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The Evolution of Laser Therapy

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For The Education Series

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The laser has been used for a variety of medical applications ever since its invention. The most common uses have been for surgical, ophthalmic and cosmetic procedures. These applications have mostly taken advantage of the laser's ability to ablate or "vaporize" specific tissues.

Applications for lasers used in a non-ablative therapeutic mode for tissue healing have also been used for many years, yet have not made the same impact as their more powerful counterparts. This is starting to change and veterinarians are playing a large role in the development and acceptance of laser therapy.

The first report of laser therapy was found in the 1960s in an experiment performed in Hungary by professor Endre Mester.** Mester was investigating the effects of laser light on tissue, particularly whether exposure could cause cancer. He shaved the hair of mice and exposed them to various levels of 694 nm radiation from a ruby laser. He found that there were no adverse effects caused by any of the laser parameters but noticed that some of the exposure levels caused more rapid hair growth than the control.

The field of medical lasers rapidly expanded since these early days. Surgical lasers were some of the first to be integrated into fields such as dentistry, plastic surgery, ophthalmology and veterinary medicine.

Low-level lasers have been used for therapeutic applications for some time. The FDA first approved laser therapy in 1996 for the adjunct treatment of carpal tunnel syndrome. There have been thousands of published studies showing the effects of laser therapy, including cellular changes and many specific clinical applications.

Early therapy lasers had very low output power. Most of the first studies were performed in vitro, and these studies led to the creation of the term "cold laser." The results of the studies, in which cells were directly exposed to laser energy in a petri dish, were questioned as to whether heat was the cause for some of the effects being observed. Scientists took extensive measures to separate experimental variables and proved that thermal effects were not the mechanism of cellular changes.

As a comparison, a surgical laser system delivering 10 watts of power to a 0.4mm spot may employ a power density of approximately 8,000 watts/cm2. Conversely, photobiomodulation lasers use power densities in the range of 0.1 to 5 Watts/cm2.

This is achieved by either a low-power (Class 3) laser with a small spot size, or a higher-power (Class 4) laser with a much larger spot size. The large beam size and the advanced delivery systems being used with most of the Class 4 lasers, such as the Companion Therapy lasers, make these devices extremely safe and easy to use.

The major difference between these two systems is that the lower output unit will treat small, discrete points and the higher power unit can cover a larger treatment area. With the higher-power laser, the clinician delivers the desired dosage over a much greater area, ensuring the site and source of pain, as well as biomechanically associated structures, receive an appropriate therapeutic dose. The ability to treat a large area in a shorter amount of time provides for more comprehensive treatments and more consistent, predictable outcomes.

One of the most important parameters in treating a condition with laser therapy is the dosage. Dosage is represented by the amount of energy (Joules) delivered to a specific area (cm2). For the device with lower output power, the treatment probe is held in one spot for a period of time. The dosage is calculated as the output energy (the output power multiplied by the time treated) divided by the area of the spot size.

The dosage applied to an area is dependent on the depth of the tissue to be treated. A wound will be treated with a relatively low dosage because the affected tissue is superficial, typically around 2 J/cm2.

When treating deeper tissue such as a back or a hip, larger dosages on the order of 7 to 10 J/cm2 will be needed. This is a fairly simple concept, as there are many cells, or chromophores, within tissue that absorb or scatter laser light. The initial energy of the beam decreases as the amount of tissue increases.

Depth of penetration is not a new concept and has been studied for years, as it is important for all medical laser applications. The important thing to understand is how deep a therapeutic dosage will reach. This effective depth depends on the amount of light you start with and its wavelength, as well as other factors like hair color, hair length, body part and body type.

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Today's scientific laser community discourages the use of the term "cold laser" as it is not descriptive and not the appropriate term for therapeutic laser applications.

"Photobiomodulation" is the scientific community's term for therapeutic laser effects. It is differentiated from other medical laser applications, such as those which cause a photothermal response, as does a surgical laser. Photobiomodulation works via a photochemical response. The ranges of energy density used for photobiomodulation lasers are orders of magnitude less than those of surgical lasers.

Whether you are using a Class 3 or a Class 4 laser, recommended dosages will be very similar. The size of the treatment area is where the greatest difference in treatment technique occurs.

It wasn't until the past five years that laser therapy has made a major impact in veterinary medicine. The main reason for this acceptance in veterinarians' offices is the advent of higher-powered therapeutic lasers with dramatically improved efficacy.

The consistent positive outcomes and ease of use are the major reasons for this acceptance. The lower-power units may achieve good results when used on certain conditions, with the correct treatment protocols and appropriate treatment times, by a skilled clinician with exceptional diagnostic skills and anatomical knowledge.

Veterinarians in North America should be proud for leading the way in embracing this advanced modality and utilizing it in the treatment of a variety of conditions.

Sharing cases, both successes and failures, will allow the continued success of this technology and resulting outcomes. You have inspired studies in conditions such as nerve regeneration, an area with significant implications in many areas of medicine. These studies are now being published and the results are remarkable.

Evidence is also what is being observed by you and your peers in practice. Talk to them; listen to their firsthand experience. This is an exciting technology, and working together, we can all help to assure it reaches its maximum potential in helping patients. ●

Dr. Pryor is a founder and the CEO of LiteCure LLC in Newark, Del. He is published in the areas of chemistry, physics, laser development and application, as well as laser applications in medicine. Dr. Pryor has been an investigator in many research studies sponsored by the National Institutes of Health, the U.S. Department of Defense and the National Institute of Standards and Technology.

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