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Original Article

Turbinoplasty of hypertrophied inferior turbinate by diode laser

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Abstract:

Background: *Different laser types have been used for the treatment of hypertrophied inferior nasal turbinates. The clinical experiences of its treatment by means of a diode laser are presented.*

Methods*: A total of 45 patients suffering from nasal obstruction due to hypertrophied inferior turbinates (HIT) were treated with a continuous diode laser (14 W- 940 nm) in "contact" mode and under local anesthesia. Thirty patients (16 with allergic rhinitis and 14 with vasomotor rhinitis) were included into this clinical trial with a follow-up of 6 months. The study was conducted by a questionnaire, photo documentation, conventional radiology of the paranasal sinuses, and histology.*

Results*: The mean operation time took 8 min/turbinate, no nasal packing was necessary and no immediate complications (e.g., bleeding) were observed. Statistical analysis revealed significant subjective improvement (86%) of the nasal airflow and nasal cavity volume (photo documentation) 6 months after laser surgery. In addition, complete relief of headache was achieved in 32%. The remission rates of persistent rhinorrhoea and post-nasal dripping were, at about 88% and 64%, respectively. Atrophic change and synechiae had not been observed.*

Conclusions*: Diode laser treatment of HIT is a useful procedure, which can be performed as an outpatient surgery under local anesthesia, resulting in a controlled coagulation and ablation of the soft tissue. The short operation time and the good results provide an excellent patient acceptance.*

Key words*: Diode Laser, Hypertrophied Inferior Turbinate, Turbinoplasty.*

Introduction:

Nasal obstruction caused by, hypertrophied inferior nasal turbinate (HIT) is one of the most common symptoms in otolaryngology. Medical treatment, including nose drops, antihistamines, topical and systemic steroids, and allergen avoidance, is usually sufficient only for a short period of time. Therefore, surgery is necessary in many cases. A variety of surgical procedures have been described for the reduction of hypertrophied inferior nasal turbinates [1–10]. Because most of these techniques are associated with a distinct risk of bleeding, pain, uncontrolled damage of the mucosa, and atrophic rhinitis, there is a need for less traumatic treatment. This can be accomplished by laser surgery, which offers the advantage of limited tissue trauma, less bleeding, and a high patient acceptance under

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outpatient conditions. Since the early 1980s, different laser types have been used for the reduction of hypertrophied inferior nasal turbinates[11–19]. The fundamental difference between these laser systems is the wavelength of the emitted light. The diode laser (940 nm) light is absorbed by water and blood and, therefore, provides excellent coagulation capabilities.This results into a decrease of nasal mucosa and an improvement of nasal breathing. Moreover, the diode laser can be used in "contact" application, offering vaporization effects with precise tissue cutting if necessary. The aim of this study was to evaluate the value of the diode laser treatment of hypertrophied inferior nasal turbinates.

Materials and Methods:

From January 2008 to July 2009, 45 patients with nasal obstruction caused by hypertrophied inferior nasal turbinates were treated with a continuous-wave diode laser emitting light at a wavelength 940 nm in Dhaka Medical College Hospital and private settings at Dhaka. Thirty patients (19 females, 11 males; mean age, 29 years; range, 18–48 years, 53.33% suffering from allergic and 46.67% from vasomotor rhinitis) were followed-up for 6 months in a prospective nonrandomized trial. All patients were refractory to preoperative medical treatment. Criteria for inclusion into the trial were nasal obstruction caused by hypertrophied inferior nasal turbinates and no further intervention during 6 months follow-up, whereas patients with evidence of a deviated nasal septum, acute rhinitis, chronic sinusitis, and polyps were excluded.

Before laser treatment topical anaesthesia was applied for approximately 10 minutes, by using cotton pads imbibed with a 10% cocaine solution. For documentation a rigid rhinoscope (0°-optic, OD 4 mm) was coupled with photo- and video-documentation devices. The laser light application was performed in "contact" mode by using a soft-bending, plastic-clad, silica fiber (400-mm core diameter) placed into a special designed laser fiber guidance system [20] (Karl Storz GmbH, Tuttlingen, FRG). The laser output power was set to 10–14 W in the continuous-wave code. Three to four laser light applications were performed by drawing the fiber from the posterior to the anterior part of the inferior turbinates, and, when necessary, some additional laser spots onto the head of the turbinates to vaporized the turbinate. After laser treatment, the operation time, laser power settings, and total energy applied were recorded. Postoperatively, the nasal cavity was filled with antibiotic ointment and the patients were put on nasal irrigation with saline, nasal ointments, and, if required, nose drops for decongestion for 4 weeks. Clinical examination and photo- and video-documentation were performed before, as well as 1 week, 4 weeks, and 6 months after laser treatment. Conventional radiologic examination of the paranasal sinuses was performed to exclude chronic sinusitis. Before and 6 months after laser treatment, the patients symptoms were documented on a home made standardized questionnaire. The questionnaire contained questions about changes in nasal obstruction, anterior and posterior rhinorrhoea, sneezing, itching of nose and eyes, olfactory disorders, headaches, and overall quality of life.

Results:

The mean operation time for diode laser treatment was 8 minutes (range, 6–12 minutes), whereas the total energy applied for each nasal turbinate ranged from 669 to 2,500 J. No acute complications such as major bleeding related to the treatment occurred. Minor bleeding was observed in 2 of 30 (6.67%) of the patients but did not require nasal packing. 3 (10%) patients reported about nasal dryness and 4 (13.33%) about pain after the operation.

Changes in functional symptoms are listed in Table-I. It shows that rhinologic symptoms, such as nasal secretion, disappeared in 4 of 22 cases (18.18%), improved in 9 of 22 cases (40.91%), remained unchanged in 6 of 22 patients (27.27%), worsened in 2 of 22 cases (9.1%), and appeared in 1 of all 30 patients (3.33%) as a new symptom after the laser treatment. Sneeze irritation disappeared in 2 of 19 patients (10.53%), improved in 9 of 19 patients (47.37%), was stable in 5 of 19 cases (26.32%), worsened in 2 of 19 cases (10.53%), and appeared in 1 of 30 patients (3.33%). Although itchiness of the nose also appeared in 1 of 30 patients (3.33%), this symptom postoperatively disappeared in 3 of 14 cases (21.43%), improved in 3 of 14 cases (21.43%), remained unchanged in 7 of 14 cases (50%), and worsened in 1 of 14 of the patients (8%). No case of postoperative worsening of paranasal sinus complaints was noted, whereas this symptom showed improvement in 2 of 4 cases (50%) and disappearance in 2 of 4 cases (50%). Headache was improved in 11 of 21 cases (52.38%). Other symptoms such as ear complaints, posterior rhinorrhoea, and nasal bleeding did not seem to be influenced significantly by the laser treatment.

Six months after laser treatment, 4 of 30 of the patients (13.33%) described no subjective improvement of nasal airflow, while rest of the patients (86.67%) described subjective improvement of nasal airflow. (Table-II). Among them 5 (16.67%) slight improvement, 14 (46.67%) described moderate improvement and 7 (23.33%) described strong improvement. Atrophic change and synechiae had not been observed in any patient within the follow-up period.

Table-I

Changes of Functional Symptoms

Subjective statement symptoms	Before laser treatment (n=**30**)	After laser treatment: Disappearance	Improvement	No change	Worsening	New appearance
Secretion	22	4/22	9/22	6/22	‘2/22	1
Sneezing	19	2/19	9/19	5/19	2/19	1
Itching Nose	14	3/14	3/14	7/14	1/14	1
Sinus Compaint	4	2/4	2/4	0/4	0/4	0
Ear Complaint	4	0/4	1/4	3/4	0/4	0
Headache	21	4/21	11/21	3/21	3/21	0
Posterior rhinorrhoea	23	3/23	5/23	14/23	1/23	1
Nasal bleeding	6	1/6	3/6	1/6	0/6	1

Table-II

Subjective Improvement

Subjective improvement	6 months after laser treatment (%)	
	No. of pt	%
No	4/30	13.33
Slight	5/30	16.67
Moderate	14/30	46.67
Strong	7/30	23.33

Discussion:

Several surgical procedures including conchotomy, inferior turbinoplasty, partial and total turbinectomy, lateral outfracture, electrocautery, cryotherapy, chemical cauterization, vidian neurectomy, and laser therapy were in use for the reduction of hypertrophied inferior nasal turbinates [1–19]. The application of a series of different laser systems such as CO_2 [11–13], Nd:YAG [14,15], KTP [16], Argon-ion [17], and Ho:YAG laser[18,19] have been discussed successfully in clinical trials. Lippert and Werner [11] used the CO_2 laser to apply single laser spots (1–4 W, laser power density 2,038 W/cm2) to the turbinates. As a result, 82.1% of the patients had an improvement 1 year and 80.4% of the patients 2 years after the laser treatment. Moreover, Kawamura et al.[12] and Fukutake et al.[13] described the subjective results of CO_2 laser surgery for allergic rhinitis. Both used a defocused laser beam at 20 W. Kawamura et al. found a success rate of 85% 2 years after laser treatment, whereas Fukutake et al. had a subjective improvement in 77% of their patients after 1 year. Olthoff et al. [15] reported a prospective study on 117 patients on whom the Nd:YAG laser in contact mode was used (8 W, 350–400 J per turbinate) for the treatment of allergic and vasomotor rhinitis with an improvement of nasal breathing in 80% of the cases 1 year. In contrast to Olthoff et al., Lippert and Werner applied the Nd:YAG laser (5–10 W, laser power density: 1,770–3,540 W/cm2) in noncontact mode, which resulted in a 72.5% success rate 1 year after laser surgery. Levine [16] treated 63 patients by using the KTP laser (5–8 W), of whom 12 patients were followed-up for 1 year. As a result, 80% of the patients had an improvement of the nasal airway passage, less nasal congestion, and less drainage. Similar results have been observed by Lenz [17] in a study using the argon-ion laser (8 W) with 411 patients suffering from vasomotor rhinitis. One to 5 years after laser therapy, 80% of the patients described a subjective improvement of nasal airflow. Finally, two studies [18,19] have been performed concerning the effects of the Ho:YAG laser on the reduction of hypertrophied inferior turbinates in vasomotor and allergic rhinitis. Although Leunig et al.[19] (repetition rate, 4–8 Hz; 0.8–1.2 J/pulse) observed a subjective improvement of nasal breathing in 77% of the patients 1 year after laser treatment, Serrano et al. [18] (repetition rate: 5 Hz; 0.8 J/pulse) noted an improvement in only 52.2% of their patients 16 months after laser therapy.

In the present study, the subjective improvement was 86.67% which agreed with the previous findings. we used the diode laser because of its deep coagulation properties inducing a large necrosis of the venous plexus of the nasal turbinates. Similar effects were described when the Nd:YAG laser was used[14,15]. The CO_2 laser light shows a precise superficial tissue ablation with nearly no hemostatic qualities, whereas the Ho:YAG laser represents a good compromise of ablation and coagulation depending on the parameters used [21,22]. Argon-ion and KTP laser emit light suitable to induce hemostasis (e.g., Osler-Weber-Rendu Disease) and to treat strong vascular structures (e.g., hemangiomas, naevi flammei) because of the absorption characteristic of hemoglobin[16,17].

In the present clinical investigation, all patients showed a moderate to severe nasal obstruction, crusting, and nasal secretion within the first 1 week after laser treatment. Afterward, nasal crusting subsided, the turbinate was re-epitheliazed, and a relief of the nasal obstruction appeared.

The present investigation indicates the usefulness of the diode laser for intranasal surgery. In contact mode, it provides an excellent coagulation of soft tissue, a controllable performance, and a good hemostasis in a mean operation time of 8 minutes. Surgical procedures should be pursued once the cause of turbinate hyperplasia has been determined and useful nonsurgical management (i.e., decongestants, antihistamines, intranasal corticosteroids, allergen avoidance) of turbinate dysfunction has failed.

Diode laser treatment of nasal obstruction due to hypertrophied inferior nasal turbinates can be performed as a minimally invasive procedure with satisfactory results. With respect to CO_2, Nd:YAG, KTP, Argon-ion, and Ho:YAG lasers the advantages of the diode laser in endonasal surgery are good coagulation properties, low costs, and the small size of the device, easily fitting into any operating theater. The advantage of a bloodless therapy in an outpatient treatment with high patient acceptance and satisfactory results compared with several surgical techniques that cause bleeding, nasal packing, and hospitalization favors, this therapeutic modality also with regard to socioeconomic aspects.

The drawbacks of our study were, we followed up only for 6 month because patient complience for follow up in our country is poor. We could not study the objective parameters like acoustic rhinometry, the mucociliary clearance test, biopsies of nasal turbinates to see the morphology due to lack of resources. There is also scope of doing comparison between different modes of treatment of HIT.

Conclusion:

The treatment of chronic allergic and vasomotor rhinitis with hypertrophied inferior nasal turbinates by means of the diode laser emitting light at a wavelength of 940 nm is a successful alternative to conventional therapeutic procedures. The application can be performed as an outpatient procedure under local anesthesia in a short operation time with high patient acceptance. It was demonstrated that at a 6-month follow-up, diode laser treatment induced significant improvement of the nasal airflow.

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