

## The Role of Diode Laser (810 nm) For Turbinate Hypertrophy Treatment in Allergic Rhinitis

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**Abstract:** Background: Allergic rhinitis involves primarily a Gell and Coombs type I immediate hypersensitivity reaction. "Allergy" requires repeated exposures to an antigen for the formation of antibodies. The allergens that generally produce allergic rhinitis have traditionally been classed as "seasonal" or "perennial" offenders. The former group consists primarily of pollens (grasses, weeds, trees), whereas the latter includes dust mites, molds, animal danders, and cockroaches. The characteristic symptoms and signs of allergic rhinitis include glandular stimulation, vasodilatation, increased vascular permeability, and irritation, changes that are responsible for the typical symptoms of itching, sneezing, rhinorrhea, and nasal congestion. There are medical and surgical treatment for allergic rhinitis and the Diode Laser is one of modalities in surgical treatment. Aim of the study: To evaluate the outcome of the use of diode laser in the reduction of hypertrophied inferior turbinate in patients with allergic rhinitis refractory to medical treatment. Patients and method: The current study was performed from June 2012 to November 2013 at Al-Yarmouk teaching hospital at department of Otorhinolaryngology. The study included forty-five patients complaining from chronic nasal obstruction due to perennial allergic rhinitis, their age was between 18-45years. The surgical technique (Diode Laser 810 nm for reduction of inferior turbinate) was explained to them. The patients consent were taken for this surgical procedure. Some patients done under local anesthesia and others under general anesthesia. Using a contact technique, and continuous mode, three lines (linear wounding) were done along the medial surface of the inferior turbinate (bilaterally). The probe was withdrawn over a period of 6 seconds for each line. The follow up of the patients up to 6 months as follow: 3rd day, 1 week, 2 weeks, 1 month, 3 months and 6 months. Results: The most common age group affected by allergic rhinitis was between 21-30 years of age (49%). The predominant chief complaint of patients was rhinorrhea (71%) while the least chief complaint was headache (15%). High titer of IgE antibody was found in 91% of patients. After three months from surgical procedure the follow-up reveals, (91%) of patients have good airway patency, (22%) have rhinorrhea, (13%) have snoring, (15%) have smell changes while mucosal edema and Crustation disappears. Conclusion: Short term results in reduction the size of inferior turbinate in patients with allergic rhinitis by Diode Laser is a useful procedure that can be performed as an outpatient surgery under local anesthesia. The short operation time and less discomfort provide other reasons for choosing this treatment for allergic rhinitis that is refractive to conservative management.

**Keywords:** Allergic rhinitis, Diode laser, Inferior turbinate hypertrophy.

### INTRODUCTION

Although not as glamorous as its surgical counterparts, the management of allergic rhinitis constitutes a large proportion of the day-to-day practice of the general otolaryngologist. In addition to its primary effect, inhalant allergy of the upper respiratory tract might affect the development and clinical course of other disease states such as sinusitis, otitis media, and asthma. Indeed, it has been said that (excluding trauma and malignancies) allergy might represent a primary or secondary factor in up to half the patients encountered in an otolaryngology practice in United States (Nathan, R. A. *et al.*, 1997).

Proper diagnosis and treatment of allergic rhinitis involves an understanding of the basic mechanisms of the disease process. More detailed information on the immunology of allergy is available in textbooks devoted entirely to the subject; what is presented here is a simplified summation of this complex subject.

The primary characteristic of the immune system is the recognition of "non-self," coupled with a "memory." The function of the immune system

involves T and B lymphocytes and soluble substances called cytokines that act inside and outside the immune system to affect it and a multiplicity of mediators. Gell, Coombs, and Lachman described four types of hypersensitivity reactions: immediate (or anaphylactic), cytotoxic, immune complex, and delayed. Others have suggested the addition of two more types (stimulating antibody and antibody-dependent, cell-mediated cytotoxicity). Allergic rhinitis involves primarily a Gell and Coombs type I immediate hypersensitivity reaction. Because various therapeutic modalities work at different points within this reaction, it is important for the clinician to have a general understanding of it. In addition, this type of reaction (anaphylactic) might be encountered in hypersensitivity reactions to drugs, contrast dyes, and insect stings, and all practitioners should be familiar with its characteristics to recognize and treat it appropriately. (Gell, P. G. H. *et al.*, 1975)

"Allergy" requires repeated exposures to an antigen for the formation of antibodies. In the case of respiratory allergy, this involves presentation of

the relevant antigenic material from an allergen by an antigen-presenting cell (macrophage) to B lymphocytes. Each person's B cells are capable of displaying millions of uniquely configured antibody sites. These cells, under the influence of various cytokines (generated in part by T lymphocytes), produce allergen-specific immunoglobulin E (IgE). It has been estimated that a minimum of five such antigen exposures are required to produce sensitization. ( King, H. C, 1990)

In type I hypersensitivity, an antigen bridges two adjacent allergen-specific IgE molecules attached to a mast cell or basophile, resulting in a dissolution of the cell and liberation of both preformed (e.g., histamine) and newly formed (e.g., prostaglandins, leukotrienes) mediators of inflammation. These produce glandular stimulation, vasodilatation, increased vascular permeability, and irritation, which are responsible for the typical symptoms of itching, sneezing, rhinorrhea, and congestion. The acute reaction takes place within a few minutes of the antigen-antibody reaction. Approximately 4 to 6 hours later, under the influence of various cells and cytokines, a late-phase reaction occurs that results in a recrudescence of symptoms. ( King, H. C, 1990)

The best and most desirable management of allergy is avoidance when possible. Although this must often be supplemented by pharmacotherapy, and sometimes with immunotherapy, environmental control remains the most important component of this therapeutic triad.

Printed material about specific control measures aimed at various antigens is readily available from numerous commercial sources but must be supplemented by advice from the physician. The most "avoidable" antigens are the perennial offenders: dust mites, molds, and animals.

House dust mites thrive in warm, moist conditions and feed on human skin scales (such as those found in bedclothes). The antigen is found in the mite feces. Control measures include elimination of reservoirs (upholstered furniture, carpeting, stuffed animals), covering of mattresses and pillows with barrier material, control of relative humidity (<50%), and the use of acaricides (benzyl benzoate) or preparations that denature the dust mite antigen (tannic acid). Unfortunately, no compound yet exists that both kills dust mites and renders their antigen harmless.

The major animal antigen that causes allergic problems is cat allergen, which is secreted by sebaceous glands and borne on light skin scales. Removing the cat is often a suggestion met with resistance (if not active rebellion), and other measures are often necessary. Mold is found in many areas of the home. It requires circumstances for growth similar to the dust mite (i.e., warmth and humidity), and control of these factors also will help control indoor mold growth. In addition, such sources of indoor mold as refrigerator drip pans, stored material in basements and attics, and the soil around indoor plants should be considered in attempting to remove mold from the patient's environment. ( Squillace, S. P, 1992)

Antigens are not always avoidable, and immunotherapy modifies the allergic response but does not always afford protection from an overwhelming antigen exposure. Therefore, symptomatic management by means of pharmacotherapy is required to some degree for every patient with allergic rhinitis. Numerous types of drugs are available for this purpose, and each has unique characteristics. The physician must tailor the regimen according to the patient's symptoms and circumstances. ( Simons, F. E. R. et al., 1994)

New therapies continue to be under development, and only time will tell how practical or important they will prove. These include tryptase inhibitors, cytokine modulators, chemokine inhibitors, cell-adhesion blockers, and costimulation inhibitors. ( Barnes, P. J, 2000)

## PATIENTS AND METHOD

The study was performed from June 2012 to November 2013 in Al-Yarmouk teaching hospital at department of otorhinolaryngology.

The study included forty five patients attending the outpatient clinic of Al- Yarmouk Teaching Hospital complaining from chronic nasal obstruction due to perennial allergic rhinitis. The surgical technique (Diode Laser 810 nm for reduction of inferior turbinate) was explained to them.

The follow up of the patients up to 6 months as follow: 3rd day, 1 week, 2 weeks, 1 month, 3 months and 6 months.

Inclusion criteria :

Clinically and positive laboratory results suggest allergic rhinitis with bilateral inferior turbinate hypertrophy with no response to proper

conventional medical management (steroid nasal spray and antihistamine for 12 weeks at least).

Exclusion criteria :

- Patients with nasal pathology other than allergic rhinitis.
- Patient previously subjected to nasal surgery.
- Age less than 18 years.

Clinical assessment by:

- History through the Questionnaire paper.
- Full E.N.T. examination with particular attention to the nose by anterior and posterior rhinoscopy and fiberoptic examination after application of local vasoconstrictor drops (xylometazoline) & local anesthesia to both nostrils to exclude bony hypertrophy of inferior turbinate.
- Patients were also sent for X-ray of the paranasal sinuses.

Laboratory evaluation by means of total serum IgE level estimation to confirm diagnosis.

Diagnostic endoscopy:

- Anesthesia: topical anesthesia was used in the diagnostic endoscopy. Cotton wicks soaked in a mixture of 2% lignocaine solution and adrenaline 1: 1000 were used for each side of the nose, two wicks were inserted, one in the middle meatus and the other in the inferior meatus and left in place for 10 minutes.
- Position: In the out-patient clinic and in a setting position all patients were examined by flexible nasopharyngoscope.

The laser that used for current study was diode laser (commercial trade market Diomed 15), which is Gallium, aluminum, arsenide [GaAlAs] emits a wavelength of 810nm  $\pm$  20nm, and a power output: 0.5-15 W in a continuous, pulsed or repeated pulses. The pulse duration is 0.1-9.9seconds in a repeated mode of 0.1- 1second pulse duration.

The patients consent was taken for this surgical procedure. The applicator used is a piston like, stainless steel, through which threaded an optical fiber with outer core diameter of 600micron, and inner core diameter is 300 micron.

The power used is between 9- 11W, depending on bulkiness of the inferior turbinate. Some patients prepared for local anesthesia and others done under general anesthesia .Using a contact technique, and continuous mode, three lines (linear wounding) were done along the medial surface of the inferior turbinate (bilaterally). The probe was withdrawn over a period of 6 seconds for each line.

Post operatively patients were given systemic antibiotics and analgesics and instructed not to use decongestant or steroid. Examination of the patient at 3<sup>rd</sup> day, 1 week, 2 weeks, one month, three months and six months regarding the following parameter:

- Pain
- Bleeding.
- Edema.
- Crustation
- Feeling of patency.

Thirty eight patients under local anesthesia & seven patients under general anesthesia,

Note: The length of inferior turbinate is about 6.2cm (average).

The time taken to pass the probe along the turbinate is 6 sec [average].

The speed of using the laser fiber is 6.2/6 which is equal to 1.03cm/sec.

Evaluation criteria:

The evaluation criteria used in current study include subjective and objective [what is found during clinical examination, cotton test, spatula test and Cottle test]. The follow up of patients for a period of 6 months.

Safety measures:

- The theater is set aside from other rooms, with one inlet to it. The walls are none reflected.
- A goggles of optical density > 5 are available.
- A notification at the door indicates that there is laser system inside.

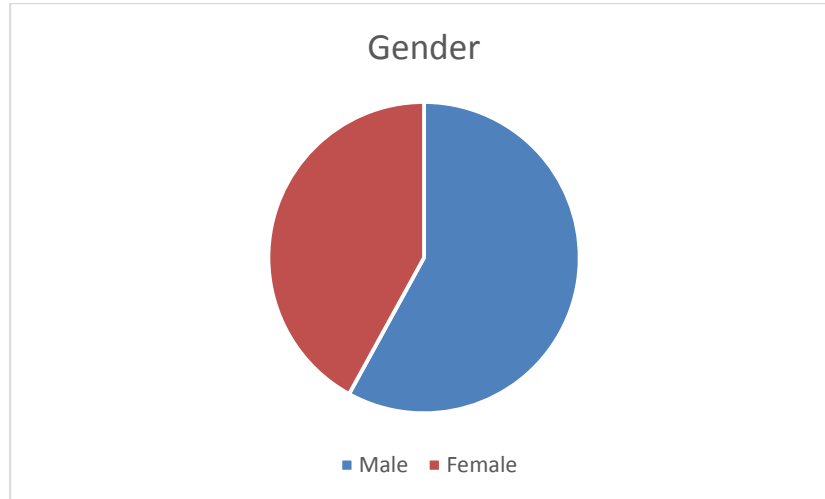
## RESULTS

The most common age group affected by allergic rhinitis was between 21-30 years of age (49%).

**Table 1:** Age distribution of Patients

Age in years	No. of Patients	%
18-20	10	22%
21-30	22	49%
31-40	8	18%
41-45	5	11%
Total	45	100%

Fifty eight percent of patients were males (26 patients) and 42% were females (19 patients).

**Figure 1:** Gender distribution.

The predominant chief complaint of patients other than nasal obstruction was rhinorrhea (71%) while the least chief complaint was headache (15%).

**Table 2:** other compliant of the patients

Complaint	No. of Patients	%
Rhinorrhea	32	71
Sneezing	31	69
Itching(ENT)	15	33
Smelling Changes	17	38
Snoring	13	29
Headache	7	15

For the duration of the chief complaint; thirty one percent of patients had duration of complaint of 3-4 years and only 5% had duration of less than 1 year.

**Table 3:** The duration of chief complaint in patients .

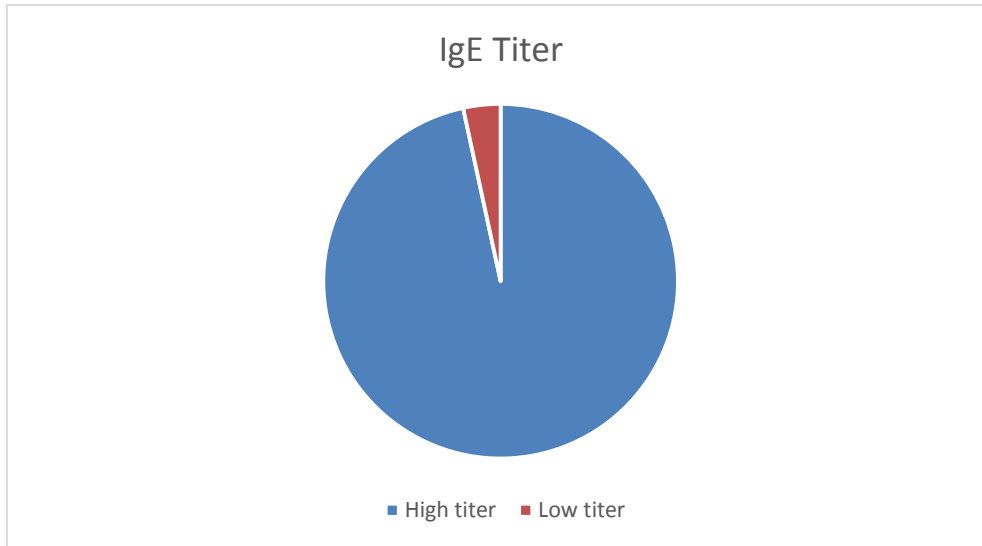
Duration	No. of Patients	%
< 1 year	2	5
1-2 years	7	15
3-4 years	14	31
5-6 years	8	18
7-8 years	8	18
> 8 years	6	13
Total	45	100

Other clinical features in patients were 71% of patients had nasal discharge while the least finding was mucosal edema (31%).

**Table 4:** other clinical features

Findings	No. of patients	%
Post nasal discharge	32	71
Pale mucosa	22	49
Mucosal edema	14	31

In the laboratory results, we found that higher titer of IgE antibodies was found in 91% of patients.



**Figure 2:** IgE antibody titer in patients

After managing patients we noticed the following patency, mucosal edema, crust, rhinorrhea, as shown in the tables below for the airway snoring and smell changes:

**Table 5:** Airway patency after laser therapy

Duration	No. of patients	Airway patency %
3 days	7	15%
1 week	11	25%
2 weeks	19	42%
1 month	36	80%
3 months	41	91%
6 months	41	91%

**Table 6:** The percentage of patients with mucosal oedema after laser reduction

Duration	No. of patients	Edema %
3 days	38	84%
1 week	26	58%
2 weeks	9	20%
1 month	0	0%
3 months	0	0%
6 months	0	0%

**Table 7:** The percentage of patients with crust after laser reduction

Duration	No. of patients	Crust %
3 days	38	84%
1 week	19	42%
2 weeks	8	18%
1 month	2	5%
3 months	0	0%
6 months	0	0%

**Table 8:** The percentage of patients with rhinorrhea after laser reduction

Duration	No. of patients	Rhinorrhea %
3 days	32	71%
1 week	32	71%
2 weeks	24	53%
1 month	16	35%
3 months	10	22%
6 months	10	22%

**Table 9:** The percentage of patients with snoring after laser reduction

Duration	No. of patients	Snoring %
3 days	19	42%
1 week	17	38%
2 weeks	14	31%
1 month	8	18%
3 months	6	13%
6 months	6	13%

**Table 10:** The percentage of patients with smell changes after laser reduction

Duration	No. of patients	Smell changes %
3 days	17	38%
1 week	17	38%
2 weeks	15	33%
1 month	11	24%
3 months	7	15%
6 months	3	7%

## DISCUSSION

current study improvement of nasal obstruction by diode laser reduction was achieved in (25%) of patients after one week, (42%) after 2 weeks, (80%) of patients one month after the operation and (91%) after 3 months.

The delayed improvement in nasal airway in the first two weeks after the operation was mainly due to mucosal oedema and crust formation.

In comparing the current study results with other studies, Janda P., Sroka R. in their study on 76 patients suffering from nasal obstruction due to hyperplastic inferior turbinate who were treated with a diode laser. Their results were that in the first 2-4 weeks after laser reduction the nasal obstruction was correlated to post operative oedema and crusting. 86% of patients described a subjective improvement of nasal air flow six months after operation, while 76% of patients described a subjective improvement one year after the operation ( Janda, P. *et al.*, 2000).

In another study by Janda P., Sroka R. on 50 patients (52% allergic rhinitis and 48% with vasomotor rhinitis) who suffered from nasal obstruction due to hypertrophied inferior nasal turbinate and were treated with diode laser. Their

results were four weeks after laser reduction an improvement of nasal air flow correlating to the extent of the ablated turbinate tissue could be determined in more than (80%) of patients, also rhinomanometry revealed a significant improvement of the nasal air flow six months and one year after the laser treatment compared to preoperative data.( Janda, P. *et al.*, 2002)

Caffier PP, Frieler K in their study on 42 patients with rhinitis medicamentosa suffering from nasal obstruction. Patients under went reduction with diode laser after topical anesthetic preparation. Follow up was at one and six weeks, as well as six and twelve months. Their results were that after six months (88%) of patients stopped decongestant abuse, while the percentage reduced to (74%) after one year.( Caffier, P. P. *et al.*, 2008)

Regals S.D, Upile T. in their study of inferior turbinate reduction in children using Holmium:YAG laser found that long term benefit was 50% .( Rejals, S. D. *et al.*, 2004)

Janda P., Sroka R. in their study of treating inferior turbinate hypertrophy using HO:YAG laser and diode laser their results showed that diode laser revealed more effective results than HO:YAG laser treatment.<sup>8</sup>

Min, Y.G, Kim H S. in their study using diode laser in treating idiopathic rhinitis. Their study included 53 patients with idiopathic rhinitis complaining of nasal obstruction. Six months following surgery obstruction was significantly improved and a significant decrease in nasal airway resistance was noted on rhinomanometric measurements ( $P < 0.05$ ). (Min, Y. G. *et al.*, 1996)

Oedema was found in (58%) of patients one week after the operation. Two weeks after the operation (20%) of patients had oedema, whereas no patients had oedema one month after the operation.

Crust was found in (42%) of patients one week after the operation. Two weeks after the operation (18%) of patients had crust. One month after the operation (5%) of patients had crust. No crust was found three month after the operation.

In current study (71%) of patients suffered from rhinorrhea before the operation. One week after laser reduction (71%) of patients have rhinorrhea, two weeks after the operation only (53 %) of patients have rhinorrhea and this figure decreased to (35%) and (22%) one month and three months respectively after the operation .

Fukutake work with CO2 laser which showed an excellent and good result at (76%) in reduction of nasal obstruction and watery nasal discharge. (Fukutake, T. *et al.*, 1986)

Snoring was found in (29%) of patients before the operation. After the operation (38%) of patients have snoring one week after the operation and this probably due to mucosal edema. Two weeks after the operation (31%) have snoring, (18%) after one month and (13%) after three months. This improvement in snoring is due to gradual improvement in airway patency with time after the operation.

Thirty eight percent of patients suffer from smell changes before the surgical procedure, the same percentage was found after one week from the surgical procedure. Two weeks after the procedure this figure decreased to (33%) , (24%) after one month, (15%) after 3 months and (7%) after 6 months.

In current study there was negligible perioperative bleeding in few patients who underwent the laser reduction which stopped without the use of anterior nasal pack. The area was left uncovered (to be healed by second intention) covered with coagulative layer which was clearly formed on the irradiated tissue surface, that effectively eliminated

bleeding and soreness after the operation. The coagulated tissue changed into a layer of scab tissue within 3 days, and the raw area was contracted from the margins of the surgical wound to its center gradually, closing inward until the wound surface was clinically healed within 7-14 days. There were no evident complications or secondary infection.

Caffier, P.P, Frieler K in their study on using diode laser in reducing hypertrophied inferior turbinate had no major perioperative bleeding requiring packing and no other perioperative complications. Postoperative oedema disappeared within the first week and crusting within six weeks after surgery.

Janda, P, Sroka R. in their study on reducing the hypertrophied inferior turbinate using diode laser had no perioperative bleeding and no nasal packing was necessary. Side effects like nasal dryness and pain were rare, less than 5%.

Rejals, S.D, Upile T. In their study found that laser and diathermy had similar efficacy but laser was associated with less morbidity and complications.

All the studies concerning the reduction of inferior turbinate hypertrophy using diode laser were not associated with perioperative bleeding. In all the studies no nasal packing was necessary after completion of the procedure, and there was no postoperative hemorrhage.

Regarding pain, it was assessed clinically and by the patient self-assessment and systemic analgesic was prescribed on need only; Patients who were undergone surgery under local anesthesia, no pain during the surgical procedure And the patients who had received general anesthesia during the postoperative period no pain was felt by the patients.

## CONCLUSION

Short term results in reduction the size of inferior turbinate in patients with allergic rhinitis by Diode Laser is a useful procedure that can be performed as an outpatient surgery under local anesthesia. The short operation time and less discomfort provide other reasons for choosing this treatment for allergic rhinitis that is refractive to conservative management.

## RECOMMENDATIONS

- 1- Further studies are required with larger groups of patients and for longer duration of follow up, to determine the long term effect of diode laser reduction of inferior turbinate

- 2- Training of ENT surgeon on laser techniques and procedures by attachments with specialized centers and with Laser institute is recommended.
- 3- Since only few surgical Lasers are available in our hospitals, we recommend providing hospitals with new & more advanced Laser systems.

Further studies for long terms follow ups and more objective test are still necessary to establish the efficacy of Diode Laser.

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