

# Laser Acupuncture Primer

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## **Abstract**

In July of this year (2001), Governor Davis vetoed the bill SB 466, our scope of practice legislation, because of his concerns, with low-level lasers, (denotes light amplification by Stimulated Emission of Radiation) despite the fact that our association, California State Oriental Medical Association (CSOMA), had adequately addressed the governor's concerns about lasers in earlier testimony. This article intends to inform and educate acupuncture professionals about the history of laser acupuncture, its technical aspects, and its potential in clinical applications. Although laser acupuncture has been researched and practiced quite extensively in China, Russia, Spain, and Germany for over 30 years, the procedure is almost unheard of in the U.S. Combining the low-level laser bio-stimulation effects known as photo-biological phenomenon, and acupuncture points, the procedure has been proven to be both effective and practical. The procedure is non-invasive, produces no pain or heat, is environmentally clean, and suitable in pediatric, geriatric care and needle-phobic adults. Laser acupuncture is not intended to replace needle acupuncture, but rather to add to our acupuncture modalities and broaden the effectiveness of acupuncture.

## **History**

Since laser was first invented in 1960, it has slowly found acceptance in the western medical community, particularly dermatology applications such as removal of black spots, tattoos, and acne scars. Recent technological advances in laser devices have prompted even wider applications in cosmetic procedures, dental treatments, and eye surgery. While most of these applications require high laser power, lower level laser power was first investigated in the early '70s in the applications of "biostimulation" and later suggested to replace the traditional metal acupuncture needle with the "light needle".

Beginning in 1973, extensive clinical laser acupuncture was conducted and results were published in China<sup>1</sup>. In the United States, one of the most notable laser acupuncture researchers is Dr. Margaret Naeser, PhD, Lic Ac, Dipl Ac, a research professor of neurology, Boston University School of Medicine, and a licensed acupuncturist in Massachusetts. Dr. Naeser has been doing research since 1984 and has published a textbook and many papers on related topics<sup>2</sup>.

## **Technology**

Laser should be no stranger to anyone in this modern life. It is in the heart of entertainment devices such as CD Players, CD-ROM drives, and the latest DVD Players. The laser used in these

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<sup>1</sup> Laser Acupuncture and Its Clinical Applications, Scientology Publisher, Beijing, China, 1993; 2-3.

<sup>2</sup> Naeser MA & Wei XB. 1994. Laser Acupuncture, An Introductory Textbook for Treatment of Pain, Paralysis Spasticity, and Other Disorders. Boston, Boston Chinese Medicine, P.4

consumer gadgets has power output no higher than about 100 milliwatts (mW). One milliwatt is one-thousandth of a watt, and one watt is expressed as a unit of work energy, or joule, per second. In general, laser acupuncture uses laser power between 5 to 500 mW (Class IIIb lasers). For comparison, the cutting lasers used in surgery are often greater than 100 Watts.

Another important parameter of laser is wavelength. Like radio waves, light travels in a pattern of waves that has peaks and valleys. The distance between the peaks and valleys is called wavelengths and is usually measured in nanometers (nm). One nanometer is one-billionth of a meter and a meter is 39.37 inches.

For example, visible light such as violet, green, red are between 400 nm and 700 nm. The light spectrum just below 400 nm is ultraviolet and beyond 700 nm, infrared. Unlike room ambient light, which scatters and contains many different wavelengths, laser light is coherent, or concentrated, and emits one single frequency. In other words, coherent (laser) light travels in a repetitive wave pattern that carries one specific wavelength. In order for laser acupuncture to be therapeutic, the useable wavelengths must be in the range of 600 to 1000 nm.<sup>3</sup> Otherwise, the hemoglobin or water may block the laser beam and desirable energy penetration cannot be achieved.

Although laser acupuncture has been investigated since the late 1960s, the cumbersome bulky and expensive helium neon gas tube laser apparatus in these earlier days had prevented more extensive clinical use. No applications of laser acupuncture procedure would be commercially viable without a novel laser source, e.g., a semiconductor laser diode. In the early 1990s, this author (SL) had worked with 30 mW, 780 nm (infrared) laser diodes, two-tenths of an inch diameter, with a cost back then of less than \$100 (in volume quantities). A variation of this laser diode (5 mW, 670 nm) is now found in expensive laser lecture pointers. In her laser acupuncture textbook, Dr. Naeser has listed some treatment protocols for hand and foot laser acupuncture using a laser pointer and a microamp TENS device.<sup>4</sup>

With red-beam laser, there is only a shallow penetration suitable for treating points such as *jing*-well points at the ends of the fingers and toes. Infrared lasers (e.g., 780 or 904 nm, for example), on the other hand, have up to 1-1.5 inches of penetration and are best used on arm or leg points, back *shu* and *Ahshi* points.<sup>5</sup> When a 5 to 20 mW laser beam is shown onto the skin, it produces no feeling – no heat, no cold, and no pain. The only possible risk is that the laser will harm the retina if one stares directly into the source of the laser beam.

Lastly, the treatment time, or light exposure time, is a function of the power and type of ailment. In general, the higher the power, the lower the treatment time; more exposure time is needed

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<sup>3</sup> Naeser MA & Wei XB, 1994. Laser Acupuncture, An Introductory Textbook for Treatment of Pain, paralysis, Spasticity, and other Disorders. Boston, Boston Chinese Medicine, P.16

<sup>4</sup> Naeser MA & Wei XB, 1994. Laser Acupuncture, An Introductory Textbook for Treatment of Pain, paralysis, Spasticity, and other Disorders. Boston, Boston Chinese Medicine, Pp. 40, 41

<sup>5</sup> Naeser MA & Wei XB, 1994. Laser Acupuncture, An Introductory Textbook for Treatment of Pain, paralysis, Spasticity, and other Disorders. Boston, Boston Chinese Medicine, Pp. 2-3

on joint pain than for soft tissue pain; and with chronic conditions than for acute. Often this parameter is expressed in terms of energy density (joules/cm<sup>2</sup>), as dosage. Protocols can be established and repeated to treat a particular disorder, with appropriate modifications on a case by case basis, often per RCM indications for point selection, etc. As stated above, one watt (W) is one joule per second. In order to determine the amount of seconds necessary to emit one joule/cm<sup>2</sup> from a given laser, you must know the following laser parameters: the mW output converted to Watts, and aperture size, in cm<sup>2</sup>, of the laser probe you are going to use to stimulate the acupuncture point. The following formula is used to calculate the necessary time to produce 1 joule/cm<sup>2</sup>:

**With a 5 mW Laser (0.005 Watts), with a 0.5 cm diameter aperture on the probe tip, the Beam Spot Size is 0.196 cm<sup>2</sup>. The necessary time to emit 1 Joule per cm<sup>2</sup> (Energy Density) as computed as follows:**

**Formula: (Average Output Power in Watts x Seconds) / Beam Area in cm<sup>2</sup> = 1 Joule per cm<sup>2</sup>**  
**(0.005 Watts) x (X Seconds) / 0.196 cm<sup>2</sup> = 1 Joule per cm<sup>2</sup>**  
**0.005 X = 0.196**  
**X = 0.196 / 0.005**  
**X = 39.2 Seconds**

**Thus, 39.2 Seconds of exposure time is required to emit 1 Joule per cm<sup>2</sup> with the 5 mW laser, with a 0.5 cm diameter aperture on the probe tip (Beam Spot Size of 0.196 cm<sup>2</sup>).**

Acupuncture points are often treated with 4 to 8 joules per cm<sup>2</sup> or about 2.5 to 5 minutes exposure time if using the laser probe in the example given above, especially to obtain an anti-inflammatory effect when treating chronic pain.<sup>6</sup>

### **Photo-biostimulation**

The idea of biological changes occurring from the stimulation, or biostimulation, of light is actually nothing new. This so-called photobiomodulation is how Vitamin D is produced in our bodies when ultraviolet rays in the sun-light strike the skin. It has been suggested that the laser biostimulation is also of a photobiological nature. The exact mechanism of the biological and physical effects of the low level laser radiation is still unknown. Much like the acupuncture development in ancient China, much of the laser acupuncture research work reported to date is empirical observation. However, two Finnish physiologists, Dr. Reijo Makela and Dr. Anu Makela, in their 1999 paper pointed out that the "trigger" function of laser light of specific wavelengths can cause biochemical, electrochemical, and structural changes at the cellular level which may in turn alter the outcome of diseases.<sup>7</sup>

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<sup>6</sup> Colls Cruanes J. 1985. *Laser Therapy Today*, 2<sup>nd</sup> Edition. Barcelona, Laser Documentation Center, S.A., Calle Dalmau 11 – 08014. Translated by Lucie Maguire.

<sup>7</sup> Dr. Reijo Makela and Dr. Anu Makela, Finland, *Laser Acupuncture, Earth Pulse Flashpoints*, 1999, [www.earthpulse.com](http://www.earthpulse.com) website page.

For example, at wavelengths of 628-652 nm, as Dr. Makela point out, phenyl pyruvate is turned into phenylalanine, which is a naturally occurring amino acid from which tyrosine is formed. Tyrosine in turn is the precursor of dopa, dopamine, norepinephrine, epinephrine, and thyroid hormones. The increase of dopamine relieves a variety of symptoms of a well-known dopamine-deficiency illness, Parkinson's Disease.<sup>8</sup> Together the two Finnish doctors have treated over 12,000 patients with lased based acupuncture over about fourteen years.

In China, laser acupuncture has been applied clinically to help treat over 200 diseases in the laser 30 years. In a paper published in 1999, in the Journal of Alternative and Complementary Medicine, Branco & Naeser observed success in treating pain in 33 of 36 hands (91.6%) with carpal tunnel syndrome, including 14 hands where surgery had failed to provide pain relief.<sup>9</sup> While laser acupuncture can help treat many ailments already treated with needle acupuncture, the advantages of laser acupuncture over needle acupuncture are several:

- 1) The laser is totally non-invasive; it produces no pain and there is no possibility for infection when used properly. It is also often used successfully in the treatment of chronic wounds that have not healed.<sup>10</sup>
- 2) The laser is suitable for children, frail elderly, and needle-phobic adults. For example, the British Journal of Anesthesia recently published a controlled study from the University of Vienna, Austria. A double-blind, randomized, placebo-controlled study with 40 children, ages 3 – 12 years, undergoing strabismus surgery, found the incidence of post-operative vomiting to be significantly lower (25%), than the placebo group (85%), following red-beam, 670 nm, 10 mW, laser irradiation of P6, at 15 minutes before induction of anesthesia and 15 minutes after arriving in the recovery room.<sup>11</sup>

In another study of children and adults with cerebral palsy (CP), from Japan, the low-level laser therapy was observed to reduce spasticity. For example, Asagai et al., (1994),<sup>12</sup> used low-level laser therapy on acupuncture points to treat spasticity in 150 cases of CP (ages 10 months to 20 years). Two semiconductor laser diodes [60mW or 100mW, continuous wave, 810 nm wavelength (near infrared)] were used for 15 to 30 seconds per point. Improvement was reported in the majority of the 150 babies and children; exceptions were those with severe joint contracture. In addition, in 42 cases whose hands were normally involuntarily clenched, 34 cases (81%) were able to open

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<sup>8</sup> Dr. Reijo Makela and Dr. Anu Makela, Finland, *Laser Acupuncture, Earth Pulse Flashpoints*, 1999, [www.earthpulse.com](http://www.earthpulse.com) website page.

<sup>9</sup> Branco K and Naeser MA: "Carpal Tunnel Syndrome: Clinical outcome after low-level laser acupuncture, microamps, transcutaneous electrical nerve stimulation, and other alternative therapies – an open protocol study." *The Journal of Alternative and Complementary Medicine*. 1995, 5(1):5-26.

<sup>10</sup> Kahn J. "Case Reports: Open Wound Management with the NeNe(6328 AU) Cold Laser." *The Journal of Orthopaedic and Sports Physical Therapy* 1984;6:203-204. Williams & Wilkins, Baltimore, MD.

<sup>11</sup> Schlager A, Offer T, Baldissera I. "Laser stimulation of point P6 reduces postoperative vomiting in children undergoing strabismus surgery." *British Journal of Anesthesia*, 1998; 81:529-532.

<sup>12</sup> Asagai Y, Kianai H, Miura Y, Ohshiro T. "Application of low reactive-level laser therapy (LLLT) in the functional training of cerebral palsy patients." *Laser Therapy*, 1994; 6: 195-202.

their hands with less effort. The authors quote Kamikaya et al. (1982)<sup>13</sup> who hypothesize that low-level laser therapy (LLLT) may cause vascular dilation through the sympathetic nervous system, and reduce tonic muscle spasms in muscles which had been in a hypoxic state. The authors concluded: "...Compared with conventional methodology, laser therapy has proved to be a simple, reliable and non-invasive method which enabled painless suppression of spasm... The effect of LLLT lasted from one to several hours in patients with severe spasticity... the authors feel that LLLT is particularly useful as a supplementary or adjunctive therapeutic modality to improve the overall efficacy of physical rehabilitation and functional training in children with cerebral palsy."<sup>14</sup>

- 3) The laser is more cost effective in the long run and environmentally friendly since needles must continue to be purchased and disposed of, while the laser apparatus can be reused over and over again.
- 4) There are only a few contraindications with low-level lasers:
  - Do not shine the laser beam directly into the eye as it can harm the retina.
  - Do not shine the laser on the unclosed fontanelles of babies, it may promote bone growth, before the skull is closed.
  - Just as with needle acupuncture, do not use the laser on standard "forbidden" acupuncture points with pregnant women. It is helpful, however, to use 5 mW, continuous wave, red-beam laser on acupuncture point UB67, five minutes per day toward the end of pregnancy, to help revert a fetus that is in the breech position.<sup>15</sup> This was successful for example, in 85% of 615 cases treated at the Shanghai medical university (the control group had a 65.7% spontaneous conversion rate). The use of the red-beam laser on UB67 is easier than moxibustion.
  - Just as with needle acupuncture, do not use the laser directly on a cancerous tumor. Red-beam laser, however, may be used on P6 to help stop nausea and vomiting, as mentioned above, in the study with children undergoing surgery.

Because of the ease of laser acupuncture, acupuncturists around the world increasingly add it to their scope of practice. The low-level laser devices are regulated in the U.S., however, regarding their medical application. In the U.S., the Food and Drug Administration (FDA) Center for Devices and Radiological Health (CDRH) has the responsibility for implementing and enforcing the laws and regulations which apply to radiation-producing electronic products and medical devices.

## **FDA and Regulation**

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<sup>13</sup> Kamikawa K, Ihnishi T, Suzuki M, Kanetani G, and Shibamoto H. "Laser Therapy for Pain." *The Journal of Japan Society for Laser Medicine*. 1982; 3, 1: 345-348.

<sup>14</sup> Kamikawa K, Ihnishi T, Suzuki M, Kanetani G, and Shibamoto H. "Laser Therapy for Pain." *The Journal of Japan Society for Laser Medicine*. 1982; 3, 1: 345-348.

<sup>15</sup> Jin Y. 1998. *Handbook of Obstetrics & Gynecology in Chinese Medicine – an integrated Approach*/ Seattle, WA, Eastland Press.

In its June, 1999 update of *Laser Facts*, CDRH stated that no biostimulation laser therapy devices have been approved by the FDA for humans. Therefore, it is illegal to make any claims of clinical effectiveness despite positive research data from this country and elsewhere in the world. Why? The FDA still considers low-energy lasers (Classified as Class IIIb: 5 to 500 mW) to be “Investigational” at the time this article is written. As a reminder, acupuncture needles were dropped from the “Investigational” list by the FDA about 5 years ago. However, at the time when the FDA made this new ruling, it was estimated that over 12 million Americans had already turned to acupuncture for treatment.<sup>16</sup>

Because of the “Investigational” nature, some FDA guidelines need to be observed if low-level lasers are to be used by a licensed acupuncturist in this country. Among the rather lengthy guidelines, the most important issue is that the acupuncturist must first obtain Institutional Review Board (IRB) approval regarding two areas: 1) the exact type of laser the acupuncturist will be using (e.g., power, wavelength). 2) The exact manner in which the licensed acupuncturist proposes to use this laser to treat which conditions (e.g., energy density or dosage from the laser to be used on specific acupuncture points, disease conditions, etc.).

An independent IRB can be set up to consist of at least five members, who meet at regular intervals to review applications from acupuncturists who wish to obtain approval for the use of low-level laser acupuncture. In addition, an IRB-approved patient informed Consent Form is required in the private practice acupuncture office. With these guidelines in mind, one can understand why laser acupuncture, which is rather common in countries like China, Spain, Germany, Russia, Austria, Czech Republic, and Hungary, lags in clinical use, and is mostly unknown within the acupuncture profession in the U.S. However, the FDA’s stand on the LLLT might be changing.

In dialogue with the FDA over the years, it has recently been “suggested” to some LLLT practitioners that if low-level lasers are permitted within the defined scope of the practice of medicine, as defined by a given state, than it is permissible to use the low-level lasers without an IRB approval and the Consent Form may not be required. At the time this article is written, this verbal understanding has not been put into writing by the FDA. Thus, legally, it would appear that the original “Investigational Use” label for Class IIIb lasers may still be in effect with the requirements of IRB approval and Informed Consent.

A key issue in this possibly new FDA policy, regarding potentially less restrictive use of low-level lasers in the U.S., is the *necessary inclusion* of low-level laser therapy into the scope of medical practice (e.g., scope of acupuncture practice) as defined by each state. In the 1993 scope of acupuncture practice guidelines in Massachusetts (Dr. Naeser’s home state), the state of Massachusetts included laser acupuncture in the scope of practice of acupuncture practice. Other states like Arkansas, Florida, Wisconsin, and New Mexico also have such inclusion. In California, despite having the majority of the U.S. acupuncturist population, in July, 2000,

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<sup>16</sup> “Nod to an Ancient Art – The FDA has OK’d acupuncture needles-and they could help you” U.S. News & World Report (May 13, 1996): 78-80.

Governor Davis vetoed a bill which in which the laser acupuncture was supposed to be included within our scope of practice. The Bill SB 466, after passing the Assembly and Senate with only one opposing vote, was vetoed by Governor Davis as soon as it reached his desk because of his concerns with low-level lasers. Through this article and the future education of acupuncturists regarding the use of low-level laser in the profession, it is the author's wish that when a similar bill is introduced next year, California acupuncturists will have a clear common goal as to why low-level laser is important to the practice of traditional Chinese medicine (TCM) as a whole.

### **Conclusion**

As we are stepping into the new Millennium to an ever-changing technological world, the area of TCM has amazingly endured and flourished from many previous millennia. Laser acupuncture, instead of being seen as an unfit, high-tech gadget within the realm of an ancient medical system, should be gracefully absorbed into this enduring system as another effective and elegant modality, which is part of other TCM modalities. Laser acupuncture therapy is safe and easy to apply, carries no Pin or side effects, has zero potential for infection, is not invasive, and is environmentally clean. Only through collaborative efforts (and governmental understanding) will more comprehensive treatment protocols develop.