The benefits of low-level laser therapy, laserpuncture, and the interaction of biophoton communication pathways through fascia

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For the Education Center

Low-level laser therapy (LLLT), utilized in rehabilitation for decades, is now emerging as a mainstream modality for veterinary medicine. Interest in applications of therapeutic laser has expanded rapidly as scientific evidence validates both the mechanisms and clinical benefits of light-based therapies.

LLLT is primarily used to promote healing, reduce pain and inflammation, and restore cellular function. Light emitted from the devices (generally red or infrared wavelengths) is absorbed into the tissues. This stimulates mitochondrial chromophores to increase adenosine triphosphate production, release nitric oxide to improve blood flow, and increase beneficial reactive oxygen species to activate diverse signaling pathways. While most research is being performed in humans, extrapolation to veterinary medicine is reasonable.

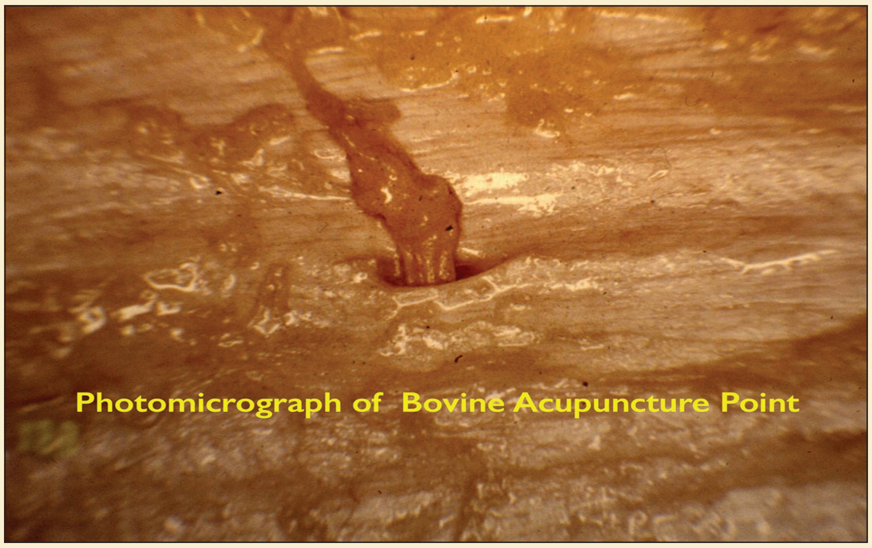
The mechanisms of laser therapy, considered by experts to activate photochemical processes, are not dependent upon thermal changes in the skin or tissue. Generally, high-powered lasers (continuous wave greater than 500 mW) ineffectively penetrate the skin due to their wavelength. No amount of power can compensate for a poor depth of penetration time profile. Excessive power often leads to rapid heating of the skin and superficial structures. Excessive tissue heating interacts with signaling molecules released during light exposures and can open pathways to apoptosis or cell death. The effects on the tissue become no longer phototherapeutic, but photothermal, which is a much different pathway than previously recognized.

Super pulsed lasers (SPL) operate more safely and efficiently than high-powered lasers and delivers red and near-infrared light to cells at power densities below the threshold that produces thermal overloading of tissues. SPL produces extremely short "bursts" of light at high peak power just billionths of seconds in duration. This results in very low thermal influence on skin and maximizes delivered dose of light to target tissues for greatest phototherapeutic effects and outcomes.

Therapeutic laser has clearly established its role in treatment and management of skin and wound healing, tendon and ligamentous injuries, muscle spasms and trigger points, as well as pain following surgical procedures, arthritis, and injury. It's an alternative yet integrative approach for applying light energy to help fight disease, promote tissue repair, and provide quick pain relief that's quickly gaining popularity.

Laserpuncture: What have we learned about the anatomical pathways for light?

Our understanding of how light can be optimized for skin penetration is becoming better understood, but what about alternate pathways for delivering light energy into our patients? Is it possible that given how transmissive collagen and fascia are to electrical energy—what about transmission of laser therapy biophotons? During the past 40 years, acupuncture, a therapeutic technique of oriental medicine, has become increasingly popular, evolving into one of the most utilized forms of complementary integrative medicine interventions in the U.S. This increase in popularity can be attributed to its effectiveness for pain management and as an increasing alternative to opioid treatment. Laserpuncture, a term commonly used to describe the stimulation of acupuncture points with light, differs from traditional acupuncture in that needles are not a requirement. Points are only stimulated or sedated by directing the light (often sequentially) to an identified point or points. Studies conducted on both humans and animals suggest that acupuncture may improve immune function, increase blood cell count, and enhance lymphocyte and natural killer cell activity.



Research has increased our overall understating of the anatomical basis of acupuncture, and as a result, new theories have emerged to explain its various effects. Perhaps none have been as comprehensive as Dr. Mae-Won Ho's liquid crystalline collagen continuum (LCCC) theory of acupuncture. It cross-links Eastern and Western philosophy and studies into a cohesive, pragmatic explanation for the scientific basis of acupuncture. Since its publication in 1998, there has been a significant upsurge of interest and research documenting the LCCC theory and fascia-based acupuncture theory.

Dr. Ho's theory proposes that the acupuncture system and the direct current bioelectrical body field are both located, in part, in the continuum of the liquid crystalline collagen fibers that constitute most of the connective tissue.[1] Collagen fibers' bound water layers provide proton conduction pathways for rapid intercommunication throughout the body, enabling the organism to function as an integrative circuit.[1] Water and collagen are two of the best conductors of electrical currents. This offers further validation to the bioelectric theory of acupuncture, that "Chi," or one component of it, is based on a bioelectrical body field located within the LCCC of the connective tissue.

Science-based acupuncture may be defined as the stimulation of specific predetermined points on the body to achieve a therapeutic or homeostatic effect. Acupuncture points (acupoints) are areas on the skin of decreased electrical resistance or increased electrical conductivity.

Acceptance is growing that all the major constituents of living organisms may be liquid crystalline. This includes lipids of cellular membranes, DNA, possibly all proteins—especially cytoskeletal proteins, muscle proteins, and proteins in the connective tissues such as collagens and proteoglycans.[1] NMR studies of muscles in living human subjects provide further evidence of their "liquid crystalline-like" structure.[1] Essentially, it appears that organisms may be fundamentally liquid crystalline.

In order to most effectively utilize light-based modalities, laser power output should be sufficient to elicit a response like that of needle acupuncture. However, the threshold for acupuncture-like effects with lasers appears to begin at an intensity of around 1 Watt/cm², and further concentration may not produce greater effects. Higher-powered lasers (greater than 500 mW) must be "swept" over the area to avoid burns or excessive heat to avoid patient discomfort. This limitation severely affects their usefulness in laserpuncture due to the specificity in target selection and the need to hold the probe static during energy delivery. Super pulsing of the laser with lower-power devices (less than 500 mW) produces much less heating of tissues at the surface, allowing for sufficient levels of energy to reach deeper target tissues.

There is strong evidence to suggest that light energy at the appropriate wavelength and power density can provide stimulation of acupuncture points and enhance biological process at both tissues and cellular levels. As additional higher-quality studies on therapeutic laser in animal models are completed and published, there is no doubt the use of therapeutic lasers for laserpuncture will continue to expand. With the understanding of how acupuncture works through the bioelectrical communication system of the fascia throughout the body, one can appreciate how LLLT also can have a rapid beneficial healing effect throughout the body. One future of veterinary medicine is to continue to develop the use of light therapy, biophotonic modulation, and LLLT as an essential vital approach to complement and accelerate healing. ●

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