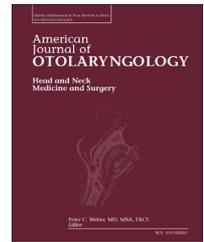


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Effectiveness of radiofrequency cryptolysis for the treatment of halitosis due to caseums

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ABSTRACT

Objective: To evaluate the effectiveness of radiofrequency (RF) cryptolysis for caseum-induced halitosis.

Study design: Clinical retrospective study.

Setting: Otorhinolaryngology Head and Neck Surgery Department of Konya Training and Research Hospital in Turkey.

Subjects and methods: Thirty-four patients with caseum-induced halitosis were included. Eight were male (23.5%) and 26 were female (76.5%). Their mean age was 28.29 ± 9.3 (range: 17–48) years. The mean duration of complaint of halitosis before RF cryptolysis was 53.41 ± 42.6 months (range: 6–182 months). The Finkelstein test, organoleptic measurements, and visual analog scale (VAS) were performed before and 12 months after RF cryptolysis.

Results: Before RF cryptolysis, all patients had a positive Finkelstein's test result, organoleptic measurements revealed that three (8.82%) had serious halitosis, 24 (70.58%) had average halitosis, and seven (20.58%) had mild halitosis, and the mean VAS score was 6.82 ± 1.45 . The follow-up period after RF cryptolysis was 12 months. After the single RF cryptolysis session, 26 patients (76.47%) were negative for Finkelstein's test, organoleptic assessments revealed that 26 (76.47%), six (17.64%), and two (5.88%) showed complete, partial, and no recovery, respectively, ($p < 0.001$), and the mean VAS score was significantly better at 1.88 ± 2.5 ($p < 0.001$). Thirty-two patients (94.1%) exhibited a decrease in VAS score.

Conclusion: RF cryptolysis is a cost-effective, safe, and easily applicable modality for the treatment of halitosis due to caseums in the crypts of the palatine tonsils.

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1. Introduction

Halitosis can be detrimental to the quality of life of individuals, their families, and their social counterparts [1]. Oral cavity diseases, followed by sinonasal diseases, are the most common causes of halitosis. Other causes are disorders of the respiratory and gastrointestinal systems, liver/renal disorders, and metabolic syndromes [2–5].

The palatine tonsils contain crypts, which are tubular structures extending from the surface to deep into the parenchyma. These crypts can accumulate epithelial waste, keratin debris, and foreign bodies, which can lead to the formation of yellowish malodorous viscous masses called caseums (a Latin name that means cheese) [6,7]. These caseums are often seen in otorhinolaryngology practice and they associate strongly with halitosis because the proteolytic

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anaerobic bacteria in the crypts produce volatile sulfur components (VSCs), namely, sulfur-derivative gases. Several studies that objectively measured VSCs by using a halitometer have confirmed the association between these VSCs and halitosis: they found that patients with halitosis due to palatine tonsil crypt caseums had high levels of VSCs [8-10]. Another study found a statistically positive correlation between the existence of caseums and higher VSC levels [11].

Patients with halitosis due to palatine tonsil crypt caseums also have other complaints, including continuous discomfort or irritation in the throat or the feeling that there is a foreign body in the throat. Tonsils with caseums are also prone to inflammation, hyperemia, and hypertrophy. Caseums can be seen in both sexes, at any age, in all tonsil types, and in one or both tonsils [12].

Several methods have been devised to control or eliminate halitosis due to caseums [12]. While mouthwash, saline flush and antiseptic solutions do not yield satisfactory outcomes, a complete cure can be achieved with tonsillectomy. However, this method is associated with postoperative pain, longer recovery time, and complications as a result of operation and anesthesia [8]. Another approach is radiofrequency (RF) cryptolysis. While RF energy has been used in various medical fields for years, including in tonsillectomy and tonsillotomy, RF cryptolysis has been a relatively recent application. In RF cryptolysis, RF waves are used to create limited thermal damage in the targeted tissue, which later heals via fibrosis. The greatest advantage of this technique is that it is limited to the tissue to which it is applied. In 2011, Tanyeri et al. reported the efficacy and tolerability of RF tonsil ablation for halitosis [13].

There are only a few studies in the recently literature, the use of RF cryptolysis for treatment of caseum-induced halitosis. The present study aimed to investigate the effectiveness of RF cryptolysis in patients with halitosis caused by caseums in palatine tonsil crypts and to contribute at the other studies.

2. Patients and Methods

2.1. Patients

This retrospective study included 34 patients with halitosis caused by palatine tonsil crypt caseums who were treated with RF cryptolysis between December 2009 and July 2012. Of these patients, 26 were females and eight were males, and the mean age was 28.29 ± 9.3 (range: 17-48 years). This study was approved by the local Research Ethics Committee of Selcuk University Faculty of Medicine, Konya, Turkey. All patients were asked to sign the patient approval form that contained detailed information about the disease and the risk and benefit of treatment.

The medical history of the patients revealed that they had all visited several doctors in the past due to long-term halitosis but their condition had not improved despite various medical treatments. All patients had caseums in one or both tonsils. In all cases, the head, neck, and otorhinolaryngological area were examined before cryptolysis. The nose, nasopharynx, oropharynx, larynx, and hypopharynx were examined by using a flexible fiber optic nasopharyngoscope. Each patient was examined for the presence of all potential causes of halitosis. The same dentist also examined each patient for potential dental and periodontal diseases. Labora-

tory tests were performed to obtain the complete blood count and to determine the urea, creatine, aspartate aminotransferase (AST), alanine aminotransferase (ALT), and pre-prandial blood glucose levels for potential causes. The use of medicines, cigarettes, and alcohol addiction were recorded. Patients with other halitosis-inducing diseases were excluded, as were smokers, alcohol-addicted patients, and patients who took medicines. All patients was treated adequately with saline, benzydamine hydrochloride and betadine gargling and also with oral amoxicillin clavulanic acid 1000 mg BID and metronidazole 500 mg twice daily for 10 days. Patients who do not benefit from treatment were included in the study.

2.2. Finkelstein tonsil-smelling test

In all patients, the tonsil-smelling test introduced by Finkelstein et al. was performed before and after RF cryptolysis. The tonsillar tissue was palpated with a gloved index finger. The gloves that were used during this procedure were not made of latex to ensure that there was no latex smell. The test results were recorded as yes, I smell a bad odor (positive) and no, I smell not bad odor (negative) by the three participants (The patient, doctor, and relatives).

2.3. Organoleptic measurement

To measure the halitosis of each patient before and after 12 months after a single RF cryptolysis, an organoleptic measurement was performed by asking the patient to blow his or her breath out towards the doctor's face, which was about 10 cm away. The doctor scored the odor according to a 0-5 point scale, where 0 represents no odor, 1 signifies an odor that is barely discernible, and 5 indicates an unbearable malodor. All odor assessments of the patients in the present study were performed by the same doctor.

2.4. Visual analog scale (VAS)

The patients and their respective family member were asked to subjectively score the intensity of malodor from 1 to 10 on a VAS before and after cryptolysis. The intensity, frequency, and duration of halitosis were asked the patients and family



Fig. 1 - Appearance of caseums on the surface of both tonsils after tonsil palpation.



Fig. 2 – Appearance of the palatine tonsils after laser cryptolysis.

member. A score of 1 indicated very little malodor while 10 indicated an unbearable malodor.

2.5. Anesthesia

Of the 34 patients, 33 underwent RF cryptolysis treatment under local anesthesia without sedation. The remaining patient underwent general anesthesia.

2.6. Radiofrequency cryptolysis technique

RF cryptolysis was performed by using a bipolar power unit with an acoustic coagulation monitor (CelonLabENT®,

Celon AG, Germany) and a specially designed ablation probe with a pin that had a diameter of 1.3 mm. To reduce the gag reflex of the patient, 1.5% lidocaine spray (Xylocaine®) was applied to the oropharynx. Lidocaine (1%) with 1/100000 adrenaline (Iekain®) was then injected into each anterior plica and tonsillary parenchyma by using a dental injector. The tonsils were deeply palpated to extract the caseum from the crypts (Fig. 1), after which all crypts with caseums (an average, 6–8 per tonsil) were cryptolyzed by using the RF probe (Fig. 2). All RF procedures employed 13-W energy. Thus, the bipolar RF applicator pin was placed into the crypt and the energy was applied by using the pedal. The doctor watched for mucosal fading or listened for a warning tone from the device. Thereafter, the pin was slowly withdrawing during diathermy. The procedure was then repeated with the other tonsil if necessary. The total average duration of the operation was less than 10 min. After the operation, all patients were given postoperative advice and acetaminophen tablets for pain and were discharged from hospital. The RF cryptolysis was performed a single session for treatment of caseum-induced halitosis.

In the first postoperative week, the patients were assessed in terms of pain and whether they had returned to their previous diet. Four, 8, and 12 weeks and 6 and 12 months after treatment, the Finkelstein test, organoleptic measurements, and VAS scoring were performed. The recurrence of caseums was also assessed at these time points.

2.7. Statistical analysis

The age, duration of complaint of halitosis, follow-up period, and visual analog scale (VAS) score of the study cohort were expressed as mean ± standard deviation (SD). These

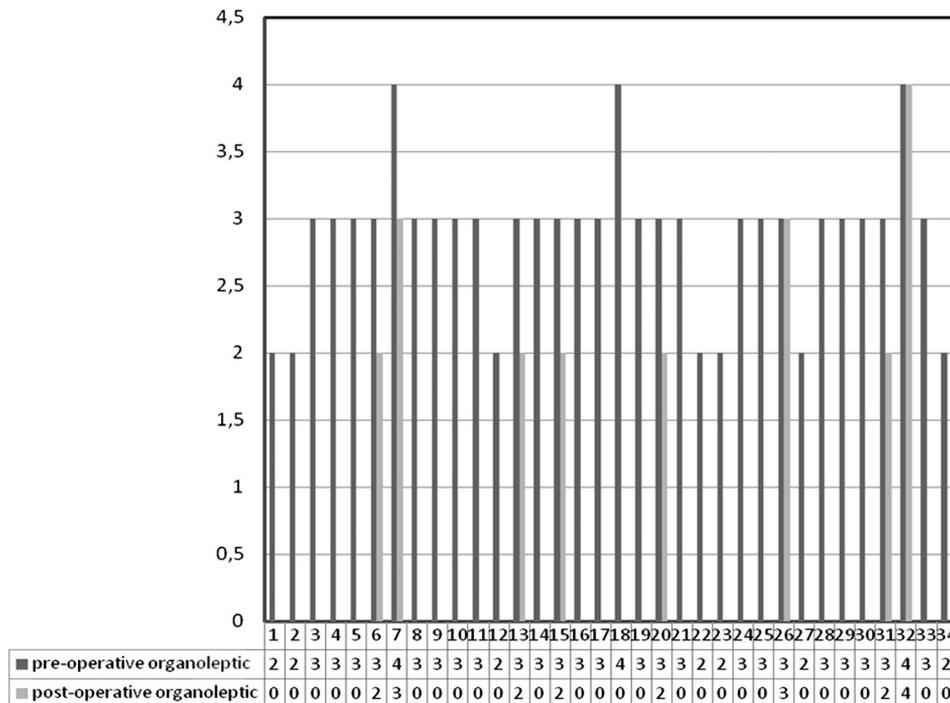


Fig. 3 – Preoperative and postoperative organoleptic measurements.

continuous variables were all tested for homogeneity of variances. While sex, Finkelstein test outcome, and the organoleptic measurements are not continuous variables, organoleptic measurements (expressed as grades 0-5) were changed to percentages (i.e., grades ranging from 0 to 100). To assess the significance of differences between pre- and postoperative VAS scores and organoleptic assessments, paired t-tests were applied. The significance of the change in the frequency of Finkelstein test positivity after cryptolysis compared to before cryptolysis was also determined. The level of significance was set at $p < 0.05$. SPSS for Windows 11.5 statistical packet program (SPSS Inc. Chicago, IL) was used to perform these data analyses.

3. Results

This study included 34 patients, of whom 26 (76.5%) were females and eight (23.5%) were males. Their mean age was 28.29 ± 9.3 (range: 17-48 years). The mean duration of complaint of halitosis was 53.41 ± 42.6 months (range: 6-182 months). The follow-up period after a single RF cryptolysis was 12 months.

Before RF cryptolysis, all patients had caseums in palatine tonsil crypts and a positive Finkelstein test result. Moreover, organoleptic measurements revealed that three patients (8.82%) had serious halitosis, 24 (70.58%) had average halitosis, and seven (20.58%) had mild halitosis. In term of 12 months after a single RF cryptolysis, caseum recurrence was not observed in 26 patients (76.47%). None of these patients had halitosis. The Finkelstein test was negative. Organoleptic measurements showed that these 26 patients exhibited complete recovery. However, in the remaining

eight patients (23.53%), caseum recurrence and positive Finkelstein tests were observed at the first month follow-up visit. RF cryptolysis was not applied for recurrence. Organoleptic measurements showed that while six of these patients (17.64% of the whole cohort) showed partial recovery, the remaining two patients (5.88% of the whole cohort) showed no recovery. Fig. 3 shows the organoleptic measurements of the cohort before and 12 months after a single RF cryptolysis. The change in these measurements was statistically significant ($p < 0.001$; $t: 13.365$).

Regarding the VAS scores, Fig. 4 shows that the mean VAS score before RF cryptolysis was 6.82 ± 1.45 (range: 4-9). However, 12 months after a single RF cryptolysis session, the mean VAS score was 1.88 ± 2.5 (range: 0-8). This difference was statistically significant ($p < 0.001$; $t: 12.699$). While VAS scores decreased in 94.1% of the patients ($n = 32$), the remaining two patients showed no change in VAS scores. These were the same two patients whose organoleptic measurements did not change 12 months after a single RF cryptolysis.

4. Discussion

The accumulation of epithelial and food wastes and secretory proteins in tonsil crypts leads to the formation of caseums. The presence of these caseums correlates strongly with halitosis because the processing of the caseums by proteolytic anaerobic bacteria leads to the production of VSCs, which result in bad breath. Other symptoms caused by caseums are the feeling of chronic irritation or a foreign body in the throat, and a tickling sensation [8]. While palatine tonsil crypt caseums can be seen across all age groups, this disease mainly affects adolescents and young adults [14]. Indeed, the

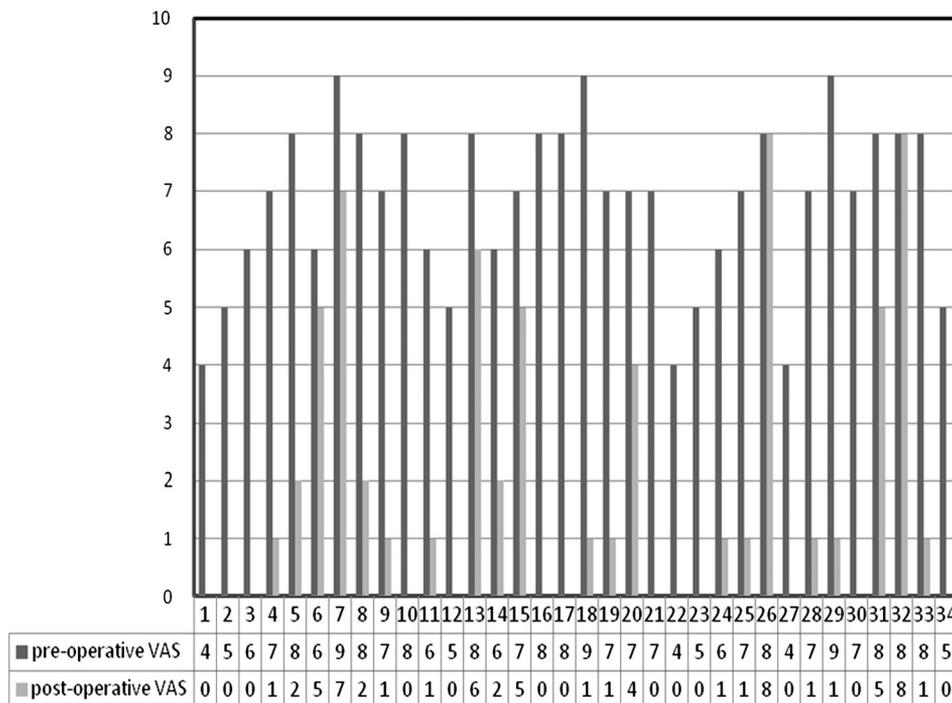


Fig. 4 – Preoperative and postoperative visual analog scale (VAS) scores.

cohort assessed in the present study included a large number of young adults: the mean age was 28.29 ± 9.3 . While sex does not play a significant role in the prevalence and severity of the disorder, patients with halitosis who are admitted to medical institutions for treatment are more likely to be female. This may reflect the greater interest of women in their health and appearance [14]. Indeed, in the present study, there were many more women than men: 26 of the 34 patients (76.5%) were women.

While anti-inflammatory and antiseptic mouthwashes and salt water are often used to treat caseum-induced halitosis, these solutions can include alcohol, which can dehydrate the oral mucosa. Ultimately, this increases caseum formation in the crypts. Another approach is to encourage the patient to extract the caseous materials by themselves using a finger. While this provides temporary relief, the caseums in the crypts generally recur [8]. By contrast, tonsillectomy is a curative treatment of halitosis that is caused by palatine tonsil crypt caseums. However, tonsils are lymphoepithelial organs that play critical roles in the immune system [15,16]. Furthermore, tonsillectomy is associated with intraoperative or postoperative complications, such as mortality, prolonged postoperative pain, malnutrition, bleeding, and complications related to the use of general anesthesia. Indeed, the amount of bleeding can reach life-threatening levels. Therefore, it is advisable that doctors try conservative methods first and only use tonsillectomy in patients who do not respond to these methods [17].

Given these issues, laser cryptolysis may be a better approach for caseum-induced halitosis and for reducing caseum formation. Compared to tonsillectomy, this treatment is associated with a lower risk of bleeding and the patients can return to a normal diet in a shorter time [9,10]. However, laser cryptolysis entails the use of more expensive equipment. It is also associated with a risk of retinal damage to the operation team and the patient. Protective glasses should be used. Moreover, in patients with a strong gag reflex and anatomic limitations, laser cryptolysis can induce labial commissure, face, oral cavity, and oropharynx burns [18]. In terms of efficacy, Finkelstein et al. reported that halitosis was completely eliminated in 52.8% of patients after one session of laser cryptolysis [19], while Dal Rio et al. found that all 38 patients recovered completely after they received laser cryptolysis treatment once a week for 4 weeks [9]. Moreover, Tanyeri et al. reported that according to Finkelstein test results, 84.4% (49/58) of the patients showed good results after one RF cryptolysis session. The remaining nine patients showed inadequate recovery ($n = 5$, 8.6%) or no recovery ($n = 4$, 6.9%). Only one patient had postoperative hemorrhage [13]. Similarly, the study of Chang et al. revealed that of seven patients treated with RF cryptolysis, five patients exhibited 80%–100% recovery and the remaining two patients showed 50%–70% recovery [18].

In the present study, all patients had positive Finkelstein test results before RF cryptolysis. After a single RF cryptolysis session, 12 months after treatment, 26 patients (76.47%) had negative Finkelstein test results while the remaining eight had a positive test result. Organoleptic measurements also showed that before RF cryptolysis, three of the patients (8.82%) had serious halitosis, 24 (70.58%) had average halitosis, and seven (20.58%) had mild halitosis. However, 12 months after a single RF cryptolysis session, 26 (76.47%) showed complete recovery,

six (17.64%) showed partial recovery, and two (5.88%) showed no recovery. These changes in organoleptic measurements after RF cryptolysis were statistically significant. Similarly, before RF cryptolysis, the mean VAS score was 6.82 ± 1.45 (range: 4–9). Twelve months after a single RF cryptolysis, the mean VAS score was 1.88 ± 2.5 (range: 0–8). This change was also statistically significant. Further analysis revealed that the VAS scores decreased in 32 of the patients (94.1%). However, in the remaining two patients, the VAS scores did not change. These were the same patients who did not evince changes in organoleptic measurements. Postoperative hemorrhage was not observed in any of the patients.

In conclusion, RF (or laser) cryptolysis is a minimally invasive procedure that yields minimal morbidity, bleeding, and other complications, unlike tonsillectomy. In addition, the operation duration and the time needed to return to work and a normal diet are short. However, this approach has some disadvantages compared to tonsillectomy, namely, complete eradication of the disease is not achieved in all patients. This may necessitate a second procedure. Moreover, this approach means that a specimen for pathology cannot be obtained [13]. Nevertheless, RF cryptolysis seems to be easier and safer than tonsillectomy for treating halitosis caused by caseums in palatine tonsil crypts. It also seems to be well-tolerated by the patients. Further research on the effectiveness and safety of RF cryptolysis for treating and controlling halitosis due to palatine tonsil crypt caseums is warranted.

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