Low-Level Laser Acupuncture

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ABSTRACT

Traditional Chinese Medicine (TCM) theory states that Qi, or the vital energy, is the living force behind life, all the cosmic forces in nature, and is the root of all things. Most practitioners of Oriental medicine believe that the human being is created when the Qi of Heaven and the Qi of Earth come together. Many also believe that the Qi of Heaven continues to enter the formed human body through the pineal organ in the form of light. We are perhaps starting to recognize, understand, and investigate the profound role light plays in regulating and maintaining health in the human body. Its application to acupuncture is natural.

INTRODUCTION

Just as Traditional Chinese Medicine and acupuncture are very old systems of medicine being rediscovered, so is light therapy. Heliotherapy (light therapy) was practiced by physicians in ancient cultures in Egypt, Greece, China, and India to address many conditions.[1] In the 1660s, Isaac Newton separated light with a prism and discovered the visible spectrum. In the 1890s, a Danish physician, Dr Niels Finsen, pioneered light therapy. He observed that tubercular skin lesions were much more common during the long dark winter months, but rare in the summer months. In 1893, he began treating this condition, lupus vulgaris, with light. Later, he would use red light to prevent scar formation from smallpox and eventually established a light institute for the treatment of tuberculosis. So successful was his work in treating skin tuberculosis with ultraviolet light that he was awarded the Nobel prize in 1903. This was the first recognized therapeutic application of an artificial light source.[2]

In the United States, Dr Dinsha Ghadiali, an American who emigrated from India in the 1800s, also did extensive work with photo therapy, but his alternative approaches to healing were met with resistance and most of his work was destroyed.[3] Low-level lasers are still considered investigational in the United States. The US Food and Drug Administration (FDA) has approved some low-level lasers for limited applications. It has been shown that low-level lasers can be effective, but their optimal treatment parameters are considered unknown.

BASIC SCIENCE

Works of the above-mentioned innovators and others provide us with sufficient empirical evidence of the value of light in medicine. The scientific evidence for this rests in quantum physics and the color theory, the photoelectric effect first discovered by Hertz, and the theory of light elucidated by Albert Einstein. According to the photoelectric effect, when light strikes any material substance, electrons are discharged, creating a current. Simply, light interacts with matter as the energy of the light is transferred to the electrons. In 1905, Einstein offered an explanation for this phenomenon with his Corpuscular Theory of Light, for which he was awarded a Nobel Prize.

Einstein proposed that light is composed of corpuscular units called photons. He further claimed that a photon is the smallest unit of light and has a dual nature, being both a particle and a wave at the same time. A photon travels at the speed of light and its energy is related to the frequency of radiation. The energy of the photon is transferred to the electrons when it collides with any material substance. The shorter the waves of light, the greater the energy is transferred to the electron (Figure 1). The intensity of the light determines how many photons strike given surface and how many electrons are, thus, affected. The higher the intensity, the greater the number of photons and therefore, the greater the amount of energy transferred to the electrons. Hence the physics of lasers were first imagined by Einstein.[2,4]

Color is frequency within the visible spectrum of light. It is composed of a small band of the total electromagnetic spectrum, from violet at 400 nm (higher-energy photon) through red at 700 nm (lower-energy photon) (Figure 2).

Beyond violet, in increasingly shorter wavelengths, are ultraviolet light, x-rays, and gamma radiation which contain tremendous amounts of energy. Infrared and radio waves are longer wavelengths outside the red end and less energetics. Each color of the spectrum is composed of a band of frequencies. Therapeutic application of light to the body is accomplished by applying a single monochromatic wavelength within that band.[2,4-7]

In the 1960s, Theodore Maiman, a physicist, constructed the first laser at Hughes Aircraft Research Laboratories in Malibu, California. The early 1960s saw the development of numerous lasers and numerous new applications in industry and medicine. Many of these new medical applications were in surgery and involved powerful instruments with outputs in the tens-to-hundreds of watts. Surgeons noticed faster healing times and less scarring when doing procedures with lasers than when using the standard scalpel. This was later found to be the result of biostimulation.[4]

Russian researchers at the Institute for Clinical and Experimental Medicine have shown that light applied to the human skin penetrates the body between 2 and 30 mm, depending on the color frequency. ***The researchers also found that only certain areas of the body were able to transfer light beneath the surface, and these areas corresponded to acupuncture points. Furthermore, the light was conducted within the body along the acupuncture meridians. It appears that the meridians are a light transferral system within the body somewhat like optical fiber.[8]***

Tina Karu, PhD, of the Laser Technology Center in Russia and affiliated with the University of California at Berkley, has researched the effects of light on the cell since the 1980s. She found ***there are photo receptors at the molecular level that, when triggered, activate a number of biological reactions such as DNA/RNA synthesis, increased cAMP levels, protein and collagen synthesis, and cellular proliferation. The result is rapid regeneration, normalization, and healing of damaged cellular tissue. Thus, light is a trigger for the rearrangement of cellular metabolism.[1,2,4,5,9]***

In 1966, Endre Mester, a physician in Hungary, performed a series of experiments that showed the biostimulatory effect of visible red and infrared laser light at low intensity. He published his findings in an obscure Hungarian medical journal, which may explain why the benefits of low-level lasers were appreciated in the Eastern bloc long before they were recognized in the West. In the United States, Margaret Naesser, PhD, research professor and acupuncturist at Boston University School of Medicine, conducted research using low-level laser acupuncture with positive results for the treatment of paralysis in patients following stroke and in carpal tunnel syndrome.[4]

LASERS DEFINED

A laser (light amplification by stimulated emission of radiation) is an amplifier of light. It is a specialized environment that will support and sustain stimulated emission. There are 2 properties of laser light that separates it from incandescent light (such as that from a light bulb).[2,4,10]

Monochromatic. A laser emits light at a specific wavelength, pure light, rather than over the wide spectral distribution of most light sources. It has a very narrow band width.

Coherent. Laser light is extremely well organized and synchronous (Figure 3). The photons emitted from a laser have been compared to a troop of soldiers marching in precise order.

Two of the most common misconceptions about lasers is that 1) all lasers are high powered, and 2) their beams are always parallel. Conversely, low-level lasers are most often designed with divergent beams as a safety precaution, and they operate at very low levels of power (0.05 to 0.5 W).[2,4]

Figure 1. Relationship of wavelength to energy

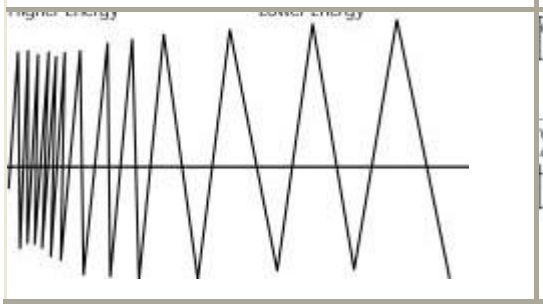
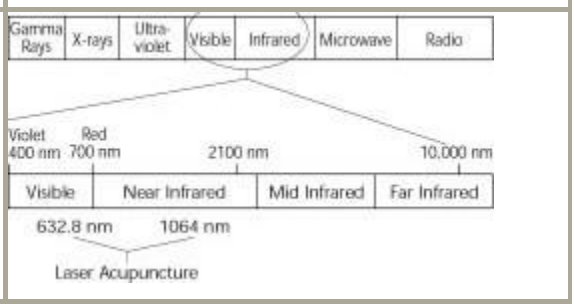


Figure 2. The electromagnetic spectrum



Principles of Use

Low-level laser acupuncture involves the application of photic energy to acupuncture points/tissues with the objective of augmentation of the normal healing process and/or pain relief. The usual wavelengths of lasers that are most commonly used in acupuncture are those that penetrate most deeply due to low absorption in the principal constituent in soft tissues, water.[1] Currently all therapeutic/low-level lasers use a diode.

Indium-Gallium-Aluminum-Phosphorus Laser (633-635 nm)
Visible red light, small and portable; higher power than the helium-neon and more durable.

Gallium-Aluminum-Arsenide Laser (780-890 nm)
Deeper penetration. Near infrared, invisible light. Useful for the treatment of pain, but also effective in healing. Valuable to reach very deep acupuncture points or deep Ah Shi points.

Gallium-Arsenide Laser (904 nm)
Greatest depth of penetration. This is due to a much longer wavelength and because they are pulsed, forcing the laser light deep into the tissues. Useful for reaching deep acupuncture points and for the treatment of pain.

Mechanism of Action

Energization of depleted enzymes. This may be denatured or depleted in areas of inflammation by hypoxia and acidosis. Examples are:

Sodium Potassium ATPase. Essential for nerve polarization in transmission of an action potential. Low-laser energies (<4 J/cm2 at a given site) tend to increase its concentration and are therefore recommended in cases where nerve regeneration or stimulation is desirable (e.g., Bell's palsy or facial paralysis).[1] (***The biostimulatory effects of low-level laser are governed by the Arndt-Schulz Law in which low energies stimulate and high energies suppress.[1,2,4]***)

High-laser energies (>4 J/cm2), in contrast, tend to decrease its concentration, therefore being indicated for pain where the object is stabilization of sensitized pain fibers.1

Superoxide Dysmutase. This enzyme breaks down free radicals, which are a cause of pain in trigger areas in myofascial pain.

Transforming Growth Factor (b Fraction). ***Energization will help accelerate the repair and healing process.***[1]

Vascular Effects. Evidence exists that laser energy is capable of initiating new vessel formation, which is an important factor in the healing process.[1,5]

Cellular Energization

Cells, after exposure to low-level laser, demonstrate accumulation of energy molecules in the form of ATP.[1,5]

Overall Effect

Low-level laser photic energy shortens the inflammatory phase, accelerating the repair process, and remodeling after tissue injury. In addition, increased plasma concentrations of certain types of prostaglandins, enkephalins, and endorphins have all been identified and most likely play a major role in the mechanisms associated with pain attenuation.[1,5,11]

Safety

Low-level lasers are very safe; however, there is a potential for damage to the eye. The laser beam, if directed through the lens of the eye, could damage the retina. Yet in more than 30 years of research and clinical practice, an event of this type has never been reported. Protective goggles that filter out the specific wavelength of the laser light should be worn by the patient and acupuncturist/physician during a therapy session.

To safely operate a laser, the practitioner must thoroughly understand the nature of the equipment.2,4,6,10 Certain technical parameters exist that one must first comprehend. These parameters are the power (for low-level lasers, this is expressed in milliwatts), wavelength, the characteristics of the laser beam (its optics; such as divergence, convergence, or parallel nature of the beam). All these influence the level of risk. Obviously, a high-power laser is riskier than a lower-power one. An infrared laser is riskier to use than a visible, red light laser with the same power and beam characteristics because the light is invisible and does not promote a blink response.[2,4,6,10]

INDICATIONS

The following is a partial list of conditions that have shown promising results with laser acupuncture. Laser acupuncture is painless and may be offered to patients of most types including children.[1,2,4,10-18]

Acute/chronic pain	TMJ dysfunction
Paresthesias	Cervical/lumbar spine syndromes
Neuralgias	Dermatoses
Allergic rhinitis/sinusitis	**Asthma**
Frozen shoulder	Phantom pain
Arthritis/arthrosis	**Fibromyalgia**
Bursitis, tendonitis	**Nerve regeneration**
Carpal tunnel syndrome	Wound healing

In addition, most lasers may be used in all instances for which moxibustion is indicated. There is no reducing or tonifying technique when performing laser acupuncture. Low-level lasers when used in pulsed mode have significant effects that may correspond with central bioresonances. The following frequencies are suggested from prior research studies.[1,2,4,10,17,18]

2 Hz	Nerve regeneration, neurite outgrowth
7 Hz	Bone growth
3-20 Hz	Pain
700-2500 Hz	Stimulatory effect
>2500 Hz	Inflammation, edema

Laser acupuncture may be combined other forms of energy medicine (e.g., homeopathy, Chinese herbs, etc), and with medications such as anticonvulsants and antidepressants in chronic pain management, thereby reducing their dosage.

DISCUSSION

No doubt, the FDA will continue to approve the use of lasers for a variety of conditions (recently, a laser company in the United States received approval for the treatment of carpal tunnel syndrome). There are FDA guidelines that govern the use of low-level lasers as an investigational device, as well as state regulations. The FDA classifies low-level lasers as class IIIB non-significant risk devices.

CONCLUSION

Low-level lasers are used extensively in Europe and Asia for many applications, including acupuncture. Low-level lasers may be an effective modality in battling many situations. More research is needed to establish ideal treatment parameters for specific conditions.

Figure 3. Comparison of laser and other light sources

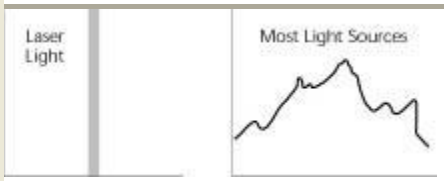
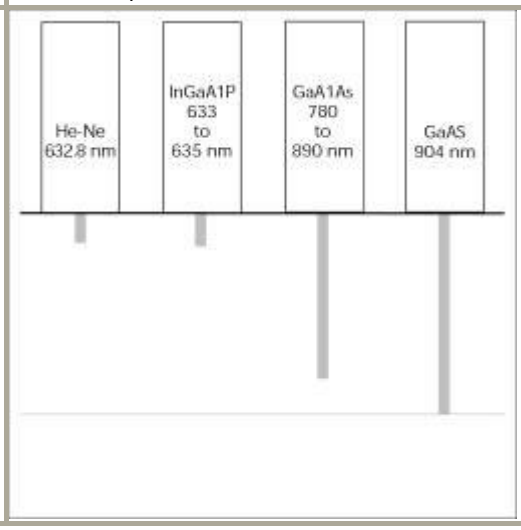


Figure 4. Relative depth of various lasers commonly used in acupuncture



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