



## International Research on Light Therapy

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### Sleep

Red Light and the Sleep Quality and Endurance Performance of Chinese Female Basketball Players  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3499892/>

### Anti aging

A Controlled Trial to Determine the Efficacy of Red and Near-Infrared Light Treatment in Patient Satisfaction, Reduction of Fine Lines, Wrinkles, Skin Roughness, and Intradermal Collagen Density Increase. Studies showed significant increase in collagen leading to the reduction of wrinkles and loose skin.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3926176/>

### Skin Rejuvenation

Bhat J, Birch J, Whitehurst C, and Lanigan SW. 2005. A single blinded randomised controlled study to determine the efficacy of Omnilux Revive facial treatment in skin rejuvenation. *Lasers Med Sci*, 20: 6–10 20 min treatments three times a week for three weeks.

ABSTRACT ONLY

<https://www.ncbi.nlm.nih.gov/pubmed/15909229>

Calderhead RG, Kubota J, Trelles MA, and Ohshiro T. 2008. One mechanism behind LED phototherapy for wound healing and skin rejuvenation: Key role of the mast cell. *Laser Ther*, 17: 141–148 830 nm 4.3 treatments per injury, range 2 – 6.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846838/>

Lee MW. 2002. Combination visible and infrared lasers for skin rejuvenation. *Semin Cutan Med Surg*, 21: 288–300. (532 nm and 1064 nm 3 to 6 times at monthly intervals)

<https://www.ncbi.nlm.nih.gov/pubmed/12512652>

Lee SY, Park KH, Choi JW, Kwon JK, Lee DR, Shin MS, Lee JS, You CE, Park MY. 2007a. A prospective, randomized, placebo controlled, double-blinded, and split-face clinical study on LED phototherapy for skin rejuvenation: Clinical, profilometric, histologic, ultrastructural, and biochemical evaluations and comparison of three different treatment settings. *J Photochem Photobiol B*, 88: 51–67. (830nm and 633nm twice a week for four weeks)  
<https://www.ncbi.nlm.nih.gov/pubmed/17566756>

Russell BA, Kellett N, and Reilly LR. 2005. A study to determine the efficacy of combination LED light therapy (633 nm and 830 nm) in facial skin rejuvenation. *J Cosmet Laser Ther* 7: 196–200. (633 nm and 830 nm nine light therapy treatments)  
<https://www.ncbi.nlm.nih.gov/pubmed/16414908>

### **Skin Tightening**

The treated subjects experienced significantly improved skin complexion and skin feeling, profilometrically assessed skin roughness, and ultrasonographically measured collagen density.  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3926176/>

Neira R, Arroyave J, Ramirez H, Ortiz CL, Solarte E, Sequeda F, and Gutierrez MI. Fat liquefaction: Effect of low-level laser energy on adipose tissue. (635 nm 6 min irradiation time)  
<https://www.ncbi.nlm.nih.gov/pubmed/12172159>

Caruso-Davis MK, Guillot TS, Podichetty VK, Mashtalir N, Dhurandhar NV, Dubuisson O, et al. Efficacy of low-level laser therapy for body contouring and spot fat reduction. (635–680 nm 30 min twice a week for 4 weeks)  
<https://www.ncbi.nlm.nih.gov/pubmed/20393809>

### **Cellulite Reduction**

Reduction in thigh circumference and improvement in the appearance of cellulite with dual-wavelength, low-level laser energy and massage. Michael H. Gold, Khalil A. Khatri, Kelley Hails, Robert A. Weiss & Nathalie Fournier (650 nm and 915 nm 83 subjects)  
<https://www.ncbi.nlm.nih.gov/pubmed/21275531>

Sasaki GH, Oberg K, Tucker B, and Gaston M. The effectiveness and safety of topical PhotoActiv phosphatidylcholine-based anti-cellulite gel and LED (red and near-infrared) light on Grade II-III thigh cellulite: a randomized, double-blinded study. *J Cosmet Laser Ther*, 2007; 9(2): 87–96. (660 nm and 950 nm 3 months.) Twice weekly, each thigh was exposed for a 15-minute treatment with LED light for a total of 24 treatments  
<https://www.ncbi.nlm.nih.gov/pubmed/17558758>

Study of the Effect of Low Level Laser Light Therapy on Reducing the Appearance of Cellulite in the Thighs and Buttocks -532nm n/a  
<https://clinicaltrials.gov/ct2/show/NCT01702259>

Low-level laser therapy (LLLT) does not reduce subcutaneous adipose tissue by local adipocyte injury but rather by modulation of systemic lipid metabolism. (650nm 6 treatments 2-3 days apart)  
<https://www.ncbi.nlm.nih.gov/pubmed/27384041>

Efficacy of a multiple diode laser system for body contouring. (532nm 6 treatments, three times per week for 2 weeks)

<https://www.ncbi.nlm.nih.gov/pubmed/21384392>

### **Skin/Acne**

Aziz-Jalali MH, Tabaie SM, and Djavid GE. 2012. Comparison of red and infrared low-level laser therapy in the treatment of acne vulgaris. *Indian J Dermatol* , 57: 128–130. (630 and 890nm twice in a week for 12 sessions)

<https://www.ncbi.nlm.nih.gov/pubmed/22615511>

Cunliffe WJ and Goulden V. 2000. Phototherapy and acne vulgaris. *Br J Dermatol*, 142: 855–856

<https://www.ncbi.nlm.nih.gov/pubmed/10809839>

Goldberg DJ and Russell BA. 2006. Combination blue (415 nm) and red (633 nm) LED phototherapy in the treatment of mild to severe acne vulgaris. *J Cosmet Laser Ther*, 8: 71–75. (415 nm and 633nm 20 min per session, 8sessions, two per week 3 days apart)

<https://www.ncbi.nlm.nih.gov/pubmed/16766484>

Lee SY, You CE, and Park MY. 2007b. Blue and red light combination LED phototherapy for acne vulgaris in patients with skin phototype IV. *Lasers Surg Med* , 39: 180–188. (415 nm and 633nm twice a week for 4 weeks)

<https://www.ncbi.nlm.nih.gov/pubmed/17111415>

Lloyd JR and Mirkov M. 2002. Selective photothermolysis of the sebaceous glands for acne treatment. *Lasers Surg Med* , 31: 115–120.

<https://www.ncbi.nlm.nih.gov/pubmed/12210595>

Papageorgiou P, Katsambas A, and Chu A. 2000. Phototherapy with blue (415 nm) and red (660 nm) light in the treatment of acne vulgaris. *Br J Dermatol* , 142: 973–978. (415 nm and 633nm daily for 15 min for 12weeks)

<https://www.ncbi.nlm.nih.gov/pubmed/10809858>

Railan D and Alster TS. 2008. Laser treatment of acne, psoriasis, leukoderma, and scars. *Semin Cutan Med Surg* , 27: 285–291

<https://www.ncbi.nlm.nih.gov/pubmed/19150300>

Rotunda AM, Bhupathy AR, and Rohrer TE. 2004. The new age of acne therapy: Light, lasers, and radiofrequency. *J Cosmet Laser Ther*, 6: 191–200.

<https://www.ncbi.nlm.nih.gov/pubmed/16020203>

Sadick NS. 2008. Handheld LED array device in the treatment of acne vulgaris. *J Drugs Dermatol*, 7: 347–350 415 nm and 633nm 8 20-minute (blue) or 30- minute (red) alternated light treatments, self- administered by a handheld unit over a period of 4 weeks

<https://www.ncbi.nlm.nih.gov/pubmed/18459515>

Seaton ED, Mouser PE, Charakida A, Alam S, Seldon PM, and Chu AC. 2006. Investigation of the mechanism of action of nonablative pulsed-dye laser therapy in photorejuvenation and inflammatory acne vulgaris. *Br J Dermatol*, 155: 748–755.

<https://www.ncbi.nlm.nih.gov/pubmed/16965424>

Stathakis V, Kilkenny M, and Marks R. 1997. Descriptive epidemiology of acne vulgaris in the community. *Australas J Dermatol* , 38: 115–123 n/a n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/9293656>

## **Psoriasis**

Ablon G. 2010. Combination 830-nm and 633-nm light emitting diode phototherapy shows promise in the treatment of recalcitrant psoriasis: Preliminary findings. *Photomed Laser Surg*, 28: 141–146. (830-nm and 633-nm two 20-min sessions over 4 or 5 weeks, with 48 h between sessions)  
<https://www.ncbi.nlm.nih.gov/pubmed/19764893>

Asawanonda P, Anderson RR, Chang Y, and Taylor CR. 2000. 308-nm excimer laser for the treatment of psoriasis: A doseresponse study. *Arch Dermatol* , 136: 619–624. 308-nm 1, 2, 4, and 20 treatments  
<https://www.ncbi.nlm.nih.gov/pubmed/10815855>

Berns MW, Rettenmaier M, McCullough J, Coffey J, Wile A, Berman M, DiSaia P, and Weinstein G. 1984. Response of psoriasis to red laser light (630 nm) following systemic injection of hematoporphyrin derivative. *Lasers Surg Med* , 4: 73–77. 630 nm  
<https://www.ncbi.nlm.nih.gov/pubmed/6235419>

De Leeuw J, Van Lingen RG, Both H, Tank B, Nijsten T, and Martino Neumann HA. 2009. A comparative study on the efficacy of treatment with 585 nm pulsed dye laser and ultraviolet B-TL01 in plaque type psoriasis. *Dermatol Surg* , 35: 80–91 585 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/19076190>

Gattu S, Rashid RM, and Wu JJ. 2009. 308-nm excimer laser in psoriasis vulgaris, scalp psoriasis, and palmoplantar psoriasis. *J Eur Acad Dermatol Venereol* , 23: 36–41. 308-nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/18717744>

Trehan M and Taylor CR. 2002. Medium-dose 308-nm excimer laser for the treatment of psoriasis. *J Am Acad Dermatol*, 47: 701–708 308-nm (3 times per week for up to 8 weeks)  
<https://www.ncbi.nlm.nih.gov/pubmed/12399761>

Finlay AY, Khan GK, Luscombe DK, and Salek MS. 1990. Validation of sickness impact profile and psoriasis disability index in psoriasis. *Br J Dermatol* , 123: 751–756. n/a n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/2265090>

## **Scars**

Phototherapy applied after inguinal-hernia surgery was effective in preventing the formation of keloids. In addition, Phototherapy resulted in better scar appearance.  
<https://pubmed.ncbi.nlm.nih.gov/19821701/>

Barolet D and Boucher A. 2010. Prophylactic low-level light therapy for the treatment of hypertrophic scars and keloids: A case series. *Lasers Surg Med* , 42: 597–601. 805 nm 30 days  
<https://www.ncbi.nlm.nih.gov/pubmed/20662038>

Bouzari N, Davis SC, and Nouri K. 2007. Laser treatment of keloids and hypertrophic scars. Int J Dermatol , 46: 80–88. 585 nm  
<https://www.ncbi.nlm.nih.gov/pubmed/17214728>

Railan D and Alster TS. 2008. Laser treatment of acne, psoriasis, leukoderma, and scars. Semin Cutan Med Surg , 27: 285–29  
<https://www.ncbi.nlm.nih.gov/pubmed/19150300>

Phototherapy applied after inguinal-hernia surgery was effective in preventing the formation of keloids. In addition, Phototherapy resulted in better scar appearance.  
<https://pubmed.ncbi.nlm.nih.gov/19821701/>

## **Vitiligo**

Lan CC, Wu CS, Chiou MH, Chiang TY, and Yu HS. 2009. Lowenergy heliumneon laser induces melanocyte proliferation via interaction with type IV collagen: Visible light as a therapeutic option for vitiligo. Br J Dermatol, 161: 273–280. 632.8 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/19438447>

Lan CC, Wu CS, Chiou MH, Hsieh PC, and Yu HS. 2006. Lowenergy heliumneon laser induces locomotion of theimmature melanoblasts and promotes melanogenesis of the more differentiated melanoblasts: Recapitulation of vitiligo repigmentation in vitro. J Invest Dermatol , 126: 2119–2126 632.8 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/16691191>

Yu HS. 2000. Treatment of vitiligo vulgaris with helium-neon laser. MB Derma 35: 13–18. 632.8 nm n/a  
<https://www.sciencedirect.com/science/article/pii/S0022202X15301184>

## **Fat Loss/ Contouring**

Independent evaluation of low-level laser therapy at 635 nm for non-invasive body contouring of the waist, hips, and thighs  
<https://www.ncbi.nlm.nih.gov/pubmed/23355338>

Body contouring using light therapy  
<https://www.ncbi.nlm.nih.gov/pubmed/24049928>

Light therapy for fat layer reduction  
<https://www.ncbi.nlm.nih.gov/pubmed/23749426>

Efficacy of low-level laser therapy for body contouring  
<https://www.ncbi.nlm.nih.gov/pubmed/20393809>

Light therapy as a non-invasive approach for body contouring  
<https://www.ncbi.nlm.nih.gov/pubmed/20014253>

Light therapy as a non-invasive approach for body contouring

<https://www.ncbi.nlm.nih.gov/pubmed/20014253>

## **Bone Healing**

Phototherapy promoted bone healing.

<http://www.ncbi.nlm.nih.gov/pubmed/19860572?itool=EntrezSystem2.PEntrez.P>

Phototherapy can promote bone healing and bone mineralization and thus may be clinically beneficial in promoting bone formation in skeletal defects.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&listuids=15906852&query\\_hl=10&itool=pub\\_med\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&listuids=15906852&query_hl=10&itool=pub_med_docsum)

## **Pain Relief and Inflammation**

In response to stimuli in the microenvironment, macrophages adopt either the M1 or M2 phenotype to coordinate the tissue repair process. Photobiomodulation (PBM) plays an important role in the modulation of acute inflammation, including cellular influx, macrophage polarization, and the release of inflammatory mediators.

<https://pubmed.ncbi.nlm.nih.gov/31152259/>

Alves, A. C., Vieira, R., Leal-Junior, E., Dos Santos, S., Ligeiro, A. P., Albertini, R., Junior, J., and De Carvalho, P. 2013. Effect of low-level laser therapy on the expression of inflammatory mediators and on neutrophils and macrophages in acute joint inflammation. *Arthritis Res Ther*, 15, R116. 808 nm

<https://www.ncbi.nlm.nih.gov/pubmed/24028507>

Bortone, F., Santos, H. A., Albertini, R., Pesquero, J. B., Costa, M. S., and Silva, J. A., Jr. 2008. Low level laser therapy modulates kinin receptors mRNA expression in the subplantar muscle of rat paw subjected to carrageenan induced inflammation. *Int Immunopharmacol*, 8, 206–210. (660 or 684 nm)

<https://www.ncbi.nlm.nih.gov/pubmed/18182228>

Ferreira, D., Zangaro, R., Villaverde, B., Cury, Y., Frigo, L., Piccolo, G., Longo, I., and Barbarosa, D. 2005. Analgesic effect of He-Ne (632.8 nm) low-level laser therapy on acute inflammation pain. *Photomed Laser Surg*, 23, 177–181. 632.8 nm n/a

<https://www.ncbi.nlm.nih.gov/pubmed/15910182>

Laraia, E. M., Silva, I. S., Pereira, D. M., Dos Reis, F. A., Albertini, R., De Almeida, P., Leal Junior, E. C., and De Tarso Camillo De Carvalho, P. 2012. Effect of low-level laser therapy (660 nm) on acute inflammation induced by tenotomy of Achilles tendon in rats. *Photochem Photobiol*, 88, 1546–1550. (660 nm 6, 24 and 72 h)

<https://www.ncbi.nlm.nih.gov/pubmed/22621670>

Pallotta, R. C., Bjordal, J. M., Frigo, L., Leal Junior, E. C., Teixeira, S., Marcos, R. L., Ramos, L., De Moura Messias, F., and Lopes-Martins, R. A. 2011. Infrared (810 nm) low-level laser therapy on rat experimental knee inflammation. *Lasers Med Sci*, 27(1), 71–78. 810-nm n/a

<https://www.ncbi.nlm.nih.gov/pubmed/21484455>

Prianti, A. C., Jr., Silva, J. A., Jr., Dos Santos, R. F., Rosseti, I.B., and Costa, M. S. 2014. Low-level laser therapy (LLLT) reduces the Cox-2 mRNA expression in both subplantar and total brain tissues in the model of peripheral inflammation induced by administration of carrageenan. *Lasers Med Sci* , 29(4), 1397–1403. 660 nm. n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/24532118>

Rees, J. D., Stride, M., and Scott, A. 2013. Tendons: Time to revisit inflammation. *Br J Sports Med* , 48(21), 1553–1557. n/a n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/23476034>

Soriano, F., Campana, V., Moya, M., Gavotto, A., Simes, J., Soriano, M., Soriano, R., Spitale, L., and Palma, J. 2006. Photobiomodulation of pain and inflammation in microcrystalline arthropathies: Experimental and clinical results. *Photomed Laser Surg*, 24, 140–150. (633 nm daily for 10 consecutive days)  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3799039/>

## **Pain Relief**

Alayat, M. S., Atya, A. M., Ali, M. M., and Shosha, T. M. 2013. -Long-term effect of high-intensity laser therapy in the treatment of patients with chronic low back pain: A randomized blinded placebo-controlled trial. *Lasers Med Sci* , 29(3): 1065–1073. n/a n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/24178907>

Basford, J., Sheffield, C., and Harmsen, W. 1999. Laser therapy: A randomised, controlled trial of the effects of low intensity Nd:Yag laser irradiation on musculoskeletal back pain. *Arch Phys Med Rehabil*, 80, 647–652. 1064nm 90 seconds at eight symmetric points along the lumbosacral spine three times a week for 4 weeks  
<https://www.ncbi.nlm.nih.gov/pubmed/10378490>

Walker, J. 1983. Relief from chronic pain by low power laser irradiation. *Neurosci Lett*, 43, 339–344.  
<https://www.ncbi.nlm.nih.gov/pubmed/6200808>

Bingol, U., Altan, L., and Yurtkuran, M. 2005. Low-power laser treatment for shoulder pain. *Photomed Laser Surg*, 23, 459–464. (904 nm 10 sessions during a period of 2 weeks)  
<https://www.ncbi.nlm.nih.gov/pubmed/16262574>

Ceylan, Y., Hizmetli, S., and Silig, Y. 2004. The effects of infrared laser and medical treatments on pain and serotonin degradation products in patients with myofascial pain syndrome. A controlled trial. *Rheumatol Int*, 24, 260–263. (810nm once a day for 10 consecutive days)  
<https://www.ncbi.nlm.nih.gov/pubmed/14628149>

Chow, R. T., Lopes-Martins, R., Johnson, M., and Bjordal, J. M. 2009. Efficacy of low-level laser therapy in the management of neck pain: A systematic review and metaanalysis of randomised, placebo and active treatment controlled trials. *Lancet*, 374, 1897–1908.  
<https://www.ncbi.nlm.nih.gov/pubmed/19913903>

Ferreira, D., Zangaro, R., Villaverde, B., Cury, Y., Frigo, L., Piccolo, G., Longo, I., and Barbarosa, D. 2005. Analgesic effect of He-Ne (632.8 nm) low-level laser therapy on acute inflammation pain. *Photomed Laser Surg*, 23, 177–181 632.8 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/15910182>

Fiore, P., Panza, F., Cassatella, G., Russo, A., Frisardi, V., Solfrizzi, V., Ranieri, M., Di Teo, L., and Santamato, A. 2011.

Short-term effects of high-intensity laser therapy versus ultrasound therapy in the treatment of low back pain: A randomized controlled trial. *Eur J Phys Rehabil Med*, 47, 367–373. n/a (15 treatment sessions, during 3 weeks)

<https://www.ncbi.nlm.nih.gov/pubmed/21654616>

Gworys, K., Gasztych, J., Puzder, A., Gworys, P., and Kujawa, J. 2012. Influence of various laser therapy methods on knee joint pain and function in patients with knee osteoarthritis. *Ortop Traumatol Rehabil*, 14, 269–277 (810 nm 1 or 2 treatments)

<https://www.ncbi.nlm.nih.gov/pubmed/22764339>

Venezian, G. C., Da Silva, M. A., Mazzetto, R. G., and Mazzetto, M. O. 2010. Low Level laser effects on pain to palpation and electromyographic activity in TMD patients: A double-blind, randomized, placebo-controlled study. *Cranio*, 28, 84–91. 780 nm twice a week (four weeks). Forty-eight (48) patients

<https://www.ncbi.nlm.nih.gov/pubmed/20491229>

Mckibbin, L. S., and Downie, R. 1991. Treatment of postherpetic neuralgia using a 904 nm (infrared) low incident energy laser: A clinical study. *Laser Ther*, 3, 35–39. 8 nm, (780nm, 830 nm, 904 nm -5 trials, 188 participants)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3802126/>

Namazawa, R., Kemmotsu, O., Otsuka, H., Kakehata, J., Hashimoto, T., Tamagawa, S., and Maumi, T. 1996. The role of laser therapy in intensive pain management of postherpetic neuralgia. *Laser Therapy*, 8, 143–148. n/a (5 minutes and 6 seconds, 15 consecutive days)

<https://www.ncbi.nlm.nih.gov/pubmed/20921635>

Trelles, M., Mayayo, E., Miro, L., Rigau, J., Baudin, G., and Calderhead, R. 1989. The action of low reactive laser therapy (LLLT) on mast cells: A possible pain relief mechanism examined. *Laser Ther*, 1, 27–30. 488, 514.5, 532, 633, 638, 670, 830, 880, 980 or 1064 nm n/a

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4639680/>

Umegaki, S., Tanaka, Y., Hisakai, M., and Koshimoto, H. 1989. Effectiveness of low-power laser therapy on low-back pain: Double-blind comparative study to evaluate the analgesic effect of low power laser therapy on low back pain. *Clin Rep*, 23, 2838–2846. n/a n/a

<https://www.ncbi.nlm.nih.gov/pubmed/12605431>

Venezian, G. C., Da Silva, M. A., Mazzetto, R. G., and Mazzetto, M. O. 2010. Low Level laser effects on pain to palpation and electromyographic activity in TMD patients: A double-blind, randomized, placebo-controlled study. *Cranio*, 28, 84–91. (780 nm twice a week (four weeks), Forty-eight (48) patients

<https://www.ncbi.nlm.nih.gov/pubmed/20491229>

Photobiomodulation (PBM) also known as low-level level laser therapy is the use of red and near-infrared light to stimulate healing, relieve pain, and reduce inflammation.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5523874/>

Phototherapy effectively relieves pain of various etiologies; making it a valuable addition to contemporary pain management armamentarium.

<http://www.ncbi.nlm.nih.gov/pubmed/20842007>



Efficacy of phototherapy in the management of neck pain.

<http://www.ncbi.nlm.nih.gov/pubmed/19913903>

This study shows that phototherapy reduces pain after treatment in acute and chronic neck pain.

<https://pubmed.ncbi.nlm.nih.gov/15389743/>

Phototherapy reduces pain immediately after treatment in acute neck pain and up to 22 weeks after completion of treatment in patients with chronic neck pain

<https://pubmed.ncbi.nlm.nih.gov/19913903/>

Analyzing the analgesic effect of phototherapy showing it as a treatment of myofascial pain syndrome.

<https://pubmed.ncbi.nlm.nih.gov/19891258/>

Phototherapy for acute neck pain with radiculopathy: a double-blind placebo controlled randomized study.

<http://www.ncbi.nlm.nih.gov/pubmed/20704667>

The results of this study show better improvement in acute LBP treated with Phototherapy.

<https://pubmed.ncbi.nlm.nih.gov/20001318/>

Phototherapy is beneficial for pain in myofascial pain syndrome.

<https://pubmed.ncbi.nlm.nih.gov/14677161/>

Phototherapy seemed to be an effective method in reducing pain and functional disability in the therapy of chronic low back

<https://pubmed.ncbi.nlm.nih.gov/12605431/>

A practice-based study of patients with acute and chronic low back pain.

<https://pubmed.ncbi.nlm.nih.gov/15129198/>

In chronic low back pain, phototherapy combined with exercise is more beneficial than exercise alone in the long term.

<https://pubmed.ncbi.nlm.nih.gov/17725472/>

Comparison of 3 physical therapy modalities for acute pain in lumbar disc herniation measured by clinical evaluation and magnetic resonance imaging.

<https://pubmed.ncbi.nlm.nih.gov/18394495/>

Phototherapy can be beneficial for the reduction of postoperative pain.

<https://pubmed.ncbi.nlm.nih.gov/14758818/>

## **Fibromyalgia**

Phototherapy is effective on pain, muscle spasm, morning stiffness, and total tender point number in fibromyalgia.

<https://pubmed.ncbi.nlm.nih.gov/11845369/>

## **Tissue Repair**

Phototherapy is a highly effective form of treatment for tissue repair.

<http://www.ncbi.nlm.nih.gov/pubmed/19698019>

Low-power phototherapy devices were first used as a form of therapy more than 30 years ago. More recent findings mandate the conclusion that phototherapy is highly effective for tissue repair and pain relief.

<https://pubmed.ncbi.nlm.nih.gov/15345176/>

Demonstrated high healing effects in the treatment of episiotomies.

<https://pubmed.ncbi.nlm.nih.gov/12614558/>

## **Thyroid**

Low-level laser therapy in chronic autoimmune thyroiditis: a pilot study (830 10 applications, twice a week for 5 weeks)

<https://www.ncbi.nlm.nih.gov/pubmed/20662037>

## **Nerve Regeneration**

Effect of near-infrared light-emitting diodes on nerve regeneration. (660 21 treatments, 1 h per day for t 3 weeks)

<https://www.ncbi.nlm.nih.gov/pubmed/20358337>

Phototherapy results in both a subjective and objective improvement in nerve deficit.

<https://pubmed.ncbi.nlm.nih.gov/8863301/>

## **Hair**

Novel Approach to Treating Androgenetic Alopecia in Females With Photobiomodulation (Low-Level Laser Therapy). 650 60 treatments

<https://www.ncbi.nlm.nih.gov/pubmed/28328705>

The growth of human scalp hair mediated by visible red light laser and LED sources in males. (655 60 treatments, every other day, 25 minute treatment)

<https://www.ncbi.nlm.nih.gov/pubmed/24078483>

The growth of human scalp hair in females using visible red light laser and LED sources. 656 (60 treatments, every other day, 25 minute treatment)

<https://www.ncbi.nlm.nih.gov/pubmed/25124964>

## **Cancer treatment side effects**

The use of low-level light therapy in supportive care for patients with breast cancer: review of the literature.

<https://www.ncbi.nlm.nih.gov/pubmed/27539464>

## **Wound healing**

Cell viability, free radical-induced oxidative stress, NF- $\kappa$ B activation, nitric oxide release, mitochondrial respiration, and wound healing repair were assessed in human endothelial cells  
<https://pubmed.ncbi.nlm.nih.gov/30145725/>

Findings indicated a beneficial effect of laser stimulation on wound healing.

<http://www.ncbi.nlm.nih.gov/pubmed/20203347>

Low level light therapy by LED of different wavelength induces angiogenesis and improves ischemic wound healing. 470 and 629 5 treatments, 5 consecutive days, 10 min applications

<https://www.ncbi.nlm.nih.gov/pubmed/25363448>

Role of low-level laser therapy in neurorehabilitation (670 nm 1 time 20 minutes)

<https://www.ncbi.nlm.nih.gov/pubmed/21172691>

Photobiomodulation by laser therapy rescued auditory neuropathy induced by ouabain.

<https://www.ncbi.nlm.nih.gov/pubmed/27666974>

The mechanistic basis for photobiomodulation therapy of neuropathic pain by near infrared laser light. (808 nm 1 time 120 seconds)

<https://www.ncbi.nlm.nih.gov/pubmed/28075022>

A comparative study of red and blue light-emitting diodes and low-level laser in regeneration of the transected sciatic nerve after an end to end neurorrhaphy in rabbits. LLL (680 nm), red LED (650 nm), and blue LED (450 nm) 14 treatments one per day for 14 days

<https://www.ncbi.nlm.nih.gov/pubmed/26415928>

Photobiomodulation Triple Treatment in Peripheral Nerve Injury: Nerve and Muscle Response.

<https://www.ncbi.nlm.nih.gov/pubmed/28001757>

Regeneration of specific nerve cells in lesioned visual cortex of the human brain: an indirect evidence after constant stimulation with different spots of light. (656nm) 656, 525, 578 and 450 n/a

<https://www.ncbi.nlm.nih.gov/pubmed/7629891>

The effect of photobiomodulation on chemotherapy-induced peripheral neuropathy: A randomized, sham controlled clinical trial.

<https://www.ncbi.nlm.nih.gov/pubmed/27887804>

Analysis of the variation in low-level laser energy density on the crushed sciatic nerves of rats: a morphological, quantitative, and morphometric study. (780nm) 780 n/a

<https://www.ncbi.nlm.nih.gov/pubmed/28063018>

Effect of photobiomodulation therapy (808 nm) in the control of neuropathic pain in mice 808 n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/28283814>

Effect of Laser Photobiomodulation with Gradual or Constant Doses in the Regeneration of Rats' Mental Nerve After Lesion by Compression. (808nm) 808 20 treatments  
<https://www.ncbi.nlm.nih.gov/pubmed/28358662>

Light promotes regeneration and functional recovery and alters the immune response after spinal cord injury. (810nm) 810  
<https://www.ncbi.nlm.nih.gov/pubmed/15704098>

Promotion of regenerative processes in injured peripheral nerve induced by low-level laser therapy. (901nm) 901 10 treatments  
<https://www.ncbi.nlm.nih.gov/pubmed/17508846>

Neuropeptide expression and morphometric differences in crushed alveolar inferior nerve of rats: Effects of photobiomodulation. (904nm 904 11 treatments)  
<https://www.ncbi.nlm.nih.gov/pubmed/28314941>

Findings indicated a beneficial effect of laser stimulation on wound healing.  
<http://www.ncbi.nlm.nih.gov/pubmed/20203347>

Phototherapy is an effective tool for promoting wound repair.  
<https://pubmed.ncbi.nlm.nih.gov/15315732/>

Shows the efficacy in post-operative wounds.  
<https://pubmed.ncbi.nlm.nih.gov/15782037/>

Phototherapy is an effective therapeutic modality for wound healing.  
<https://pubmed.ncbi.nlm.nih.gov/16387711/>

Phototherapy effects on wound healing.  
<https://pubmed.ncbi.nlm.nih.gov/12928819/>

In addition to accelerated wound healing, the main advantages of Phototherapy with injuries include prevention of side effects of drugs, significantly accelerated functional recovery and earlier return to work.  
<https://pubmed.ncbi.nlm.nih.gov/11800105/>

Phototherapy resulted in enhanced healing.  
<https://pubmed.ncbi.nlm.nih.gov/15496990/>

This NASA research shows that Phototherapy will greatly enhance the natural wound healing process, and more quickly return the patient to a pre injury/illness level of activity.  
<https://pubmed.ncbi.nlm.nih.gov/11776448/>

Hawkins, D., Houreld, N., and Abrahamse, H. (2005). Low level laser therapy (LLLT) as an effective therapeutic modality for delayed wound healing. Ann. N Y Acad. Sci., 1056, pp.486–493  
<https://www.ncbi.nlm.nih.gov/pubmed/16387711>

Hopkins, J.T., McLodot, T.A., Seegmiller, J.G., and Baxter, G.D. (2004). Low-level laser therapy facilitates superficial wound healing in humans: A triple-blind, sham-controlled study. *J. Athl. Train.* , 39(3), pp. 223–229 n/a 2 minutes, 5 seconds  
<https://www.ncbi.nlm.nih.gov/pubmed/15496990>

Lucas, C., Stanborough, R.W., Freeman, C.L., and DeHaan, R.J. (2000). Efficacy of low-level laser therapy on wound healing in human subjects: A systematic review. *Lasers Med. Sci.* , 15, pp. 84–93 904 nm 125s  
[https://www.researchgate.net/publication/10605213\\_Efficacy\\_of\\_lowlevel\\_laser\\_therapy\\_in\\_the\\_management\\_of\\_stage\\_III\\_decubitus\\_ulcers\\_A\\_prospective\\_observerblinded\\_multicentre\\_randomised\\_clinical\\_trial](https://www.researchgate.net/publication/10605213_Efficacy_of_lowlevel_laser_therapy_in_the_management_of_stage_III_decubitus_ulcers_A_prospective_observerblinded_multicentre_randomised_clinical_trial)

Saltmarche, A.E. (2008). Low level laser therapy for healing acute and chronic wounds: The Extendicare experience. *Int.Wound J.* , 5, pp. 351–360  
<https://www.ncbi.nlm.nih.gov/pubmed/18494640>

### **Non Healing Wounds and Ulcers**

Kim, S.W., Kim, J.S., Lim, W.B., Jeon, S.M., Kim, O.S., Koh, J.T., Kim, C.S., Choi, H.R., and Kim, O.J. (2013). In vitro bactericidal effects of 625, 525, and 425 nm wavelength (red, green and blue) light-emitting diode irradiation. *Photomed. Laser Surg.*,31(11), pp. 554–562. 625, 525, and 425 nm 1, 2, 4, and 8 h  
<https://www.ncbi.nlm.nih.gov/pubmed/24138193>

Stadler, I., Evans, R., Narayan, V., Buehner, N., Naim, J.O., and Lanzafame, R.J. (2001). 830 nm irradiation increases wound tensile strength in a diabetic murine model, *Lasers Surg. Med.*, 28(3), pp. 220–226. 831 nm Daily over 0-4 days or 3-7 days  
<https://www.ncbi.nlm.nih.gov/pubmed/11295756>

DeLand, M.M., Weiss, R.A., McDaniel, D.H., and Geronemus, R.G. (2007). Treatment of radiation-induced dermatitis with light-emitting diode (LED) photomodulation. *Lasers Surg. Med.* , 39, pp. 164–168  
<https://www.ncbi.nlm.nih.gov/pubmed/17311276>

### **Diabetic studies**

Effects of low-level light therapy on hepatic antioxidant defense in acute and chronic diabetic rats (670 18 treatments)  
<https://www.ncbi.nlm.nih.gov/pubmed/19202557>

### **Muscle Performance**

Dos Reis FA, da Silva BA, Laraia EM, de Melo RM, Silva PH, Leal-Junior EC, et al. Effects of pre- or post-exercise low-level laser therapy (830 nm) on skeletal muscle fatigue and biochemical markers of recovery in humans: Double-blind placebo-controlled trial. *Photomed Laser Surg.* 2014; 32(2): 106–112. Epub2014/01/25. 830 nm two sessions, with a 1 week interval between them  
<https://www.ncbi.nlm.nih.gov/pubmed/24456143>

Lopes-Martins RA, Marcos RL, Leonardo PS, Prianti AC, Jr., Muscara MN, Aimbire F, et al. Effect of low-level laser (Ga-AlAs 655 nm) on skeletal muscle fatigue induced by electrical stimulation in rats. *J Appl Physiol* (1985). 2006; 101(1): 283–288. Epub 2006/04/22. 655 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/16627677>

Patrocinio T, Sardim AC, Assis L, Fernandes KR, Rodrigues N, and Renno AC. Effect of low-level laser therapy (808 nm) in muscle after resistance exercise training in rats. *Photomed Laser Surg* . 2013; 31(10): 492–498. Epub 2013/10/10 808 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/24102167>

Leal-Junior EC, Lopes-Martins RA, de Almeida P, Ramos L, Iversen VV, and Bjordal JM. Effect of low-level laser therapy (GaAs 904 nm) in skeletal muscle fatigue and biochemical markers of muscle damage in rats. *Eur J Appl Physiol* . 2010; 108(6): 1083–1088. Epub 2009/12/22. 904 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/20024577>

Leal-Junior EC, Lopes-Martins RA, Dalan F, Ferrari M, Sbabo FM, Generosi RA, et al. Effect of 655 nm low-level laser therapy on exercise-induced skeletal muscle fatigue in humans. *Photomed Laser Surg* . 2008; 26(5): 419–424. Epub 2008/09/27. 655-nm two sessions (on day 1 and day 8) at a 1-wk interval,  
<https://www.ncbi.nlm.nih.gov/pubmed/18817474>

Leal-Junior EC, Lopes-Martins RA, Vanin AA, Baroni BM, Grosselli D, De Marchi T, et al. Effect of 830 nm low-level laser therapy in exercise-induced skeletal muscle fatigue in humans. *Lasers Med Sci* . 2009; 24(3): 425–431. Epub 2008/07/24. 830 nm 200 s total irradiation time  
<https://www.ncbi.nlm.nih.gov/pubmed/18649044>

de Almeida P, Lopes-Martins RA, De Marchi T, Tomazoni SS, Albertini R, Correa JC, et al. Red (660 nm) and infrared (830 nm) low-level laser therapy in skeletal muscle fatigue in humans: What is better? *Lasers Med Sci* . 2012; 27(2): 453–458. Epub 2011/08/05. 660 or 830 nm 100 s irradiation per point,  
<https://www.ncbi.nlm.nih.gov/pubmed/21814736>

Leal-Junior EC, Lopes-Martins RA, Baroni BM, De Marchi T, Taufer D, Manfro DS, et al. Effect of 830 nm low-level laser therapy applied before high-intensity exercises on skeletal muscle recovery in athletes. *Lasers Med Sci* . 2009; 24(6): 857–863. Epub 2008/12/06. 830 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/19057981>

Toma RL, Tucci HT, Antunes HK, Pedroni CR, de Oliveira AS, Buck I, et al. Effect of 808 nm low-level laser therapy in exercise-induced skeletal muscle fatigue in elderly women. *Lasers Med Sci* . 2013; 28(5): 1375–1382. Epub 2013/01/09. 808 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/23296713>

de Brito Vieira WH, Bezerra RM, Queiroz RA, Maciel NF, Parizotto NA, and Ferraresi C. Use of low-level laser therapy (808 nm) to muscle fatigue resistance: A randomized double-blind crossover trial. *Photomed Laser Surg* . 2014; 32(12): 678–685. Epub 2014/12/17. 808 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/25496083>

Felismino AS, Costa EC, Aoki MS, Ferraresi C, de Araujo Moura Lemos TM, and de Brito Vieira WH. Effect of low-level laser therapy (808 nm) on markers of muscle damage: A randomized double-blind placebo-controlled trial. *Lasers Med Sci* . 2014; 29(3): 933–938. Epub 2013/09/06. 808 nm 10 s on four points

<https://www.ncbi.nlm.nih.gov/pubmed/24005882>

Ferraresi C, de Brito Oliveira T, de Oliveira Zafalon L, de Menezes Reiff RB, Baldissera V, de Andrade Perez SE, et al. Effects of low-level laser therapy (808 nm) on physical strength training in humans. *Lasers Med Sci* . 2011; 26(3): 349–358. Epub 2010/11/19. 808 nm 140 s

<https://www.ncbi.nlm.nih.gov/pubmed/21086010>

Vieira WH, Ferraresi C, Perez SE, Baldissera V, and Parizotto NA. Effects of low-level laser therapy (808 nm) on isokinetic muscle performance of young women subjected to endurance training: A randomized controlled clinical trial. *Lasers Med Sci* . 2012; 27(2): 497–504. Epub 2011/08/27. 808 nm n/a

<https://www.ncbi.nlm.nih.gov/pubmed/21870127>

Kelencz CA, Munoz IS, Amorim CF, and Nicolau RA. Effect of low-power gallium-aluminum-arsenium noncoherent light(640 nm) on muscle activity: A clinical study. *Photomed Laser Surg* . 2010; 28(5): 647–652. Epub 2010/10/22 640 nm 60 s

<https://www.ncbi.nlm.nih.gov/pubmed/20961231>

Paolillo FR, Milan JC, Aniceto IV, Barreto SG, Rebelatto JR, Borghi-Silva A, et al. Effects of infrared-LED illumination applied during high-intensity treadmill training in postmenopausal women. *Photomed Laser Surg* . 2011; 29(9): 639–645. Epub 2011/07/14 (850 nm treatment time 30 min)

<https://www.ncbi.nlm.nih.gov/pubmed/21749263>

## **Muscle performance and accelerate recovery**

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. red and infrared 16 tests

<https://www.ncbi.nlm.nih.gov/pubmed/24249354>

Muscle performance and accelerate recovery 905, 975 and 640 (3 weeks, 17 sites, 3, 10, 30, and 60 minutes) Photobiomodulation Therapy Improves Performance and Accelerates Recovery of High-Level Rugby Players in Field Test: A Randomized, Crossover, Double-Blind, Placebo-Controlled Clinical Study.

<https://www.ncbi.nlm.nih.gov/pubmed/27050245>

## **Sports Recovery**

Photobiomodulation Therapy Improves Performance and Accelerates Recovery of High-Level Rugby Players in Field Test: A Randomized, Crossover, Double-Blind, Placebo-Controlled Clinical Study (905 nm, 875nm, and 640nm- 3 weeks, 17 sites, 3, 10, 30, and 60 minutes)

<https://www.ncbi.nlm.nih.gov/pubmed/27050245>

Using Pre-Exercise Photobiomodulation Therapy Combining Super-Pulsed Lasers and Light-Emitting Diodes to Improve Performance in Progressive Cardiopulmonary Exercise Tests. (906 nm, 875nm, and 640nm 17 sites)  
<https://www.ncbi.nlm.nih.gov/pubmed/26942660>

A new treatment protocol using photobiomodulation and muscle/bone/joint recovery techniques having a dramatic effect on a stroke patient's recovery: a new weapon for clinicians.(8 treatments, once per week for 1 hour)  
<https://www.ncbi.nlm.nih.gov/pubmed/22967677>

Phototherapy can reduce inflammation and pain in Achilles tendonitis.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=16371497&query\\_hl=29&itool=pub med docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16371497&query_hl=29&itool=pub med docsum)

Phototherapy can potentially be effective in treating tendinopathy.  
[http://www.ncbi.nlm.nih.gov/pubmed/19708800?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=90](http://www.ncbi.nlm.nih.gov/pubmed/19708800?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=90)

## **Tennis Elbow**

This study revealed that phototherapy is effective in relieving pain, and in improving the grip strength and subjective rating of physical function of patients with lateral epicondylitis.  
[http://www.ncbi.nlm.nih.gov/pubmed/17508839?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17508839?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

Therapeutic Effects of Phototherapy on Lateral Epicondylitis.  
[http://www.ncbi.nlm.nih.gov/pubmed/19874256?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=22](http://www.ncbi.nlm.nih.gov/pubmed/19874256?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=22)

Effects of phototherapy in the treatment of lateral epicondylitis.  
[http://www.ncbi.nlm.nih.gov/pubmed/17603862?ordinalpos=20&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17603862?ordinalpos=20&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

A systematic review with procedural assessments and meta-analysis of phototherapy in lateral elbow tendinopathy (tennis elbow).  
[http://www.ncbi.nlm.nih.gov/pubmed/18510742?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18510742?ordinalpos=7&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

## **Raynaud's Syndrome**

Phototherapy reduces frequency and severity of Raynaud attacks.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=15570642&query\\_hl=18&itool=pub med DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15570642&query_hl=18&itool=pub med DocSum)



## **Multiple Sclerosis**

Muili, K. A., Gopalakrishnan, S., Eells, J. T., and Lyons, J. A. (2013). Photobiomodulation induced by 670 nm light ameliorates MOG35-55 induced EAE in female C57BL/6 mice: A role for remediation of nitrosative stress. PLoS ONE, 8, pp. E67358. 670 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/23840675>

Muili, K. A., Gopalakrishnan, S., Meyer, S. L., Eells, J. T., and Lyons, J.-A. (2012). Amelioration of experimental autoimmune encephalomyelitis in C57BL/6 mice by photobiomodulation induced by 670 nm light. PLoS ONE, 7, pp. E30655 670 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/22292010>

## **Parkinson's**

Neuroprotective Effects Against POCD by Photobiomodulation: Evidence from Assembly/Disassembly of the Cytoskeleton. been demonstrated in experimental models of macular degeneration, neurological, and cardiac conditions.  
<https://www.ncbi.nlm.nih.gov/pubmed/26848276>

670nm photobiomodulation as a novel protection against retinopathy of prematurity: evidence from oxygen induced retinopathy models. (670 nm 3 minutes a day)  
<https://www.ncbi.nlm.nih.gov/pubmed/23951291>

Photobiomodulation-induced changes in a monkey model of Parkinson's disease: changes in tyrosine hydroxylase cells and GDNF expression in the striatum.  
<https://www.ncbi.nlm.nih.gov/pubmed/28299414>

## **Brain**

660 nm red light-enhanced bone marrow mesenchymal stem cell transplantation for hypoxic-ischemic brain damage treatment (660 7 treatments, 7 consecutive days 24 hours per day)  
<https://www.ncbi.nlm.nih.gov/pubmed/25206807>

Shining light on the head: Photobiomodulation for brain disorders. (ABSTRACT)  
<https://www.ncbi.nlm.nih.gov/pubmed/27752476>

Significant Improvement in Cognition in Mild to Moderately Severe Dementia Cases Treated with Transcranial Plus Intranasal Photobiomodulation: Case Series Report. (810 nm 12 weeks)  
<https://www.ncbi.nlm.nih.gov/pubmed/28186867>

## **Traumatic Brain Injury**

Transcranial, Red/Near-Infrared Light-Emitting Diode Therapy to Improve Cognition in Chronic Traumatic Brain Injury. 633 (18 treatments, 3 times per week for 6 weeks, 9 min 45 sec each application)  
<https://www.ncbi.nlm.nih.gov/pubmed/28001756>

## Thyroid

Assessment of the effects of low-level laser therapy on the thyroid vascularization of patients with autoimmune hypothyroidism by color Doppler ultrasound. (n/a 10 treatments)

<https://www.ncbi.nlm.nih.gov/pubmed/23316383>

Effects of low-level laser therapy on the serum TGF- $\beta$ 1 concentrations in individuals with autoimmune thyroiditis. (830 nm 10 treatments)

<https://www.ncbi.nlm.nih.gov/pubmed/25101534>

Low-level laser in the treatment of patients with hypothyroidism induced by chronic autoimmune thyroiditis: a randomized, placebo-controlled clinical trial. (830 nm 10 treatments)

<https://www.ncbi.nlm.nih.gov/pubmed/22718472>

## Lungs

The chemokines secretion and the oxidative stress are targets of low-level laser therapy in allergic lung inflammation.

<https://www.ncbi.nlm.nih.gov/pubmed/27649282>

Laser Therapy Inhibits Tumor Growth in Mice by Promoting Immune Surveillance and Vessel Normalization. (abstract did not indicate what level laser therapy)

<https://www.ncbi.nlm.nih.gov/pubmed/27475897>

"Quantum Leap" in Photobiomodulation Therapy Ushers in a New Generation of Light-Based Treatments for Cancer and Other Complex Diseases: Perspective and Mini-Review. age related macular degeneration, diabetic retinopathy, glaucoma, retinitis pigmentosa) and the central nervous system (e.g., Alzheimer's and Parkinson's disease).

<https://www.ncbi.nlm.nih.gov/pubmed/26890728>

Low-level light therapy potentiates NPe6-mediated photodynamic therapy in a human osteosarcoma cell line via increased ATP. (810nm and 652nm 2 hours)

<https://www.ncbi.nlm.nih.gov/pubmed/25462575>

Exploring the effects of low-level laser therapy on fibroblasts and tumor cells following gamma radiation exposure. (infra red 24 hours)

<https://www.ncbi.nlm.nih.gov/pubmed/27322660>

Low-level laser therapy/photobiomodulation in the management of side effects of chemoradiation therapy in head and neck cancer: part 2: proposed applications and treatment protocols. (633 and 685nm or 780-830nm two to three times a week up to daily)

<https://www.ncbi.nlm.nih.gov/pubmed/26984249>

## HEART

Arrest of progression of pre-induced abdominal aortic aneurysm in apolipoprotein E-deficient mice by low level laser phototherapy. (780 nm 4 weeks, 9 minutes)

<https://www.ncbi.nlm.nih.gov/pubmed/25409657>

## Laser Acupuncture

Litscher, G., Wang, L., Wang, X., and Gaischek, I. (2013). Laser acupuncture: Two acupoints (Baihui, Neiguan) and two modalities of laser (658 nm, 405 nm) induce different effects in neurovegetative parameters. *Evid Based Complement Alternat Med*, doi:10.1155/2013/432764. 405 nm, 658 nm 10 minutes  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3686055/>

Cafaro, A., Arduino, P. G., Gambino, A., Romagnoli, E., and Broccoletti, R. (2015). Effect of laser acupuncture on salivar flow rate in patients with Sjögren's syndrome. *Lasers Med Sci*, 30(6),pp. 1805–1809. 650 nm 120 s per acupoint  
<https://www.ncbi.nlm.nih.gov/pubmed/24820476>

Ferreira, D. C. A., De Rossi, A., Torres, C. P., Galo, R., PaulaSilva, F. W. G., and Queiroz, A. M. (2014). Effect of laser acupuncture and auricular acupressure in a child with trismus as a sequela of medulloblastoma. *Acupunct Med*, 32, pp.190–193 n/a n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/24384541>

Sutalangka, C., Wattanathorn, J., Supaporn, M., Thukhammee, W., Wannanon, P., and Tong-un, T. (2013). Laser acupuncture improves memory impairment in an animal model of Alzheimer's disease. *J Acupunc Meridian Stu*, 6(5), pp. 247–251. 405 nme daily for 10 minutes for a period of 14 days  
<https://cyberleninka.org/article/n/128980.pdf>

Adamskaya, N., Dungal, P., Mittermayr, R., Hartinger, J., Feichtinger, G., Wassermann, K., Redl, H., and van Griensven, M. (2011). Light therapy by blue LED improves wound healing in an excision model in rats. *Injury*, 42(9), pp. 917–921 470 nm, 630nm five consecutive days for 10 min  
<https://www.ncbi.nlm.nih.gov/pubmed/22081819>

## Eye Disease

Photobiomodulation with 670 nm light increased phagocytosis in human retinal pigment epithelial cells. (670 8 treatments, twice a day, 250 s/per time for 4 d.)  
<https://www.ncbi.nlm.nih.gov/pubmed/26321863>

## Visual System

Albarracin, R., and Valter, K. (2012b). Treatment with 670 nm light protects the cone photoreceptors from white light induced degeneration. *Adv. Exp. Med. Biol.*, 723, 121–128 670 nm 15 min per day for 34 weeks  
[https://www.researchgate.net/publication/272517333\\_A\\_safety\\_and\\_feasibility\\_study\\_of\\_the\\_use\\_of\\_670\\_nm\\_red\\_light\\_in\\_premature\\_neonates](https://www.researchgate.net/publication/272517333_A_safety_and_feasibility_study_of_the_use_of_670_nm_red_light_in_premature_neonates)

Albarracin, R., Natoli, R., Rutar, M., Valter, K., and Provis, J. (2013). 670 nm light mitigates oxygen-induced degeneration in the C57BL/6J mouse retina. *BMC Neurosci.*, 14 125–130. (670 nm once daily for 5 consecutive days)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4015810/>

Begum, R., Powner, M.B., Hudson, N., Hogg, C., and Jeffery, G. (2013). Treatment with 670 nm light upregulates cytochrome c oxidase expression and reduces inflammation in an age-related macular degeneration model. PLoS ONE, 8, e57828. (670 nm 6 minutes twice a day for 14 days)

<https://www.ncbi.nlm.nih.gov/pubmed/23469078>

Fitzgerald, M., Bartlett, C.A., Payne, S.C., Hart, N.S., Rodger, J., Harvey, A.R., and Dunlop, S.A. (2010). Near infrared light reduces oxidative stress and preserves function in CNS tissue vulnerable to secondary degeneration following partial transection of the optic nerve. J. Neurotrauma, 27, 2107–2119. (670 nm 30 min exposure)

<https://www.ncbi.nlm.nih.gov/pubmed/20822460>

Fitzgerald, M., Hodgetts, S., van den Heuvel, C., Natoli, R., Hart, N., Valter, K., Harvey, A.R., Vink, R., Provis, J., and Dunlop, S.A. (2013) Red/near infrared irradiation therapy for treatment of central nervous system injuries and disorders. Rev. Neurosci., 24, 205–226 670 and 830nm n/a

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4126771/>

Ishiguro, M., Ikeda, K., and Tomita, K. (2010). Effect of near infrared light-emitting diodes on nerve regeneration. J. Orthop. Sci., 15, 233–239 (660 nm 1 h per day for 3 weeks)

<https://www.ncbi.nlm.nih.gov/pubmed/20358337>

Ivandic, B.T., and Ivandic, T. (2008) Low-level laser therapy improves vision in patients with age-related macular degeneration. Photomed. Laser Surg., 26, 241–245 (780 nm 40s)

<https://www.ncbi.nlm.nih.gov/pubmed/18588438>

Karu, T.I., Pyatibrat, L.V., Kolyakov, S.F., and Afanasyeva, N.I. (2008). Absorption measurements of cell monolayers relevant to mechanisms of laser phototherapy: Reduction or oxidation of cytochrome c oxidase under laser radiation at 632.8 nm. Photomed. Laser Surg. 26, 593–599 632.8 nm 10s

<https://www.ncbi.nlm.nih.gov/pubmed/19099388>

Kokkinopoulos, I., Colman, A., Hogg, C., Heckenlively, J., and Jeffery, G. (2012). Age-related retinal inflammation is reduced by 670 nm light via increased mitochondrial membrane potential. Neurobiol. Aging, 34, 602–609 (670 nm five 90-second exposures over 35 hours.)

<https://www.ncbi.nlm.nih.gov/pubmed/22595370>

Liang, H.L., Whelan, H.T., Eells, J.T., and Wong-Riley, M.T. (2008). Nearinfrared light via light-emitting diode treatment is therapeutic against rotenone- and 1-methyl-4-phenylpyridinium ion-induced neurotoxicity. Neuroscience, 153, 963–974 n/a n/a

<https://www.ncbi.nlm.nih.gov/pubmed/18440709>

Natoli, R., Valter, K., Barbosa, M., Dahlstrom, J., Rutar, M., Kent, A., and Provis, J. (2013). 670 nm photobiomodulation as a novel protection against retinopathy of prematurity: Evidence from oxygen-induced retinopathy models. PLoS ONE, 8, e72135 670 nm 3 minutes a day

<https://www.ncbi.nlm.nih.gov/pubmed/23951291>

Rutar, M., Natoli, R., Albarracin, R., Valter, K., and Provis, J. (2012). 670 nm light treatment reduces complement propagation following retinal degeneration. J. Neuroinflamm., 9, 257–263. (670 nm 3 minutes daily over 5 days)

<https://www.ncbi.nlm.nih.gov/pubmed/23181358>

Szymanski, C.R., Chiha, W., Morellini, N., Cummins, N., Bartlet, C.A., O'Hare Doig, R.L., Savigni, D.L., Payne, S.C., Harvey, A.R., Dunlop, S.A., and Fitzgerald, M. (2013). Paranode abnormalities and oxidative stress in optic nerve vulnerable to secondary degeneration: Modulation by 670nm light treatment. PLoS ONE, 8, e66448 (670 nm 30 minutes per day)  
<https://www.ncbi.nlm.nih.gov/pubmed/23840470>

## Visual Retinal

Mitochondrial signal transduction in accelerated wound and retinal healing by near-infrared light therapy. (630-1000 nm n/a)  
<https://www.ncbi.nlm.nih.gov/pubmed/16120414>

Photobiomodulation reduces drusen volume and improves visual acuity and contrast sensitivity in dry age related macular degeneration. (590 nm, 670nm, and 790nm 3 weeks)  
<https://www.ncbi.nlm.nih.gov/pubmed/27989012>

Near-Infrared Photobiomodulation in Retinal Injury and Disease.  
<https://www.ncbi.nlm.nih.gov/pubmed/26427443>

Treatment of dry Age-related Macular Degeneration with Photobiomodulation (670nm 88 +/- 8 seconds.)  
<http://lumithera.com/wp-content/uploads/2014/04/TORPA-Clinical-Study.pdf>

Near-Infrared Photobiomodulation in Retinal Injury and Disease (abstract)  
<https://www.ncbi.nlm.nih.gov/pubmed/26427443>

## Arthritis

Hagiwara S, Iwasaka H, Hasegawa A, et al. Pre-irradiation of blood by gallium aluminum arsenide (830nm) low-level laser enhances peripheral endogenous opioid analgesia in rats. Anesth Analg . 2008; 107: 1058–1063 830 nm n/a  
<https://www.ncbi.nlm.nih.gov/pubmed/18713929>

Kamrava SK, Farhadi M, Rezvan F, et al. The histological and clinical effects of 630 nanometer and 860 nanometer low level laser on rabbits' ear punch holes. Lasers Med Sci . 2009; 24(6):949–954. 980 nm three minutes for 21 days  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5853997/>

Carlos FP, de Paula Alves da Silva M, de Lemos Vasconcelos Silva Melo E, et al. Protective effect of low-level laser therapy (LLLT) on acute zymosan-induced arthritis. Lasers Med Sci . 2014; 29: 757–763 659 nm 10 s  
<https://www.ncbi.nlm.nih.gov/pubmed/23933663>

Chow R, Armati P, Laakso EL, et al. Inhibitory effects of laser irradiation on peripheral mammalian nerves and relevance to analgesic effects: A systematic review. Photomed Laser Surg . 2011; 29: 365–381

<https://www.ncbi.nlm.nih.gov/pubmed/21456946>

Jang H, Lee H. Meta-analysis of pain relief effects by laser irradiation on joint areas. *Photomed Laser Surg* . 2012; 30: 405–417. 633 to 1000 nm 1 to 300 s

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3412059/>

Phototherapy significantly reduces pain and improves health status in chronic joint disorders.

[http://www.ncbi.nlm.nih.gov/pubmed/12775206?ordinalpos=20&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/12775206?ordinalpos=20&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

## **Osteoarthritis**

This study demonstrated that applications of phototherapy was a safe and effective method in treatment of knee osteoarthritis.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&listuids=14677160&query\\_hl=18&itool=pub med\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&listuids=14677160&query_hl=18&itool=pub med_DocSum)

Phototherapy reduces pain in knee osteoarthritis and improves microcirculation in the treated area.

[http://www.ncbi.nlm.nih.gov/pubmed/19530911?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum&ordinalpos=145](http://www.ncbi.nlm.nih.gov/pubmed/19530911?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=145)

## **Frozen Shoulder Pain**

Phototherapy was effective in reducing pain and disability scores with frozen shoulder.

[http://www.ncbi.nlm.nih.gov/pubmed/18341417?ordinalpos=34&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/18341417?ordinalpos=34&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

## **Carpal Tunnel Syndrome**

Phototherapy was effective in treating carpal tunnel syndrome pain.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&listuids=12098159&query\\_hl=29&itool=pub med docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&listuids=12098159&query_hl=29&itool=pub med docsum)

Phototherapy was proven to be an effective and noninvasive treatment modality for carpal tunnel syndrome.

[http://www.ncbi.nlm.nih.gov/pubmed/17334675?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DiscoveryPanel.Pubmed\\_Discovery\\_RA&linkpos=2&log\\$=relatedarticles&logdbfrom=pubmed](http://www.ncbi.nlm.nih.gov/pubmed/17334675?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_Discovery_RA&linkpos=2&log$=relatedarticles&logdbfrom=pubmed)

Phototherapy is effective in treating carpal tunnel syndrome paresthesia and numbness and improves the subjects' power of hand grip and electrophysiological parameters.

[http://www.ncbi.nlm.nih.gov/pubmed/18754533?ordinalpos=8&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed](http://www.ncbi.nlm.nih.gov/pubmed/18754533?ordinalpos=8&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed)

## [d\\_RVDocSum](#)

Phototherapy is a promising new, conservative treatment for mild/moderate carpal tunnel syndrome cases.

[http://www.ncbi.nlm.nih.gov/pubmed/16706688?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DiscoveryPanel.Pubmed\\_Discovery\\_RA&linkpos=5&log\\$=relatedreviews&logdbfrom=pubmed](http://www.ncbi.nlm.nih.gov/pubmed/16706688?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_Discovery_RA&linkpos=5&log$=relatedreviews&logdbfrom=pubmed)

## **Nerve**

Phototherapy in treatment of long-term incomplete peripheral nerve injury: a randomized double-blind placebo-controlled study.

[http://www.ncbi.nlm.nih.gov/pubmed/17975958?ordinalpos=44&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17975958?ordinalpos=44&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

## **Dental**

De Medeiros, J. S., Vieira, G. F., and Nishimura, P. Y. 2005. Laser application effects on the bite strength of the masseter muscle, as an orofacial pain treatment. *Photomed Laser Surg*, 23,373–376. n/a n/a

<https://www.ncbi.nlm.nih.gov/pubmed/16144479>

Tanboga, I., Eren, F., Altinok, B., Peker, S., and Ertugral, F. 2011. The effect of low level laser therapy on pain during dental tooth-cavity preparation in children. *Eur Arch Paediatr Dent*, 12, 93–95. 980 nm 20 seconds, single dose, 44 participants

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5775948/>

Eren, F., Altinok, B., Ertugral, F., and Tanboga, I. 2013. The effect of erbium, chromium:yttrium-scandium-galliumgarnet (Er,Cr:Ysgg) laser therapy on pain during cavity preparation in paediatric dental patients: A pilot study. *Oral Health Dent Manag*, 12, 80–84. n/a n/a

<https://www.ncbi.nlm.nih.gov/pubmed/23756423>

Phototherapy seemed to be conducive to the reduction of long-standing sensory nerve impairment following third molar surgery.

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&listuids=16480503&query\\_hl=18&itool=pub\\_med\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&listuids=16480503&query_hl=18&itool=pub_med_docsum)

Phototherapy has positive effects in orthodontic patient.

[http://www.ncbi.nlm.nih.gov/pubmed/16979496?ordinalpos=22&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_DefaultReportPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/16979496?ordinalpos=22&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum)

## **TMD**

Phototherapy can be a supportive therapy in the treatment of TMD  
<http://www.ncbi.nlm.nih.gov/pubmed/20976388>

Effectiveness of phototherapy in temporomandibular disorder.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list\\_uids=12737331&query\\_hl=18&itool=pub\\_med\\_DocSum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12737331&query_hl=18&itool=pub_med_DocSum)

Results show that phototherapy is an effective therapy for the pain control of subjects with temporomandibular disorder.  
[http://www.ncbi.nlm.nih.gov/pubmed/17696035?ordinalpos=174&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/pubmed/17696035?ordinalpos=174&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum)

Phototherapy is an important tool to treat disorders of the maxillofacial region.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list\\_uids=9796491&query\\_hl=1&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=9796491&query_hl=1&itool=pubmed_docsum)

Phototherapy is an important tool and brings many benefits for the treatment of many disorders of the maxillofacial region.  
[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list\\_uids=9612167&query\\_hl=1&itool=pubmed\\_docsum](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=9612167&query_hl=1&itool=pubmed_docsum)