Photobiomodulation

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This is Dr. Tom Robertson, the director of Sports Medicine for Aspen Laser Systems. And I also work with three major chiropractic universities in the US and 15 university sports medicine programs. I've been doing class 4 laser therapy for the last 8 to 10 years.

The science of laser therapy or photobiomodulation. All light is composed of photons. Photons are small packets of light energy in the form of waves with a defined wavelength and frequency.

Laser, the acronym Light Amplification by Stimulated Emission of Radiation. It can be used as a therapeutic device which produces monochromatic, one-wavelength, coherent, constant phased, and polarized directional light.

Photobiomodulation has been officially defined as a form of light therapy that utilizes nonionizing forms of light sources, including lasers, LEDs, and broadband light in the visible and infrared spectrum. It is a nonthermal process involving endogenous chromophores, eliciting photophysical and photochemical events at various biological scales. Please remember that the heat felt on the surface of the skin has nothing to do with the treatment but is a byproduct of the wavelength and the power in watts used to treat the condition.

Photons. All light is composed of photons. Photons are small packets of light energy in the form of waves with a defined wavelength and frequency. Photon energy is able to move efficiently, effectively, and penetrate the skin and the underlying structures, therefore accelerating the healing process. Laser light holds its intensity until it's absorbed by a medium, the body, the cells.

When applied to an organism, laser light tuned to specific wavelengths, frequencies, stimulates metabolic processes at the cellular level. It accelerates the production of ATP in the cells, accelerating the healing process.

Tissue interactions. As you can see by this slide, the laser beam is focused on the tissue and can have different effects. Part is reflection, part is scattering, part is absorption and transmission. Of course, the most important part of this slide is the absorption and transmission down into the cells for treating the inflammation and pain with a class 4 laser.

Class 4 lasers. There are two types of class 4 lasers. One is for surgery, and the other is for therapy, or the therapeutic lasers. The biological effect for the therapeutic lasers is not thermal, unlike surgical lasers. It's used for stimulation of cellular function, provides effective dosage levels in deep tissue.

Both are class 4 lasers, but they have different purposes and different effects. The surgery lasers, obviously, cut. And the therapy lasers stimulate the mitochondria, which is the brain of the cell, into producing more ATP, accelerating the healing process.

Biological effects of laser therapy. The two most important are anti-inflammation and anti-pain, or analgesic. For anti-inflammation, laser therapy has an effect that it causes vasodilation. But it also activates the lymphatic drainage system. And as a result, there is a reduction of swelling caused by bruising or inflammation.

Laser therapy also has a beneficial effect on nerve cells, which block pain transmitted by these cells to the brain and which decreases nerve sensitivity. Also, due to less inflammation, there is less edema and less pain. Pain and inflammation are the two primary indications for using pain laser therapy.

Biological effects of laser therapy. Accelerated tissue repair and cell growth. Photons of light from lasers penetrate deeply into tissue and accelerate cellular production and growth. Laser therapy increases the energy available to the cell so that the cell can take on nutrients faster and get rid of waste products.

As a result of exposure to the laser light, the cells of tendons, ligaments, and muscles are repaired faster. The depth of laser penetration is dictated in nanometers by the wavelength of the specific laser being used, or wavelengths. It can be two or three if found necessary.

Improved vascular activity. Laser light will significantly increase the formation of new capillaries in damaged tissue. That speeds up the healing process, closes wounds, and quickly reduces the scar tissue. Additional benefits include acceleration of angiogenesis, which causes temporary vasodilation and increases the diameter of blood vessels. Laser therapy works quickly if the cells-- and if the cells stay healthy and you have no more pain, you are finished.

Biological effects of laser therapy. One is increased metabolic activity. Laser therapy creates higher outputs of specific enzymes, greater oxygen and food particle loads for the blood cells. Trigger points and acupuncture points. Laser therapy stimulates muscle trigger points and acupuncture points on a noninvasive basis, providing musculoskeletal pain relief.

Reduced fibrous tissue formation. Laser therapy also reduces the formation of scar tissue following tissue damage from cuts, scratches, burns, or surgery. Stimulate the acupuncture points and treating scar tissues by exciting the mitochondria is a beautiful, noninvasive means of increasing the biological effects of laser therapy through putting photons into the cellular area.

Two more biological effects of laser therapy are improved nerve function and immunoregulation. In improved nerve function, you slow the recovery of nerve functions damaged in tissue. This can result in numbness and impaired limbs. Laser therapy, laser light, will speed up the process

of nerve cell reconnection and increase the amplitude of action potentials to optimize muscle action.

Laser light has a direct effect on the immunity status by stimulating immunoglobulins and lymphocytes. Laser therapy is absorbed by the chromaphores that react to laser lights. They do this by increasing the ATP in the cells, which is a major carrier of cellular energy and the source for all chemical reactions in the cells. When you can stimulate the increase of ATP and get a cellular response that holds in the cells, and they stay healthy instead of inflamed, in most cases you are done with the treatment. This is the goal of laser therapy, to get the cells stabilized so that they stay healthy.

One more biological effect of laser therapy is faster wound healing. Laser light stimulates fibroblast development. They are the building blocks of collagen, which is predominant in wound healing and in damaged tissue.

Collagen is the essential protein required to replace the old tissue and/or repair tissue injuries. As a result, laser therapy is effective in open wounds and burns. You can perform this treatment daily, BID, TID, whichever is convenient to you and your patient and your schedule.

Key principles in laser therapy. One, the most important aspect of successful laser outcome, are the number of watts or the power put into the tissue. And the treatment area for a large class 4 laser is usually 4 to 5 inches by 6 inches. And painting the photons onto the tissue, spreading it out equally, or as equal as possible, into this whole area.

Next is the wavelength is a key principle, in nanometers. And our lasers are 810 or 980 or both. And then the dosage, which is measured in joules, J-O-U-L-E-S. And that will give you a-- by combining all of these aspects, you will get a successful treatment.

If you're not getting the desired result you want in a patient, you should check that you're making-- and make sure that you're treating the exact spot by having the patient place one finger on the area. And since you are doing it in a 4- or 5-inch by 6-inch area, you can surround this area to make sure you're getting into the exact spot where they are hurting. And you can also, if it isn't working, put in a few hundred or 1,000 more joules into the tissue, which the literature, as of this date, indicate that if it is an inflamed cell, it will accept the charge into the tissue. If it is a healthy cell, the mitochondria will ignore the stimulation and let it pass right on through, virtually ignoring the stimulation.

Laser safety. A checklist should be made for the laser operator and laser safety officer for the office. Post the appropriate warning signs for lasers is in treatment, either on the door, on the laser cart, or some place where it's visible in the treatment area. Make sure that access to the treatment area and laser is secure and controlled.

Visually inspect and clean all optical connectors for dirt and debris. Also inspect laser for proper function. Visually inspect and clean all safety goggles. Extra goggles can be placed outside or inside the room if necessary. Please be advised that people within the room should be wearing the goggles if the laser is in operation.

Remove all surface jewelry during the treatment so that perspiration does not form between the skin and the jewelry, creating a potential for a burn. Document laser treatment and post-treatment outcome for your results, whether it's a digital record or written.

Contraindications for laser therapy and relative contraindications are do not treat over the heart in case of a pacemaker, just like any other electronic device, and over the uterus in case of pregnancy. Also, when going over tattoos, please be aware that you can treat over them, but please advise your patient that the ink on a tattoo will heat up immediately, so that if it's not comfortable, you have two choices. You can move the wand faster and/or you can reduce the power by 2 watts until it's comfortable for the patient to do so. Also, a relative contraindication, I have had a couple of patients who did have a definite allergic reaction to sunlight that had an adverse response to the laser, just a little bit of swelling and reddening, even though some reddening does occur in normal treatments.

Some precautions in laser therapy is listed on this slide. Hairline sensitivity, patients using anticoagulants. This next one, don't treat through any clothing, period. It absorbs 60% to 80% of the treatment, so it makes half of your time wasted. Get to the skin, treat it, and get done. Do not treat through clothing.

Steroid therapy. Darker skin does treat and absorb the photons at a warmer rate. Now, remember that this heat that you feel on the surface from class 4 laser therapy is only felt in the dermis and epidermis. It is not part of the mechanism of action in any way, but a byproduct of the wavelength and the number of watts that you're putting into the tissue combined.

In summary, for Aspen laser therapy using a class 4 laser from 10 to 60 watts, which is what our systems go to, we have the most effective therapeutic modality, including the ideal wavelengths-- 810 and 980, separately or together, whichever you wish-- for ideal power and ideal depth of penetration. It's safe and effective. It's an excellent addition to any practice. It's adding state of the art medical technology with a marketing program and everything that you will need to operate it in your practice or clinic, and increasing the value of your staff members in your clinic.

It provides pain relief, reduction of inflammation, and faster tissue healing and recovery. What I look for in my patients and the athletes I work with is the condition to be pain-free longer and longer. When this is not occurring, there might be an underlying condition causing this, or they're doing something and not letting you be aware of it. Adequate laser therapy should be progressive and accumulative, and each treatment lasts longer and longer for effective relief. Thank you very much.