

## Laser Acupuncture to Treat Paralysis in Stroke Patients, CT Scan Lesion Site Study

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### Purpose:

1) To study the effectiveness of low-level laser stimulation of acupuncture points to treat paralysis in stroke patients; 2) To examine the relationship between neuroanatomical lesion sites on CT scan and potential for improvement following laser acupuncture treatments. We have conducted previous research with needle stimulation of acupuncture points in the treatment of paralysis in stroke patients (1-3).

### Subjects:

Seven stroke patients participated (ages 48-71 years when entering the study; 5 men, 2 women). Five cases had single left hemisphere stroke; two cases, single right hemisphere stroke. Five patients were treated for residual arm/leg paralysis; they had greatly reduced arm and leg power (and severely reduced or no voluntary isolated finger movement). Two cases were treated only for hand paresis; they had good arm and leg power, but they had mildly reduced isolated finger movement. CT scans were obtained on all patients after at least 3 months poststroke.

Six patients began receiving the laser acupuncture treatments during the chronic phase poststroke (10 months to 6.5 years). These times are beyond the spontaneous recovery period of up to 6 months poststroke (4, 5). One hand paresis case began receiving treatments during the acute phase poststroke (1 month poststroke). Because all patients were beyond the spontaneous recovery period except for one, each patient served as his/her own control. No sham laser treatments were administered. None of the stroke patients was receiving physical therapy or occupational therapy treatments during the course of the laser acupuncture treatments.

### Method:

A 20 mW Gallium Aluminum Arsenide (780 nm) near-infrared, diode laser (Uni-laser, Denmark) with 1 mm diameter aperture, was used for 20-40 seconds (51-103 J/cm<sup>2</sup>) on each acupuncture point. The laser was used for 20 seconds on shallow points (hands and face), and 40 seconds on deeper acupuncture points (arms and legs). The points used on the paralyzed arm included: LI 4 (Hegu), LI 11 (Quchi), LI 15 (Jianyu), TW 5 (Waiguan), TW 9 (Sidu), and three distal Baxie points in the web-spaces between the fingers. The points used on the paralyzed leg included: ST 31 (Biguan), ST 36 (Zusanli), GB 34 (Yanglingquan), GB 39 (Xuanzhong), and LIV 3 (Taichong). Points used on the non-paralyzed side included LI 4 (Hegu) and ST 36 (Zusanli). These points include some of those used in our previous research where needle acupuncture was used to treat paralysis in stroke patients (1-3). If facial paralysis was present, the following points on

the paralyzed side were used: ST 4 (Dicang), ST 6 (Jiache), ST 7 (Xiaguan), LI 20 (Yingxiang), and SI 18 Quanliao).

The patients were tested a few days prior to the first laser acupuncture treatment, and within a few days after completing the 20th, 40th and/or 60th laser acupuncture treatment. P.T. and O.T. testers were blinded; testers were part of a needle acupuncture study with real or sham or no acupuncture. Some patients received only 20 or 40 treatments. The number of treatments a patient received (20, 40 or 60) was based solely on patient availability and transportation issues. All patients were offered a maximum of 60 laser treatments. The patients were treated 2 - 3 times per week, for 3 - 4 months.

For patients with arm/leg paralysis, improvement was defined as a minimum increase of at least 10% isolated active range of motion, on at least one arm/leg test, following 20, 40 or 60 laser acupuncture treatments. For the patients treated for hand paresis, improvement was defined as an increase of at least 1 lb., on at least one hand strength test, following 20, 40 or 60 laser acupuncture treatments.

#### Results:

Overall, 5/7 patients (71.4%) treated with laser acupuncture showed improvement. Four of the six chronic stroke patients (66%) showed improvement. The single acute stroke patient (hand paresis case) also showed improvement.

Three of the five arm/leg cases showed a minimum of at least 10% improvement in isolated active range of motion on knee flexion; knee extension and/or shoulder abduction (range, +11 to +28%; mean, +15.8%, S.D., 7.08).

The two cases with hand paresis each showed improvement in hand strength. For the chronic hand paresis case (33 months poststroke), grip strength, pre- treatment, 62.7 lbs., post- 20 treatments, 68.4 lbs; strength in first 2 fingers opposing thumb (3-Jaw Chuck), pre- 12, post- 18 lbs.; strength in index finger opposing thumb (Tip Pinch), pre- 8, post- 11 lbs; and strength in thumb opposing the lateral surface of index finger (Lateral Pinch) pre- 12, post- 14 lbs. For the acute hand paresis case (starting at 1 month poststroke), grip strength, pre- 32.2, post- 20 Tx.'s, 47.7 lbs.; 3-Jaw Chuck, pre- 0, post- 11.3 lbs.; Tip Pinch, pre- 0, post- 10.7 lbs; Lateral Pinch, pre- 3.7, post- 14.7 lbs.

The five cases who showed improvement following the laser acupuncture treatments had either no lesion in, or lesion in less than half of the motor pathway areas, including the periventricular white matter (PVWM) area on CT scan. The PVWM area is located adjacent to the body of the lateral ventricle, superior to the posterior limb, internal capsule. The two arm/leg cases who showed no improvement following the laser acupuncture treatments had lesion in more than half of the motor pathway areas, including the PVWM area. These behavioral and neuroanatomical findings are similar to our previous research using needle acupuncture to treat paralysis in stroke patients.

The PVWM area appears to be the most important area to examine on CT scan or MRI scan, in understanding whether a stroke patient is likely to benefit from needle or laser acupuncture to help reduce the severity of paralysis. This area contains many important intra- and inter-hemispheric pathways including, in part: 1) The descending pyramidal fibers from motor cortex, where the pathways for the leg are more medial. 2) The body of the caudate nucleus. 3) The mid-callosal pathways. 4) The medial subcallosal fasciculus containing connections to caudate from supplementary motor area and cingulate gyrus. 5) The occipito-frontal fasciculus. 6) The superior lateral thalamic peduncle which includes projections from dorsomedial nucleus and anterior nucleus to cingulate and projections from the ventrolateral nucleus to motor cortex.

Thus, even within this small PVWM region there are numerous motor systems that might, if incompletely damaged, respond to needle or laser acupuncture. These systems include dorsal striatum, supplementary motor area, or the frontal-striatal-ventrolateral thalamic-frontal loop, as well as the descending pyramidal system.

One patient with severe arm/leg paralysis did have improvement in her facial paralysis with good control of food and liquids in the left side of her mouth for the first time poststroke (4 years poststroke). She also improved in walking, with a "loosening" of the left Achilles tendon.

The author has observed that red-beam laser stimulation (4.59 J/cm<sup>2</sup>) on the Jing-Well points on the fingers (LU 11, Shaoshang; LI 1, Shangyang; PC 9, Zhongchong; TW 1, Guanchong; HRT 9, Shaochong; SI 1, Shaoze), in combination with the use of a microamps TENS device (MicroStim 100 TENS, Tamarac, FL) placed on the hand (HRT 8, Shaofu; and TW 5; Waiguan), is helpful in treating hand paresis and reducing hand spasticity in stroke patients (6, p. 40, Naeser Laser HAND Treatment Program). This method is also helpful in the prevention/ reduction of contractures of the hand, in patients with severe hand paralysis (personal observation).

#### Discussion:

The use of low-level laser for long-term treatment is especially desirable for chronic stroke patients with hand paresis. The patient can be trained to treat him/herself at home, using an inexpensive 5mW red-beam diode, laser pointer and a microamps TENS device (MicroStim 100, Tamarac, FL). See Websites listed below.

Acupuncture studies using needle acupuncture have observed the best outcome levels when acupuncture treatments were initiated at less than 3 months poststroke (7, 8), and especially when the acupuncture treatments were initiated at less than 24 hours and 36 hours poststroke (9, 10).

This is the first study to examine the effect of low-level laser therapy on acupuncture points to treat paralysis in stroke patients where lesion location was known for each patient. Results suggest that low-level laser therapy on acupuncture points is effective to help reduce the severity of paralysis in stroke patients, especially those with mild-moderate paralysis. The treatments should be initiated as soon as possible poststroke,

even within 24 hours poststroke. A comprehensive rehabilitation program of P.T., O.T. plus needle and/or laser acupuncture is recommended.

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#### **Additional Information:**

[www.Acupuncture.com/Acup/Naeser.htm](http://www.Acupuncture.com/Acup/Naeser.htm) and [www.Acupuncture.com/Acup/laser.htm](http://www.Acupuncture.com/Acup/laser.htm)

See also: Naeser MA: *Neurological Rehabilitation: Acupuncture and Laser Acupuncture to Treat Paralysis in Stroke and Other Paralytic Conditions and Pain in Carpal Tunnel Syndrome*. Chapter in National Institutes of Health Consensus Development Conference

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Abstract based on: Naeser MA, Alexander MP, Stiasny-Eder D, Galler V, Hobbs J, Bachman D, Lannin L: Laser Acupuncture in the Treatment of Paralysis in Stroke Patients: A CT Scan Lesion Site Study. *Am J of Acupuncture*, 23(1):13-28, 1995:

Mitochondrial Metabolism and the Injured Cell Response to Near-Infrared Light  
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Mitochondria contain pigments that respond to light. When cells are stressed or injured, mitochondria can shift their metabolism from being energy producers, to being net consumers of ATP. Associated with the injured cell response, mitochondrial oxidative phosphorylation is down-regulated, anaerobic glycolysis is up-regulated, and the transmembrane potential ( $\Delta\psi$ ) is maintained by a reversal in the normal direction of proton pumping through the F<sub>0</sub> subunits of the ATP Synthase. Loss of the  $\Delta\psi$  can be associated with cytochrome c release from mitochondria, activation of caspases, and cell death by apoptosis. One of the light-sensitive molecules in mitochondria is cytochrome aa<sub>3</sub>, a component of the fourth complex in the mitochondrial electron transport chain, cytochrome c oxidase (COX). The injured cell response to near-infrared light involves several different pathways. The spectral properties of certain mitochondrial cytochromes and the role of mitochondria in models of cell injury and dysfunction will be discussed.