Therapeutic Laser

Due to advancements in veterinary medicine and surgery over the last several decades our pets are living longer and experiencing more issues related to degenerative joint disease (arthritis) and physical rehabilitation issues following orthopedic joint surgery. There also is a more recent increase in dogs entering performance events such as agility, free-style dancing, obedience, rally, flyball and service dogs participating in search and rescue, police work, military dogs, etc. When these dogs experience injuries they often return to function quicker with physical rehabilitation equipment and techniques taken from the human side.

"Laser" stands for Light Amplification by Stimulated Emission of Radiation. I think it is beyond the scope of this article to get into the theory and physics of the laser but the following points clarify some aspects of lasers:

1. Class I and Class II lasers are low power lasers used in CD players, DVD players, laser printers and bar code readers.
2. Class III lasers are laser pointers and low level therapy devices (lasers<0.5Watts).
3. Class IV lasers are surgical lasers (cutting) and higher power therapy lasers (lasers >0.5 Watts up to 10Watts). The therapeutic laser is NOT a surgical laser and CANNOT cut a patient.
4. The Class IV therapeutic laser has a maximum power of 10Watts which can penetrate several inches into the muscle and joints as opposed to Class III therapeutic lasers with the highest power capability of 0.5Watts which can only penetrate in millimeters.
5. The Class IV therapeutic laser delivery system is a quartz fiber hand-held device.

LED (Class III) phototherapy should not be confused with laser therapy.

How do therapeutic lasers work?

When laser light is directed at tissue it is reflected, scattered, absorbed or transmitted. The absorption of laser light is the key therapeutic goal. Wavelength and tissue composition is critical to defining the depth of tissue penetration. Absorption is wavelength dependant with longer wavelengths being absorbed less by superficial tissues and penetrating deeper. The Class IV therapeutic laser has a wavelength of 980nm which penetrates more deeply into tissue. When laser light penetrates tissue there are a number of mechanisms of action. All involve photochemical interactions of photons with the tissue. The laser light changes biochemistry by a process called photobiomoduation or photobiostimulation. This process consists of tissue mechanisms of action and cellular mechanisms of action.

1. Tissue mechanisms
   The laser light creates electrical, temperature and pressure gradients in the tissue. These gradients impact electrolyte movement and transport of cellular nutrients and wastes across cell membranes. Ordinary light cannot do this.
2. Cellular Mechanisms
   The cellular mechanism of action of Class IV therapy lasers is dependent on photon absorption by tissue chromophores. Tissue chromophores are components of cellular and sub-cellular organelles which absorb light. Chromophobes located in mitochondria (cellular "batteries") absorb photons from the laser light. The absorbed energy stimulates the energy-producing chemical reactions in the cell and increases the synthesis of DNA and RNA. Essentially the cells are "turned on" with increased metabolic activity.

The clinical changes noted after use of the Class IV laser therapy include reduced pain, reduced inflammation and accelerating healing. These changes are a result of a combination of biological and biochemical effects.

Accelerated cell growth and reproduction
- —Activation of the Kreb's Cycle
- — Increased ATP production
- — Increased polymerase and transcriptase levels
- — Increased metabolic activity

Analgesic effects
- — Increased release of tissue endorphins

— Suppression of nociceptors (pain receptors)
— Increased stimulation threshold for pain
— Reduced neuron impulses in nerves associated with pain
— Reduced pain perception

Anti-inflammatory effects
— Decreased prostaglandins — PGE_2
— Decreased release of inflammatory mediator
— Activation of lymph drainage system
— Decreased edema formation

Wound healing
— Increased cytokines (Growth Factor, PDGF)
— Improved vascular activity — increased angiogenesis and capillary formation.
— faster wound healing due to stimulation of fibroblasts with resultant increase in collagen production.

Anti-microbial effects
— Direct effect on microbes — cell membrane changes and pigment absorption
— Activation of patient defenses — increased macrophage activity and stimulation of white blood cells.

Applications:

1. Traumatic and surgical wounds
2. Slow-healing injuries,
3. Soft tissue injuries such as hematomas, swelling, edema, inflammation, etc.
4. Chronic arthritis
5. Burns
6. Scar tissue
7. Ulcers
8. Sport injuries such as muscle contusions, tendonitis, fasciitis, sprains, strains, partial tears, bruising
9. Contaminated wounds
10. Chronic ears infections
11. Lick granulomas
12. Gingivitis/stomatitis
13. Acute injuries for pain management
14. Cats with interstitial cystitis (FLUTD)
15. Post-op surgical incisions
16. Chronic skin issues
17. Adjunct to physical rehabilitation
18. Intervertebral disc disease
19. Use in performance dogs

There are some safety issues in the performance of laser therapy. These center around possible eye damage and heating of tissues. The owner and the operator wear required eye glasses to prevent damage to the eyes caused by reflection of the laser light. This reflection is minimal with the Class IV therapeutic laser. Animals may also have to be restrained so they can't look at the light or wear protective eye wear such as goggles or a blind fold. Overheating of the tissues is prevented by controlling the laser head properly, constantly moving the laser probe and using your hand to evaluate temperature of the skin.