Getting Consistent Outcomes with Laser Therapy Just Got Easier

Technological advances continue to make treatment of many conditions in veterinary medicine more effective and efficient, and laser therapy is no exception.

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A half-century ago, Hungarian physician Endre Mester discovered that photobiomodulation therapy, or PBMT (formerly known as low-level laser therapy), had positive effects on hair growth and superficial wound healing in a mouse model.[1] Since then, advances in our understanding of the basic science of PBMT have influenced the development of laser technology innovations and practical applications of these devices to treat a variety of conditions in veterinary medicine, particularly pain and orthopedic conditions.

Over the years, hundreds of in vitro studies have characterized the doses needed to achieve a cellular response with light. While these studies offered a baseline for the amount of laser energy needed to achieve results at a tissue level, the development of definitive protocols has been slower to evolve as scientists must consider the wide range of contributory factors for various conditions.

The use of best-in-class PBMT devices allows clinicians to apply higher doses of light safely at the skin surface and to reach deeper tissues.

Parameters for Laser Success

One of the most important advances in PBMT was the recognition that optimal therapeutic parameters for transcutaneous dosing (laser light applied to the surface of the skin with an applicator) should be based on the dose of light energy reaching the intended target tissues[2] (intraarticular surfaces, muscles, nerves, etc.). Historically, effective energy density (fluence) doses were based on cell culture studies, but these lower doses proved ineffective when clinicians began using them to treat tissues located deeper within the body.[2,3] The recognition that these negative results may have been due to underdosing in vivo rather than to the modality itself was a huge advance.

To achieve optimal clinical results, sufficient light must reach the target tissue. Various parameters are considered when calculating dose[2,3]:

- Wavelength (nm) of light being used
- Fluence (J/cm^2)
- Irradiance (W/cm^2)
- Size and depth (in cm^2) of the treatment area and the optical properties of any tissues being treated
- Application technique (on-contact vs. off-contact as well as operator differences)

Much of the published research either does not report these parameters or reports them inaccurately. Closer examination of the dosimetry used in a study is often required before conclusions can be drawn about the relevance of the results. Fortunately, more research is being published every day that allows for continual improvement in our approach to PBMT dosing and our ability to achieve optimal clinical results for our patients.

Advances in Therapeutic Devices Make Dosing Easy

Advances made in the devices we use to apply PBMT in clinical practice have allowed us to address these dosimetry challenges. Compared with older, lower-power devices, the use of higher-power class IV devices allows clinicians to apply higher doses of light safely at the skin surface and to achieve adequate total doses of light for deep tissue musculoskeletal conditions (especially pain) within a more efficient time frame.

More advanced software in laser devices allows for designing and updating automatic protocols, which calculate doses for treatments ranging from superficial wounds to deep tissue swelling or painful conditions. While these protocols should never replace a thorough understanding of how to customize your own doses safely and effectively for each patient's individual condition, they serve as a convenient guide for starting out.

Recent studies of light transmission in the spinal canal of dogs,[4] as well as a review of effective parameters used in previously published in vivo studies, have also shown that light losses due to reflection from the surface of the skin can be minimized. This allows an increase of up to 67% in light transmission to deeper tissues by treating in firm contact with the skin compared with off-contact application. The issue of incidental light absorption by non-biologically active chromophores (such as melanin and hemoglobin) must also be addressed[3] in order to optimize light penetration to deeper tissues.

The Benefits of Smart Software and Smart Delivery

Certain laser manufacturers have consistently improved their technologies to address the challenge of optimizing clinical treatment parameters in practice. Companion Animal Health's CTX-IQ laser with SmartCoat Plus technology calculates patient-specific treatment parameters based on the laser therapist's input of patient characteristics and treatment conditions. This specialized software makes adjustments not only for coat and skin color (taking melanin into account) but also for increased tissue depth (overweight vs. thin body condition) or unshaven or thicker haircoats. A patented deep tissue applicator designed for the type of on-contact treatment mentioned above also compresses tissue and blanches superficial blood vessels to deliver even more light to deeper tissues.

Lastly, when combined with the Companion Animal Health Empower IQ Delivery System, the laser therapist can take advantage of real-time recommendations for appropriate treatment head selection as well as visual and haptic feedback on treatment delivery speed (CTX-IQ is the only laser currently on the market with this capability). This ensures consistent treatments among therapists within the same veterinary practice and provides guidance beyond the initial training for any staff members new to laser therapy.

Looking to the Future

This is an exciting time for the use of advanced modalities in the treatment of many conditions in veterinary medicine. Through further research on the optimal parameters for PBMT as well as the continued development of PBMT devices, we will only continue to advance patient care and wellbeing in veterinary practice.

References

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