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Original Research

Efficacy of Erb-Laser on Inferior Turbinate Hypertrophy: A Retrospective and Cohort Study

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Abstract

Objectives: Nasal obstruction (NO) is a very common complaint in the practice of otolaryngology. The cause of NO can be due to inferior turbinate hypertrophy (ITH), which may be a result of allergic rhinitis, hyperreactivity, hormonal causes, rhinitis medicamentosa or idiopathic. The most commonly used treatments today include local nasal or systemic corticosteroids, cauterization or microdebrider, or thermal ablation with radiofrequency, coblation or ablative laser (mainly carbon dioxide or diode lasers), and submucosal reduction. Erbium YAG laser in non-ablative and SMOOTH thermal mode is considered as a non-invasive treatment and could be a novel and safe alternative.

The aim of this study was to evaluate the safety and performance of a new Erb-laser treatment protocol on bilateral ITH, during and after 3 sessions of treatment throughout 6 months.

Methods: This retrospective study was carried out over 30 patients with complaints of NO, sneezing, itching, discharge, and nasal congestion refractory to medical management from July 2019 to December 2020 in the Department of Otorhinolaryngology of a private hospital in Famagusta, North Cyprus. Symptoms were evaluated subjectively by using NO Score and Visual Analog Scale (VAS). Patients were evaluated at the post-procedural 1st-week, and 1st-, 3rd-, and 6th-month postoperatively. During each follow-up visit, symptoms were reassessed by VAS and NO Score.

Results: Differences between pre-operative and post-operative VAS and NO Scores were statistically significant. All patients had significant symptomatic improvements, which started from the post-operative 1stweek and persisted throughout the follow-up period. The active laser treatment showed high improvement during and after the procedure, regarding NO, and decreased the nasal burden on quality of life.

Conclusion: Erbium YAG laser treatment is a simple, safe, effective, and non-invasive method effective on ITH, with minimal damage on the nasal mucosa. It can be done as an office procedure, with minimal complications. This method will provide a great advantage in the future treatment of NO.

Keywords: Inferior turbinate hypertrophy, laser, nasal obstruction, nasal obstruction scale, visual analog scale

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Nasal Obstruction(NO) is the major symptom experienced by individuals with bilateral hypertrophic inferior concha/turbinate.While this NO due to inferior turbinate hypertrophy (ITH) can cause minor discomfort in some people, it is a significant source of discomfort in others and affects the quality of life. ITH is generally observed in patients with chronic sinusitis,vasomotor rhinitis, and allergic rhinitis.Therefore, in addition to nasal congestion, sleep disturbance, difficulty to concentrate, headache may accompany.[1]

Chronic inflammatory process in the nasal mucosa is the major etiology that leads to the accumulation of collagen in the submucosal tissue and eventually causes the turbine bone remodeling.This sets the stage for the development of ITH.[2] In the beginning, symptoms respond to systemic antihistamines, steroids, and local decongestants, but in later periods, this response may begin to decrease.Since this condition is a chronic process, it leads to different alternative therapies that is more effective, safer, and will provide long-term efficacy other than medical and invasive surgical treatments. Various techniques such as total or partial turbinectomy, turbinoplasty, chemical cautery, dia-termi, radio frequency, volumetric tissue reduction, laser turbinate reduction,and cryotherapy are among the chosen surgeries.[3]

Comprehensive research on the various medical and surgical treatments of ITH revealed us only a few articles written on the effect of Erb-laser. In this study, we suggest a new non-invasive and easily applied intervention with minimal complications that can be used in wide range of age groups and minimally effected by comorbidities.[4]

Based on the previous studies including non-invasive (potassium titanyl phosphate (KTP) and carbon dioxide laser (CO2) Nd: YAG laser), and minimally invasive methods used in ITH, there are few articles written on Erb-laser which seems to be safe and effective solution for the symptoms of nasal blockage and allergic rhinitis.Therefore, the objective of this study is to state the advantages of our proposed new Erb-YAG laser protocolover the other laser treatment.[5-7]

Methods

In this retrospective study, 30 patients (15–75 year-old) with symptomatic bilateral ITH were included. Indıviduals were refractory to medical treatment in the Department of Otorhinolaryngology, Famagusta Private Hospital between September 2019 and July 2020. Male to female ratio was 18:12.

The study was reviewed and approved by the Research and Publication Ethics Board of Eastern Mediterranean University. Previously operated, those who experienced nasal trauma, and malignancy of nose and paranasal sinuses, ongoing upper airway infection,and NO caused byany other pathologies (deviated septum or deviated nose tip, alar cartilage weakness,nasal polyps) were excluded from the study.

Signed informed consent formwas taken from each patients. They were evaluated pre-operative, post-operative 1st week, 1st month, 3rd month and 6th month with nasal endoscopy and symptoms were documented as Visual analog scale (VAS) and NOSE scores. Procedure was done by the same ENT surgeon with the same endoscope (O degree Karl Storz). All patients were assessed for any post-operative otorhinolaryngological and dermatological complaints or complications in each visit.

History of nasal congestion, discharge, sneezing, and itching symptoms of allergic rhinitis not responding to medical treatment were assessed with VAS in which the patients ratetheir symptoms from a score of 0–10, score 0 being asymptomatic and 10 being the most severe symptoms.

A modified version of NOSE score is also used to state the severity of symptoms. This is a subjective and validated instrument which rates the severity of nasal symptoms. Comprising five components which are nasal blockade or obstruction (0–4), trouble breathing through the nose (0–4), trouble sleeping (0–4), unable to get enough air during exertion (0–4) Scores were noted as 0– not a problem, 1 –very mild problem, 2 –moderate problem, 3–fairly bad problem, and 4 –very severe problem. The sum of all symptoms was rated over a score of 20.

Fotona Sp Dynamis laser on Er-YAG mode (PS03, 2.2 J/cm^2 12 Hz 5–7mm) is used once a week for 7.5 minutes on various parts of each inferior concha for 3 consecutive weeks. No packing or any kind of anesthesiawas used. No medical treatment is applied 1-week pre/per/post-procedure and between sessions. Furthermore, no medical treatment was given any of the patients during 6-month follow-up period.

Ethics Committee Approval

The approval for this study was obtained from Eastern Mediterranean University Board of Scientific Research and Publication Ethics. Ethics Committee of Clinical Studies (decision number: ETK00-2021-0186). All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Statistical Analysis

Analysis of the data was performed on SPSS Version 23 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp).Descriptive analyses were done to calculate mean, standard deviation, and median together with minimum and maximum values for each componentof the severity of nasal symptoms specified aboveat five different times (pre and after the procedure). Severity scores of the symptoms at preprocedure and after 1st week, 1st month, 3 rd month, and 6th month for every component were compared by performing Friedman's Two-way Analysis of Variance test. For significant findings, Wilcoxon Pairwise Signed Ranks test was conducted to specify the differences between pairs of time points.

Results

All 30 patients experienced subjective improvement of their symptoms. Congestion and sneezing occurred immediately after sessions in six patients which lasted a couple of hours.One patient complained about sensation of dryness which subsided 2 weeks after theprotocol was completed. Two patients complained about short duration of burning sensation during procedure that subsided immediately.

The median NOSE scores before and after ER-YAG laser treatment were significantly different from each other ($p<0.0001$). Furthermore, the change in symptom scores was remarkable at the end of each follow-up period. This improvement persisted throughout the follow-up period of post-operative 1 week, 1 month, 3 months, and 6 months. While the recovery gained momentum in the 1st week, this improvement reached its maximum level at the end of the 1st month and stayed constant for the following 5 months.

The pre- and post-treatment VAS scores were found to be statistically significant ($p<0.0001$) for each entity including congesting, sneezing, itching, and discharge. We obtained statistically significant differences in VAS scores in each visit.

On the other hand, when we compared VAS scores of sneezing and discharge at the end of 1st week and 1st month plus the end of 1st week and 3rd month, differences were not significant. Besides, VAS scores of sneezing, itching, and discharge stayed stable after a decrease at the end of 1st week. All descriptive and inferential statistical results are given in Table 1.

Discussion

A solid state laser and Erb-YAG laser, with a wavelength of 2,940 nm, was defined first in 1974 by Zharikov et al. It is often used in the reconstruction, contraction,remodeling, and tightening of the skin as well as the upper respiratory tract and vaginal mucosa.[4]

Since the wavelength of 2.940 nm overlap with the wide absorption band for water, the absorption of the Er: YAG laser in water is the largest amongall lasers emitted in the near and mid-infrared spectral range. Er: YAG laser is well absorbed by all water containing tissues. This laser is indicated for both soft tissues and ablation of hard tissues. Irradiation causes the development of micro bursts by converting the water within the tissue into steam.[8]

All surgical procedures used today are carried out with the risk of bleeding, infection, epiphora, synechia, perforation, pain, osteonecrosis, and crust formation. Surgery is painful and leave unwanted crusts and scar tissue and/or various degree of dysfunctional mucosa.[9]

When all treatment methods,including both medical and surgical alternatives,are taken into consideration, there is a strong need to adopt a treatment method that is cost-effective in terms of hospital stay and, if possible, does not even require local anesthesia and no need to pre-operative preparation and post-operative care. The advantages of laser in this matter are explained. Therefore, it is of high value to find a harmless but effective treatment with long-term effect.[10]

CO2 laser, Nd: YAG laser, argon laser, diode laser, and KTP laser are different types of lasers currently used. Tissue-cutting effects of Erb-laser and CO2 laser are comparable to each other. In addition to this, coagulation effect is similar to argon laser, and ERb-Yag is absorbed more than Nd: YAG laser by water containing tissue. Whereas mechanism of action of Erb-laser totally depends on the water absorption and microexplotions of the effected tissue.[11] Among the other techniques applied for ITH such as submucosal resection, shaving, bipolar and/or monopolar cautery, outfacturing, and radiofrequency, lasers are more advantageous by means of absence of vibration and manual pressure during use; risk of surgical field contamination,damage to the surrounding tissues. Thus, lasers produce rapid wound healing.[12,13]

In addition to aforementioned characteristics, Erb: YAG lasers cause almost no intraoperative and post-operative pain because of the sealing effect on sensory nerve endings.[8]

A randomized and placebo-controlled trial reported high

Table 1. Comparison of pre-operative and post-operative visual analog scale and nasal obsruction scores

Measure	Statistic	Pre	Week 1	Month 1	Month 3	Month 6	Comparison	Pairwise Comparisons
NOSE	Mean±SD	13.7±3.8	10.2±3.55	3.8±2.76	3.7±2.84	3.77±2.75	p<0.0001	Pre versus Week1 (p<0.001) Pre versus Month1 (p<0.001) Pre versus Month3 (p<0.001) Pre versus Month 6 (p<0.001) Week1 versus Month1 (p<0.001) Week1 versusMonth3 (p<0.001) Week1 versus Month6 (p<0.001)
	Median (min, max)	14 (8, 20)	9.5 (5, 17)	3 (0, 13)	3 (0, 14)	3 (1, 14)		
VAS-Congestion	Mean±SD	4.63±2.93	2.9±2.34	1.43±1.38	1.57±1.46	1.77±1.65	p<0.0001	Pre versus Week1 (p<0.001) Pre versus Month1 (p<0.001) Pre versus Month3 (p<0.001) Pre versus Month 6 (p<0.001) Week1 versus Month1 (p<0.001) Week1 versus Month3 (p<0.001) Week1 versus Month6 (p=0.001)
	Median (min, max)	3.5 (0, 10)	2 (0, 9)	1 (0, 6)	1.5 (0, 7)	1.5 (0,7)		
VAS - Sneezing	Mean±SD	2.9±2.78	2.13±2.27	1.07±1.08	1.23±1.1	1.3±1.15	p<0.0001	Pre versus Week1 (p<0.001) Pre versus Month1 (p<0.001) Pre versus Month3 (p<0.001) Pre versus Month 6 (p<0.001) Week1 versus Month1 (p<0.001) Week1 versus Month3 (p=0.002) Week1 versus Month6 (p=0.004)
	Median (min, max)	2 (0, 10)	1 (0, 9)	1 (0, 4)	1 (0, 4)	1 (0, 4)		
VAS - Itching	Mean±SD	2.83±2.83	1.97±2.31	1±1.23	1.2±1.45	1.27±1.41	p<0.0001	Pre versusWeek1 (p<0.001) Pre versus Month1 (p<0.001) Pre versus Month3 (p<0.001) Pre versus Month 6 (p<0.001) Week1 versus Month1 (p=0.001) Week1 versus Month3 (p=0.004)
	Median (min, max)	2 (0, 10)	1 (0, 9)	1 (0, 4)	1 (0, 5)	1 (0, 5)		
VAS - Discharge	Mean±SD	1.97±2.37	1.47±2.19	0.73±1.39	0.87±1.31	0.83±1.49	p<0.0001	Pre versus Week1 (p=0.001) Pre versus Month1 (p<0.001) Pre versus Month3 (p<0.001) Pre versus Month 6 (p<0.001) Week1 versus Month1 (p=0.002) Week1 versus Month6 (p=0.003)
	Median (min, max)	1 (0, 8)	0.5 (0, 8)	0 (0, 6)	0 (0, 5)	0 (0, 6)		

VAS: Visual analogue scale.

improvement in NO and in quality of life both subjectively and objectively after repetitive three sessions of Erbium YAG laser applications in SMOOTH thermal non-ablative mode on 20 patients who haveITH.[4]

Supporting this literature, as a result of our newly proposed Erb-YAG laser protocol, we have observed a considerable decrease in NO and allergic symptoms starting right after the first session. This decrease was progressive till the end of 1st month. Besides, frequency and severity of symptoms were reported more or less the same until 6th month.

Conclusion

Our study showed that Erbium YAG laser could be an effective, rapid, non-invasive, pain free, and safe alternative method for the treatment of NO with ITH.

Poor adherence to treatment protocols especially immunotherapy, contraindications of medical treatment, side effects of drugs, and no desire to take drugs leads to a need of less-invasive most effective surgical intervention like the Erb-YAG laser we propose in this paper.

Limitations

Among the limitations of our study is relatively low number of patients because high cost of this treatment. Need of frequent hospital visits and repetitive applications may impare patients' compliance to this protocol. Sneezing and runny nose seem to be less affected with this laser protocol and we do not know if patients with allergy could benefit from the treatment during season.

Disclosures

Ethics Committee Approval: The approval for this study was obtained from Eastern Mediterranean University Board of Scientific Research and Publication Ethics. Ethics Committee of Clinical Studies (decision number: ETK00-2021-0186).

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Conflict of Interest: None declared.

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