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CASE REPORT: Multidisciplinary Management of Snoring and OSA using the Minimally Invasive NightLase® Er:YAG Laser Treatment in Combination with a Mandibular Advancement Device

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ABSTRACT

Snoring can significantly impact an individual's quality of life, along with their partner's, causing sleep disturbances that may lead to relationship problems. It is also frequently associated with a potentially life-threatening condition – obstructive sleep apnea (OSA). This clinical note presents the findings of a multidisciplinary approach to reducing snoring and improving sleep quality in a patient with loud snoring and moderate non-positional OSA.

The NightLase® laser treatment using Er:YAG LP (long pulse) laser and the Fotona SMOOTH® protocol was used as an initial treatment to reduce the Apnea-Hypopnea Index (AHI) and snoring severity, with the subsequent additional introduction of a Mandibular Advancement Device (MAD). The combined treatment decreased the Apnea-Hypopnea Index (AHI) from an initial 25.2 (moderate) down to 5.2 (mild) and the snoring score from "severe" (44.6%) to "non-relevant" (2.9%), providing valuable insights into the efficacy and safety of this kind of combined multidisciplinary approach to snoring and OSA treatment.

Key words: Er:YAG, OSA, snoring, NightLase, MAD.

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I. INTRODUCTION

Obstructive Sleep Apnea (OSA) is a common sleep disorder characterized by recurrent partial or complete collapse of the upper airway during sleep, leading to disrupted breathing and reduced oxygen levels [1]. Snoring, a common symptom of OSA, is caused by the vibration of relaxed tissues in the airway during sleep. Aside from significantly impacting the quality of life of affected individuals, OSA may also pose serious health risks, including cardiovascular disease, cognitive impairment, and daytime fatigue [2].

Conventional treatment modalities for OSA can be behavioral or involve appliances or surgical methods. The most common approaches are Continuous Positive Airway Pressure (CPAP) therapy and Mandibular Advancement Devices (MADs). While CPAP is effective, it may be poorly tolerated by some patients due to discomfort, claustrophobia, or noise [3]. MADs, on the other hand, are oral appliances that help maintain an open upper airway by advancing the mandible and stabilizing the tongue, resulting in improved airflow during sleep. MADs have shown promising results in managing snoring and mild to moderate OSA cases (4]. However, MADs can be associated with certain unwanted short-term side effects, such as excessive salivation or mouth dryness, as well as damaging forces on the oral soft tissues and teeth, and even temporomandibular problems [4-7].

Despite the effectiveness of MADs, certain cases may not respond optimally to these devices alone [8]. This has led to the exploration of adjunctive therapies to enhance the outcomes of MAD treatment. One such modality is the use of the Er:YAG (Erbium-doped Yttrium Aluminum Garnet) laser using a minimally-invasive NightLase® laser-assisted uvulopalatoplasty (LAUP) approach. As a result of the contraction of the soft tissue originating from the posterior border of the hard palate, the treated tissue is elevated and advanced, leading to enhanced upper airway volume. Previous clinical observations of this treatment approach in reducing symptoms of sleep-disordered breathing (SDB) have demonstrated a decrease in total snoring scores and Apnea-Hypopnea Index Scores (AHI) as well as improvements in Quality-of-Life evaluation tests [9-15], along with an augmentation of airway volume determined by cone beam computed tomography (CBCT)[12,16].

Recent studies have investigated the addition of a non-invasive Er:YAG laser treatment to the MAD therapy as a novel approach to further enhance the

therapeutic efficacy of the management of snoring and OSA, without the required subsequent use of the MAD for maintenance of the results [17].

Our case report aimed to show new findings of this type of multidisciplinary approach to reduce snoring and improve sleep quality in a patient with loud snoring and moderate non-positional OSA. NightLase® laser treatment using Er:YAG with LP (long pulse) and the Fotona SMOOTH® protocol was used as an initial treatment to reduce the AHI and snoring severity with the subsequent introduction of a Mandibular Advancement Device (MAD).

II. CASE

A 50-year-old male presented at our clinic with a chief complaint of loud snoring. No other relevant medical history was reported. Initial ambulatory polysomnography revealed 44.6% snoring time per night and an Apnea-Hypopnea Index (AHI) of 25.2, indicating moderate, non-positional apnea. Pre-treatment Cone Beam Computed Tomography (CBCT) Upper Airway Imaging revealed a Minimum AP of 11.1 mm, Minimum LAT of 29.7 mm, Volume of 24.0 cm^3 and a Minimum area of 168.1 mm^2 (Fig. 1). The patient scored 7 (higher normal daytime sleepiness) on the Epworth Sleepiness Scale questionnaire (ESS) (1) and "High risk for OSA" on the STOP-Bang questionnaire (18).

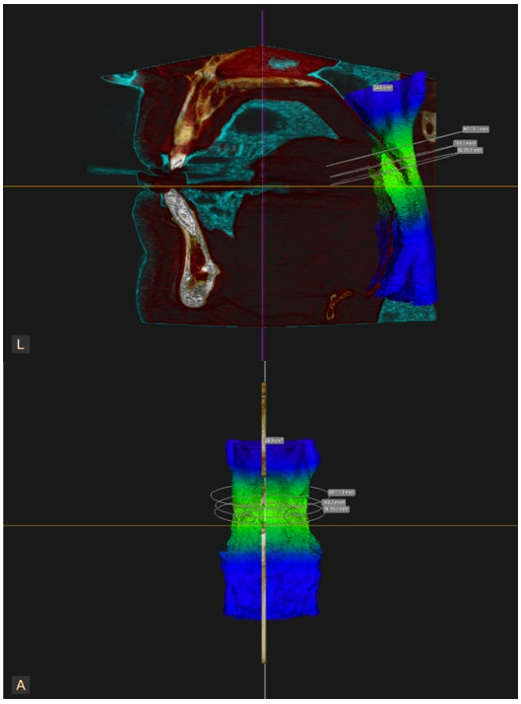

Figure 1: Pre-treatment CBCT Upper Airway Imaging results: minimum AP = 11.1 mm, minimum LAT = 29.7 mm, volume = 24.0 cm^3, minimum area = 168.1 mm^2.

We decided to perform three laser treatment sessions (at 0, 2, and 4 weeks) with laser parameters (LightWalker AT-S, Fotona d.o.o.) adopted from Monteiro et al. 2020 (19) as described in Table 1.

Table 1: NightLase® laser treatment parameters. Three treatment sessions were performed (at 0, 2, and 4 weeks).

Laser Source	LightWalker, Er:YAG, 2940 nm	
	Step 1	Step 2
Pulse duration	LP mode	SMOOTH Mode
Fluence	2 J/cm^2	9 J/cm^2
Frequency	10 Hz	2 Hz
Handpiece	PS04	PS04
Technique	Scanning with 50% overlap	Static with no overlap
Spot size	7 mm	7 mm
Shots per sites	/	3 or 4
Passes per area	6	6
Total shots	From 9000 to 11000	From 9000 to 11000

At the 4-month follow-up, clinical photos revealed evident tissue shrinkage (Fig. 2). Polysomnography assessed with respiratory polygraphy (BTI-APNiA®, BTI Biotechnology Institute, Vitoria, Spain) at the 5-month follow-up revealed a decrease in AHI from an initial 25.2 down to 16.2 (Fig. 3). The level of snoring, evaluated as the % of time spent snoring during the night, decreased from "Severe" (44.6%) to "Moderate" (21.3%) (Fig. 4).

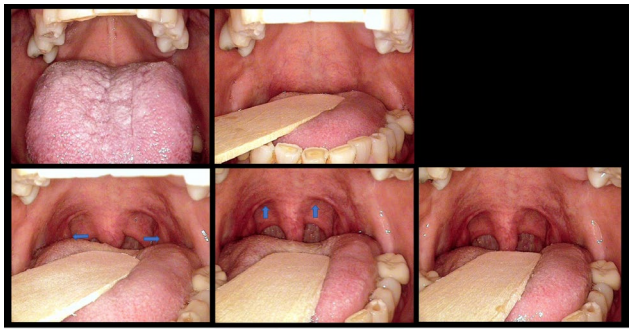

Figure 2: Clinical photos before (upper row) and 4-months after (bottom row) three NightLase® treatment sessions.

After the treatment with laser was completed and since the AHI 16.2 still indicated mild-moderate obstructive sleep apnea, we consented with the patient to incorporate a Mandibular Advancement Device (MAD) treatment with the BTI DIA Oral Appliance (BTI Apnia, Vitoria, Spain). The upper and lower dental arches were digitally scanned, a bite at maximum

occlusion was taken, and the initial advancement was fixed at 4 mm (Fig. 5). Polysomnography after 6 weeks of use revealed an AHI of 5.2 with complete control of OSA (Fig. 3). Snoring was reduced from "Severe" (44.6%) to "Moderate" (21.3%) with laser and to "Non-relevant" (2.9 %) with the MAD (Fig. 4).

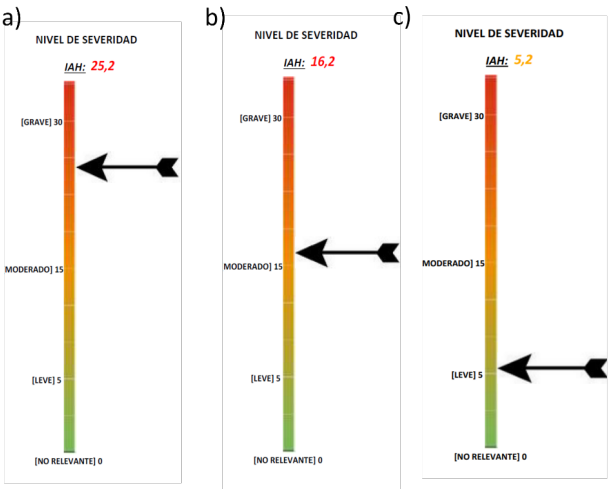

Figure 3: Outpatient polysomnography results before (a) and 5 months after NightLase® treatment (b), revealing a decrease in AHI (IAH) from 25.2 to 16.2. Subsequent 6-week use of a MAD managed to further decrease AHI from 16.2 to 5.2 (c).

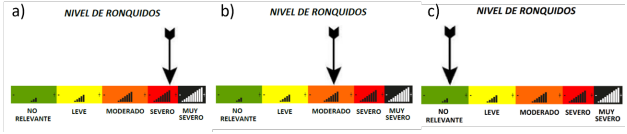

Figure 4: The level of snoring, evaluated as the % of time spent snoring during the night, decreased from initial "Severe" (44.6%) (a) to "Moderate" (21.3%) (b) with 3 laser treatments, and to "non-relevant (2.9%) (c) with subsequent use of a MAD.

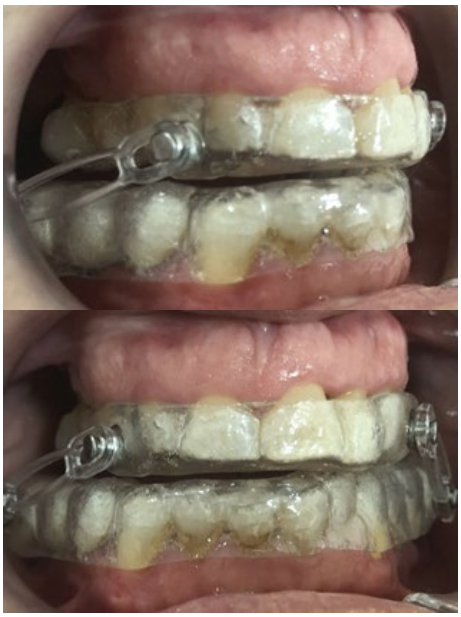

Figure 5: Mandibular Advancement Device used (MAD).

Unfortunately, we were not able to perform CBCT imaging after the treatment. However, at the end of the treatment (both laser and MAD) the patient scored 5 (lower normal daytime sleepiness) on the ESS scale and "low risk" on the STOP-Bang questionnaire.

The patient reported no adverse effects and no discomfort during or after the MAD or laser procedures. The patient continued to use the MAD also after the treatment.

III. DISCUSSION

Our usual snoring and OSA management strategy involves an initial differential diagnosis to find out if the patient only suffers from simple snoring or suffers from snoring and OSA. In cases of bruxism, in patients with a loss of vertical dimension, the intermaxillary vertical dimension should first be restored before continuing with treatment for OSA, as this frequently reduces their apnea-hypopnea index (AHI). Then, if necessary, the NightLase® treatment is performed and, if required, a MAD device is made for total control of the apnea syndrome. In cases of simple snorers without OSA, NightLase® therapy is established as the first and only choice of treatment.

Previous case reports by Bisheimer et al. (2021) showed that NightLase® therapy applied after 2 months of use of a MAD, is safe and may gradually lead to the maintenance of open airways and could at least temporarily decrease the requirement for use of the MAD (17). This case report highlights the potential of performing a non-invasive Er:YAG laser therapy also as a primary treatment option for patients with OSA, before the introduction of a MAD. While a MAD can serve as an initial management strategy, it is conceivable that using Er:YAG laser before MAD therapy, with the purpose to tighten the relaxed soft tissue of the oropharynx, is also a safe and effective approach to the treatment of snoring and OSA. Further blinded, randomized controlled clinical trials with placebo controls are needed to determine the best management strategy and the efficacy and safety of the combined approach using NightLase® and a MAD.

IV. CONCLUSIONS

This clinical case highlights the safety and potential benefits of using NightLase® laser therapy and provides valuable insights into its efficacy as an adjunctive treatment option with the use of a MAD in the multidisciplinary treatment of snoring and OSA. Such an approach of combining a MAD with NightLase® laser treatment could mitigate the long-term risks associated with continuous appliance use and address

concerns frequently observed with the use of a MAD while offering comprehensive therapeutic benefits for patients with OSA.

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