Laser and Radiosurgery in Veterinary Dentistry

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KEYWORDS

• Laser • Radiosurgery • Oral surgery • CO_2 • Diode • Therapy laser

KEY POINTS

- The CO_2 and Diode lasers are most commonly used in veterinary dental surgery.
- Radiosurgery is useful for incising and excising oral tissues.
- Therapy low level lasers help to decrease oral inflammation.

LASER AND RADIOSURGERY IN VETERINARY DENTISTRY

The laser unit produces light of a single color wherein all light waves are coherent, which means that each wave is identical in physical size and shape. Basically a laser is concentrated light focused into an extremely small spot delivering a large amount of energy. This monochromatic, coherent wave of light energy emerges from the laser device as an efficient source of energy. When the laser light hits an object, it reflects, transmits, scatters, or is absorbed. The surgical laser can be adjusted to incise, excise, vaporize (ablate), cauterize, or amputate oral tissues. One important difference compared with scalpel surgery is that hemostasis can be provided while the tissue is being incised.

Lasers are named for the material contained within the center of the device, called the optical cavity. The core of the cavity is comprised of chemical elements, molecules, or compounds (the active medium), which can be a container of gas, a crystal, or a solid-state semiconductor. One popular laser in veterinary dentistry uses carbon dioxide as a gaseous active medium. Other devices are solid-state semiconductor wafers made with multiple layers of metals or solid rods of garnet crystal grown with various combinations of other elements. For simplicity the semiconductor lasers are called diodes, and the crystal lasers are designated with acronyms such as Nd:YAG (neodymium-doped yttrium, aluminum, garnet), Er,Cr:YSGG (erbium, chromium-doped yttrium, scandium, gallium, garnet), or Er:YAG (erbium-doped

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yttrium, aluminum, garnet). This article will focus on the carbon dioxide (CO_2), diode, and therapy lasers and on radiosurgery as it applies to dentistry.

1. Diode and Nd:YAG wavelengths target the pigments in soft tissue and pathogens, and inflammatory and vascularized tissue.
2. CO_2 lasers interact with free water molecules in soft tissue and vaporize the intracellular water of pathogens.

Depending on the instrument's parameters and the optical properties of the tissue, the temperature will rise and various effects will occur. In general, most nonsporulating bacteria, including anaerobes, are readily deactivated at temperatures of 50°C. At 60°C, hemostasis can be obtained and inflammatory soft tissue present in periodontal disease can be removed. Soft tissue excisional or incisional surgery is accomplished at 100°C, wherein vaporization of intracellular and extracellular water causes ablation or removal of biologic tissue.

Differences in tissue content of substances such as water, protein, hemoglobin, and melanin can substantially influence the affect of a specific wavelength.

The cutting action depends on the type of laser and the targeted tissue. Generally, lasers operated in continuous mode cut comparably to a scalpel, whereas those in lower-pulsed modes (10–20 pulses/second) incise slower or rougher. For this reason, diode lasers used in contact mode often drag when making oral incisions.

CARBON DIOXIDE LASER (10,600 NM)

The water content of oral tissues absorbs the CO_2 wavelength (**Fig. 1**). CO_2 lasers are used in oral surgery for precise cutting or vaporizing soft tissue with hemostasis. Typically, "what you see is what you get" when using the CO_2 laser. Shallow thermal

Fig. 1. Twenty-Watt CO_2 laser. (*Courtesy of* Aesculight Luxacare, Woodinville, WA, USA; with permission.)