State of the Art Laser Surgery

What is a laser?

LASER stands for Light Amplification by Stimulated Emission of Radiation. A laser produces a highly concentrated light rays that can ablate (vaporize) or seal tissue.

What is laser surgery?

The interaction of laser light with tissue provides a fundamentally different approach to surgery. In laser surgery, a highly focused laser beam efficiently vaporizes the living tissue. At the same time, it seals capillaries, small blood vessels, lymphatics, and nerve endings, with significant benefits to both patients and surgeons.

What is the most efficient soft-tissue surgical laser?

The most commonly used surgical laser is CO2 laser. Unlike some lasers, the CO2 laser wavelength (10.6 micrometer) is highly absorbed by soft tissues containing water. Because of their outstanding versatility and precision, CO2 surgical laser is the most efficient and dominant soft-tissue surgical laser in human and veterinary medicine since the 1960s. Many thousands of CO2 lasers are used daily around the world in various surgical specialties at veterinary and human medical establishments.

Laser surgery benefits for patients

**Less Bleeding** As it cuts, the laser seals small blood vessels. This drastic reduction in bleeding enables a number of surgical procedures that are not practical with conventional scalpel.

**Less Pain** The CO2 laser beam seals nerve endings and lymphatics, resulting in less edema and pain. The patient experiences a far more comfortable post-operative recovery.

**Reduced risk of infection** This is one of the unique features of the CO2 laser beam. It efficiently kills bacteria in its path, producing a sterilizing effect.

**Quicker recovery time** Reduced risk of infection, less bleeding, less pain and less swelling often allow the patient a far quicker recovery after the surgery.

Laser surgery benefits for surgeons

**Unique surgical capabilities** Laser surgery improves many surgical procedures by making them simpler and reducing risk. This enables surgeries that are not practical with conventional methods.

**Enhanced visibility of the surgical field** The laser light seals capillaries and small blood vessels as it cuts, thereby dramatically reducing bleeding. This results in a much clearer and drier surgical site.

**Increased precision and control** The focal spot size of the beam may be adjusted down to a small fraction of a millimeter or expanded for a much wider coverage. The laser power may be set for rapid removal of relatively large tissue amounts, or adjusted to remove only one cell layer at a time.

**Reduction of surgery time** The hemostatic effect of the laser beam and the improved visibility of the surgical field often reduce the duration of the surgery.
General surgery procedures:


"...laser surgery offers better hemostasis and visibility, less post-operative swelling, and decreased post-operative pain. In certain procedures, better hemostasis and visibility will reduce overall surgical time."

Timothy L. Holt, DVM and Fred A Mann, DVM, MS
"Soft Tissue Application of Lasers"

"The carbon dioxide laser is a very effective tool for treating diseases of the perianal region. The skin of the perianal region is thin and sensitive. The carbon dioxide laser offers a 'no touch' method of excising these lesions, which helps decrease postoperative discomfort and irritation. The carbon dioxide laser is very effective in controlling hemorrhage from vessels smaller than 0.5 mm. This is sufficient in controlling most hemorrhage caused from the rich blood supply of the perianal region. The perianal region is contaminated with bacteria. The carbon dioxide laser photothermally vaporizes bacteria, so that bacterial numbers are decreased, which helps reduce the risk of postoperative infections. These factors help the patient recover quicker and return to function sooner.

The light emitted from a carbon dioxide laser has a wavelength of 10,600 nm, which is in the far-infrared light spectrum. This wavelength of light is highly absorbed by water, creating a thermal effect. Because all soft tissues in the body are composed mainly of water, the carbon dioxide laser penetrates very shallow into tissue, and there is very little collateral thermal damage. This interaction makes the carbon dioxide laser a useful tool for incising, excising, and photothermally vaporizing soft tissue and allows for fine, controlled dissection of tissue. The axiom of 'what you see is what you get' applies to the properties of the carbon dioxide laser. Finally, the carbon dioxide laser seems to have a lower learning curve when compared with other types of lasers."

Bert A. Shelley, DVM, MS
"Use of the carbon dioxide laser for perianal and rectal surgery."

Ophtamology surgery procedures:


"The CO2 laser does have a valuable role for vaporization of eyelid masses, particularly when located adjacent to the medial canthus making scalpel excision and closure difficult; for treating diffuse eyelid papillomatosis; and for safely extending surgical margins after excision or debulking of neoplasms, such as fibrosarcoma and squamous cell carcinomaoft the eyelid, limbus, or nictitans."

Margi A. Gilmour, DVM, ACVO

ENT and oral surgery procedures:

"Carbon dioxide (CO\textsubscript{2}) lasers are used in oral surgery for precisely cutting or vaporizing soft tissue with hemostasis. CO\textsubscript{2} lasers intended for dental applications are CW lasers. The CO\textsubscript{2} wavelength is absorbed by the water content of oral tissues. Thermal necrosis zones of 100 to 300 lm at cut tissue edges are typical, providing better oral structure safety compared with other lasers (neodymium:yttrium aluminum garnet [Nd:YAG], argon, and diode), which may penetrate up to several millimeters. With the CO\textsubscript{2} laser, 'what you see is what you get' compared with the Nd:YAG laser where no immediately visible change appears in the tissue surrounding the zone of vaporization. With the Nd:YAG laser, it is difficult to estimate the true extent of thermal necrosis. This advantage of replacing traditional excisional techniques with CO\textsubscript{2} laser ablation permits removal of the damaged epithelium with as little as 0.1 to 0.2 mm of reversible thermal injury to the submucosa. CO\textsubscript{2} lasers are used for oral, soft tissue procedures, such as gingivectomy, gingivoplasty, frenectomy, and biopsy. Tissue vaporization is more efficient with the CO\textsubscript{2} laser than with other lasers discussed because of the direct absorption of this wavelength by water."

Jan Bellows, DVM
"Laser Use in Veterinary Dentistry"

**Dermatology surgery procedures:**


"The CO\textsubscript{2} laser proved to be an excellent choice for laser surgery because of the ability to limit the zones of damage to microsurgery with little to no collateral damage. This laser is the primary laser in use today in veterinary dermatology. The operator can easily control the device for use in three ways: skin incision, lesion excision, and ablation. It can be readily controlled for precise microsurgery or can be used for ablating larger lesions. Because of its high absorption by water, there is little to no collateral tissue damage with this laser when used properly. ...the ability for the operator to control the effect of the laser beam essentially to the area that you can see with no collateral damage, has led to wide use of this laser in many areas of medicine, including veterinary dermatology ..."

David Duclos, DVM
"Lasers in Veterinary Dermatology"