

Effectiveness of low level laser therapy in treating various conditions

A rapid review

By

WorkSafeBC Evidence-Based Practice Group

Dr. Craig W. Martin, Senior Medical Advisor

November 2008

Effectiveness of low level laser therapy in treating various conditions

Background

Recently, the Evidence-Based Practice Group (EBPG) received a query regarding the effectiveness of chiropractic laser treatment. Following a search employing Google (http://www.google.ca/search?sourceid=navclient&ie=UTF-8&rlz=1T4ADBS_enCA284CA284&q=laser+chiropractic+treatment+british+columbia) and examination of several websites based in British Columbia, the EBPG found that the laser treatment offered by these chiropractic offices involves the application of low level laser (referred to by some practices as cold laser). Low level laser therapy (LLLT) is offered by various chiropractic offices to treat many conditions including:

- athletic injuries
- lower back pain
- knee and foot pain
- shoulder injuries
- carpal tunnel syndrome
- arthritis and muscle spasms
- relief of muscle and joint pain
- skin infections including cold sores, warts, and verruca
- relief of stiffness, promoting muscle relaxation
- wound treatment including ulcers, pressure sores, and burns
- soft tissue injuries including sprains and strains, tendonitis, and haematoma
- joint disorders including arthritis and tenosynovitis
- chronic pain including trigeminal neuralgia as well as chronic neck and back pain

Given the many conditions for which treatment by LLLT is being promoted, the EBPG conducted a rapid systematic review to investigate the effectiveness of LLLT on treating conditions as published in the literature.

Methods

- Systematic literature searches were performed on November 1, 2008. These searches were done on commercial databases, including the Cochrane Database of Systematic Reviews, ACP Journal Club, the York University (UK) Database of Abstracts of Reviews of Effects, the Cochrane Controlled Trial Registry, the York University (UK) based Health Technology Assessment database, the York University (UK) based NHS Economic Evaluation database, Ovid MEDLINE In-Process & Other Non-Indexed Citations, Ovid MEDLINE, and Ovid MEDLINE Daily Update. These databases are available through the OvidSP interface.
- The searches employed the simple keywords of “low level laser therapy OR low level laser treatment”.
- The searches were limited to studies conducted in human subjects as well as to studies published in the English language (or where at least the abstract was in English).
- These searches yielded 38 published articles.⁽¹⁻³⁸⁾ Four review articles,^(4,14,28,33) one of which was a Cochrane review,⁽¹⁴⁾ were identified. Of these 38 articles,⁽¹⁻³⁸⁾ 24^(1,3-7,11-14,16,20-23,25,28,31-33,35-38) were thought to be relevant and were retrieved in full for further appraisal.

Results

Our search identified the application of LLLT in treating various conditions including chronic leg ulcers,⁽¹⁾ diabetic foot ulcers,⁽³²⁾ venous ulceration,^(20,22) minor post surgical wounds,⁽²¹⁾ plantar fasciitis,⁽⁵⁾ delayed muscle soreness,^(3,11-13) lateral epicondylitis,⁽⁶⁾ low back pain,⁽⁷⁾ age-related macular degeneration,⁽¹⁶⁾ pain due to diabetic polyneuropathy,⁽³⁷⁾ pain in temporo-mandibular disorder,^(23,36) benign fibrotic lumps in the breast post reduction mammoplasty,⁽²⁵⁾ recurrent herpes labialis,⁽³¹⁾ rheumatoid arthritis,⁽³⁸⁾ and plantar calcaneal enthesophytosis.⁽³⁵⁾

1. Review articles

Of the four review articles,^(4,14,28,33) three^(4,28,33) were expert reviews (level of evidence 5 – see Appendix 1) on the various applications of LLLT and one⁽¹⁴⁾ was a Cochrane review (level of evidence 1) on the application of LLLT in treating plantar fasciitis. All of these reviews concluded that even though LLLT may be safe, its effectiveness in treating various disorders remains to be established. Crawford and Thomson⁽¹⁴⁾ explicitly concluded that there was no evidence on the effectiveness of LLLT in treating plantar fasciitis. It should be noted that Crawford and Thomson⁽¹⁴⁾ included the only randomized controlled trial (RCT) study available on the application of LLLT in treating plantar, by Basford et al.⁽⁵⁾

2. Primary studies

- Case series/reports (level of evidence 4)
 - In small case series/reports, LLLT has been applied in treating chronic leg ulcers,⁽¹⁾ age-related macular degeneration,⁽¹⁶⁾ diabetic foot ulcers,⁽³²⁾ venous ulceration,⁽²⁰⁾ and benign fibrotic lumps in the breast post reduction mammoplasty.⁽²⁵⁾

- With the exception of the application of LLLT in treating age-related macular degeneration,⁽¹⁶⁾ these studies showed positive outcomes on the application of LLLT in treating chronic leg ulcers,⁽¹⁾ diabetic foot ulcers,⁽³²⁾ venous ulceration,⁽²⁰⁾ and benign fibrotic lumps in the breast post reduction mammoplasty.⁽²⁵⁾ However, it should be strongly noted that these were either case reports or small case series (two cases) that have not been repeated by other studies. In the case of venous leg ulcers, a subsequent controlled trial⁽²²⁾ failed to provide evidence of its effectiveness.
- Randomized/controlled trials (level of evidence 1)
 - In randomized/controlled trials, LLLT did not show any evidence of its effectiveness in delaying the onset of muscle soreness,^(3,11-13) or in treating plantar fasciitis,⁽⁵⁾ lateral epicondylitis,⁽⁶⁾ pain due to diabetic polyneuropathy,⁽³⁷⁾ venous ulceration,⁽²²⁾ minor post surgical wounds,⁽²¹⁾ pain due to temporo-mandibular disorder,^(23,36) or rheumatoid arthritis.⁽³⁸⁾
 - LLLT was claimed to be effective in treating low back pain,⁽⁷⁾ recurrent herpes labialis,⁽³¹⁾ and plantar calcaneal enthesophytosis.⁽³⁵⁾ However, it should be strongly noted that these studies suffered from various basic flaws in data analysis including failure to account for confounders, multiple outcomes with multiple comparisons, and inappropriate statistical analysis/tests. It is likely that these flaws affected the results/conclusions presented in these studies.

Summary/conclusion

- In the last 15 years, LLLT has been applied in treating various conditions including chronic leg ulcers, diabetic foot ulcers, venous ulceration, minor post surgical wounds, plantar fasciitis, delayed muscle soreness, lateral epicondylitis, low back pain, age related macular degeneration, pain due to diabetic polyneuropathy, pain in temporo-mandibular disorders, benign fibrotic lumps in the breast post reduction mammoplasty, recurrent herpes labialis, rheumatoid arthritis, and plantar calcaneal enthesophytosis.
- At present, there is no evidence of the effectiveness of LLLT in delaying the onset of muscle soreness, or in treating plantar fasciitis, lateral epicondylitis, low back pain, recurrent herpes labialis, plantar calcaneal enthesophytosis, pain due to diabetic polyneuropathy, venous ulceration, minor post surgical wounds, pain due to temporo-mandibular disorder, or rheumatoid arthritis.
- There is very low level evidence (case report or small case series) on its effectiveness in treating chronic leg ulcers, diabetic foot ulcers, and benign fibrotic lumps in the breast post reduction mammoplasty.

References

1. Ashford R, Lagan K, Brown N, Howell C, Nolan C, Brady D, Walsh M. Low intensity laser therapy for chronic venous leg ulcers. *Nursing standard*. Oct 1999;14(3):66-70,72.
2. Azevedo LH, de Paula Eduardo F, Moreira MS, de Paula Eduardo C, Marques MM. Influence of different power densities of LILT on cultured human fibroblast growth: a pilot study. *Lasers in Medical Science*. Jul 2006;21(2):86-9.
3. Barlas P, Craig J, Baxter GD, Walsh DM, Allen JM. (.A double blind placebo controlled investigation of the effects of combined phototherapy/low intensity laser therapy upon delayed muscle soreness. 12th Intern Congress World Confed Physical Therapy. 1995;30:1088.
4. Basford JR. Low intensity laser therapy: still not an established clinical tool. *Lasers in Surgery & Medicine*. 1995;16(4):331-42.
5. Basford JR, Malanga GA, Krause DA, Harmsen WS. A randomized controlled evaluation of low-intensity laser therapy: plantar fasciitis. *Archives of Physical Medicine & Rehabilitation*. 1998;79(3):249-54.
6. Basford JR, Sheffield CG, Cieslak KR. Laser therapy: a randomized, controlled trial of the effects of low intensity Nd:YAG laser irradiation on lateral epicondylitis. *Archives of Physical Medicine & Rehabilitation*. 2000;81(11):1504-10.
7. Basford JR, Sheffield CG, Harmsen WS. Laser therapy: a randomized, controlled trial of the effects of low-intensity Nd:YAG laser irradiation on musculoskeletal back pain. *Archives of Physical Medicine & Rehabilitation*. 1999;80(6):647-52.
8. Bril V, Ngo M, Ng E, New P, Gogov S, Skandarajah S. The results of low-intensity laser-therapy for painful diabetic sensorimotor polyneuropathy. *Journal of the Peripheral Nervous System*. 2003;8:8.
9. Burduli NM, Gutnova SK. State of humoral immunity and phagocytic activity of neutrophils in patients with ulcer and effect of low-intensity laser therapy. *Experimental & Clinical Gastroenterology*. 2004;4:29-32.
10. Cambier D, Blom K, Witvrouw E, Ollevier G, De Muyenck M, Vanderstraeten G. The influence of low intensity infrared laser irradiation on conduction characteristics of peripheral nerve: A randomised, controlled, double blind study on the sural nerve. *Lasers in Medical Science*. 2000;15(3):195-200.
11. Craig JA, Barlas P, Baxter GD, Walsh DM, Allen JM. Delayed-onset muscle soreness: lack of effect of combined phototherapy/low-intensity laser therapy at low pulse repetition rates. *Journal of Clinical Laser Medicine & Surgery*. 1996;14(6):375-80.
12. Craig JA, Barlas P, Baxter GD, Walsh DM, et al. Delayed onset muscle soreness: effect of combined phototherapy/low intensity laser therapy at low pulse repetition rates. *Irish Journal of Medical Science*.

1994;163(2):97.

13. Craig JA, Barron J, Walsh DM, Baxter GD. Lack of effect of combined low intensity laser therapy/phototherapy (CLILT) on delayed onset muscle soreness in humans. *Lasers in Surgery and Medicine*. 1999;24(3):223-30.
14. Crawford F, Thomson C. Interventions for treating plantar heel pain. *Cochrane Database of Systematic Reviews* 2003, Issue 3. Art. No.: CD000416. DOI: 10.1002/14651858.CD000416.
15. Cruz DR, Kohara EK, Ribeiro MS, Wetter NU. Effects of low-intensity laser therapy on the orthodontic movement velocity of human teeth: a preliminary study. *Lasers in Surgery & Medicine*. 2004;35(2):117-20.
16. Figueroa M, Schocket LS, DuPont J, Metelitsina TI, Grunwald JE. Effect of laser treatment for dry age related macular degeneration on foveolar choroidal haemodynamics. *British Journal of Ophthalmology*. 2004;88(6):792-5.
17. Goranova V, Marinckiev M, Goranova M, Sapunarova K. Application of low intensity laser radiation in extravasal infiltrates caused by cytostatics in children with acute leukemia. *Folia Medica (Plovdiv)*. 1999;41(1):92-5.
18. Jones R, Gorvett T, Brenton K, Price D, Chung W. (Foot Study Group Meeting). A study examining the efficacy of low intensity laser therapy (LILT) in the management of diabetic foot ulcers. *Diabetic* 2002, 29 August - 1 September; Budapest, Hungary 2002.
19. Karu TI, Pyatibrat LV, Ryabykh TP. Nonmonotonic behavior of the dose dependence of the radiation effect on cells in vitro exposed to pulsed laser radiation at $\lambda = 820$ nm. *Lasers in Surgery & Medicine*. 1997;21(5):485-92.
20. Lagan KM, McDonough SM, Clements BA, Baxter GD. A case report of low intensity laser therapy (LILT) in the management of venous ulceration: potential effects of wound debridement upon efficacy. *Journal of Clinical Laser Medicine & Surgery*. 2000;18(1): 15-22.
21. Lagan KM, Clements BA, McDonough S, Baxter GD. Low intensity laser therapy (830nm) in the management of minor postsurgical wounds: a controlled clinical study. *Lasers in Surgery & Medicine*. 2001;28(1):27-32.
22. Lagan KM, McKenna T, Witherow A, Johns J, McDonough SM, Baxter GD. Low-intensity laser therapy/combined phototherapy in the management of chronic venous ulceration: a placebo-controlled study. *Journal of Clinical Laser Medicine & Surgery*. 2002;20(3):109-16.
23. Mazzetto MO, Carrasco TG, Bidinelo EF, de Andrade Pizzo RC, Mazzetto RG. Low intensity laser application in temporomandibular disorders: a phase I double-blind study. *Cranio*. 2007; 25(3):186-92.

24. Mokhtar B, Baxter GD, Walsh DM, Bell AJ, Allen JM. Double-blind, placebo-controlled investigation of the effect of combined phototherapy/low intensity laser therapy upon experimental ischaemic pain in humans. *Lasers in Surgery & Medicine*. 1995;17(1):74-81.
25. Nussbaum EL. Low-intensity laser therapy for benign fibrotic lumps in the breast following reduction mammoplasty. *Physical Therapy*. 1999;79(7):691-8.
26. Nussbaum EL, Lilge L, Mazzulli T. Effects of 810 nm laser irradiation on in vitro growth of bacteria: comparison of continuous wave and frequency modulated light. *Lasers in Surgery & Medicine*. 2002;31(5):343-51.
27. Rallis TR. Low-intensity laser therapy for recurrent herpes labialis.[comment]. *Journal of Investigative Dermatology*. 2000;115(1):131-2.
28. Reddy GK. Photobiological basis and clinical role of low-intensity lasers in biology and medicine. *Journal of Clinical Laser Medicine & Surgery*. 2004;22(2):141-50.
29. Saied GM, Kamel RM, Dessouki N. Low intensity laser therapy is comparable to bromocriptine-evening primrose oil for the treatment of cyclical mastalgia in Egyptian females. *Tanzania Health Research Bulletin*. 2007;9(3):196-201.
30. Saied GM, Kamel RM, Dessouki NR. The effect of mastectomy and radiotherapy for breast carcinoma on soft tissues of the shoulder and its joint mobility among Egyptian patients. *Tanzania Health Research Bulletin*. 2007;9(2):121-5.
31. Schindl A, Neumann R. Low-intensity laser therapy is an effective treatment for recurrent herpes simplex infection. Results from a randomized double-blind placebo-controlled study. *Journal of Investigative Dermatology*. 1999;113(2):221-3.
32. Schindl A, Schindl M, Pernerstorfer-Schon H, Kerschman K, Knobler R, Schindl L. Diabetic neuropathic foot ulcer: successful treatment by low-intensity laser therapy. *Dermatology*. 1999;198(3):314-6.
33. Schindl A, Schindl M, Pernerstorfer-Schon H, Schindl L. Low-intensity laser therapy: a review. *Journal of Investigative Medicine*. 2000;48(5):312-26.
34. Schindl A, Schindl M, Schindl L, Jurecka W, Honigsmann H, Breier F. Increased dermal angiogenesis after low-intensity laser therapy for a chronic radiation ulcer determined by a video measuring system. *Journal of the American Academy of Dermatology*. 1999;40(3):481-4.
35. Tikiz C, Unlu Z, Ay K, Tuzun C. Efficacy of low level laser treatment in plantar calcaneal enthesophytosis. *Journal of Rheumatology and Medical Rehabilitation*. 2006;17(1):8-15.
36. Venancio Rde A, Camparis CM, Lizarelli Rde F. Low intensity laser therapy in the treatment of temporomandibular disorders: a double-blind study. *Journal of Oral Rehabilitation*. 2005;32(11):800-7.

37. Zinman LH, Ngo M, Ng ET, New KT, Gogov S, Bril V. Low-intensity laser therapy for painful symptoms of diabetic sensorimotor polyneuropathy: a controlled trial. *Diabetes Care*. 2004;27(4):921-4.
38. Zvereva KV, Grunina EA. The negative effects of low-intensity laser therapy in rheumatoid arthritis. *Terapevticheskii arkhiv*. 1996;68(5):22-4.

Appendix 1

WorkSafeBC - Evidence-Based Practice Group Levels of Evidence ^(adapted from 1,2,3,4)

1	Evidence from at least 1 properly randomized controlled trial (RCT) or systematic review of RCTs.
2	Evidence from well-designed controlled trials without randomization or systematic reviews of observational studies.
3	Evidence from well-designed cohort or case-control analytic studies, preferably from more than 1 centre or research group.
4	Evidence from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments could also be included here.
5	Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees.

References

1. Canadian Task Force on the Periodic Health Examination: The periodic health examination. CMAJ. 1979;121:1193-1254.
2. Houston TP, Elster AB, Davis RM et al. The US Preventive Services Task Force Guide to Clinical Preventive Services, Second Edition. AMA Council on Scientific Affairs. American Journal of Preventive Medicine. May 1998;14(4):374-376.
3. Scottish Intercollegiate Guidelines Network (2001). SIGN 50: a guideline developers' handbook. SIGN. Edinburgh.
4. Canadian Task Force on Preventive Health Care. New grades for recommendations from the Canadian Task Force on Preventive Health Care. CMAJ. Aug 5, 2003;169(3):207-208.