

*Original research-Orijinal araştırma*

## Comparison of the outcomes of partial turbinectomy and radiofrequency tissue ablation of inferior turbinates

### *Alt konkaların kısmi türbinektomi ve radyofrekans doku ablasyonu sonuçlarının karşılaştırılması*

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#### Abstract

**Aim.** One of the major causes of chronic nasal airway obstruction is inferior turbinate hypertrophy. Partial turbinectomy is a classical way of solution; however radiofrequency tissue ablation of inferior turbinates is a relatively new method. Comparison of the nasal function was made after treatment by partial turbinectomy and radiofrequency tissue ablation of the inferior turbinates using subjective symptom scores and objective tests. **Methods.** 12 of the patients (24 turbinates) with chronic nasal obstruction due to turbinate hypertrophy were treated by radiofrequency tissue ablation (RFTA), another 11 patients (22 turbinates) were treated by partial turbinectomy (PT). Preoperatively and at the postoperative 6th week; acoustic rhinometry, saccharin test, and evaluation of the nasal obstruction complaint by visual analogue scale (VAS) were done. The patients were followed by weekly nasal endoscopy and VAS scores during the postoperative 6 weeks. **Results.** In both groups postoperative acoustic rhinometry results were significantly higher than preoperative ones ( $p<0.05$ ). There was not any significant difference between the groups in the improvement of the acoustic rhinometry results ( $p>0.05$ ). There was not a significant difference between preoperative and postoperative saccharin test results in both groups ( $p>0.05$ ). When the VAS scores were compared, PT group's nasal obstruction scores appear to be significantly less than RFTA group's scores, beginning from the first week ( $p<0.05$ ). Endoscopic follow-up during the next 6 weeks revealed that edema and secretions were significantly more in RFTA group, whereas crusts were significantly more in PT group ( $p<0.05$ ). **Conclusion.** Both methods were found to have good results in solving nasal breathing problems and preserving nasal mucociliary function. By weekly follow-ups, PT was found to solve breathing problems more rapidly than RFTA.

**Keywords:** Acoustic rhinometry, saccharin test, turbinate hypertrophy, allergic rhinitis, nasal obstruction

#### Özet

**Amaç.** Kronik nazal havayolu tıkanmalarının esas sebeplerinden biri alt konka hipertrofidir. Kısmi türbinektomi çözümün klasik yolu olmakla beraber, alt konkanın radyofrekans doku ablasyonu göreceli olarak yeni bir metottur. Alt konkanın kısmi türbinektomi ve radyofrekans doku ablasyonu ile tedavisi sonrası subjektif semptom skorları ve objektif testler kullanılarak nazal fonksiyonların mukayesesi yapılmıştır. **Yöntem.** Konka hipertrojisinden dolayı kronik burun tıkanıklığı olan 12 hasta (24 konka) radyofrekans doku ablasyonu ile tedavi edildi. Diğer 11 hasta (22 konka) kısmi türbinektomi ile tedavi edildi. Ameliyat öncesinde ve ameliyat sonrası altıncı haftada akustik rinometri, sakkarin testi ve görsel analog skala ile burun tıkanma şikayeti değerlendirildi. Hastalar ameliyat sonrası 6 hafta boyunca görsel analog skala ve burun endoskopisi ile haftalık olarak takip edildi. **Bulgular.** Her iki grupta ameliyat sonrası akustik rinometri sonuçları ameliyat öncelerinden belirgin olarak yüksekti ( $p<0,05$ ). Akustik rinometri sonuçlarının iyileşmesinde gruplar arasında belirgin farklılık yoktu ( $p>0,05$ ). Görsel analog skala skorları kıyaslandığında kısmi türbinektomi grubunun burun tıkanması skorlarının ilk haftadan başlayarak radyofrekans doku ablasyonu grubunun skorlarından belirgin olarak az olduğu görülmektedir ( $p<0,05$ ). Altı hafta boyunca yapılan endoskopik takip ödem ve sekresyonun

radıofrekans doku ablasyonu grubunda, kabuklanmanın ise kısmi türbinektomi grubunda belirgin derece daha fazla olduğunu ortaya koymuştur ( $p<0,05$ ). **Sonuç.** Her iki metodun burun nefes alma problemlerini çözmeye ve mukosilyer fonksiyonları korumada iyi sonuçlara sahip olduğu bulunmuştur. Yapılan haftalık takiplerle kısmi türbinektominin solunma problemlerini radıofrekans doku ablasyonundan daha hızlı çözdüğü bulunmuştur.

**Anahtar sözcükler:** Akustik rinometri, sakkarin testi, konka hipertrofisi, allerjik rinit, burun tıkanması

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## Introduction

Inferior turbinate hypertrophy is one of the major causes of nasal obstruction. Some epidemiologic investigations have shown that 20% of population has nasal obstruction due to turbinate hypertrophy [1, 2]. There are a number of interventions for the treatment of inferior turbinate hypertrophy, including cryosurgery, electrocautery, out-fracture, total or partial turbinectomy (PT), turbinoplasty, submucous resection, laser-assisted turbinoplasty, and radiofrequency tissue ablation (RFTA) of inferior turbinates. An ideal procedure for turbinate reduction should produce minimal adverse reactions and preserve the physiological function of the turbinate. None of the techniques is perfect, and each is associated with short- and long-term complications [3]. For finding the best intervention, comparison of different techniques was done. Some studies which showed that RFTA and PT are effective in solving nasal obstruction problems are present [4-6]. It is shown that RFTA and PT have same effects on nasal obstruction and mucociliary function [7]. Actually, during the first postoperative weeks, patients who underwent RFTA and PT have different recovery periods and complaints. But there are no detailed articles for early postoperative period outcomes of these two techniques. In the present study, we used both subjective symptoms and objective tests to assess the efficacy of RFTA and PT in treatment of nasal obstruction and preserving mucociliary function, during early postoperative period.

## Material and methods

### Study design

A prospective randomized clinical study was conducted on two groups of 23 adult volunteer patients who were chosen from 37 patients receiving follow-up care in our clinic with a diagnosis of turbinate hypertrophy. All these 23 patients had symptoms and signs of nasal obstruction and stuffiness related to turbinate hypertrophy and participated in this study between November 2008 and February 2009. All patients gave their written informed consent before being included in the study, which was approved by the Ethics Committee. All procedures were performed by one author (Y.S.).

### Patients

Patients had been treated previously with antihistamines, topical corticosteroids, and decongestants and those whose complaints had subsided partially or not at all were admitted to the study. Patients with previous turbinate surgery, septal deformities, septal perforation, nasal polyps or tumor, sinusitis, or nasal radiotherapy were excluded. Twenty-three patients were randomly assigned into two groups, 12 in RFTA and 11 in PT groups. RFTA was done to 24 inferior turbinates of 12 patients (6 male, 6 female) under local anesthesia. For the radiofrequency energy Gyrus ENT (G-1 Temperature Controlled

Radiofrequency Generator) generator and (Gyrus ACMI Somnoplasty Model 1120) handpiece were used. The radiofrequency electrode was inserted submucosally, and 400 Joule, 75°C radiofrequency energy was delivered to each different points in the anterior, middle, and posterior portions of each turbinate. Nasal pack was not applied. Partial turbinectomies of 11 patients (22 turbinates) were done under general anesthesia (6 male, 5 female). Inferior turbinates medialisation was done, and turbinates were brought to horizontal position. The inferior one third of the turbinates was cut by turbinate scissors. During the procedure the scissors were used in vertical plane for preventing septal and lateral nasal wall injuries. The cut was done till posterior end of the turbinate, until the part of the turbinate planned for resection was separated. Tearing the mucosa which holds the cut part of the turbinate by grasping and forced pulling with punch was avoided, for reducing the mucosal injury of turbinates. And in the end turbinate lateralization was done. Nasal pack was applied for 48 hours. Antibiotic therapy with amoxicillin for five days postoperatively and nasal irrigation with saline for two weeks were given.

### **Evaluation**

Preoperatively and at the postoperative 6th week acoustic rhinometry, saccharin test, and evaluation of the nasal obstruction complaint by visual analogue scale (VAS) were done. The patients were followed by weekly nasal endoscopy and VAS scores during postoperative 6 weeks. Severity of nasal obstruction was measured by a standard 10-cm visual analogue scale (VAS). A score of 0 represented no obstruction, and a score of 10 indicated complete nasal obstruction. Nasal endoscopy was done by 0° rigid endoscopes. The scores for intranasal findings are present in table 1. Additionally the patients in PT group were followed for healing of mucosal defect on the inferior border.

**Table 1. Scores of the intranasal findings.**

Edema: no	0
Edema: present	1
Secretions : no	0
Secretions: between turbinate and nasal floor or turbinate and septum	1
Secretions: between turbinate and nasal floor + turbinate and septum	2
Secretions: more than these regions	3
Crusts: no	0
Crusts: less than 0.5 cm <sup>2</sup>	1
Crusts: between 0.5-1.5 cm <sup>2</sup>	2
Crusts: bigger than 1.5 cm <sup>2</sup>	3

The preoperative and postoperative 6th week's mucociliary functions of patients were evaluated by saccharin test. 20 mg saccharine sodium was placed on medial wall of inferior turbinate, just 2-3 mm posterior to most anterior point. The patients were instructed to sit with their head inclined forward at an angle of 10 degrees, while saccharine transit time was measured. During the test, the patient had to swallow every 30 seconds and avoid blowing their nose. The test was stopped when the saccharine was tasted. Acoustic rhinometry was performed with the Eccovision Acoustic Rhinometer (Hood Labs, USA). The patients were acclimatized for about 20 to 30 minutes before the measurements to minimize all mucovascular variations attributable to the decongestive effect of physical exercise. The C-notch (corresponding with anterior tip of the inferior turbinate) minimal cross-sectional area (MCA, in cm<sup>2</sup>) values were measured and analyzed.

### **Statistical analysis**

For statistical analysis Friedman test, T-test (independent samples test, paired samples test),  $\chi^2$ -test, Wilcoxon signed ranks test and Mann-Whitney U tests were performed with the statistical software package SPSS for Windows. The endoscopic findings and VAS scores of these two groups, during the postoperative 6 weeks were compared by Mann-Whitney U test. A P value <0.05 was considered to be statistically significant.

## Results

PT group's mean age was 36.82 years ( $\pm 13.01$  standard deviation {SD}), RF group's mean age was 29.5 years (14.47 SD). There was no difference between these two groups by means of age (T-test,  $p=0.79$ ) and gender ( $\chi^2$ ,  $p=0.99$ ).

### Intranasal findings

There was not any significant difference between RF and PT group's edema during the first three postoperative weeks ( $p=0.327$ ,  $p=0.568$ ,  $p=0.153$ , respectively). At the 4th and 5th weeks in the PT group edema was significantly less than the edema in the RF group ( $p=0.042$ ,  $p=0.004$ , respectively). At the 6th week the edema in the RF group decreased and no significant difference between these groups was found ( $p=0.338$ ). Secretions in RF group was found to be significantly more than those in PT group for the first three weeks ( $p=0.000$ ,  $p=0.047$ ,  $p=0.003$ ). RF group's excess in the secretions during the last three weeks was not considered to be statistically significant ( $p=0.416$ ,  $p=0.592$ ,  $p=0.192$ ). Incrustation in PT group was significantly more during the 1st week ( $p=0.02$ ). During the last five weeks there was no significant difference between two groups' crust scores. PT group's incrustation was observed on turbinate's inferior border, where the mucosal defect was (Table 2).

**Table 2. Nasal findings and VAS scores (mean $\pm$ SD)**

	1st week	2nd week	3rd week	4th week	5th week	6th week
PT VAS	0.5 $\pm$ 1.263	0.32 $\pm$ 0.945	0.32 $\pm$ 0.945	0.55 $\pm$ 1.503	0.32 $\pm$ 0.839	0.23 $\pm$ 0.612
RF VAS	5.79 $\pm$ 1.641	3.96 $\pm$ 1.876	3.29 $\pm$ 1.967	2.79 $\pm$ 2.105	1.92 $\pm$ 1.932	1.33 $\pm$ 1.435
PT edema	0.82 $\pm$ 0.395	0.86 $\pm$ 0.351	0.50 $\pm$ 0.512	0.36 $\pm$ 0.492	0.05 $\pm$ 0.213	0.00 $\pm$ 0.000
RF edema	0.92 $\pm$ 0.282	0.92 $\pm$ 0.282	0.71 $\pm$ 0.464	0.67 $\pm$ 0.482	0.42 $\pm$ 0.504	0.04 $\pm$ 0.204
PT secretions	1.09 $\pm$ 0.811	1.00 $\pm$ 0.756	0.73 $\pm$ 0.631	0.64 $\pm$ 0.727	0.45 $\pm$ 0.596	0.14 $\pm$ 0.351
RF secretions	2.21 $\pm$ 0.833	1.46 $\pm$ 0.658	1.33 $\pm$ 0.637	0.83 $\pm$ 0.816	0.63 $\pm$ 0.824	0.33 $\pm$ 0.565
PT crusting	1.14 $\pm$ 1.037	0.32 $\pm$ 0.568	0.23 $\pm$ 0.528	0.36 $\pm$ 0.658	0.05 $\pm$ 0.213	0.00 $\pm$ 0.000
RF crusting	0.46 $\pm$ 0.509	0.17 $\pm$ 0.381	0.08 $\pm$ 0.282	0.00 $\pm$ 0.000	0.04 $\pm$ 0.204	0.04 $\pm$ 0.204

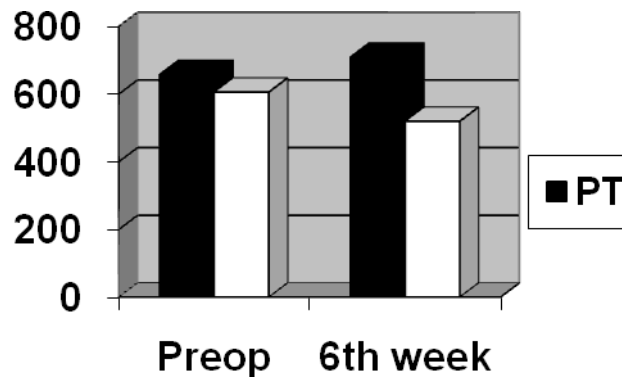
VAS: Visual analogue scale  
 PT: Partial turbinectomy group  
 RF: Radiofrequency tissue ablation group

### Visual analogue scale

RF and PT groups were found to be homogenous according to their preoperative VAS scores ( $p=0.498$ ). In postoperative period, PT group's nasal obstruction complaint altered since the 1st week, whereas nasal obstruction in RF group slowly decreased during six weeks. PT group's VAS scores were significantly less than RF group's scores during all the six weeks ( $p=0.000$  for the first four weeks,  $p=0.001$  for the 5th week and  $p=0.002$  for the 6th week). RF group's postoperative VAS scores were significantly less than preoperative ones since the 1st week ( $p=0.007$  for the first week,  $P=0.000$  for the 2nd to the 6th weeks). In addition, PT group's each postoperative VAS scores were found to be significantly less than preoperative ones ( $p=0.000$  for the 1st to the 6th weeks).

### Saccharine test

There was no significant difference between two groups regarding the preoperative saccharine test results ( $p=0.482$ ). The mean value of PT group's preoperative saccharine test was 10 min 57.68 sec ( $\pm 5$  min 1.83 sec SD) and it increased to 11 min 49.41 sec ( $\pm 3$  min 53.27 sec SD) at the 6th week. Preoperative saccharine test mean value was 10 min 5.75 sec ( $\pm 5$  min 18.31sec SD) for RF group and decreased to 8 min 39.42 sec ( $\pm 4$  min 28.34 sec SD) at the 6th week. Each group's preoperative and postoperative saccharine test mean values were compared, and no significant difference was found ( $p=0.396$  for PT group,  $p=0.355$  for RF group). When the mean of difference of preoperative and postoperative saccharine test values were compared between PT and RF groups, no significant difference was found ( $p=0.221$ ) (Figure 1).



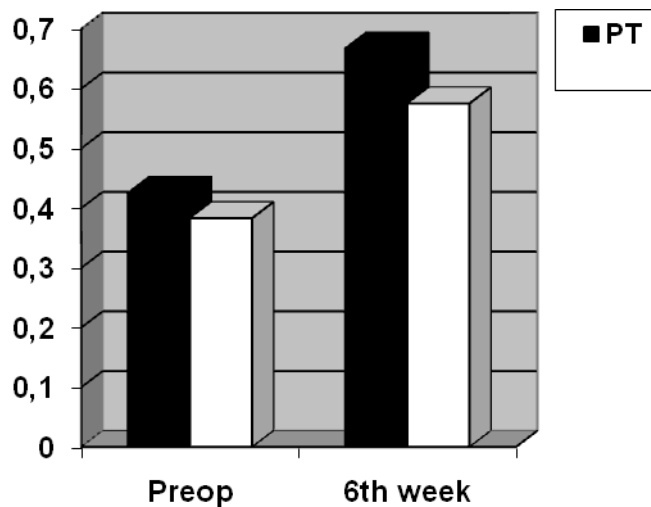
**Figure 1. Preoperative and postoperative 6th week's saccharine test results diagram of PT and RFTA groups (in seconds).**

#### ***Acoustic rhinometry***

Preoperative acoustic rhinometry mean value of PT group was  $0.425 \text{ cm}^2 (\pm 0.093 \text{ SD})$ , whereas for RF group this value was  $0.383 \text{ cm}^2 (\pm 0.109 \text{ SD})$  and no significant difference between these groups' preoperative rhinometry mean values was found ( $p=0.097$ ). Postoperative 6th week's rhinometry mean value for the PT group was  $0.677 \text{ cm}^2 (\pm 0.191 \text{ SD})$ , and  $0.575 \text{ cm}^2 (\pm 0.141 \text{ SD})$  for RF group. For both groups there was a significant difference between preoperative and 6th week's values ( $p=0.000$ ). To understand which method increases nasal passage more, means of the difference of preoperative and postoperative rhinometric values of each group were compared. There was not any significant difference between rhinometric value increase of these two groups ( $p=0.148$ ) (Figure 2).

#### ***Mucosal defect healing***

No uncontrolled bleeding was observed during the operations and postoperatively in both groups. PT group's mucosal defects on inferior border of turbinates were observed during the healing process. At the 1st week mucosal defect was found on 17 of the 22 turbinates (77.27%). At the 2nd week mucosal defects were on 7 turbinates (31.81%), and there was not any mucosal defects at the 3rd week.



**Figure 2. Preoperative and postoperative 6th week's acoustic rhinometry results diagram of PT and RFTA groups.**

## Discussion

At the end of the nineteenth century, most surgeons including Jones and Holmes, advocated total turbinectomy. However, rhinologists such as Freer criticized total and near total turbinate resection, prevalent procedures of the day, because of associated bleeding and prolonged postoperative crusting. As aggressive turbinate surgery fell into disrepute and was abandoned by most, many training surgeons were taught that the turbinates not to be touched [8]. One of the surgeons who redeveloped interest in turbinate reduction was Ballenger. In 1914 he argued that surgical turbinate reductions were highly effective procedures without significant complications enough to preclude their use. In 1924 Spilberg introduced the concept of submucous resection of the turbinates and later in 1950s House further popularized this technique. In 1970s and 1980s interest in surgical turbinate reduction increased. New technologies were developed for turbinate therapy, including infrared reduction, radiofrequency ablation, and refinement of laser techniques in 1990s [8]. RFTA is a surgical technique that uses radiofrequency heating to induce submucosal tissue destruction. Because the alternating current generated by electrodes induces ionic agitation at the tissue, the heat emanates from the tissue. The target tissue temperature can be maintained in the range of 60°C to 90°C and the heat dissipation is limited. Therefore, thermal lesion should occur in the deep mucosa, just 2-4 mm around the active portion of electrode and does not damage the surface. Fibrosis induced by healing process leads to tissue volume reduction [9, 10]. Radiofrequency has been used successfully in cardiology, urology, neurosurgery, and oncology. Recently, radiofrequency has also been used for the treatment of the hypertrophied turbinate. RFTA technique, which has 81% to 100% success rates in improvement of nasal obstruction [10, 11] and which can be performed in an outpatient department with local anesthesia, is a short lasting technique and it does not cause much limitation for patients. That is why the technique is widespread and many patients choose this technique for solving their nasal obstruction [12]. In the present study, we compared early postoperative period outcomes of RFTA and PT. In such comparison studies, generally 1st week, 1st, 3rd, 6th months and 1 year results are evaluated and techniques are found to have similar results. In our study, we aimed to search the differences between these techniques during 6 postoperative weeks, while healing is going on. In two studies of Cavaliere et al. [12, 13], the postoperative 1st week VAS scores for nasal obstruction after RFTA procedure were found to be statistically unchanged, but 1st month results were significantly improved and improvement was observed in 3rd month results, also. Kızılkaya et al. [14] showed significant improvement in 12th week VAS scores after RFTA. In the present study nasal obstruction was followed by weekly VAS scores, during postoperative 6 weeks. In PT group the improvement was severe since the 1st week, whereas in RFTA group nasal obstruction improved slowly. In spite of slow improvement, RFTA group's VAS scores were significantly better than preoperative ones since 1st week till 6th week. To assess edema, secretions, and crusting in two groups of patients, who undergone RFTA and turbinoplasty, Cavaliere et al. [12] made endoscopy at the end of the 1st week, 1st and 3rd months. Intranasal findings were scored as absent-0, mild-1, moderate-2, and severe-3. In both groups significant improvement in edema and secretions were observed at the end of the 1st month. Crusting was observed in turbinoplasty group at the 1st week, and disappeared at the end of the 1st month. There was not any crusting in RFTA group. In our study, we suggested to score more comparable aspects of findings, like site of secretions, and size of crusts. For edema we decided to evaluate the presence or absence of it. During the first three weeks there was no significant difference in edema between groups. At the 4th and 5th weeks PT group's edema recovered and there was a significant difference between two groups. Only at the 6th week RFTA group's edema recovered also. During all these time, RFTA group's secretions were more than those of PT group. In their histological study, Berger et al. [15] showed that, nasal obstruction increases secretions and obstruction improvement decreases amount of goblet cells. We think that, one of the causes of excess amount of

secretions in RFTA group was slow improvement in edema and nasal obstruction. As the crusting observed on wounds on inferior edge of turbinates, and when the wound healed, no crusts have found, we concluded that the cause of significant difference at the 1st week between the groups was mucosal defect on inferior edge of turbinates. When pre- and post-operative acoustic rhinometry values were compared, both PT and RFTA methods were effective in improving nasal passage volume. Similar results are also achieved in other studies [4, 16]. In our study, we compared these two methods' rhinometric findings and we showed that there was no significant difference in improving nasal passage volume between them. There are some studies which compare RFTA with PT, submucous resection, and submucosal resection with microdebrider. It is shown that RFTA has the same effectiveness in increasing nasal passage volume and decreasing nasal resistance [7, 14, 17]. Saccharine test results showed that both methods have no permanent negative effect on mucociliary clearance. Coste et al. [18] showed that even at the 1st week after the RFTA ciliated cells were still present and were able to ensure effective mucociliary clearance as evaluated by the saccharine test. There are some clinical investigations that support this histological study [4, 5]. In one of them, Cavaliere et al. [12] compared the preoperative and postoperative 1st week and 1st month saccharine test results of patients who underwent RFTA and turbinoplasty. At the 1st week, saccharine test results of turbinoplasty group were significantly increased, whereas at the end of the 1st month, there was no significant difference between saccharine test results. The increase was related to temporary damage of the mucosa in turbinoplasty group. For RFTA group no significant difference between the preoperative 1st week, and the 1st month saccharine test results was found. Neither increased secretions nor crust observed during the 1st week was interpreted as a result of that. In evaluation of various turbinate interventions we must consider function of the turbinates, and all methods should be judged based on the effectiveness in improved breathing with minimum side effects. In the present study, we demonstrated that both RFTA and PT are effective in solving nasal breathing problems and none of the methods cause permanent damage on mucociliary clearance. Our weekly follow-ups showed that PT is a more rapid solution for nasal breathing problems. In our study, we investigated the early outcomes of PT and RFTA in the treatment of chronic nasal obstruction due to turbinate hypertrophy. Both methods are effective in improving nasal obstruction, but PT solves this problem in a shorter period. Acoustic rhinometry showed that both methods similarly increase C-notch values (MCA), related to head of inferior turbinate. None of the methods cause permanent damage on mucociliary clearance. During early postoperative period, crusting is more in PT group, whereas secretions and edema is more in RFTA group. Mucosal defect on inferior border of turbinate in PT group is covered by mucosa within 3 weeks.

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