

## Light Emitting Diodes LED Technology In the Aesthetic Market

Light-emitting diodes (LED). LED technology normally uses one or more individual wavelengths of light delivered at a low intensity. Whereas laser and IPL deliver light in short (millisecond) pulses at extremely high power, LED is a constant, gentle nonthermal treatment. It is rated as a Class I or II device by the FDA, depending on the model, with only a relatively minor risk of eye injury. For comparison's sake, bar code readers and laser pointers are Class I and II devices. LED equipment can be sold to and used by anyone, although devices marketed for home use may be less powerful than professional models. LED light is visible as colored light—most often red, blue or amber. When infrared wavelengths also are incorporated, those are not visible. Covering the client's eyes is recommended, but protective eyewear is not required for the technician.

LED light therapy is a form of phototherapy, and technicians sometimes make a comparison to photosynthesis—the production of organic substances in plants in the presence of sunlight—to help explain its beneficial effects. This may be a good starting point, because the public already understands that plants convert light to cellular energy. This type of light therapy sometimes is referred to as photomodulation, photobiomodulation, low-level laser therapy, low-energy laser therapy or light therapy.

When low-energy laser light passes through the skin, different components of the skin and the cells are affected by various wavelengths, stimulating certain beneficial effects. Red and infrared light therapies have been used therapeutically in Eastern Europe for 40 years, and UV therapy for psoriasis has been utilized in the United States for many years, as has light therapy for treating jaundice in newborns.

Light therapy also has been effective as a remedy for depression; in combination with photosensitive chemicals to treat brain cancer; to heal mouth and skin ulcers for children undergoing chemotherapy; for gum diseases, tendonitis and carpal tunnel syndrome; for muscle and joint pain, and inflammation; in conjunction with acupuncture; to increase wound healing for astronauts on long space missions; for collagen synthesis; to ease rheumatoid arthritis and osteoarthritis; and for blood cleansing and treating infections. These various therapeutic uses are due to the many beneficial tissue and cellular effects of photomodulation.

Photomodulation stimulates fibroblasts to produce collagen, improving elasticity, fine lines, scar tissue and skin thickness. After a series of LED treatments, fibroblasts can continue to produce new collagen for up to six months and lymph activity is increased, helping to reduce edema, or fluid buildup. Increasing lymph activity also can help to quicken the healing process, because the lymph system is responsible for helping the body to eliminate waste products and bacteria. Macrophages are stimulated by LED light therapy. Within the lymph nodes, macrophages destroy microorganisms—this process is called phagocytosis—so that the lymph system can begin the process of removing them from the body.

Adenosine triphosphate (ATP) production is stimulated by certain light wavelengths. ATP is found in muscle fibers and in all cells, and can be considered the fuel, or energy source, needed for all cellular functions. In order to be used by the cells for energy, ATP is broken down and must be replenished constantly. You think of food as your energy source, but it needs to be converted to ATP before your cells can use it. Increased ATP translates into enhanced cellular metabolism and proliferation. Anabolism (one aspect of metabolism—the synthesis of complex compounds from simpler ones) and catabolism (anabolism's opposite—the breaking down of large molecules into smaller ones) are both increased. Additionally, RNA and DNA synthesis in cells is increased, improving the reproduction of healthy cells. Photomodulation has been shown to activate the release of growth factors that stimulate cell growth and metabolism.

In all, various studies have reported therapeutic benefits targeting the circulatory, lymphatic, immune and nervous systems, in addition to recent studies reporting on beneficial cosmetic results.

LED equipment currently is being manufactured specifically for cosmetic purposes, similar to lasers and IPL. LED light therapy can be performed without medical supervision and often is delivered through the use of hand-held equipment. This technology is becoming widely available, and can be used safely and confidently in both medical spas and day spas.

## References

1. C Enwemeka PhD FACSM, Laser Photostimulation: An old mystery metamorphosing into a new millennium marvel. *Laser Therapy* (12, 13) World Association for Laser Therapy (2004)
2. D Fitz-Ritson DC, FCCRS(C), DACRB, Lasers and Their Therapeutic Applications in Chiropractic. *J Can Chiropr Assoc* 45(1) 26 (2001)
3. D McDaniel, MD, Light Tissue Interactions: Photothermolysis vs Photomodulation. *PCI Journal* 10(3) 15 (2002)
4. E J Spear, Light's Action. *Dayspa* 221 27 (May 2005)
5. G K Reddy, et al, Laser Photostimulation of Collagen Production in Healing Rabbit Achilles Tendons. *Lasers Surg Med* 22(5) 281 (1998)
6. I Neuman, MD, et al, Narrow-band Red Light Phototherapy in Perennial Allergic Rhinitis and Nasal Polyposis. *Annals of Allergy, Asthma, & Immunology* 78 399 (April 1997)
7. J Mercola Light Therapy for Eye Injuries. *New Scientist* (12 July 2002)
8. K Carney, Shedding Light on Beauty. *Les Nouvelles Esthetiques*, 154 (January 2005)
9. LEDs Illuminate the Future of Light-Based Skin Renewal. *The American Society of Dermatologic Surgery* (10 April 2002)
10. L R Horwitz DPM, CWS, et al, Augmentation of Wound Healing Using Monochromatic Infrared Energy. *Advances in Wound Care* 12(1)35 (Jan/Feb 1999)
11. M S El-Genk, The NASA Light-Emitting Diode Medical Program – Progress in Space Flight and Terrestrial Applications. *CP504 Space Technology and Applications International Forum* (2000)
12. New Photo Rejuvenation Treatments Offer a Quick and Easy Solution to Aging Skin. *American Academy of Dermatology* (5 March 2001)
13. P Papageorgiou, et al, Phototherapy with blue (415 nm) and red (660 nm) light in the treatment of acne vulgaris. *British Journal of Dermatology* 142 973 (2000)
14. P Pugliese MD, Fundamentals of Laser Science, Part I. *Skin Inc. magazine* (July 2004)
15. P Pugliese MD, Fundamentals of Laser Science, Part II. *Skin Inc. magazine* (August 2004)
16. P Rogers MRCVS, Laser. From Post Graduate Course in Veterinary AP, Dublin. (1992, updated 1993, 1995)
17. R Bryant, Low-level Laser Outshines Other Modalities. *Cosmetic Surgery Times Special Report* (1 July 2004)
18. R Das et. al., Light-Emitting Diode (LED) Irradiation Enhances the Wound Healing Process by Altering Gene Expression Patterns.