

A comparative study on the effects of surgery alone and along with radiofrequency in improvement of patients with nocturnal snoring in Isfahan, Iran

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BACKGROUND: Nocturnal snoring is a common complication. In addition to the harassment of the people around, it can lead to cardiovascular diseases, reduced awareness of the environment, and higher statistics of accidents. The treatment of this disorder is mostly by surgical approach. It is also common to use other techniques such as radiofrequency (RF). The purpose of this study was to compare the effects of simultaneous uvulopalatopharyngoplasty (UPPP) and RF treatment with surgery alone for reducing the upper airway obstruction as well as decreasing or eliminating snoring in affected patients. **METHODS:** This clinical trial was conducted in Isfahan, Iran during 2009-10. A total number of 46 patients were consecutively assigned into two groups. The first group underwent UPPP whereas the second group received RF in addition to UPPP. The severity of snoring and sleepiness in patients were recorded before and after the surgery using a checklist. The obtained results were then compared. A visual analogue scale (VAS) was used to assess snoring status based on the patients' idea. The Epworth Sleepiness Scale (ESS) was also used to evaluate sleepiness. **RESULTS:** In the UPPP group, the mean score of nocturnal snoring decreased from 80 ± 23.3 to 23.9 ± 28.4 ($p < 0.001$). In the group of UPPP with RF, the mean intensity of snoring decreased from 86.5 ± 24.4 to 31.7 ± 27.7 ($p < 0.001$). The snoring score reduction was not significantly different between the UPPP and UPPP and RF groups (56.1 ± 34.5 vs. 58.8 ± 38.6 ; $p = 0.47$). **CONCLUSIONS:** Considering the findings of this study and previous research, it can be suggested that RF may have a complimentary effect in treating simple snoring and obstructive sleep apnea syndrome (OSAS). When indicated, RF can result in more favorable medical improvement in a shorter period of time than UPPP alone.

KEYWORDS: Snoring, Radiofrequency, Uvulopalatopharyngoplasty

BACKGROUND

Nocturnal snoring is associated with an increase in upper airway resistance. Because of its complications, it has recently received lots of attention. Apnea accompanied by snoring at night may be associated with serious and even life-threatening complications.^[1] The best way to reach the correct diagnosis is taking the patient's history. Loud snoring together with gasping, sleepiness during the day, morning headaches, and obesity and systemic high blood pressure should be considered in connection with nocturnal snoring.^[1] Simple snoring has a high prevalence with the rates being as high as 40% in the UK.^[2] While loud snoring is one of the three criteria for the diagnosis of sleep-disordered breathing (SDB) in adults, other criteria include restless sleep and daytime sleeping. SDB is very common and involves about 24% of men and 9% of women in adulthood (30 to 60 years).^[1,3,4] Obstructive sleep apnea syndrome (OSAS) is one of the most dramatic presentations of SDB. It can lead to cardiovascular

diseases, reduction in quality and functioning of life, and the reduction of consciousness and awareness to the environment.^[4] OSAS causes morbidity and mortality and increases social costs. It is also followed by a 2 to 7-time increase in motor vehicles accidents.^[4] In some patients with snoring, obstruction is at the level of palatal and nasopharyngeal while in some others, the obstruction is further in the area of hypopharynx.^[5] OSAS includes 3 main points of upper airway obstruction, i.e. nose, soft palate, and hypopharynx.^[1]

The first step in treating nocturnal snoring and the related apnea is to provide the patients with medical advices such as weight loss, avoiding alcohol consumption and smoking, using sedatives, not sleeping with a full stomach, using pillows with appropriate height, and side sleeping. However, snoring may recur and it is generally difficult to achieve long-term results. Although tricyclic antidepressants increase the length of non-rapid eye movement (NREM) stage of sleeping and are thus somewhat effective, they are not well tolerated

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due to their anti cholinergic side effects.^[6] Orthodontic devices, which alter the relationship between the tongue and the jaw and correct the upper airway, are effective for nightly snoring. However, they are not as efficient for people with severe apnea. One of the tools that are used to treat nocturnal snoring is continuous positive airway pressure (CPAP). It is a nasal mask that is placed on the face and prevents collapsing during sleep by sending positive pressure to the air ducts.^[6] Clinical surgeries are generally 50% effective for the correction of nocturnal snoring and apnea. Such surgeries open the upper airway in the oropharyngeal area and include uvulopalatopharyngoplasty (UPPP), mandibular osteotomy, forwarding the genioglossus, and reducing the volume of the tongue base.^[7]

Reducing the tissue volume of the tongue by radio-frequency (RF) is induced by thermo-therapy. It is considered as a minimally invasive method which was first introduced by Powell et al. in 1999.^[6] RF is currently used in otolaryngology to reduce the volume of the tongue base and soft palate, and the size of tonsils and turbinate.^[3,7,8] In the study of Fischer et al. in Japan, the application of RF on the soft palate was successful in snoring treatment.^[9] Guo et al. also showed that the use of RF ablation in the treatment of snoring and moderate and mild OSAS brought significant improvement in the patients during 4 to 8 weeks after the treatment.^[10] Van Den Broek et al. suggested that adding tongue base RF to UPPP had a little effect in improving snoring compared with UPPP alone in patients with mild to severe OSAS. They however reported using RF to be well tolerated by patients and to have few side effects.^[11] In another study conducted by Eun et al., using tongue base RF with UPPP was found to be a safe and effective method in treating OSAS patients with obstruction at different levels. It was thus proposed as the first-line therapy in such patients.^[4]

Many studies in other countries have focused on snoring treatment.^[4,9-13,14-17] However, to the best of our knowledge, no study has prospectively evaluated the effects of surgical techniques on snoring treatment in Iran.

According to the recent supplementary role of RF in the treatment of snoring and OSAS, the current study aimed to investigate the simultaneous impact of UPPP and RF on reducing the upper airway obstruction (and thus reduction or elimination of snoring) and to compare the outcomes with surgery alone.

METHODS

This study was a randomized clinical trial conducted in Alzahra Hospital in Isfahan, Iran during 2009-10. The target population consisted of adult patients who referred to the hospital due to suffering from snoring at night with obstructive apnea. The inclusion criteria were the existence of indications for surgery (daytime sleepiness, daily dysfunction, obstructive sleep apnea with an apnea, hypopnea index over 15, snoring and obstructive sleep apnea which have not been improved despite the medical treatments), having tonsils with grade III or IV, and willing to participate in the study. Informed consents were obtained from all patients. The sample size was calculated based on the formula suggested for comparing means between two independent samples, i.e. $n = 2[(Z_{1-\alpha/2} + Z_{1-\beta})^2 S^2] / \Delta^2$ where α (type 1 error) was 0.05, β (type 2 error) was 0.10, S (the variance of snoring score) was 16.7, and Δ (the difference in mean of snoring score between the two groups) was 3. We considered snoring score as the main variable. Therefore, $n = [(1.96 + 1.28)^2 \cdot (0.1)] / (2 \cdot (0.2)^2) \approx 23$. According to the formula mentioned above, 23 patients were needed in each group for adequate power. Patients were recruited consequently in the study. For allocating patients in different groups, random sequencing (random permuted blocks) was generated in SPSS (SPSS Inc., Chicago, IL, USA). In this study, patients were not blinded. Half of them were allocated to undergo simultaneous UPPP and RF while the other half were allocated to the receive UPPP alone.

Procedure

The 3 common causes of obstruction are nasal obstruction, velopharyngeal insufficiency, and tongue base obstruction. Nasal obstruction was rejected on physical examination. The absence of nasal congestion was approved and a history of the patient was recorded in a questionnaire. All patients underwent tonsillectomy initially. The mucosa and sub-mucosa of soft palate were then debrided. The palatoglossus and palatopharyngeus muscles were preserved as much as possible. The uvula was shortened and the tip of uvula was brought out. The soft palate was then returned toward the front and top and portions of the anterior and posterior parts of the tonsils were removed to create more space. The surgery site was stitched and restored. Afterwards, RF was applied on the remaining parts in half of the patients. RF settings were based on each individual's anatomy. All the patients underwent physical examination before and three months after UPPP. The severity of daytime sleepiness and the snoring intensity were evaluated based on a visual analo-

gue scale (VAS) and recorded in related questionnaires. Since body mass index (BMI), neck circumference, and blood pressure are associated with the status of upper airway obstruction,^[2] these values were also measured in initial examinations and recorded in the questionnaires.

Statistical analysis

The data was analyzed in SPSS_{16.0} for Windows (SPSS Inc., Chicago, IL, USA) using statistical tests such as chi-square test and student's t-test on two-independent samples.

RESULTS

In this trial, 46 patients who suffered from snoring at night were studied. While 23 patients underwent surgery alone, RF was used after the surgery in the other 23. There were 21 men in the surgery group and 17 men in the surgery with RF group (91.3% vs. 73.9%). According to the Fisher's exact test, the two groups were not significantly different in male-to-female ratio ($p = 0.24$). The mean ages of patients in surgery and surgery with RF groups were 39.09 ± 11.7 and 36.17 ± 15.4 years, respectively (t-test; $p = 0.47$). The mean systolic blood pressure was 119.1 ± 10.8 and 117.17 ± 16.6 mmHg in the UPPP and UPPP with RF groups, respectively ($p = 0.79$). The mean diastolic blood pressure in the two groups was 72.8 ± 7.5 and 72.2 ± 10.8 mmHg, respectively ($p = 0.4$). The mean values of BMI and neck circumference of patients in the two groups were not significantly different

(Table 1). In the UPPP and UPPP with RF groups 6 and 7 patients had chronic nasal congestion (26.51% vs. 30.4%), respectively. There was no significant difference between the two groups based on the Fisher's exact test ($p = 0.99$). The studied patients were investigated in terms of the uvula, soft palate, and tonsils grading. Overall, 15 patients (32.6%) had normal uvula and 31 patients (67.4%) had loose and large uvulas. In addition, large and loose uvula was observed in 14 patients of the UPPP group and 17 patients of the UPPP and RF group. Based on chi-square test, there was not a significant difference between the two groups ($p = 0.35$). The soft palates of 16 patients in the UPPP and 14 patients in the UPPP RF group were large and loose. Chi-square test was gain applied which showed no significant difference between the two groups ($p = 0.54$).

In the UPPP group, 17 patients (73.9%) with grade III and 6 patients (26.1%) with grade IV tonsils status were identified. In the UPPP with RF group, 19 and 4 patients (82.6% and 17.4%) had grade III and IV tonsils status, respectively. Chi-square test showed no significant difference between the two groups ($p = 0.48$) (Table 2). The mean scores of nocturnal snoring in the UPPP group were 80 ± 23.3 and 23.9 ± 28.4 before and after the surgery, respectively. Based on paired t-test, the average score of snoring after the surgery was significantly lower ($p < 0.001$). In the UPPP with RF group, the mean intensity of snoring was 86.5 ± 24.4 and 27.7 ± 31.7 before and after the surgery, respectively. Therefore, the intensity of snoring was significantly reduced ($p < 0.001$).

Table 1. Body mass index (BMI) and neck circumference in the uvulopalatopharyngoplasty (UPPP) and UPPP with radiofrequency (RF) groups

Group Variable	UPPP + RF	UPPP	p
BMI	26.0 ± 3.6	27.3 ± 2.9	0.41
Neck Size	39.9 ± 4.2	40.7 ± 2.5	0.41

Table 2. Distribution frequency of the uvula, soft palate and tonsils in the two groups

Variable	Group Level	UPPP + RF	UPPP	p
		Number (%)	Number (%)	
UVULA status	Normal	6 (26.1%)	9 (39.1%)	0.35
	Large and loose	17 (73.9%)	14 (60.9%)	
Palate status	Normal	9 (39.1%)	7 (30.4%)	0.54
	Large and loose	14 (60.9%)	16 (69.6%)	
Tonsils Grade	III	19 (82.6%)	17 (73.9%)	0.48
	IV	4 (17.4%)	6 (26.1%)	

radio-frequency+ uvulopalatopharyngoplasty

** uvulopalatopharyngoplasty

The mean changes in snoring scores were 56.1 ± 34.5 in the UPPP group and 58.8 ± 38.6 in the UPPP with RF group. T-test did not reveal any significant differences between the two groups ($p = 0.8$). Figures 1 to 3 show the distribution of snoring scores including the range of change, 25% and 75% percentiles, and also the median in the two studied groups.

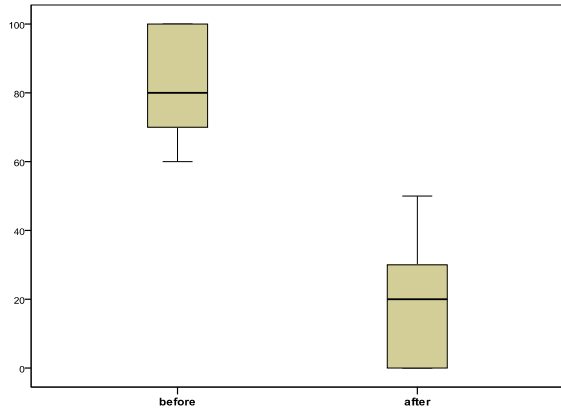


Figure 1. Distribution of the severity of snoring before and after surgery in the uvulopalatopharyngoplasty group

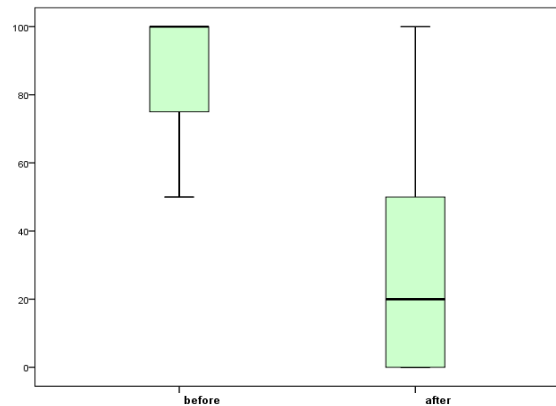


Figure 2. Distribution of the severity of snoring before and after surgery in the uvulopalatopharyngoplasty + radiofrequency group

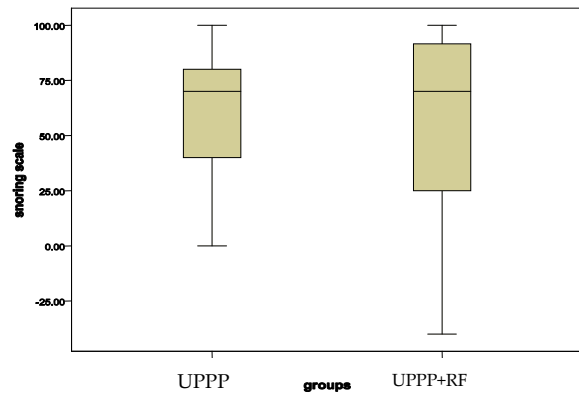


Figure 3. Distribution of snoring severity changes before and after surgery in the uvulopalatopharyngoplasty (UPPP) and UPPP + radiofrequency (RF) groups

After the surgery, the mean score of sleepiness in the UUUP group significantly decreased from 9.9 ± 5.7 to 7.3 ± 5.5 (paired t-test; $p = 0.022$). In the UPPP with RF group, the mean scores of sleepiness were 9.7 ± 4.9 and 5.6 ± 3.4 before and after the surgery, respectively. The reduction in this group was also significant ($p < 0.001$). The mean changes in sleepiness in the UPPP and UPPP with RF groups were 1.65 ± 3.2 and 4.13 ± 2.9 , respectively. According to student's t-test, the score of sleepiness in the UPPP with RF group reduced significantly more than the UPPP group (Figures 4 to 6). Overall, 16 patients (69.6%) were completely satisfied with the outcome. Moreover, 6 patients (26.1%) in UPPP group and 7 patients (30.4%) in the UPPP with RF group were satisfied with the results of the surgery. Likewise, from the total study population only one patient was dissatisfied with the outcome that was in the UPPP group. Fisher's exact test did not show any significant difference in satisfaction rates between the two groups ($p = 0.58$) (Figure 7).

The whole process of the study is summarized in a consort diagram in Figure 8.

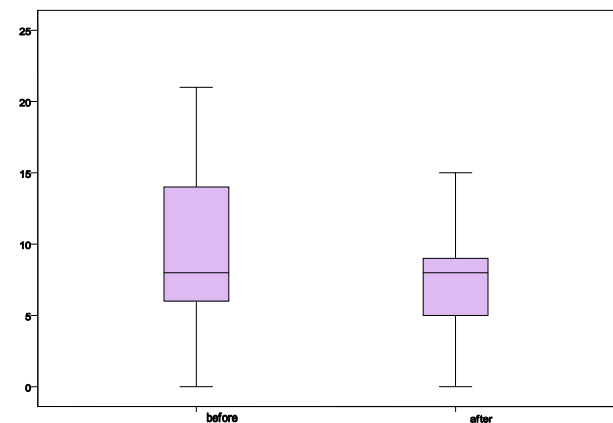


Figure 4. Distribution of sleepiness before and after surgery in the uvulopalatopharyngoplasty group

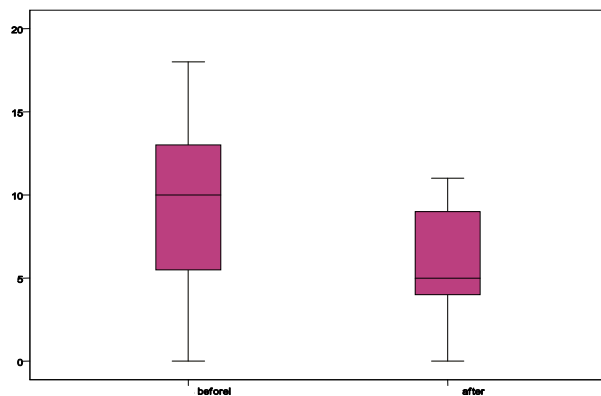


Figure 5. Distribution of sleepiness before and after surgery in the uvulopalatopharyngoplasty + radiofrequency group

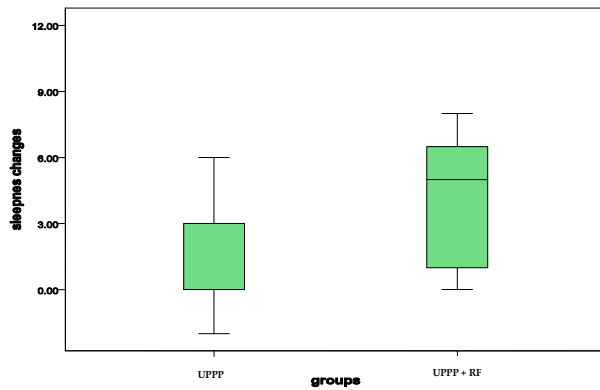


Figure 6. Distribution of changes in sleepiness intensity before and after surgery in the uvulopalatopharyngoplasty (UPPP) and UPPP + radiofrequency (RF) groups

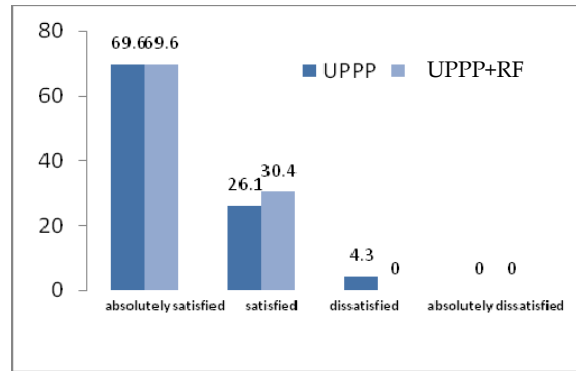


Figure 7. Percentage of satisfaction frequency in the uvulopalatopharyngoplasty (UPPP) and UPPP + radiofrequency (RF) groups

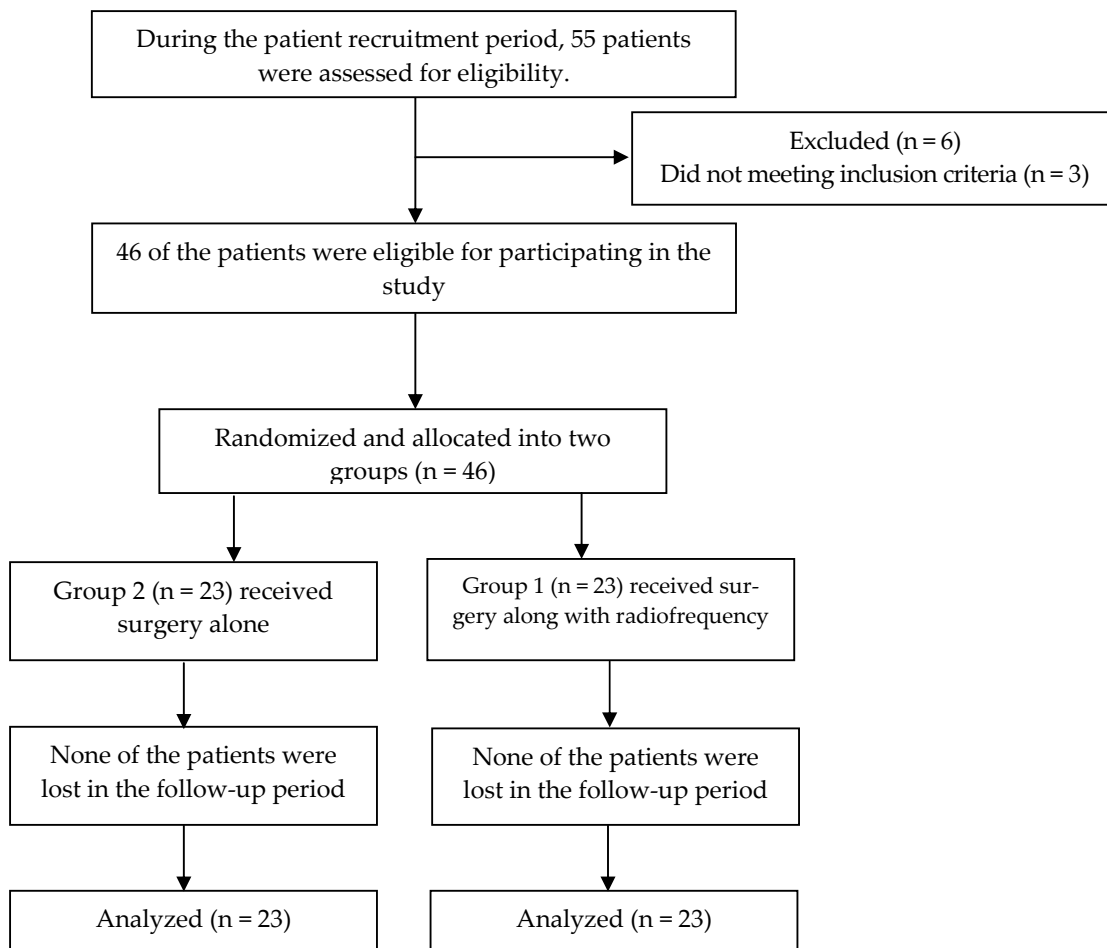


Figure 8. Flow diagram of the present research

DISCUSSION

The main objective of this study was to compare the effectiveness of surgery with and without RF for improvement of patients with snoring at night during 2009-10. In this trial, the two groups were compared in terms of age, gender, BMI, neck circumference, and blood pressure. However, no significant differences

were found between the two groups. Hence, it can be assumed that there was no confounding variable in this study and the two groups were comparable. There were no significant differences in the patients of the two groups in terms of chronic congested nose, features of the uvula and soft palate, and the status of tonsils. Therefore, obstruction had no confounding effect in this study. The mean scores of nocturnal snoring in

the UPPP group were 80 ± 23.3 and 23.9 ± 28.4 before and after the surgery, respectively. The surgery thus significantly reduced the mean score of snoring ($p < 0.001$). In the UPPP with RF group, the mean severity of snoring was 86.5 ± 24.4 and 27.7 ± 31.7 before and after the surgery, respectively. In this group, the intensity of snoring was significantly reduced, as well. The mean changes in snoring scores of the UPPP and UPPP with RF groups were 56.1 ± 34.5 and 58.8 ± 38.6 , respectively. There were no significant differences between the two groups. In a Japanese study by Fischer et al., the application of RF on soft palate was successful in treatment of snoring.^[9] Similarly, Guo et al. used RF ablation in the treatment of snoring and moderate and mild OSAS and found significant improvements in patients during 4 to 8 weeks of follow-up.^[10] Van den Broek et al. showed that adding tongue base RF to UPPP had a little effect in improving snoring compared to UPPP alone in patients with mild to severe OSAS. However, RF was well tolerated and had few side effects.^[11] Eun et al. reported the application of tongue base RF with UPPP to be a safe and effective method in treating OSAS patients with obstruction at different levels. They thus proposed it as the first-line therapy in such patients.^[4] In a systematic review by Back et al., most clinical trials obtained results similar to ours. In fact, they suggested RF to have no significant effect on snoring improvement in patients.^[12] In another study by Hultcrantz et al. on 29 people suffering from snoring, RF was shown to play an important role on long-term improvement of the patients.^[13] A prospective trial which compared azithromycin versus fluticasone failed to find significant differences in snoring outcomes after six weeks of treatment.^[18] According to the recent supplementary role of RF in the treatment of snoring and OSAS, this study aimed to assess the impact of UPPP and UPPP simultaneous with RF to reduce the upper airway obstruction and thus reduce or eliminate snoring in the patients. Based on the findings of this study and previous research, it could be acknowledged that RF has an effective supplementary role in treating simple snoring and OSAS. It can be applied in patients with indications for its use to achieve more favorable medical results during a shorter period of time.

Considering satisfaction rates in all participants, 16 patients (69.6%) were completely satisfied with the outcome. Moreover, 6 patients (26.1%) in the UPPP group and 7 patients (30.4%) in the UPPP with RF group were satisfied with the result of the surgery. Moreover, from the total study population, only one patient in the UPPP group was dissatisfied with the outcome.

Heavy expenses, lack of budget, and patients' non-cooperation led to a number of problems. First of all, it was better to consult a nutritionist to modify the lifestyle of the patients to help them lose weight, give up smoking and perform other useful tasks. On the other hand, polysomnography was not performed before and after the surgery while it was needed for measuring and comparing apnea-hypopnea index as the obstruction criterion in patients.

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