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Laser Therapy and Pain Relief

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Light amplification of stimulated emission of radiation (laser) is a light beam from the electromagnetic spectrum. Unlike conventional light sources a laser beam travels in only one direction and is monochromatic with its photons (little packets of energy) which are all identical in size, traveling equidistant in time and space. Low-level laser therapy (LLLT) has been investigated and used clinically for over 30 years, mostly in Eastern Europe and Asia. The ability of lasers to cut, cauterize and destroy tissue is well known. These same or similar lasers at lower powers can nonthermally and nondestructively alter cellular function. This phenomenon, known as laser biostimulation, is the basis for the current use of lasers to treat a variety of articular, neural and soft tissue conditions.[1]

A variety of names have been used to describe the same type of low-level laser: biostimulation, low energy, low reactive, low intensity, soft and or cold laser. In current practice, LLLT uses low output levels (15100 mW), short treatment times (10-240 seconds), and low energy levels (1-4 J/cm2).[1]

The mechanism and effectiveness of LLLT has been compared with ultrasound therapy,[2] and should be considered as an extension to the accepted physiotherapy modalities that currently utilize parts of the electromagnetic spectrum, such as shortwaves, microwaves, infrared, and ultraviolet therapy.[1]

Lasers produce nonionizing, electromagnetic radiation that is extremely monochromatic, polarized and coherent.[3] Laser light has been reported to penetrate human tissue in the ranges of .8-15mm,[4,5] but the majority of the light will be absorbed within the first 4mm.[6,7] Although this may seem superficial, it should be noted that chemical processes may be initiated and mediate physiological effects at a deeper level.[8]

The initial studies utilizing LLLT on nerve tissue produced mixed results regarding nerve conduction velocity and distal latency. These earlier studies utilized low powered HeNe lasers (<=1mW) and resultant low energy densities (<=.012 J/cm2).1 More recent studies utilizing higher energy densities and deeper penetrating lasers have found alterations in distal nerve latency and conduction velocity by a few to many

percent, and which can last for periods of 30 minutes or greater.[1,9-11] It appears that nerve tissue has a photosensitive component, which results in a biostimulation blockade response following laser exposure.[12] It is felt that LLLT reduces the excitability of the nerve cells by an interruption of the fast pain fibers with a resultant reduction in pain.[12-15] LLLT has also been shown to accelerate the repair process of crush damaged nerves and improve function in both the CNS and peripheral nerves after injury.[1,16-18]

Laser Safety

LLLT is a relatively safe procedure. Due to the low level, nonthermal nature of the laser, there is no tissue destruction or other hazards that you would find associated with the higher powered lasers. The FDA has classified the most commonly used low level lasers as a class III, nonsignificant risk, medical device for investigations use only.[19]

Because of the coherent nature of the laser beam, ocular damage is the main concern for the LLLT user. The operator should not attempt to stare directly into the beam. Suitable goggles to attenuate the wavelengths would be used by both the operator and patient.[20] Other suggested contraindications would be to avoid exposure to sensitive tissue such as fetus, gonads and malignancy.[20]

Clinical Studies

A number of papers have shown a reduction of pain with laser treatments directed over acupuncture points.[21-24] Altered skin resistance with a reduction of pain were also noted in subjects who receive LLLT over muscular trigger points.[25-26]

A group of subjects with chronic tendinopathies, that had been previously treated unsuccessfully with physical therapy, NSAIDS, local injections, and or surgery, had an 87 percent success rate in pain reduction following the application of LLLT.[27]

In a study involving over 4,000 subjects who had suffered from conditions such as degenerative arthritis; muscle pain; tendinitis and tension myalgia. More than 80 percent of the subjects found a marked lessening of their symptoms following irradiation with an IR laser.[28-30]

In a study involving a total of 69 subjects and 302 total laser treatment sessions, more that 80 percent of the subjects with chronic radiculopathies and over 90 percent of the subjects with chronic neuropathies experienced a greater than 50 percent total relief of pain following LLLT.[14] In a similar study involving 60

total patients and 111 total laser treatments, it was shown that LLLT produced an immediate reduction of pain in 79 percent of the subjects.[15]

In a study involving over 100 subjects and over 500 laser treatments, it was observed that acute soft tissue pain syndromes showed a dramatic response following the initial laser treatment with a marked reduction in tissue swelling, bruising and good pain relief.[31] Subsequent treatments (2-3) produced further improvement.[31] It was also noted that chronic pain syndromes were slower to respond to LLLT (average of eight treatments), although 75 percent of the subjects noted significant pain relief.[31]

A two-stage survey of 116 chartered physiotherapists in Northern Ireland, who utilize LLLT as part of their clinical practice, ranked LLLT effective for the treatment of myofascial and postoperative pain syndromes; rheumatoid arthritis; muscle tears; hematomas; tendinitis; shingles; herpes simplex; scarring; burn and would healing.[32] In this same survey, LLLT was ranked first, on the basis of relative effectiveness, when compared with four other modalities (interferential therapy, shortwave diathermy, ultrasound, and pulsed electromagnetic therapy), for use in pain relief and wound healing.[32]

Suggested Mercy Conference Review

Low Level Laser Therapy: Low level laser therapy (LLLT) is a conservative procedure that utilized visible red and/or infrared regions of the electromagnetic spectrum. It is used as a physiotherapy modality for a variety of articular, neural and soft tissue conditions.

Rating: Investigational to promising, awaiting FDA approval.

Evidence: Class I, II, III.

Conclusions

Laser therapy is gaining laboratory and clinical data to prove its effectiveness. LLLT has gained acceptance for treating a variety of osseous, neural and soft tissue conditions in many parts of the world. The acceptance in the U.S. has been limited because of the rigors of the FDA approval process. Many of the earlier studies involving laser use lacked proper scientific controls. Today there are many controlled studies that are well-designed and multicentered. These studies include the use of modern electrodiagnostic and magnetic resonance imaging to monitor the subjects response in an effort to objectively study the role of LLLT in treating neuromusculoskeletal pain. There is a current need for clinical investigators to research

these new laser medical devices. Additional research is required to obtain data concerning success rates in treating specific conditions, length of exposure, frequency of treatments, and related therapeutic protocols.

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