



INTELLIGENT LIGHT THERAPY

BOOK OF LIGHT

“If you want to find the secrets of the universe, think in terms of energy, frequency and vibration.”

- Nikola Tesla

ENHANCE PERFORMANCE

ACCELERATE RECOVERY

1. INTRODUCTION

Overview of Light Therapy	4
Light Generating Systems	5

2. AILMENTS

Acne	6
Alzheimers	7
Angiogenesis	8
Anti-Aging	9 - 10
Anti-Inflammatory	11
Anxiety	12
Arthritis	13
Attention	14
Body Contouring	15
Bone Regeneration	16
Brain Function	17 - 19
Cancer Treatment Side Effects	20
Chronic Kidney Disease	21
Circulation	22
Depression	23
Diabetes	24
Ears	25
Eczema	26
Erythema	27

Fertility	28
Fibromyalgia	29
Hair Loss	30
Insomnia	31
Memory	32
Mouth, Teeth & Gums	33
MRSA & Superbugs	34
Muscle Regeneration & Performance	35 - 36
Neuropathy	37
Peripheral Nerve Regeneration	38
Pain	39 - 40
Parkinson's Disease	41
P.T.S.D.	42
Rosacea	43
Seasonal Affective Disorder	44
Scars	45
Skin	46
Sports	47 - 48
Stroke	49
Thyroid	50
Traumatic Brain Injury	51
Wound Healing	52 - 53

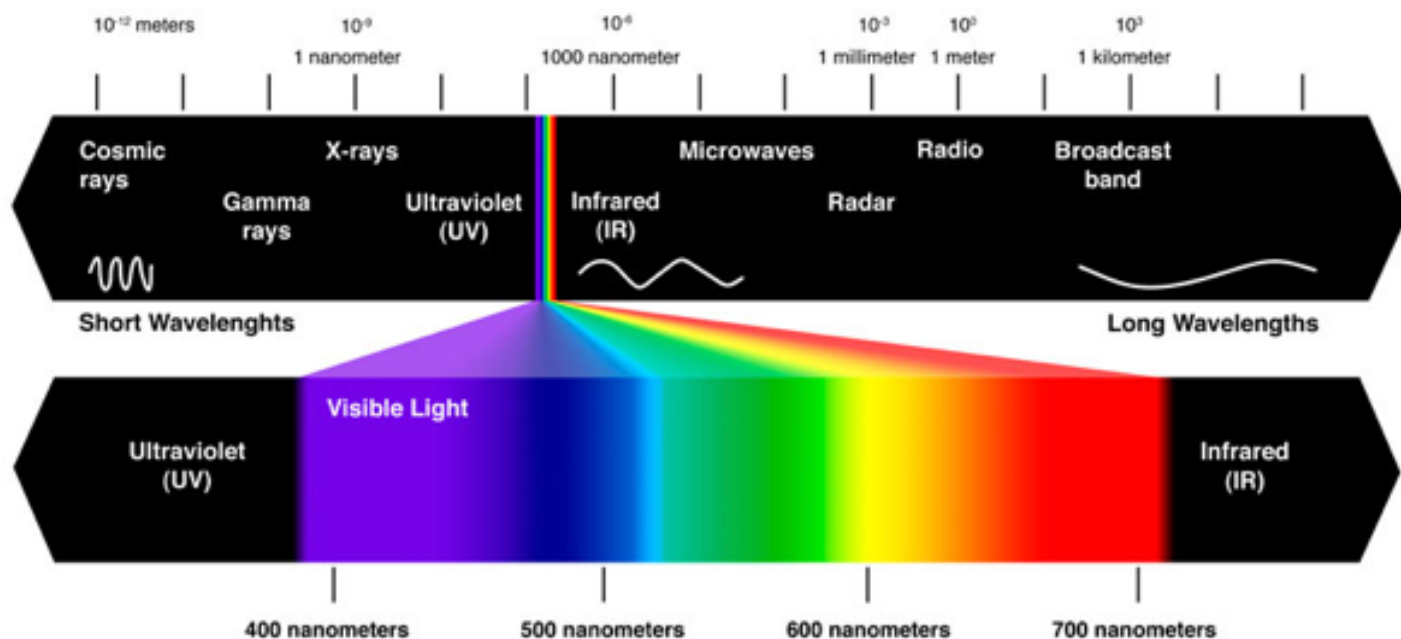


Light therapy has been shown in over 60 years of independent research worldwide to deliver powerful therapeutic benefits to living tissues and organisms. Both visible red, blue and “invisible” infrared light effect at least 24 positive changes at the cellular level.

Red light, which is visible, at a wavelength of 650-670 nanometers (nm; 1 nanometer is equal to one billionth of a meter), penetrates tissue to a depth of about 8-10 mm. It is very beneficial in treating issues close to the surface such as wounds, cuts, scars, trigger and acupuncture points and is particularly effective in treating infections. Infrared light (880 nm) penetrates to a depth of about 30-50 mm, which makes it more effective for bones, joints, deep muscle, etc. Some scientists suggest infrared can penetrate up to 10 cm or about 4-5 inches.

Light therapy causes biologic effects because different wavelengths are absorbed by specific proteins. In other words, diverse tissue and cell types in the body all have their own unique light absorption characteristics because they are characterized by different proteins; that is, they will only absorb light at specific wavelengths and not at others. For example, because of the skin’s high blood flow, it has many different types of proteins and a high water content and thus absorbs red light very readily, while the calcium and phosphorus found in deeper tissue and bone can absorb infrared light, which is a different wavelength than red light.

Recently (2009) scientists reported that two proteins, hemoglobin found in red blood cells and myoglobin found in muscle, both absorb red and infrared light and during this absorption, nitric oxide is released. Nitric oxide triggers the vasodilation effects of red and infrared light. Evidence supporting local nitric oxide increases in normal subjects during LLLT was published by Mitchell in 2013.



Light Generating Systems

Light Emitting Diodes (LED's) are a form of light therapy that is a relatively recent outgrowth from the laser industry. LEDs are similar to lasers in that as they have the same healing effect but differ in the way that the light energy is delivered. LED disperses light (red, blue or infrared) over a greater surface area; this tends to result in shorter overall treatment times for a given area than laser.

Why does it help?

The main benefit of red light therapy for acne is that it has been found to reduce painful swelling and thus can decrease spot size. Red light therapy also stimulates how cells make energy, giving them a higher metabolism. Red light is also able to improve circulation, which improves the flow of oxygen and nutrient-rich blood to the cells, enabling them to function better. This also includes improved lymphatic drainage, which is the method by which the body clears away waste products. By encouraging lymphatic drainage, the body is able to flush away impurities and toxins, which can cause spots and pimples. Blue light is more commonly used at home from light-emitting devices, especially for the treatment of acne. It's been found that blue light reaches the sebaceous (oil) glands in the skin and can help kill porphyrins, which are compounds inside acne bacteria.

Research Articles

Avci P, Gupta A, Sadasivam M et al. "Low-level laser (light) therapy (LLLT) in skin: stimulating, healing, restoring." *Semin Cutan Med Surg.* 2013 March ; 32(1): 41–52.

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC4126803/

Weiss RA, McDaniel DH, Geronemus RG, Weiss MA, Beasley KL, Munavalli GM, Bellew SG "Clinical experience with light-emitting diode (LED) photomodulation" *Journal Dermatology surg.* 2005. Sept:31{9 part 2}: 1199-205

Link: www.ncbi.nlm.nih.gov/pubmed/16176771

Tripathi SV, et al. "Side effects of common acne treatments." *Expert Opin Drug Saf.* 2013 Jan;12(1):39-51. doi: 10.1517/14740338.2013.740456. Epub 2012 Nov 20.

Link: www.ncbi.nlm.nih.gov/pubmed/23163336

Kim WS and Calderhead RG. "Is light-emitting diode phototherapy (LED-LLLT) really effective?" *Laser Ther.* 2011;20(3):205-15.

Link: www.ncbi.nlm.nih.gov/pubmed/24155530

Why does it help?

Light therapy has the potential to develop into a safe and effective neuroprotective treatment for patients with Alzheimer's and Parkinson's disease (and presumably other neurodegenerative diseases such as multiple sclerosis and amyotrophic lateral sclerosis). If light therapy was applied at early stages of the disease process, for example at first diagnosis, it could potentially slow further progression by protecting neurons from death. Consequently, over time, the greater neuronal survival would lessen the clinical signs and symptoms. Sleep disorders are often associated with Alzheimer's disease. Insomnia and the related daytime sleepiness are two symptoms that a person with Alzheimer's often experiences. Sundowning is another. Sundowning is an increased agitation that occurs in the evening and is often accompanied by wandering. Sleep disorders of this type are not a minor problem. It imposes an added burden on a care-partner's already difficult position, and wandering can be dangerous and even fatal. Unfortunately, the disruption in the circadian rhythms of a person who has Alzheimer's disease is not as easy to fix as jet-lag. It doesn't result from a vacation or business trip, but from brain damage caused by the disease. An increasing amount of evidence shows that bright, full spectrum light can reset the circadian rhythm in people suffering from Alzheimer's. Daily exposure to this type of light helps dementia patients with sleep disorders sleep longer and spend more time in deep sleep. As an added benefit, cognitive deterioration slowed with regular exposure to bright light, and decreased depression symptoms.

Research Articles

Johnstone DM, Moro C, Stone J, Benabid AL, Mitrofanis "Turning On Lights to Stop Neurodegeneration: The Potential of Near Infrared Light Therapy in Alzheimer's and Parkinson's Disease". Journal Frontiers in Neuroscience. 2016 Jan 11;9:500.

Link: www.ncbi.nlm.nih.gov/pubmed/26793049

Hanford,N,and Figueiro M. "Light Therapy and Alzheimers disease and related dementia: Past, present and future". Journal of Alzheimers Disease 2013. January;33{4}913-922

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC3553247/

Rixt F,Riemersma-van der Lek et al "Effect of Bright Light and Melatonin on Cognitive and Non-cognitive Function in Elderly Residents of Group Care Facility" (A randomized controlled trial) JAMA. 2008;299 (22):2642

Link: www.ncbi.nlm.nih.gov/pubmed/18544724

Meng C, He Z, Xing D. "Low-level laser therapy rescues dendrite atrophy via upregulating BDNF expression: implications for Alzheimer's disease." J Neurosci. 2013 Aug 14;33(33):13505-17. doi: 10.1523/JNEUROSCI.0918-13.2013.

Link: www.ncbi.nlm.nih.gov/pubmed/23946409

Why does it help?

Researchers at the Medical College of Wisconsin, knowing the critical role of nitric oxide in angiogenesis (new blood vessel formation), and understanding low level light's influence on increasing nitric oxide levels, decided to perform a study to see if LLLT was able to independently effect nitric oxide levels and angiogenesis. As expected, the study concludes with supporting light therapy's ability to independently increase nitric oxide levels and increase new blood vessel growth in oxygen-deficient areas. Studies are being performed to understand the mechanism of action inside the body when light therapy is delivered. It has been shown when looking at angiogenesis in wound healing, that the angiogenesis is increased towards the wound. This gives us insight that improved blood flow through angiogenesis may be one of the key factors in light therapy's ability to help improve the wound healing process. Human blood vessels have also been exposed to red and infrared light, with results showing beneficial growth and an influence of two key growth factors: vascular endothelial growth factor (VEGF)-A and transforming growth factor (TGF)-B.

Research Articles

Colombo, F. et al. "Effect of low-level laser therapy ($\lambda 660$ nm) on angiogenesis in wound healing: a immunohistochemical study in a rodent model." *Braz Dent J.* 2013;24(4):308-12. doi: 10.1590/0103-6440201301867.

Link: www.ncbi.nlm.nih.gov/pubmed/24173246

Lohr NL, Ninomiya JT, Wartier DC, Weihrauch D. "Far red/near infrared light treatment promotes femoral artery collateralization in the ischemic hindlimb." *J Mol Cell Cardiol.* 2013 Sep;62:36-42. doi: 10.1016/j.yjmcc.2013.05.007. Epub 2013 May 20.

Link: www.ncbi.nlm.nih.gov/pubmed/23702287

Szymanska J, et al. "Phototherapy with low-level laser influences the proliferation of endothelial cells and vascular endothelial growth factor and transforming growth factor-beta secretion." *J Physiol Pharmacol.* 2013 Jun;64(3):387-91.

Link: www.ncbi.nlm.nih.gov/pubmed/23959736

Lohr NL, Keszler A, Pratt P, Bienengraber M, Wartier DC, Hogg N. Enhancement of nitric oxide release from nitrosyl hemoglobin and nitrosyl myoglobin by red/near infrared radiation: potential role in cardioprotection. *J Mol Cell Cardiol.* 2009 Aug;47(2):256-63. doi: 10.1016/j.yjmcc.2009.03.009. Epub 2009 Mar 25.

Link: www.ncbi.nlm.nih.gov/pubmed/19328206

Why does it help?

Throughout our lives, when we get sick, injured or stressed, our cells' mitochondria produce excess nitric oxide, causing oxidative stress, which can lead to cellular death. Red and infrared light breaks the cycle of this damage and our cells can return to healthy cellular function. This stimulates collagen production, which has been proven to improve the elasticity, firmness, and fullness of the skin. Light therapy helps to reverse the signs of aging on the skin by softening wrinkles and fine lines. Additionally, light therapy can benefit muscles in concern of atrophy due to aging by stimulating the tissues to regenerate muscle cells.

Research Articles

Avci P, Gupta A, Sadasivam M et al. "Low-level laser (light) therapy (LLLT) in skin: stimulating, healing, restoring." *Semin Cutan Med Surg.* 2013 March ; 32(1): 41–52.

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC4126803/

Baez F, Reilly LR. "The use of light-emitting diode therapy in the treatment of photoaged skin". *Journal Cosmetic Dermatol.* 2007 Sep;6 {3}: 189-94

Link: www.ncbi.nlm.nih.gov/pubmed/17760698

Weiss RA, McDaniel DH, Geronemus RG, Weiss MA, Beasley KL, Munavalli GM, Bellew SG "Clinical experience with light-emitting diode (LED) photomodulation" *Journal Dermatology surg.* 2005. Sept:31{9 part 2}: 1199-205

Link: www.ncbi.nlm.nih.gov/pubmed/16176771

Pertille A, Macedo AB, Oliveira CP. "Evaluation of muscle regeneration in aged animals after treatment with low-level laser therapy." *Rev Bras Fisioter.* 2012 Nov-Dec;16(6):495-501. Epub 2012 Oct 9.

Link: www.ncbi.nlm.nih.gov/pubmed/23060238

Barolet D, Roberge CJ, Auger FA, Boucher A, Germain L. "Regulation of skin collagen metabolism in vitro using a pulsed 660 nm LED light source: clinical correlation with a single-blinded study". *Journal Invest Dermatology.* 2009 Dec;129(12):2751-9.

Link: www.ncbi.nlm.nih.gov/pubmed/19587693

Wunsch, A and Karsten Matuschka. "A controlled trial to determine the Efficacy of Red and Near-Infrared Light treatment in patient satisfaction, Reduction and Intradermal Collagen Density Increase" *Photomedicine and Laser Surgery.* 2014. Feb; 32{2}:93-100

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC3926176/figure/f4/

Ferraresi C, Hamblin M, and Parizotto N. "Low-level laser (light) therapy (LLLT) on muscle tissue; performance, fatigue and repair benefitted by the power of light". Phototonics Lasers Med. 2012 November 1;1 {4}: 267-286.

Link: www.ncbi.nlm.nih.gov/pubmed/23626925

Kim H, Choi K, Kweon OK, Kim WH. "Enhanced wound healing effect of canine adipose-derived mesenchymal stem cells with low-level laser therapy in athymic mice." J Dermatol Sci. 2012 Dec;68(3):149-56. doi: 10.1016/j.jdermsci.2012.09.013. Epub 2012 Sep 28.

Link: www.ncbi.nlm.nih.gov/pubmed/23084629

Why does it help?

Light therapy is very well known for providing a strong and localized anti-inflammatory effect inside the body. These effects are so strong, that many people report having immediate pain relief following its application, and sometimes as strong as their current medications used to help with inflammatory pain related disorders. The mechanism however is mainly through the immediate production of reactive oxygen species created following the light application. This then causes a very strong and localized anti-inflammatory response by the body towards this region. The caveat over NSAIDS and other anti-inflammatory mediations is that light therapy not only has a strong and localized anti-inflammatory effect, but it also then aids in the body's ability for final repair.

Research Articles

Michael R. Hamblin. "Mechanisms and applications of the anti-inflammatory effects of photobiomodulation". AIMS Biophys. 2017;4{3}: 337-361

[Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC5523874/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5523874/)

Pertille A, Macedo AB, Oliveira CP. "Evaluation of muscle regeneration in aged animals after treatment with low-level laser therapy." Rev Bras Fisioter. 2012 Nov-Dec;16(6):495-501. Epub 2012 Oct 9.

[Link: www.ncbi.nlm.nih.gov/pubmed/23060238](http://www.ncbi.nlm.nih.gov/pubmed/23060238)

T. Hashmi, et al. "Effect of Pulsing in Low-Level Light Therapy." Lasers Surg Med. 2010 Aug; 42(6):450-66 doi: [10.1002/lsm.20950]

[Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC2933784/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2933784/)

Why does it help?

Levels of serotonin, a brain chemical commonly associated with depression, can be adjusted by increasing exposure to light. New research indicates that negative ions can also impact serotonin levels and in turn, help people suffering from mood disorders. In a study just after 2 weeks of using light therapy, patients reported significant reductions in depressive and anxiety symptoms. The primary target for stimulation was found to be the forehead where the prefrontal cortex of the brain is situated.

Research Articles

Schiffer,F et al."Psychological benefits 2 and 4 weeks after a single treatment with near infra red light to the forehead: a pilot study of 10 patients with major depression and anxiety". Biomed central {ejournal}. 2009 5:46

Link: www.behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-5-46

Why does it help?

Red and infrared (IR) wavelengths of light between 600nm and 1000nm are absorbed by our cells, increasing natural energy (ATP) production. When LED infrared light penetrates the skin, it is absorbed by mitochondria in the cell (which is also called the powerhouse of the cell). The red light exposure leads to an increase in metabolism of the collective cells, which causes healing of the damaged tissues and ultimately relieves the pain. Also, the red light is known for activation of the production of endorphins and blocks pain-transmitting chemicals.

Research Articles

Al Rashoud AS, Abboud RJ, Wang W, Wigderowitz C. "Efficacy of low-level laser therapy applied at acupuncture points in knee osteoarthritis: a randomised double-blind comparative trial" *Physiotherapy*. 2014 Sep;100{3}: 242-8

Link: www.ncbi.nlm.nih.gov/pubmed/24418801

Brosseau L ,Welch V et al. "Low level laser therapy for osteoarthritis and rheumatoid arthritis: a meta-analysis". *Journal of Rheumatology*. 2000. Aug; 27(8):1961-9

Link: www.ncbi.nlm.nih.gov/pubmed/10955339

Michael Hamblin "Can osteoarthritis be treated with light?" *Arthritis Research and Therapy*. 2013; 15(5): 120.

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC3978432/

Baltzer et al. "Synergic effects of ultrasound and laser on the pain relief in women with hand osteoarthritis" *Laser Medical Science*. 2015 Jan;30(1):279-86

Link: www.ncbi.nlm.nih.gov/pubmed/25239030

Paolillo et al. "Positive effects of low level laser therapy (LLLT) on Bouchard's and Heberden's osteoarthritis". *Lasers Surgical Medicine*. 2016 Jul; 48(5):4

Link: www.ncbi.nlm.nih.gov/pubmed/26833862

Alghadir A et al. "Effect of low-level laser therapy in patients with chronic knee osteoarthritis: a single-blinded randomized clinical study" *Lasers Medical Science*. 2014 March; 29(2):749-55

Link: www.ncbi.nlm.nih.gov/pubmed/2391277

Why does it help?

Researchers at the University of Texas, Austin published a study in the journal of Neuroscience, stating that this was the first demonstrated study showing the beneficial effects of transcranial light stimulation on cognitive and emotional functions in humans. With particular focus on the frontal cortex of the brain, they looked at neuropsychological tests on attention, memory, and mood, following transcranial light therapy. The results of this study showed that ALL 3 parameters measured were significantly improved. This innovative approach could lead to the development of non-invasive, performance enhancing interventions in healthy humans and in those of need of neuropsychological rehabilitation.

Research Articles

Barrett DW, Gonzalez-Lima F. "Transcranial infrared laser stimulation produces beneficial cognitive and emotional effects in humans" Neuroscience. 2013 Jan 29;230:13-23

Link: www.ncbi.nlm.nih.gov/pubmed/23200785

Viola AU, James LM, Schlangen LJ, Dijk DJ "Blue- enriched white light in the workplace improves self-reported alertness, performance and sleep quality" Scandavian Journal Work Environmental health. 2008. Aug;34 (4):297-306

Link: [www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=Abstract%20\[PubMed\]](http://www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=Abstract%20[PubMed])

Why does it help?

Red light therapy is proven to reduce overall body circumference measurements of the hips, waist, thighs, and upper arms, with recent studies demonstrating the long-term effectiveness of results. Red and infrared rays are proven to boost collagen and elastin production (reversing breakdown of collagen typical to cellulite and restoring damaged skin). Researchers have concluded that light therapy is, "safe and effective for improving the appearance of cellulite in the thighs and buttocks. In contrast with other technologies, LLLT is effective as a stand-alone procedure without requiring massage or mechanical manipulation."

Research Articles

Avci P et al "Low-level laser therapy for fat layer reduction: a comprehensive review". Lasers Surgical Medical. 2013 Aug;45(6):349-57.

Link: www.ncbi.nlm.nih.gov/pubmed/23749426

McRae E and Boris J. "Independent evaluation of low- level laser therapy at 635 nm for non-invasive body contouring of the waist, hips, and thighs". Lasers in Surgery and Medicine. Jan 2013;45(1):1-7.

Link: www.ncbi.nlm.nih.gov/pubmed/23355338

Jackson RF, Roche GC, Shanks SC. "A double-blind, placebo-controlled randomized trial evaluating the ability of low-level laser therapy to improve the appearance of cellulite." Lasers Surg Med. 2013 Mar;45(3):141-7. doi: 10.1002/lsm.22119.

Link: www.ncbi.nlm.nih.gov/pubmed/23508376

Why does it help?

There have been plenty of studies documenting the ability of light therapy to effectively enhance bone formation. This study confirmed many of these previous studies when they took a group of rabbits and exposed them to light therapy following implants.

Research Articles

Soares LG, et al. "New bone formation around implants inserted on autologous and xenografts irradiated or not with IR laser light: a histomorphometric study in rabbits." *Braz Dent J.* 2013;24(3):218-23. doi: 10.1590/0103-6440201302186.

Link: www.ncbi.nlm.nih.gov/pubmed/23969909

Jawad MM, et al. "Effect of 940 nm low-level laser therapy on osteogenesis in vitro." *J Biomed Opt.* 2013 Dec;18(12):128001. doi: 10.1117/1.JBO.18.12.128001.

Link: www.ncbi.nlm.nih.gov/pubmed/24337495

Fávaro-Pípi E, et al. "Comparative study of the effects of low-intensity pulsed ultrasound and low-level laser therapy on bone defects in tibias of rats." *Lasers Med Sci.* 2010 Sep;25(5):727-32. doi: 10.1007/s10103-010-0772-2. Epub 2010 Jun 3.

Link: www.ncbi.nlm.nih.gov/pubmed/20521077

Kiyosaki T1, Mitsui N, Suzuki N, Shimizu N. "Low-level laser therapy stimulates mineralization via increased Runx2 expression and ERK phosphorylation in osteoblasts." *Photomed Laser Surg.* 2010 Aug;28 Suppl 1:S167-72. doi: 10.1089/pho.2009.2693.

Link: www.ncbi.nlm.nih.gov/pubmed/20649430

Pires-Oliveira DA, et al. "Laser 904 nm action on bone repair in rats with osteoporosis." *Osteoporos Int.* 2010 Dec;21(12):2109-14. doi: 10.1007/s00198-010-1183-8. Epub 2010 Mar 4.

Link: www.ncbi.nlm.nih.gov/pubmed/20204601

Why does it help?

The LED therapy increases blood flow in the brain, as shown on MRI scans. It also appears to have an effect on damaged brain cells, specifically on their mitochondria. These are bean-shaped subunits within the cell that put out energy in the form of a chemical known as ATP. The red and near-infrared light photons penetrate through the skull and into brain cells and spur the mitochondria to produce more ATP. That can mean clearer, sharper thinking. Other studies have shown benefits for a wide range of neurological conditions like strokes, TBIs, and neurodegenerative diseases. Researchers have found that localized light application to the cortical area of the brain produced a significant increase in ATP. It was also seen to raise mitochondrial membrane potential, reduce intracellular calcium concentrations, reduce oxidative stress, and reduce nitric oxide levels.

Research Articles

Margaret A. Naeser et al. "Significant Improvements in Cognitive Performance Post-Transcranial, Red/Near-Infrared Light-Emitting Diode Treatments in Chronic, Mild Traumatic Brain Injury: Open-Protocol Study". *Journal of Neurotrauma*, 2014; 31 (11)

Link: www.ncbi.nlm.nih.gov/pubmed/24568233

Schiffer, F et al. "Psychological benefits 2 and 4 weeks after a single treatment with near infra red light to the forehead: a pilot study of 10 patients with major depression and anxiety". *Biomed central {ejournal}*. 2009 5:46

Link: www.behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-5-46

Viola AU, James LM, Schlangen LJ, Dijk DJ "Blue- enriched white light in the workplace improves self-reported alertness, performance and sleep quality" *Scandinavian Journal Work Environmental health*. 2008. Aug;34 (4):297-306

Link: [www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=Abstract%20\[PubMed\]](http://www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=Abstract%20[PubMed])

Vandewalle G et al "Wavelength-dependent modulation of brain responses to a working memory task by daytime light exposure". *Cerebral Cortex*. 2007;17:2788-95.

Link: www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=17404390&dopt=Abstract [PubMed]

Huang YY, Nagata K, Tedford CE, Hamblin MR. "Low-level laser therapy (810 nm) protects primary cortical neurons against excitotoxicity in vitro." *J Biophotonics*. 2014 Aug;7(8):656-64. doi: 10.1002/jbio.201300125. Epub 2013 Oct 15.

Link: www.ncbi.nlm.nih.gov/pubmed/24127337

Margaret A. Naeser et al. "Significant Improvements in Cognitive Performance Post-Transcranial, Red/Near-Infrared Light-Emitting Diode Treatments in Chronic, Mild Traumatic Brain Injury: Open-Protocol Study". *Journal of Neurotrauma*, 2014; 31 (11)

[Link: www.ncbi.nlm.nih.gov/pubmed/24568233](http://www.ncbi.nlm.nih.gov/pubmed/24568233)

Schiffer, F et al. "Psychological benefits 2 and 4 weeks after a single treatment with near infra red light to the forehead: a pilot study of 10 patients with major depression and anxiety". *Biomed central {ejournal}*. 2009 5:46

[Link: www.behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-5-46](http://www.behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-5-46)

Viola AU, James LM, Schlangen LJ, Dijk DJ "Blue- enriched white light in the workplace improves self-reported alertness, performance and sleep quality" *Scandinavian Journal Work Environmental health*. 2008. Aug;34 (4):297-306

[Link: www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=Abstract%20\[PubMed\]](http://www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=Abstract%20[PubMed])

Vandewalle G et al "Wavelength-dependent modulation of brain responses to a working memory task by daytime light exposure". *Cerebral Cortex*. 2007;17:2788-95.

[Link: www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=17404390&dopt=Abstract \[PubMed\]](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=17404390&dopt=Abstract [PubMed])

Huang YY, Nagata K, Tedford CE, Hamblin MR. "Low-level laser therapy (810 nm) protects primary cortical neurons against excitotoxicity in vitro." *J Biophotonics*. 2014 Aug;7(8):656-64. doi: 10.1002/jbio.201300125. Epub 2013 Oct 15.

[Link: www.ncbi.nlm.nih.gov/pubmed/24127337](http://www.ncbi.nlm.nih.gov/pubmed/24127337)

Lohr NL, Ninomiya JT, Wartier DC, Weihrauch D. "Far red/near infrared light treatment promotes femoral artery collateralization in the ischemic hindlimb." *J Mol Cell Cardiol*. 2013 Sep;62:36-42. doi: 10.1016/j.jmcc.2013.05.007. Epub 2013 May 20.

[Link: www.ncbi.nlm.nih.gov/pubmed/23702287](http://www.ncbi.nlm.nih.gov/pubmed/23702287)

Rojas JC, Gonzalez-Lima F. "Neurological and psychological applications of transcranial lasers and LEDs." *Biochem Pharmacol*. 2013 Aug 15;86(4):447-57. doi: 10.1016/j.bcp.2013.06.012. Epub 2013 Jun

[Link: www.ncbi.nlm.nih.gov/pubmed/23806754](http://www.ncbi.nlm.nih.gov/pubmed/23806754)

Jagdeo JR, Adams LE, Brody NI, Siegel DM. "Transcranial red and near infrared light transmission in a cadaveric model." *PLoS One*. 2012;7(10):e47460. doi: 10.1371/journal.pone.0047460. Epub 2012 Oct 15.

[Link: www.ncbi.nlm.nih.gov/pubmed/23077622](http://www.ncbi.nlm.nih.gov/pubmed/23077622)

Wan S, Parrish JA, Anderson RR, Madden M. "Transmittance of nonionizing radiation in human tissues." Photochem Photobiol. 1981 Dec;34(6):679-81.

Link: www.ncbi.nlm.nih.gov/pubmed/6458827

Mochizuki-Oda N, et al. "Effects of near-infra-red laser irradiation on adenosine triphosphate and adenosine diphosphate contents of rat brain tissue." Neurosci Lett. 2002 May 3;323(3):207-10.

Link: www.ncbi.nlm.nih.gov/pubmed/11959421

Uozumi Y, et al. "Targeted increase in cerebral blood flow by transcranial near-infrared laser irradiation." Lasers Surg Med. 2010 Aug;42(6):566-76. doi: 10.1002/lsm.20938.

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC3065857/

Gonzalez-Lima F, Barrett DW. "Augmentation of cognitive brain functions with transcranial lasers." Front Syst Neurosci. 2014 Mar 14;8:36. doi: 10.3389/fnsys.2014.00036.

Link: www.ncbi.nlm.nih.gov/pubmed/24672439

Why does it help?

Research done by NASA in conjunction with the University of Alabama has shown that red light technology can successfully reduce symptoms experienced by cancer patients, including painful side effects caused by radiation or chemotherapy. Using red/infrared light emitting diode devices has been shown to release long wavelength energy in the form of photons that stimulate cells to aid in healing. NASA tested whether they could treat oral mucositis in cancer patients, a very common and painful side effect, and concluded that 96% of patients experienced improvement in pain.

Research Articles

"NASA Light Technology Successfully reduces Cancer Patients Painful side effects from Radiation and Chemotherapy" 3.3.2011 online

Link: www.nasa.gov/topics/nasalife/features/heals.html

Smoot B, et al. "Effect of low-level laser therapy on pain and swelling in women with breast cancer-related lymphedema: a systematic review and meta-analysis." J Cancer Surviv. 2015 Jun;9(2):287-304. doi: 10.1007/s11764-014-0411-1. Epub 2014 Nov 29.

Link: www.ncbi.nlm.nih.gov/pubmed/25432632

Why does it help?

The purpose of this study was to investigate light therapy's effect on chronic kidney disease and for the first time, researchers believe that they were able to document that light therapy had a protective effect regarding renal interstitial fibrosis.

Research Articles

Oliveira FA, et al. "Low-level laser therapy decreases renal interstitial fibrosis." *Photomed Laser Surg.* 2012 Dec;30(12):705-13. doi: 10.1089/pho.2012.3272. Epub 2012 Nov 7.

Link: www.ncbi.nlm.nih.gov/pubmed/23134313

Why does it help?

Low-level light therapy (LLLT) is believed to affect various physiological mechanisms of change that include: improved blood flow and increased cell metabolism, advanced healing, anti-inflammatory actions, and stimulation of the immune system. In one study, LLLT was applied to the forearm of 15 subjects. Before and subsequent to this procedure, blood levels were regularly measured for levels of nitric oxide (NO). The results demonstrated that LLLT increased NO levels in venous blood draining from the treatment site, and this phenomenon peaked after 5 minutes of light therapy.

Research Articles

Zang, K. "Study of Low Level Laser Light Therapy to Improve Blood Circulation in People With Chronic Heel Pain" July 2015

Link: www.clinicaltrials.gov/ct2/show/NCT01882725

Colombo, F. et al. Effect of low-level laser therapy ($\lambda 660$ nm) on angiogenesis in wound healing: a immunohistochemical study in a rodent model. *Braz Dent J.* 2013;24(4):308-12. doi: 10.1590/0103-6440201301867.

Link: www.ncbi.nlm.nih.gov/pubmed/24173246

Lohr NL, Ninomiya JT, Wartier DC, Weihrauch D. "Far red/near infrared light treatment promotes femoral artery collateralization in the ischemic hindlimb." *J Mol Cell Cardiol.* 2013 Sep;62:36-42. doi: 10.1016/j.jmcc.2013.05.007. Epub 2013 May 20.

Link: www.ncbi.nlm.nih.gov/pubmed/23702287

Szymanska J, et al. "Phototherapy with low-level laser influences the proliferation of endothelial cells and vascular endothelial growth factor and transforming growth factor-beta secretion." *J Physiol Pharmacol.* 2013 Jun;64(3):387-91.

Link: www.ncbi.nlm.nih.gov/pubmed/23959736

Mitchell UH, Mack GL. "Low-level laser treatment with near-infrared light increases venous nitric oxide levels acutely: a single-blind, randomized clinical trial of efficacy." *Am J Phys Med Rehabil.* 2013 Feb;92(2):151-6. doi: 10.1097/PHM.0b013e318269d70a.

Link: www.ncbi.nlm.nih.gov/pubmed/23334615

Why does it help?

In the last 20 years, a plethora of studies have further defined the depressive populations who are responsive to light treatment; the optimal timing, intensity, spectral frequency, and duration of treatment; its comparison with other pharmacological interventions; predictors of response; side-effect profiles; viable placebo- control conditions; alternative devices and forms of administration; potential mechanisms and anatomical pathways mediating light's physiological effects; and its application to other disorders and subsyndromal states. These studies have been conducted across multiple countries with surprisingly consistent results. Further work is needed to clarify the specific mechanism of action in subtypes of depressive disorders and differential age and gender effects.

Research Articles

Schiffer, F et al. "Psychological benefits 2 and 4 weeks after a single treatment with near infrared light to the forehead: a pilot study of 10 patients with major depression and anxiety". Biomed central {ejournal}. 2009 5:46

Link: www.behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-5-46

Parry, B and Maurer, E. "Light treatment of mood disorders" Dialogues of Clinical Neuroscience. 2003 Dec; 5(4): 353–365.

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC3181775/

Why does it help?

Many previous studies have shown that diabetic wounds can be positively affected with low-level light therapy. In one study, it was shown that the type 1 collagen production was specifically increased as was overall wound healing.

Research Articles

Bashiri H. "Evaluation of low level laser therapy in reducing diabetic polyneuropathy related pain and sensorimotor disorders." *Acta Med Iran*. 2013 Sep 9;51(8):543-7.

Link: www.ncbi.nlm.nih.gov/pubmed/24026991

Ayuk SM, Houeild NN, Abrahamse H. "Collagen production in diabetic wounded fibroblasts in response to low-intensity laser irradiation at 660 nm." *Diabetes Technol Ther*. 2012 Dec;14(12):1110-7. doi: 10.1089/dia.2012.0125. Epub 2012 Oct 11.

Link: www.ncbi.nlm.nih.gov/pubmed/23057714

Houeild NN, Sekhejane PR, Abrahamse H. "Irradiation at 830 nm stimulates nitric oxide production and inhibits pro-inflammatory cytokines in diabetic wounded fibroblast cells." *Lasers Surg Med*. 2010 Aug;42(6):494-502. doi: 10.1002/lsm.20812.

Link: www.ncbi.nlm.nih.gov/pubmed/20662026

Why does it help?

After perforating the tympanic membrane (eardrum) of a group of guinea pigs, low-level light therapy was applied for 10 consecutive days. Researchers followed up 2 weeks later and noted significant healing of the membranes in this group.

Research Articles

Maleki SH, et al. "Effect of local irradiation with 630 and 860 nm low-level lasers on tympanic membrane perforation repair in guinea pigs." *J Laryngol Otol.* 2013 Mar;127(3):260-4. doi: 10.1017/S002221511300008X. Epub 2013 Feb 21.

Link: www.ncbi.nlm.nih.gov/pubmed/23425439

Why does it help?

Exposure to red light helps in suppressing overactive skin cells, which are the main reason for the inflammatory skin. The red light has the ability to penetrate deep into your skin and chemically react with the damaged tissues. The light, which has a similar wavelength to that of your skin, is helpful in healing it and reducing the signs of eczema over time. It is an effective treatment for both kids and adults for moderate to severe conditions of eczema. Studies have also shown improvements in eczema patients who have not responded well to other types of treatments.

Research Articles

Kim CH, Cheong KA, Lee AY. "850nm light-emitting-diode phototherapy plus low-dose tacrolimus (FK-506) as combination therapy in the treatment of Dermatophagoides farinae-induced atopic dermatitis-like skin lesions in NC/Nga mice." J Dermatol Sci. 2013 Nov;72(2):142-8. doi: 10.1016/j.jdermsci.2013.06.002. Epub 2013 Jun 12.

Link: www.ncbi.nlm.nih.gov/pubmed/23810774

Why does it help?

As proven, traditional sunscreen has its limitations. This study was conducted to observe if light therapy would offer increased skin resistance to ultraviolet damage. The reduction of erythema was considered significant in the study especially when LED therapy is used prior to exposure.

Research Articles

Wien Klin Wochenschr. "Photoprotection by psoralen- UVA therapy: experimental and clinical results" 1979 Dec 21;91(24):812-7.

Link: www.ncbi.nlm.nih.gov/pubmed/547490

Why does it help?

Studies show that the mitochondria of older eggs produce significantly less ATP, which is the source of cellular energy. This has a significant impact on fertility, as the rate of division and successful implantation of embryos has more to do with how much energy (ATP) the cells have than with maternal age per se. Consequentially, the capacity of light therapy to improve the ATP production of eggs has a potentially dramatic effect on their viability. In male fertility studies, Light therapy more significantly than the routine therapy raised concentration and number of mobile forms of sperm, reduced their degenerative forms, and elevated the level of sexual hormones. Studies suggest that low-level light therapy could also help by improving blood circulation, softening of scar tissue and reducing inflammation. These factors are all beneficial to both male and female reproduction in general and to the receptivity of the uterine lining.

Research Articles

Lurshin VV, Sergienko NF, Illarionov VE. "Etiopathogenetic basis for using magnetolaser therapy in the complex treatment of male infertility" *Urologiia* 2003 Mar-Apr; (2);23-5

Link: www.ncbi.nlm.nih.gov/pubmed/12811920

Toshio Ohshiro "Personal Overview of the Application of LLLT in Severely Infertile Japanese Females" 2012 July 3;21(2):97-103 *Laser Therapy*

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC3944482/

Toshio Ohshiro "LLLT for Female Infertility: No Longer Just a Dream" 2015 Oct 2;24(3)169-17

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC4639673/

Arne, Grinsted "Laser therapy for male and female infertility" *The Annals of Laser Therapy*. Copenhagen, 2016-11-26.

Link: www.laserannals.com/2016/12/04/laser-therapy- for-female-and-male-infertility/

Why does it help?

Red light therapy for fibromyalgia is one of the amazing treatments for the condition. It substantially lowers the pain levels and helps the body to feel more flexible, as it is able to significantly reduce muscle aches. Red light therapy is one of the few techniques that is a drug-free, non-invasive and chemical-free alternative known to reduce discomfort and pain to a great extent. One can be fairly sure this therapy won't lead to any extreme side effects -- a statement that is not possible with other medical treatments.

Research Articles

Ibrahim et al "Long-lasting antinociceptive effects of green light in acute and chronic pain in rats" The Journal of the International Association for the Study of Pain. February 2017 - Volume 158 - Issue 2 - p 347-360

Link: www.journals.lww.com/pain/Fulltext/2017/02000/Long-lasting_antinociceptive_effects_of_green.19.aspx

de Carvalho Pde T, et al. "Effect of low-level laser therapy on pain, quality of life and sleep in patients with fibromyalgia: study protocol for a double-blinded randomized controlled trial." Trials. 2012 Nov 21;13:221. doi: 10.1186/1745-6215-13-221.

Link: www.ncbi.nlm.nih.gov/pubmed/23171567

Why does it help?

Yet another anti-aging effect of red light therapy is reversing hair loss and stimulating follicle growth, which works in many of the same ways as red light therapy for wound healing. Results have been mixed according to studies, but at least a moderate portion of both male and female patients have had positive results for reversing baldness/hair loss when using low-level light therapy. A study in 2013 (double blind randomized controlled trial) looked at red light therapy and found that participants benefitted by around a 35% increase in hair count.

Research Articles

Avci, P et al "Low-level laser (light) therapy (LLLT) for treatment of hair loss." Lasers Surgical Medicine. 2014 Feb(4692):144-51

Link: www.ncbi.nlm.nih.gov/pubmed/23970445

Lanzafame, RJ et al "The Growth of human scalp Hair mediated by visible red light laser and LED sources in males" 2013. Lasers Surgical Medical. 2014 Apr;46(4):373.

Link: www.ncbi.nlm.nih.gov/m/pubmed/24078483/

Kim H, et al. "Low-level light therapy for androgenetic alopecia: a 24-week, randomized, double-blind, sham device-controlled multicenter trial." Dermatol Surg. 2013 Aug;39(8):1177-83. doi: 10.1111/dsu.12200. Epub 2013 Apr 3.

Link: www.ncbi.nlm.nih.gov/pubmed/23551662

Why does it help?

Exposure to blue light during the day can make you feel more alert and improve reaction time, focus, and productivity, according to research from Brigham and Women's Hospital in Boston. "Photo receptors in the eye, which link to the areas of the brain that control alertness, are most sensitive to blue light. Therefore, when blue light hits them, the receptors set off activity in those brain regions, making you more energized," says Shadab A. Rahman, Ph.D. Another perk: Daytime exposure may protect your sleep from the disruptive effects of blue light at night, a study from Uppsala University in Sweden found. "When you get a lot of bright light during the day, levels of melatonin, a hormone that makes you sleepy, are suppressed," researcher Frida Rångtjell says. "In the evening, melatonin increases sharply, and night-time blue-light exposure has less of an impact."

Research Articles

Lack, L. and Wright, H. "The use of bright light in the treatment of insomnia." Behavioral Treatments for Sleep Disorders. 2011, Pages e1-6.

Link: www.sciencedirect.com/science/article/pii/B9780123815224000420

Viola AU, James LM, Schlangen LJ, Dijk DJ "Blue- enriched white light in the workplace improves self-reported alertness, performance and sleep quality" Scandavian Journal Work Environmental health. 2008. Aug:34 (4):297-306

Link: [www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=A+bstract%20\[PubMed\]](http://www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=A+bstract%20[PubMed])

Why does it help?

Many studies have clearly demonstrated benefits of trans-cranial application of low-level light therapy (red and infrared wavelengths). One article goes over the main mechanisms involved, which is based on photon energy absorption of cytochrome oxidase (a photoreceptor). Once these high-energy photons transfer their energy to the photoreceptors of the brain, it allows for cognitive enhancement and higher-order brain functioning. In addition, this energetic transference from these high-energy light particles allows for neuro-protection, which can explain many previous studies on the benefits of light therapy for neurological conditions.

Research Articles

Viola AU, James LM, Schlangen LJ, Dijk DJ "Blue- enriched white light in the workplace improves self-reported alertness, performance and sleep quality" Scandavian Journal Work Environmental health. 2008. Aug;34 (4):297-306

Link: [www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=A bstract%20\[PubMed\]](http://www.ncbi.nlm.nih.gov/pubmed/18815716?dopt=A bstract%20[PubMed])

Barrett DW, Gonzalez-Lima F. "Transcranial infrared laser stimulation produces beneficial cognitive and emotional effects in humans" Neuroscience. 2013 Jan 29;230:13-23

Link: www.ncbi.nlm.nih.gov/pubmed/23200785

Rojas JC, Gonzalez-Lima F. "Neurological and psychological applications of transcranial lasers and LEDs." Biochem Pharmacol. 2013 Aug 15;86(4):447-57. doi: 10.1016/j.bcp.2013.06.012. Epub 2013 Jun 24.

Link: www.ncbi.nlm.nih.gov/pubmed/23806754

Why does it help?

Light therapy has been used for decades in the field of dentistry for many different applications. One study looked at dental stem cells following the application of light therapy and found there to be a stimulatory effect on the proliferation of these cells. Other studies have shown that light therapy was able to decrease the effect of chemotherapy on oral mucositis and pain in a variety of malignancies.

Research Articles

Soares DM, Ginani F, Henriques ÁG, Barboza CA. "Effects of laser therapy on the proliferation of human periodontal ligament stem cells." *Lasers Med Sci*. 2015 Apr;30(3):1171-4. doi: 10.1007/s10103-013-1436-9. Epub 2013 Sep 7.

Link: www.ncbi.nlm.nih.gov/pubmed/24013624

Arbabi-Kalati F, Arbabi-Kalati F, Moridi T. "Evaluation of the effect of low level laser on prevention of chemotherapy-induced mucositis." *Acta Med Iran*. 2013 Apr 6;51(3):157-62.

Link: www.ncbi.nlm.nih.gov/pubmed/23605599

Why does it help?

Red and near-infrared light aren't the only types drumming up excitement in medical-research circles. Blue light is another potential source of powerful benefits because of its ability to kill both superbugs and cancer cells. Scientists have found evidence in recent years to suggest that blue light can obliterate infections, including the antibiotic-resistant form of bacteria *Staphylococcus aureus*. Recently, important studies have been consistently showing that two of the most common strains of MRSA can be virtually eliminated through simple exposure to blue light. Though fewer than 5 percent of MRSA strains can be killed by penicillin and 40 to 50 percent of MRSA strains have become resistant to antibiotics, they appear to have no resistance to blue light, which is free of UV radiation.

Research Articles

Enwemeka, CS et al. "Blue 470-nm Light Kills Methicillin- Resistant *Staphylococcus aureus* (MRSA) in Vitro" *Photomedicine and Laser Surgery* Vol.27, No.2 2009

Link: www.liebertpub.com/doi/pdfplus/10.1089/pho.2008.2413

Why does it help?

Studies are now showing that the simple addition of light is able to cause an increase in the muscle torque at the beginning of exercise and maintain levels of lactate after resistance exercise, and overall improve muscle performance and accelerate muscle recovery. Light therapy is often used in rehabilitation to improve muscle performance in elite athletes. It's not just in exercise that light therapy is helping muscles, however. In one study, part of the sciatic nerve was removed and the affected muscle area was observed for 30 days with the addition of light therapy. The area where the light therapy was applied showed a significant reduction in muscle breakdown that would normally be observed following the innervation to the muscle. It was concluded that light therapy would benefit in the early stages of muscle atrophy, preserving the denervated muscle. Similarly, another study following muscle damage in older rats applied light therapy and demonstrated effective muscle regeneration.

Research Articles

Ferraresi C, Hamblin M, and Parizotto N. "Low-level laser (light) therapy (LLLT) on muscle tissue; performance, fatigue and repair benefitted by the power of light". *Phototonics Lasers Med.* 2012 November 1;1 {4}: 267- 286.

Link: www.ncbi.nlm.nih.gov/pubmed/23626925

dos Santos Maciel, T. et al. Phototherapy effect on the muscular activity of regular physical activity practitioners. *Lasers Med Sci.* 2014 May;29(3):1145-52. doi: 10.1007/s10103-013-1481-4. Epub 2013 Nov 28.

Link: www.ncbi.nlm.nih.gov/pubmed/24288083

Leal-Junior, EC. et al. "Effect of phototherapy (low-level laser therapy and light-emitting diode therapy) on exercise performance and markers of exercise recovery: a systematic review with meta-analysis." *Lasers Med Sci.* 2015 Feb;30(2):925-39. doi: 10.1007/s10103-013-1465-4. Epub 2013 Nov 19

Link: www.ncbi.nlm.nih.gov/pubmed/24249354

Rochkind S, Shainberg A. "Protective effect of laser phototherapy on acetylcholine receptors and creatine kinase activity in denervated muscle." *Photomed Laser Surg.* 2013 Oct;31(10):499-504. doi: 10.1089/pho.2013.3537.

Link: www.ncbi.nlm.nih.gov/pubmed/24102168

Pertille A, Macedo AB, Oliveira CP. "Evaluation of muscle regeneration in aged animals after treatment with low-level laser therapy." *Rev Bras Fisioter.* 2012 Nov-Dec;16(6):495-501. Epub 2012 Oct 9.

Link: www.ncbi.nlm.nih.gov/pubmed/23060238

Borsa PA, Larkin KA, True JM. "Does phototherapy enhance skeletal muscle contractile function and postexercise recovery? A systematic review." *J Athl Train*. 2013 Jan-Feb;48(1):57-67. doi: 10.4085/1062-6050-48.1.12.

Link: www.ncbi.nlm.nih.gov/pubmed/23672326

Patrocinio T, et al. "Effect of low-level laser therapy (808 nm) in skeletal muscle after resistance exercise training in rats." *Photomed Laser Surg*. 2013 Oct;31(10):492-8. doi: 10.1089/pho.2013.3540.

Link: www.ncbi.nlm.nih.gov/pubmed/24102167

da Silva Alves MA, et al. "Acute effects of low-level laser therapy on physiologic and electromyographic responses to the cardiopulmonary exercise testing in healthy untrained adults." *Lasers Med Sci*. 2014 Nov;29(6):1945-51. doi: 10.1007/s10103-014-1595-3. Epub 2014 Jun 13.

Link: www.ncbi.nlm.nih.gov/pubmed/24925070

Why does it help?

This study was performed on 60 patients with diabetic neuropathy, whereby they were given light therapy twice per week for a full month. The results showed the improvement of neuropathy outcomes in the light-treated group. This study supports and validates the use of light therapy in which the authors noted has been used over the past three decades by physicians for the management and the treatment of diabetic peripheral neuropathy.

Research Articles

Bashiri H. "Evaluation of low level laser therapy in reducing diabetic polyneuropathy related pain and sensorimotor disorders." *Acta Med Iran.* 2013 Sep 9;51(8):543-7.

Link: www.ncbi.nlm.nih.gov/pubmed/24026991

Why does it help?

After researchers evaluated using light therapy following injury to the sciatic nerve, they concluded that, "based on these results, it is recommended that low-level light therapy should be started as soon as possible after peripheral nerve injury."

Research Articles

Alcântara CC, et al. "Effect of low-level laser therapy (LLLT) on acute neural recovery and inflammation-related gene expression after crush injury in rat sciatic nerve." *Lasers Surg Med*. 2013 Apr;45(4):246-52. doi: 10.1002/lsm.22129. Epub 2013 Apr 8.

Link: www.ncbi.nlm.nih.gov/pubmed/23568823

Rochkind S, Drory V, Alon M, Nissan M, Ouaknine GE. "Laser phototherapy (780 nm), a new modality in treatment of long-term incomplete peripheral nerve injury: a randomized double-blind placebo-controlled study." *Photomed Laser Surg*. 2007 Oct;25(5):436-42

Link: www.ncbi.nlm.nih.gov/pubmed/17975958

Why does it help?

The idea behind low-level light therapy (LLLT) for pain is that red and infrared light penetrates the skin without cutting it. There is evidence that infrared light stimulates mitochondrial functioning. The mitochondria is the part of the cell that stimulates healing and produces protein and collagen. Physiotherapists and sports medicine specialists are treating a wide variety of acute and chronic musculoskeletal injuries and pain with phototherapy. The benefits of light therapy are that they reduce the discomfort of pain and inflammation while promoting blood flow and the body's own tissue repair mechanisms. Following a thorough review on whether or not light therapy is really effective, researchers concluded that one of the clinical applications for LLLT is in pain and inflammation, including pain that occurs post surgery and particularly where edema and inflammation are involved and where many states of inflammation can be significantly reduced.

Research Articles

Gale, G "Infrared therapy for chronic low back pain: A randomized, controlled trial" *Pain Res Management*. 2006 Autumn; 11(3): 193–196.

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC2539004/

Cidral-Filho, FJ. "Light-emitting diode therapy induces analgesia in a mouse model of postoperative pain through activation of peripheral opioid receptors and the L-arginine/nitric oxide pathway." *Lasers Med Sci*. 2014 Mar;29(2):695-702. doi: 10.1007/s10103-013-1385-3. Epub 2013 Jul 6.

Link: www.ncbi.nlm.nih.gov/pubmed/23832179

Kim WS and Calderhead RG. "Is light-emitting diode phototherapy (LED-LLLT) really effective?" *Laser Ther*. 2011;20(3):205-15.

Link: www.ncbi.nlm.nih.gov/pubmed/24155530

Konstantinovic LM, et al. "Low-level laser therapy for acute neck pain with radiculopathy: a double-blind placebo-controlled randomized study." *Pain Med*. 2010 Aug;11(8):1169-78 doi: 10.1111/j.1526-4637.2010.00907.x.

Link: www.ncbi.nlm.nih.gov/pubmed/20704667

Chow RT, Johnson MI, Lopes-Martins RA, Bjordal JM. "Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomised placebo or active-treatment controlled trials." *Lancet*. 2009 Dec 5;374(9705):1897-908. doi: 10.1016/S0140-6736(09)61522-1. Epub 2009 Nov 13

Link: www.ncbi.nlm.nih.gov/pubmed/19913903

Chow RT, Johnson MI, Lopes-Martins RA, Bjordal JM. "Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomised placebo or active-treatment controlled trials." *Lancet*. 2009 Dec 5;374(9705):1897-908. doi: 10.1016/S0140-6736(09)61522-1. Epub 2009 Nov 13

Link: www.ncbi.nlm.nih.gov/pubmed/19913903

Pereira TS, et al. "Efficacy of red and infrared lasers in treatment of temporomandibular disorders--a double-blind, randomized, parallel clinical trial." *Cranio*. 2014 Jan;32(1):51-6.

Link: www.ncbi.nlm.nih.gov/pubmed/24660647

Why does it help?

Light therapy has the potential to develop into a safe and effective neuroprotective treatment for patients with Alzheimer's and Parkinson's disease (and presumably other neurodegenerative diseases such as multiple sclerosis and amyotrophic lateral sclerosis). If light therapy was applied at early stages of the disease process, for example at first diagnosis, it could potentially slow further progression by protecting neurons from death. Consequently, over time, the greater neuronal survival would lessen the clinical signs and symptoms. The LED therapy increases blood flow in the brain, as shown on MRI scans. It also appears to have an effect on damaged brain cells, specifically on their mitochondria. These are bean-shaped subunits within the cell that put out energy in the form of a chemical known as ATP. The red and infrared light photons penetrate through the skull and into brain cells and spur the mitochondria to produce more ATP. That can mean clearer, sharper thinking. Other studies have shown benefits for a wide range of neurological conditions like strokes, TBIs and neurodegenerative diseases. Researchers have found that localized light application to the cortical area of the brain produced a significant increase in ATP.

Research Articles

Johnstone DM, Moro C, Stone J, Benabid AL, Mitrofanis "Turning On Lights to Stop Neurodegeneration: The Potential of Near Infrared Light Therapy in Alzheimer's and Parkinson's Disease". Journal Frontiers in Neuroscience. 2016 Jan 11;9:500.

Link: www.ncbi.nlm.nih.gov/pubmed/26793049

Why does it help?

Study author Margaret Naeser says brain damage caused by explosions, or exposure to pesticides and other neurotoxins – such as in the Gulf War – could impair the mitochondria in cells. She believes light therapy can be a valuable adjunct to standard cognitive rehabilitation, which typically involves “exercising” the brain in various ways to take advantage of brain plasticity and forge new neural networks.

Research Articles

Margaret A. Naeser et al “Significant Improvements in Cognitive Performance Post-Transcranial, Red/Near-Infrared Light-Emitting Diode Treatments in Chronic, Mild Traumatic Brain Injury: Open-Protocol Study”. Journal of Neurotrauma, 2014; 31 (11)

Link: www.ncbi.nlm.nih.gov/pubmed/24568233

Schiffer, F et al. “Psychological benefits 2 and 4 weeks after a single treatment with near infrared light to the forehead: a pilot study of 10 patients with major depression and anxiety”. Biomed central {ejournal}. 2009 5:46

Link: www.behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-5-46

Barrett DW, Gonzalez-Lima F. “Transcranial infrared laser stimulation produces beneficial cognitive and emotional effects in humans” Neuroscience. 2013 Jan 29;230:13-23

Link: www.ncbi.nlm.nih.gov/pubmed/23200785

Why does it help?

Visible red light from a high quality and powerful LED device can penetrate your skin to a depth of about 8-10mm. When the red light wavelength reaches your skin affected by Rosacea, the skin cells absorb it and results in increased microcirculation. More blood comes rushing in, bringing more healing nutrients and more oxygen to the exposed area, which accelerates the healing and rebuilding ability of the cells. The result: flushing, swelling, bumps, pain, and sensitivity to triggers are noticeably relieved without medication and topical creams (which only trigger more flare ups). There are many studies proving red light's ability to reduce skin inflammation and boost skin healing – both are relevant in managing Rosacea.

Research Articles

Mark, Ka et al "Objective and quantitative improvement of rosacea-associated erythema after intense pulsed light treatment". *Dermatology Surgical* 2003. Jun;29 (6):600-4

Link: www.ncbi.nlm.nih.gov/pubmed/12786702

Why does it help?

Some studies have shown that patients with major depression show a more pronounced light-associated increment of parasympathetically controlled cardiac functions compared with other depressed patients and controls. Parry and Maurer expanded on studies done in 1981. Bright artificial light was used to treat a manic-depressive patient with a seasonal mood cycle. Light therapy normalizes transducin (G1 protein) levels observed to be reduced in winter depression.

Research Articles

Nussbaumer, B et al "Light therapy for preventing seasonal affective disorder" Cochrane database of systematic reviews, Nov 2015

Link: www.cochranelibrary-wiley.com/doi/10.1002/14651858.CD011269.pub2/abstract;jsessionid=4F7F45D572C439934F5C5477AC7A5D90.f04t02

Schiffer, F et al. "Psychological benefits 2 and 4 weeks after a single treatment with near infrared light to the forehead: a pilot study of 10 patients with major depression and anxiety". Biomed central {ejournal}. 2009

Link: www.behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-5-46

G. Virk "Short exposure to light treatment improves depression scores in seasonal affective disorder" 2009

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC2913518/

Parry, B and Maurer, E. "Light treatment of mood disorders" Dialogues of Clinical Neuroscience. 2003 Dec; 5(4): 353–365.

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC3181775/

Glickman G, Byrne B, Pineda C, Hauck WW, Brainard GC. "Light therapy for Seasonal Affective Disorder with blue narrow-band light-emitting diodes." Biol Psychiatry. 2006;59:502–7.

Link: www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=16165105&dopt=Abstract [PubMed]

Why does it help?

Keloids and hypertrophic scars represent a large concern in the cosmetic industry, mainly for aesthetic reasons. Stretch marks are another common concern, brought about by saggy skin either from weight loss or aging. Collagen depletion from the body results in having loose, stretchy and saggy skin. Red light therapy helps stimulate collagen production, thus lightening and diminishing scars, preventing further development of stretch marks, and evens out the overall skin tone, thus enhancing patient outcomes and their quality of life.

Research Articles

Mamalis, AD, et al. "Laser and light-based treatment of Keloids- a review" J Eur Acad Dermatol Venereol. 2014 Jun;28(6):689-99. doi: 10.1111/jdv.12253. Epub 2013 Aug 27.

Link: www.ncbi.nlm.nih.gov/m/pubmed/24033440

Freitas CP, Melo C, Alexandrino AM, Noites A. "Efficacy of low-level laser therapy on scar tissue." J Cosmet Laser Ther. 2013 Jun;15(3):171-6. doi: 10.3109/14764172.2013.769272.

Link: www.ncbi.nlm.nih.gov/pubmed/23607736

Why does it help?

Harvard Medical School Department of Dermatology is encouraging further testing of light therapy for dermatological conditions, particularly due to the “non-invasive nature and almost complete absence of side effects.” This published article goes over some of the potential benefits of light therapy for the skin including wrinkles, acne, scars, psoriasis, and healing of burns. Furthermore, sensitive skin represents a major concern, both medically and aesthetically for the general population due to its high prevalence. In another study, skin cells were treated with sodium laurel sulphate. Following the addition of this chemical agent onto the skin, light therapy was applied and ALL patients showed both subjective and objective improvements from the light therapy. The results suggest that low-level light therapy could be a useful and safe treatment modality for sensitive skin.

Research Articles

Weiss RA, McDaniel DH, Geronemus RG, Weiss MA, Beasley KL, Munavalli GM, Bellew SG “Clinical experience with light-emitting diode (LED) photomodulation” *Journal Dermatology surg.* 2005. Sept:31{9 part 2}: 1199-205

Link: www.ncbi.nlm.nih.gov/pubmed/16176771

Avci P, et al. “Low-level laser (light) therapy (LLLT) in skin: stimulating, healing, restoring.” *Semin Cutan Med Surg.* 2013 Mar;32(1):41-52.

Link: www.ncbi.nlm.nih.gov/pubmed/24049929

Kim WS and Calderhead RG. “Is light-emitting diode phototherapy (LED-LLLT) really effective?” *Laser Ther.* 2011;20(3):205-15.

Link: www.ncbi.nlm.nih.gov/pubmed/24155530

Choi M, Kim JE, Cho KH, Lee JH. “In vivo and in vitro analysis of low level light therapy: a useful therapeutic approach for sensitive skin.” *Lasers Med Sci.* 2013 Nov;28(6):1573-9. doi: 10.1007/s10103-013-1281-x. Epub 2013 Feb 10.

Link: www.ncbi.nlm.nih.gov/pubmed/23397274

Why does it help?

Physiotherapists and sports medicine specialists are treating a wide variety of acute and chronic musculoskeletal injuries and pain with low-level light therapy. The benefits of light therapy are that it reduces the discomfort of pain and inflammation while promoting blood flow and the body's own tissue repair mechanisms. Light therapy is really about channelling a wavelength of light energy to tissue that can activate the regenerative capacity of the cells through their mitochondria when, for example, a person has tendonitis, a pulled hamstring, or is contending with a slow-healing wound.

Research Articles

Stergioulas A. "Low-level laser treatment can reduce edema in second degree ankle sprains". Journal of Clinical Laser Medical Surgery. Apr 2004. 22(2):125-8.

Link: www.ncbi.nlm.nih.gov/pubmed/15165387

Baroni, BM et al "Effect of low level laser therapy on muscle adaptation to knee extensor eccentric training". European Journal Applied Physiology. 2015 Mar; 115 {3}: 639-47

Link: www.ncbi.nlm.nih.gov/pubmed/25417170

David et al. "In chronic low back pain, low level laser therapy combined with exercise is more beneficial than exercise alone in the long term: a randomised trial" Australian Journal of Physiotherapy. 2007;53(3):155-60.2007

Link: www.ncbi.nlm.nih.gov/pubmed/17725472

Ferraresi C et al. "Low-level laser (light) therapy (LLLT) on muscle tissue performance, fatigue and repair benefitted by the power of light". Phototonics Lasers Med. 2012 November 1;1 {4}: 267-286.

Link: www.ncbi.nlm.nih.gov/pubmed/23626925

dos Santos Maciel, T. et al. "Phototherapy effect on the muscular activity of regular physical activity practitioners." Lasers Med Sci. 2014 May;29(3):1145-52. doi: 10.1007/s10103-013-1481-4. Epub 2013 Nov 28.

Link: www.ncbi.nlm.nih.gov/pubmed/24288083

Leal-Junior, EC. et al. "Effect of phototherapy (low-level laser therapy and light-emitting diode therapy) on exercise performance and markers of exercise recovery: a systematic review with meta-analysis." *Lasers Med Sci.* 2015 Feb;30(2):925-39. doi: 10.1007/s10103-013-1465-4. Epub 2013 Nov 19.

Link: www.ncbi.nlm.nih.gov/pubmed/24249354

Soares LG, et al. "New bone formation around implants inserted on autologous and xenografts irradiated or not with IR laser light: a histomorphometric study in rabbits." *Braz Dent J.* 2013;24(3):218-23. doi: 10.1590/0103-6440201302186.

Link: www.ncbi.nlm.nih.gov/pubmed/23969909

Borsa PA, Larkin KA, True JM. "Does phototherapy enhance skeletal muscle contractile function and postexercise recovery? A systematic review." *J Athl Train.* 2013 Jan-Feb;48(1):57-67. doi: 10.4085/1062-6050-48.1.12.

Link: www.ncbi.nlm.nih.gov/pubmed/23672326

T. Hashmi, et al. "Effect of Pulsing in Low-Level Light Therapy." *Lasers Surg Med.* 2010 Aug; 42(6):450-66doi: [10.1002/lsm.20950]

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC2933784/

Why does it help?

Due to improved perfusion, compromised blood flow is dramatically reduced through the production of nitric oxide following application of low-level light therapy (LLLT). Studies have been done with the conclusion that, "Transcranial infrared light stimulation has been proven to be safe and successful at improving neurological outcome in humans in controlled clinical trials of stroke." One of the results from LLLT and why it helps is that significant improvements have been made due to light's ability to aid in neurogenesis – the development of new brain cells. This innovative approach could lead to the development of non-invasive, performance enhancing interventions for those of need of neuropsychological rehabilitation.

Research Articles

Barrett DW, Gonzalez-Lima F. "Transcranial infrared laser stimulation produces beneficial cognitive and emotional effects in humans" *Neuroscience*. 2013 Jan 29;230:13-23

Link: www.ncbi.nlm.nih.gov/pubmed/23200785

Huang YY, Nagata K, Tedford CE, Hamblin MR. "Low-level laser therapy (810 nm) protects primary cortical neurons against excitotoxicity in vitro." *J Biophotonics*. 2014 Aug;7(8):656-64. doi: 10.1002/jbio.201300125. Epub 2013 Oct 15.

Link: www.ncbi.nlm.nih.gov/pubmed/24127337

Lohr NL, Ninomiya JT, Warltier DC, Weihrauch D. "Far red/near infrared light treatment promotes femoral artery collateralization in the ischemic hindlimb." *J Mol Cell Cardiol*. 2013 Sep;62:36-42. doi: 10.1016/j.yjmcc.2013.05.007. Epub 2013 May 20.

Link: www.ncbi.nlm.nih.gov/pubmed/23702287

Xuan W, et al. "Transcranial low-level laser therapy improves neurological performance in traumatic brain injury in mice: effect of treatment repetition regimen." *PLoS One*. 2013;8(1):e53454. doi: 10.1371/journal.pone.0053454. Epub 2013 Jan 7.

Link: www.ncbi.nlm.nih.gov/pubmed/23308226

LampI Y. "Laser treatment for stroke." *Expert Rev Neurother*. 2007 Aug;7(8):961-5.

Link: www.ncbi.nlm.nih.gov/pubmed/17678491

Oron A, et al. "Low-level laser therapy applied transcranially to rats after induction of stroke significantly reduces long-term neurological deficits." *Stroke*. 2006 Oct;37(10):2620-4. Epub 2006 Aug 31.

Link: www.ncbi.nlm.nih.gov/pubmed/16946145

Why does it help?

Low thyroid levels are a common concern and one form is due to an autoimmune disorder where the immune system attacks the thyroid gland causing a medical condition known as autoimmune thyroiditis. In one study, 15 patients diagnosed with this condition and on levothyroxine (a thyroid medication) were evaluated in a 2-week course of light therapy (consisting of only 10 sessions of light delivered bi-weekly). To objectively document the results, ultrasounds were performed before the light therapy, and then at 30 days following. Of more clinical relevance, ALL 15 patients who were evaluated reduced their thyroid medication, and 7 of those 15 did NOT require any thyroid medications at the 9-month follow up.

Research Articles

Hofling DB, Chavantes MC, et al. "Low-level laser in the treatment of patients with hypothyroidism induced by chronic autoimmune thyroiditis: a randomized, placebo- controlled clinical trial". *Lasers in Surgery and Medicine*. May 2013; 28(3): 743-53

Link: www.ncbi.nlm.nih.gov/pubmed/22718472

Höfling DB, et al. "Low-level laser therapy in chronic autoimmune thyroiditis: a pilot study." *Lasers Surg Med*. 2010 Aug;42(6):589-96. doi: 10.1002/lsm.20941.

Link: www.ncbi.nlm.nih.gov/pubmed/20662037

Why does it help?

Light therapy readily passes through the skull and exerts its powerful effects within the brain and surrounding tissue. Studies have shown a protective effect (neuroprotection) for TBI and concussion sufferers. More importantly, the enhanced blood flow and energy allow for the growth, repair and regeneration of the damaged tissue. Based on these physiological benefits, many new experimental and clinical studies are currently being done to test light therapy for TBI. The results have been very promising and will hopefully help to improve the quality of life of TBI patients.

Research Articles

Huang YY, Nagata K, Tedford CE, Hamblin MR. "Low-level laser therapy (810 nm) protects primary cortical neurons against excitotoxicity in vitro." J Biophotonics. 2014 Aug;7(8):656-64. doi: 10.1002/jbio.201300125. Epub 2013 Oct 15.

Link: www.ncbi.nlm.nih.gov/pubmed/24127337

Xuan W, et al. "Transcranial low-level laser therapy improves neurological performance in traumatic brain injury in mice: effect of treatment repetition regimen." PLoS One. 2013;8(1):e53454. doi: 10.1371/journal.pone.0053454. Epub 2013 Jan 7.

Link: www.ncbi.nlm.nih.gov/pubmed/23308226

Margaret A. Naeser et al. "Significant Improvements in Cognitive Performance Post-Transcranial, Red/Near-Infrared Light-Emitting Diode Treatments in Chronic, Mild Traumatic Brain Injury: Open-Protocol Study". Journal of Neurotrauma, 2014; 31 (11)

Link: www.ncbi.nlm.nih.gov/pubmed/24568233

Wu Q, et al. "Low-level laser therapy for closed-head traumatic brain injury in mice: effect of different wavelengths." Lasers Surg Med. 2012 Mar;44(3):218-26. doi: 10.1002/lsm.22003. Epub 2012 Jan 24.

Link: www.ncbi.nlm.nih.gov/pubmed/22275301

Naeser MA, et al. "Improved cognitive function after transcranial, light-emitting diode treatments in chronic, traumatic brain injury: two case reports." Photomed Laser Surg. 2011 May;29(5):351-8. doi: 10.1089/pho.2010.2814. Epub 2010 Dec 23.

Link: www.ncbi.nlm.nih.gov/pubmed/21182447

Takahiro Ando, et al. "Comparison of Therapeutic Effects between Pulsed and Continuous Wave 810-nm Wavelength Laser Irradiation for Traumatic Brain Injury in Mice." PLoS One. 2011 Oct; 6(10): e26212.

Link: www.doi.org/10.1371/journal.pone.0026212

Why does it help?

Red light therapy directly stimulates regenerative processes in the skin through increased cellular proliferation, migration and adhesion. Red light therapy has been shown to positively affect skin cells through regeneration of fibroblasts, keratinocytes and modulation of immune cells (including mast cells, neutrophils and macrophages) all found within skin tissue. Treating inflammation with low-level light has been a major research focus of Eells and her team. One of their studies included a group of military veterans with spinal cord injuries who were afflicted with stubborn bedsores. In illness or injury, white blood cells gather at the site of damage, creating inflammation. "Chronic wounds are 'stuck' in the inflammatory phase of healing," Eells says. She wondered: What if light could reset the defenses of the veterans' bodies to reduce the inflamed sores? For the study, the researchers kept the wounds clean and free of infection for 4 weeks. Some patients' wounds were treated with red light phototherapy three times a week over a period of 4 weeks. Afterward, the researchers compared the rate of wound healing with and without light therapy and found that the wounds treated with red light healed 2.5 times faster than those that weren't treated with light. The researchers concluded that when injury or illness triggers the immune response, red and infrared light therapy resets the mitochondria so they can function normally again. It does this by triggering the cells to make anti-inflammatory proteins that will speed up healing, while turning on antioxidant and energy-boosting genes.

Research Articles

Eells, Janis. "New light based Therapy could better treat ulcers" Cited in: Advanced Tissue.2016 April

Link: www.advancedtissue.com/new-light-based-therapy-could-better-treat-ulcers/

Emilia de Abreu Chaves M, Rodrigues de Araujo A, Piancastelli ACC and Pinotti M. "Effects of low power light therapy on wound healing: LASER x LED" An Bras Dermatol.2014 Jul-Aug; 89 {4}: 616-623

Link: www.ncbi.nlm.nih.gov/pmc/articles/PMC4148276/

Colombo, F. et al. Effect of low-level laser therapy ($\lambda 660$ nm) on angiogenesis in wound healing: a immunohistochemical study in a rodent model. Braz Dent J. 2013;24(4):308-12. doi: 10.1590/0103-6440201301867.

Link: www.ncbi.nlm.nih.gov/pubmed/24173246

Szymanska J, et al. "Phototherapy with low-level laser influences the proliferation of endothelial cells and vascular endothelial growth factor and transforming growth factor-beta secretion." J Physiol Pharmacol. 2013 Jun;64(3):387-91.

Link: www.ncbi.nlm.nih.gov/pubmed/23959736

Soares LG, et al. "New bone formation around implants inserted on autologous and xenografts irradiated or not with IR laser light: a histomorphometric study in rabbits." *Braz Dent J.* 2013;24(3):218-23. doi: 10.1590/0103-6440201302186.

Link: www.ncbi.nlm.nih.gov/pubmed/23969909

Arbabi-Kalati F, Arbabi-Kalati F, Moridi T. "Evaluation of the effect of low level laser on prevention of chemotherapy-induced mucositis." *Acta Med Iran.* 2013 Apr 6;51(3):157-62.

Link: www.ncbi.nlm.nih.gov/pubmed/23605599

Ayuk SM, Houreld NN, Abrahamse H. "Collagen production in diabetic wounded fibroblasts in response to low-intensity laser irradiation at 660 nm." *Diabetes Technol Ther.* 2012 Dec;14(12):1110-7. doi: 10.1089/dia.2012.0125. Epub 2012 Oct 11.

Link: www.ncbi.nlm.nih.gov/pubmed/23057714

Kim WS and Calderhead RG. "Is light-emitting diode phototherapy (LED-LLLT) really effective?" *Laser Ther.* 2011;20(3):205-15.

Link: www.ncbi.nlm.nih.gov/pubmed/24155530

Houreld NN, Sekhejane PR, Abrahamse H. "Irradiation at 830 nm stimulates nitric oxide production and inhibits pro-inflammatory cytokines in diabetic wounded fibroblast cells." *Lasers Surg Med.* 2010 Aug;42(6):494-502. doi: 10.1002/lsm.20812.

Link: www.ncbi.nlm.nih.gov/pubmed/20662026

Whelan HT, et al. "Effect of NASA light-emitting diode irradiation on wound healing." *J Clin Laser Med Surg.* 2001 Dec;19(6):305-14.

Link: www.ncbi.nlm.nih.gov/pubmed/11776448



(321) 987-9424

info@lsprosystems.com

www.lsprosystems.com