Health problem addressed

The CO2 laser is applied extensively in gynecology, genitourinary, plastic, dental, hepatic, orthopedic, and cardiovascular surgery and are considered the mainstay of laser neurosurgery. They are used for cutting, dissection, and coagulation of a wide range of tissues.

Product description

Devices that typically consist of a laser tube, a laser pump, a cooling system, an aiming laser, and a delivery system. A typical CO2 laser delivery system consists of a hollow articulated arm with mirrors set in each rotating joint so that the handpiece can aim the beam in any direction. The handpiece has a focusing lens to control spot size and focal length.

Principles of operation

CO2 lasers have two main modes of operation: continuous wave (CW) and pulsatile (e.g., superpulse, pulser). In the CW mode, the laser continuously delivers energy as long as the footpedal is depressed. This mode releases the highest average power, but it is the least precise of the operating modes. Pulsatile modes allow the laser to fire much shorter pulses than the CW mode. Superpulse emits pulses that are 200 to 1,000 microseconds (μsec) long; it is used when precise control is necessary. Pulser, a second type of pulsatile mode, emits energy for 2 to 25 milliseconds (msec). A newer, highly developed type of pulsatile mode is ultrapulse; the peak energy of each pulse in this mode lasts longer than that of superpulse, subjecting tissue to a substantially greater amount of energy per pulse.

Operating steps

These devices are intended to create surgical incisions, to excise or vaporize deeper tissues (e.g., to remove tumors) after incisions, to coagulate very small bleeding vessels, to vaporize surface anomalies (e.g., warts), and to excise or vaporize tissue accessible by both rigid and flexible endoscopes.

Reported problems

Serious eye injuries have resulted from exposure to direct or reflected laser light; many of these injuries occurred because eye protection was inappropriate. Fire is a risk, particularly during laser surgery in the area of the head and neck. Oxygen and nitrous oxide can enter the surgical site or collect in the oropharyngeal cavity and increase the flammability of nearby materials. Other risks include excessive bleeding resulting from the CO2 laser’s inability to effectively coagulate blood vessels.

Use and maintenance

User(s): Surgeon
Maintenance: Medical staff; technician; biomedical or clinical engineer
Training: Initial training by manufacturer and manuals

Environment of use

Settings of use: Hospital; clinic; physician office
Requirements: Stable power source; smoke evacuation

Product specifications

Approx. dimensions (mm): 350 x 400 x 1190
Approx. weight (kg): 49
Consumables: CO2 compressed gas
Price range (USD): 13,019-75,000
Typical product life time (years): 7
Shelf life (consumables): Variable

Types and variations

Free-flowing tube; sealed tube