

Laser Therapy Units: Facts and Fallacies

In light of its ability to combat pain, muscle injury and inflammation, laser therapy (LT) is gaining prominence in practices across the country. The scientific literature on this topic is proliferating rapidly, shining light on LT's panoply of mechanisms and applications.

In fact, so many papers are appearing annually that the journal *Photomedicine and Laser Surgery* now offers a monthly compilation to keep evidence-based practitioners abreast of new papers.¹

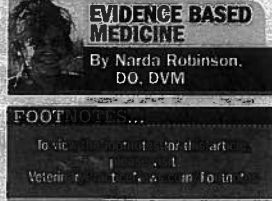
The popularity and promise of LT come at a price, however. Literally speaking, the monetary outlay for a Class IIIb laser (1 milliwatts (mW) to 500 mW) starts in the low thousands while a Class IV laser (>500 mW power) can approach 20 grand.

More figuratively, the "promise" of laser, as one vet quipped, "to cure everything except death," sparks skepticism among those who have heard before about gadgetry with guarantees of glowing results.

Which Is Right for You?

As more makers crowd the marketplace, laser manufacturers highlight unique features of their products. Depending on the power of the unit they sell (i.e., Class IIIb or Class IV equipment), the prospective buyer can expect to receive an earful of information about the superiority of either the lower or higher powered machines.

Members of the Class IIIb camp criticize the higher-powered Class IV units as having the potential to burn patients. When utilized correctly, Class IV lasers don't, however,



"cook" patients, nor do they "burn a hole right through them" as some Class IIIb proponents have stated.² Still, one should exert extra caution while treating highly pigmented patients or those with neurologic injuries who cannot provide appropriate feedback if their tissues are overheated.

Class IIIb aficionados emphasize that most of the research on LT pertains to Class IIIb lasers. Class IV manufacturers retort that research is being published on newer, stronger therapeutic light sources; several studies have been done or are in process at veterinary medical institutions.

Furthermore, Class IV folks respond that they are honoring practitioner requests for machines with more power, now with wattage in the double digits (e.g., 10 W). Higher wattage delivers more joules per square centimeter (i.e., the laser "dose") in a shorter amount of time; therefore, treatments require less time to complete.

On the other hand, shorter illumination time may not prove beneficial in the long run. Rodent research from a collaborative study at Harvard and MIT evaluated the effectiveness of LT on inflammatory arthritis.

Longer illumination times outperformed shorter sessions, regardless of total fluence or irradiance.³ [Total fluence is de-

finied as the total number of photons absorbed; irradiance refers to the power density, calculated as the power in watts divided by the area in square centimeters (W/cm²).]

Case Types Matter

The ideal laser would deliver sufficiently powered light with a wavelength capable of initiating photobiologic activity in targeted tissue(s). The wavelength of the emitted light determines the depth of penetration into the tissue, in accordance with the absorption spectra exhibited by chromophores (photoacceptor molecules) in living tissue.⁴

Deeper tissues such as nerves, tendons, bones, cartilage, skeletal muscle, cardiac muscle, and central nervous system structures do respond to LT. However, instituting reparative processes in internal organs depends on laser's ability to access those areas, either directly through the tissue, or indirectly through the circulation and/or activation of neural reflexes.⁵

So a veterinarian aiming to directly influence spinal cord injury with LT might opt for a robust device that reaches further into tissue via longer wavelengths (830 nm - 980 nm), rather than a machine better suited to treat surface wounds with 650 nm light and lower power.

With respect to tissue regrowth, a commonly heard argument against Class IV devices holds that higher energy inhibits healing while laser of a lower but sufficient dose

stimulates it. Many who take this position tout the "Arndt-Schulz Law" to describe the dose-dependent features of LT. A flaw in this 19th century premise is that the Arndt-Schulz law predates LT and was in fact applied to the chemical activity of toxic agents on yeast.⁶

Arndt-Schulz and LT

More commonly referred to as "hormesis," the Arndt-Schulz law thus describes substances, but not light's, capacity to inhibit biological processes at high concentrations and stimulate them with minute amounts. Its extrapolation to LT has not been substantiated unequivocally.

More Considerations

The construction of the applicator(s) attached to the LT device may impact delivered dose. Does the hand piece bring the beam close to the patient? A distance between the light source and the patient increase photons dissipate due to reflection and divergence; this translates into more scatter and therefore less LT for the patient.

The wand should rest gently on or close to the patient. Laser companies are now producing applicators with changeable heads that allow the practitioner to alter the focus or other features of the beam and better tailor the treatment to the patient's needs.

Veterinary medical schools and national conferences are now offering instruction in laser therapy. The North American Association for Laser Therapy will hold its annual conference in Milwaukee on Sept. 22-24. It includes a preconference session on veterinary applications along with lectures on the science and clinical significance of LT.

Furthermore, a recent study that looked at different power settings of laser on calcaneal tendon repair questions the claim that higher power densities impede tissue repair.⁷ While dosage guidelines from the World Association of Laser Therapy recommend the maximum power density for Achilles tendon treatment of 100 mW/cm², this study found that power densities up to 3.5 W/cm² produced greater amounts of type III and type I collagen.

Clearly, as research on laser proceeds, commonly accepted parameters may require revision.

It's easy to get caught up in the quest for more power and fancier systems. One should not lose sight of the possible benefit of low-tech light from light-emitting diodes for some applications.

Don't Overlook LEDs

LEDs differ from laser in that the light is non-coherent; i.e. of different wavelengths. Laser beams, on the other hand, are coherent in that they occupy one wavelength of the visible or non-visible spectrum. Laser beams are also collimated meaning that their rays follow a nearly parallel path with minimal divergence.

LEDs have been dismissed all too often due to their non-coherent and non-collimated properties. However, a new study on the analgesic effects of LED versus laser for orthodontic pain showed that LED therapy outperformed laser, although the LEDs were stronger. The calculated energy dose from the

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