

COLD LASER

by Tamara Genest & Lyn Paul Taylor

"A splendid light has dawned on me..."- Albert Einstein

In 1917, Albert Einstein established the physical principle of **Light Amplification by Stimulated Emission of Radiation (LASER)**. The first laser was operated by Theodoro H. Maiman at Hughes Research Laboratories, Malibu, California in 1960 using a ruby crystal, now known as the ruby laser.

A laser is a coherent and highly directional radiation source. Essentially, a laser is a device that transforms one type of energy, usually electrical, into optical energy. The light waves in the resultant beam are nearly parallel (collimated), nearly monochromatic, and coherent. The light beam is produced by exciting atoms and causing them to radiate their energy in phase. This generates an extremely intense, small and nearly non-divergent beam of monochromatic radiation in the visible region, with all the waves in phase, capable of mobilizing immense heat and power when focused at close range. A laser is basically comprised of a cylinder with mirrors at both ends. The cylinder itself is filled with materials such as crystal, glass, liquid, gas, or dye, which produce different types of beam forms.

Since the late 1960's advances in laser application and delivery include variations in modulation or frequency and intensity as well as different wavelengths. These variations in laser delivery produce different and more desirable effects on living tissue. In 1967, Professor Andre Mester, through his research, pioneered the use of therapeutic lasers in medicine. Dr. Mester is recognized by many as the grandfather of laser therapy.

Laser types

In general there are two types of medical laser systems, **contact (hot laser) and non-contact (cold laser)**. **Contact** systems work by sending laser light through a fiber or sapphire crystal tip. The tip absorbs the radiant energy and becomes hot. Direct contact between the tissue and the heated tip causes conduction of the heated energy from the tip to the tissue, resulting in the vaporization of the target cells. In contrast, **non-contact** laser systems do not directly touch the tissues. Instead, the laser light transfers radiant energy to the tissue. Heat results when the cell absorbs the radiant energy and

the molecules in the tissue begin to move. In both types of system, the laser light itself is not hot. Heat is created only after the laser's radiant energy is absorbed, either by the tip or the tissue.

Contact lasers affect human tissue by transforming radiant energy to the target cells. The radiant energy turns into heat when the cells absorb it. As the target cells are heated, all their proteins are destroyed and their internal pressure rises rapidly. The cells then explode, giving off smoke-like steam called a laser plume. The major effects of most lasers on tissue are coagulation of blood and protein, and vaporization. Vaporization is the removal of tissue through its conversion from a solid to a gas. In contrast, the photons of **non-contact laser** penetrate through the skin and are absorbed by special components of the body's cells called chromophores. Just as photosynthesis creates energy for plants, the absorption of photons in the cells causes increased cellular activity. In areas of injury or damage, increased production of cellular activity improves the rate and quality of healing. This is referred to as *biostimulation*.

The F.D.A. classifies medical lasers into three categories:

- Class 4 Surgical Lasers (contact)
- Class 3B Non-Surgical Lasers (non-contact)
- Class 3A Low-Level Lasers (non-contact)

Class 4 Surgical Lasers (contact) are typically indicated to cut, destroy, remove or coagulate tissue, generally soft tissue, for general surgical purposes in medical specialties of general and plastic surgery.

Class 3B Non-Surgical Lasers (non-contact) are painless, non-burning, and non-cutting forms of lasers. They have the ability to penetrate and assist in the healing process of deep tissue and joint problems.

Class 3A Low-Level Lasers (non-contact) do not have the intensity to damage cells. Typically they will not penetrate below the skin's surface.

Low-Level Laser Therapy (LLLT) implements the use of low-level lasers exclusively for healing purposes. One could define therapy with lasers as a form of intensive light therapy, using directed light of a defined wavelength and various frequencies to produce positive physiological cell changes and support the organism in its healing process. Low-level lasers are used for wound healing, tissue regeneration, inhibiting inflammation, and for soothing pain.

Because of its bio-stimulatory nature, laser therapy has the potential to help any situation wherein the body's cells are not working at their optimum potential. Studies on tissue cultures reveal a wide range of beneficial effects including increased levels of endorphins and other beneficial chemicals. Lasers also have the potential to reduced levels of

harmful compounds including C-reactive protein and interleukin-1, pain modulation through a variety of mechanisms, with an increased rate and quality of tissue healing.

Low Level Laser Therapy (LLLT) is a painless form of therapy because the laser does not generate perceivable heat. Therefore, when the laser contacts the skin the patient experiences no warmth or burning as a result of the laser. Although certain nerves may be stimulated by the light, most patients feel nothing at all, while a few may feel a slight tingling during the treatment.

Low Level Laser Therapy (LLLT) is quickly becoming the first line of attack in pain control and tissue healing in rehabilitation medicine (*in some settings*). It is safe, painless quick and easy to apply and results are often immediate with no side effects. Low level lasers do not have sufficient strength to damage cells. In fact, after 30 years of clinical use, low level lasers have not been found to have any adverse what so ever, and are not carcinogenic.



**A German manufactured Cold Laser containing 21 individual lasers;
pictured with a pair of protective glasses**



An American manufactured single laser which simultaneously electrically stimulates the tissues being treated; pictured with a tube of conductive gel

The cold laser is utilized, in our setting, as an adjunct to other modalities for the treatment of the various syndromes described in the following text. These modalities may include electrical stimulation,

ultrasound, soft tissue manipulation (a very important treatment form), or mechanical vibration. It is never used as a “stand alone” treatment form.

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