THE CO_2 LASER IN DERMATOLOGY

Dermatology was one of first disciplines to use laser therapy, presumably because skin is so accessible to laser energy. Laser devices emit light from various segments of the electromagnetic energy spectrum, and, on absorption by tissue, the laser energy is converted into thermal energy. The resulting heat alters the tissue both structurally and chemically, depending on the degree of heating. With rapid and extreme heating (100°C), the tissue is vaporized.

The carbon dioxide laser is the system most widely used in dermatology and other surgical disciplines.

The CO_2 laser emits invisible light in the far infrared portion of the electromagnetic energy spectrum. A low-intensity, visible red helium-neon laser beam is used as an aiming device.

DERMATOLOGIC USES

This technology has two dermatologic applications (*Table 1*). Vaporization, or airbrushing, is used to remove superficial lesions from the skin or for gradually tracing lesions out beneath the skin surface. When used for excision, the beam is reduced to its minimum possible diameter, so that it becomes a light scalpel.

In both uses, the wound remains dry but viable because the beam produces almost perfect hemostasis as it removes tissue. Lymphatic vessels are sealed spontaneously, which has a theoretic advantage in the treatment of malignant melanoma or squamous cell carcinoma where lymphatic infiltration may be a factor. The beam also seals or caps the ends of cutaneous nerves that are transected, resulting in minimal postoperative discomfort. Because there is little peripheral damage to surrounding tissue elements, the resulting wound has little inflammation and necrotic tissue to be sloughed. For excisional procedures, there is no need to touch the operative field.

Vaporization results in a plume of vapor and a fine film of carbon residue on the surface of the wound. The plume is a cloud of steam, tissue particles, and, in the case of infectious lesions, viable viral particles. The laser will eradicate fungi, bacteria, and yeast, but it will not rid the field of certain viruses, such as those that cause hepatitis and AIDS. The plume also has a noxious odor, so specially designed smoke evacuation equipment must be used. The surface of the wound also must be kept cleared of the carbon residue; otherwise, the laser energy will heat the carbon particles and the underlying tissue will be thermally coagulated rather than vaporized.

TABLE 1
DERMATOLOGIC APPLICATIONS FOR CO_2 LASER

Vaporization	Excision
Actinic cheilitis	Acne keloidalis nuchae
Angiofibroma	Keloid
Balanitis xerotica obliterans	Lesion with specific indications (infected, highly vascularized)
Basal cell carcinoma (superficial)	?Malignant melanoma
Epidermal nevus	Mohs surgery
Lichen sclerosus et atrophicus	Patient with specific indications (hypertension, anticoagulant therapy, pacemaker)
Lymphangioma circumscriptum	Rhinophyma
Myxoid cyst	Scalp reduction
Neurofibroma	?Squamous cell carcinoma
Portwine stain	
Rhinophyma	
Syringoma	
Tattoo	
Trichoepithelioma	
Wart	
Xanthelasma	

CO_2 laser therapy is particularly useful for patients who are hypertensive or are taking anticoagulants, for excision of tumors in highly vascularized areas, and for removal of keloids without recurrence. Laser therapy in the treatment of recurrent plantar warts has a 90% cure rate, compared to 40% with conventional methods. It is also useful in treatment of painful warts that appear in the nail area in immunosuppressed patients.

Laser vaporization is the treatment of choice for condyloma acuminata, achieving cure in one outpatient session, using local anesthesia. Tattoo removal also can be achieved in one sitting.

The previous treatment for actinic chelitis was 5-fluorouracil for three weeks, cryosurgery, or surgical excision of the lip. With CO_2 laser vaporization, this precursor to squamous cell carcinoma can be treated in the office in a few minutes. The wound heals in two to three weeks with no dressing, and the incidence of scar formation and distortion of vermilion is less than 1%.

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BIBLIOGRAPHY

Bailin PL, Ratz JL. Argon laser. [In] Roenigk RK and Roenigk HH, eds. Dermatologic Surgery: Principles and Practice. New York: Marcel Dekker 1988, pp 881-896.

Bailin PL, Ratz JL, Wheeland RG. Laser therapy of the skin: a review of principles and applications. [In] Bailin PL, Ratz JL, Wheeland RG, eds. Dermatologic Clinics. Philadelphia: WB Saunders 1987, 5(2) pp 259-285.

Ratz JL, Bailin PL. CO_2 laser. [In] Roenigk RK and Roenigk HH, eds. Dermatologic Surgery: Principles and Practice. New York: Marcel Dekker 1988, pp 865-879.