Turning photons into results

Shining new light on laser therapy

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For The Education Center

Laser therapy has had many contradictory and confusing names such as cold-laser therapy, low-level laser therapy, Class III laser therapy, and Class IV laser therapy. Unfortunately, these terms describe the devices being used rather than the effect they have on tissue. Terminology based on the effects therapy lasers have on tissue is more descriptive and accurate.

The term most descriptive of the complex mechanisms and the cascade of physiological events that follow laser therapy is photobiomodulation. Photobiomodulation describes the way photons interact with the target tissues. It accurately describes a nonthermal interaction within the tissue, dependent on endogenous chromophores that absorb the energy in photons and elicit photophysical and photochemical events.

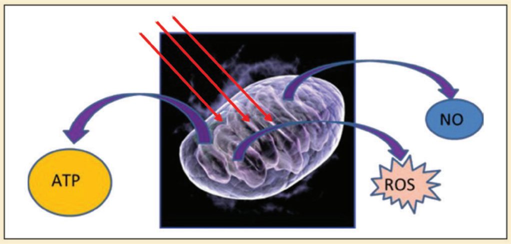
Indications

Noninvasive and nonpharmacological photobiomodulation accomplishes three main things: pain reduction, inflammation modulation, and healing process acceleration in soft tissue and bone. These effects make photobiomodulation therapy indicated in a wide variety of conditions.

Add photobiomodulation therapy to standard protocols for surgical patients as part of pain management. Treat acute painful and inflammatory conditions such as pyotraumatic dermatitis during the initial treatment. Treat soft tissue trauma—such as burns, wounds, snakebites, and musculoskeletal injuries—both on initial presentation and throughout the entire healing process. In addition, laser therapy can be an extremely important component in management of more chronic conditions, including arthritis and other degenerative joint diseases, anal sacculitis, stomatitis, sinusitis, and lower urinary tract disease.

Photons, tissue, and photobiomodulation

Key to photobiomodulation is the absorption of photonic energy by chromophores within cells. The chromophore cytochrome oxidase is concentrated within mitochondria; it absorbs the energy in photons and delivers it into metabolic processes including the Krebs cycle. This results in increased adenosine triphosphate production, as well as increased levels of nitric oxide and reactive oxygen species, important in cellular signaling. Metabolic activity increases and cell growth and reproduction are accelerated.



Other complex mechanisms occur at same time. There is an increased release of endogenous opioids, and beta-endorphin levels rise. There is a direct effect on nerve tissue producing suppression of nociceptors and an increase in stimulation threshold. Neuron impulses are reduced, reducing pain.

A marked and rapid effect on inflammation is due to modulation of chemical mediators with a decreased release of pro-inflammatory substances such as prostaglandins. A transient vasodilation results in increased circulation and oxygenation of the tissue. In addition, there is a similar effect on lymph vessels, activating the lymph drainage system and reducing edema.

Significant stimulatory effects on the healing process are induced. As with the anti-inflammatory effect, chemical mediators are involved, with an increased release of pro-healing cytokines. Angiogenesis is stimulated, fibroblast replication and migration increases, collagen production increases, and wound contraction is accelerated by the conversion of fibroblasts into myofibroblasts.

A similar effect stimulates bone healing. Angiogenesis is stimulated at the fracture site, accompanied by an elevation of osteogenic factors in the damaged tissue, resulting in accelerated development of new bone and faster fracture healing.

Predictable and reproducible results

Several treatment parameters help achieve predictable and reproducible results. An appropriate wavelength of light must be used (800 to 1,000 nanometers), and it must be delivered to the tissue in an appropriate way, with an appropriate dose.

A therapeutic dose of energy must reach the target tissue. Target doses are expressed in J/cm^2. A joule is a quantity of energy; 1 joule is the energy of 1 watt (W) of power delivered for 1 second. Target doses express how much energy, in the form of photons, to deliver to a given area of tissue to induce photobiomodulation.

1 joule (J) = 1 watt (W) per second

When treating conditions that are more superficial in tissue (those we can see), recommended starting doses are 3 to 4 J/cm^2. When treating deeper tissue conditions (those we cannot see), higher target doses are required. To ensure enough photons reach deeper target tissue, more photons must be delivered to the tissue surface to overcome superficial absorption by nontarget chromophores. Recommended deep tissue target doses are in the 8 to 10 J/cm^2 range for companion animals and can easily be much higher for larger patients.

Superficial tissue 3 to 4 J/cm^2
Deep tissue 8 to 10 J/cm^2

Protocols for treatment of specific conditions are available in the software in better quality, veterinary-specific therapy lasers. These software-defined treatment protocols have proven very effective when used to treat appropriately sized areas of affected tissues. With scientifically calculated software protocols that include appropriate dose calculations, treatments result in predictable and reproducible results.

New software developments allow for the input of patient-specific characteristics: body type, skin color, and coat length and color. The software uses this information to deliver a protocol that ensures a correct dose is delivered with maximum photon penetration, and that every patient is treated with the correct dose, for every condition, every time.

Shine your light with laser therapy

Today's veterinary practice can turn photons into results. With the use of modern, up-to-date therapeutic lasers, practitioners can improve their quality of care and the quality and quantity of patients' lives, and excite the entire practice team and clients with this advanced, cutting-edge technology.

For more than a decade, veterinarians and practice teams have joined together to shine new light on their patients with laser therapy. As laser therapy enters its second decade in veterinary medicine, the light has never been brighter. ●

Dr. Godbold, Jr., has a general practice background and has been teaching colleagues about laser technologies since 2001. He is a contributing author and co-editor of Laser Therapy in Veterinary Medicine - Photobiomodulation. *In high demand as a laser trainer, he has spoken at more than 550 workshops, wet labs, and continuing education courses throughout the world.*

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