Veterinary Practice News

The use of therapeutic laser continues to expand in veterinary medicine

With virtually no side effects and minimal contraindications, low-level laser therapy treatments are gaining popularity in veterinary medicine

May 14, 2021

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Low-level lasers—most specifically non-thermal uses of lasers—were found to have profound biological effects on tissue, including increased cell proliferation,[1] accelerating the healing process, promoting tissue regeneration, preventing cell death,[2] pain relief,[3] and anti-inflammatory activity.[4]

Unlike most common procedures, the information on veterinary laser therapy comes from research in humans, and more uses and medical indications have been transferred to veterinary medicine.

Low-level laser therapy is used before, during, and after common surgical procedures to improve post-operative outcomes.
Photos courtesy Animal Home Veterinary Hospital

Picking the right color

Therapeutic lasers use light of a specific wavelength to either stimulate or inhibit biological function that promotes repair and analgesia. Nearly all therapeutic devices utilize either red (620 nm to 750 nm) or near infrared (750 nm to 950 nm) wavelengths. Also, it is now understood a desired biological effect is associated with the wavelength.

Red wavelengths tend to activate photochemical effects in the body like reducing inflammation and promoting healing. Infrared wavelengths produce greater photophysical changes that affect the nerve conduction in peripheral nerves and inhibit the nociceptors to mitigate pain.

Blue wavelengths (450 nm to 495 nm) are becoming more popular for their known antimicrobial action in treatment of infections, dermatological issues, and use during dental procedures.[5] Additionally, the use of concurrent multiple wavelengths is starting to demonstrate beneficial effects that are stronger than what a single wavelength can produce alone.

When and why power matters

The type of response (tissue repair or pain relief as controlled by the biphasic dose response) depends primarily on the wavelength of the light, which controls the penetration depth, and secondly, on the amount of energy or power of the device. That is, the light must be able to penetrate the skin and an adequate amount of energy must be absorbed to have an effect. Therefore, wavelength and power are related.

Confusion sets in when determining how much power is necessary. Higher output of power means a desired dose (measured in joules) will be delivered at the tissue surface more quickly. It may seem logical to utilize high-powered lasers to reduce treatment time; however, the dose at the surface does not equate to the dose that reaches a target inside the body.

Red light reduces inflammation and infrared wavelengths are beneficial in mitigating pain.

The amount of light that penetrates the skin is dependent upon the characteristics of the wavelength and not the power driving it. So, while hundreds of joules may be exposed to the skin, only a fraction of that energy may penetrate beyond it. This, in turn, may not shorten the treatment time, as the dose at the target still needs to be sufficient.

We know we can improve on the efficiency of power and wavelength with several new observations. Any energy not transmitted is either lost due to reflection or is transformed into heat by the skin.

It has been established that longer wavelengths penetrate better into deeper muscle and bone, while shorter wavelengths (red) will penetrate less deeply and be more suited for superficial conditions. Choosing appropriate wavelengths based upon the ideal target selection can reduce time needed by delivering a greater proportion of the light into the body.

While a very low-powered device may be able to deliver some energy to a desired target, adequate accumulation is needed to trigger a biological reaction. If the device is too low-powered, it could take an impossibly long time to reach the necessary dose. Conversely, greatly increasing the power may increases the risk—eye safety, skin safety, device regulatory controls—or create an unwanted thermal effect. Simply put, penetrating the skin barrier cannot be compensated by a higher power output; a balance of power as it relates to the wavelength is needed. Typical outputs seen in devices range from 100 milliwatts to several watts.

Clinical benefits: Laser therapy has been successful in helping animals recover from illnesses, injuries, and surgical procedures. Its effects on pain control, resolving inflammation, and promoting healing have been demonstrated clinically for a variety of conditions.

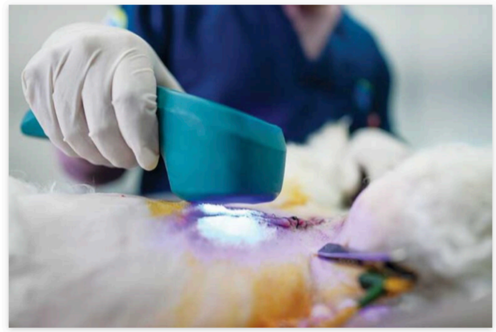
Relieving pain: The direct effect of laser therapy at the peripheral nerve endings of nociceptors prevents the nerve from reaching thresholds, similarly to opioids causing postsynaptic inhibition. This inhibitory effect can create analgesia in as little as 10 to 20 minutes following a treatment.[6] Therefore, it can be helpful in managing fractures, post-operative pain,[7] ligament sprains, and muscle strains. Laser therapy also encourages vasodilation and activation of the lymphatic drainage system, thus reducing swelling.

Controlling inflammation: Although the standard of care for many inflammatory diseases is immunosuppressive agents, such as corticosteroids with undesirable toxicities, laser therapy offers a unique approach by being noninvasive and incurring minimal side effects. These anti-inflammatory mechanisms and the noninvasive nature of laser therapy suggest that it would be used effectively for animals suffering from chronic disorders such as osteoarthritis[8] and inflammatory diseases[9] such as otitis, stomatitis, or dermatitis.

Healing wounds: In general, wounds heal in an orderly complex process consisting of three overlapping phases: inflammatory reaction, proliferation, and remodeling. Recent studies in veterinary medicine show the potential benefit of wound healing using laser therapy, including accelerated wound healing.[10,11] Early use of the laser is associated with reduced inflammatory infiltration intensity and increased proliferation and early epithelialization.

Recently, antimicrobial blue light has been the subject of several clinical wound trials, the results of which could demonstrate the viability of this technology as a clinical treatment to reduce different resistant bacteria[12,13]

Laserpuncture: Laserpuncture (laser acupuncture) is the term commonly used for the application of a low-level laser sequentially to acupoints. It is a simple, effective, noninvasive method showing reliable promise in managing pain.[14] Some of the main benefits of this type of stimulation are that it can be done without needles, treatment times are short, and the procedures are simple to learn.



Blue light is now being utilized for the reduction of infection, during dental procedures, and for common dermatological conditions.

Perioperative care: Most dental and surgical procedures, especially a neuter or spay, create some degree of acute inflammation, followed by a tissue repair phase and the need for post-procedure pain management. Several studies suggest that pretreatment of the surgical site can improve post-operative outcomes, especially scar formation[15] when applied prior to the procedure, and help minimize postprocedure pain.[16]

Therefore, a surgical candidate should be treated up to one hour before surgery (to avoid the vasodilation caused by the laser), possibly during the procedure with antimicrobial blue light, and postoperatively. The neural blockage that occurs 20 minutes following the procedure will remain present at the time of the surgery and recovery.

Rehabilitation: Laser therapy can be a great adjunct to a comprehensive rehabilitation program.[17] Compared to many other modalities, it can be easily integrated into the plan of care. A vital component and goal of the rehabilitation program is the proper management of pain; if pain is under control, the patient will be able to return to function by building strength and range of motion.

Applying laser therapy to painful joints and muscles before and sometimes after therapeutic exercise can help to minimize discomfort during and after the exercise. Laser therapy is an extremely valuable modality to achieve the goals of the veterinarian and the patient.

Expanding role of at-home use

Some conditions treated with laser therapy may require owners to bring their pets into the office on a semi-regular basis. In more chronic cases, ongoing treatment may be needed to mitigate or manage symptoms. This can create an undue burden of transporting the animal to a veterinary office, finding time in a hectic daily schedule, and possibly leading to the pet's anxiety of repeated visits to the office. Even for the most dedicated pet owners, the benefits may outweigh the burden.

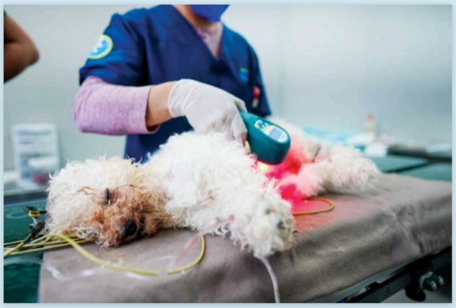
There are new options for at-home laser therapy. These devices can offer therapy to be performed by the owner in the comfort of their home. Home care can accelerate the injury recovery and reduce pet anxiety and the number of trips to the clinic. By adding laser therapy as a part of the pain management program, this may reduce the time the pet remains in pain and reduce the usage of medications.

Veterinarians or their staff can direct owners in the proper use of the device, including operation and cleaning of the device in just several minutes. Devices can be rented on a daily or weekly basis, with follow up visits scheduled to check the progress of the patient or a telemedicine consultation.

In conclusion

With virtually no side effects and minimal contraindications, low-level laser therapy treatments are gaining recognition and popularity in veterinary medicine. Studies show promise in assisting with the most common ailments and procedures seen in the veterinary clinic, including managing pain, reducing inflammation, healing wounds, in post-operative and rehabilitation settings, and more. The simplicity and safety of this modality offers an additional benefit of at-home treatments for pets. Laser therapy promises veterinarians a new tool to provide safe, noninvasive care to keep pets healthy and put pet parents at ease.

THE HISTORY AND SCIENCE OF LASER THERAPY



For more than a century, it has been known that light has special properties. Used in conjunction with or in place of medication to manage pain, inflammation, and wound healing, veterinary laser therapy has gained acceptance in recent years as veterinarians see its benefits for pets.

However, this was not always the case. There was an inherent lack of scientific understanding behind the basic method of action, but also which parameters are necessary to deliver consistent and reliable outcomes. With only poor scientific evidence available in the early years of introduction, light therapy was labeled as an alternative form of therapy, similar to acupuncture or massage therapy, and therefore did not gather mainstream adoption.

Rooted in an early discovery by Endre Mester, laser therapy describes the unique use of light energy to activate innate biological processes of the body to treat various diseases and disorders. With a new paper published on light therapy nearly every day, the last five years has fielded an explosion of new information and insight.

Unlike other medical laser procedures, it is now understood laser therapy is a nonthermal process where the light absorption causes a chemical change rather than being ablative. Light energy from lasers and light-emitting diodes positively affects the healing rates of injured tissue by providing effective analgesia for acute and chronic pain. When a photon of light is absorbed by an endogenous chromophore (molecule that absorbs light) in a cell, an electron in the chromophore is excited and jumps from a low-energy orbit to a higher-energy orbit. This stored energy fuels the acceleration of the electron transport chain and reestablishes oxidative phosphorylation. The increase in energy in the form of adenosine triphosphate (ATP) can be used by the living system to perform various tasks, such as cellular metabolism, microcirculation, promoting oxygen availability, and modulation of the inflammatory process.

The key to optimization of the phototherapeutic response is the proper selection of device parameters. While there may be a considerable difference among devices, successful outcomes are based on two main considerations: the wavelength (identified in nanometers and denotes the color) and the power (energy, measured in watts or milliwatts).

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Iker Asteinza Castro, MVZ, MSc, Dipl. Small Animal Medicine and Surgery, has more than 20 years' experience and owns two reference veterinary hospitals in Mexico City, Mexico. He lectures on laser therapy in international congresses, as well as the benefits of laser therapy in the everyday practice.

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