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# LASERS IN ENDONASAL SURGERY

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The laser has a valuable primary and adjunctive role in the management of various sinus and nasal disorders.[3] This article discusses the safety of the laser unique to intranasal use, instrumentation for intranasal use, the type of pathology that can be treated, the energy dosage for that pathology, and the results that might be expected.

## LASER SAFETY

In any use of the laser for the management of otolaryngologic pathology, several safety precautions must be utilized. Both the surgeon and the laser operator must be familiar with the laser. Issues such as safety, energy dosage, fiber management, and instrumentation must be understood. Many of the general principles governing safe use of the laser endonasally are the same as those applying to laser utilization elsewhere in the body.

The surgeon and laser operator must communicate consistently and frequently about whether the laser is "on" or "off" and in regard to the wattage and exposure. The surgeon should clearly and succinctly state, "Laser on" (or "standby"), and the wattage and exposure time. The laser operator should repeat the instruction.

Proper signage outside of the laser suite must include a warning that the laser is being used, the wavelength, and the type of eye protection needed. Many surgeons and staff wear eye protection when the laser is being used in an open wound but opt not to wear eye protection when working in a closed cavity such as the nose, sinus, or oral cavity. Patient

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protection should include eye protection with goggles for procedures performed under local anesthesia or monitored sedation and moistened eyepads for procedures performed under general anesthesia.

When the laser is coupled with nasal endoscopes for use within the nose and sinuses, a proper eye safety filter is used and inserted between the endoscope and beam splitter or camera.

## ENDONASAL LASER INSTRUMENTATION

Many intranasal procedures with the laser can be performed with a headlight, laser safety glasses, a nasal speculum, and a laser fiber with appropriate hand piece. This is especially true for anterior nasal pathology and much of the surgery on the inferior and anterior middle turbinate. For most other intranasal and endonasal procedures, the nasal endoscope provides visualization for the surgeon. One of several laser hand pieces (Fig. 1) is used depending on the area to be operated on.

## ENERGY DOSAGE

Energy dosage is determined as in any other laser procedure. Spot size, wattage, and exposure time are all important.

Cutting requires high-energy density achieved with a small spot size, high wattage, and variable exposure, calculated by the following equation:

$$\text{Energy Density} = \text{Power} \times \text{Time/Area (watts/sec/cm}^2\text{)}$$

Coagulation requires a low-energy density achieved with a large (defocused) spot size, low-to-intermediate wattage, and variable exposure. Vaporization requires high-energy density achieved with an intermediate spot size, high energy, and variable exposure.

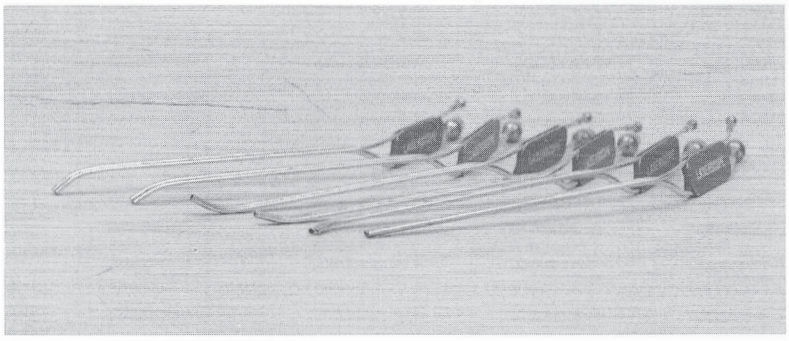


**Figure 1.** Various laser handpieces of differing angles allow the laser to be used within the recesses of the nose and sinuses.

## ENDONASAL PATHOLOGY

### Turbinate Dysfunction

Vasomotor and allergic rhinitis are common problems that can be challenging to manage. Medical management with antihistamines with or without decongestants and various nasal sprays is usually effective. Despite adequate medical management, nasal obstruction and congestion may persist. In these instances, laser photocoagulation is often an appropriate adjunctive or complete management option.

Fukatake[1] has described the use of the $CO_2$ laser for allergic rhinitis. The laser is used at 12 watts and 0.1 second at weekly intervals for 5 weeks to reduce the turbinate. In a group of 1000 patients, 46% had an excellent result, 34% a good result, and 20% no change.[1] In a previous report, Fukatake[2] described histologic studies which showed a layer of scar tissue forming beneath the submucosa. It is thought that the scar tissue prevents the turbinate from expanding when stimulated by external irritants. The laser probably decreases the number of goblet-secreting cells and the autonomic innervation of the turbinate.

The author has observed a series of 425 patients who underwent KTP/532 reduction of the turbinate for 2 to 4 years. Laser reduction was performed with the patient under local anesthesia. The power was set at 8 watts and continuous to cross-hatch the anterior two-thirds of the inferior turbinate. This allowed the nasal mucosa to regenerate, preserving a normal surface while creating a layer of scar tissue in the submucosa.[4] Of the 425 patients, 71.1% were asymptomatic with no nasal medications, and 20.2% were asymptomatic but required occasional use of nasal medications. The remaining 8.7% were no better. None were worse.

The laser seems to provide adequate turbinate reduction without crusting or atrophy. Healing is rapid and morbidity low. The laser improves the airway and reduces secretions in most instances.

### Vascular Disorders

Hereditary hemorrhagic telangiectasia is an autosomal dominant disorder affecting the smooth muscle of blood vessels. Bleeding frequently occurs from the nasal mucosa. The laser has been used to photocoagulate the telangiectatic vessels. It is not curative but, rather, controls the bleeding by either sealing bleeding vessels or creating a layer of scar over the vessels to toughen the surface and minimize trauma.

Both the Nd:YAG and KTP/532 laser have been used in treatment.[3,6,7] Both lasers have controlled bleeding by lessening the frequency and severity of epistaxis. Most of the patients have undergone laser photocoagulation using the KTP/532 laser because of its more superficial depth of penetration in comparison with the Nd:YAG laser.

The laser is used at a low-energy density of 1.5 to 3 watts with a defocused spot size and intermittent mode of 0.1 second on and 0.1 second off. This allows the greatest degree of coagulation. Patients are operated

on under general anesthesia to avoid the need for topical or injectable local anesthesia with vasoconstriction. This allows blood vessels to be easily seen, and there is little worry about aspiration of blood. Blood vessels are photocoagulated beginning peripherally and working centrally. If bleeding occurs, suction cautery is used briefly to dry the field, and then laser photocoagulation is continued. Approximately 70% of patients report a reduced frequency and severity of epistaxis 12 months after laser photocoagulation.

Chronic epistaxis is not an entity usually managed by laser treatment. On occasion, individuals will present with frequent epistaxis secondary to aggregates of blood vessels on the mucosal surface of the nose. Traditional cautery in the office does not control the bleeding, and therefore laser treatment is an option. The laser is used in the same manner as in the management of hereditary hemorrhagic telangiectasia.

## Nasal Polyposis with Eosinophilia

Nasal polyposis with eosinophilia is one of the most challenging problems facing the rhinologist. Patients frequently have asthma, aspirin sensitivity, or both associated with the nasal polyposis. The asthma is often more difficult to manage because of ongoing sinusitis, often secondary to the nasal polyposis.

Patients are treated with endoscopic sinus surgery followed by topical nasal corticosteroid spray. At the earliest sign of recurrence, systemic steroids are used. If systemic steroids are ineffective or must be used for a lengthy time, laser photocoagulation of the sinus cavity is undertaken.

The laser is used under nasal endoscopic control to photocoagulate the entire sinus cavity where polyposis appears. The power is set at 6 to 10 watts (depending on the depth of polypoid tissue) and the spot size slightly defocused and in an intermittent mode to cool the underlying tissue between laser bursts.

A total of 46 patients have been observed for 24 months (Table 1). Some of the patients have required medical management in addition to the laser photocoagulation. This medical management was often effective when it had previously failed.

Success was measured by determining the number of patients who either had no symptoms or improved symptoms either with or without

**Table 1.** KTP/532 LASER PHOTOCOAGULATION OF NASAL POLYPS WITH EOSINOPHILIA ($n$ = 46)

| | Follow-up = 24 Months | |
|---|---|---|
| **Outcome** | **Medical Management** | **No Treatment** |
| No symptoms | 15 | 7 |
| Improved | 17 | 1 |
| No better | 4 | 0 |
| Worse | 2 | 0 |

medical management. A total of 40 of 46 patients (86.6%) were in this category. Although this number is encouraging, it may decrease with longer follow-up.

### Intranasal Scarring

Nasal and sinus surgery can result in scar tissue formation which may or may not pose problems for the patient.[5] Scar tissue might involve ostiomeatal complex narrowing with or without obstruction, intranasal synechiae, narrowing of various ethmoid sinus air cells, or maxillary or sphenoid sinus ostia.

The KTP/532 laser can be used in a vaporization or cutting mode (8 to 12 watts and either continuous or intermittent depending on the area used) to remove scar tissue. If necessary, a spacer of Silastic or Gelfilm may be needed to prevent recurrence of the scar.

## POSTOPERATIVE MANAGEMENT

Most patients have some crusting and edema following nasal and sinus procedures with the laser. All patients are given saline nasal spray to be used at least six to seven times a day. Steroids and antibiotics have been used in the past but have not made a difference in the healing or postoperative discomfort. Patients are allowed to blow the nose gently about 1 week after surgery.

## References

1. Fukatake T: $CO_2$ laser and turbinate dysfunction. Presented at the XII International Symposium on Infection and Allergy of the Nose (ISIAN), Seoul, Korea, October 8–11, 1993
2. Fukatake T, Yamashita T, Tomoda K, et al: Laser surgery for allergic rhinitis. Arch Otolaryngol Head Neck Surg 112:1280–1282, 1986
3. Levine HI: KTP/532 laser for nasal sinus disease. Ann Otol Rhinol Laryngol 98:46–51, 1989
4. Levine HL: The potassium-titanyl phosphate laser for treatment of turbinate dysfunction. Otolaryngol Head Neck Surg 104:247–251, 1991
5. May M, Levine HL, Mester SJ, et al: Complications of endoscopic sinus surgery: Analysis of 2108 patients—incidence and prevention. Laryngoscope 104:1080–1083, 1994
6. Mehta AC, Livingston DR, Levine HL: Fiberoptic bronchoscope and Nd:YAG laser in the treatment of severe epistaxis from nasal hereditary hemorrhagic telangiectasia and hemangioma. Chest 91:791, 1987
7. Parkin JL, Dixon JA: Laser photocoagulation in hereditary hemorrhagic telangiectasia. Otolaryngol Head Neck Surg 89:204–208, 1981

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