

# The effectiveness of diode laser in reduction of inferior turbinate

Hrvoje Mihalj<sup>1,2</sup>, Andrijana Včeva<sup>1,2</sup>, Željko Zubčić<sup>1,2</sup>, Anamarija Šestak<sup>3</sup>, Vjeran Bogović<sup>2</sup>, Stjepan Grga Milanković<sup>2</sup>, Tin Prpić<sup>2</sup>, Ivan Abičić<sup>2</sup>, Matej Rezo<sup>2</sup>

<sup>1</sup> Department of Otorhinolaryngology and Maxillofacial Surgery, Medical Faculty Osijek, University J.J. Strossmayer Osijek, J. Huttlera 4, 31000 Osijek, Croatia

<sup>2</sup> Department of Otorhinolaryngology and Head and Neck Surgery, Clinical Hospital Centre Osijek, J. Huttlera 4, 31000 Osijek, Croatia

<sup>3</sup> Department of Otorhinolaryngology, General Hospital Vukovar, Županijska ul. 35, 32 000 Vukovar, Croatia

## ABSTRACT:

**Introduction:** Inferior turbinate hypertrophy that is refractory to conservative therapy is one of the most common problems in rhinology. Reduction of the inferior turbinate with a diode laser is a minimally invasive and safe method that can be performed under local anesthesia.

**The aim of this study is to show the efficiency of diode laser in reduction of inferior turbinate based on symptoms of nasal obstruction, nasal secretion, headache, hyposmia, and rhinomanometry findings before and after surgery.**

**Materials and Methods:** A total of 62 patients were included in this study, who underwent diode laser turbinate reduction between November 2017 and December 2019. Patients were followed up after seven days and one month after surgery. Rhinomanometry was performed before and after surgery.

**Results:** Nasal obstruction was present in all patients before surgery, nasal secretion in 50% of patients, headache in 22.5%, and hyposmia in 16.1% of patients before surgery. One month after surgery, 88% of patients no longer complained of nasal obstruction and 83.8% of nasal secretion. In 6.5% of patients the symptom of headache persisted and 4.8% of patients continued to complain of decreased sense of smell. Total nasal resistance was significantly lower after surgery ( $p < 0.001$ ). Synechiae were observed in one patient as a postoperative complication.

**Conclusions:** Reduction of inferior turbinate with diode laser is a safe, effective method with minimal complications and a short patient recovery period, and can be performed under local anesthesia.

**KEYWORDS:** diode laser; inferior nasal turbinate; rhinomanometry

## ABSTRACT:

EFIKASNOST REDUKCIJE DONJIH NOSNIH ŠKOLJKI DIODNIM LASEROM

**Uvod:** Hipertrofija donjih nosnih školjki koja je refraktorna na konzervativnu terapiju je jedan od najčešćih problematika u rinologiji. Redukcija donjih nosnih školjki s diodnim laserom je minimalno invazivna i sigurna metoda koja se može provesti u lokalnoj anesteziji.

**Cilj rada je prikazati efikasnost redukcije donjih nosnih školjki diodnim laserom na temelju subjektivnih simptoma nazalne opstrukcije, nazalne sekrecije, glavobolje i smanjenog osjeta mirisa, te nalaza rinomanometrije.**

**Materijali i metode:** U studiju je uključeno 62 pacijenta kojima je učinjena redukcija donjih nosnih školjki diodnim laserom u razdoblju od studenog 2017. godine do prosinca 2019. godine.

Postoperativno kontrole su provedene sedmi dan i mjesec dana nakon operacije.

Svim pacijentima je učinjena rinomanometrija na kompjuteriziranom rinomanometru prije i nakon operacije.

**Rezultati:** Kod svih pacijenata je bila prisutna nazalna opstrukcija prijeoperativno. Kod 50 % pacijenata je bila prisutna nazalna sekrecija prijeoperativno, kod 22,5 % glavobolja, te u 16,1% slučajeva pacijenti su slabije osjetili mirise. Mjesec dana postoperativno 88% pacijenata se više nije žalio na nazalnu opstrukciju, a 83,8% na nazalnu sekreciju. Kod 6,5% pacijenata je i dalje perzistirao simptom glavobolje, te 4,8% pacijenata se i dalje žalio na smanjen osjet mirisa.

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### Correspondence:

Hrvoje Mihalj, M.D., Ph.D.,  
hrvoje.mihalj@gmail.com  
orcid.org/0000-0002-8642-073X

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Značajno su manje vrijednosti ukupnog otpora zraka na rinomanometrijskom nalazu postoperativno ( $p < 0,001$ ).

Kod jednog pacijenta su uočene sinehije kao postoperativna komplikacija.

Zaključak: Upotreba diodnog lasera u redukciji donjih nosnih školjki je sigurna, efektivna metoda s minimalno komplikacija i kratkim periodom oporavka pacijenata, te se može provesti u lokalnoj anesteziji.

**KLJUČNE RIJEČI:** diodni laser; donje nosne školjke; rinomanometrija

Hypertrophy of the inferior turbinate is a common occurrence in patients with allergic rhinitis, vasomotor rhinitis, chronic rhinosinusitis, deviated nasal septum, and rhinitis medicamentosa. Inferior turbinate hypertrophy (ITH) is the second most common cause of nasal obstruction, after septal deviation<sup>1</sup>.

The inferior turbinate is composed of the bony turbinate, the submucosal tissue and the overlying nasal mucosa<sup>2</sup>. The most important functions of inferior turbinates are warming and humidification of inhaled air. Many factors can cause pathologic enlargement of inferior turbinate<sup>3</sup>.

Inferior turbinate hypertrophy is caused by the deposition of collagen in submucosal tissue, which remodels the turbinate bone. This pathophysiological mechanism occurs in chronic inflammation of the nasal mucosa, which is present in allergic and vasomotor rhinitis. The primary conservative therapy for ITH includes topical decongestants, antihistamines and corticosteroids. The most common symptoms in patients with inferior turbinate hypertrophy are nasal obstruction, sneezing, rhinorrhea and headache<sup>4</sup>.

Surgical treatment includes resection, ablation or crushing part, or all of the turbinate to increase the size of the nasal airway. The best choice of procedure may depend on a patient's anatomy and other concurrent procedures performed (such as septoplasty) as well as the presence or absence of other comorbidities such as allergic rhinitis<sup>2</sup>.

If conservative medical treatment does not produce results, then surgical reduction of the inferior turbinate is usually performed. The optimal surgical technique should be a compromise between effective turbinate volume reduction, but also preserving the nasal function, and avoiding complications. The diode laser coagulation effect is comparable to that of the argon laser. Its tissue-cutting effect is comparable to that of the CO<sub>2</sub> laser. Laser turbinate reduction can be performed under local or general anesthesia. Surgery often takes a short time. It has minimal intraoperative and postoperative complications and is usually well tolerated by the patients<sup>4</sup>.

The objective of this prospective study was to show the efficiency of diode laser in the treatment of ITH, based on symptoms of nasal obstruction, nasal secretion, headache, hyposmia, and rhinomanometry findings before and after surgery.

#### MATERIALS AND METHODS:

This prospective clinical study included 62 patients who underwent inferior turbinate reduction with a diode laser (LEON-

ARDO® DUAL by biolitec®, Germany), between November 2017 and December 2019. The inclusion criteria were: inferior turbinate hypertrophy, which is refractory to conservative therapy with corticosteroids. The exclusion criteria were: presence of acute infectious diseases, nasal septum deviation, nasal polypsis, age less than 18 years, patients who did not want to sign an informed consent, and who did not attend to postoperative follow-up visits.

At the first visit, all patients underwent complete ENT examination, including nasal endoscopy and anterior rhinomanometry. Nasal endoscopy was performed to evaluate nasal septum, meatuses, turbinates, and nasal valve. History of nasal obstruction, nasal secretion, headache and hyposmia were noted. Patients were followed up after seven days and one month after surgery. One month after surgery, anterior rhinomanometry was repeated and patients symptoms were noted.

The measurements were done by using anterior rhinomanometry (Rhino 31 computer rhinomanometer, Atmos, Germany) in accordance with the guidelines<sup>5</sup>. The rhinomanometry was carried out in the sitting position, with one nostril of the patient being completely blocked with a nose olive filled with sponge, and the patient was asked to breathe through an unblocked nose olive with the mouth closed. The measurement data were displayed in real time as a rhinogram. The parameter that was recorded and statistically processed was total nose resistance. Although, the nose resistance was calculated at a pressure of 75, 150, and 300 Pa/cm<sup>3</sup>/s, only the data for the pressure of 150 Pa/cm<sup>3</sup>/s will be discussed.

This study was approved by the Ethical committee of our institution. All the patients involved were adequately informed about the methods and objectives of this study. They have voluntarily accepted to participate in the survey, and informed consent was obtained from all participants involved in the study.

#### STATISTICAL ANALYSIS:

All the data were analysed using SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). The normality of the distribution of numerical variables was tested by the Kolmogorov-Smirnov test. Differences between the two independent groups were tested with the Mann-Whitney U test. Differences between the two dependent groups were tested with the Wilcoxon test. The McNemar test was used to analyze the presence of nasal obstruction, nasal secretion, headache and hyposmia before and after laser turbinate

Table 1. Number of patients with respect to presence of symptoms before and one month after laser turbinate reduction

	Symptoms after surgery			P*
	YES	NO	Total	
Nasal obstruction before surgery				
YES	14	48	62	<0.001
NO	0	0	0	
Total	14	48	62	
Nasal secretion before surgery				
YES	10	21	31	<0.001
NO	0	31	31	
Total	10	52	62	
Headache before surgery				
YES	4	10	14	0.002
NO	0	48	48	
Total	4	58	62	
Hyposmia before surgery				
YES	4	6	10	0.03
NO	0	52	52	
Total	4	58	62	

reduction. All P values are two sided. The significance level was set at  $\alpha = 0.05$ .

## RESULTS

Out of 62 patients (median age 32.5 years, interquartile range 23.8-42 years), 34 were males with a median age of 30 years (interquartile range 22.8-35.5 years) and 28 were women with median age of 36.5 years (interquartile range 27- 44.5 years). There was no significant difference in age with respect to gender ( $p = 0.11$ , Mann-Whitney U test).

Significantly fewer patients had symptoms of nasal obstruction, nasal secretions, headaches, and hyposmia after laser turbinate reduction compared with before surgery (Table 1).

There was significantly lower value of total nasal resistance after laser turbinate reduction (Table 2).

Synechiae were observed in only one patient after surgery. At first follow-up visit, seven days after surgery, all patients had nasal crusting.

## DISCUSSION

Nasal obstruction caused by inferior turbinate hypertrophy is a comorbidity that affects the quality of patients' life<sup>6</sup>. The primary treatment of nasal obstruction caused by inferior turbinate hypertrophy is conservative. Inferior turbinate hypertrophy that is refractory to conservative therapy is one of the most common problems in rhinology. The surgical approach is considered if conservative therapy is not satisfying enough. There are many surgical techniques of inferior turbinate reduction, which confirms the lack of good outcome so far<sup>7</sup>. The diode laser inferior turbinate reduction technique is a method that is minimally invasive and safe, and which was confirmed by several other studies<sup>8-11</sup>. The most frequent symptoms affecting the quality

of life in patients with inferior turbinate hypertrophy are nasal obstruction, nasal secretion, sneezing, headache, hyposmia and snoring.

In this study, we have focused on four symptoms: nasal obstruction, nasal secretion, headache and hyposmia.

The results show that there were more males than females with inferior turbinate hypertrophy, which is in line with findings of previous studies<sup>12</sup>.

Before surgery, nasal obstruction was present in all of the patients in this study. In the preoperative period, nasal secretion was present in 31/62 (50%), headache was present in 14/62 (22.5%) and hyposmia in 10/62 (16.1%) of the patients. All patients felt subjective improvement postoperatively, and there were a significantly smaller number of patients complaining of nasal obstruction, nasal secretions, headaches, and hyposmia after laser turbinate reduction. This result is consistent with previous research<sup>13</sup>. In the most of the patients there was a significant improvement regarding nasal obstruction and only 14/62 (22.5%) patients complained of nasal obstruction after surgery. The remaining symptoms of nasal obstruction that were present in 14 patients after surgery can be explained with postoperative oedema and crusts. When comparing our results to those of older studies<sup>4,12,13</sup> it must be pointed out that we used anterior rhinomanometry as an objective evaluation method for nasal obstruction, and that there was significantly lower value of total nasal resistance after diode laser inferior turbinate reduction. However, similar to our findings, Min et al. reported that patients in diode laser turbinate reduction group had significant improvement in nasal obstruction and significant decrease in nasal airway resistance 6 months following the surgery<sup>14</sup>. Janda et al.<sup>15</sup>, showed that patients in diode laser turbinate reduction group did not have much improvement in the symptom of nasal obstruction during the first

Table 2. Total nasal resistance before and one month after laser turbinate reduction

	Median (interquartile range)		P*
	Before surgery	After surgery	
Total nasal resistance (all patients)	0.83 (0.77-0.93)	0.59 (0.57-0.60)	<0.001

2–4 weeks owing to the postoperative edema and crusting, but they had statistically significant improvement of the nasal airflow and nasal cavity volume 6 months and 1 year after laser surgery respectively. A subjective improvement of nasal airflow was described in 76% of patients after 6 months and 1 year of laser treatment respectively in their study 15. Volk et al. 16, reported that diode laser turbinoplasty led to improvement of nasal airflow of 37.1%, eight weeks after the surgery, and total of 73.2% of patients reported improvement of nasal obstruction and only 12.2% experienced deterioration. Rhee et al. 17 compared radiofrequency volumetric tissue reduction and diode laser turbinate reduction, demonstrating improvement of 87.5% patients in laser turbinate reduction group. In both groups the severity and frequency of nasal obstruction and statistically significant improvement was observed at 4 weeks after treatment<sup>17</sup>. In our study majority of patients had significant improvement in nasal obstruction 1 week after surgery and relief of nasal obstruction persisted in 88% of patients one month postoperatively. One month after the surgery, 52/62 (83.8%) did not complain about nasal secretion. This result is in line with research by Supiyaphun et al. 18, who showed that KTP laser turbinate reduction produces significant reduction in rhinorrhea post operatively. The relief in rhinorrhea can be explained with the destruction of vascular submucosa, seromucinous glands and branches of poste-

rior nasal nerve, which plays an important role in hypersecretion. Out of 14 patients who complained of headache before surgery, at the end of the one month follow up period, 10 (71.4%) patients showed an improvement in regards to headache. This may be because of improved nasal patency. Hyposmia was present in 10 (16.1%) patients in our study, before surgery. Out of 10 patients with hyposmia, 7 (70%) of them were not complaining about the symptom one month postoperatively. The improvement may be attributed to the improvement in nasal patency following surgery.

Crusting was the main complaint in the immediate postoperative period, and synechia were observed only in one patient. In a study by Papon et al.<sup>19</sup>, crusting occurred in 41.6% of the patients who underwent Nd: YAG laser turbinate reduction. There was no incidence of septal perforation, epiphora or osteonecrosis of the turbinate bone in our study.

In conclusion, this prospective clinical study dealt with one of the commonest conditions in rhinology; that of inferior turbinate hypertrophy unresponsive to conservative therapy. The diode laser turbinate reduction is minimally invasive, safe, effective in improving the symptoms associated with ITH, and can be performed under local anesthesia. There are no serious intraoperative and postoperative complications.

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