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BOOK 1
VETERINARY LOW-LEVEL LASER THERAPY

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In 1917, Prof. Albert Einstein established the theoretical foundation for the LASER in the paper Zur Quantentheorie der Strahlung (On the Quantum Theory of Radiation). Einstein wrote the concept of spontaneous emission, and stimulated emission of electromagnetic radiation. Years later, Theodore Maiman (1960) demonstrated the first functional laser at the Hughes Research Laboratories in the United States, capable of producing short pulses according to Einstein’s theory.

LASER is an acronym for Light Amplification by Stimulated Emission of Radiation, wherein light broadly denotes electromagnetic radiation. Laser’s definition is “any device which can be made to produce or amplify electromagnetic radiation in the wavelength range from 180 nm to 1 mm primarily by process of controlled stimulated emission.”

The radiation is a coherent electromagnetic monocromatic (one wavelength) beam, advances in one plane and one direction, and does not diverge. As a result of atomic excitation in a diode, uniform wavelength photons are released and forced to exit in one particular direction. These properties are the reason for the laser’s strength and its penetration ability and its many uses.

Surgical laser beams are stronger and can reach 300 W (Watt) and higher. Low-level laser strength is 1 to 1000 milliwatts (mW), and this type of laser (low level laser) is the subject of this presentation. In 1967, a few years after the first working laser was invented, Prof. Endre Mester in Semmelweis University, Hungary, experimented with the effects of lasers on the skin. He studied the safety of laser applications in order to avoid induction of skin cancer. While applying lasers to the backs of shaved mice, he noticed that the shaved hair grew back more quickly on the treated group than the untreated group.

The Mester application is known today as Low Level Laser Therapy (LLLT) in human medicine, and Veterinary Low Level Laser Therapy (VLLLT) when used for animal benefits. The technique is also referred to as Cold Laser Therapy and Low-Powered Laser Therapy (LPLT), and it is a light source treatment that generates a coherent light of single wavelength. LLLT uses red-beam or near-infrared lasers with a wavelength between 600 and 1,000 nanometers (nm) and from 5 to 500 mW. It was also found that the maximal skin penetration is in wavelengths of 800 to 830 nm. LLLT emits no heat, sound, or vibration. Instead of producing a thermal effect, LLLT acts by photochemical reactions in the cells (bio-stimulation).

What is the biological background behind low level laser activity in live animals? It is a photochemical effect comparable to photosynthesis in plants whereby the light is absorbed by chromophores as chlorophyll and exerts chemical changes. In animals one of the chromophores that exerts chemical changes is Cytochrome C Oxidase (Cox) in the mitochondria, and it induces an increase in the production of ATP.

The physiological effects of VLLLT can be summarized as follows:

1. Increases ATP production
2. Biostimulation — improved metabolism, increase of cell metabolism
3. Increases speed, quality, and tensile strength of tissue repair.
4. Improved blood circulation and vasodilation, and as a result increases blood supply
5. Analgesic effect, relieving acute/chronic pain
6. Anti-inflammator and anti-edematous effects
7. Stimulation of wound healing, promotes faster wound healing/clot formation
8. Helps generate new and healthy cells, as well as tissue
9. Increases collagen production
10. Increases macrophage activity
11. Stimulates the immune system
12. Alters nerve conduction velocity and as a result stimulates nerve function

More in-depth information on the mechanisms behind soft laser therapy can be found in the article “Efficacy of low-level laser therapy” (Lancet 2009;374:1897-1908). The first two veterinary articles on VLLLT were published in 1983: Basko, “A new frontier: Laser therapy” in (California Veterinarian1983;10:17) and McKibbin and Paraskev, “A study of the effects of laser therapy on chronic bowed tendons at Whitney Hall Farm Limited, Canada” (Lasers in Surgery and Medicine 1983;3:55). In the last few decades several veterinary papers have been published on the different aspects of VLLLT: its dermatalogic uses, in orthopedics, for neural deficiencies, and in dentistry, as well as in combination with acupuncture.

In the last three years we began using VLLLT at our institution and clinics using these guidelines to set up our program:

1. In order to be effective the owners of the animals should be able to treat the animal at home twice a day for 6 to 8 minutes each time for 14 days. This protocol improves clinical success rate.
2. In order to achieve the first goal we need to have a mobile and lightweight laser (100–200 grams instead of 5–15 kg as in the past). The laser should have rechargeable capacity with batteries that will give at least 5 hours of operation time after charging at the clinic.
3. The laser should be easy for the animal’s owner to operate, and the clinician’s team must be able to explain its use to the owner.
4. Safety issues: With the type 1 laser, there is no need for specific protective goggles. Simple precautions must be explained to the user: avoid reflection into the eyes of people and animals; avoid the low abdominal area in pregnant animals.
5. The laser will be leased to the owner for the term of the therapy at a reasonable cost. We found that we needed to buy at least 10 lasers to get a cost-effective price.
6. Once every 7 days or less the animal should be re-evaluated by the clinician.
7. The laser emission area should be broad enough to cover at least 1 square cm in order to avoid the need to pinpoint radiation, a task that is hard to perform by the owners.

We have used VLLLT on dogs and cats in our clinics (Hod-Hasharon Veterinary Clinics, Hod-Hasharon, Israel) and on horses at the stables of Academic College at Wingate Institute, Israel. We have used VLLLT for different myofascial pain syndromes (e.g., knee pain, low back pain, neck/upper back pain, muscle pain, superficial or deep digital flexor tendons), joint disorders such as arthritis or arthrosis (e.g., hip dysplasia, elbow arthrosis), medical skin conditions (e.g., acral lick granuloma, healing wounds post surgery, healing wounds post skin and subcutaneous tumor removal), dental diseases (e.g., feline stomatitis-gingivitis-fauclusis syndrome), and neural deficits (e.g., facial paralysis, radial nerve paralysis, spinal cord disk protrusion also known as intervertebral disk disease, IVDD).

Our routine protocol is application of VLLLT by the owner twice a day for 14 days, and each application is done for 6 to 8 minutes. Evaluation of the animal is done before laser application, after 7 days or earlier if needed, and after 14 days.

Our experience thus far in using the mobile VLLLT unit is summarized below:

1. **Neural deficits** — A complete recovery of facial paralysis in 5 dogs, vestibular syndrome in 4 dogs, and 5 out of 6 cases of radial nerve paralysis in cats. We are also using it for any case of IVDD as part of more complex protocol.

2. **Dental diseases** — In 5 cases of severe feline stomatitis-gingivitis-fauclusis syndrome, we were able to reduce the frequency of steroid injections in all 5 cats from every 2 weeks to once every 12 weeks or longer.

3. **Medical skin conditions** — We have treated dogs and cats for psychogenic dermatosis (as acral lick granuloma) and all 9 of them stopped the self-mutilation behavior within a few days of therapy. Owners of all dogs and cats that have any type of surgery at the clinic now are routinely offered the option to add VLLLT for their pet's wound healing; we have done numerous sessions using VLLLT and recovery times have been reduced by 30%.

4. **Joint disorders/arthrosis/arthrosis** — As a routine practice we now apply VLLLT for every dog with hip dysplasia or elbow arthrosis. In 21 dogs we have been able to cease administration of drugs given in the past for these conditions (e.g., carprofen [Rimadyl] or etodolac [Etesic]).

5. **Myofascial pain syndromes** — All treated animals (6 dogs, 6 cats, and 4 horses) have had a great improvement in their condition according to their owner and clinician evaluation.

We are currently investigating VLLLT in different animals for different conditions. Our conclusion so far based on our own experience and the literature is that VLLLT is clinically effective in the following conditions: facial paralysis, vestibular syndrome, radial nerve deficits, IVDD, feline stomatitis-gingivitis-fauclusis syndrome, psychogenic dermatosis, as an adjuvant for surgical wound healing, hip dysplasia or elbow arthrosis, and myofascial pain syndromes (e.g., low back pain, neck/upper back pain, muscle pain).
LOW-LEVEL LASER THERAPY FOR SEVERE DERMATITIS

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A 9-year-old, spayed female dog, medium size and mixed breed, was diagnosed by a veterinary oncology specialist as having a soft tissue sarcoma on its left front leg, proximal to mid radial bone area, after surgery done at another clinic at the end of August 2009.

Three months later (December 2009) the tumor reappeared, and the owner refused to go for a leg amputation procedure as a radiation therapy currently is not available in the area.

The owner approached us for a complementary and alternative veterinary medicine consultation. After reviewing all the data we offered a local therapy of zinc chloride and Sanguinaria canadensis (bloodroot) paste local application followed by a veterinary low-level energy laser therapy (VLLLT).

PASTE PREPARATION AND APPLICATION PROTOCOL

The final paste is zinc chloride and Sanguinaria canadensis 1:1 mixture by dry weight.

1. ZnCl₂ powder stands in room temperature for 24 hours, and turned to be a paste.
2. We add a Sanguinaria canadensis root dry powder to the paste and mix it. We let the final mixture stand for 24 hours before application.
3. The final mixture can be kept and be re-used for the next 18 months if it is tightly closed in a dark plastic canister.
4. Upon application we need to protect ourselves with gloves. Protect the treated animal with Vaseline ointment surrounding the area to be treated. A head collar to the dog might be needed in certain circumstances. Keep in mind — in certain cases — there is also a need to protect the owner and the environment.
5. Apply a thin film (applied locally and not injected).
6. Re-check and re-evaluate every 3 to 4 days. At every re-evaluation, take off necrotic tissue.

The remedy was applied three times during December 2009 and the tumor disappeared, leaving a deep and extended open skin and a subcutaneous tissue lesion/wound.

VETERINARY LOW-LEVEL ENERGY LASER THERAPY PROTOCOL

The wound was lightly bandaged and treated with veterinary low-level therapy (VLLLT) for healing of the extensive lesion.

Keep in mind that due to the special mixture there is no need for antibacterial ointment/tablets/injections or any special drugs during VLLLT, but maybe just a bit of K-Y gel to keep the area on skin below bandage with some moisture.

The bandage was taken off for every VLLLT session and then re-applied after each session. The therapeutic procedure was demonstrated to the owner on Day 0, and the owner administered the therapy twice a day for 6 to 8 minutes for each session. Re-checks were done every few days at the veterinary clinic for 21 days.

At every re-check, the skin and coat were observed to be healing well and both were completely normal by 21 days of therapy. The dog was using his leg completely normally with normal function.

Our conclusion at 21 days from the beginning of VLLLT was that the therapy using the B-CURE LASER LLLT-808 was very efficient in promoting a quick recovery of skin and coat with no scars, no granulomatous reaction, and normal movement of the leg.

Almost 2 years after the completion of the therapy (September 2011), the original clinic saw the dog and reported that the dog is moving normally, with normal skin and coat, and local x-ray radiographs did not show any abnormal changes.