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## ORIGINAL ARTICLE

# Laser Versus Diathermy Assisted Inferior Turbinoplasty In Zagazig University Hospitals

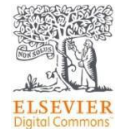
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## ABSTRACT

**Introduction:** When conservative medical treatment options, such as anti-histamines, topical decongestants, and topical corticosteroids, fail in inferior turbinate hypertrophy, reduction of the inferior turbinate can be performed using various surgical techniques.

**Objective:** To Assess effect of using diode laser on symptomatic hypertrophied inferior turbinate and to compare between diode laser and diathermy.

**Methods:** Interventional study (clinical trial) carried out in Otorhinolaryngology –Head and Neck surgery Department ORL-HNS department Zagazig University in the period from Jan 2018 till Feb 2019. On a total sample size of 55 11 in each group of Submucosal technique by diode laser, Linear technique by diode laser, Cross hatching technique by diode laser, Bipolar Diathermy and Monopolar diathermy groups. Also 10 medical staff volunteered as control for methylene blue colored saccharine test.

**Results:** There was high significant difference as regard postoperative nasal obstruction and headache findings (most of submucosal technique by diode laser improved). There was significant difference between the studied groups in post operative complications as regard pain, crusting and synechia.

**Conclusion:** Laser reduction seems to be standing out as methods that can be applied under local anesthesia providing minimal morbidity (very low risk of intra- and postoperative bleeding and other (complications) combined with high patients comfort (time-saving application, outpatient procedure, no nasal packing).

**Key words;** Laser, diathermy, inferior turbinoplasty, Hypertrophied inferior turbinate, peri-ciliary liquid, Mucociliary Clearance, Ciliary beat frequency

## INTRODUCTION

Nasal airflow disturbance occur in about 30% of the population causing nasal obstruction and most common cause being hypertrophied inferior turbinate [1]. Nasal obstruction is a result of submucosal or mucosal hypertrophy due to increased vascularity as the anterior end of the inferior turbinate is an erectile tissue [2]. The inferior

turbinate serve several important functions. They contribute to inspiratory resistance, which is necessary for normal breathing. This is known as the ‘Resistor function’ of the turbinate. It is also a part of the valve area, which helps in changing the inspiratory lamellar air stream into a turbulent flow [3]. Laser surgery has the advantages of limited tissue trauma and reduced bleeding.

Different lasers, such as carbon dioxide (CO<sub>2</sub>), neodymium: yttrium–aluminum garnet (Nd:YAG), holmium: yttrium–aluminum garnet (Ho:YAG), potassium titanyl phosphate (KTP), diode, and argon plasma lasers, have been used to treat ITH [4]. The diode laser is the most portable and least expensive of the lasers available for rhinologic applications today [5]. So we will make five groups, the first use monopolar diathermy, the second use bipolar diathermy, other three groups using three different techniques of diode laser (linear, cross-hatching and interstitial) To Assess effect of using diode laser on symptomatic hypertrophied inferior turbinate and to compare between diode laser and diathermy.

### **Patients and Methods**

This study included 55 patients with nasal obstruction due to hypertrophied inferior turbinates resistant to medical treatment for a period not less than six weeks. Our study included 29 males and 26 females with mean age of (range 18-50 years), The study work was done in Otorhinolaryngology Department in Zagazig University Hospitals in the period from Jan 2018 to Feb 2019.

Written informed consent was obtained from all participants. The study was approved by the research ethical committee of Faculty of Medicine, Zagazig University (ZU-IRB#4156).

The work has been carried out in accordance with The Code of Ethics of the World Medical Association (declaration of Helsinki) for studies involving humans.

These patients are divided into five groups :

First group: 11 patients treated by monopolar diathermy.

Second group: 11 patients treated by bipolar diathermy.

Third group: 11 patients treated by linear (surface) technique of diode laser.

Fourth group: 11 patients treated by submucosal technique of diode laser.

Fifth group: 11 patients treated by cross-hatching (surface) technique of diode laser.

### **Exclusion criteria:**

Age below 18 years old .Severe deviated nasal septum.Chronic sinusitis.

Acute rhinitis. Nasal polyp.

### **Inclusion criteria:**

Age above 18 years old .Nasal obstruction caused by hypertrophied inferior turbinate

No intervention during a 1 year follow-up.

Fit for general anesthesia although it could be done with local anesthesia in cooperated and selected cases.

**These patients were subjected to the following:**

### **History taking.**

#### **Personal history.**

#### **Present and past history.**

E.N.T. diseases and / or operations including: systemic disease ,drugs and previous operations.

### **Examination:**

General examination.

Nasal examination:

### **Investigation:**

- 1- Routine laboratory investigations eg. complete blood picture, liver function tests, kidney function tests, random blood sugar, coagulation profile, viral markers ....etc .
- 2- CT scanning of the nose and paranasal sinuses was done for each patient.
- 3- Diagnostic nasal endoscopy was done preoperative and postoperative. **The endoscopic evaluation** was carried out with a straight (4 mm, 0°) endoscope before the nasal mucosa was decongested. **The degree of hypertrophy was classified** into 3 endoscopic scores (ES) according to the turbinate width/engorgement:
  - Grade 1: inferior turbinate fully retracted.
  - Grade 2: inferior turbinate engorgement filling half of the nasal fossa.
  - Grade 3: inferior turbinate engorgement reaching the nasal septum.

### **Management:**

#### **Medical treatment:**

Medical treatment was given to all patients before C.T.scan in the form of:

Nasal decongestant drops twice daily for three days.Antihistamines.Antibiotics, if there is suspected infection (amoxicillin clavulanic e.g. Augmentin 1 gm twice daily for 7 days).Local steroid spray.

If patients did not improve after six weeks from medical treatment, we would use surgical treatment.

**Surgical treatment:****Criteria for surgery:**

Patient not responding to trials of medical treatment (At least six weeks). No or mild septal deviation is present. hypertrophied inferior turbinate. complain of nasal obstruction.

**Preparation for inferior turbinoplasty by diode laser or diathermy:**

Standard preparation involves general anesthesia with cuffed endotracheal tube and wet pharyngeal pack. The endotracheal tube is usually taped to the left side of the patient's mouth, to allow the surgeon to be positioned on the right side of the patient. The head is wrapped with 2 surgical towels, leaving the eyes, nose, cheeks and upper lip exposed. The eyes are taped with clear adhesive dressing for protection. Also this operation could be done under local anesthesia.

**The methods were compared with each other regarding the following objective and subjective parameters:****Subjective by**

1. Improvement of symptoms by visual analogue scale (VAS) (rhinorrhea, headache , nasal obstruction , tiredness ) postoperative (first week , first month and third month).

**Objective by**

1-The incidence of postoperative complications among procedures as synechia, bleeding, crusts, atrophy and postoperative pain.

2- Saccharine test with methylene blue was done preoperative and postoperative (first week, first month and third month) for mucociliary clearance system affection.

It was done by putting saccharine with methylene blue at tip of inferior turbinate and measuring time needed. When the patient senses the taste of sugar (saccharine), we detect the time of sensation and visualize endoscopically the blue color of the dye at the same time of sensation at nasopharynx and oropharynx by endoscope using lens zero degree.

**Operative technique:**

After obtaining informed consent from the patient, local anesthesia in selected and co-operated patients or general endotracheal anesthesia was induced with cuffed

endotracheal tube and wet pharyngeal pack. Utilizing a zero degree rigid nasal endoscope, any blood and secretions were removed from the nostril with a Frazier-tipped suction. Diode laser probe was then inserted into the nostril under endoscopic visualization, operative microscopy or optic loop for magnification .The prolonged use of endoscope in this operation was hazard because the steam of the vaporizing inferior turbinate make vision difficult and cause damaging to the lens of endoscope. So we preferred to use optic loop or operative microscopy.

**Diathermy techniques for reduction of hypertrophied inferior turbinate:****1. Monopolar cautery:**

Inert electrode was placed under right thigh. A7.5 cm 22 gauge spinal needle was used as monopolar probe and inserted longitudinally into the anterior end of inferior turbinate surface. The cautery (adjusted at 25 w) was turned on for 30 to 45 seconds till the anterior end of turbinate blanches avoiding charring. The cautery is then removed and reinserted medially and superiorly a distance of 1 to 2 cm from the initial site then posterior part of the turbinate with precaution not to injure septum and ala.

**2. Bipolar diathermy:**

We make linear cautery at free border of inferior turbinate. Cauterization was from posterior to anterior with 2mm distance separation between the two arms of bipolar cautery. Bipolar cautery was controlled with foot switch. After using monopolar and bipolar diathermies, nasal cavity was packed by Vaseline packs and removed after 48 hours postoperative. Medical treatment was with antibiotic 7days postoperative and nasal saline wash four times daily and antihistaminic if allergic.

**We used three different techniques by diode laser in inferior turbinoplasty:****1. Submucosal technique:**

The laser energy level was set to 6W and pulse mood ( 0.3 second pulse, 0.1second break). The radial fiber probe was placed submucosally 3 cm into head of the inferior turbinate. Application of laser was done under slow retraction of the probe with 10

seconds per centimeter, so total energy of 60J/cm was applied. A total energy of about 180J/turbinate was used.

## 2. linear (surface) technique:

Three to four laser applications were performed by drawing the fiber (400-600 micron ) from the posterior to anterior part of the inferior turbinate, if necessary, some additional laser spots onto the head of the turbinate.

## 3. Cross-hatched technique:

Entire turbinate cross-hatched on surface of turbinate by diode laser

### Post-Operative Care and Follow-up

Patients were followed up weekly, 1<sup>st</sup> month then monthly for one year. On follow up careful recording of symptoms (nasal obstruction, headache and rhinorrhea) was done by visual analogue scale (VAS). In every office visit patients underwent nasal endoscopy and saccharine test. All results and findings were collected and tabulated.

### Patient satisfaction score of 3:

1- Subjective by continuity of complain of the patient or not postoperative. If there is nasal obstruction, it will be scored zero.

If there is no nasal obstruction, it will be scored 1.

If there is headache, it will be scored zero.

If there is no headache, it will be scored 1.

Score 3 → Excellent satisfaction.

Score 2 → Good satisfaction.

Score 1 → Bad satisfaction.

Score zero → Very bad satisfaction.

2- Objective by

-endoscope if opened air way (shrinkage of turbinate) scoring 1 and if closed (no shrinkage of turbinate) scoring zero according to vision of the surgeon.

- Saccharine test.

### Postoperative assessment stressed on:

If there is nasal obstruction or not. If headache is totally relieved, decreased or persisted. Identify any residual pathology and the presence of **any complications**:. Presence of postoperative pain and bleeding. Post-operative adhesions. Post-operative crusts.

### Criteria of cure, improvement and failure:

Complete cure is considered if the patient was completely free of nasal obstruction, headache and rhinorrhea according to

endoscopic view, VAS and saccharin test with methylene blue. Otherwise failure is considered.

### Statistical Analysis:

All data were collected, tabulated and statistically analyzed using SPSS 19.0 for windows (SPSS Inc., Chicago, IL, USA), MedCalc 13 for windows (MedCalc Software bvba, Ostend, Belgium) and Microsoft Office Excel 2010 for windows (Microsoft Cor., Redmond, WA, USA). Continuous data are expressed as the mean ± SD & median (range), and the categorical data are expressed as a number (percentage). Continuous variables were checked for normality by using Shapiro-Wilk test. Wilcoxon signed ranks test was used to compare two dependent groups of non-normally distributed data. Percent of categorical variables were compared using the Chi-square ( $\chi^2$ ) test. All tests were two tailed.  $p < 0.05$  was considered statistically significant (S),  $p < 0.01$  was considered highly statistically significant (HS), and  $p > 0.05$  was considered non statistically significant (NS). Non parametric test for comparison of more than two groups was done by Kruskal wallis.

### RESULT

This table shows that there is no significant difference between the studied groups as regard preoperative findings[table1]. This table shows that there is high significant difference as regard one week postoperative nasal obstruction and headache findings (most of submucosal technique by diode laser improved but no improvement in surface laser and diathermy (bipolar & monopolar)). Also there is significant difference between the studied groups as regard rhinorrhea (most of surface techniques by diode laser improved then bipolar diathermy but no improvement in monopolar)[table2]. This table shows there is significant difference between the studied groups in 1st month postoperative as regard nasal obstruction and headache (most of submucosal technique by diode laser improved then surface laser then bipolar). Also there is significant difference between the studied groups as regard rhinorrhea (most of surface laser technique improved then bipolar diathermy). But in monopolar

diathermy there is no improvement as regard nasal obstruction and rhinorrhea[table3]. This table shows that in submucosal laser saccharine test improved than preoperative at first month (about 81.8% of patients) and still improved at third month (100% of patients), in surface laser (72% of patients) improved at third month and in bipolar diathermy (about 45% of patients) improved at third month and (about 54.5% of patients ) not recovered to preoperative time , while in monopolar diathermy (about 36%of patients only)

improved at third month and (about 63.3% of patients) not recovered to preoperative time[table4]. This table shows that there is significant difference between the studied groups in 1st month postoperative complications as regard pain, crusting and synechia[table5]. There is a high significant difference between the studied groups as regard patient satisfaction score. The higher score is for submucosal (interstitial) laser then surface laser[table6].

**Table (1) preoperative symptoms of the studied groups:**

Variable	Laser						Diathermy				$\chi^2$	P
	Submucosal		Surface technique				Bipolar Diathermy (n=11)		Monopolar diathermy (n=11)			
	Submucosal technique by diode laser (n=11)	Linear technique by diode laser (n=11)	Cross hatching technique by diode laser (n=11)									
No.	%	No.	%	No.	%	No.	%	No.	%			
<b>Nasal obstruction</b>											0.0	1
No	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Yes	11	100.0	11	100.0	11	100.0	11	100.0	11	100.0		
<b>Headache</b>											0.0	1
No	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Yes	11	100.0	11	100.0	11	100.0	11	100.0	11	100.0		
<b>Rhinorrhea</b>											0.73	0.95
No	4	36.4	5	45.5	5	45.5	5	45.5	6	54.5		
Yes	7	63.6	6	54.5	6	54.5	6	54.5	5	45.5		

**Table (2) one week postoperative symptoms of the studied groups:**

Variable	Laser						Diathermy				$\chi^2$	P
	Submucosal		Surface				Bipolar Diathermy		Monopolar diathermy			
	Submucosal technique by diode laser (n=11)	Linear technique by diode laser (n=11)	Cross hatching technique by diode laser (n=18)									
No.	%	No.	%	No.	%	No.	%	No.	%			
<b>Nasal obstruction</b>											18.7	<0.001**
No	8	27.3	2	81.8	1	9.1	1	9.1	1	9.1		
Yes	3	72.7	9	18.2	10	90.9	10	90.9	10	90.9		
<b>Headache</b>											18.7	<0.001**
No	8	27.3	2	81.8	1	9.1	1	9.1	1	9.1		
Yes	3	72.7	9	18.2	10	90.9	10	90.9	10	90.9		
<b>Rhinorrhea</b>											11.9	<0.05*
No	8	72.7	10	90.9	11	100	5	45.5	6	54.5		
Yes	3	27.3	1	9.1	0	0.0	6	54.5	5	45.5		

**Table (3) First month postoperative symptoms of the studied groups:**

Variable	Laser						Diathermy				$\chi^2$	P
	submucosal		Surface				Bipolar diathermy (n=11)		Monopolar diathermy (n=11)			
	No.	%	No.	%	No.	%	No.	%	No.	%		
<b>Nasal obstruction</b>												
No	9	81.8	8	72.7	7	63.6	4	36.4	3	27.3	<b>9.91</b>	<b>0.042*</b>
Yes	2	18.2	3	27.3	4	36.4	7	63.6	8	72.7		
<b>Headache</b>												
No	10	90.9	9	81.8	6	54.5	4	36.4	3	27.3	<b>13.89</b>	<b>0.007*</b>
Yes	1	9.1	2	18.2	5	45.5	7	63.6	8	72.7		
<b>Rhinorrhea</b>												
No	8	72.7	10	90.9	11	100	5	45.5	6	54.5	11.9	<b>&lt;0.05*</b>
Yes	3	27.3	1	9.1	0	0.0	6	54.5	5	45.5		

**Table (4) Saccharine test findings (recovery of muco-ciliary clearance) of the studies groups:**

Saccharine test	Pre-operative		One week post operative		One month post operative		Three month post operative		$\chi^2$	P value <sup>a</sup>
	No.	%	No.	%	No.	%	No.	%		
<b>submucosal technique by diode laser</b> <i>Normal prolonged</i>	2	18.2	0	0.0	9	81.8	11	100.0	30.9	<b>&lt;0.001**</b>
	9	81.8	11	100	2	18.2	0	0.0		
<b>linear technique</b> <i>Normal prolonged</i>	2	18.2	0	0.0	0	0.0	8	72.7	22.26	<b>&lt;0.001**</b>
	9	81.8	11	100	11	100	3	27.3		
<b>cross hatching technique</b> <i>Normal prolonged</i>	2	18.2	0	0.0	0	0.0	8	72.7	22.26	<b>&lt;0.001**</b>
	9	81.8	11	100	11	100	3	27.3		
<b>Bipolar diathermy</b> <i>Normal prolonged</i>	2	18.2	0	0.0	0	0.0	5	45.5	11.38	<b>&lt;0.05*</b>
	9	81.8	11	100	11	100	6	54.5		
<b>monopolar diathermy</b> <i>Normal prolonged</i>	2	18.2	0	0.0	0	0.0	4	36.7	8.4	<b>&lt;0.05*</b>
	9	81.8	11	100	11	100	7	63.3		

Table(5) 1st month Postoperative complications :

Variable	Laser						Diathermy				$\chi^2$	P
	Submucosal		Surface				bipolar Diathermy (n=11)		Monopolar diathermy (n=11)			
	Submucosal technique by diode laser (n=11)	Linear technique by diode laser (n=11)	Cross hatching technique by diode laser (n=11)									
No.	%	No.	%	No.	%	No.	%	No.	%			
<b>Pain</b>												
No	11	100.0	10	90.9	9	81.8	5	45.5	6	54.5	<b>12.84</b>	<b>0.012*</b>
Yes	0	0.0	1	9.1	2	18.2	6	54.4	5	45.5		
<b>Crusting</b>												
mild	7	63.6	6	54.5	4	36.4	2	18.2	1	9.1	<b>16.8</b>	<b>0.032*</b>
Moderate	4	36.4	4	36.4	5	45.5	8	72.7	5	45.5		
Severe	0	0.0	1	9.1	2	18.2	1	9.1	5	45.5		
<b>Synechia</b>												
No	11	100.0	11	100.0	11	100.0	6	100.0	6	100.0	<b>18.3</b>	<b>&lt;0.100**</b>
Yes	0	0.0	0	0.0	0	0.0	5	0.0	5	0.0		
<b>Bleeding</b>												
No	11	100.0	11	100.0	11	100.0	9	81.8	9	81.8	6.47	0.166
Yes	0	0.0	0	0.0	0	0.0	2	18.2	2	18.2		

Table(6) Patient satisfaction score of the studied groups

Variable	Submucosal technique by diode laser (n=11)	Linear technique by diode laser (n=11)	Cross hatching technique by diode laser (n=18)	Monopolar diathermy	bipolar diathermy	Kruskal Wallis test	P
Satisfaction score							
Median	3	3	2	1	2	35.19	<b>&lt;0.001**</b>
Range	(2-3)	(2-3)	(2-2)	(1-2)	(0-2)		



**Figure (1) Diode laser (Manufactured by Wuhan Gigaa Optronics Technology Co.,Ltd.)(Lotus Global Co.,Ltd.)**

**Name:Touch Screen Control System.**

**Model: V-100...SN:GA13V872**

**Laser Classification: class4**

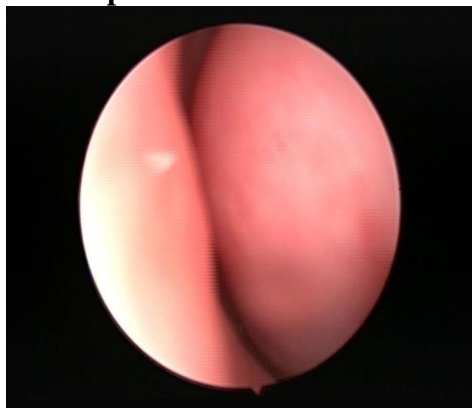
**EN60825-1:2007**

**\*Type of fiber: Bare Laser Fiber**

**GA-400-1 OR GA-600-1.**

**Manufactured also by Gigaa Optronics Technology Co.,Ltd.**

**Case 1 follow up submucosal diode laser on lt side**



**Fig (2) Preoperative view**



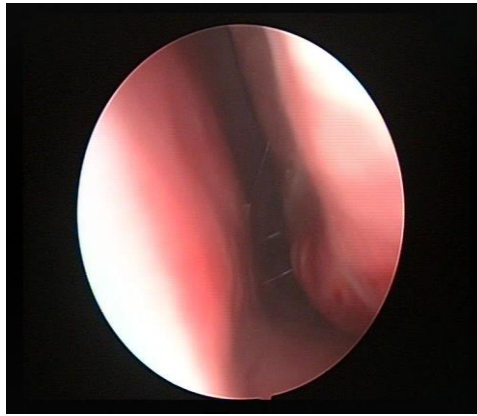
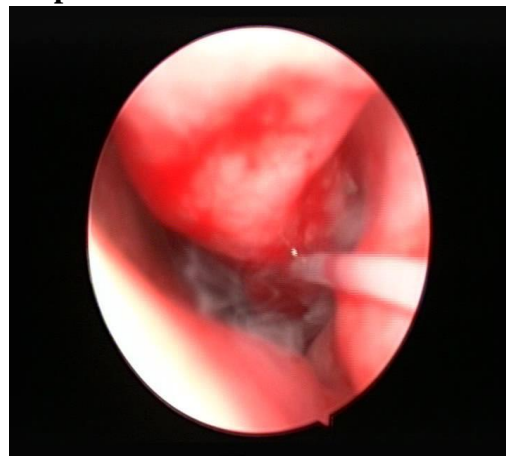
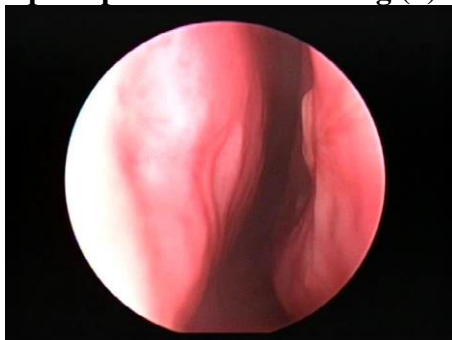
fig(3)1<sup>st</sup> month postoperative viewFig (4) 1<sup>st</sup> week postoperative

fig (5) Operative view

Fig(6) 2<sup>nd</sup> month postoperative

### DISCUSSION

Nasal airflow disturbance occur in about 30% of the population causing nasal obstruction and most common cause being hypertrophied inferior turbinate [1]. Nasal obstruction is a result of submucosal or mucosal hypertrophy due to increased vascularity as the anterior end of the inferior turbinate is an erectile tissue [2]. The diode laser has special effect on vascular tissue and it is the most portable and least expensive of the lasers available for rhinologic applications today [5].

Monopolar diathermy acts on surface of the turbinate so it is opposed what is called submucosal diathermy. It is proven by occurring histological mucosal changes which include conversion of columnar epithelium into cuboidal epithelium as a result of burn injury [9]. The diode laser was used because of its deep coagulation properties including necrosis of the venous plexus of the nasal turbinate [10]. In the present study there was high significant difference between the pre and postoperative findings of submucosal technique by diode laser as regard nasal obstruction and headache. Similar findings

were reported by *Janda et al.,[11]* . showed that diode laser treatment of hyperplastic inferior nasal turbinates resulted in a subjective improvement of nasal airflow in 76% of patients and did not correlate with significant variations in the muco-ciliary function test. Also *Mabry[13]*,. found no extensive postoperative bleeding or crusting after removing the nasal packing, and patients reported an improvement of their nasal breathing. In accordance with *Newman and Anand,[14]* it was concluded that diode laser treatment is ideally suited for intranasal use resulting in a controlled coagulation and ablation of the soft tissue in a short treatment times with excellent patient acceptance. Also in our study no significant difference as regard rhinorrhea in submucosal (interstitial) technique by diode laser. This finding supported by *Jovanovic and Dokic[15]*, who found that allergy testing showed that the long-term results of the laser treatment of the nasal turbinates differed for patients suffering from allergic rhinitis as opposed to vasomotor rhinitis. In our study interstitial (deep) technique by diode laser is the least technique in complications and the best in the healing period that is consistent with *Cavaliere et al.[16]*, who found that submucosal diode laser is an effective and simple method for treatment of ITH. The advantages of laser surgery are lack of bleeding, high precision and good healing of the wound *Sroka et al.[17]*,

In our study patients treated by interstitial technique by diode laser suffered from crusts at 1<sup>st</sup> week and subsides at 1<sup>st</sup> month follow up visit. *Kassab et al.[18]*, found that patients treated by means of the diode laser showed a moderate to severe nasal obstruction, crusting and secretion within the first 4 weeks after laser treatment. Afterward, nasal crusting subsided and a subjective relief of the nasal obstruction became apparent. The present study demonstrated that there was significant difference between the studied groups as regard recovery of saccharine test for muco-ciliary transport time in each technique ( submucosal diode laser as rapid improvement occurs in it at 1<sup>st</sup> month) that was reported by *Janda et al.[12]*, who found that The muco-

ciliary function test revealed no significant change between the pre and postoperative nasal clearance, which proves that the diode laser as well as the Ho:YAG laser treatment seems to preserve the overall function of the ciliary cells of the nasal turbinate. Also *Veit et al.[19]*, found that In the submucosal(interstitial) diode laser group the change in muco-ciliary transport time(MCTT) from a median 13 to 11 minutes was not significant ( $P = .652$ ). In our study interstitial technique by diode laser has an excellent score in patient satisfaction score and high acceptance from our patient, which are consistent with *Caffier et al.[20]*, who claimed that Satisfactory results have been reported after interstitial trans-mucosal diode laser. The advantage of this technique is that the laser energy is not applied on the respiratory epithelium; instead, because of submucosal placement of the laser probe the mucosa is spared [19].

In our study there was high significant difference between the pre and postoperative findings of surface techniques (linear and cross-hatching) by diode laser as regard rhinorrhea. It is supported by *Havel et al.[22]*, who found that histopathological changes following laser surgery could be shown that the lamina propria was occupied by fibrous tissues, and that the number of vessels and sero-mucinous glands in the turbinates had decreased. Also *Kassab et al.[18]*, found that endoscopic examination showed a significant reduction in turbinate size, confirmed by an increase in total nasal cavity volume of 46.9 and 56.6 per cent after one and six postoperative months, respectively, compared with pre-operative values. Also *Havel et al.[22]*, Found that no infection, bleeding, or other complications were reported on endoscopic examinations and questioning of the patients in the course of the postoperative period. In our study saccharine test is delayed and muco-ciliary clearance is impaired in superficial (surface) technique by diode laser. This agreed with *Cassano et al.[23]*, who found that laser assisted surface turbinate surgery disturbed muco-ciliary function. In contrast, *Pang and Willatt[24]*, found the postoperative muco-ciliary clearance to be

unchanged. In our study there was no significant difference between the pre and postoperative findings of monopolar and bipolar diathermy as regard nasal obstruction and headache and also complications as crusts, adhesion and bleeding. That was consistent with *Rao et al.[9]*, who found that in monopolar diathermy, half of the patients were still having persistent nasal obstruction after 6 weeks, because the effect of monopolar diathermy is often limited or temporary, so the procedure has to be repeated. Also *Rao et al.[9]*, found that the mean reduction in nasal obstruction after three months was  $63.0 \pm 16.25\%$  with monopolar electrocautery,  $78.0 \pm 23.19\%$  with bipolar electrocautery,  $49.0 \pm 17.14\%$  with complete turbinectomy and  $48.0 \pm 24.99\%$  with Inj. sodium tetradecylsulphate infiltration. It is consistent with *Rao et al.[9]*, Who found that inferior turbinate reduction using bipolar cautery was better and safe method, when compared to monopolar cautery.

Also *Sroka et al.[17]*, found that cauterization might induce serious complications like blindness and anosmia and are therefore should be obsolete.

### CONCLUSION

Laser reduction seems to be standing out as methods that can be applied under local anesthesia providing minimal morbidity (very low risk of intra- and postoperative bleeding and other (complications) combined with high patients comfort (time-saving application, outpatient procedure, no nasal packing). Diode Laser is better than diathermy because Short operation time, High patient acceptance and satisfaction, No packs for two days after operation, it can be done under local anesthesia in selected and cooperated cases, Relieving of nasal obstruction and other symptoms, Lesser in complications (no epistaxis, no prolonged healing, no adhesion and no crusts) with frequent follow up, Recovery of muco-ciliary clearance system in short period about one month and fiber of diode laser is flexible and can be easily positioned but need experience. Interstitial (deep) laser is better than superficial (surface) laser in improvement of nasal obstruction and function of cilia (improvement of muco-

ciliary clearance system in 1<sup>st</sup> month follow up postoperative). Superficial laser is better in improvement of rhinorrhea than interstitial laser.

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