

FUNCTIONAL RESULTS OF VELAR RADIOFREQUENCY SNORING TREATMENT RÉSULTATS FONCTIONNELS DU TRAITEMENT DU RONFLEMENT NOCTURNE PAR RADIOFRÉQUENCE VÉLAIRE

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ABSTRACT

Background: Velar radiofrequency is a therapeutic method of chronic snoring. It has been successful over the last decade due to its technical simplicity and low morbidity. However, its effectiveness is controversial. The objectives were to determine the functional results of radiofrequency treatment for snoring and analyse prognostic factors.

Methods: This was a prospective longitudinal descriptive and analytical study, including twenty patients, carried out between 2019 and 2020 in the Ear-Nose-Throat department of Mohamed Taher Maâmouri Hospital, Nabeul. Adults aged at least eighteen years living with partners, cases of snoring associated or not with mild Obstructive Sleep Apnea (OSA) and patients who underwent velar radiofrequency with or without uvulectomy were included. Patients receiving psychotropic treatments, having severe or moderate OSA, presenting an obstructive focus other than the soft palate and having a history of velar surgery were not included. We excluded patients who were lost to follow-up post-operatively before a period of eighteen months or whose partners were lost to follow-up. The evaluation of the functional results was made by the partner at three, six and eighteen months based on the post-operative visual analog scale compared to the pre-operative one. The snoring was judged to be significantly improved if the difference between pre-operative and post-operative visual analog scales was at least five points.

Results: Seventeen, sixteen and twelve patients showed significant improvement at three, six and eighteen months respectively. The mean differences between preoperative visual analog scale and postoperatives ones were equal to 7.8; 6.7 and 6.5 points respectively at three, six and eighteen months ($p < 0.05$). OSA and overweight were associated with poor functional outcomes.

Conclusion: Velar radiofrequency has proven its effectiveness as a treatment of chronic ronchopathy with or without mild OSA. Functional results are better in the short and medium terms than in the long term. OSA and overweight are factors of functional failure. In case of overweight, weight loss by following hygienic and dietary rules must precede the velar radiofrequency.

Key-words: Snoring, Obstructive sleep apnea, Radiofrequency, Functional Result, Soft palate

RÉSUMÉ

Introduction: La radiofréquence vélaire est un moyen thérapeutique du ronflement nocturne chronique. Elle a connu un succès pendant cette dernière décennie du fait sa simplicité technique et sa faible morbidité. Néanmoins, son efficacité suscite des controverses. Les objectifs de notre étude étaient d'analyser les résultats fonctionnels du traitement du ronflement nocturne par radiofréquence et de déterminer les facteurs pronostiques.

Méthodes : Il s'agissait d'une étude prospective longitudinale descriptive et analytique, incluant vingt patients, réalisée entre 2019 et 2020 au service d'Oto-Rhino-Laryngologie de l'Hôpital Mohamed Taher Maâmouri, Nabeul. Ont été inclus les adultes âgés d'au moins dix-huit ans vivant avec des partenaires, les cas de ronflement nocturne associé ou non à un syndrome d'apnées obstructives du sommeil léger ou modéré, les opérés d'une radiofréquence avec ou sans uvulectomie. N'ont pas été inclus les patients recevant des traitements psychotropes, ayant un syndrome d'apnées obstructives du sommeil (SAOS) sévère ou modéré, présentant un foyer obstructif autre que le voile du palais, ayant des antécédents de chirurgie vélaire. Ont été exclus les perdus de vue en post-opératoire avant un délai de dix-huit mois ou ne vivant plus avec leurs partenaires. L'évaluation du résultat fonctionnel a été faite par le conjoint à trois, six et dix-huit mois en se basant sur l'échelle visuelle analogique (EVA) post-opératoire par comparaison à l'EVA pré-opératoire. Le ronflement a été jugé en amélioration significative si la différence entre les scores pré-opératoire et post-opératoire était au moins cinq.

Résultats : Dix-sept, seize et douze patients étaient en amélioration significative respectivement à trois, six et dix-huit mois. Les différences moyennes entre les scores d'EVA pré-opératoire et post-opératoire étaient égales à 7,8; 6,7 et 6,5 respectivement à trois, six et 18 mois avec des valeurs de $p < 0,05$. Le SAOS ainsi que le surpoids étaient liés à un résultat fonctionnel insatisfaisant.

Conclusion : La radiofréquence vélaire a prouvé son efficacité comme traitement de la ronchopathie avec ou sans syndrome d'apnées obstructives du sommeil léger. Les résultats fonctionnels sont meilleurs à court et moyen termes qu'à long terme. Le SAOS ainsi que le surpoids représentent des facteurs de mauvais résultat fonctionnel.

Mots-clés: Ronflement, Apnée obstructive du sommeil, Thermocoagulation, Résultat fonctionnel, Voile du palais



INTRODUCTION:

Chronic snoring is a common pathology which causes significant social embarrassment. It can be isolated or part of an OSA. Several treatment options are available for simple snoring or mild OSA. Aside from sleep hygiene and dietary advices, there are different surgical techniques which aim to reduce velar vibrations and reduce the tissue mass of the soft palate: uvulopalatopharyngoplasty (UPPP), laser treatments and radiofrequency [1,2].

Velar radiofrequency (RF), introduced in 1998 by Powell's team [3], has been successful over the last decade thanks to a low morbidity and a similar effectiveness to other techniques [4].

However, long term functional results as well as prognostic factors still give rise to controversies. Objectives of our study were to analyze the functional results of velar radiofrequency for snoring and to identify prognostic factors.

Methods: This was a prospective, longitudinal and analytic study, including 20 patients and carried out in ENT department of Mohamed Taher Maâmourî University Hospital in Nabeul from January 2019 to December 2020. We included adults living with partners, aged over 18 and who benefited from velar RF with or without uvulectomy for chronic snoring combined or not to mild OSA. We didn't include patients who presented any of the following criteria: neuropsychiatric history and/or receiving long-term psychotropic treatments, moderate or severe OSA, obstructive site other than the soft palate, a history of velar surgery, obesity defined as a body mass index (BMI) ≥ 30 . We excluded patients that were followed for less than 18 months postoperatively or whose partners no longer live with them. Snoring was assessed pre-operatively by the visual analogue scale VAS as follows: 0 corresponded to snoring absence and 10 to audible snoring from a neighboring room or which justified sleeping in a separate room. Excessive daytime sleepiness was assessed using the Epworth scale [5]. All the patients benefited of general, ENT and maxillofacial examinations including a nasopharyngeal endoscopy associated with a Muller maneuver (forced inspiration on closed glottis). If there was clinical suspicion of OAS combined to snoring, a respiratory polygraphy was carried out. For OAS diagnosis, we based on criteria established by the American Academy of Sleep Disorder AASD [6], the AASD classification into mild, moderate and severe OSA was adopted. All patients were operated by the same surgeon, under general anesthesia. During the study period, we used a single RF generator (Celon AG° 465KHz) in monopolar mode. The probe was applied intramuscularly for 10 seconds with an intensity varying from 15 to 20 Watts. Three points of application were made: a median one 10 to 15mm above uvula base and two lateral points. As for the uvulectomy, we used classic equipment: Metzenbaum Curbes scissors, Adson forceps. RF treatment included one to three sessions with intervals

of eight weeks, the sessions were repeated until the life partner considered the result to be satisfactory. Post-operatively, patients received an oral analgesic (paracetamol or ibuprofen), a local anti-septic and anti-inflammatory solution. Life partner evaluated functional results at three, six and 18 months after the last RF session based on VAS. Outcomes were considered as follows:

Significant improvement (SI) if the difference between pre-operative VAS and post-operative VAS was at least five points.

Non-significant improvement (NSI) if the difference was less than five points.

No improvement or worsening if the difference was respectively equal to or less than zero

Statistical analysis was carried out using the IBM SPSS Statistics (Statistical Package for the Social Science) in its 26th version. The statistical significance threshold (p) was set at 0.05

RESULTS

Patients average age was 38.3 years. There were 14 men and six women. Medical histories were high blood pressure, diabetes, dyslipidemia and sarcoidosis in five, three, two and one cases, respectively. Five patients were smokers with an average of 16 packs/year. Chronic alcoholism was noted in four patients. We found a profession requiring vigilance in two patients: a taxi driver, a driving school instructor. Prior to treatment with velar RF, ethyl patients adhered to withdrawal and patients having overweight adopted hygienic and dietary measures aimed at weight reduction. For all patients, snoring was rated $\geq 5/10$ on the VAS, among them five patients with a VAS of 10/10. Combined to snoring, nocturnal apnea and restless sleep were noted in four and eight patients, respectively. Excessive daytime sleepiness was reported by 12 patients. Seven patients had a pathological score > 10 on the Epworth scale. On oropharyngeal examination, patients had Mallampati scores ranging from II to IV with a predominance of score II, none of them had obstructive palatal tonsils or macroglossia. Five patients presented with a hypertrophic uvula. Nasal endoscopy was normal in all the patients as well as maxillo-facial examination. Average neck perimeter was 37,4 and extremes were 32,9 to 42. On general examination, five patients had overweight defined as $25 \leq \text{BMI} < 30$. BMIs varied from 22,7 to 29,2 with an average of 24,8. Two patients had elevated blood pressure. Respiratory polygraphy had been performed in 12 patients who had excessive daytime sleepiness, among them the seven cases of pathological Epworth score. Seven patients presented mild OSA. Velar RF (figure 1) was combined to uvulectomy in five patients presenting with hypertrophied uvula during the first RF session. The average number of RF sessions was 1.46 with extremes ranging from one to three sessions. Immediate post-operative complications were velar edema in 12 cases that resolved in one to four days



and mucosal erosions in four patients. The patient who had sarcoidosis under long-term corticosteroid treatment presented a velar infection nine days after RF. Thus, he benefited of oral antibiotic therapy and then had favorable progress.

Three months post operatively, one patient presented a disappearance of snoring, SI was noted in 16 patients with a mean difference between pre-operative VAS and post-operative VAS equal to 7.8 points and extremes ranged from five to nine ($p=0.031$), snoring percentage reduction was $\geq 75\%$ in 10 patients (figure 2). The three remaining cases had differences equal to two, three and four. At six months, 16 patients showed SI, including the patient who had total disappearance of snoring at three months. The average difference between pre-operative VAS and post-operative VAS was equal to 6.7 points and extremes ranged from five to eight ($p=0.043$), snoring percentage reduction was $\geq 75\%$ in eight patients. The remaining four cases showed NSI ($p=0.67$), including the three patients who did so at three months, differences between pre-operative VAS and post-operative VAS were equal to two, three, three, four respectively. At 18 months, one patient had disappearance of snoring although previously had had NSI. Twelve patients among those who were previously significantly improved remained so. The mean difference between pre-operative VAS and post-operative VAS was equal to 6.5 points with extremes ranging from five to eight ($p=0.049$), snoring percentage reduction was $\geq 75\%$ in five patients (figure 3). Seven patients showed NSI ($p=0.72$) with a mean difference between pre-operative VAS and post-operative VAS equal to 2.8 and extremes ranging from one to four.

Comparison between OSA group and isolated snoring group (table I) showed that whatever the postoperative delay, RF results were significantly higher in the absence of OSA than in its presence and p values were equal to 0,026; 0,01; 0,047 respectively at three, six and 18 months post operatively. Comparison between overweight group and normal weight group (table II) showed that RF results were significantly higher in normal weight group at three and six months, p values were equal to 0,023 and 0,042 respectively. Nevertheless, at 18 months, SI rates were similar in the two groups. At three months, functional results of isolated RF group were significantly superior to those of RF+ uvulectomy group ($p=0.01$), while at six and 18 months, the results of the two groups were comparable with p values $\geq 0,05$ (table III)

Only two patients, among the seven with mild OSA, benefited from post-operative respiratory polygraphy which showed no disappearance of OSA but an improvement with AHI gains equal to 4 and 5 points. These patients had presented a non-significant improvement of post operative VAS at three, six and 18 months.

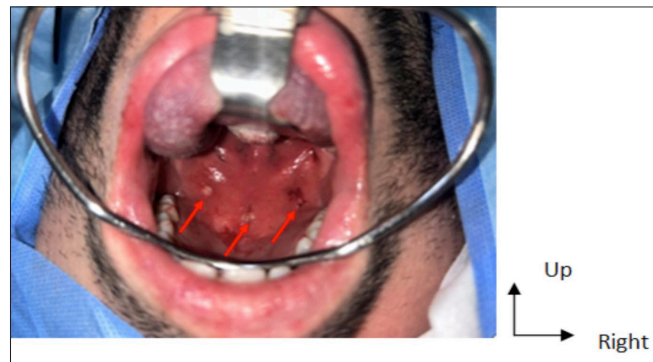


Figure 1: Intraoperative photo of velar radiofrequency at three points of application (arrows); patient in supine position

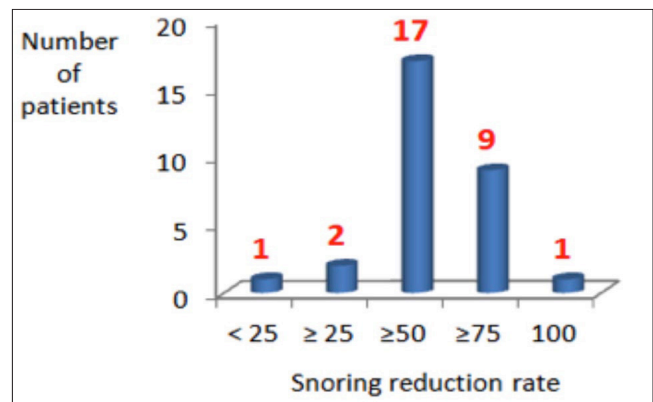


Figure 2: snoring VAS reduction rate at three months post operatively

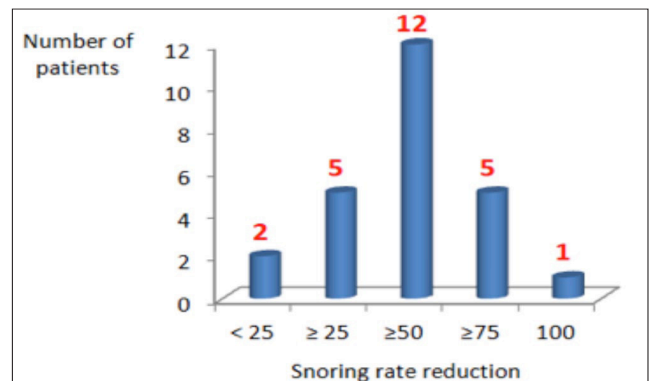


Figure 3: snoring VAS reduction rate at eighteen months post operatively

Delay \ OAS	3 months	6 months	18 months
Yes (n=7)	SI= 5 NSI= 2	SI= 4 NSI= 3	SI= 3 NSI= 4
No (n= 13)	Disappearance=1 SI= 11 NSI= 1	SI= 12 NSI= 1	Disappearance= 1 SI= 9 NSI= 3

Table I: Functional results of velar radiofrequency for snoring in presence and absence of OAS respectively

Delay \ Procedure	3 months	6 months	18 months
RF+ uvulectomy (n=5)	SI= 3 NSI= 2	SI= 4 NSI= 1	SI= 3 NSI= 2
Isolated RF (n=15)	Disappearance=1 SI= 13 NSI= 1	SI= 12 NSI= 3	Disappearance=1 SI= 9 NSI= 5

Table II: Functional results of velar radiofrequency with and without uvulectomy respectively



Delay	3 months	6 months	18 months
Overweight			
Yes (n=5)	SI= 3 NSI= 2	SI= 3 NSI= 2	SI= 3 NSI= 1
No (n= 15)	Disappearance=1 SI= 13 NSI= 1	SI= 13 NSI= 2	Disappearance =1 SI= 9 NSI= 6

Table III : Functional results of velar radiofrequency for snoring in patients with overweight and normal weight, respectively

DISCUSSION

RF is a well-tolerated procedure to reduce velar vibrations and soft palate mass [7]. Its morbidity is lower compared to other velar surgical treatments, whether conventional surgery (UVPP) or laser surgery [1,8]. To our knowledge, the most recent literature review concerning velar RF results was published in 2009 [8]. It included 13 studies among them two randomized controlled trials and concluded that: The average duration of analgesics use after RF varied from 0.3 to 1.3 days compared to 5.8 to 11.8 days for laser and 10.1 to 12.4 days for UPPP. There are no major complications in the short, medium or long term, especially there is no risk of voice alteration, besides two studies [9,10] analyzed by objective measurements the voices of patients operated on velar RF compared to those of control groups (untreated) and concluded that there was no statistically significant difference between the two groups voices. Most of the complications were minor such as superficial mucosal erosions, edema, desquamation of the uvule and healed spontaneously within a few days. Velopalatine fistula has rarely been described [11,12]. Our study results are consistent with literature data. Most studies, whether randomized controlled trials or uncontrolled trials have reported a statistically significant improvement in postoperative VAS compared to the pre-operative VAS whatever the delay (short or long term) [8]. For example, in Kermadec et al study [13] that included 228 patients, the average preoperative VAS was 8.1 ± 1.5 , immediate average postoperative VAS was 3.5 ± 2.2 ($p < 0.0001$) and long-term average VAS was equal to 5.7 ± 2.9 which was significantly lower than preoperative values ($p < 0.001$). Stuck et al [14] noted a significant difference ($p=0.045$) between the group treated with velar RF (VAS score increased from 8.1 to 5.2) and the placebo group with a VAS score increasing from 8.4 to 8. In our study the differences between post-operative VAS and pre-operative VAS were statistically significant equal to 7.8; 6.7 and 6.5 respectively at 3, 6 and 18 months with p values < 0.05 . Pessey et al [1], whose serie included 175 patients, noted 73,3% of significant improvement at 3 months and this is comparable to our results, but unlike us, they found a clear deterioration in the long term results with significant improvement percentages equal to 37.8 and 26.3% at one and two years respectively. Blumen et al [15] reported 50% of post operative VAS deterioration beyond 13 months. Furthermore, studies [1,11,16, 17] analysed the influence of the following factors on RF outcome:

--The person evaluating the EVA: they concluded that VAS scores were the same whether the assessment was made by the patient, by life partner or by both.

--The type of generator: they deduced that this factor had no impact on the post-operative VAS, in fact, the VAS scores were comparable for five different types of generators (among them there were monopolars and bipolars) $p=0.21$. In our study we opted for a homogeneous population concerning the above-mentioned factors, in fact, we used the same generator for all patients and the evaluation of the VAS score was made by the life partner in all cases.

--Obesity: the majority of authors [1,16,17] agree that obesity is a failure factor of velar RF, for this we chose not to include obese patients in our study, however we included 5 overweight cases who started hygienic and dietary rules before RF. At three and six months, we noted significantly higher functional results in normal weight group compared to overweight group. Nevertheless, the two groups results were similar at 18 months but this is maybe related to the weight loss in overweight group that follow hygienic-dietary rules.

--Uvulectomy: Authors [1,8] concluded that laser uvulectomy (for hypertrophied uvules) potentiated radiofrequency effectiveness when it was differed (three months after RF). In our study, at three months, the functional outcome of isolated RF group was significantly higher than the outcome of RF + uvulectomy group ($p=0.01$). This is was probably due to the simultaneity of the two surgical procedures which had delayed healing. As for other delays (six and 18 months) the results of the two groups were similar.

--OAS: studies that had included OSA cases [8] analyzed postoperative AHI but their results were controversial, the majority of them did not retain significant improvement of AHI.

A review published in 2015 including 894 coblations in adults [18] found that 6 months after operation, the patients' sleep Monitoring results were improved remarkably ($P<0.01$) and their symptoms of snore got improved. SF-36 health questionnaire survey [18] showed that social function, energy and mental health dimension scores were significantly higher than the preoperative ($P<0.05$). We did not statistically analyze post operative AHI since only two patients/seven agreed to do postoperative respiratory polygraphy, nevertheless, we compared the postoperative VAS of OAS group to those of the simple snoring group and we found significantly higher result in simple snoring group.

Conflicts of interest

The authors declare that they have no conflict of interest
Availability of data

The data underlying this case report will be shared on reasonable request to the corresponding author.

Ethic committee approval

The hospital ethics committee approved this study

**REFERENCES:**

1. Pessey JJ, Rose X, Michenet F, Calmels MN, Lagleyre S. Traitement du ronflement simple par coblation vélaire. *Ann Otolaryngol Chir Cervicofac.* 2005;122(1):21-6
2. Picavet VA, Dellian M, Gehrking E, Sauter A, Hasselbacher K. Treatment of snoring using a noninvasive Er:YAG laser with SMOOTH mode (NightLase): a randomized controlled trial. *Eur Arch Otorhinolaryngol.* 2023 Jan;280(1):307-12.
3. Powell NB, Riley RW, Troell RJ, Li K, Blumen MB, Guilleminault C. Radiofrequency volumetric tissue reduction of the palate in subjects with sleep-disordered breathing. *Chest.* 1998;113:1163-74
4. Stuck BA, Hofauer B. The Diagnosis and Treatment of Snoring in Adults. *Dtsch Arztebl Int.* 2019 Nov 29;116(48):817-24
5. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep.* 1991 Dec;14(6):540-5
6. Sateia MJ. International classification of sleep disorders-third edition: highlights and modifications. *Chest.* 2014 Nov;146(5):1387-94.
7. Hofauer B, Braumann B, Heiser C, Herzog M, Maurer JT, Plöbßl S et al. Diagnosis and treatment of isolated snoring—open questions and areas for future research. *Sleep Breath.* 2021 Jun;25(2):1011-17
8. Bäck L, Hytönen M, Roine R, Malmivaara A. Radiofrequency Ablation Treatment of Soft Palate for Patients with Snoring: A Systematic Review of Effectiveness and Adverse Effects. *Laryngoscope.* 2009;119:1241-50
9. Haraldsson PO, Karling J, Lysdahl M, Svanborg E. Voice quality after radiofrequency volumetric tissue reduction of the soft palate in habitual snorers. *Laryngoscope.* 2002;112:1260-63
10. Birkent H, Soken H, Akcam T, Karahatay S, Gerek M. The effect of radiofrequency volumetric tissue reduction of soft palate on voice. *Eur Arch Otorhinolaryngol.* 2008;265:195-8
11. Reckley LK, Fernandez-Salvador C, Chang ET, Camacho M. Soft palate fistula after radiofrequency ablation for primary snoring: a case report and literature review. *Braz J Otorhinolaryngol.* 2020;86(S1):S20-22
12. Kezirian EJ, Powell NB, Riley RW, Hester JE. Incidence of complications in radiofrequency treatment of the upperairway. *Laryngoscope.* 2005;115:1298-304
13. De Kermadec H, Blumen MB, Engalenc D, Vezina JP, Chabolle F. Radiofréquence vélaire dans l'apnée du sommeil: résultats à 6 ans. *Ann Otolaryngol Chir Cervicofac.* 2014;131:19-23
14. Stuck BA, Maurer JT, Hein G, Hormann K, Verse T. Radiofrequency surgery of the soft palate in the treatment of snoring: a review of the literature. *Sleep.* 2004;27:551-5
15. Blumen MB, Dahan S, Wagner I, De Dieuleveult T, Chabolle F. Radiofrequency versus LAUP for the treatment of snoring. *Otolaryngol Head Neck Surg.* 2002;126:67-73
16. Blumen MB, Chalumeau F, Gauthier A, Bobin S, Coste A, Chabolle F. Comparative study of four radiofrequency generators for the treatment of snoring. *Otolaryngol Head Neck Surg.* 2008;138:294-9
17. D'Souza A, Hassan S, Morgan D. Recent advances in surgery for snoring—somnoplasty (radiofrequency palatoplasty) a pilot study: effectiveness and acceptability. *Rev Laryngol Otol Rhinol.* 2000;12:111-5
18. Wu Y, Zhang Q. A retrospective study of coblation-assisted treatment in adult with obstructive sleep apnea-hypopnea syndrome. *J Clin Otolaryngol Head Neck Surg.* 2015 Jan;29(1):79-82.