TREATMENT OF POST HERPETIC NEURALGIA USING A 904 nm (INFRARED) LOW INCIDENT ENERGY LASER: A CLINICAL STUDY

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Thirty-nine patients (25 female and 14 male) were treated for post-herpetic neuralgia (PHN). A linear analog scale from 0–10 was used to score the results (10 represents extreme pain, 0 represents no pain). A 904 nm low energy infrared laser pulse at 4000 Hz (Hertz) was used. A laser head containing 10 diodes, emitting a total of 6 mW (milliwatts) per s was placed over the affected area for 20 min. Patients received approximately 7 joules of energy per treatment (five treatments = 1 session). Each treatment had a rest period of 4 h before next treatment. Pain was reported for 6 months to 1 year on average. Subjects peak pain level was a mean of 8.54 (median = 9.00). Eighteen of 39 subjects (46.2%) reported the maximum pain level of 10 before treatment. At the end of treatment subjects scored their pain level at a mean of 3.28 (median = 2.00). After treatment 11 of 39 subjects (28.2%) reported a pain level of zero (no pain). One year later subjects rated their pain level at a mean of 2.74 (median = 1.00). Fifteen of 34 subjects (44.1%) reported a pain level of zero. For the sample \( N = 39 \) increasing age is a significant predictor of level of pain from shingles \( (p < 0.05) \). For subjects aged 60 years or greater \( (N = 27) \). The reported level of PHN pain decreased significantly after treatment \( (p < 0.05) \).

**Key words** Post herpetic neuralgia (PHN)  Infrared  Gallium arsenide  904 nm  Low energy

**Introduction**

Shingles is becoming an affliction of the elderly. *Herpes zoster*—the viral cause of shingles—is a member of the herpes family of organisms. Herpes 1 causes cold sores and Herpes 2 causes genital infections. Another family member, the Epstein-Barr virus, causes infectious mononucleosis.

Shingles was recognized by ancient physicians but understanding the affliction did not occur until this century. In 1954 Dr Thomas H. Weller and colleagues determined that the virus at work in shingles was the same one that caused a childhood infection—chicken pox. During the active stages of infection the multiplying virus finds its way into nearby nerve cells. The virus undergoes a biological trek along nerve pathways to permanent homes (cellular) in areas of nerve tissue close to the brain and spinal cord. The virus enters a latency period. Incidence increases with age corresponding with the natural decline in cell mediated immunity. Other reasons include a serious illness which temporarily saps the immune system and the use of immunity-compromising drugs.

Once reinvigorated, the virus re-emerges in nerve branches serving the skin (dermatomes). Symptoms appear—the pox rash and blistering, whereas the chicken pox rash is generalized. Shingles symptoms are now limited to nerve tissue, and confined to the area served by the nerve branch. The affected area is almost always unilateral and in the general area of the waist or chest. The eye (trigeminal) area is sometimes involved.

Post-herpetic neuralgia (PHN) may be defined as pain persisting or occurring at the site of shingles over 30 days after the onset of the acute infection. There is little agreement as to the best treatment approach. Treatment of *Herpes zoster* aims at reducing the upset caused by the acute infection as well as preventing complications, especially PHN.

**Method**

At the Acupuncture Institute 39 patients (25 female and 14 male) were treated for post-herpetic neuralgia. A 904 nm low energy infrared laser pulse at 4000 Hz was used as the treatment modality. A laser head containing 10 diodes emitting a total energy of 6 mW per s was placed over the affected area. The area was treated for a period of 20 min. Patients received approximately 4 joules per centi-
meter square of energy per session. A session is comprised of five 20-min treatments with at least 4 h between treatments.

Subjects were random computer selected from existing clinical records and post-tested (asked to fill out a questionnaire after treatment was completed). A linear analog scale from 0 to 10 was used to score the results. Subjects evaluated their own pain level. Zero represented little to no pain while 10 represented extreme pain. At the time of the survey (December 1987) subjects scored their pain level (0 to 10) at time of treatment and at the end of treatment. A follow-up questionnaire (December 1988) was sent out one year later. Subjects were asked to rate their pain level (0 to 10) one month before treatment and pain level one year after treatment. Of the 39 original subjects, 34 responded to this follow-up questionnaire.

Chi-square was used as the test for statistical significance. A value of $P < 0.05$ was considered to be statistically significant. Other representations of mean, mode and percentage of actual counts are used to present the data.

Results

The age of the subjects ranged from 26 years to 85 years of age. The mean age was 62.25 years. Twenty-four of 39 (24/39) or 61.25% of the study subjects were over 60 years of age.

Prior to treatment of The Acupuncture Institute (23/39) (58.9%) of subjects had previously been on medication for post herpetic neuralgia. Subjects reported pain from PHN for 6 months to 1 year on average. The subjects with PHN reported that blistering occurred for 1 week to 1 month during shingles development. Subjects scored their peak pain level at a mean of 8.54 (mode = 9.00).

Eighteen of 39 (18/39) subjects (46.2%) reported the maximum pain level of 10 (see Figure 2). At the end of treatment subjects scored their pain level at a mean of 3.28 (mode = 2.00). Eleven of 39 subjects (11/39) (28.2%) reported a pain level of zero (see Figure 3).

In the follow-up study (completed one year after initial study) subjects rated their pain 1 year after treatment completed. Pain level was scored with a mean of 2.74 (mode = 1.00). Fifteen of 34 (15/34) subjects (44.1%) reported a pain level of zero (see Figure 4). Subjects also scored their pain level one month before treatment commenced. The mean pain level reported was 9.00 (mode = 10.00). Twenty of 34 subjects (58.8%) reported a pain level of 10 one month before treatment (see Figure 1). During treatment subjects reported receiving a mean average of 2.72 groups of laser treatments (mode = 2.00). A group being five 20-min treatments.

From survey number 1 ($N = 39$) there is a relationship of statistical significance between age of respondent and pain level reported when beginning treatment ($p < 0.05$). Age is a predictor of reported levels of pain from PHN. Increasing age gives rise to increasing levels of reported pain from subjects in this study.

At the finish of laser treatments subjects reported level of pain diminished from their initial level of reported pain (see Figure 5). Fourteen (41.2%) reported reduction of pain measuring 70 to 100% improvement. Twelve (31.5%) report at least a 50%
The level of significance ($P < 0.05$) indicates a very consistent response, by subjects, in the two surveys. When reported pain levels after treatment are cross-tabulated with reported pain levels 1 year later a significant relationship exists ($P < 0.01$). Subjects receiving initial relief from pain after laser treatment continued to improve during the follow-up year.

Discussion

The incidence of *Herpes zoster* in the general population is 0.8 to 4.8 cases per 1000 individuals.\textsuperscript{3,8}

*Herpes zoster* occurs spontaneously in normal people and most cases are self-limiting and completely resolved.\textsuperscript{2,3} Accompanying pain may be severe but is usually transitory.\textsuperscript{7} Complications occur in 15 to 20\% of the cases. The most common (9 to 14\%) of these is PHN.\textsuperscript{9} Increasing age increases both the duration and severity of *Herpes zoster* neuralgia.\textsuperscript{2,6}

Corticosteroids are commonly used to prevent the development of neuralgia, despite conflicting results in the studies.\textsuperscript{10-11} Conventional analgesics are ineffective in managing the neurogenic pain.\textsuperscript{9}

Anti-viral agents (such as Acyclovir) are the most common treatment approach for shingles. High dosages early in the illness (within 48 h of onset of rash) modifies the rash and reduces pain.\textsuperscript{7,12} This treatment does not diminish the likelihood of developing neuralgia.\textsuperscript{13,14}

Multiple and repeated sympathetic and somatic nerve blocks relieve pain of acute shingles and are valuable in preventing subsequent neuralgia.\textsuperscript{6,7} The most efficacious treatment is probably prolonged treatment with anticonvulsants and tricyclic agents.\textsuperscript{12,15,16} Topical capsaicin (a neurotensin active agent) may play an important therapeutic role.\textsuperscript{17}
Non-drug therapies have gained popularity. Acupuncture and transcutaneous stimulation (TES and TENS) are other possibly effective adjuvant treatments.

Conclusions

Low energy (IR) laser therapy was pioneered in Europe and Russia in the late 1960's. By definition low energy laser therapy takes place at irradiation intensities so low that any biological effects are due to the direct effects of the radiation and not as a result of heating. The pulsed (IR) laser can penetrate tissue for several millimeters. Studies suggest that infrared laser (IR) treatment may be more efficacious for analgesia. Research suggests that acupuncture related mechanisms are the basis of laser-induced analgesia. Long suggests that a wavelength of 904 nm and a cycle of 3000 Hz was the most effective treatment. Basford suggests that the effects of low energy laser irradiation may be due to the effect of light in general and not to the unique quality of lasers. Wavelength-dependent photobiochemical reactions occur throughout nature. The 904 nm wavelength is close to the absorbance maximum for several biological pigments such as hemoglobin and mitochondrial cytochromes.

Siemens and Salet et al. have shown that photochemical effects occur at the level of the mitochondria. Laser stimulation can increase the adenosine triphosphate (ATP) levels in the cell and effect cellular functions. Abergel et al. suggests a treatment schedule of one daily exposure for 3 or 4 consecutive days enhances the effects of the laser treatment. Rochkind et al. shows low energy irradiation will affect the electrical activity (nerve conduction and action potentials) of an injured nerve. This effect lasts for at least 1 year following a short series of irradiations. Scar tissue development is minimized and nerve tissue regeneration is enhanced.

Acupuncture related mechanisms supposedly potentiate opioid-mediated analgesia by releasing stimulating the release of endogenous opioids. Klize hypothesized that acupuncture mechanisms repeatedly activate physiological systems involved in pain perception. These systems can be trained, by repeated treatments, to continuity of activity of these physiological systems and thereby continue pain relief after treatment.

This study is an evaluation of the efficacy of treatment of post-herpetic neuralgia using 904 nm low energy laser. It does not attempt to discern the biophysiological mechanisms underlying the treatment. Results show infrared laser treatment to be effective for the relief of PHN. These individuals receive immediate (by end of treatment) relief from pain. There is a long term pain relief (1 year or more) and subjects tend to improve further with time (reporting less pain). On average, pain relief requires 10 to 15 20-min treatments (at least 4 h

![Figure 6. Pain score comparisons one month before and 1 year after therapy](chart)

![Figure 7. Reduction in pain from 1 month prior to therapy to 1 year post-therapy (as percentage)](chart)
between treatment). Subjects having pain reduction by the end of treatment almost always remain with less to very little pain. Subjects having little pain reduction by the end of treatment may have smaller levels of pain reduction in the long term.

Infrared laser appears to be an effective treatment modality when long-term affliction of PHN occurs. It also appears effective when alternative drug therapies are not effective. These two points may be especially noteworthy for treating elderly patients with PHN.

The results of this study on post herpetic pain are in line with the conclusions of prolonged and effective pain relief through infrared laser treatment. The mechanism is undetermined and research needs to continue to determine the exact biophysical mechanisms involved.

References