

## Light Therapy in Sport

Professional baseball's San Diego Padres are seeing--and feeling--the light. As the Padres prepare for their season of 162 games in 180 days, some of the players are treating their aches and pains with a therapy that uses light. The Philadelphia Eagles' football team and many other professional athletes and trainers have followed suit in this form of therapy. Light therapy (also known as "phototherapy") is showing dramatic results and is all the buzz in many physical therapy circles.

The Padres use a handheld LED device that emits infrared light that penetrates the skin to stimulate blood flow and circulation in targeted areas. The device provides temporary relief of minor aches and pains where heat is required. In addition, infrared light is one of the only physical therapies that acts to create a healing effect. Cells that are injured can actually be rejuvenated by light. This form of light therapy can be used to treat ankle sprains as well as nerve cells damaged from spinal cord injuries. "This is the single biggest breakthrough in healthcare I've seen in 30 years," said Len Saputo, an internist who is also the founder and director of the Health Medicine Forum.

Light has been used for healing for many centuries. The Greeks and Romans recognized the positive, healing effects of sunlight. The ancient Greek physician, Hippocrates, even had patients recuperate in roofless buildings where they could soak up the rays of the sun. Nils Finsen won the Nobel Prize in 1903 for "Physiology of Medicine" for his treatments of Lupus and Tuberculosis patients with ultraviolet light. And just recently, modern-day scientists have come to understand more about the nature of light and its restorative capacity. Medical researchers have been able to develop techniques and devices that use light as an integral element of the healing process.

What we usually refer to as "light" is actually the visible part of the spectrum of electromagnetic radiation. Light is that range of colors that comprise an ordinary rainbow. Conventional light has a thermal effect; it warms up the skin. Ultraviolet light is the part of the spectrum that causes a tanning of one's skin. Infrared light is used as a heat source.

Light Emitting Diodes (LED's) have been around for a long time, but have been introduced as a legitimate therapy option in recent years. LED's are similar to lasers in that as they can emit the same light but differ in the way that the light energy is delivered. Lasers are focused beam single-wavelength light emitters that can be intense enough (a 'hot' laser) to burn/cut tissue or 'cold' enough to only have light therapy effects. LED's do not deliver enough power to damage the tissue, but they do deliver enough energy to promote natural self healing and pain relief. With a low peak power output but high duty cycle

(50%), the LED's provide a much gentler delivery of the same healing wavelengths of light as does the laser but without the same risk of accidental eye damage that lasers do.

LED's are merely convenient devices for producing light at specific wavelengths, and in addition to the one already cited, several other studies establish that it is the light itself at specific wavelengths that is therapeutic in nature and not the machine which produced it. All biological systems have a unique absorption spectrum which determines what wavelengths of radiation will be absorbed to produce a given therapeutic effect. The visible red and invisible infrared portions of the spectrum have been shown to have highly absorbent and unique therapeutic effects in living tissues.

LED's also allow the light beam to spread out instead of being a pinpoint light beam and they generate a broader band of wavelengths than does the single-wavelength laser. The wide-angle diffusion of the LED confers upon it a greater ease of application, since light emissions are thereby able to penetrate a broader surface area. The multiplicity of wavelengths in the LED, contrary to the single-wavelength laser, may enable it to affect a broader range of tissue types and produce a wider range of photochemical reactions in the tissue. Since LED light disperses over a greater surface area, this results in a faster treatment time for a given area than laser.

"This is a tremendous addition to our arsenal of treatments that can be used to manage sports injuries of any kind," Saputo said. "This will be something that will be mainstream therapy for professional athletes around the world." While infrared light has been used in Europe and Asia for almost three decades, the therapy is relatively new in the United States, only recently gaining FDA approval.

Infrared light is one of the safest therapies on the market today. Athletes can use infrared light therapy before a competition to loosen up muscles and after a game to reduce soreness, pain and swelling.

A practitioner holds the device where treatment is needed, just above the skin's surface. With some of these devices, you can adjust the frequency or the amount of light the device will emit, depending on the patient's age, weight and muscle mass. When infrared laser light is administered, it reduces sensitivity of neural pathways and causes the body to release endorphins that provide a nontoxic, natural form of pain relief.

The USA Track and Field team started using this type of therapy during the 2000 Olympic Games in Sydney and the Olympic Trials in Sacramento, California where over 50 athletes were treated. It has

spread rapidly since that time. The Padres were the first major league baseball team to use this form of therapy. Companies have begun actively marketing similar products to athletics trainers, and many if not all pro teams have hopped onboard, including baseball, basketball, football, hockey, gymnastics, and even the horse industry.

Unlike ultrasound and electrical stimulation, infrared technology is so gentle that athletes can use it frequently without causing more damage to injuries. That competitive edge is critical in sports such as baseball, where just a few days or weeks of photonic stimulation can mean the difference between riding the bench and completing the season.

Light therapy has broader implications beyond sports medicine. Using these devices, hip fractures can heal faster and full motion can be restored within just a few treatments, Saputo said. People with back problems, nerve damage, muscular diseases, tennis elbow, burns and other ailments have all shown marked signs of improvement using infrared light therapy.

The technology can also offset the long-term costs of surgery, steroid injections, pain medicines and physical therapy visits. We will be seeing infrared light used for all kinds of pain control in the future. There will always be a place for ultrasound and electrical stimulation, and now doctors will also start using light for treatment.

Infrared light therapy "is really a breakthrough in healthcare and pain management," Saputo agreed. "In sports medicine it will be a panacea as soon as people recognize it." NASA has plans to use infrared lights in space to heal astronauts' wounds or injuries. Light and heat therapy can be used separately or together, or they can be combined with other treatments, such as acupuncture, physical therapy and chiropractic work. In the 20th century, people were looking at sound as being a powerful tool. The 21st century will be a century of the photon, fiber optic cable, and the Internet. You will see lasers and fiber optics play a bigger part in therapy."

The FDA has approved light therapy for the treatment of head and neck pain, as well as pain associated with CTS (Carpal Tunnel Syndrome). In addition to these conditions, the literature indicates that light therapy may be beneficial in three general areas:

- Inflammatory conditions (eg, bursitis, tendonitis, arthritis, etc).
- Wound care and tissue repair (eg, diabetic ulcers, venous ulcers, bedsores, mouth ulcer, fractures, tendon ruptures, ligamentous tear, torn cartilage, etc).

- Pain control (eg, low back pain, neck pain, and pain associated with inflammatory conditions—carpal tunnel syndrome, arthritis, tennis elbow, golfer’s elbow, post-herpetic neuralgia, etc).

#### How it works

Evidence indicates that cells absorb photons and transform their energy into adenosine triphosphate (ATP), the form of energy that cells utilize. This occurs in the mitochondria or the cell's energy factory. The resulting ATP is then used to power metabolic processes; increases RNA and DNA synthesis as well as synthesis of proteins, enzymes, and other products needed to repair or regenerate cell components; foster mitosis or cell proliferation; and restore homeostasis (the maintenance of a stable internal environment). This helps damaged cells to be replaced more promptly.

#### Uses of Infrared Light Therapy (Phototherapy)

- The clinical benefits include pain relief in conditions such as carpal tunnel syndrome (CTS), bursitis, tendonitis (elbow, shoulder or knee), ankle sprain and temporomandibular joint (TMJ) dysfunction, neck and shoulder pain, arthritis, sciatica, and post-herpetic neuralgia, as well as tissue repair in cases of diabetic ulcer, venous ulcer, bedsore, mouth ulcer, fractures, tendon rupture, ligamentous tear, torn cartilage, and nerve injury.
- Promotes healing. Raises white blood cell counts. Improves cell growth as well as DNA synthesis and protein synthesis in cells.
- Increases circulation by increasing the formation of new capillaries, which are additional blood vessels that replace damaged ones. New capillaries speed up the healing process by carrying more oxygen as well as more nutrients needed for healing and they can also carry more waste products away.
- Promotes blood circulation. Eases chronic inflammatory diseases, such as rheumatism. Eliminates soreness & pain, fatigue and stress. Relieves all forms of arthritis and carpal tunnel syndrome.
- Hyperthermic therapies for detoxification or clearing toxins from the body.
- Helps sports-related and musculoskeletal injuries such as repetitive strain injury or bursitis.
- Helps with hypertension, arteriosclerosis, and coronary artery disease by dilating arteries, blood vessels, and tiny capillaries.
- Stimulate the production of collagen. Collagen is the most common protein found in the body. Collagen is the essential protein used to repair damaged tissue and to replace old tissue. It is the substance that holds cells together and has a high degree of elasticity. By increasing collagen production less scar tissue is formed at the damaged site.

- Stimulates metabolism, promoting the elimination of toxins that accumulate in cells (i.e., poisons, carcinogenic heavy metals, toxic substances from food processing, lactic acid, free fatty acids, and uric acids).
- Increases lymphatic system activity. Edema, which is the swelling or natural splinting process of the body, has two basic components. The first is a liquid part which can be evacuated by the blood system and the second is comprised of the proteins which have to be evacuated by the lymphatic system. Research has shown that the lymph vessel diameter and the flow of the lymph system can be doubled with the use of light therapy. The venous diameter and the arterial diameters can also be increased. This means that both parts of edema (liquid and protein) can be evacuated at a much faster rate to relieve swelling.
- Accelerates metabolism, thereby preventing or slowing down the aging process as well as discomposing and discharging surplus to stay slim.
- Stimulate tissue granulation and connective tissue projections, which are part of the healing process of wounds, ulcers or inflamed tissue.
- Improves skin conditions (including cellulite) and serves as an all-around beauty treatment.
- Provides deep, infrared heat that can penetrate far below the surface of the skin to produce a soothing, comforting effect on the nerves and subcutaneous fat associated with aging.
- Relieves pain. The photons of light energy enter the body as negative ions. This calls upon the body to send positive ions like calcium among others to go to the area being treated. These ions assist in firing the nerves thereby relieving pain. Light therapy is successfully used in pain therapy, dermatology and rheumatology with excellent therapeutic effects in the treatment of shoulder humerus peri-arthritis, tendonitis and carpal tunnel syndrome.
- Increase phagocytosis, which is the process of scavenging for and ingesting dead or degenerated cells by phagocyte cells for the purpose of clean up. This is an important part of the infection fighting process. Destruction of the infection and clean up must occur before the healing process can take place.

#### Precautions

- Do not point the infrared unit at the eyes or look into the unit. Retinal damage may occur if used improperly.
- Do not use if you are pregnant.
- Do not use if you have any malignancies.
- Do not use on children without a physician's advice.
- Do not use on wet areas of the body. (This could cause serious burns.)

- Do not use on abdominal pain. (This could cause serious complication.) If pain persists, consult your physician.

- Precautions: At this time, research has shown no side effects from this form of therapy. Occasionally, one may experience an increase in pain or discomfort for a short period of time after treating chronic conditions. This occurs as the body reestablishes new equilibrium points following treatment. It is a phenomenon that may occur as part of the normal process of recovery.

FYI:

Visible Red Light: Light that is within the visible spectrum, from 400nm (violet) to 700nm (red). At a wavelength of 660 nanometers (nm - 1 nanometer is equal to one billionth of a meter), penetrates tissue to a depth of about 8-10 mm (about 3/8"). It is very beneficial in treating problems close to the surface such as wounds, cuts, scars, trigger points and acupuncture points, and is particularly effective in treating infections.

Infrared Light: Light in the invisible spectrum (below red), from 700nm to 2,000nm. Infrared Ray is not visible to the eye, but you feel it as heat penetrating into your skin. It penetrates to a depth of about 30-40 mm (1.2" to 1.4"), which makes it more effective for bones, joints, deep muscles, bursa, etc. Although both red and infrared wavelengths penetrate to different depths and affect tissues differently, their therapeutic effects are similar.