraoperative pain was in the bipolar cautery group and was significantly different from those in the other groups. In this group, an uptrend was observed in the mean VAS scores for postoperative pain over ten days. The most likely cause of this is direct tissue trauma caused by the procedure. Pain scores showed similar trends during the first two days in the Ho-YAG laser group and the first four days in the radiofrequency treatment group. Still, there was no significant difference between these two groups.

Another important issue examined in our study is the characteristics of parosmia caused by the techniques used for turbinate reduction and its recovery times. In the study, the highest rate and most prolonged duration of parosmia occurred in the bipolar cauterization group. The group in which parosmia was seen at the lowest rate was the laser group, and it completely recovered by the end of the 1st month. The exact mechanism of parosmia after turbinate reduction is not known. The correlation between nasal crusting durations and parosmia suggests that malodor may be due to crusting. Rather than the smell of burnt rubber and rotten vegetables described in classical parosmia, our patients often told what they sensed resembled the smell of pus.

CONCLUSION

This research is important because it gives information about the crusting times and the effects of different surgical modalities on olfactory functions in the early recovery period. In addition, there is no study showing the effect of Ho-YAG laser application on olfactory functions. Although we demonstrated the positive effects of the Ho-YAG laser on early olfactory functions in this study, we believe that further studies with longer-term results will contribute more to the literature.

Ethics Committee Approval: This study was approved by Istinye University Clinical Research Ethics Committee (Date: 10.11.2021, No: 2/2021.K-84).

Informed Consent: Written informed consent was obtained.

Peer Review: Externally peer-reviewed.

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