Riding the Wave Light Therapy in Athletics

Ready to put your athletes on a new wavelength in their rehab? Then it might be time to give light therapy a ride.

By R.J. Anderson

R.J. Anderson is an Assistant Editor at Training & Conditioning. He can be reached at: rja@MomentumMedia.com.
Training & Conditioning, 15.9, December 2005, http://www.momentummedia.com/articles/tc/tc1509/wave.htm

Want to know a secret to seven-time Tour de France champion Lance Armstrong's cycling success? In addition to an out-of-this-world VO2 max and unparalleled will to win, Armstrong had a little something else on his side: light therapy.

From the 2000 Tour until his retirement following his 2005 victory, Armstrong and his Team Discovery teammates received laser treatments before and after most of the event's 21 stages. Whether using it to unlock tight quadriceps before the start of a stage or applying it post-race to stimulate tissue repair after a high-speed spill, Jeff Spencer, DC, chiropractor for Armstrong and his teammates, considers his 635-nm laser an integral part of his tool kit.

"Other than my hands, it's the most important modality I use," says Spencer, a former Olympic cyclist who boasts a star-studded client list that also includes Tiger Woods and Troy Glaus, MVP of the 2002 World Series. "The laser does some things to promote healing and integrate body processes that little else compares to."

While light therapy has been a popular modality in Europe since the 1960s, it has only recently found its way into the hands of sports-medicine practitioners in the United States. In fact, it wasn't until 2002 that low-level lasers, the most powerful form of light therapy, received approval from the U.S. Food and Drug Administration for adjunctive use in pain therapy. Currently, sports-medicine professionals are using the technology to treat damaged tissue resulting from sprains, strains, and contusions. In this article we'll discuss the science behind the technology and talk to sports-medicine experts who use light therapy for a variety of applications.

SEEING THE LIGHT
Light therapy, also called phototherapy, is an umbrella term defined by the North American Association for Laser Therapy (NAALT) as "a therapeutic physical modality that uses photons (light energy) from the visible and infrared spectrum for tissue healing and pain reduction." No one is 100-percent certain exactly how light therapy works. Most researchers theorize that the waves of light passing through living tissue rejuvenate injured cells. Experts claim light boosts the cells' ability to produce adenosine triphosphate (ATP), which is largely responsible for supplying cells with energy.

"Light has a way of creating a physiological change within the cell, which leads to positive changes and promotion of healing, anti-inflammatory effects, improved blood circulation, increased lymphatic flow, and edema reduction," says Donald Chu, PhD, PT, ATC, CSCS, a private practitioner and former Director of Rehabilitation and Athletic Training at Stanford University, who frequently lectures on the technology.

Modalities of light therapy can be categorized in several different ways. To start, they are usually defined by their light source, of which there are three variations:

• Light emitting diodes (LEDs)
• Super bright LEDs or superluminous diodes (SLDs)
• Low-level laser diodes.

SLDs are more powerful versions of LEDs, and both are usually used to treat more superficial wounds than lasers. The LEDs and SLDs are also less expensive than lasers.

Laser diodes differ from LEDs/SLDs in that they generate monochromatic light that is confined to a specific wavelength, collimated (non-divergent), and coherent (speckled). This means that the light beams generated by laser diodes are narrower than those from LEDs/SLDs. Being coherent, they produce small pockets of higher energy levels that are deposited throughout penetrated tissue.

In contrast, LED-based light is neither collimated nor coherent, and it consists of multiple wavelengths. LEDs/SLDs are frequently arranged in multiple-diode clusters, which are especially helpful in treating skin wounds.

Technically, laser therapy is one category of light therapy, and LEDs/SLDs are not laser therapy. However, many companies manufacture products that offer both laser and LED/SLD therapy, and the terms “laser therapy” and “light therapy” are sometimes used interchangeably. Low-level lasers are also sometimes called cold lasers to differentiate from surgical (or hot) lasers, which are used to cut through tissue for surgical procedures.

Another way therapeutic light devices are categorized is by the wavelength of light they emit, which usually falls between 600 and 900 nanometers (nm). One nanometer is a millionth of a meter (.000001 m). Wavelengths between 400 and 800 nm fall within the red visible light spectrum. Wavelengths ranging from 800 to 1,000 nm are classified as infrared. Wavelength determines depth of penetration, and in general, infrared light penetrates deeper than visible light—up to five centimeters for high-powered laser diode-based products.

These modalities also have differing amounts of power. The greater the wavelength and deeper the beam, the more energy (measured in joules) is needed to ensure that sufficient light is delivered to initiate a therapeutic outcome. Joules are the dosage for any given treatment and represent the sum of power (watts) multiplied by the exposure time in seconds. Light therapy units can generate energy levels between one and six joules/cm2.

DO THEY WORK?
Despite 40 years of use, light therapy is still relatively unknown in this country. And athletic trainers looking for hard data on the effects of light therapy may have a hard time

finding adequate research from sources they know and trust.

“In order to get FDA approval, the light therapy companies had to initially do their own research,” says Chu. “And usually that research was done in another country by scientists we hope are reputable, but we just don’t know that much about them.

“It’s kind of a wild, wild west situation,” continues Chu. “There is a lot of unexplored territory and the medical community really needs to devote more time to this area to substantiate whether this really is an effective modality.”

However, anecdotal information on light therapy’s effectiveness is starting to pile up. Ellen Spicuzza, RN, an advanced practice nurse with a degree in exercise physiology, uses an 830-nm laser to treat contusions, sprains, strains, plantar fasciitis, carpal tunnel syndrome, tendinitis, and muscle spasms. As Spicuzza’s use of the laser has grown, so has her clientele, which includes a number of college and professional athletes from the Boston area, including members of the New England Patriots.

“The laser is basically good for anything that’s inflamed because it expedites the healing process,” says Spicuzza. “I know how long these injuries usually take to heal without the laser, and how much faster they heal with it.”

Charlie Ridgeway, PT, Physical Therapist for Georgia Tech athletics, is also using light therapy more and more. Ridgeway once used light therapy to treat a hamstring injury that a female athlete battled for nearly a year. For most of that time he had treated the injury with a handful of traditional modalities and had little success. About 11 months into the injury, Ridgeway added a laser to his tool kit and introduced the new modality to the injured hamstring.

“I treated it once a day for three weeks with the laser and started seeing much faster improvement,” says Ridgeway, noting that after three weeks of treatments the patient was symptom-free. “I’d been doing other stuff for a while and only treading water. Once we added the laser, the healing sped up significantly.”

Aaron Nelson, ATC, NASM-PES, CSCS, Head Athletic Trainer for the Phoenix Suns, has also had success with light therapy. “To me it’s a lot like ultrasound in that there is some evidence that it works, even though we aren’t sure exactly how well it works,” he says. “I haven’t seen any negatives from using the laser, and we have definitely had some positive experiences with it.”

A JUMP START

Spencer has enough confidence in his laser that he’ll use it anytime, anywhere, and on almost anybody (contraindications for lasers are patients with pacemakers, pregnancy, labile epilepsy, and cancer). His 635-nm laser device is the size of a shoebox, and he carries it wherever he goes. He has even been known to provide on-the-spot treatment during Team Discovery’s bus rides to and from race venues.

If there's an acute traumatic injury that involves some type of significant tissue damage, Spencer turns to his laser before doing anything else, typically spending five to 20 minutes applying treatment. "After that, I may come back with some other treatments or modalities, but everything pyramids down from my use of the laser," he says. "I want to make sure I reset the healing mechanisms and jump start the recovery process, which is what the laser does."

Spencer compares the laser's therapeutic systemic effects to those provided by acupuncture—both are typically used not to treat an injury locally, but to open up the body's natural healing mechanisms along with local effect application. "When you talk about the laser, you have to talk about using the technology for healing in an entirely different way than you would for most other modalities," says Spencer. "An important aspect of healing is making sure all the switches in the body that control and regulate healing are turned on. If they're not, then all the processes that you use to support tissue recovery or healing are compromised and aren't functioning as fast as they should be."

Spencer also uses the laser just as frequently to help head off potential injuries. "If Lance Armstrong goes out and rides a stage of the tour with an inhibited muscle, his body is going to have to recruit other muscles to get the job of pedaling done," he says. "That puts more stress on his system and can lead to something like tendinitis. If I can use a laser before the race to turn that muscle back on in a matter of seconds, his pedaling action can return to normal and the chances of further injury are reduced."

SHARING THE HEALTH

While laser treatments are often the first step Spencer takes with his patients, most others are still experimenting and using it alongside other modalities. "It's a good adjunctive tool, but it's not a stand-alone technique," says Spicuzza. "You can't just put the laser on somebody and 'Bam!' they're healed."

Chu agrees. "Some people think that it's a magic wand, and if they wave it something miraculous will happen—and that's not the case," he says. "You have to be careful about what you're doing and how you're approaching patients to ensure that you're enacting a positive change."

At Georgia Tech, physical therapists use a modality that features attachments for both a direct laser probe and an SLD cluster probe, offering a choice of 690 or 830 nm wavelengths. This versatility allows Ridgeway to address tissue damage at varying depths of penetration, which he finds helpful when treating the variety of injuries he sees. In addition to chronic quad and hamstring strains, Ridgeway has found the modality effective for treating tendinitis, plantar fasciitis, and muscle strains.

In one case of plantar fasciitis, Ridgeway says the patient had significant improvement after four or five laser treatments. Using a cluster probe, Ridgeway applied three joules/cm2 of energy for 30 seconds on three sites—one at the heel, which was the origin of the injury, and then two more at attachment sites at the metatarsals.

“It cleared up very nicely,” says Ridgeway, who complemented the laser treatments with ice, manual massage, and stretching. “Compared to the traditional modalities I use to treat plantar fasciitis, the laser accelerated recovery by a week or two.”

One of Nelson’s best light therapy experiences involved a player with an acute ankle sprain. The 10-minute treatments began with Nelson placing the head of his 830-nm laser on three different areas of the ankle in order to increase lymphatic flow around the injury. Nelson then positioned the laser on the tenderest area of the ankle to address the local tissue damage.

“Normally we had him back from a Grade-I ankle sprain after two to three weeks,” says Nelson. “This time we had him back in a week.”

To get the most out of clinical observations, Chu recommends having a specific evaluation protocol that includes recording baseline measurements, such as pain indicators, before any treatment takes place. And after therapy is administered, new measurements and observations should be documented and compared to the baseline readings.

“I think people sometimes get kind of lax in the way they apply a modality—whether it be ultrasound, laser, or anything—and they tend to generalize,” says Chu. “Everything becomes treatable with that particular modality, and as a result you have less thought going into the process and people not understanding why they’re using it.”

PURCHASING ONE

As light therapy technology gains a better foothold in American sports medicine, Chu is sure that U.S. practitioners will develop a better understanding of it. In the meantime, he suggests those interested in buying a laser do their homework before they make a purchase.

“If all lasers produced the same wavelength and power, and had the same light source, then we could compare apples to apples,” says Chu. “But, what we’re doing right now is comparing apples to oranges. Every machine is different.”

First, he advises potential buyers to make sure the manufacturer-provided research lines up with what the laser actually does. “If you read their study, you may find that its parameters do not comply with the parameters of the machine they’re selling,” he says. “It can be overwhelming, but you need to exercise due diligence, look at the research, and ask a lot of questions. You need to pin that company down and say, ‘Show me exactly what is being accomplished here.’”

Spencer’s advice is to gather as much insight as possible from practitioners who have used a variety of products. “That can help you decide which laser accommodates your practice level,” he says. “I would also evaluate the capacity of the laser and find out whether it is suitable for pre-competition preparation, assisting in the recovery process, and injury management.”

Spencer also acknowledges that buyers should not consider maximum power and wavelength as the sole reason for selecting one light therapy device over another. “Power shouldn’t be the only criterion by which you judge a laser,” he says. “The body responds to very low power and too much power can inhibit the healing and upregulation response. Certain wavelengths support certain physical processes required for rapid healing, and different frequencies can be used to initiate different therapeutic processes.”

Of course, investigating and defining personal need should be the key factors when selecting a light therapy device. When Ridgeway began shopping for his unit, he also made a list of other modalities he planned to use. Those needs helped guide his decision to purchase a combination unit that not only featured light therapy, but also ultrasound and electric stimulation.

“It really didn’t make much sense to buy multiple units when I could get an all-in-one model,” says Ridgeway. “I ended up paying much less for all the technologies by purchasing the all-in-one model.”

Much like how X-rays and arthroscopes have gained acceptance from skeptics over time, most experts feel light therapy will eventually become more mainstream within sports medicine. “There are a lot of things out there that people don’t believe in, but that doesn’t mean they don’t work,” says Spencer. “A lot of sport cultures are so steeped in tradition that some innovations can’t make their way in. Hopefully, laser therapy will not fall into that category.”