

THERAPEUTIC LASER FOR CHRONIC LOW BACK PAIN

Laser therapy offers a safe and effective treatment modality as either primary or adjunctive therapy.

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Low back pain will affect 75-85% of all Americans at some point during their lifetime. Approximately 50% of them will have a recurrence within a year. Approximately 90% improve without surgery.¹ Low back pain is the number 2 reason that Americans see their doctor—second only to colds and flu. Approximately 7.4% of patients with low back pain account for 75% of the money

spent on low back pain.³ The vast majority of acute low back pain is the result of injury such as sprain or strain, while the cause of chronic low back pain is multifactorial.² Chronic low back pain is defined as pain of more than three months duration. It occurs in 2-8% of those who experience low back pain.³

The five most common pain producing structures of low back pain are:

1. Posterior longitudinal ligament
2. Interspinous ligament
3. Spinal nerve root
4. Facet joints
5. Deep muscles.

These structures do not fully account for the pain experienced by many chronic low back pain sufferers. The exact mechanisms of the causes of chronic low back pain continue to be a mystery. Recent scientific studies have implicated a number of chemical mediators as possible contributors to the production of chronic low back pain. These include:

- The peptide somatostatin
- Pro-inflammatory cytokines such as IL-1, IL-6, IL-10, and TNF-alpha
- PGE2
- Nitric oxide.⁴

Patients with chronic low back pain may also have emotional factors such as depression with a four times higher incidence of clinical depression than those without chronic low back pain. Studies have shown that 62% of the patients treated at pain clinics for low back pain have some type of depression.⁵

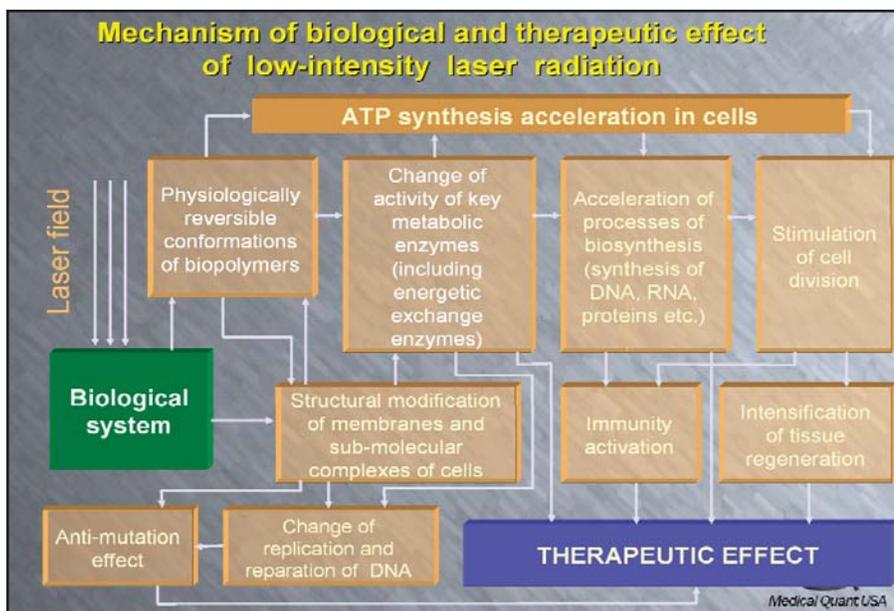


FIGURE 1. Flowchart of some of the most commonly observed biochemical effects of therapeutic lasers. (Courtesy of MedicalQuant)

Biochemical Effects

In a prior article, this author discussed a number of biochemical effects that have been observed with laser therapy/phototherapy in a prior article in this journal.⁶ Several of these effects directly relate

to the management of the patient with chronic low back pain. Three of the most prevalent features of patients suffering from chronic low back pain are: inflammation, pain, and edema.⁶ Injured cells and tissues generate enzymes that encourage the receipt of photons more readily than healthy cells and tissues. Primary photoacceptors, which are activated by light, are thought to be flavins, cytochromes, and porphyrins.^{7,8}

These photoacceptors are located in the mitochondria and can convert light energy into electro-chemical energy. Chromophores, in the form of porphyrins have been shown to play an important role. Small amounts of singlet oxygen have been shown to accumulate in tissues irradiated with laser light.⁹ Singlet oxygen affects the formation of ATP in the mitochondria.¹⁰

Laser-related research has demonstrated a number of interesting bio-chemical responses that can have a positive clinical effect the chronic low back pain patient. These effects include:

- Stabilization of the cell membrane¹¹
- Enhancement of ATP synthesis¹²
- Stimulated vasodilation along with increased histamine, NO and serotonin¹³
- acceleration of leukocyte activity
- Increased Prostaglandin synthesis¹⁴
- Reduction in Interleukin-1 levels¹⁵
- Increased angiogenesis¹⁶
- Enhanced superoxide dismutase¹⁷
- Decreased C-reactive protein and neopterin levels¹⁸

Research in laser and light therapy has documented that red and near infrared light reduces pain by a combination of these responses (see Figure 1):

- Increases in b-Endorphins
- Blocked depolarization of C-fiber

afferent nerves¹⁹

- Axonal sprouting and nerve cell regeneration²⁰
- Decreased Bradikynin levels
- Ion channel normalization²¹

Tissue Penetration and Saturation

Chronic low back pain is a complex clinical condition which involves many different tissue levels from subcutaneous and muscle tissues to the deeper tendons and ligaments, including the inter-vertebral disc. Laser therapy, if it is to be effective, must be applied in a way that will effectively produce significant biochemical changes in the superficial, medium, and deep tissues. One may recall from the previous article that red light will affect the skin and subcutaneous tissue to an approximate depth of 1 cm. Infrared light will effect deeper tissue structures from 1 -5 cm depth.²² Comprehensive laser/light therapy for treating chronic low back pain must therefore include the use of both red and infrared wavelengths (See Figure 2).

Laser therapy produces primary, secondary and tertiary effects in the body as I previously discussed in the author's last article.²³ All three of these effects are desirable in the treatment of low back pain. A GaAs superpulsed infrared laser, or high output GaAlAs infrared laser, is necessary to obtain the deep tissue penetration needed to effectively treat the deeper structures of the back. Gruszka, using a GaAs superpulsed laser, found that 9 Joules/cm² of energy applied to appropriate points were effective at ameliorating pain in patients with herniated lumbar discs and radiculopathy.²⁴ Most modern diode lasers utilize pre-programmed treatment settings that help insure adequate numbers of Joules of light energy will be irradiated into the patient's tissues.

Tasaki found that relief was obtained in low back pain patients using a GaAlAs laser in the 30–80 mW output range.²⁵ Reductions in the size of lumbar disc herniations have been demonstrated by Gruszka,²⁶ Tatsuhide,²⁷ and others. Tertiary effects by treating acupuncture points have been shown to be effective at decreasing low back pain. Nikolic found that treating acupoints with a 630 nm red laser was most effective.²⁸

The results from the application of laser therapy will be maximized by combining several laser techniques together. Clinicians have found that tissue saturation of the effected area of the low back to be the best place to begin. Stimulation of acupoints and/or reflex points is also valuable. The irradiation of lymphatic structures is beneficial, especially when edema is present. Pulse frequency is of some importance, especially when using a GaAs superpulsed laser.²⁸ Pain relief is best achieved in the frequency range of 1-100 Hz. Inflammation responded well to the 3000-5000 Hz range. Edema responds well to 1000 Hz (see Figure 3).

The amount of time it takes to adequately treat an area of involvement (therapeutic levels of Joules of photon energy) in the low back depends on the size of the area and the power output of the laser/light therapy device. This is known as photon or power density (see Figure 4). You can use Figure 5 as a general guide for average duration of treatment at different penetration depths versus laser power output.²⁹

Treatment Modality

A typical treatment approach for a patient with chronic low back pain would involve the following:

1. History of condition, physical exam-

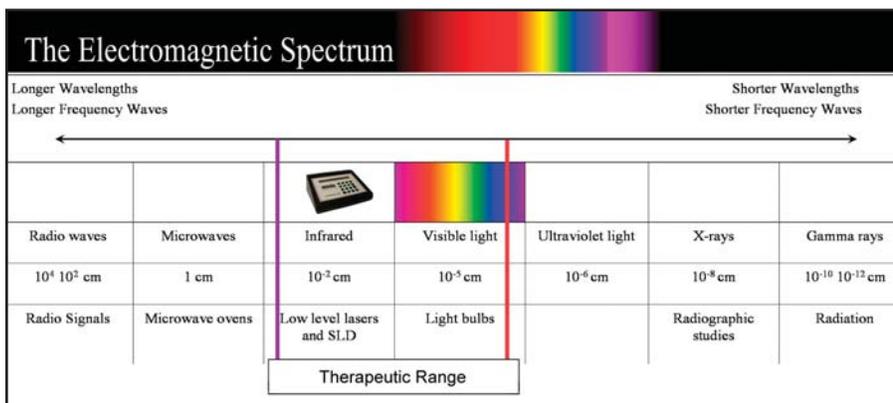


FIGURE 2. Therapeutic range within the electromagnetic spectrum. (Courtesy Doug Johnson, ATC, CLS)

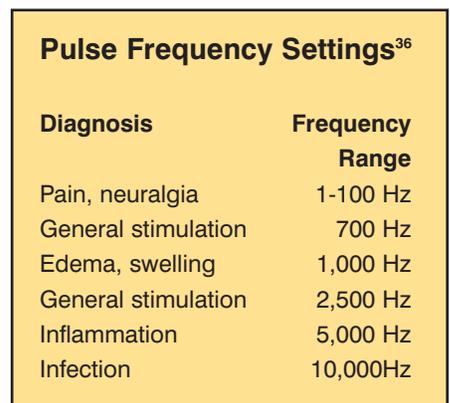


FIGURE 3. (Courtesy Doug Johnson, ATC, CLS)

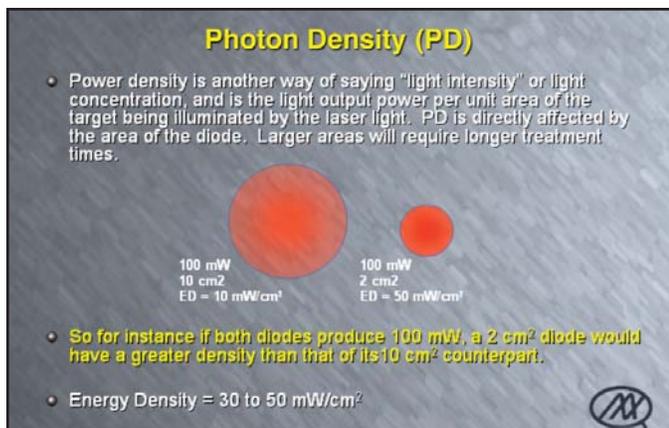


FIGURE 4. Photon (Power Density) (Courtesy MedicalQuant-West)

Treatment Time for 50cm² Surface Area with a GaAs Laser

Depth	10mW	25mW	50mW	100mW	200mW
.5 cm	2.5 min	1 min	30 sec	15 sec	10 sec
1 cm	5 min	2 min	1 min	30 sec	15 sec
2 cm	10 min	4 min	2 min	1 min	30 sec
3 cm	15 min	6 min	3 min	1.5 min	45 sec
4 cm	20 min	8 min	4 min	2 min	1 min

The output powers are average powers. Treatment should be done with skin contact.

FIGURE 5. Note: A surface area of 50 cm² is roughly equivalent the surface area of an average sized apple sliced in half horizontally. (Courtesy Doug Johnson, ATC CLS)

ination of the low back paying particular attention to the level of abnormal muscle, nerve and joint function, as well as pain level. This would include lumbar and pelvic range of motion, lumbar and pelvic orthopedic tests, lower extremity deep tendon reflexes, and Visual Analog Scale.

2. The initial treatment aim is to saturate the primary area of involvement. A good choice would be to use 3000-5000 Hz for 5-10 minutes with a GaAs laser in order to help reduce inflammation. A scanning contact is utilized for this technique in order to maximize the tertiary or systemic effects (see Figure 6). Note that treating the lymph nodes proximal to the area of involvement with 3000 Hz laser emitter utilizing a pumping action—prior to treating the area of involvement—will enhance the reduction of edema (see Figure 7).

3. The secondary treatment aim is to reduce pain and stimulate healing in the deeper tissue of the Right low back. A GaAs superpulsed laser at 5-50 Hz for 5-10 minutes is the best choice in order to get the deepest penetration.³⁰ This is performed with a stationary contact with the emitter. Note that patients with chronic low back pain can become exacerbated after the initiation of laser therapy so it is advisable to use one half of the above dose during the first treatment, until the individual patient's response can be determined on the first follow-up visit (see Figure 8).

4. A third technique often applied during a treatment session is stimulation of acupoints with the laser emitter. The exact points used are dependant on the clinician's training and experience with acupuncture or acupressure. Treatment involves

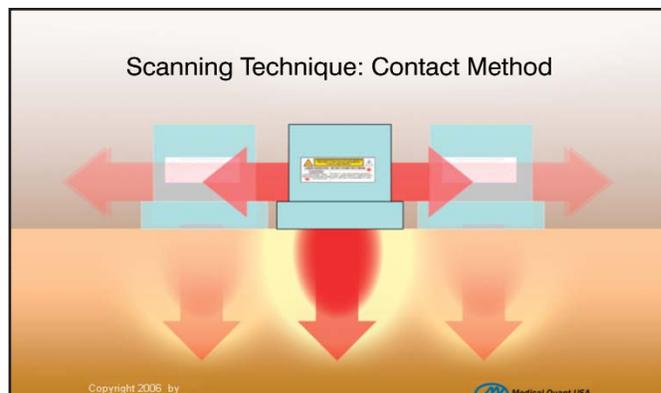


FIGURE 6. Scanning Technique (Courtesy MedicalQuant-West)

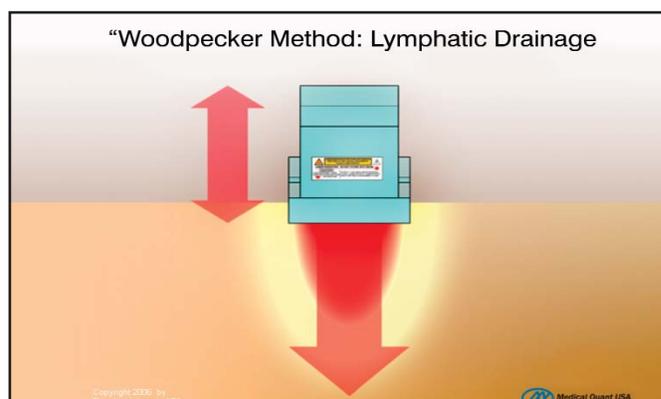


FIGURE 7. "Woodpecker" pumping method of treating over lymph nodes. (Courtesy MedicalQuant)

stimulation of each acupoint for 1 minute at 1000 Hz. See Figures 9 and 10.

Laser therapy treatment times are usually 10–20 minutes per session. Chronic low back pain patients will usually respond best to 3-4 treatments per week. Maximum effect is often reached in 3-4 weeks but several months of care may be necessary in extremely complex cases. It is important to allow for delayed effects and cumulative effects which commonly occur in patients receiving laser therapy. Treating a patient too frequently can actually slow down the recovery process and increase symptoms.³¹ While laser therapies can often produce results as a stand alone therapy, they also work very well adjunctively with other therapies such as: physical therapy, manipulation, exercise and stretching. The wound healing effects of therapeutic lasers are well documented in laser related literature suggesting it is also a valuable adjunct during post operative recovery.³² Laser therapy is extremely safe has few contra-indications as described in Figure 11.

Conclusion

Therapeutic lasers and other phototherapy devices offer a safe, often effective, easily utilized primary or adjunctive therapy that is relatively cost effective to both the clinician and patient. Laser therapy can be a viable part of the multi-faceted approach often needed to bring relief to the millions of chronic low back pain sufferers that present in offices, clinics, and hospitals. The future is promising as research continues to increase understanding of this new healing modality. ■



FIGURE 8. Stationary contact to the Left L4 area. (Courtesy MedicalQuant-West)

CONTRAINDICATIONS

Absolute Contraindications

- Cancer (tumors or cancerous areas)
- Direct irradiation of eyes
- Photosensitivities

Relative Contraindications

- Irradiation of the fetus or treatment over the pregnant uterus
- Over areas recently injected with corticosteroids
- Over the thyroid gland

FIGURE 11. Contra-indications as recommended by NAALT (Courtesy MedicalQuant-West)

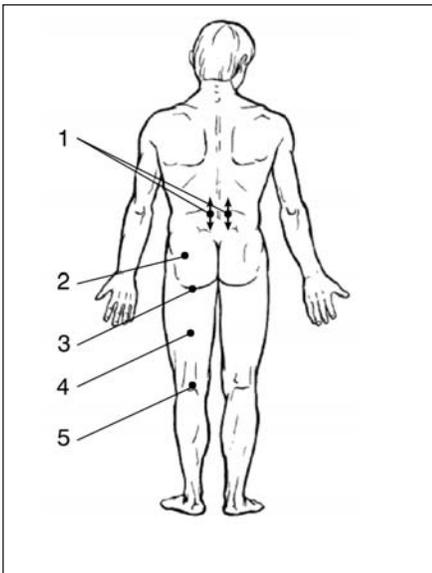


FIGURE 9. #1 Treatment area of tissue; #2-5 Acupoints for LBP

Dr. Kneebone studied nursing at Cook County Hospital in Chicago graduating as an RN in 1972. He completed an anesthesia program at St. Francis Hospital in La Crosse, Wisconsin in 1974. Dr. Kneebone practiced anesthesia until he graduated from Palmer College of Chiropractic in 1978. He has been in a complementary medicine practice in the San Francisco Bay area since 1978. He has post graduate certification in nutrition and homeopathy. He is also a Fellow of the International Academy of Medical Acupuncture and a Diplomate of the International Academy of Clinical Thermology. Dr. Kneebone has been using therapeutic lasers in his practice for over 7 years and has been teaching laser seminars for the past four years. He is scheduled to teach 25 to 30 Cutting Edge Laser Seminars™ next year around the US. He can be contacted at drknee@pacbell.net

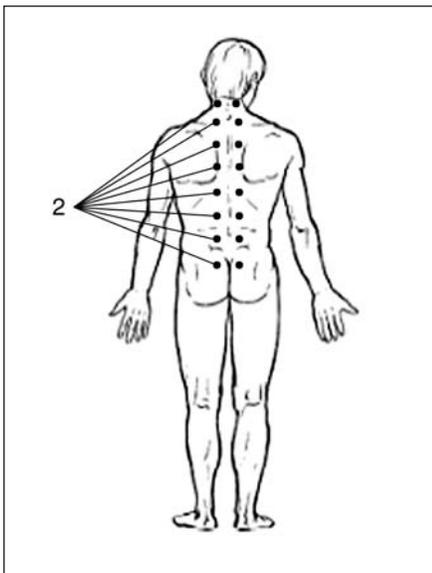


FIGURE 10. Acupoints for the entire techniques for the low back.

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