WETENSCHAPPELIJKE EVIDENTIE PEMF

* Approved by FDA in 1979 for T/t of fractures and non-union fractures
* “PMFT at least as effective as further surgery in cases of non-union with an overall success rate of 81% against 82% for surgery, although infected non-unions showed a success rate of 81% for PMFT against 69% for surgery” ***Gossling et al 1992.***
* In a large group of long-term non-unions and failed arthrodeses (average non-union 4.7 yrs) who had extensive surgical failure(3.4 previous surgical failures) and relatively high infection rate (35%), bony healing took place in 75% of the patients treated with PMFT ***Bassett et al 1982***
* In a double-blind prospective study of lumbar inter-body fusions, PMFT group had 92% healing rate whereas non-PMFT group had only 65% healed. ***Mooney V. Spine***
* Similar study in 2000 showed 97.6% fusion rate in PMFT group but only 52.6% in control group. ***Marks RA. 2000***
* Systematic literature review naar  de "Therapeutic effects of whole-body devices applying pulsed electromagnetic fields (PEMF)”. ***Hug en collega’s 2012***

BIOLOGICAL EFFECTS OF LASER

* 300% increase in ALP expression in rat femoral fractures. ***Dickson et al The Queens Uni., Belfast***
* Effect appears to be photo-chemical – NOT thermic
* Activates mitochondrial respiratory chain components
* Increases electron transfer in cytochrome oxidase  
  (Cytochrome oxidase is key photo-acceptor of light in NIR spectral range)
* Increases levels of ATP synthesis in isolated mitochondria
* Increases osteoblast activity and reduces osteoclast activity   
  ***Yaakobi + Oron Tel Aviv Uni.***
* Weight percentages of Ca and P increased – P= 0.037 Ca and P= 0.034 P  
  ***Khadra M et al 2004***

**Hoofd**

* Gottschling, S., Meyer, S., Gribova, I., Distler, L., Berrang, J., Gortner, L., & Shamdeen, M. G. (2008, 15 juli). Laser acupuncture in children with headache: a double-blind, randomized, bicenter, placebo-controlled trial. *Pain*, *137*(2), 405-412.

**Nek**

* Chow, R. T., Johnson, M. I., Lopes-Martins, R. A. B., & Bjordal, J. M. (2009, 05 december). 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. *The Lancet*, *374*(9705), 1897-1908.
* Ozdemir, F., Birtane, M., & Kokino, S. (2001). The clinical efficacy of low-power laser therapy on pain and function in cervical osteoarthritis.. *Clinical Rheumatology*, *20*(3), 181-184.
* Soriano, F. A., Ríos, R., Pedrola, M., Giagnorio, J., & Battagliotti, C. R. (1996, januari). Acute cervical pain is relieved with gallium-arsenide (GaAs) laser irradiation. A double-blind preliminary study.. *Laser Therapy*, *8*(2), 149-154.

**Schouder**

* Ip, D., & Fu, N. Y. (2015, mei). Two-year follow-up of low-level laser therapy for elderly with painful adhesive capsulitis of the shoulder.. *Journal of Pain Research*, *8*, 247-252.
* Stergioulas, A. (2008, april). Low-power laser treatment in patients with frozen shoulder: preliminary results.. *Photomedicine and Laser Surgery*, *26*(2), 99-105.
* England, S., Farrell, A. J., Coppock, J. S., Struthers, G., & Bacon, P. A. (1998, februari). Low Power Laser Therapy of Shoulder Tendonitis. *Scandinavian Journal of Rheumatology*, *18*(6), 427-431.

**Elleboog**

* Emanet, S. K., Altan, L. I., & Yurtkuran, M. (2010, juni). Investigation of the effect of GaAs laser therapy on lateral epicondylitis..*Photomedicine and Laser Surgery*, *28*(3), 397-403.
* Bjordal, J. M., Lopes-Martins, R. A. B., Joensen, J., Couppe, C., Ljunggren, A. E., Stergioulas, A., & Johnson, M. I. (2008, 29 mei). A systematic review with procedural assessments and meta-analysis of Low Level Laser Therapy in lateral elbow tendinopathy (tennis elbow). *BMC Musculoskeletal Disorders*, *9*(75), 1-15.
* Lam, L. K., & Cheing, G. L. (2007, april). Effects of 904-nm low-level laser therapy in the management of lateral epicondylitis: a randomized controlled trial. *Photomedicine and Laser Surgery*, *25*(2), 65-71.
* Simunovic, Z., Trobonjaca, T., & Trobonjaca, Z. (1998, juni). Treatment of medial and lateral epicondylitis–tennis and golfer’s elbow–with low level laser therapy: a multicenter double blind, placebo-controlled clinical study on 324 patients.. *Journal of Clinical Laser Medicine & Surgery*, *16*(3), 145-151.

**Rug**

* Konstantinovic, L. M., Kanjuh, Z. M., Milovanovic, A. N., Cutovic, M. R., Djurovic, A. G., Savic, V. G., & Milovanovic, N. D. (2010, 12 augustus). Acute low back pain with radiculopathy: a double-blind, randomized, placebo-controlled study.. *Photomedicine and Laser Surgery*, *28*(4), 553-560.
* Gur, A., Karakoc, M., Cevik, R., Nas, K., & Sarac, A. J. (2003). Efficacy of low power laser therapy and exercise on pain and functions in chronic low back pain.. *Lasers in Surgery and Medicine*, *32*(3), 233-238.
* Soriano, F., & Ríos, R. (1998, januari). Gallium Arsenide Laser Treatment of Chronic Low Back Pain: A Prospective, Randomized and Double Blind Study. *Laser Therapy*, *10*(4), 175-180.

**Knie**

* Nakamura, T., Ebihara, S., Ohkuni, I., Izukura, H., Harada, T., Ushigome, N., … Kubota, A. (2014, 27 december). Low Level Laser Therapy for chronic knee joint pain patients. *Laser Therapy*, *23*(4), 273-277.
* Al Rashoud, A. S., Abboud, R. J., Wang, W., & Wigderowitz, C. (2014, september). Efficacy of low-level laser therapy applied at acupuncture points in knee osteoarthritis: a randomised double-blind comparative trial.. *Physiotherapy*, *100*(3), 242-248.
* Baroni, B. M., Leal Junior, E. C., De Marchi, T., Lopes, A. L., Salvador, M., & Vaz, M. A. (2010, november). Low level laser therapy before eccentric exercise reduces muscle damage markers in humans. *European Journal of Applied Physiology*, *110*(4), 789-796.
* Hegedus, B., Viharos, L., Gervain, M., & Gálfi, M. (2009, augustus). The effect of low-level laser in knee osteoarthritis: a double-blind, randomized, placebo-controlled trial. *Photomedicine and Laser Surgery*, *27*(4), 577-584.
* Bjordal, J. M., Johnson, M. I., Lopes-Martins, R. A. B., Bogen, B., Chow, R., & Ljunggren, A. E. (2007, 22 juni). Short-term efficacy of physical interventions in osteoarthritic knee pain. A systematic review and meta-analysis of randomised placebo-controlled trials. *BMC Musculoskeletal Disorders*, *8*(51), 1-14.

**Enkel**

* Stergioulas, A., Stergioula, M., Aarskog, R., Lopes-Martins, R. A.B., & Bjordal, J. M. (2008, mei). Effects of low-level laser therapy and eccentric exercises in the treatment of recreational athletes with chronic achilles tendinopathy. *The American Journal of Sports Medicine*, *36*(5), 881-887.
* Bjordal, J. M., Johnson, M. I., Lopes-Martins, R. A. B., Bogen, B., Chow, R., & Ljunggren, A. E. (2006, januari). A randomised, placebo controlled trial of low level laser therapy for activated Achilles tendinitis with microdialysis measurement of peritendinous prostaglandin E2 concentrations. *British Journal of Sports Medicine*, *40*(1), 76-80.
* Stergioulas, A. (2004, april). Low-level laser treatment can reduce edema in second degree ankle sprains. *Journal of Clinical Laser Medicine & Surgery*, *22*(2), 125-128.

**Algemeen**

* Douris, P., Southard, V., Ferrigi, R., Grauer, J., Katz, D., Nascimento, C., & Podbielski, P. (2006, juni). Effect of phototherapy on delayed onset muscle soreness.. *Photomedicine and Laser Surgery*, *24*(3), 377-382.
* Bjordal, J. M., Couppé, C., & Ljunggren, A. E. (2001, mei). Low Level Laser Therapy for Tendinopathy. Evidence of A Dose–Response Pattern. *Physical Therapy Reviews*, *6*(2), 91-99.
* Simunovic, Z. (1996, augustus). Low Level Laser Therapy with Trigger Points Technique: A Clinical Study on 243 Patients. *Journal of Clinical Laser Medicine & Surgery*, *14*(4), 163-167.

**Pijn**

* Bjordal, J. M., Johnson, M. I., Iversen, V., Aimbire, F., & Lopes-Martins, R. A. B. (2006, 17 mei). Low-Level Laser Therapy in Acute Pain: A Systematic Review of Possible Mechanisms of Action and Clinical Effects in Randomized Placebo-Controlled Trials.*Photomedicine and Laser Surgery*, *24*(2), 158-168.

**Fibromyalgie**

* Ruaro, J. A., Fréz, A. R., Ruaro, M. B., & Nicolau, R. A. (2014, 07 mei). Low-level laser therapy to treat fibromyalgia. *Lasers in Medical Science*, *29*(6), 1815-1819.
* Gur, A., Karakoc, M., Nas, K., Cevik, R., Sarac, J., & Ataoglu, S. (2002, september). Effects Of Low Power Laser And Low Dose Amitriptyline Therapy On Clinical Symptoms And Quality Of Life In Fibromyalgia: A Single-Blind, Placebo-Controlled Trial. *Rheumatology International*, *22*(5), 188-193.
* Gur, A., Karakoc, M., Nas, K., Cevik, R., Sarac, J., & Demir, E. (2002, januari). Efficacy Of Low Power Laser Therapy In Fibromyalgia: A Single-Blind, Placebo-Controlled Trial. *Lasers in Medical Science*, *17*(1), 57-61

Wetenschappelijke evidenties/ case studies van Proff. Dr. R. Saggini

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