Is it Time to Invest in Class IV Laser Therapy?

By Bryan Stephens, PhD, and Phil Harrington, DC, CMLSO
For the Education Series

Since the first Class IV laser therapy booth appeared at the 2006 North American Veterinary Conference in Orlando, the modality has become arguably the fastest growing one in the veterinary profession.

Why is everyone talking about laser therapy? Is it all hype? Why have more than 3,000 practices invested in it?

To understand Class IV laser therapy’s rapid growth, one needs to recall practice trends of six years ago. Multi-million dollar marketing campaigns targeting pet owners transferred purchases of medications, food and products from veterinary practices to online and big-box pet stores. Similar direct-to-consumer campaigns focused on pharmaceutical solutions to pain management problems. These trends caught the attention of educated pet owners, which affected clinic revenue. The profession recognized this threat and developed renewed appreciation for sustainable practice-based service revenue, which could only be lost through competition from other practices.

Clinical Considerations

Class IV laser therapy does not treat conditions. Rather, it stimulates the body’s inherent healing mechanisms via a process called photobiomodulation or biostimulation.

Pet owners searching for pain management solutions for older pets had begun to seek non-pharmaceutical, non-surgical solutions. Class IV therapy lasers provided the solution with a simple three- to eight-minute non-invasive treatment.

Veterinary professionals and pet owners saw a positive response in one to four treatments.

The science behind this light-based biostimulation has been researched for years, but most studies were in vitro and done with low-powered lasers needed for cell cultures. Class IV laser power provides the same therapeutic dose (4 to 10 J/cm2) but to a larger volume of patient tissue, and stimulates pain relief in deep joints and tissues of animals.

The American veterinary profession understood biostimulation and began looking beyond pain management. Early adopters discovered accelerated wound healing responses for soft tissue, bone and infection. Many have seen dramatic post-surgical resolution for orthopedic and soft tissue surgical cases.

Some Class 3b laser (<0.5 watts) proponents inaccurately contend that Class 4 laser power is unsafe and burns patients. Based on the number of installations, it is estimated that 1,560,000 animals have been safely treated with Class IV therapy lasers in the USA.

Business Considerations

K-Laser USA of Franklin, Tenn., brought an interesting clinical and business solution to the forefront in January 2006. It encouraged practices to offer a pain-management service performed by nursing and technical staff.

The service required three to six visits, with chronic cases receiving monthly or quarterly single-treatment boosters. The average U.S. charge was $25 to $50 per treatment.

Efficient technical staff could perform four to six treatments per hour, resulting in doctor-level revenue at technician costs. Time with the pet owner allowed staff members to answer client questions, lift a lip and discuss dentistry and educate about geriatric exams or other important services the practice offered.

Is 2012 Your Year?

Manufacturers estimate that 2,000 veterinary practices will implement Class IV laser therapy this year. In choosing a vendor, understanding the technical specifications is imperative. But Steve Jobs and Apple Inc. demonstrated that corporate culture can be equally important.

Implementation and training will ensure safe, effective treatments. Training designed by laser-accredited professionals must be based on standards from the medical and science community, rather than vendor-created laser training academies.

Selecting a Device

Wavelength. The “therapeutic window” is the region between the peaks of melanin and water’s absorption where sufficient penetration is possible. All lasers in this range (700-1000 nm) will be useful to some extent. Some companies offer multiple and selectable wavelengths for more effective targeting.

Continuous Wave (CW) or Pulsed. Different tissue types respond better to different frequencies. It is important, therefore, to have a laser that has the ability to deliver the same dose at different frequencies to stimulate the most comprehensive healing.

Power. This defines the amount of energy emitted from a laser per unit time. For a given wavelength, and with knowledge of the optical properties of the tissue to be irradiated, power is the principal quantity that determines both penetration depth and duration of treatment.

To deliver the proper treatment, a technician selects species, body part, indicator and patient size.

Spot Size. The output spot size is important for two reasons: It determines the power density, which is the most important parameter of laser therapy; and Not every ailment is the same size. Having the ability to change your spot size to fit the need of the specific treatment is crucial.

Pre-set Programs (Multi-Frequency Protocols). Different ailments are better treated using different power, wavelength, frequency and treatment time settings, and so the technical versatility of the machine needs to be matched by a software platform that allows a simple way to identify and select the most appropriate settings.

Training and certification. These are not only important for safety, but also to get optimal clinical and financial results. A company that sells a laser without full implementation and training for you and your entire staff is doing you a disservice.

R and D

In the last few years, the knowledge base for laser therapy has grown by leaps and bounds. Granted, clinicians pioneered this movement with very general hypotheses and virtually unguided protocol “guestimation.” We are now getting a solid grasp on the underlying mechanisms and identifying the optimal treatment parameters.

Continued research and development of this modality is important and will come in the form of case histories, implementing standardized and definitive clinical trials, and quantifying millimeter accurate dosimetry of laser treatment sessions.

This Education Series article was underwritten by K-Laser USA of Franklin, Tenn.
Lasers Promote Faster, Stronger Wound Closure

By Bryan J. Stephens, Ph.D.
For The Education Series

Wounds and dermatology issues represent perhaps the widest variety of ailments in veterinary practice, both in origin and complication.

From an acute burn to a chronic lick granuloma, from an ischemic ulcer to a dehiscent surgical site, no two wounds will be alike. Compound this variation with different histologies and enzyme over/under-expressions; then throw bacterial or fungal infections on top of all that; now plan for a dog gnawing at it constantly or a horse sleeping in a dirty stall.

Needless to say, having one modality that functions well throughout this gauntlet of variation is invaluable. Laser therapy has documented success treating each corner of this wound healing domain, with particular success (over other modalities) in contaminated wounds and infections.

Through increased cellular oxygenation and metabolism, lasers promote fibroblast proliferation, collagen regulation and a host of positive enzymatic changes that lead to faster and stronger wound closure. Simultaneously bringing more oxygen to anaerobic fungi and bacteria, lasers can provide anti-microbial protection.

Unfortunately, the job is not finished when the wound has been disinfected and closed. Scarring, both internal and external, can lead to a host of problems for the animal.

In joints, for example, a post-surgical scar can lead to limited range of motion as well as chronic arthritis. A scar on an internal organ can affect the functional recovery. Fortunately, the fundamental nature of laser therapy can reduce this risk.

At the core of every wound there is a region that has a very high concentration of collagen, through which there is minimal blood flow. After a time, the fibrotic cross-linking of this collagen matrix denies any nutrients to the central cells, and they become dormant, never to be fully healed. Laser therapy counteracts this process in two ways.

First, laser will increase the micro-circulation via angiogenesis through the matrix, vasodilation and increased overall blood perfusion. Dozens of papers have demonstrated this effect, some through histology reports of mast cell degranulation and prostaglandin increases, others through thermography and laser speckle flowmetry, but most notably Kubota (Lasers Med Sci 2002, 17:146–153) and Uozumi et al. (Lasers Surg Med 2010, 42:568–576). These papers, among others, have shown an immediate as well as a lasting increase in localized blood flow.

With this increase of blood flow and nitric oxide concentration comes a subsequent increase in cellular oxygenation. This phenomenon alone is well known to speed up the wound closure and repair processes (in fact, the entire negative-pressure modality is based on this), but laser therapy goes one step further.

There is profound evidence that laser’s interaction with cytochrome oxidase in the mitochondria leads to more rapid redox cycle and ultimately an increase of ATP synthesis (Karu et al. Photomed Las Surg 2008, 26, 6:593–599). Once the cell is introduced to and has burned its oxygen-fuel into chemical energy, all of the cellular compartments will begin to function, and the cells that were previously nutrient-poor and dormant will self-regulate their collagen, reducing the breadth and rigidity of the scar.

Of course other modalities are specifically suited to aid in the healing process of a particular type of wound based on the histological and enzymatic profile of a given patient. But the fundamental action of laser therapy makes it perhaps the most versatile piece of equipment a general practitioner can have. Neither the origin of nor the complications that arise from any wound a veterinarian faces (malignant cancers aside) will exclude the potential benefits of laser therapy.

For a full bibliography of case histories, fundamental mechanism papers and literature metareviews of wound healing and other applications of laser therapy in veterinary medicine, contact the author directly at bstephens@k-laserusa.com.

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Stimulating Micro-Circulation with Laser Therapy

By Bryan J. Stephens, Ph.D.
For The Education Series

The target for an effective laser therapy treatment is not any particular pathology itself, but rather stimulation of appropriate cell components that enhance the body's natural repair mechanisms.

These natural functions are not only extremely numerous, ranging from protein synthesis to enzyme secretion, from cell signaling to physical movement, but also highly cell-type dependent. Any attempt to directly target one of these specific enzymes is difficult and fundamentally unnecessary.

If instead cellular metabolism, specifically the cell's ability to use oxygen to create energy, can be stimulated, the functionality of all its natural processes will be enhanced.

To do so, we have to introduce more oxygen, the principal fuel for aerobic organisms. The only way to get oxygen and nutrients to the cells for processing and waste products like lactic acid and carbon dioxide away from the cells is through the blood. Generating local circulation, both input and output of blood, is one of the primary mechanisms of laser therapy.

Blood pressure determines the rate at which blood flows throughout the body. Obviously, it would help if the animal got up and ran around the office to increase its heart rate and blood flow, but for a lame dog, that’s not an option. When animals have conditions in the extremities, blood flow is poor so we need a way to make better use of the local flow.

In the capillaries, blood flow is regulated through microscopic pressure and thermal gradients. It is not simply temperature elevation, but rather the creation of temperature differences that is of primary importance.

Real-World Example

Applying a hot pad will temporarily increase circulation, but only because that pad has a higher temperature relative to the body’s ambient temperature. After a few minutes, the body’s temperature will plateau (be-cause it does not want to live at the hot pad’s temperature), and it will employ several mechanisms attempting to counteract the applied heat (Vogel J. Biosci. 2005, 30(4) 449-460 & 581-590).

Applying a hot pad for 20 minutes then removing it for 20 minutes is a useful technique for boosting blood flow throughout the body. Obviously, it would help if the animal got up and ran around the office to increase its heart rate and blood flow, but for a lame dog, that’s not an option. When animals have conditions in the extremities, blood flow is poor so we need a way to make better use of the local flow.

In the capillaries, blood flow is regulated through microscopic pressure and thermal gradients. It is not simply temperature elevation, but rather the creation of temperature differences that is of primary importance.

Quick Physics

Therapeutic laser moves at the speed of light, and contrary to popular lore, does not lose energy as it propagates. Though its direction may change, a photon of infrared radiation will travel at the speed of light until it is completely absorbed in one event. A beam of photons will “lose power” only in the sense that its constituent photons will continue to be absorbed until the number of photons (not the energy or speed of each) eventually diminishes.

Water molecules in the cells absorb light energy in the therapeutic laser wavelength range. Water is a very simple molecule chemically, and when it absorbs a photon of infrared radiation, all of the energy gets converted to heat.

The bonds that connect the hydrogens to the oxygen start to vibrate and all of that energy becomes heat. (Contrast with ionizing radiation such as ultraviolet and X-rays; these photons can break molecular bonds. Non-ionizing radiation does not have enough energy per photon to break bonds and the only effect is gentle heating.) The cell is made up of more than 80 percent water, so targeting water with radiation is the most efficient way to produce the temperature gradients that will initiate blood-flow.

The water molecule is very small compared to the cell at large. After an absorption event, there is a local hot spot in the cell relative to the rest of the cell around it. This causes a local temperature gradient, which also creates a pressure gradient, along which blood will flow more readily. With more absorption events there are more temperature gradients, and local micro-circulation increases dramatically (Ozumi et al. Lasers Surg Med 2010, 42:566-576).

How is this any different from ultrasound or electrical stimulation?

These modalities send either sound waves or electricity through the body in a very uniform manner. Only the smooth attenuation of the sound waves or interface reflections between different tissue types determines any heterogeneity of the deposited “dose.” Therapy lasers do the job better.

Zooming out one level, random interference of coherent laser light will form what is called a “speckle” pattern that creates mini “hot and cold” spots within the laser beam. Cells, with water as the main thermal conductor, can dissipate heat very quickly, on the order of milliseconds. Pulsing a laser beam can allow these temperature gradients to form not only spatially (due to speckle) but also temporally, and on a time scale that corresponds with the natural thermal dissipation properties of the body.

Enhancing local micro-circulation is the first step; not just input of blood, but through-put. This is one reason your laser-using colleagues have success treating both ends of the spectrum. In a condition like neuropathy, where the blood vessels are constricted, not enough blood gets to the nerve endings and pain results. But it also works on contusions and edema where there is already enough “dirty” blood present, full of toxins that need to be flushed away from the site.

Circulation is certainly not the end of the road when it comes to how laser therapy benefits the body, but it is a necessary and important step toward biostimulation.

For a more complete set of references or to learn more about how laser stimulates cellular metabolism after micro-circulation is increased and oxygen gets to the affected cells, contact the author directly at bstephens@k-laserusa.com.

This Education Series article was underwritten by K-Laser USA of Franklin, Tenn.
Change Is Inevitable; Profitability Is Optional

By Ronald E. Whitford, DVM
For The Education Series

The only constant in life is change; witness the veterinary profession over the past 50 years. Change has involved all facets of practice from species to quality and scope of medications and available treatment modalities. Reluctance to stay abreast of changes results in an increased chance of becoming obsolete in today’s competitive environment. This is especially true with the relative stagnation generated by an increased number of practices vying for the same limited pet population.

To understand today’s problems, one must look back to the inception of veterinary medicine in the United States. Initially the profession’s minds and hands were not emphasized when price was placed on veterinary services. These services limit competition because of the conversion from selling products at the veterinary clinic. At that time, “value” was defined as “convenience” at least as much as the cost of the product.

Now times have changed and a down economy has generated more interest in cheapest pricing rather than value-added services that may cost the consumer a little more.

The survival of the today’s small animal veterinary practice depends on the conversion from selling products to selling services. Simply handing the client some stuff is easier than taking the time to educate the pet owner on appropriate needed services.

Selling services results in a higher profit margin than selling products. Services are unique for each practice and cannot be compared as easily as a product that can be bought from other vendors. One must play by the rules of retailing, not the rules of professional service fee setting.

Major retailers work on very low profit margins and must be excellent managers. Few veterinarians have the interest or expertise to compete on these low profit margins.

Today’s veterinary practice could continue to sell products, but must question the impact pricing of products has on the perception of value for veterinary services. Could this be part of the reason for the increasing client perception that veterinarians are overpriced? It certainly is not from our current service fees, which truly are the most value to the pet owner when all medical and dental fields on the human side are compared.

Another major problem is that approximately 70 percent of all veterinary services provided are related to preventive care, which is much easier for the pet owners to “shop.”

Wellness exams, lab screening, vaccinations, spay/neuters, routine dental cleanings, flea control products and heartworm preventives are perceived to be the same at all veterinary practices. Pricing becomes a major factor any time a service or product is perceived to be the same or have no difference in outcome.

An emerging strategy for practice survival is diversification of services provided, thereby offering a competitive advantage. These services limit competition because of time, expertise or cost of equipment needed. Laser surgery once was limited to no more than one per city due to the above requirements. However over the last 10 years, it has become a competitive disadvantage to not offer this service.

Class 4 laser therapy is one of the new modalities stepping up to the front as a service that has tremendous potential to help pets while at the same time help the practice. It is drug free, surgery free and perceived by the public as a professional service now used commonly in human medicine.

Thousands of published studies demonstrate its clinical effectiveness. Clients love it because they can be participants by being with the pet during the procedure and even wearing laser safety glasses to watch what is going on. Most pets relax during the procedure, silently telling the owner it is not painful.

Laser therapy works by increasing circulation, drawing nutrients to the area, and reducing swelling, muscle spasms, stiffness and pain. I have seen excellent results on tendinitis, back pain, chronic wounds, MRSA infections, lick granulomas and after ACL repair.

In my practice, marketing has been very simple. I simply state that the pet needs Class 4 laser therapy as part of the best treatment veterinary medicine has to offer. It is not optional. Frequently I will be discussing the procedures needed while a pet is in the next room receiving a Class 4 laser therapy treatment from our technician.

On Saturday mornings, we often take clients and pets back to the treatment area to decrease waiting time. We may have as many as four tables in that area occupied by pets and owners being worked up. Frequently a Class 4 laser therapy treatment will be going on for other clients to observe from a distance. I call this passive marketing.

Fees may be charged on a per-treatment basis but I have found it best to offer a package of five treatments with a small discount over the individual treatment cost.

When first introduced, Class 4 laser therapy units were perceived as quite expensive. As competition has grown, the cost has decreased so that most practices can afford them.

The most important thing to remember is that once the unit is purchased (which can be written off in one year under current tax rules), there is no major continuing cost such as reagents needed for lab equipment. In addition, the procedures are performed by your techs, meaning there is no additional labor cost as they are there all day anyway.

Veterinary practices adapting to change and looking to the future will consider adding services such as Class 4 laser therapy.

Dr. Ronald Whitford is based in Clarksville, Tenn., and has been in private practice for 40 years. In addition to daily practice, Dr. Whitford provides on-site practice management consultation evaluations for practices all over the United States.

This Education Series article was underwritten by K-Laser USA of Franklin, Tenn.
An Early Adopter of Class IV Therapy

By Phil Harrington, DC, CMLSO
For The Education Series

Dan Core, DVM, of Airline Animal Health and Surgery Center in Bossier City, La., was an early adopter of Class IV laser therapy.

Tell us about yourself, your background and how you became interested in laser therapy.
I graduated from the Louisiana State University School of Veterinary Medicine in 1981, started my own practice in 1986 and started another practice, my current one, in 2005.

Our clinic is state of the art. It is 12,000 square feet, full service and I have two associate veterinarians and a staff of 15.

I became interested in CO2 laser surgery and purchased my first unit in 2000. Shortly after I opened my current clinic, the first therapy lasers became available in 2006. It was very interesting to see the research being done in laser therapy. It was being done on cell and tissue cultures, so it made sense to me that to treat, let’s say, a big dog’s hip, that I’d need a higher powered therapy laser.

I bought my first therapy laser in March 2006. It quickly became an integral part of our practice.

Describe the training supplied for you and your staff.
The company provided the training, a four-hour presentation that covered why we use it, how we use it, safety—everything was covered. Two years ago, I upgraded to a newer unit, and again the company representative did a first class job, spending an afternoon with us, doing a lot of hands-on work with the laser.

The staff became very familiar and comfortable in using it. I wanted them to know the benefits, to be believers just as I was. Clients are going to ask the staff questions about laser therapy, so I wanted them to answer the questions. I invited all my staff to treat their own animals with it, and they could see the improvement.

What are the top five conditions you treat with Class IV laser therapy?
I use it on every incision we make, except when I am dealing with cancer or thyroid. We’ll usually do just one laser treatment post-surgically, but if I know I’ve got a case where it will be traumatic, such as a hit by car or a hip, we will do one treatment pre-surgery also.

We do a lot of orthopedic surgery. We do cruciates, medial patellar luxations, intervertebral disc, and we have estimated just from what we see that our patients recover from orthopedic surgery eight to 14 days quicker since we have implemented therapy laser.

Other conditions we treat with therapy laser include every neuter and spay, degenerative joint disease, canine hip dysplasia, intervertebral disc, back pain, all of the musculoskeletal and neurologic conditions we use it on all types of wounds. This includes bite wounds, trauma, snake bites—because we live in the South we have a lot of snakes.

We also do a lot of ear work, since we are in the Red River Valley, which is a very infectious region. We have tons of fungus and mold, so we see lots of ear disease. We treat lots of allergic conditions on the skin, and use therapy laser for edema and congestion and contaminated wounds.

How has laser therapy affected your bottom line?
We include the charge on every surgery we do in which we are not worried about neoplasia. All of our orthopedic surgeries have a package of six laser therapy treatments.

If the client is unsure about the effectiveness, we’ll sometimes tell him we’ll do just one and have him tell us if he sees improvement in the pet. Nine times out of 10, they will come back and buy a package. And now that we have been using laser therapy for a few years, the word is out in the community.

We do a lot of orthopedic surgery.
We do cruciates, medial patellar luxations, intervertebral disc, and we have estimated just from what we see that our patients recover from orthopedic surgery eight to 14 days quicker since we have implemented therapy laser.

How did you introduce this new service to your clients?
When you get your staff on board, they are able to tell the clients, “You know I used this on my own pet, too, and here’s the improvement we saw.” That way your staff becomes part of the team and they will tell clients and people they know about it.

The laser company gave us pamphlets and information for our website, and we included it in our Yellow Page ad. I talk about laser therapy with every case, and introduce it to the client that we are going to do CO2 laser surgery and then do laser therapy afterwards.

We do still use non-steroidals and pain medications, but I would much rather be able to treat patients with the therapy laser than send them home with meds. With all the hubbub nowadays, with the cats reacting to non-steroidals and the dogs who already have sensitivity, I would rather provide laser therapy than use carprofen, to be honest with you. All drugs have side effects, so if it was me, I would prefer to use laser therapy over meds.

It’s kind of an obligation on our part to offer laser therapy, because it does not hurt the body. It is helping the body get better by itself, without having to give it [pharmaceuticals]. Clients are going to be happier, patients are going to get better quicker, and the bottom line is, “Is it going to pay for itself?” Our therapy laser pays for itself every five and a half months.

What would you say to your colleagues about laser therapy?
We do still use non-steroidals and pain medications, but I would much rather be able to treat patients with the therapy laser than send them home with meds. With all the hubbub nowadays, with the cats reacting to non-steroidals and the dogs who already have sensitivity, I would rather provide laser therapy than use carprofen, to be honest with you. All drugs have side effects, so if it was me, I would prefer to use laser therapy over meds.

I used to think I was a voice crying out in the wilderness about laser therapy, but it is becoming much more accepted now. It is an integral part of our practice. I can remember back when we started using diagnostic ultrasound or digital radiography … it gets to be where you can’t imagine that you did not use it.
Using Class IV Therapeutic Lasers

Eye Protection is Paramount When Using Class IV Therapeutic Lasers

By Phil Harrington, DC, CMLSO
For The Education Series

An increasing number of veterinary practices are using class IV therapy lasers to help patients with conditions ranging from ear infections to anal glands, and acute injuries to chronic hip dysplasia. Laser therapy is a scientifically based modality that helps reduce pain and inflammation while increasing blood flow and enhancing the rate and quality of tissue healing.

Lasers are classified by the potential for hazard to the eye, with class IV being the highest. There are complicated definitions for the specifications of each laser class, but generally a laser with power greater than half a watt is a class IV laser. Several companies market class IV therapy lasers in the veterinary industry.

Misconceptions

The therapy laser used to treat Tails the dachshund for intervertebral disc disease and the airborne military laser that shot down a ballistic missile are both Class IV lasers, which has led to many misconceptions. Some report that the former can and will cause the same degree of thermal damage as a surgical or industrial laser.

Class IV therapy lasers deliver more energy per unit of time, but are they safe? This article addresses laser safety concerns for Class IV therapy lasers in veterinary practice.

Safety

Laser safety guidelines must be followed due to the risk of eye injury and, secondarily, skin injury. Exposure to direct or reflected laser light can be focused by the lens of the eye, potentially causing damage to the retina and resulting in scotoma, a blind spot in the fovea. Light incident on the lens is magnified more than 100,000 times by the lens.

Visible light has wavelengths between 400 and 700nm (Figure 1), and class IV therapy lasers use wavelengths near infrared, between 800 and 980nm. Infrared light is invisible to the human eye but can be visualized using a digital camera (Figure 2). The beam from a surgical laser is tightly collimated, whereas the beam from a therapy laser is divergent. Wavelengths from 400 to 1,400nm are focused by the cornea and lens and absorbed by the retina.

Humans and animals have innate protection against exposure to bright light. The blink reflex is “lid closure associated with the involuntary upward movement of the eye, triggered by an external event such as a bright flash of light” and the aversion response is “movement of the eye, eyelid or the head to avoid an exposure to a bright light.” It can occur in a quarter of a second, which includes the blink reflex time.

Because class IV therapy lasers use invisible infrared wavelengths, they do not trigger the blink reflex or aversion response. Therefore, class IV therapy laser companies must supply the appropriate eye protection, which clinics need to use appropriately.

The maximum permissible exposure (MPE) is “the level of laser radiation to which a person may be exposed without hazardous effects ... in the eye or skin.” In the MPE calculation, the worst-case scenario is assumed, in which the eye lens focuses the light into the smallest possible spot size on the retina for the particular wavelength and the pupil is fully open. Exposure to direct or reflected laser light above the MPE can result in injury.

The nominal hazard zone (NHZ) is “the space within which the level of the direct, reflected or scattered radiation during normal operation exceeds the applicable MPE.” The NHZ for most class IV therapy lasers is about 20 feet. All people within the NHZ must wear appropriate eye protection when the laser is in operation.

Eye protection must be supplied by the laser company, as normal sunglasses do not provide adequate protection. Laser safety eyewear is marked with the optical density (OD), a measure of the ability to block out specific wavelengths of laser light to a safe level below the MPE.

Using Lasers with Pets

Because pets are unlikely to cooperate by wearing safety glasses, a dark towel can shield the patient’s eyes. Some companies sell special goggles for dogs, but the specifications must be inspected to be sure they block infrared light. However, in most cases the animal is not able to look directly at the area of laser application and will not have direct exposure to the therapeutic laser light (Figure 3).

A small amount of infrared laser light does reflect back to the laser technician, but it does not have any harmful effects on the technician’s skin. Clothing will block reflected laser light, so it is safe for a pregnant technician to apply class IV laser therapy treatments.

Class IV therapy lasers do not emit ionizing radiation. Dosimetry badges, such as those for exposure to X-rays, are not required.

Clinical lasers are orders of magnitude lower than for surgical lasers. Moreover, class IV lasers are for interventional applications and not for surgical applications. Proper handling and use of laser safety eyewear will ensure safety for all.

Dr. Harrington is manager of education and clinical support for K-LaserUSA. He has a degree in physics from Iowa State University and is a Certified Medical Laser Safety Officer (CMLS).

This article was underwritten by K-LaserUSA of Franklin, Tenn. Readers with questions about K-Laser’s products are welcome to contact Dr. Harrington at 866-595-7749, ext. 104, or pharrington@klaserusa.com

Figure 1

Figure 2

In most cases the animal cannot look directly at the area of laser application.

Figure 3
Some Insight on Laser Overdosage Claims

By Bryan J. Stephens, Ph.D.
For The Education Series

It is important to understand the order of magnitudes involved when it comes to applications in radiation. Far too often, people make overdosage generalizations without at least a relative scale. A prime example of such hand-waving arguments is the ubiquitous citation of the Arndt-Schultz law, which refers to “U” shaped dose response curves for external agents: below a threshold there is no effect, a small amount of something has small effect, a moderate amount has a precipitous change in cellular processes, and thus the higher thermal accumulation.

Free Radicals

Radiation oncology takes special advantage of free radicals as they are potent DNA breakers; in fact, the hydroxyl radical that comes as a by-product of ionized water accounts for about two-thirds of all radiation-induced mammalian DNA damage**.

In lower levels, however, ROSs serve as cell-signal carriers as well as to induce an endogenous response that leads to an increased long-term defense capacity against exogenous radicals and other foreign toxins. But, it is crucial to remember that this is not a “law” at all, nor is it based on fundamental principles or cellular processes, and so to claim that more than X amount of radiation is inhibitory because the Arndt-Schultz law says so is completely unfounded.

Virtually all the empirical investigations that attempt to narrow the optimal treatment parameters have been performed in vitro. These studies have the advantages that the majority of the parameters can be easily measured and well controlled, and many of the results of these experiments have indeed shown an optimal dose region for biostimulation above which inhibition takes place.

There are, however, inherent limitations in extrapolating these results to conclusions on the effects in bulk tissue, as well as some fundamental shortcomings in the breadth of their investigations.

The first is simply the range of doses used and the a priori assumption that there is only one peak in the biostimulatory spectrum. Tiina Karu, among others, has shown this to be an invalid assumption, and that for a given cell line, there may be several peaks of similar biostimulatory effect separated by several orders of magnitude of doses**. So the “U” shaped dose response curve cited by a particular study may illustrate only one of the several potential peaks in a curve whose full range has not been measured.

The second major shortcoming of extrapolating in vitro results to in vivo conclusions is the idea that the reciprocity rule (i.e., the idea that the biological effect of treatment is directly proportional to the dose irrespective of the administration technique or treatment time) is simply not valid, in general.

Whatever energy of radiation is absorbed in the monolayer of cells and the serum environment is converted to heat, and in a petri dish thermal diffusivity is extremely low. Dose is defined as energy density and so the higher the dose, the more energy is absorbed, and thus the higher thermal accumulation.

There have been several studies, even on the same cell line with the same laser, that show that in different dose regions of the same response curve, the reciprocity rule is obeyed and then broken**. This speaks again to the idea that studies that claim this rule is strictly obeyed probably have not investigated the full dose domain.

Thermal Accumulation

When studies do attempt to explore the higher dose range, a third limitation presents itself: thermal accumulation.

Whatever energy of radiation is absorbed in the monolayer of cells and the serum environment is converted to heat, and in a petri dish thermal diffusivity is extremely low. Dose is defined as energy density and so the higher the dose, the more energy is absorbed, and thus the higher thermal accumulation.

To get a real idea of what contribution this has to the cellular environment, imagine we are testing the viability of 100 J/cm² of 980 nm radiation on a monolayer of cells in a petri dish. If you were to calculate how much heat resulted from the absorption of that much radiation exposure, you would find that at a minimum, the serum of the petri dish would rise to above 40 degrees C.

It is well known that bulk tissue can undergo irreversible tissue damage above 40 degrees C, never mind in a monolayer of cells with only two degrees of freedom to dissipate heat. In fact, this thermal accumulation is often taken advantage of, and clinical hyperthermia is an increasingly popular technique in oncology.

In hindsight then, testing any more than about 30 J/cm² of 980 nm beam of radiation on cell cultures will never yield positive results (without some micro-fluidic design to remove the heat).

Remember, this effect is simply an artifact of in vitro experimentation, where there is (intentionally) a lack of thermal diffusivity to maintain cell viability. The body, on the other hand, is very well suited to deal with both internal and external heat or cooling sources. After all, we live in an environment that ranges from much cooler to marginally warmer than our internal temperature; we also have the ability to drink hot coffee or hold an ice cube in our mouths without experiencing hyper- or hypothermia.

This ability to handle heat is also very fortunate for another reason.

If you were to add up all of the sun’s radiation that falls into the near infrared (NIR: from 700-1000 nm), you would find a constant power density of 33 mW/cm² of NIR light. Add this up for 3,600 seconds and realize that the sun delivers 120 J/cm² to every square centimeter of our body in every hour of sunshine. This should give some peace of mind as well as some insight next time you hear about some laser overdosage claims.

We Are Not Petri Dishes

In any case, it is clear that while in vitro experimentation is highly necessary to isolate individual chromophore absorption characteristics and cellular mechanisms of action, the petri dish environment is quite different from our bodies.

This idea resonates throughout the entire biological community: the reaction of a macroscopic matrix of cells that form tissue is NOT the sum of the reactions of each of the individual cells.

One of the great mysteries of biology involves the complexity of cell-cell signaling and the ubiquity of bystander effects. Accordingly, we have to narrow the scope of individual cell and single cell monolayer studies to the search for absorption sites and the cellular functions affected by these sites, and stay away from making broader tissue-scale generalizations.

Bryan J. Stephens, Ph.D., is the director of research and development for K-Laser USA. He is an expert in radiation’s interaction with biological matter, specifically in radiation dosimetry and photobiology.

One of the great mysteries of biology involves the complexity of cell-cell signaling and the ubiquity of bystander effects.

**For individual citations referenced here or a more complete bibliography of laser therapy studies, contact the author directly at bstephens@k-laserusa.com.

This Education Series article was underwritten by K-Laser USA of Franklin, Tenn.
Laser Protocols Depend on Depth Analysis

Practitioners need to understand transmission losses, beam shapes.

By Bryan J. Stephens, Ph.D.
For The Education Series

Internal dosimetry of laser therapy is far too often overlooked or questioned but is crucial information for the design of treatment protocols and prediction of biological efficacy. In vitro studies give a general idea of the biostimulatory dose range, but their results should not be directly extrapolated to form conclusions in vivo.

It is universally understood qualitatively that the body is a turbid medium, which attenuates radiation penetration through a combination of absorption and scattering. For laser therapy to be incorporated into mainstream medicine we must predict quantitatively the transmission losses and beam shape augmentation at depths through the variety of tissue types involved.

“One or “enough” are not good answers to the question, “If you laser a dog’s hip, how much gets to the center of the joint?”

Learning More

One study’s methodology comes from radiation oncology, not only in radiobiology, but also in understanding how radiation is absorbed and scattered within living tissue. This is the first detailed investigation of laser therapy’s internal dosimetry, that is, a modeling and measurement of what the beam looks like more than a few millimeters inside the body. We utilize three techniques of approximation and measurement: water phantom measurements, Monte Carlo simulation, and ex vivo detection.

The mammalian body is like a tub of water. Cells are 80 percent water, so the first step was to measure the transmission of radiation through different depths of water. A detector is placed face up and the laser is at a fixed distance above it, pointing down, and then increasing amounts of water are added between them. The data is illustrated in Figure 1.

With 100 percent at the surface, the intensity decays exponentially with depth in the water. The beam also flattens as it spreads out at depth. Neglecting the skin and all the other absorbers and scatterers, at a 6-cm depth (just over 2 inches) we are left with just about 30 percent of the beam intensity remaining. This is a good start but is just an approximation, so let’s go one step better and model it.

Figure 2 is an MRI of a canine shoulder from which topography of the different tissue-types is obtained. For Monte Carlo simulations (the gold standard in any field where accurate models are necessary), the input parameters for each tissue type are absorption coefficient, scattering coefficient, anisotropy factor (tells you in which direction the beam is likely to be scattered), and the refractive index. With these data a three-dimensional matrix is created with each voxel (3-D pixel) containing all four of those values for the corresponding tissue type in that volume.

The simulation initiates 1 billion photons that are tracked until their full absorption. Each originates at the red arrow moving in that direction, and the dose deposition is tracked. Observe how the beam spreads out radially and decays with depth in the patient.

Next the simulation data is overlaid back onto the MRI to see exactly where the dose is deposited. If you as the veterinarian know where the pain originated, you can see how much of what is exposed to the surface was actually delivered to the target area. This is a very accurate method of dosimetry and is used daily in every radiation oncology clinic. In our industry as well, this technique can be used as both a predictive estimation and a retrospective tool to analyze past treatments.

Testing

Modeling is quite precise, but as always the most accurate data comes from measurement. Wendy Baltzer, DVM, a board-certified surgeon at Oregon State University, secured six fresh canine cadavers with a variety of breed, coat color, coat length, skin color and obesity represented. Utilizing a series of silicon detectors sensitive to microwatts of power, she measured the penetration through several tissue types at several depths.

First the skin was resected, a detector placed inside, and the skin was folded back over. Laser therapy was delivered to the surface, and the amount reaching the detector was measured. Next, the detector was placed beneath a layer of fat, then some muscle, then the front side of the bone, then in the middle of the joints, then the far side of the joint, and so on. With these measurements (over 2,000 data points recorded) on several different positions on the cadavers, the delivered dose and optimal handpiece positioning were mapped out for all anatomical positions.

As expected, the first-order experiments underestimated the beam attenuation, but Monte Carlo results served as an accurate prediction of ex vivo observation. Doses delivered at therapeutic depths are up to two and three orders of magnitude less than those delivered to the surface. With enough data on different species using a variety of skin, tissue and bone thicknesses, this type of analysis will yield a full dosimetric profile.

Much more work remains to be done in quantitative internal dosimetry of laser therapy. This study, however, is a necessary step on the path of extrapolating the amazing cellular mechanisms to useful clinical insight.

Once further enlightened, we will be able to review both existing and future studies to better understand the biological effect of the delivered dose that came from the reported treatment prescriptions, and eventually converge on the optimal treatment parameters for clinical success.

Needless to say, words like “some” and “enough” are slowly disappearing from our vocabulary. Unfortunately, not everyone is paying close enough attention, but in truth, any laser company that attempts to build protocols without due attention to penetration analysis is simply guessing.

Bryan J. Stephens, Ph.D., is the director of research and development for K-Laser USA. For a more complete bibliography of laser therapy studies, contact the author at bstephens@k-laserusa.com.

This Education Series article was underwritten by K-Laser USA of Franklin, Tenn.
Class IV Laser Therapy for Canine Ear Infections

By Phil Harrington, DC, CMLSO
For The Education Series

Laser therapy is arguably the fastest growing modality in the veterinary profession. To this point, many veterinary clinics offer Class IV laser therapy as a treatment for small animal conditions such as arthritis, sprains and strains and back pain, as well as post-surgical soft tissue trauma and lick granulomas.1

Laser therapy is supported by more than 20 years of evidence-based medicine2 and is being discovered as a means to assist faster, stronger closure of wounds.3

Some veterinarians are moving beyond the musculoskeletal and wound healing applications of laser therapy and finding it an effective treatment for canine ear infections. This article will explain Class IV laser therapy technique in treating ear infections; it will discuss left to the attending doctor. “We’ve been treating Rocky, a cocker spaniel who has been suffering from an ear infection,” said Dr. Janie Wilson of Harrison, Ohio. “He’s had nearly everything—surgery, ear drops and/or oral medications. Once it has been determined that the patient is suffering from otitis, Class IV laser therapy can be used in addition to standard treatments such as topicals, ear drops and/or oral medications.

Technicians administering Class IV laser therapy treatments must wear protective eyewear, specific to the laser device’s wavelengths.4 Thorough training, the responsibility of the laser company, is important to ensure eye safety of the animal. Canine goggles are available, but some may object to wearing them and attempt to shake them off. A black cloth may be used to shield the animal’s eyes, or an assistant can help to steady the animal. Dogs typically find the therapy laser treatments to be soothing and will be cooperative during the procedure.

Treatment would be administered to the external ear, targeting the vertical and horizontal canals, to the bulla and down the auditory tube. Internal treatment can be accomplished by lifting the pinna. A typical treatment plan is for six treatments over a three-week period.

Doctors are using Class IV laser therapy after surgical interventions with infected dogs.

Dr. Rick Campbell of Willow Creek Pet Center in Cottonwood Heights, Utah, reports, “The best results that I’ve had are when I do lateral ear resections. These dogs are chronically infected, and what I have done after the surgery—it does not matter how you clean it up—the horizontal canal will swell shut. I have used the K-Laser on one canal, and let the other one go, and lo and behold after two or three treatments that one that I have treated is open and draining and the other one is still swollen shut. I’ve seen this happen many times, so now we use it on all post-resection cases.”

Dr. Harrington is manager of education and clinical support for K-LaserUSA. He has a degree in physics from Iowa State University and is a Certified Medical Laser Safety Officer (CMLSO).

Most bacteria are anaerobes that proliferate and metabolize much better in the absence of oxygen. Fortunately, this is in direct contradiction with the way our cells flourish and so stimulating the oxygen intake and conversion process will simultaneously help our healthy cells and inhibit bacteria.

safety and mechanisms of action, along with testimonials from veterinarians who have discovered success in treating canine ear infections.

Class IV therapy lasers utilize infrared wavelengths that penetrate skin and bone to deliver an optimum therapeutic dosage to the targets inside the body.4 Distinct wavelengths target different cellular components in the tissue with the end result of increased circulation and oxygen delivery along with enhanced cellular metabolic activity.5

Bacteria, the source of most of these infections, have a different characteristic, though: They do not like oxygen. Most bacteria are anaerobes that proliferate and metabolize much better in the absence of oxygen. Fortunately, this is in direct contradiction with the way our cells flourish and so stimulating the oxygen intake and conversion process will simultaneously help our healthy cells and inhibit bacteria.

As with any condition, proper diagnosis of a dog that presents with head shaking, red ears, offensive odor and other symptoms indicative of ear infection will determine the most effective course of treatment. Discussion of diagnosis is beyond the scope of this article and will be

FOOTNOTES

4. Internal Dosimetry: Combining Simulation with Phantom and Ex Vivo Measurement. B. J. Stephens, PhD; W. Baltzer, DVM, PhD, DACVS; P. Harrington, DC, CMLSO, NAALT 2011 Poster Session B. September, 2011.

This Education Series story was underwritten by K-LaserUSA of Franklin, Tenn. Readers with questions about K-Laser’s products are welcome to contact Dr. Harrington at 866-595-7749, ext. 104, or pharrington@k-laser.com
Laser Therapy Success, Inside and Out

By Bryan Stephens, Ph.D.
For the Education Series

All year at K-Laser USA have presented you with scientific evidence of laser therapy, from fundamental biochemistry to the physics of laser penetration. You have heard from the experts in this field, but the most important story-tellers are the owners of the pets whose lives have been forever changed. Below are two polar opposite examples (one superficial and the other deep-seated) to illustrate the enormous diversity of Class IV laser therapy applications.

Bryan J. Stephens, Ph.D., is the director of research and development for K-Laser USA. He is an expert in radiation’s interaction with biological matter, specifically in radiation dosimetry and photobiology.

Treating From the Inside Out

Laika, 3-year-old, 15-pound female intact French bulldog

February-March 2011: Laika developed a chronic head tilt and became unstable on her feet going upstairs and around the home. Following treatment a total ear canal ablation (TECA) was performed.

On April 28, 2011, a CT scan was made of the dog’s head as the condition had returned. The resulting scan showed a soft tissue material filling the right tympanic bulla that was not confined by a membranous structure. No sign of infiltration was evident in the area where the lateral ear canal had been present—it was only confined to the bulla region. The left ear canal was normal with no significant changes in the appearance of the left bulla.

Cefotaxime and prednisolone were initially prescribed, but the dog’s condition worsened. During the summer months Laika’s stability was inconsistent, but gradually deteriorated until she was readmitted in September 2011 as the head tilt had returned and her gait was becoming unstable again. CT scan showed increased para-aural and tympanic bulla soft tissue infiltrate and no evidence of any abcessation. Her clinical signs had improved to almost normal. Laika’s owner was extremely happy with the clinical outcome for her dog. After such a long period of surgical and medical intervention the head tilt did not fully resolve until Class IV laser therapy was introduced.

A) Initial CT: the green arrow shows the increased density within the right semicircular canals. This can only be seen on a wide window suggesting a high density.

B) Monte Carlo Dosimetry Simulation

C) Final CT showing marked improvement in para-aural and tympanic bulla with no evidence of abcessation.

Treating from the Outside In

Toto, a 4-year-old, 25-pound male neutered rat terrier mix

Toto was brought to West Palm Animal Clinic on July 21, 2011, from Palm Beam Animal Care and Control with a severe burn along his back. Animal welfare professionals speculated that the cause could be deliberate injury, gang activity, accidental chemical burns and/or use of off-label products for flea and parasite control.

The dog was sedated and the wound was cleaned and sutured. He was immediately treated with laser therapy and started on antibiotics. The first two weeks, laser therapy was administered Monday, Wednesday and Friday using the contaminated wound setting. The following weeks it was administered twice per week (Tuesday and Thursday) with the same setting. On Aug. 8 he tested positive for ringworm and demodectic mange and treatment was instituted.

When treatments were complete, he was taken back to Animal Care and Control on Sept. 1 and was soon adopted. He had healed completely with a minimal scar. On September 21, 2011, the new owner brought Toto in for us to take pictures of his scar.

For more details on these and other laser success stories, or for a full bibliography of case histories, fundamental mechanisms papers, and literature meta-reviews of laser therapy in veterinary medicine, contact the author directly at bstephens@klaserusa.com.

This Education Series article was underwritten by K-Laser USA of Franklin, Tenn.
Techs Give Thumbs-up to Laser Therapy

This educational series on veterinary applications of Class IV laser therapy has explored its scientific and clinical aspects, along with safety and practice management considerations. But what do veterinary technicians have to say about Class IV laser therapy?

After all, they are the ones at the front lines—delivering the treatments and educating the clients about conditions that can be treated, how it works, and what to expect from a course of treatment.

For this article we interviewed five veterinary technicians:

-Shayna Rodriguez, CVT, CCRP, of Newtown Veterinary Hospital in Newtown, Pa.
-Stacy Bender of Great Bridge Veterinary Hospital in Chesapeake, Va.
-Alicia Brand of Andalusia Road Veterinary Centre Ltd. in Milan, Ill.
-Lorraine Kendall of the Animal Hospital of North Asheville in Asheville, N.C.
-Kendrah Jensen of La Zoetry Pet Clinic in Cheyenne, Wyo.

A common first reaction to laser therapy was skepticism. Since it was a new modality for all five, they were unsure of the safety or efficacy of the treatments. “Are we really going to use it, or will it just sit around like other things we have tried to bring in?” Brand asked. Jensen wondered, “Does this really work?”

Laser therapy companies should do more than just sell equipment; they are duty-bound to provide proper training and implementation support—which should be included in the purchase price and not listed as an add-on to the sale. Asked about the learning curve involved for delivering effective treatments, Kendall commented, “We had a lot of questions in the beginning, but the staff of the laser company were so helpful! They are very easy to get a hold of and can make laser very understandable.”

“It is somewhat intimidating at first, maybe because of the word ‘laser,’ but after doing the (company-supplied) training it becomes like second nature,” Jensen said. What was the initial client reaction to laser therapy? All five technicians responded with enthusiasm.

“Our clients have been so excited to try the laser therapy and are very impressed with the results. They even take time out of their day to call us and let us know how happy they are with the treatment,” said Jensen. “We have had patients carried in on a stretcher thinking it was the end for them. By the third visit they are walking again,” Kendall reported.

And Brand simply stated, “They love it!”

Many animals can be nervous when it comes time for their first laser therapy treatment. But our surveyed technicians all reported that their patients have responded very favorably to the addition of laser therapy.

“I even think coming to the clinic to get laser therapy has eased their minds from associating the clinic with irritating poking and prodding,” Jensen said, to which Kendall added that animals can be nervous on the first treatment, but on subsequent visits they get excited, run in and flop down on the bed ready for treatment.

What are the top three applications for Class IV laser therapy in their clinics? The technicians responded with an impressive list: post-dental, post-surgical, wound healing, hot spots, snake bites, osteoarthritis, intervertebral disc disease, stifles and acupuncture points. Rodriguez emphasized, “My patients have greatly benefited from our use of Class IV laser therapy.”

Since most treatments are performed by technicians, the modality adds an important role to their responsibilities in the clinic, along with a lot of interactive time with clients. This increases the opportunity to not only educate clients about laser therapy, but on other services offered by the clinic, such as dental work or preventive exams.

“I love using the laser and continually push for its use on every animal we see,” said Rodriguez. Brand agreed and added, “I enjoy being able to go in and treat an animal and just talk with the owners rather than always having to get the history and lab work and the doctor does the rest.”

“I love doing laser because I know the pain and misery that the patient is enduring will be relieved and the owner worry will also be relieved,” Kendall said.

“The Class IV laser adds a whole new facet to our jobs at the clinic,” Jensen noted. “I am so happy to be able to offer a non-invasive, medication-free way to reduce our patients’ pain. Getting the word out and letting clients know how excited we are about this has really helped our clinic grow.”

What message would they pass on to other veterinary practices considering purchasing a therapy laser? Kendall said, “Please, for the well-being and comfort of your patients and relief for the owners, try laser. You will wonder where this has been all of your life/career.”

Jensen wholeheartedly agreed: “Class IV laser therapy is an essential tool in getting the patient back to normal as quickly as possible, whether it be surgery, an ongoing condition, or a one-time wound. It benefits everyone—the patients benefit with less down time and pain, the client is pleased with results and cost effectiveness, and the clinic is happy to have been able to help.”

FOOTNOTES...


This article was underwritten by K-Laser USA of Franklin, Tenn.
What We Have Learned This Year About Lasers

By Bryan J. Stephens, Ph.D.

2012 has been the most explosive year in the ever-growing therapy laser industry. Whether you have been reading these Education Series articles, attending trade shows, participating in continuing education seminars or simply talking with your colleagues, it should be clear by now that laser therapy is the fastest growing modality in veterinary medicine. Unparalleled clinical efficacy coupled with a recurring, service-based revenue stream has contributed to this truly revolutionary change in pain- and wound-management in the veterinary world.

What is the biggest reason for this increased popularity? The wide range of applications. This is not a modality that you have to create a demand for. From hip dysplasia to stomatitis, from infected wounds to soft tissue trauma, from fractures to otitis, Class IV therapy lasers are useful to upwards of 80 percent of the clients who visit you every month.

The Science

From the dozens of articles published in this magazine alone, you have heard several interpretations of the underlying mechanisms of how laser enhances the body’s natural ability to heal itself.

First and foremost, therapy lasers are an engine for micro-circulation. Blood is the conduit for the transport of oxygen and nutrients to the cell and waste products like lactic acid and carbon dioxide away. In the capillaries, blood flow is regulated through microscopic pressure and thermal gradients. Targeting water with radiation—most efficiently in the Near Infrared (NIR) at 970 nm—is the best way to produce the temperature gradients that will increase localized blood flow.

Once more blood reaches the cells, the hemoglobin that carries the oxygen has to reduce, or drop off, its oxygen supply; it does so sporadically at its normal pace. At the same time, these blood cells carry the waste products away from the cells.

Laser therapy can speed up this process because when hemoglobin absorbs light (most efficiently in the NIR at 905 nm), this “reduction” process increases and the blood dumps more of its oxygen to the cell to be processed into cellular energy.

Once out of the blood, oxygen passes through the membrane and into the mitochondria, where it is processed by a chain of respiratory enzymes whose end product is ATP. Cytochrome oxidase is the transport enzyme between the end of the respiratory chain and ATP synthase, the enzyme that produces ATP.

Each back-and-forth cycle produces a molecule of ATP, and without laser, this process happens at its normal pace. But in either state of this enzyme, whether “reduced” or “oxidized,” if it absorbs laser light (most efficiently in the NIR at 800 nm), it will flip. More laser means more energy to the cells and quicker healing by the body.

The Technology

All this science is useless unless the available equipment can capitalize on what we have learned. And what we have learned, above all, is that there are a variety of targets in the body. On top of that, it is quite clear that the different tissue-types in the body respond better to different laser parameters (i.e. wavelength, pulse frequency and energy).

This means that the single-wavelength, continuous wave (CW) only devices are today’s rotary telephones: still useful, but antiquated technology. The future of veterinary laser medicine will require more options: more wavelengths, broader frequency ranges and more power (tens, not hundreds of watts—that much power will put holes in your patients).

Beyond the mere capabilities of these machines, the future’s laser must be able to tailor the use of this wider range of parameters to best suit the particular condition.

If we know that a shoulder, for example, consists of bones, cartilage, connective tissue, soft tissue, nerve endings and blood vessels, and we know that each of these tissues responds optimally to different parameters, then why wouldn’t you use several parameters within one treatment protocol for that shoulder? Which are the right parameters for each tissue type?

To be fair, our industry is still fairly ignorant to this answer, if there is, in fact, a single right answer at all. Allow me to humbly suggest that we employ the scientific theory here: let’s try lots of options, and refine our knowledge based on the results. In fact, let’s use many configurations of treatment parameters (the choices for which come from several well-founded hypotheses of the fundamental mechanics) to have the best chance of optimally targeting the many tissues.

For those of you who think this to be a little too much trial and error, let me remind you that if we waited to use fire until we understood all the underlying mechanisms of combustion, we would literally still be in the Stone Age. Perhaps more suitable for veterinarians, if you waited to use any given surgical procedure until it was performed 500,000 times (this is the estimated number of animals who have been treated using Class IV therapy lasers), you would still be using a hot iron to cauterize a surgical wound.

And just like you are willing (in fact, mandated) to educate yourself to continually improve your medical practice, find a laser that will evolve as our knowledge base expands. A remotely updatable laser is not just useful for user-friendly enhancements, but will undeniably increase the clinical efficacy of its treatments over time. Upgradability is not just sound investing to avoid obsolescence, but is absolutely necessary for the inevitable advancement of the medicine you practice.

Moving Forward

2012 is nearly over and hundreds more practices every month are capitalizing on the clinical and financial benefits of therapy lasers. Do not let prideful skepticism get in the way of the advancement of medicine. If you doubt the underlying principle that light can help the body heal itself, open your eyes—literally, open your eyes and try to reconcile our sense of vision without the simple premise that light induces chemical changes on our bodies. If you doubt the clinical results, do some homework and read the journals. If you doubt that laser therapy will be useful in your practice, talk to your colleagues. If you doubt that this is a sound investment, do the math.

For a list of references on the fundamental mechanisms of laser therapy or the evidence of its clinical efficacy, visit the Library of Evidence at www.k-laserusa.com/results-research/k-laser-library/ or contact the author directly at bstephens@k-laserusa.com.

Dr. Stephens is director of research and development for K-Laser USA. He is an expert in radiations interaction with biological matter, specifically in radiation dosimetry and photobiology.

This Education Series article was underwritten by K-LaserUSA of Franklin, Tenn.
Explore the boundaries of laser therapy

By Bryan J. Stephens, Ph.D.
For The Education Center

T here is clearly some resistance to considering laser therapy as mainstream veterinary medicine, and as with anything in life, the majority of reluctance stems from ignorance. In the case of laser therapy, this ignorance is shared between the practitioners yet to embrace it and the industry itself.

For the most part, acquaintance with radiation in veterinary education (from technicians all the way to specialists) is limited to diagnostic radiology. All you need to know to functionally be able to interpret a radiograph is which tissues block the X-rays (resulting in underexposure of the film and bright spots) and which tissues are transparent to X-rays (thus overexposing the film and producing dark spots).

Though enormously useful, this teaches the practitioner nothing about the absorption of light in tissue, nor about the significant physiological changes that light can initiate once absorbed.

The industry’s knowledge deficit has many more facets. Before about 10 years ago, we simply didn’t know enough about what was going on at the cellular level to make meaningful clinical conclusions, let alone persuade practitioners to include laser in their practice. But we did persuade many, quite successfully. It is precisely this success that has been the Achilles’ heel of laser therapy’s progress into mainstream medicine.

After all, what do you really need to prove to show that any modality “works”? Depending on your level of skepticism, any one of the following may carry more weight, but without each, you would be rash to accept anything new. First, some basic fundamental science is necessary (this eliminates snake oil); second, evidence of safety; third, trusted testimonials of someone who has had success with it; and finally, some unbiased clinical studies.

These studies have been the source of much controversy, but not for the reason raised by most skeptics. The majority of unbelievers claim that there is not enough evidence in the current literature to support the use of lasers.

If you perform a PubMed search for “laser therapy” you get over 60,000 results, not all of which are terribly relevant, but if you restrict that search to just the titles and abstracts, you still get over 5,000 results.

Folks, there is plenty of research.

The quality of all the papers, however, is the issue, and for several reasons. The majority of clinical papers written on lasers predated the mechanism papers, and so there was no context to the “laser group was better than control” conclusions.

Secondly, an embarrassingly high number of papers failed to report the parameters of laser used in the study, making any cross-comparison or replication impossible.

This leads to the biggest problem. Up until the start of this millennium, the people who were writing the articles, and more importantly, reviewing these “laser” journals, were not themselves experts in lasers.

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Forgive me for saying this, but someone who has used the laser with success, regardless of for how long, is not an expert. I’m not saying he/she can’t be, but by expert I mean someone who has been formally trained on light’s interaction with biological matter AND who has thoroughly reviewed the past and current literature on the subject. “AND” here is important.

Most of the certifications courses on laser are limited to functional knowledge of the safety of lasers with respect to wavelength and power and exposure level—a necessary step to understanding the limitations of laser, but by no means do they delve into the intricacies of photobiology.

On the other hand, anyone can read up on lasers and compile a substantial knowledge base, but since there is such variety of laser parameters in the literature, a fundamental understanding of how different types of radiation interact with different cell-types is absolutely necessary, not only to interpret the results of any study, but also to cross-compare or extrapolate the conclusions among several.

The number of experts in our field (Ph.D.s, ASLMS fellows, etc.) is steadily rising, though this hasn’t stopped the lecture podium from being filled with successful practitioners “teaching” lasers to their colleagues, and with the last decade of research and clinical use, most of our fundamental ignorance has been erased, only to be replaced by new questions about the frontier of laser therapy applications and the search for the optimal parameters for any given condition.

But these ARE the questions. “Does laser work?” is truly a 5-10 year-old question, not state-of-the-art research.

What are we really trying to prove, then? And going forward, what is the best way to do so? From the practitioner standpoint, this is fairly simple: get on board, and use it on everything.

Beyond the small handful of absolute contraindications, laser therapy has virtually no adverse side effects, and because the treatment times are minimal, there is little to no moral or ethical reason not to explore the limits of laser therapy. Your decision to charge for this service on some “experimental” applications will come from your anecdotal success, but this endeavor can turn into some serious insight (and future profit).

When you experience an unexpected success, practice good medicine and put some time into figuring out why and what exactly you just figured out.

Learn about the different laser parameters, why they might produce a different effect, and test some of them out (assuming you have a laser that gives you the ability to do so); then pass that information on to your colleagues and the laser companies so that we can build on our understanding.

For the industry, we too have to push the boundaries. We have to continue to build university relationships and recruit young graduate students/residents to plan innovative studies. We have to continue to take what the literature reveals and turn that into more robust lasers, patients, and diagnostics.

Most importantly though, we have to put aside the antique quest of merely proving laser “works” and find out which parameters work best on which conditions—what are we really trying to prove, even if that means historic change in hardware.

For both evidence of laser’s clinical efficacy as well as examples of the forefront of modern laser research, visit the Library of Evidence at http://www.k-laserusa.com/results-research/k-laser-library/ or contact Dr. Stephens directly at bstephens@k-laserusa.com.

This Education Center article was written by K-LaserUSA of Franklin, Tenn.
Quantifying systemic effects of laser therapy

By Bryan J. Stephens, Ph.D.
For The Education Center

The vast majority of clinical papers, as well as this author’s focus in the 2012 Education Series articles, concern the local effects of laser therapy. We have shown that laser therapy can stimulate the increased epithelialization and granulation of open wounds (both clean and infected), cleaner cases of otitis and pseudomonas ears, fusion of malunion fractures, and much improved weight-bearing of both surgical and non-surgical orthopedic cases.*

For those who have embraced laser therapy, many of your anecdotal success stories (which are substantiated by myriad published results*) are also accompanied by a general reduction of pain.

The Nervous, Endocrine Systems

The goal here is not to delve into the intricacies of and differences between nociceptive, inflammatory, neuropathic and dysfunctional pain, but rather to spotlight some studies that have quantified remarkable enhancements of the two main complexes involved in pain management: nervous and the endocrine systems.

At this point I’m going to ask that you take your mechanism-seeking hat off because even though we have some good first- and even second-order qualitative ideas of how laser interacts with both of these systems, their underlying dynamics are still a mystery, even when you subtract laser from the equation. Instead, try to focus your attention on how you would be able to use some of these results in your clinic.

If you had asked a neurologist 15 years ago if nerve cells could regenerate, the answer was a definitive “No.” But in the last decade we have come to understand that though we may have to redefine the word “regenerate,” there is certainly evidence that where there was no signal, there can later be a signal.

Perhaps the world’s foremost authority on the subject is Shimon Rochkind, a neurosurgeon at Tel Aviv University, where he has shown that the use of lasers based on a range of issues, from traumatic brain injury and ischemic stroke to spinal cord injury and peripheral nerve damage.

Profound Findings

But the interconnectivity of the peripheral and central nervous systems is usually the culprit (and therefore the target) of pain management; here is where the evidence is most encouraging. In a 2001 study,* his group crushed a peripheral nerve, but then instead of using laser on the crushed (sensory) nerve, they irradiated the spinal cord, then measured the electrophysiologic activity (compound muscle action potential) across the crushed peripheral nerve.

They measured that after three weeks, the peripheral nerve activity of the rats whose spinal cords were irradiated dropped to only about 90 percent of its pre-crushed activity, while the non-irradiated group dropped to 20 percent in the same time.

What’s more is that after three months, there was no statistical difference between the irradiated group and the control group—the one without inducement of nerve damage. Think about how profound these findings are. In a very controlled manner, this group showed a significant benefit in a clinically meaningful response of the peripheral nervous system by laser therapy on the central nervous system.

You can probably imagine more implications of this kind of systemic benefit of laser therapy than I can, but there is even more to the pain puzzle than the strength of signaling between peripheral nerves and the brain. In fact, there is more to the pain puzzle than the pain itself. The quality of a patient’s sleep and other behavioral responses is often equally consequential on recovery percentage and time as fixing the actual cause of the pain. Your ability to interpret these behavioral changes and trace them to any given pathology is what, in my opinion, empowers veterinarians from any other medical practitioner.

Sleep patterns, analgesic response and many other behavioral tendencies are governed, in part, by the endocrine system, and though its main regulatory glands are located center-mass (mostly in the head and neck, though many of our internal organs have secondary endocrine functions), there are trigger points all over our bodies that use the nervous system to enable the production or secretion of hormones and endorphins that can lead to positive physiological change (or even a sensation thereof).

Though there are medications designed to stimulate this system, most do so in a very general way with overlapping consequences.

Large-scale Systemic Effects

It turns out that lasers can have a significant effect on the neurotransmitters that facilitate the above processes. A Turkish study in 2004 performed on 46 humans with myofacial pain syndrome measured not only the differences in pain after treating the trigger points with laser therapy, but also the amount of serotonin degradation products excreted in the urine.

After 10 days of treatment, the patients in the laser group showed a 128 percent increase in serotonin and a 61 percent increase in tryptophan in their urine, not to mention the 45 percent decrease in pain scores, while the placebo group showed only meager improvements in each category (14 percent, 7 percent and 17 percent, respectively).

These are astonishing results that, though might not shed much light on any particular localized mechanism of laser absorption, certainly give weight to the idea that beyond the heavily supported evidence on wound healing and musculo-skeletal benefits of laser therapy, there are also some large-scale systemic effects that can enhance your patients’ quality of life.

Please take what you have seen here, be skeptical, and take the time to learn more about it.

For those of you who have therapy lasers, after you have convinced yourself that there are virtually no adverse side-effects of laser therapy, put some of these hypotheses to the test in your clinic.

Even anecdotal success can help us improve our understanding of the full benefit of lasers, so please pass your results on to your colleagues and back to the laser companies so we can continue to expand the frontiers of laser therapy.

Dr. Stephens is director of research and development for K-LaserUSA. He is an expert in radiation’s interaction with biological matter, specifically in radiation dosimetry and photobiology.

REFERENCES...

*For full references of all published papers, as well as more examples of the footprint of modern laser research, visit the Library of Evidence at www.k-laserusa.com/results-research/k-laser-library/ or contact the author directly at bstephens@k-laserusa.com.
Pulsing in laser therapy: 
Dose is not the whole story

By Bryan J. Stephens, Ph.D.
For The Education Center

By now, we in the laser community hope to have convinced you that the central question is no longer “Does laser therapy work?” but rather “How do we best deliver the right dose.”

You have seen attempts to simplify the complexities of radiation transport in the body in order to explain and quantify how much dose is delivered to internal targets, given a certain exposure to the surface. From these measurements and back-calculation, we have a pretty good idea of what the “right” dose prescriptions are for a variety of ailments.

But when speaking of clinical efficacy, dose is not the end of the story; there is another very important treatment parameter. The way you deliver that dose very much dictates the clinical results.

There are two main delivery modes for laser therapy: continuous wave (CW) and pulsing (which can then be subdivided into frequency modulated and super-pulsed—more on this next month).

There are two main delivery modes for laser therapy: continuous wave (CW) and pulsing (which can then be subdivided into frequency modulated and super-pulsed—more on this next month).

One thing we know very well as an industry is that the responses of different tissue-types vary widely within a large range of pulse frequencies.

Notice I didn’t say different conditions respond to different parameters.

Though this is quite true, the fact is that individual cells (and even further, the chromophores within these cells) absorb light, not entire shoulders or hips or stifles.

The cells that comprise the different tissues within these anatyses vary in size, composition and density, and these variations lead to a diversity in absorption, and equally important, relaxation characteristics. Even with injuries that include fewer tissue types (i.e. wounds, contusions, fractures, etc.) the literature shows a range of response given the same dose.

A Review

One example is a meta-review from Harvard University** which analyzed all of the relevant laser literature from 1970-2010 regarding the effects of pulsing in laser therapy. This review makes two main conclusions: 1) that indeed, different tissues respond better to different frequencies, and 2) we have yet to determine why and which ones are the best, but that there is no “one size fits all” frequency that is optimal for all conditions.

On the most basic level, these are very simple experiments to carry out. Take several different tissue types and expose each to exactly the same dose, but in each case, using a different frequency. Continuous wave would be a frequency of 0 Hz; the beam is always on. Then when you measure the cellular activity, whether it be by ATP synthesis, DNA proliferation rate, enzyme regulation, or whatever, you’ll find that the different tissue-types respond to different frequencies.

The direct mechanisms are unclear, but a good first-order explanation is that is has to do with the different thermal dissipation characteristics.

Cells are small enough to dissipate heat on the order of micro- or milli-seconds, which can be between pulses of laser. Each cell type has different thermal relaxation time constants, probably due to their different water content; osteoblasts are something like 60 percent water whereas smooth muscles cells are more like 90 percent water.

Water is our principal biological conductor of heat and so the higher the water content, the quicker that cell can dissipate its heat.

This could be why bones seem to respond better to lower frequency, while soft tissue heals faster with higher frequency; bones are slower to thermally relax, so lower frequencies allow for more time between pulses for this dissipation to occur.

This observation also coincides with conclusions by Tiina Karu—pretty much the “godmother” of laser therapy—that show that the most important pulsing parameter to be the “dark-time” between pulses**. She showed, on the same cell line given the same dose, a distinct difference between pulse widths of 2 milliseconds (which corresponds to 500 Hz) and 100 microseconds (which corresponds to 10,000 Hz).

Getting to What is Useful

How, then, do we extrapolate this information to be clinically useful?

First, for the veterinarian, it is important to identify which tissues are involved in the healing of a given condition. In a ligament tear, for example, obviously the ligament is damaged, but the insertion points at the bone and the muscle, as well as the blood vessels supplying nutrients to each, are all very much involved in the healing process.

In general, for any particular condition, several tissue types are present, regardless of the type of injury. In a shoulder, for example, bone, cartilage, connective tissue, muscles, blood vessels, nerve endings and more are involved.

To choose one parameter set (i.e. wavelength/power/frequency combination) to treat the entire ailment, just because the manufacturer says so, or because you read one paper that shows efficacy using that parameter set, is not the most efficient technique. This set might have worked in that study (and therefore might work on your patient) and might even be optimal for one of the tissue-types involved, but it is certainly not the “best” setting for each of the tissues involved.

Instead I suggest that you embrace our collective ignorance and progress through several combinations within a single treatment protocol; you will have a better chance of individually stimulating each tissue type, thus healing the condition quicker.

Any laser on the market worth its weight will give you the ability not only to deliver both continuous and pulsed light, but also to offer a full spectrum of frequencies to efficiently target the many types of tissues in the body.

Some offer these recommendations within their software, others in a “cook book” of sorts, but make sure that the decisions to use whichever parameters are based on relevant characteristics of both the patient (size, coat color, etc.) and the condition (anatomy, tissue makeup, etc.).

Every day we are learning more. Though it is easier to remain in the comfort zone of “If it’s not broken, don’t fix it,” I urge you to reconsider. If we know that there are different tissues present in a condition, and that each will probably respond better to a different set of parameters (frequencies, in this case), then use some common sense, use multiple parameters and let’s get these animals back on their feet faster.

**For full references of the cited publications, as well as more examples of the forefront of modern laser research, visit the Library of Evidence at http://www.k-laserusa.com/results-research/k-laser-library/ or contact the author directly at bstephens@k-laserusa.com.
Laser protocols depend on depth analysis

Practitioners need to understand transmission losses, beam shapes.

**By Bryan J. Stephens, Ph.D.**

**For The Education Series**

Internal dosimetry of laser therapy is far too often overlooked or guesstimated but is crucial information for the design of treatment protocols and prediction of biological efficacy. In vitro studies give a general idea of the biostimulatory dose range, but their results should not be directly extrapolated to form conclusions in vivo.

It is universally understood qualitatively that the body is a turbid medium, which attenuates radiation penetration through a combination of absorption and scattering. For laser therapy to be incorporated into mainstream medicine we must predict quantitatively the transmission losses and beam shape augmentation at depths through the variety of tissue types involved.

“Some” or “enough” are not good answers to the question, “If you laser a phantom at depths through the variety of tissues, must you predict quantitatively the transmission losses and beam shape augmentation at depths through the variety of tissue types involved?”

Learning More

One study’s methodology comes from radiation oncology, not only in radiobiology, but also in understanding how radiation is absorbed and scattered within living tissue. This is the first detailed investigation of laser therapy’s internal dosimetry, that is, a modeling and measurement of what the beam looks like more than a few millimeters inside the body. You utilize three techniques of approximation and measurement: water phantom measurements, Monte Carlo simulation, and ex vivo detection.

The mammalian body is like a tub of water. Cells are 80 percent water, so the first step was to measure the transmission of radiation through different depths of water. A detector is placed face up and the laser is at a fixed distance above it, pointing down, and then increasing amounts of water are added between them. The data is illustrated in Figure 1.

With 100 percent at the surface, the intensity decays exponentially with depth in the water. The beam also flattens as it spreads out at depth. Neglecting the skin and all the other absorbers and scatterers, at a 6-cm depth (just over 2 inches) we are left with just about 30 percent of the beam intensity remaining. This is a good start but is just an approximation, so let’s go one step better and model it.

Figure 2 is an MRI of a canine shoulder from which topography of the different tissue-types is obtained. For Monte Carlo simulations (the gold standard in in vivo dosimetry of laser therapy) one is paying close enough attention, but in truth, any laser company that attempts to the target area. This is an accurate prediction of ex vivo observation. Doses delivered to therapeutic depths are up to two and three orders of magnitude less than those delivered to the surface. With enough data on different species using a variety of skin, tissue and bone thicknesses, this type of analysis will yield a full dosimetric profile.

Much more work remains to be done in quantitative internal dosimetry of laser therapy. This study, however, is a necessary step on the path of extrapolating the amazing cellular mechanisms to useful clinical insight.

Bryan J. Stephens, Ph.D., is the director of research and development for K-Laser USA. For a more complete bibliography of laser therapy studies, contact the author at bstephens@k-laserusa.com.
Lasers in combination with stem cells and PRP

By Bryan J. Stephens, Ph.D.

Laser as a stand-alone therapy is the single fastest growing modality in veterinary medicine. With the current market availability of in-house kits for stem cell and platelet-rich plasma (PRP) injections gaining popularity, an obvious (and exciting) frontier to be explored is the combination of laser with these injections.

Before diving in head first, however, let’s make sure these are compatible, even theoretically.

Stem Cells

Stem cell therapy consists of inserting autologous non-differentiated cells into an area of tissue damage, and waiting for (and hoping that) the local physiological environment (pH, nutrient content, etc.) will trigger the differentiation of these cells into the type necessary for the overall rebuilding of that tissue. In bone repair, this may mean osteoblasts; in connective-tissue, fibroblasts; in the gut, endothelial cells; and so on.

While it remains debatable whether adipose-derived stem cells are truly undifferentiated, they have certainly been shown to develop into a broad range of cell types, even organ-specific tissue under the right experimental or physiological conditions. **

Perhaps most importantly to the clinic, the extraction and reduction process has become readily available and financially reasonable in today’s market, whether as an in-house kit or contracted overnight services.

For the injection of stem cells to have a biological effect, these cells need to start metabolizing and dividing. Enter laser therapy.

Antecedent to the myriad secondary and tertiary anti-inflammatory and analgesic effects, the fundamental function of laser therapy is to enhance cellular metabolism: to increase the throughput of oxygen to energy.

While the proposed ideas of lasering the adipose tissue before extraction or while the cells are in a vial is laughable, the technique of adding laser to post-injection sites should be obvious, because the actual process that benefits the patient doesn’t start until the stem cells divide INSIDE the tissue you are trying to rebuild.

Regardless of the condition, if stem cells are going to work at all, they will do so better if their metabolism can be sped up, and if you are not yet convinced that laser therapy enhances this process, then you REALLY need to do some better homework.

PRP

With PRP, the mechanism is slightly different.

The benefits of injecting a high concentration of autologous platelets come from their release of growth factors and cytokines that can stimulate healing of a variety of tissues. All of the “good stuff” in platelets is encapsulated in granules, so if an external source can increase the probability of degranulation, this effect can be enhanced.

This same mechanism holds for other naturally occurring granules such as those in mast cells. But here is the tricky part.

There are some instances where you do not want mast cells to degranulate—think of an allergic reaction—and others where you do—think of an open wound. It turns out that lasers have been shown to increase the local number of mast cells, but under certain circumstances these mast cells have been initiated to degranulate quicker, while other times not.**

This may seem contradictory, but it falls in line with the other secondary and tertiary effects of laser.

Regulator proteins like bradykinin, prostaglandin and even collagen do very different things when they are over- or under-expressed, and laser has been shown to promote both over- and under-expression depending on the condition. ** What? How?

Laser is the enabler. The local environment dictates which direction these mediators turn, not laser. Laser simply provides more fuel (oxygen to the area) and ignites the engine (forces the oxygen to be processed into ATP more efficiently).

So whichever way the body is inclined to heal itself, laser will provide the boost.

It should be no surprise, then, that the alpha granules inside platelets release their growth factors more readily when exposed to laser therapy. And while this seems very theoretical and abstract right now, with the number of practices utilizing these combinations (of laser with stem cell- or PRP-injections) ever increasing, the clinical data will start to fill in the gaps; the case history below is a good example.

In any case, if your clinic is forward-thinking enough to use either of these injection techniques, laser offers the next step, if it wasn’t already your first step.

**For full references, as well as more examples, visit www.k-laserusa.com/results-research/k-laser-library/ or contact the author at bstephens@k-laserusa.com.

Dr. Stephens is director of research and development for K-LaserUSA.

Case History

Thierry Poltte, DMV, DIU Douleur
Cliniques Vétérinaires Ile de Ré France

A 9-year-old male pointer, 25 kg, with Achilles tendinomusculotendinous junction rupture.

Clinical and orthopedic exam

The general clinical exam does not show any abnormality. The distal orthopedic exam shows severe limping of the left pelvic member associated with a severe plantigrade (photos 1 and 2). A closer exam reveals that there is edema, swelling and light hemorrhage in the calcaneal tendon region.

The palpation pressure is painful and shows noticeable thickness of the musculotendinous junction without the tendon being sectioned. The articular test of stifle hyperextension shows incomplete flexion of the hocks without toe flexion (picture 3).

Differential diagnosis

The acute tendinosis leads to thickness and pain limited in the tendon region. The hock flexion is normal without plantigrade locomotion. The complete sectioning of Achilles tendon results in a complete hock flexion; the palpation reveals a tendon discontinuation. The partial rupture of the Achilles tendon with preservation of the superficial toes’ flexible tendon causes an incomplete flexion of the hock with excessive flexion of the toes.

Complementary exams

The radiography confirms the absence of associated bone lesions; an ultrasound exam reveals the presence of hemorrhages and heterogeneous areas in relation with the fibers’ discontinuation.

Treatment proposals

Because of the exaggerated flexion of the tarso-cural articulation, a surgical treatment of immobilization by external fixation for tibiartisian bypass is suggested. Because of the hesitation of the client, the following alternative is offered: We want to associate laser sessions to platelet rich plasma (PRP) injections to take care of the pain, swelling and tendon scars.

Chosen protocol

The goal of the first laser session (K-CUBE 3, 8W) is to take care of the pain and reduce edema. It is associated with a Meloxicam 0.2 mg/kg IV injection followed by oral Meloxicam 0.1 mg/kg once per day PO for two days. Strict rest and leash walking are advised.

D4: Local inflammation is regressing significantly. Injections of PRP (double ACP Arthrex syringe system) are given under general anesthesia at the Achilles tendon level.

D7, D11, D17 and D30: Four more laser sessions are done to promote tendon healing.

Results

Progressive improvement is noticed. At Day 17, the function recuperation is significant, and is complete at Day 30. Inflammation has almost disappeared; the only non-painful induration at the musculotendinous junction level being present (pictures 4 and 5). The dog is presenting normal locomotion without plantigrade and does not limp when walking, trotting or running with a leash.

Strict exercise restriction orders are maintained for a month. Afterward, the dog came back to the clinic on Day 60 and does not show any functional aftereffects anymore.

This article and case history were underwritten by K-LaserUSA of Franklin, Tenn.
Therapy lasers: Under the hood

By Bryan J. Stephens, Ph.D.
For The Education Center

Discussions of laser therapy usually break down into one of two categories: “Does it work and on what?” and then eventually, “Which laser is right for me?”

Most of our Education Center stories are dedicated to the former, because you shouldn’t really look to sales reps for their take on this, for obvious reasons. The answer, coming from an elementary literature search or by talking with existing users, is a simple “Yes, and on a lot of stuff.”

The latter question is where the marketing propaganda muddies the water.

Of the issues that get the most attention, some are cut-and-dried and can be easily tabulated side-by-side (even if you don’t agree with the importance of each): wavelengths/powers/frequencies employed, portability, upgradeability, warranty, etc. Then there are the subjective categories: user-friendliness of the interface (though this could be quantified by number of touches to get where you need to go), level of training provided, extent and glamour of the included marketing kit, etc.

The real mud-slinging comes when salespeople start talking about engineering, describing what is “under the hood” or their machine vs. another. This is lost on some, not only because they often don’t tell the truth (whether intentionally or out of ignorance) but also because their audience doesn’t know any better. So here is a breakdown of the basics.

Anatomy of a Laser

There are five principal components between the user and the patient that make up the technology (and the inherent cost of a laser): diodes, the drivers that control the diodes, the cooling mechanism, the electronics that control the first three, and the optics that channel the light.

Diodes

Diodes produce the light, and they are wavelength specific. Though some diodes put out multiple wavelengths, the majority of the ones used in this industry are single-wavelength diodes. They come in different sizes, but the cost is not linearly proportional to the power (amount of light per second) they produce; two 5-Watt diodes cost less than one 10-Watt diode, a lot less.

Some laser manufacturers take advantage of this supralinear cost vs. power curve and utilize a chain of diodes. The former, because you shouldn’t really look to sales reps for their take on this, for obvious reasons. The answer, coming from an elementary literature search or by talking with existing users, is a simple “Yes, and on a lot of stuff.”

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Some laser manufacturers take advantage of this supralinear cost vs. power curve and utilize a chain of diodes. The former, because you shouldn’t really look to sales reps for their take on this, for obvious reasons. The answer, coming from an elementary literature search or by talking with existing users, is a simple “Yes, and on a lot of stuff.”

The latter question is where the marketing propaganda muddies the water.

Of the issues that get the most attention, some are cut-and-dried and can be easily tabulated side-by-side (even if you don’t agree with the importance of each): wavelengths/powers/frequencies employed, portability, upgradeability, warranty, etc. Then there are the subjective categories: user-friendliness of the interface (though this could be quantified by number of touches to get where you need to go), level of training provided, extent and glamour of the included marketing kit, etc.

The real mud-slinging comes when salespeople start talking about engineering, describing what is “under the hood” or their machine vs. another. This is lost on some, not only because they often don’t tell the truth (whether intentionally or out of ignorance) but also because their audience doesn’t know any better. So here is a breakdown of the basics.

Anatomy of a Laser

There are five principal components between the user and the patient that make up the technology (and the inherent cost of a laser): diodes, the drivers that control the diodes, the cooling mechanism, the electronics that control the first three, and the optics that channel the light.

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The latter question is where the marketing propaganda muddies the water.
Laser therapy continues to be an invaluable modality in more than 6,000 veterinary clinics around the world, with documented benefits ranging from the acute to chronic, soft tissue to orthopedic.

The principal reason that treatment applications have grown so vast is the lack of negative side-effects and contraindications. Once doctors convince themselves that there is “no harm in trying” laser on a strange new condition that is not responding to other modalities, they often stumble onto impressive success stories.

Safety concerns have been thoroughly evaluated by governing bodies (FDA, Health Canada, CE, etc.) and international organizations (WALT, NAALT, etc.) via thermal tests, histology reports and other worst-case scenario experiments. They all reach the same conclusions: Laser therapy is a perfectly safe, non-invasive modality with benefits of pain relief, decrease in inflammation and general bio-stimulation.

There is no universally endorsed contraindication list, however, and the conditions laser companies and training organizations might include on one do not come from any negative data points from any studies. Such lists are created from theoretical possibilities of danger and medical legal precautions.

While it is absolutely necessary to disclose this list to your patients and staff, it is useful to understand the actual dangers in each. In doing so, you may find that we can still safely push the boundaries of laser applications.

The List
This author’s version of the absolute contraindications of laser therapy is as follows: exposure to the eyes, known malignancies, gravid uterus, the thyroid, and in combination with steroid/NSAID injection.

The Eyes
The eyes contain the most photosensitive cells in the body. This fact alone should throw up some red flags when dealing with high-powered light sources like lasers. The most crucial feature of the eye relevant to safety is the lens and its focusing power.

Figure 1 shows a very basic illustration of the key features of the eye. Briefly, whatever light that is not absorbed or reflected by the pupil passes through the lens and gets focused onto a spot on the retina (fovea centralis), which then connects to the brain where the light gets processed and interpreted as an image.

For a given wavelength of light, the laser parameter that dictates the safe/dangerous limit is power density (W/cm²; i.e. amount of energy delivered per second per unit area). Note: power alone says nothing of safety because a 100 W lamp spread over an entire room is perfectly safe and a 0.5 W laser delivered through a 0.001 cm fiber can do surgery.

You’ll notice that once an external power density of 1 W/cm² (one that is perfectly safe to any tissue in your body) is focused by the lens, the retina is exposed to a power density of over 80 W/cm². This amount of focused energy can cause irreversible damage to the eye and can lead to partial or total blindness. You can see that even scattered light from high-powered sources poses a potential risk, which is why wavelength-specific eye protection must be used by both doctor and pet owner, and why precaution (whether goggles or a towel or the doctor’s hand) should be taken to protect the patient.

An important point, though, is that this magnification is the true source of danger, not the exposure of the retina to light.

In fact, numerous studies have shown laser increasing signaling of peripheral and central nerves like the ones in and behind the eye. Plus, many pathologies of the eye involve swelling that pinches nerves, constricts blood flow, and impinges surrounding tissue. These are very much in the realm of laser therapy benefits, but how can you treat them and still protect the eye?

Treat outside the field (cone) of vision. If the light does not pass through the lens and get magnified, then its power density is reduced at depths in the body and so the same benefits you experience with laser on the other related conditions of the body can be exploited safely around the eyes.

Cancer
Cancer is dangerous for two main reasons: It proliferates much more quickly than healthy tissue, and when it does, it is doing something it’s not supposed to. So you clearly do not want to stimulate an already over-stimulated cell line that is working against your body and having a negative biological effect. Because the light does not distinguish between healthy or cancerous cells, you should absolutely not treat an area with known malignancies.

There are three scenarios in which laser may not be such a bad idea, though. The first is after a surgical resection of a tumor where the surgeon is confident in his margins. Obviously, there may still be some cancerous cells in the area (after all, we all have cancerous cells somewhere in our body at any given time), but the wound healing benefits and pain relief may outweigh the risk. The second is as palliative care at the end of a patient’s life. If the patient’s condition is severe and you’re certain that he is at his end, but want to provide some heightened quality of life, laser therapy may be an option. Many pet owners have come into a clinic to euthanize a pet, but have been given an extra month with their companion due to laser therapy.

The third is in conjunction with chemotherapy on large tumors. The main reason that chemotherapy has limited effects on large tumors is that there is very little vasculature to the center of these tumors and so no drugs can be delivered; rather, they work by killing the edges and moving inward. If you recall, one of laser therapy’s primary mechanisms is an increase in local blood flow, so laser in conjunction with chemotherapy can increase the cytotoxicity.

In all these three scenarios, there is always the risk that laser will stimulate the cancer, and so written letters of disclosure and consent are highly recommended.

Pregnancy
There has never been a single report of a miscarriage or any deformity that can be linked to laser therapy; in fact, this is even theoretically implausible. But again, for medical and legal reasons this is on everyone’s list of no-no’s. For pregnant techs, the combination of clothing and the arm’s-length treatment distance mitigates any risk.

The Thyroid
Theoretically, you could set a patient into a thyroid storm by over-stimulating the production of any given hormone, but this author is not aware of any single negative report. On the flip side, there is good evidence (see the February 2013 issue) that we can stimulate the endocrine system and create some systemic pain relief by targeting the pituitary and other regulatory glands.

Laser with Steroids/NSAIDs
Laser therapy directly over a recent intramuscular or intra-articular injection can cause tenderness, swelling and pain. The main reason is that the local drug concentration is too high, and some of these drugs are photosensitive (others heat-sensitive), and this combination leads to a flare-up.

A standard recommendation is to wait the biological half-life of the drug (usually about seven to 10 days) after the injection to treat over the site. Treating before an injection has no effect since the light is absorbed within nanoseconds of treatment. Also, oral or IV applications do not require any delay because these drugs are designed to be widespread and not locally concentrated.

That’s It
Please be diligent in your adherence to strict safety procedures when using laser—eye protection, warning signs, staff/pet owner education, etc. Knowing a bit more about why the limits are in place and where their boundaries are, you can extend the range of your applications safely and effectively. Who knows, maybe you’ll find something new we can treat.

Dr. Stephens is the director of research and development for K-LaserUSA.

This Education Center article was underwritten by K-LaserUSA of Franklin, Tenn.
Lasers offer safe pain relief for cats

By Sarah Gallagher, CVPM
For The Education Center

The aging cat presents a diagnostic challenge when it comes to evaluating musculoskeletal conditions and their often-attendant chronic pain. The pet cat's life is usually very different from that of the family dog. Cats usually aren't taken for walks, nobody takes their cat hunting, and there are no herding, racing or Frisbee-catching cats. The aging cat's decline into a sedentary lifestyle is often accepted by the client as normal, but evidence increasingly shows that many of these patients are compromised by pain.

A 2002 study from North Carolina State University revealed radiographic evidence of degenerative joint disease in 90 percent of cats over age 12. While we can't conclude that all those patients experienced joint pain, it's certain that a significant percentage did.

In addition to the difference between cats' and dogs' lifestyles, which may reduce the client's recognition of pain, office-exam detection of feline osteoarthritis and degenerative joint disease can also be more difficult for a number of species-specific reasons:

- Patient anxiety is often higher and behavior more compromised than that of the dog.
- Cats are usually much less tolerant of the clinician's manipulation of limbs; crepitus is less common in any case.
- Radiographic changes are less severe and harder to detect than in dogs.
- Lameness is not always evident to the owner or the practitioner—cats typically deal with pain in a much more stoic manner than dogs.

Feline Patients

It's a rare practice that wouldn't appreciate an increase in feline patient activity and revenue, and everyone has cat-owning clients who would do anything for their pet. Engaging these clients in a discussion of the cat's behavior at home can reveal important areas of need and opportunity.

Senior profile questionnaires, including the questions about behavior at home, are invaluable. Many times the owners of aging cats simply forget that their cat used to jump up on the kitchen counter, get on a favorite chair, etc. Digging into their memory banks may reveal radiographic evidence of degenerative joint disease in 90 percent of cats over age 12. While we can't conclude that all those patients experienced joint pain, it's certain that a significant percentage did.

During my almost 18 years at one veterinary hospital, I adopted a number of cats when owners decided they didn't want to pay for treatment of an injury their cat suffered. Most of the issues were musculoskeletal—broken hips, legs that needed amputation, etc. It's been six years since I adopted any cats, so my clan is aging—I have seven cats between the ages of 10 and 18—but my continual use of laser therapy on them and the results I have seen still blow me away.

Behaviors that they used to engage in, that I simply forgot about, they started doing again. The transition of avoiding certain behaviors was gradual so I didn't notice it.

Other Stuff

Aside from the incredible benefits of treating arthritis, DJD and other chronic pain issues, some of my other favorite issues to treat are wounds and stomatitis. An apparent 30-50 percent acceleration of healing of wounds is typical and because the laser is working at the cellular level, better healing with less scarring is also achieved. Since cats with stomatitis have an underlying condition that cannot be cured, we can't make it go away, but we can give them relief without the negative side effects of pharmaceutical treatments typically used.

From a human resource point of view, I love the ability to have something new for the staff to do that's enjoyable for the patient. It's rare that veterinary hospitals find new tasks for staff that are actually fun.

‘We’ work for vet hospitals because we love animals and then at the VERY least we have to stock thermometers where no one wants them to be stuck. Performing treatments that animals actually find pleasant is huge for staff—it helps keep them engaged and happy. That makes for appreciative and happy clients, because the staff will treat the visit as a welcome part of their work, not an interruption of it.

It's normal for technicians to see visible relaxation of the patient during the treatment. Veterinary hospitals generally love the 'wow factor' of making a patient feel better. With laser therapy, the 'wow factor' is achieved on a regular basis, not just once in a while. I truly believe that within a few years, laser therapy will become a standard of care that all veterinary hospitals are expected to have as part of their arsenal of treatments.

A Secure Profit Center

Lastly, as over-the-counter and pharmaceutical income centers slowly disappear, veterinary hospitals need to focus on services that big-box stores, grocery stores, etc., can't take away. Back in the day, pharmaceutical, heartworm and flea and tick preventive sales constituted a huge chunk of the profit and loss statement where I worked; that is no longer the case for many hospitals.

This income must be made up somewhere, but it must be valuable to the client as well as the patient to be utilized and appreciated. This safe and effective service-based modality can be the answer.

The practices I managed had the typical imbalance between canine and feline visits and revenue. What practice today wouldn't benefit from the addition of a modality that's safe, effective, extremely gratifying, and which can go a long way toward improving that imbalance?

Sarah Gallagher, a certified veterinary practice manager, is a laser consultant with K-LaserUSA.
Integrating Class IV laser therapy into your daily practice

By Ernie Ward, DVM
For The Education Center

I’m always searching for ways to improve my patient care and client service. Throughout the past 23 years, I’ve helped pioneer senior-care programs, long-term drug monitoring protocols, and weight management and nutritional counseling alongside regimented staff training, communication role-playing and innovations in veterinary hospital design. For the past five years, I’ve been integrating Class IV laser therapy into my daily practice with impressive results.

If you’re considering adding Class IV laser or any new therapy or service to your clinic, try these simple steps to improve compliance and success.

**STEP 1: Believe in It**

Successfully adding a new service or product into your daily practice begins with personal experience and firm belief. Whenever veterinarians struggling to gain acceptance of a new therapy confront me, I ask if they’ve tried it themselves and believe in it. It’s nearly impossible to recommend a procedure to your clients that you haven’t personally experienced and trust. I wouldn’t offer a product or perform a treatment on my personal pets that I didn’t believe was safe and effective and the same goes for my patients. Nothing speaks louder than personal testimony.

Class IV laser therapy is an FDA-cleared treatment. Numerous research studies conclude Class IV laser therapy helps reduce pain and inflammation while facilitating tissue regeneration. In simplest terms, Class IV laser therapy can boost circulation to damaged tissues, creating an optimal healing environment. Scientific studies aside, I know firsthand the power of Class IV laser therapy.

Many of you may know my love of endurance sports, especially the Ironman triathlon. The Ironman is an event combining a 2.4-mile swim, 112-mile bike and 26.2-mile marathon in a single day. Years of this sort of fun have caused a few scars and stresses on my joints.

In 2011, as I was preparing for an Ironman, I developed debilitating bursitis in a previously injured shoulder. I was in danger of not making it to the starting line. Friends recommended a variety of remedies, none of which helped. Finally, an exercise physiologist buddy suggested Class IV laser treatment.

After two treatments, I could move pain-free. Within two weeks, I was back in the ocean swimming miles. I also recommend working with rescue groups and animal bloggers to distribute clinic news and updates. Other good outlets for sharing the laser story are weekly or monthly community or business magazines. Don’t make the mistake of delaying a new service until you’ve published a press release and gained news media. Start with yourself, extend to your team and then share with your clients and community.

After you’re comfortable with Class IV laser or a new service, it’s time to contact your local media. Newspapers, radio and television are always looking for local stories to highlight, and pet news is always welcomed. As your confidence in a new product or service passes those three tests, try it. If you’re satisfied with the service, it’s time to contact your local media.

**STEP 2: Use It Often**

I have a friend who worked in marketing at Coca-Cola for many years. One evening, we were discussing the “cola wars” and he revealed the secret to winning: accessibility.

The goal of Coke, in his opinion, was to be as close as possible to every human being on the planet. If Coke was within arm’s reach, an individual was more likely to reach for it. I’ve taken those words to heart and applied it to my practices. If you want a recent addition to gain acceptance in your daily practice, it’s got to be within arm’s reach.

I recently visited a practice owner friend who had completed a new facility. He had bragged about all the latest gadgets he’d acquired, and I was eager to see his dream clinic.

As he escorted me through his sparkling high-tech temple, I didn’t see his boasted high-dollar ultrasound machine anywhere. He led me to a back room where he kept it until needed. He told me it was simply too expensive to risk leaving out in his treatment area. I asked how often he used the gleaming gizmo. At least a couple of times a month, he replied. Needless to say, I wasn’t impressed, and his investment certainly wasn’t as profitable as it should’ve been.

Out of sight, out of mind; out of use, out of revenue. Use it or lose it, as the saying goes.

Part of our daily clinic routine is to place our laser device in the treatment area, turn it on and confirm it’s ready to go on a moment’s notice. Because our teams understand how Class IV laser can help heal inflammation and mitigate pain, I want its presence to serve as a constant reminder we can help. The more my teams remember to use it, the better they’ll become using it.

The better we become at something, the more likely we are to do it. Frequent use accelerates learning and understanding of a new product or service. If you only use or recommend something a couple of times per month, you’re never going to gain the expertise our clients and patients need and deserve. Have your laser unit easily accessible and prepared for action; you’ll be surprised at the number of opportunities you have each day to use it.

**STEP 3: Share It**

As your confidence in a new product or service grows and your experience grows, you’ll want to share it with your clients and community. Begin by creating a “Success Book” detailing complex cases with outstanding results. Take pictures of every Class IV laser therapy case at diagnosis, throughout treatment and at completion of healing. Ask pet owners for a brief quote about their experience and if they’d recommend Class IV laser to others. Combining personal testimony with client recommendations is powerfully compelling and can aid pet owners in making more informed veterinary care decisions.

In today’s fast-paced and constantly changing medical environment, it’s more important than ever to keep your clinic welcome brochures and website updated with new services. Consider crafting personalized client brochures, explaining what Class IV laser is, how it works and why you’re excited to offer it. Add this content to your website and repurpose it for social media postings.

Ernie Ward, DVM, is a veterinarian from Ocean Isle Beach, N.C. Visit his website at www.DrErnieWard.com

This Education Center article was underwritten by K-LaserUSA of Franklin, Tenn.
How to launch Class IV laser in your clinic

By Ernie Ward, DVM
For The Education Center

Buyer’s bliss: The euphoric feeling you experience when purchasing the latest high-tech gizmo guaranteed to revolutionize your practice. Buyer’s remorse: The realization the revolution isn’t happening.

If you’re a practice owner, you’re probably familiar with these two emotions. How many expensive ultrasound machines have been relegated to coat hanger status, stashed away in a lonely closet? How many cutting-edge contraptions and pioneering gadgets litter our offices, basements and attics?

I’ve learned there are better ways to purchase and launch new equipment such as Class IV laser, imaging tools and surgical tools. If you approach these decisions methodically and strategically, you can maintain bliss and avoid acquisition agony.

1. Does your clinic need it?

Browse the exhibitor hall at any major veterinary convention with a critical eye. By how many pieces of equipment you don’t have. Worse, as you listen to sales pitches, you can’t imagine how you’ve survived without whatever they’re selling.

A good salesperson doesn’t sell anything; they save you from certain doom. It’s easy to get caught up in the hype without asking yourself if your practice really needs a given piece of equipment. The way I overcome this reaction is to have a clear understanding of the identity of my practice, what we believe and offer, and how our community distinguishes us.

To know if you need something you must first know who you are and your clientele. If your practice promotes a more progressive, less-invasive approach to your patients, therapies such as Class IV laser may be more appealing. If your clinic prides itself on low-cost care, spay and neuter services and vaccines, advanced imaging such as ultrasound may not be a good fit for your clientele.

The best equipment purchases align with a clinic’s mission, core competencies and client needs.

2. Is it medically sound?

While this seems basic, not all equipment and service claims are crystal clear, scientifically speaking.

We’re scientists; use your training and experience to critically analyze the available information and make an educated, independent assessment. It’s OK if we disagree on the validity of certain techniques, modalities and technologies. What matters most is that each veterinarian decides for herself and himself how to critically analyze the available information and make an educated, independent assessment.

Once you get the hang of them, you won’t know why you ever lived without them. Don’t rely on revenue rules-of-thumb (everyone’s thumb is different, after all), hunches (“It’ll pay for itself in a year”) or best guesses (“Dr. Joe does about 10 a month”). Spreadsheets are your best friend when making capital outlays.

3. Do your clients want it?

A new piece of equipment will succeed only if the clinic and clientele support it. Before I added laser therapy, I conducted a simple survey of my clients. At the time, Class IV was relatively unknown in veterinary practice and even though I was excited, I wanted to determine if my rural pet owners were ready for it before plunking down my cash.

I started by casually asking some of my better clients with pets who would benefit from laser therapy. During an exam or recheck, I’d drop this new technology, explain a little of the evidence, probable pricing and gauge their response.

After receiving overwhelmingly positive feedback, I began floating the idea on social media and in newsletters. More encouragement.

4. Is it a good investment?

As a responsible business owner, I have to make sure I’m using my practice profits wisely. Before signing an equipment deal, I run several cost and revenue projections to see if the purchase makes financial sense.

In general, I perform a variety of calculations based on changes in price, labor and overhead costs, usage and depreciation. If you’re unfamiliar with these forecasts, ask your accountant or financial consultant.

Once you get the hang of them, you won’t know how you ever lived without them.

5. Set up for success

Buyer’s remorse typically begins with the realization that you don’t know how to maximize your investment.

Before you buy, write down how you’ll train your staff and educate your clients, pricing scenarios, best conditions to treat, and usage goals. When I launched laser therapy, I began by composing a simple staff script on how to explain laser therapy to clients and the top indications for using it.

I then started a social media awareness campaign with simple posts describing the conditions that most benefited from this exciting new technology. I relied on my initial research and conversations with veterinarians, manufacturer reps and clients to create these tools.

We also picked easy targets. In order to generate excitement and word-of-mouth referrals, we contacted some of our best pet owners struggling with their pets’ osteoarthritis. Our doctors and colleagues invited them to try Class IV laser and see if it would help.

We didn’t offer discounts or giveaways; we approached caring clients willing to try something to help their beloved companion.

We also presented many of our team members’ pets to gain their acceptance and personal experience will build confidence. Our staff was amazed with the results.

Within a couple of weeks, we had what we needed: Testimonials to share with other clients.

These early adopters transformed into therapy laser advocates. As our staff saw positive outcomes both in their personal pets as well as in their team members’ pets, they began recommending it to more clients. As pet owners raved on social media, new clients called.

As we gained confidence, we began expanding our usage and broadened our definitions for treatment. Nothing builds a service or product as much as first-hand endorsements.

We picked up good ideas from colleagues and industry reps along the way. One of my favorites is the “Laser Prescription Pad.” Similar to a drug prescription, our doctors briefly “prescribe” the frequency and duration of a treatment protocol. I also like a simple handout for dogs and cats detailing the “Top 10 Class IV Laser Treatable Conditions.”

If you board pets or offer day care or grooming, this handy handout can be sent home with a dog or cat displaying any symptoms.

I favor treatments clients can participate in. I’ve found the compassion and comforting connection pets feel when their owner is present to be healing.

The fact that pet owners can observe laser therapy (safely behind protective eyewear, of course), watch their dog or cat relax and rejuvenate, and appreciate the staff’s expertise is priceless. Many will share pictures of their pet during treatment. You can’t buy that kind of advertising.

I’ve been tremendously happy with my equipment purchases over the years. My glee is due to knowing and believing in the science backing my investments, understanding my clinic and clientele, and having a sound strategy for implementation.

Before you add anything to your practice, have a plan. You’ll be more successful, fulfilled and perhaps more blissful.

This Education Center article was underwritten by K-LaserUSA of Franklin, Tenn.
Laser therapy nears a new horizon

For The Education Center

Laser therapy is becoming one of the hottest topics in the veterinary industry. You can no longer pick up a journal or magazine, attend a conference, peruse the Veterinary Information Network or talk with colleagues without the topic of laser therapy coming up. The positive reports and clinical studies continue to grow.

Lasers, laser light and LEDs are integral parts of our daily life, from communications and entertainment to medical, industrial and military applications. Lasers and light (photons) are replacing copper wires and electricity (electrons) to improve the speed and efficiency of computer processing and transmitting data.

High powered industrial lasers improve precision and quality in materials production. Lasers are used for enhanced precision and guidance as well as direct cuts in military and transportation settings.

The medical front is inundated with life-changing and -saving advances attributed to lasers. Of course cosmetic lasers have many uses, but not only for vanity purposes. Many disfiguring dermatologic conditions can be treated and improved with laser applications. This directly affects a patient’s quality of life.

We have improved LASIK as well as slowing, repairing or reversing diseases such as glaucoma, intraocular pathologies and retinal disease. Dental and oral health is improved by many laser procedures. Minimally invasive surgery and laser have revolutionized how we approach numerous neurologic conditions, prostate disease, orthopedics and intra-thoracic and -abdominal conditions.

And then there is laser therapy! Using laser light in a non-ablative way will safely deliver photons to the tissue to produce a direct photobiomodulating effect within the body. These effects have been discussed at length in numerous other articles.

The science behind the positive analgesic, inflammatory modulating and enhanced healing effects are well established and becoming better understood and more refined every day. The question, “Does laser therapy work?” has been answered conclusively and emphatically—yes!

The benefits of laser therapy for a wide range of dermatologic, neurologic and musculoskeletal conditions is experienced daily by tens of thousands of human and veterinary patients. Even the safety of laser therapy has been found to be wider than initially hypothesized. The pertinent questions today are related to how to use the laser more efficiently, improve outcomes even further, and expanding laser applications.

Here are a few trends that are on the horizon and may become standard of care.

Post-neurologic recovery and trauma recovery are greatly enhanced by laser therapy. Recent studies have made bold statements in their concluding remarks such as the following:

In a study on post-traumatic neuropathic pain, it was concluded that laser therapy “can improve a patient’s quality of life, proving to be a helpful tool in pain armamentarium, especially when all other measures have failed.”

In a study involving spinal cord and brain injury patients, it was concluded that “We could help patients untreatable with other therapies.”

And in yet another study, researchers stated that laser therapy “has the potential to revolutionize post-operative repair of severe peripheral nerve injury.”

The University of Florida studied laser therapy on spinal cord injury in dogs and found the results to be “amazing.” In an article from Gainesville, Fla., Dr. Schubert said, “The results were so profound that we’re doing this procedure now on all dogs that come to us with this condition.”

Lasers and other light devices are integral to our daily life, and evidence is accumulating for laser therapy to become the standard of care for conditions such as pain, recovery, neuropathic pain and more.

Laser light is used in vitro to enhance stem cell proliferation during the amplification process. Now many companies are looking into the synergistic effect of regenerative cell procedures and laser treatment in vivo to enhance treatment response and patient benefits.

The International Centre for Genetic Engineering and Biotechnology is an intergovernmental organization in the United Nations Common System. Its mandate is “to provide a Centre of Excellence for research and training in genetic engineering and biotechnology.” It has performed studies that demonstrate positive results of laser therapy on the treatment of dermatitis induced by radiation in breast cancer patients. Even more exciting were the positive results in preventing and resolving “chemotherapy-induced oral mucositis in onco-hematological paediatric patients.”

The center is continuing studies on the positive effects laser therapy can have on the immune system and even as an adjunct in treating neoplastic lesions. (Most texts still list laser therapy directly over cancer as a contraindication.)

Many pathologic conditions in the lungs are responding favorably to laser therapy. It has been beneficial in slowing the progression and/or decreasing the intensity of drug therapy in conditions such as interstitial pulmonary fibrosis (Westie lung disease), feline asthma and even tuberculosis. The University of Minnesota is using laser therapy as an adjunct in its treatment and research on Westie lung disease.

Intra-abdominal conditions are another area of interest and excitement. Chronic kidney disease patients have shown clinical improvement related to appetite, well-being and decreased nausea. Chronic bladder issues including persistent infections and feline idiopathic cystitis (FLUTD) have shown greater improvement when laser therapy was added to the regimen.

Laser therapy has been used as an adjunct to improve inflammatory bowel syndromes and other enteropathies. There are even reports of decreased morbidity and mortality in parvo enteritis with the addition of laser therapy.

The improved cellular function and structure has had some profound effects in severe traumatic injuries that have traditionally been less responsive to current treatment options. Equine tendon and ligament recovery is an exciting area of research due to the decreased length of rehab and the enhanced integrity of the structures with more normal collagen alignment and a higher degree of type I collagen production.

It has been shown to decrease the time of recovery with a higher level of performance and reduced incidence of relapse or re-injury.

The applications of laser therapy continue to expand. To capitalize on all that laser therapy has to offer, one needs to understand the optimal parameters that allow it to be so effective across a broad range of applications. Next month we will look into all the factors that should be considered to keep up with the expanding opportunities in laser therapy.

Topics will include power levels and how they relate to adequate dosage; the benefit of wavelength selection; delivery mode (CW/Pulsed or Modulated/ SuperPulse) and how it can enhance overall improvement; contact and non-contact delivery techniques and how they relate to tissue absorption; proper protocols, which can enhance clinical outcomes and improve client compliance; and general features that can simplify the use and implementation of laser therapy.

Ignoring or dismissing certain elements will decrease the consistency in results, the degree or quality of improvement, and/or the number of conditions that will respond to laser therapy. These limitations are important to realize if you already have a laser but especially if you’re still looking to implement laser therapy into your practice.

With the proper understanding and the proper equipment, the modality’s full potential can be realized and evolve as the science continues to progress. Lasers will continue to grow as an integral part of medical therapy. Don’t let technological limitations restrict you from capitalizing on the advances in laser therapy and all that it has to offer.

This Education Center article was underwritten by K-LaserUSA of Franklin, Tenn.

Using laser light in a non-ablative way will safely deliver photons to the tissue to produce a direct photobiomodulating effect within the body.
Therapy-optimal parameters deliver best results

This is the second in a three-part series looking at the applications of laser therapy and reviewing trends that likely will lead to new standards of care.

For The Education Center

The numerous applications where laser therapy is being used are very exciting. Even more exciting are some of the newer conditions that we are learning will respond to laser therapy. New applications and how to improve treatment protocols is where the bulk of studies and interest are concentrated today.

Again, there is no longer a question as to whether laser therapy works. The pertinent questions today are related to what else can we do and especially how can we do it better.

The next two articles will look at all the parameters critical for optimal results with laser therapy across the broad range of potential applications. These include wavelength, power/dosage and delivery mode, which can be continuous wave (CW), pulsed (modulated or gated) and superpulsed. This article will look at wavelength selectability and delivery mode.

The wavelength is what determines the best function of any particular laser. Laser therapy works by a wavelength-specific form of photobiomodulation. Cellular chromophores within the blood stream and tissue mitochondria absorb the laser energy, and a series of direct biochemical processes along with a broad cascade of secondary and tertiary effects are stimulated or enhanced.

Target Chromophores

The reason most therapeutic lasers now have the capability to produce more than one wavelength is because of the better understanding of the direct photophysical effects produced when a photon of light is absorbed by specific chromophores within the body.

The most important target chromophores are water, which has a nice peak of absorption in the 970 to 980 nm range; hemoglobin, which has a broad absorption peak at 890 to 990 nm; and cytochrome-c-oxidase, with peak absorption at 780 to 830 nm. Laser light in these ranges causes an improved efficiency of the respiratory chain within the mitochondria of every living cell. This leads to an increase synthesis of ATP.

In addition, reactive oxygen species such as NO and SOD are produced and there is a shift in the redox state. A cascade of secondary effects can then take place, including DNA and RNA synthesis; activation of fibroblasts, macrophages and lymphocytes; growth factor release; neurotransmitter release; vasodilation; collagen synthesis; improvement of cell membrane permeability; and function of the Na+/K+ pump.

Increased metabolic activity will increase oxygen and nutrient availability, which leads to enhanced protein and enzyme production. These factors will accelerate/stimulate cell reproduction and growth, which leads to faster repair of damaged tissues and moderation of the inflammatory response, as well as providing analgesia.

Delivery Modes

Let’s now look at the delivery modes used in laser applications. These can be modified and tailored to optimize therapy across the broad range of applications and patient parameters. What we are talking about here is the time domain of the laser or Hertz/strobe effect of delivering laser energy. This can be done in continuous wave, pulsed (modulated or gated), or superpulsed.

The pulse rate with which the laser is delivered will have differing physiologic effects on tissue. Lower pulse rates and continuous wave, for example, impart a better effect on pain modulation while higher frequencies are more anti-inflammatory and bio-stimulatory.

Different tissue types also seem to respond more efficiently to differing pulse rates. It may not only be as simple as the rate but even the duration of time the laser is on vs. off could affect tissue response in a more positive manner. These are still being studied but current literature consistently shows that adding pulse frequencies (modulation) to the treatment protocols produces better overall and long-term results than just CW delivery.

Individual studies on multiple conditions confirm this, particularly for wound healing and certain neurologic injuries. This topic was covered thoroughly in the March 2013 issue of Veterinary Practice News. It cites one example from a meta-review from Harvard University which analyzed all relevant laser literature from 1970 to 2010 regarding the effects of pulsing in laser therapy.

The researchers’ conclusion was that although CW light has been the gold standard and has been used for all types of low-level laser therapy applications, overall, pulsed light may be superior or to CW light with everything else being equal. Another review presented by Engel et al from the NIH at the 2015 American Society for Laser Medicine and Surgery annual meeting concluded that the effects of laser pulsing on distinct cell types suggests that optimization of laser treatments based on target cell types could improve clinical efficacy and therapeutic benefit for photobiomodulation.

Even at the cellular level, a recent study conducted by the International Centre for Genetic Engineering and Biotechnology showed a more consistent and prolonged stimulation of cellular ATP production using pulsed delivery modes over CW delivery modes.

Superpulse is another laser delivery mode for all types of lasers including surgical and industrial units. Superpulsing laser energy can mitigate thermal and absorption effects of pigmented tissue. It may therefore improve penetration and with proper parameters increase the number of photons that reach the target tissue.

Again, it is very important to keep in mind the average power or total joules per minute being delivered for effective results. Don’t be misled by statements that merely reflect peak power.

Contact, Non-contact

One last concept related to delivery mode is administering therapy in a contact or non-contact mode. Just to clarify, unless you are using a laser for surgical applications, no laser fiber directly touches the patient during therapy. All lasers transmit the energy through some configuration of a contact head.

This is especially important in our veterinary patients because many of the conditions we treat are through the hair coat. In human treatments, clothing is removed. Hair can be just as big a barrier to laser energy but if we had to shave all patients for every treatment, it would greatly decrease client compliance.

Using a contact head (and proper dosage), the hair can be displaced adequately to allow for enough photons to reach our target tissue. The most important point to remember is that there is no study that shows any delivery system to be superior to any other on the market. The pertinent feature of the contact head, therefore, would be related strictly to its ease of use and cleaning/sterility, durability and adjustability.

The last parameter to discuss will be that of dosage and how this relates to the average power delivered by specific laser products. It is one of the primary factors that will determine the success of laser therapy. This also seems to be one of the more confusing issues among laser therapy practitioners. This will be thoroughly covered in next month’s article.
Power, dosage are critical

The laser’s class is dictated by FDA and relates to the maximum average laser output. Maximum laser output is calculated by the total average power (Joules/sec), not a single burst or peak power. Always ask what the average power is or the number of Joules per minute that can be delivered.

If it is not revealed easily or if it is dismissed as unimportant, that should raise a red flag. This is not meant to distinguish or categorize lasers as good or bad. This is not a question of high-powered vs. low-powered. It is merely to emphasize the importance of proper dosage and having the right tool for the job you want to do.

The only thing we can say for sure is that if you give too little a dosage, you will produce little to no response. If you have been following these articles, you may be feeling like laser therapy is a very complicated proposition. Although the principles behind laser therapy can be very intricate, they are well understood. More importantly, though, is that all this information is being used to produce very user friendly laser products.

The protocols already set up in most therapeutic lasers simplify all these parameters in an easy to use “point-and-shoot” technique. Because of the wide margin of safety, laser therapy can be instituted quickly and easily. It can and should be delegated to the staff for the “point-and-shoot” technique. Because of the wide margin of safety, laser therapy can be instituted quickly and easily. It can and should be delegated to the staff for the...