Low level laser therapy for healing venous leg ulcers: a WHAM evidence summary

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CLINICAL QUESTION

What is the best available evidence for low level laser therapy (LLLT) for healing venous leg ulcers (VLUs)?

SUMMARY

Low level laser therapy is sometimes used as an adjunctive therapy for promoting healing in venous leg ulcers (VLUs). The therapy delivers light emissions to the wound bed to stimulate healing processes and to reduce inflammation[1-6]. However, the evidence on clinical effectiveness of LLLT demonstrated in the research is limited. *Level 1* evidence[1, 5, 7, 8] and showed variations in both wound healing outcomes, including complete wound healing, time to heal and reduction in VLU size. *Level 1* evidence[1, 5, 7] also showed variations in patient reported outcomes. Although no benefits for improving wound healing have been demonstrated in the identified research, there were also no delays in wound healing or adverse events, suggesting that it is probably safe to use LLLT as an adjunct therapy alongside gold standard treatment for VLUs (e.g., compression therapy and moisture managing dressings).

CLINICAL PRACTICE RECOMMENDATIONS

All recommendations should be applied with consideration to the wound, the person, the health professional and the clinical context.

There is insufficient evidence to make a recommendation on the use of low level laser therapy for healing venous leg ulcers.

SOURCES OF EVIDENCE

This summary was conducted using methods published by the Joanna Briggs Institute.[9-11] The summary is based on a systematic literature search combining search terms related to laser light therapy and VLUs. Searches were conducted in Embase, CINAHL, Medline, PubMed, the Cochrane Library and Google Scholar for evidence published from 2000 up to October 2024 in English.

BACKGROUND

Venous leg ulcers (VLUs) are wounds resulting from chronic venous insufficiency. Venous insufficiency causes sustained venous hypertension due to venous obstruction or venous valve dysfunction or both. As a result of changes in the venous and lymphatic systems, inflammation of the skin and ultimately skin breakdown in the form of an ulcer can occur[1]. Characterised by their slow healing process and recurrent nature, VLUs lead to significant morbidity, reduced quality of life and increased healthcare costs, posing a substantial challenge for patients and wound professionals[12, 13]. First-line treatment for VLUs is compression therapy, coupled with moisture-managing and/or antimicrobial wound dressings. However, in many cases conventional therapy fails to produce timely healing outcomes, leading to a need for effective adjunctive therapies[5]. Low level laser therapy has emerged as a potential non-invasive, adjunctive treatment for VLUs. The potential therapeutic effect of LLLT is based on theories suggesting specific low-power wavelengths of light can stimulate cellular processes, promoting healing through mechanisms such as increased collagen synthesis, enhanced angiogenesis, and reduced inflammation[1-6].

Table 1: Levels of evidence for intervention studies reporting on LLLT for VLU healing

Level 1 evidence	Level 2 evidence	Level 3 evidence	Level 4 evidence	Level 5 evidence
Experimental designs	**Quasi-experimental designs**	**Observational – analytic designs**	**Observational – descriptive studies**	**Expert Opinion/bench research**
1.c RCT[1, 5, 7, 8]	None	None	None	None

Low level lasers emit non-ionizing, polarized, monochromatic, coherent and collimated light, and are defined by their wavelength parameters (300 to 10,600 nm) and power (10^{-3} to 10^{-1} W)[1, 5]. They are sometimes described by their fluence, which is the amount of energy of each laser pulse per unit area.

CLINICAL EVIDENCE

Clinical evidence on LLLT for healing VLUs comes from four randomised controlled studies (RCTs) that were primarily at high risk of bias. The studies had small sample sizes and reported on different laser devices and treatment regimens (see Table 2).

VLU wound healing outcomes

A double-blinded RCT[8] at low risk of bias evaluated the effects of LLLT in healing VLUs. Participants (n=44) were randomised into three groups: LLLT group (n=17), non-laser placebo light therapy (n=17) and standard care only group (n=10). When comparing change in size of VLU between baseline and 90-day follow-up, the placebo group achieved the most significant improvement (p=0.011), while the control group showed no significant difference (p=0.066). The LLLT group had the least improvement over time, with no statistically significant decrease in VLU size (p=0.683)[8] (*Level 1*).

A RCT[1] by Vitse et al. (2017) at low risk of bias evaluated the effects of LLLT on VLUs in 24 adults. Both the intervention and control groups received standard wound care. The intervention group also received LLLT, while the placebo group received the same regimen using a sham laser. Complete wound closure was achieved for 23% of participants in the intervention group (n = 13) and 18% in the control group (n = 11). After 12 weeks, there was no statistically significant difference between the two groups in VLU complete healing (p = 1.0) or reduction in ulcer size (p = 0.80)[1] (*Level 1*).

A non-blinded RCT[5] at high risk of bias explored the effectiveness of LLLT in promoting VLU healing compared to standard care. Participants (n = 40) were randomised to either the intervention group that received standard care plus adjuvant LLLT or to the control group that received only compressive treatment and topical wound care. The study found that after 16 weeks, the LLLT group exhibited significantly higher rates of complete healing, (58.1% versus 35.8%, p = 0.031). The study also assessed wound characteristic clinical outcomes using the Nursing Outcome Classification Wound Healing: Secondary Intention and Tissue Integrity. The LLLT group showed statistically significantly better results for ulcer size (p = 0.01), scar formation (p = 0.034), granulation (p = 0.010), and exudate (p = 0.011)[5] (*Level 1*).

The fourth RCT[7] (n = 34) was at high risk of bias. The study evaluated the effectiveness of LLLT compared to standard VLU care. After nine weekly sessions, there were no statistically significant differences in time or healing (p < 0.05) or number of VLUs healed (p = 0.68). In the control group, the VLUs decreased to an average of 94.3% compared to 74.2% in the intervention group (p = 0.60)[7] (*Level 1*).

Patient reported outcomes

While one of the RCTs[1] above reported a significant decrease in wound pain levels from start of LLLT regimen until 4 weeks following completion of the 12-week LLLT (p < 0.01), the two other studies[5, 7] showed no statistically significant differences in pruritis[5], pain levels during LLLT treatment[7] or wound pain generally[5, 7] (*Level 1*).

One study[7] reported LLLT was well-tolerated and easy to administer, while another reported no differences compared to standard treatment for patient satisfaction[1] (*Level 1*).

CONSIDERATIONS FOR USE

There is variation in the way energy levels and power of LLLT devices are described. If using LLLT, ensure the medical device is approved for use and is used according to manufacturer's instructions and local policies.

Table 2. LLLT types and regimens reported in the research

Study	Country	Laser power and dose	Regimen	Level of evidence
Bavaresco & Lucena (2022)[5]	Brazil	Laser with 660 nm diodes with power of 30mW and an energy variation of 1–3 joules/cm² (device self-calculates irradiation time)	Not reported	Level 1.c
Kopera et al. (2005)[8]	Austria	Laser composed of 685nm diodes at a fluence of 200mW producing 4 joules/cm²	2 weeks of daily treatment then 2 weeks of alternate day treatment	Level 1.c
Leclère et al. (2010)[7]	France	Laser composed of 980nm diodes of 8 mm each with overall power of 15W, resulting fluence of 90 joules/cm²	Approximately 10-minute sessions, weekly sessions for 9 weeks	Level 1.c
Vitse et al. (2017)[1]	France	Laser composed of three 635nm diodes with power of 17.5mW optical output per diode, resulting fluence of 2.95 joules/cm² with an intensity of 2.46×10^{-3} watts/cm²	20-minute sessions, twice weekly, until complete wound healing or 12 consecutive weeks	Level 1.c

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CONFLICTS OF INTEREST

The author declares no conflicts of interest in accordance with International Committee of Medical Journal Editors (ICMJE) standards.

About wham evidence summaries

WHAM evidence summaries are consistent with methodology published in Munn Z, Lockwood C, Moola S. *The development and use of evidence summaries for point of care information systems: A streamlined rapid review approach*, Worldviews Evid Based Nurs. 2015;12(3):131-8. Methods are provided in detail in resources published by the Joanna Briggs Institute as cited in this evidence summary and on the WHAM website. WHAM evidence summaries undergo peer-review by an international multidisciplinary Expert Reference Group. More information: https://www.whamwounds.com

WHAM evidence summaries provide a summary of the best available evidence on specific topics and make suggestions that can be used to inform clinical practice. Evidence contained within this summary should be evaluated by appropriately trained professionals with expertise in wound prevention and management, and the evidence should be considered in the context of the individual, the professional, the clinical setting and other relevant clinical information.

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