

# Outcome assessment in patients with chronic obstructive rhinitis CO<sub>2</sub> laser treated

## *Valutazione dei risultati ottenuti nei pazienti affetti da rinite cronica ostruttiva trattati con il laser a CO<sub>2</sub>*

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### Key words

Rhinitis • Surgical treatment • CO<sub>2</sub> Laser • Quality of life

### Parole chiave

Rinite • Trattamento chirurgico • Laser a CO<sub>2</sub> • Qualità della vita

### Summary

Surgical lasers have been used to restore nasal flow in chronic obstructive rhinitis, with a significant improvement in symptoms having been reported in almost all cases. However, evidence supporting the efficacy at long-term, and studies on the assessment of quality of life remain limited. In the present study, efficacy at long term and improvement in the quality of life were assessed in patients with chronic obstructive rhinitis, treated with CO<sub>2</sub> laser. A total of 308 patients with chronic obstructive rhinitis were enrolled. The primary outcome measure assessed was the change in score regarding specific and general symptoms, between baseline to 2-4.5 and 7.8 mean years follow-up. Laser turbinotomy restored nasal flow and induced a change in total score which was statistically significant, for specific and general symptoms at the first, second and third follow-up,  $p < 0.01$ . CO<sub>2</sub> laser turbinate surgery improved symptoms and quality of life in patients with chronic obstructive rhinitis as observed at 2-4.5 and 7.8 mean years follow-up.

### Riassunto

La chirurgia laser è stata impiegata nel ripristino della pervietà nasale nei soggetti affetti da rinite cronica ostruttiva (COR); la maggior parte degli Autori riporta un significativo miglioramento della sintomatologia. Sono tuttavia pochi gli studi che ne supportino l'efficacia a lungo termine e che valutino l'impatto sulla qualità di vita (QoL). Gli Autori hanno valutato i risultati a lungo termine e la QoL nei pazienti affetti da COR, trattati con il laser a CO<sub>2</sub>. Sono stati inclusi nello studio 308 pazienti con rinite cronica ostruttiva. Il principale parametro di valutazione di efficacia è stato il cambiamento in termini di score sintomatologico, per i sintomi generali e specifici, tra il tempo zero, il primo, secondo e terzo follow-up (tempo medio 2-4,5 e 7,8 anni). Lo studio evidenzia che la turbinotomia effettuata con il laser a CO<sub>2</sub> ripristina il flusso respiratorio nasale ed induce modifiche statisticamente significative negli score totali per i sintomi generali e specifici al primo, secondo e terzo follow-up, migliorando la QoL.

## Introduction

Chronic obstructive rhinitis (COR) causes air flow disorders, headache, smell disorders, sleep disturbance, irritability, behaviour problems, etc.

The frequency and importance of these problems, of which only some might be present, with one or other often predominating over the others, can considerably modify symptoms. However, it is clear that COR has a strong impact on health and quality of life (QoL), therefore, every effort must be made to restore nasal flow and improve associated disorders.

Surgical techniques have been employed to improve nasal obstruction when medical treatment has failed, and, recently, surgical lasers have been used in

turbinate surgery <sup>1,2</sup>. CO<sub>2</sub> laser with its longer wavelength (10.6  $\mu\text{m}$ ) scatters less in tissues and is less harmful than other surgical lasers, the zone of thermal damage being, typically, 300  $\mu\text{m}$  <sup>3</sup>. The laser beam, delivered through a surgical microscope, avoids laser energy being partially absorbed by the fiberoptic cable. Moreover, a custom self-retaining nasal speculum (Fig. 1) allows the surgeon to have both hands free, making laser treatment easier and less time-consuming.

The present study is an extension and confirmation of a previous study <sup>4</sup> on the use of CO<sub>2</sub> laser turbinotomy in COR, and long-term evaluation of results and QoL.

Long-term subjective and objective results have been



**Fig. 1.** Custom self-retaining nasal speculum allows surgeon to have both hands free, making laser treatment easier to perform and in less time.

assessed in a previously identified cohort of 124 patients<sup>4</sup>, and another group of 184 patients submitted to CO<sub>2</sub> laser treatment prior to 1996, who accepted to take part in the follow-up (FU) programme and who had undergone pre-operative rhinomanometry (RMN). Almost all authors<sup>2,3,5</sup> have reported a significant improvement in symptoms following laser turbinate surgery, however evidence supporting the efficacy of laser surgery, over more than two years, with objective measurement of nasal patency<sup>5-9</sup> and studies on overall QoL in patients with COR, is still limited<sup>10</sup>. Aim of this study was to evaluate long-term clinical results and QoL outcome, more than two years after laser surgery.

## Materials and methods

Study design, patient recruitment, evaluation of patency of nasal airway, criteria for exclusion from laser turbinotomy and our method in the use of CO<sub>2</sub> laser, in turbinate surgery, have been reported elsewhere<sup>4</sup>. Briefly, CO<sub>2</sub> laser cuts the tissue and makes a groove along the superomedial border of the inferior turbinate from the anterior to the posterior end, over the entire length, the width of the wound being



**Fig. 2.** CO<sub>2</sub> laser cuts tissue and makes a groove along superomedial border of inferior turbinate from anterior to posterior end along entire length.

approximately 5 mm and depth in some points reaching the turbinate bone (Fig. 2). Ablation of turbinate mucose and scar tissue contraction reduce turbinate bulk and restore nasal flow.

A total of 308 patients (175 male, 133 female), age range 12-72 years (mean 31.4), who underwent CO<sub>2</sub> laser turbinotomy for COR between June 1994 and April 1997, and had had RMN before laser treatment, were enrolled in the study; 140 patients with hypertrophic rhinitis (HR) – group 1, 168 with allergic rhinitis (AR) – group 2.

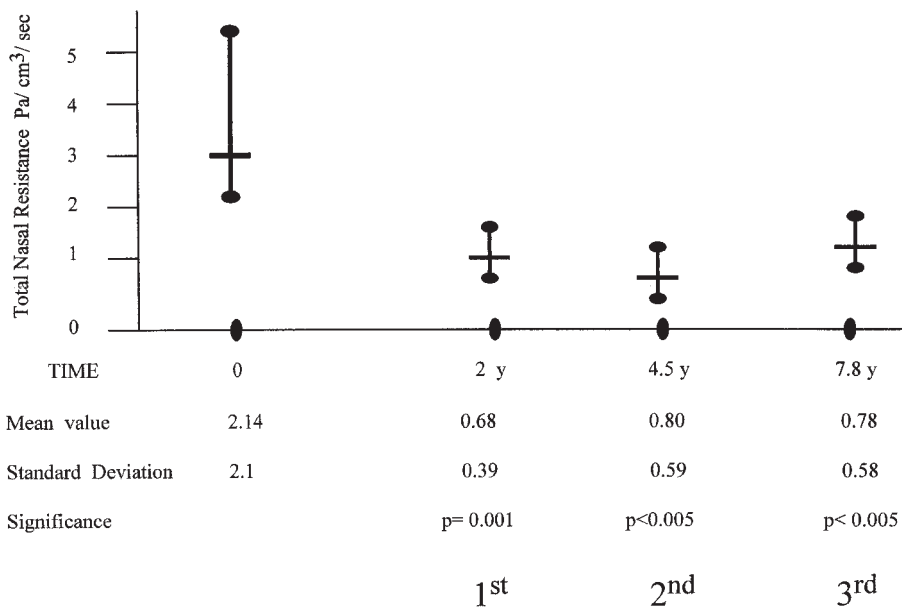
All patients, were routinely submitted, before and at mean 2-4.5 and 7.8 years FU, to endoscopic evaluation, RMN according to measurement criteria reported in our previous study<sup>4</sup>, using a Mercury electronic NRG rhinometer, at a reference pressure of 150 Pa in accordance with the guidelines of the International Committee for the Standardization of RMN, providing information regarding specific and general symptoms. Patients were asked to indicate the importance of each identified specific and general symptom using a four point scale from 0 to 3 (0: absent; 1: slight; 2: fair; 3: severe).

The specific symptoms assessed were: nasal blockage, smell disorders, headache and, for AR patients, also rhinorrhea, sneezing and asthma. The general symptoms assessed were: behaviour problems, sleeping disorder, poor concentration, irritability, need of nasal sprays (daily use of nasal decongestant). Other symptoms, such as changes in vocal quality, disorders of middle ear, taste disturbance, sexual problems, all of which may be difficult to evaluate for patients, were not listed. The frequency and importance of baseline values of the specific and general symptoms assessed, are reported in Table I.

Patients in the second group suffering from perennial AR, those with severe symptoms, received H<sub>2</sub> an-

**Table I.** Frequency and mean importance of specific and general items reported by 40 hypertrophic rhinitis patients and 168 allergic rhinitis patients before CO<sub>2</sub> laser turbinotomy.

		Hypertrophic rhinitis patients		Allergic rhinitis patients	
		Frequency	Mean importance	Frequency	Mean importance
Specific items	Nasal blockage	100	3.0	116	3.0
	Headache	35	2.7	53	2.6
	Smell disorders	46	2.5	63	2.5
	Rhinorrhoea			102	2.9
	Sneezing			82	2.6
	Asthma			32	2.8
		Mean 2.73		Mean 2.73	
General items	Behaviour problems	56	2.7	56	2.6
	Trouble sleeping	61	2.8	60	2.8
	Poor concentration	48	2.5	92	2.6
	Irritability	55	2.4	88	2.9
	Need nasal spray	63	2.6	110	3
		Mean 2.6		Mean 2.78	

**Fig. 3.** Decrease in total airway resistance in patients with chronic obstructive rhinitis following CO<sub>2</sub> laser treatment, at first, second and third follow-up.

tagonists intravenously (iv) before laser treatment, following a previously described protocol <sup>11</sup>. This treatment was repeated at the beginning of the pollen season to prevent allergic recruitment.

The other AR patients, with less severe symptoms received histamine type 1 antagonist orally for two weeks. Six (4.2%) HR patients and 9 AR patients (5.3%) underwent further laser treatment due to re-

lapse of symptoms of nasal obstruction, 3 to 6 months after laser surgery.

Of the 308 patients who completed the first FU at two years, 10 patients (3.2%) failed to complete the second FU at mean 4.5 years (range 3.9-5.7 years) and 16 patients (5.2%) failed to complete the third FU at mean 7.8 years (range 7.2-9.1 years); these patients were considered treatment failures.

Statistical analysis was performed using Student's t test.

## Results

Laser turbinotomy restored nasal flow as confirmed by a significant reduction of total nasal airway resistance (NAR mean value from 2.14, baseline to 0.78, third FU) (Fig. 3). Restored nasal flow improved all the specific and general symptoms which characterize the complex symptomatology of COR.

Improvements at the first, second and third FU, evaluated for specific and general symptoms for HR and AR patients, was statistically significant  $p < 0.01$  (Fig. 4, 5).

In particular, as far as concerns specific symptoms, the average degree of reported symptom improvement ranged, for HR patients, from 90%, 83% and

86% for nasal blockage, and 63%, 60% and 57% for headache, from 70%, 65% and 62% for smell disorders at the first, second and third FU respectively. For AR patients, improvement ranged from 86%, 83% and 81% for nasal obstruction, from 60%, 58% and 52% for headache, from 76%, 73% and 70% for smell disorders, at the first, second and third FU, respectively.

In these AR patients, at the first, second and third FU, the greatest improvement for the other specific symptoms was seen in rhinorrhea, 84%, 78% and 72%, and the least improvement in sneezing, 72%, 68% and 66%, respectively.

After laser treatment, patients with severe chronic AR were given H<sub>2</sub> antagonists or steroids during the pollen season to prevent recruitment of allergic disease.

However, medication led to a notable decrease, also in patients with asthma who reported improvement in the severity and frequency of bronchospastic events. General symptoms improved by 80%, 76% and 71% for sleep disturbance and by 73%, 70% and 67% for irritability, in both groups, at the first, second and third FU, respectively (Fig. 4, 5).

Improvement was also reported for non-listed symptoms by many patients. No peri-operative or post-operative complications or other adverse events oc-

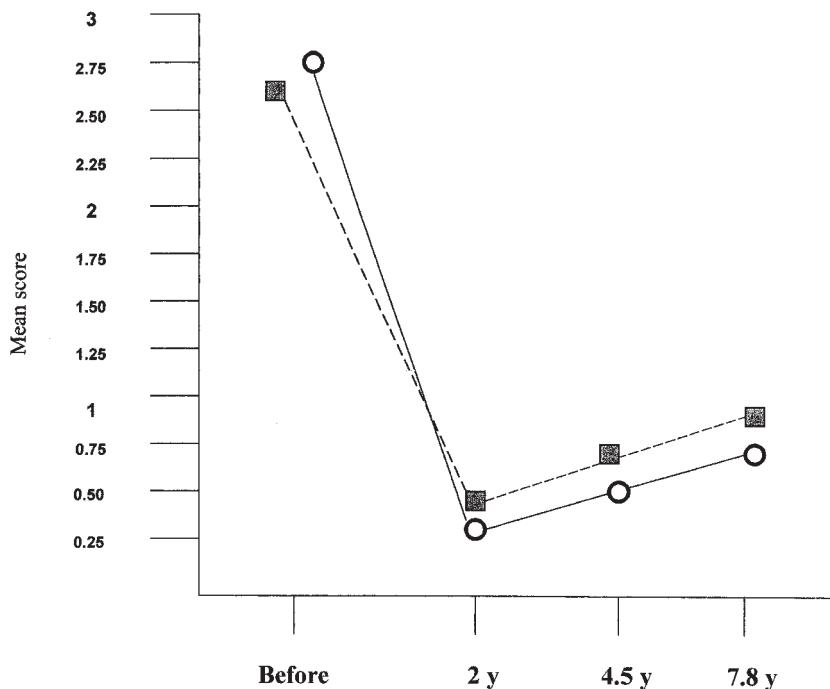


Fig. 4. Mean specific (o) and general (■) symptom scores recorded in 140 hypertrophic rhinitis patients before, at mean 2, 4.5 and 7.8 years after laser turbinotomy.

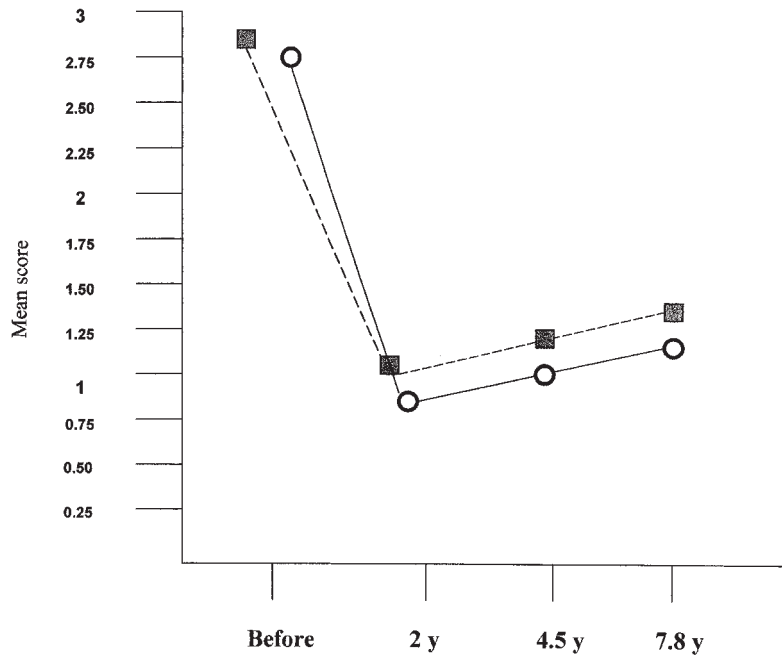


Fig. 5. Mean specific (o) and general (■) symptom scores recorded in 168 allergic rhinitis patients before, at mean 2, 4.5 and 7.8 years after laser turbinotomy.

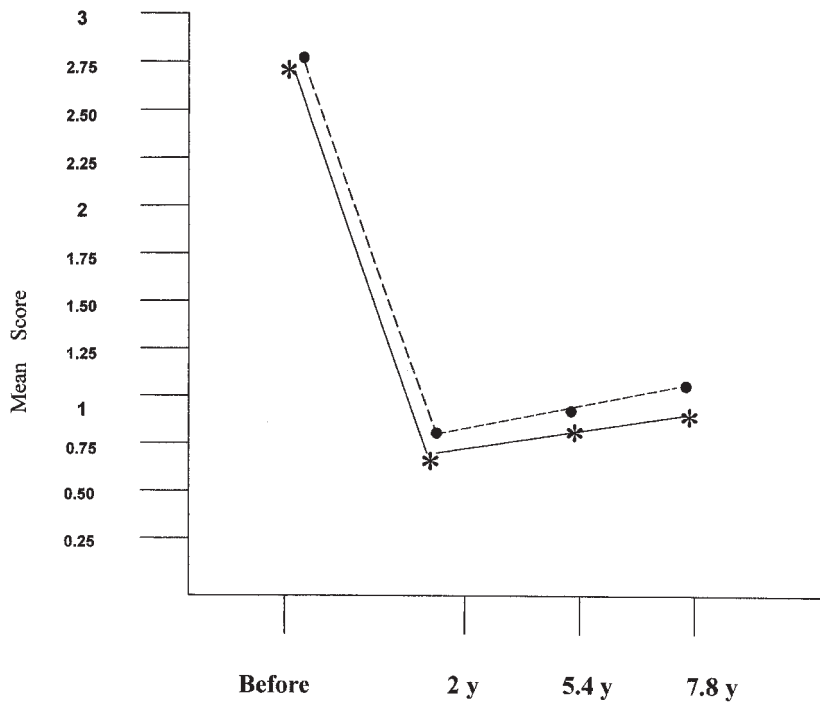


Fig. 6. Overall quality of life evaluation expressed as mean of specific and general symptoms for a total of 8 items for hypertrophic rhinitis (\*) and 11 items for allergic rhinitis (•) patients, before, at mean 2, 4.5 and 7.8 years after CO<sub>2</sub> laser turbinotomy.

curred in our treated patients. No synechia, no crusting and no worsening were observed in our laser-treated patients.

Overall, QOL, expressed as the mean of specific and general symptoms for a total of 8 items for HR and 11 items for AR patients, showed a statistically significant improvement at the first, second and third FU  $p < 0.01$  (Fig. 6).

## Discussion

CO<sub>2</sub> laser turbinotomy restores nasal flow and improves correlated symptoms. Improvement is long lasting. The advantages of this treatment include less pain and bleeding, very brief hospital stay and faster healing with a substantial reduction in health care costs.

We have attempted to quantify subjective levels of improvement following CO<sub>2</sub> laser turbinate surgery, both overall and with regard to specific and general symptoms. Comparison of the subscale scores before and after CO<sub>2</sub> laser turbinate surgery demonstrates a significant improvement in HR patients for specific and general symptoms at the first, second and third FU,  $p < 0.01$  (Fig. 4). Improvement becomes almost the same, for AR patients, for specific and general symp-

toms at the first, second and third FU,  $p < 0.01$  (Fig. 5). The greatest improvement was seen in the blocked nose, confirmed by a reduction of total nasal airway resistance (NAR), being almost equal in the two groups and statistically significant  $p < 0.01$  (Fig. 3). Furthermore, other non-listed symptoms were reported to have improved by many patients. Overall QoL, expressed as the mean of specific and general symptoms for a total of 8 items for HR patients and 11 items for AR patients, showed a statistically significant improvement at the first, second and third FU,  $p < 0.01$  (Fig. 6).

## Conclusion

CO<sub>2</sub> laser turbinate surgery improves specific and general symptoms of COR as well as QoL of patients. Thus CO<sub>2</sub> laser can be deemed useful for treatment of COR.

This study provides evidence that CO<sub>2</sub> laser turbinotomy can positively influence the QoL of patients with COR; the most frequent expression used by these patients to identify their improvement was "the joy of being able to breathe through the nose once more".

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