



**MEET THE
AUTHOR**

Renaud "Ren" Houyoux, LVT
Companion Animal Health,
Newark, DE

Photobiomodulation Therapy: Healing at the Speed of Light

This article discusses some of the basics of photomodulation therapy (PBMT), such as the veterinary nurse's role, dosing, promoting a fear-free environment, and integration into practice. Photobiomodulation therapy remains an evolving aspect of medicine. Because we now have powerful units using appropriate wavelengths, which enable clinically significant results, the next few years will eclipse use of the modality over the last few decades. The savvy technician would be wise to remain fluent in the current developments and trends.

Renaud "Ren" Houyoux studied at the Bel-Rea Institute in Denver, Colorado. Since then, he has practiced in multiple states at both general-practice and specialty-level facilities. His areas of interest include photobiomodulation therapy, regenerative medicine (platelet-rich plasma and stem cell therapy), and rehabilitation therapy. He teaches, writes, and speaks on these topics as the veterinary support specialist for Companion Animal Health, the veterinary division of LiteCure LLC.

BACKGROUND AND EVOLUTION

From the original concept of phototherapy to today's application of PMBT as a medical modality, we have come a long way in understanding how light affects organic tissues.^{1,2} Some early civilizations believed light affected living tissues. Others revered the sun for its healing properties. Even the early hominids may have made a correlation between light exposure and sunburns.

Sir Isaac Newton discovered that a prism separated white light into visible wavelengths. From that point on, we began to better understand the properties of light and consider the notion of light therapy. In the 1960s, the scientific community started to develop what has become today's PMBT. Endre Mester first studied the properties of light as a form of electromagnetic radiation that produces a measurable physiologic response to specific wavelengths of light. He noted significant hair regrowth when skin was exposed to near-infrared light.³ The scientific community has transformed this observation into a complicated yet flexible modality for varying species and myriad conditions.⁴

Because further development of this modality is possible, we must enable its continued evolution. Failure to provide leading-edge medical care breaks our primary tenet: "First, do no harm." Inaction is as detrimental as applying ineffective treatments. Because powerful units now enable efficient delivery of treatments that use appropriate wavelengths of light to enable deep tissue exposure, this modality will evolve greatly in the next few years. There are several manufacturers in the



FIGURE 1. Typical treatment with client present and patient relaxed.



VITAL KNOWLEDGE

Veterinary nurses, as operators, are responsible for roughly 95% of PMBT.

industry, each with units that have specific properties, advantages, and restrictions. Regardless of the unit chosen (as long as it is valid), any practitioner who has adopted PMBT is still an early adopter.

The next 5 years will go far beyond the last 10. Our understanding and applications of the modality are approaching a tipping point. When (not if) this point is reached, it will be an exponential leap for PMBT. The most challenging aspect of PMBT is its lack of integration in the field and teaching institutions. When that challenge is overcome, use and incorporation into standard of care will pick up speed. Once research has been completed, the results will speak for themselves.

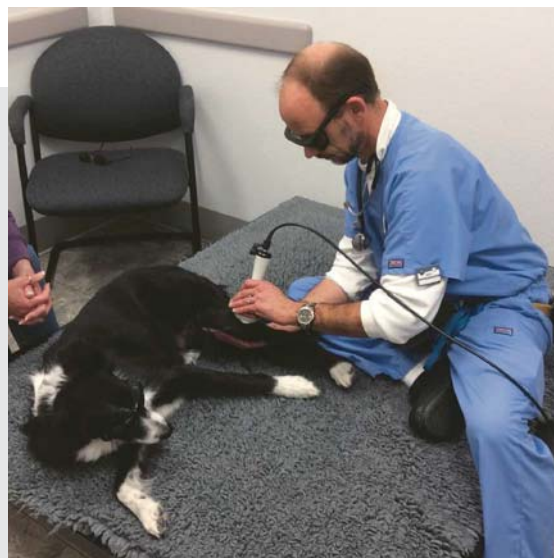


FIGURE 2. Correct on-contact treatment technique showing hand piece with the deep tissue applicator being held correctly: perpendicular to and in contact with tissues, with application of a moderate amount of tissue compression.

ROLE OF THE VETERINARY NURSE

This is a unique time to be a veterinary nurse. We are responsible for applying a budding modality that is not yet fully understood or used. Operators must share their successes and failures so that we can help develop PBMT. Veterinary nurses, as operators, are responsible for roughly 95% of PBMT (**FIGURE 1**). The doctor's involvement is diagnosing and ordering medical care, then periodically rechecking patients through treatment phases or resolution. If the patient is painful, has inflammation, or has incurred tissue disruption, it is a likely candidate for PBMT.⁵⁻⁹

DOSING CONSIDERATIONS

Overdosing a patient is probably nearly impossible. An adverse event would more likely arise from operator error. Just as with any other aspect in medicine, we must use the tool correctly (**FIGURE 2**). Some argue that a biphasic dose response, supporting the Arndt-Schultz principle, has been seen in vitro. Nurses should be aware of this research, but our patients are not cell lines in a Petri dish. Doses derived from in vitro research must be extrapolated and optimized for in vivo use.

I have seen the benefit of delivering treatments with a higher than usual fluence to patients not responding to standard protocols. This does not mean we should make our patient laboratory experiments but rather should know the flexibility of the modality. In the past decade, the advised fluence (dosage in J/cm² rather than mg/kg) has increased for superficial tissues, deep tissues, and nonhealing wounds. Understanding of the energy needed for a significant clinical response and sustained

effects has also grown. This upward trend will continue until we fully understand exposure of organic tissues to electromagnetic radiation in the near-infrared spectrum.

Veterinary nurses should consider thinking in terms of J/cm³ instead of J/cm². Our patients are 3-dimensional, not a flat surface area. Tissue inhomogeneity in sites being treated and specific patient characteristics will result in varying photonic scattering, refraction, and transmission throughout tissues. Variance of tissue inhomogeneity leads to certain hurdles for treating different species, as well as animals within each species. These challenges will be met and overcome as our understanding increases.

REDUCING PATIENT ANXIETY

PBMT offers a therapeutic tool and, as the name implies, is meant to have a therapeutic effect. Performing these treatments is as therapeutic for the operator as it is for the patient (**FIGURE 2**). The patient will quickly habituate because no pain occurs when treatments are designed and carried out appropriately. PBMT is a perfect fit for the current initiative in decreasing patient fear in a medical setting. This is a hot topic and is quickly gathering momentum.

EXPANDING THE SCOPE

Novice operators will at first rely on preset protocols for specific conditions, such as pyotraumatic dermatitis, osteoarthritis (**FIGURE 3**), feline lower urinary tract disease, pain/strain, and coelomic disorders. Another common application is establishing laser-puncture points as an alternative



FIGURE 3. Patient receiving treatment for osteoarthritis. Note the use of range of motion when a joint is involved.



FIGURE 4. Intraoperative (enterotomy site) treatment.

to invasive needling. The applications of PBMT are as varied as the species treated with it.

As operators' experience grows, so will their skill set and ability to better assess patients while focusing on symptoms due to inflammation, pain, and tissue disruption. Cases I have assisted with include generalized demodicosis; laryngeal paralysis; asthma; pneumonia; pancreatitis; degenerative myelopathy; rattlesnake envenomation; palliative hospice care; parvoviral enteritis; gingival hyperplasia; dental pulpitis; and perioperative, intraoperative, and postoperative (**FIGURES 4 AND 5**)/convalescent care. In each case, attaining reasonable expectations for that patient was the goal. Treatment design and delivery must be responsive to the patient's specific needs.

EXPLAINING PBMT TO CLIENTS

The veterinary nurse has a key role in all aspects of PBMT. We must explain the modality to clients, design and deliver treatments (**FIGURE 1**), schedule further care, and deal with unexpected setbacks. We don't need to be experts in laser physics. In explaining the therapy, keep it simple, brief, and within the scope of common knowledge: PBMT is a type of light interaction with tissues; an analogy can be made to photosynthesis. The tissues and type of light differ, but both PBMT and photosynthesis demonstrate a similar process in different settings.

Beyond this simple explanation lies more technical details. The PBMT delivery platform operates in the therapeutic window of light (wavelengths of 700 nm to 1100 nm), specifically the near-infrared spectrum.



FIGURE 5. Postoperative (spay) treatment.



PBMT is a perfect fit for the current initiative in decreasing patient fear in a medical setting.

This accounts for tissue absorption characteristics and enables optimal exposure to target tissues instead of incidental absorbers (e.g., hemoglobin, oxyhemoglobin, and melanin). PBMT normalizes cellular functioning when there is tissue disruption. Energy is delivered in the form of electromagnetic radiation to target chromophores (cytochrome-C oxidase) in the mitochondria. This radiation is nonionizing (unlike x-rays) and will not cause tissue degradation. The chromophores absorb this photonic energy and modulate it into chemical energy for cellular response, eliciting a cascade of physiologic events that result in tissue remodeling and normalization.

Energy is neither created nor destroyed; it only changes form—this is a universal truth. PBMT is just one example of energy modulation. For clients with a scientific background or medical experience, savvy operators will adjust their conversation and level of complexity in explaining PBMT.

GROWTH AND CONTROVERSY

PBMT permits tissue remodeling; it does not just cause a palliative response by attenuating symptoms. While PBMT is unique because of its noninvasive, nonsurgical, nonpharmaceutical properties, it is best used as an adjunct. PBMT does not replace proven medical protocols. Although a minority of practitioners are using it, recognition is growing as applications expand. For example, the American Animal Hospital Association and the American Association of Feline Practitioners included PBMT in their pain management guidelines.¹⁰

Although the research and validation for the modality are rapidly growing, finer points remain controversial, such as whether a specific pulsing



Used appropriately, PBMT is a powerful tool that delivers safe, effective treatments and helps the body better heal itself.¹⁴

frequency can lead to a specific tissue response.^{11,12} Because the science has proven valid and more manufacturers are producing new units, consensus in the community is difficult and inconsistency remains.

NETWORKING

Veterinary nurses should network with other operators to share experiences and results, as well as knowledge of delivery platforms for varying conditions. Through networking, veterinary nurses can also share information about the user interface and software of each unit, their experience with achieving consistent results, and the amount of training and support from the manufacturer. Lastly, networking helps veterinary nurses learn to be fluid in their treatment techniques.

Sharing knowledge among veterinary nurses (**FIGURE 6**) enables us to improve patient care and give credit to a modality still widely misunderstood and underused. All career veterinary nurses know this truth: We follow a calling, not a job. We have a direct, positive impact in the lives of not only our patients but also their human companions.¹³

FUTURE DEVELOPMENTS

We still have our work cut out for us in developing the modality and improving patient care. We do this by developing treatments for conditions not currently being treated. Prudence is always required, but if reasonable scientific reasoning leads to new applications, we should face the challenge.

We must understand that if we want to walk on water, we have to step off the boat. This is not a “leap of faith”—it is a calculated move into

the unknown based on scientific reasoning and logical deduction. Used appropriately, PBMT is a powerful tool that delivers safe, effective treatments and helps the body better heal itself.¹⁴

Regardless of the amount of time we have in practice, we should always be students in the art of medical care. We must learn to use new tools and improve on current modalities. Isn't this why we call it medical “practice”? **TVN**

References

1. Anders JJ, Lanzafame RJ, Arany PR, et al. Low-level light/laser therapy versus photobiomodulation therapy. *Photomed Laser Surg* 2015;33:183-184.
2. National Library of Medicine. MeSH database. Photobiomodulation. ncbi.nlm.nih.gov/mesh/?terms=photobiomodulation. Accessed November 30, 2016.
3. Mester E, Szende B, Gärtner P. [The effect of laser beams on the growth of hair in mice]. *Radiobiol Radiother (Berl)* 1968;9:621-626.
4. Riegel R, Godbold J. *Laser Therapy in Veterinary Medicine: Photobiomodulation*. Ames, IA: Wiley; 2017.
5. Chung H, Dai T, Sharma SK, Huang YY, Carroll JD, Hamblin MR. The nuts and bolts of low-level laser (light) therapy. *Ann Biomed Eng* 2012;40:516-533.
6. Farivar S, Malekshahabi T, Shiari R. Biological effects of low level laser therapy. *J Lasers Med Sci* 2014;5:58-62.
7. Fulop AM, Dhimmer S, Deluca JR, et al. A meta-analysis of the efficacy of laser phototherapy on pain relief. *Clin J Pain* 2010;26:729-736.
8. Karu T. Primary and secondary mechanisms action of visible to near-IR radiation on cells. *J Photochem Photobiol B* 1999;49:1-17.
9. Pryor B, Millis DL. Therapeutic laser in veterinary medicine. *Vet Clin North Am Small Anim Pract* 2015;45:45-46.
10. Epstein ME, Rodanm I, Griffenhagen G, et al. 2015 AAHA/AAFP pain management guidelines for dogs and cats. *JAAHA* 2015;51:67-84.
11. Hashmi JT, Huang YY, Sharma SK, et al. Effect of pulsing in low-level light therapy. *Lasers Surg Med* 2010;42:450-466.
12. Karu TI, Pyatibrat LV, Ryabykh TP. Nonmonotonic behavior of the dose dependence of the radiation effect on cells in vitro exposed to pulsed laser radiation at 820 nm. *Lasers Surg Med* 1997;21:485-492.
13. Jergler. Staff embrace laser therapy. *Vet Pract News*. November 14, 2013. veterinarypracticenews.com/staffs-embrace-laser-therapy. (accessed May 10, 2018)
14. Mandel A, Hamblin MR. A renaissance in low-level laser (light) therapy - LLLT. *Photon Lasers Med* 2012;1:231-235.

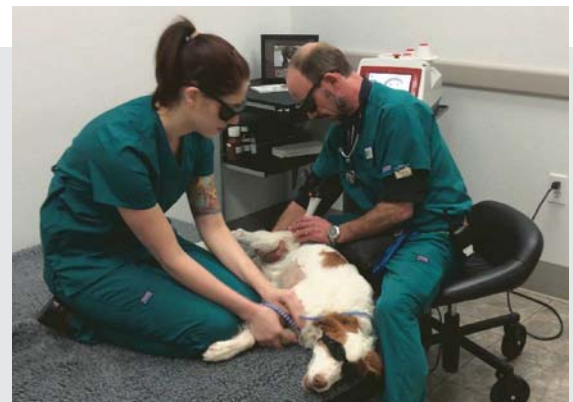


FIGURE 6. Hands-on training.