

Photobiomodulation (PBM) / Low Level laser Therapy (LLLT)

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Notes:

Low level laser therapy for the management of breast cancer-related lymphedema: A randomized controlled feasibility study.

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OBJECTIVES: This study aimed to determine the feasibility of conducting a full scale randomized controlled trial investigating the effectiveness of low level laser therapy (LLLT), also known as photobiomodulation (PBM) therapy, used in addition to conventional therapy, for managing breast cancer related lymphedema (BCRL). **MATERIALS AND METHODS:** Patients with BCRL were recruited from the Southern District Health Board (New Zealand) via lymphedema therapists' referrals, and randomly allocated into either the laser group, which received BCRL conventional therapy (e.g., wearing compression garments, massage therapy, and/or exercise) plus a 6-week LLLT (PBM) intervention program (wavelength: 980/810 nm (80:20 ratio); output power: 500 mW beam spot size: 5 cm **RESULTS:** Over a 6-month recruitment window, 17 participants with BCRL were recruited in the study, and randomized into the two groups (recruitment rate of 81%, and randomization rate of 100%). Treatment adherence was high in the laser group (88.9% of participants completed all treatments). Retention rates were 88.9% for the laser group and 100% for the control group at both 6 and 12 weeks post-randomization. All participants who completed LLLT (PBM) treatment indicated that they were satisfied with the treatment. No serious adverse reactions were reported in this study. Clinical outcomes failed to show additional benefits of LLLT (PBM) intervention. **CONCLUSION:** This study demonstrated that it is feasible to conduct a fully powered RCT to definitively test the effectiveness of the additional use of LLLT (PBM) in the management of BCRL. For such a trial, 114 participants will be needed at baseline. Lasers Surg. Med. © 2018 Wiley Periodicals, Inc.

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Photobiomodulation or low-level laser therapy in the management of cancer therapy-induced mucositis, dermatitis and lymphedema.

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PURPOSE OR REVIEW: There is a large body of evidence supporting the efficacy of low-level laser therapy (LLLT) also known as PhotoBioModulation (PBM) when used for the prevention and/or treatment of oral mucositis in patients undergoing radiotherapy for head and neck cancer, or high-dose chemotherapy regimens. This review aims at giving the state of the art of this technique in this indication. **RECENT FINDINGS:** Recent advances in LLLT/PBM technology, together with a better understanding of mechanisms involved and dosimetric parameters may lead to the management of a broader range of complications associated with cancer treatment. This could enhance patient adherence to cancer therapy, and improve quality of life and treatment outcomes. **SUMMARY:** The article discusses LLLT/PBM mechanisms of action, dosimetry, and safety, and aims to identify some cancer treatment side-effects for which LLLT/PBM may prove to be effective (oral mucositis, radiation dermatitis, lymphedema). In addition, LLLT/PBM parameters for each of these complications are suggested and future research directions are discussed.

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Low level laser therapy (Photobiomodulation therapy) for breast cancer-related lymphedema: a systematic review.

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BACKGROUND: Breast cancer related lymphedema (BCRL) is a prevalent complication secondary to cancer treatments which significantly impacts the physical and psychological health of breast cancer survivors. Previous research shows increasing use of low level laser therapy (LLLT), now commonly referred to as photobiomodulation (PBM) therapy, for BCRL. This systematic review evaluated the effectiveness of LLLT (PBM) in the management of BCRL. **METHODS:** Clinical trials were searched in PubMed, AMED, Web of Science, and China National Knowledge Infrastructure up to November 2016. Two reviewers independently assessed the methodological quality and adequacy of LLLT (PBM) in these clinical trials. Primary outcome measures were limb circumference/volume, and secondary outcomes included pain intensity and range of motion. Because data were clinically heterogeneous, best evidence synthesis was performed. **RESULTS:** Eleven clinical trials were identified, of which seven randomized controlled trials (RCTs) were chosen for analysis. Overall, the methodological quality of included RCTs was high, whereas the reporting of treatment parameters was poor. Results indicated that there is strong evidence (three high quality trials) showing LLLT (PBM) was more effective than sham treatment for limb circumference/volume reduction at a short-term follow-up. There is moderate evidence (one high quality trial) indicating that LLLT (PBM) was more effective than sham laser for short-term pain relief, and limited evidence (one low quality trial) that LLLT (PBM) was more effective than no treatment for decreasing limb swelling at short-term follow-up. **CONCLUSIONS:** Based upon the current systematic review, LLLT (PBM) may be considered an effective treatment approach for women with BCRL. Due to the limited numbers of published trials available, there is a clear need for well-designed high-quality trials in this area. The optimal treatment parameters for clinical application have yet to be elucidated.

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Current Treatments for Breast Cancer-Related Lymphoedema: A Systematic Review

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Background and objective: Breast cancer-related lymphoedema (BCRL) is a disabling complication with long term impact on quality on life after breast cancer treatment. Its management remains a major challenge for patients and health care professionals; the goal of this overview was to summarize effects of different treatment strategies for patients with BCRL. **Methods:** A thorough search was undertaken to allow a systematic review or meta-analysis of treatments for BCRL. Two investigators independently selected studies and abstracted the data. **Results:** Combined physical therapy (CPT) with different combinations of surgery, oral pharmaceuticals, low-level laser therapy, weight reduction, mesenchymal stem cell therapy, kinesio tex taping, and acupuncture might be effective in reducing lymphoedema, but exercise demonstrated no obvious benefit. The results of direct comparisons showed CPT might be more effective than standard physiotherapy (ST). Manual lymphatic drainage (MLD) may not offer additional benefits to ST for swelling reduction, but could facilitate compression bandaging. MLD seemed to have similar effects with self-administered simple lymphatic drainage (SLD) or using an intermittent pneumatic compression pump (IPC). IPC might also not be associated with additional effectiveness for CPT. Efficacy of stem cell therapy vs. compression sleeve or CPT, as well as the effects of daflon and coumarin could not be established. **Conclusion:** Although many treatments for BCRL might reduce lymphoedema volume, their effects were not well established. The quality of many of the original studies in the included reviews was not optimal, so that in future randomized control trials are a high priority.

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Photobiomodulation Therapy in breast cancer-related lymphedema: a randomized placebo-controlled trial.

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BACKGROUND: The aim of our study was to examine the effects of Photobiomodulation Therapy (PBMT) in the treatment of breast cancer-related lymphedema using a compactly designed treatment regime consisting of eight therapy sessions in combination with a cluster laser device covering a total area size of 78.54 cm^2 over the axillary. **METHODS:** 40 patients with unilateral lymphedema were enrolled in this double blind, placebo-controlled trial in order to evaluate effects of PBMT on lymphedema-related pain, quality of life, grip strength and limb volume difference. Subjects received irradiation for ten minutes per session using a cluster laser covering a beam area of 78.54 cm^2 . The applied energy was 384 Joules resulting in an energy density of 4.89 J/cm^2 . **RESULTS:** Post-treatment, a 50% reduction in median pain scores and an increase in mean quality of life were observed. Mean grip strength was persistently higher after eight sessions of PBMT compared to pretreatment, however, no statistically significant intergroup differences ($p > 0.05$) were found over the time course. **CONCLUSION:** PBMT using a compactly designed treatment regime in combination with a cluster laser device did not significantly improve quality of life, pain scores, grip strength and limb volume over the time course. This article is protected by copyright. All rights reserved.

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<http://www.ncbi.nlm.nih.gov/pubmed/?term=27943450>

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

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Breast cancer is the most common cancer in women worldwide, with an incidence of 1.7 million in 2012. Breast cancer and its treatments can bring along serious side effects such as fatigue, skin toxicity, lymphedema, pain, nausea, etc. These can substantially affect the patients' quality of life. Therefore, supportive care for breast cancer patients is an essential mainstay in the treatment. Low-level light therapy (LLLT) also named photobiomodulation therapy (PBMT) has proven its efficiency in general medicine for already more than 40 years. It is a noninvasive treatment option used to stimulate wound healing and reduce inflammation, edema, and pain. LLLT is used in different medical settings ranging from dermatology, physiotherapy, and neurology to dentistry. Since the last twenty years, LLLT is becoming a new treatment modality in supportive care for breast cancer. For this review, all existing literature concerning the use of LLLT for breast cancer was used to provide evidence in the following domains: oral mucositis (OM), radiodermatitis (RD), lymphedema, chemotherapy-induced peripheral neuropathy (CIPN), and osteonecrosis of the jaw (ONJ). The findings of this review suggest that LLLT is a promising option for the management of breast cancer treatment-related side effects. However, it still remains important to define appropriate treatment and irradiation parameters for each condition in order to ensure the effectiveness of LLLT.

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Managing chronic oedema in a patient with arterial disease and leg ulceration.

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Treating lymphoedema in patients with critical arterial disease can be contraindicated. This case study describes current methods of managing lymphoedema in a patient with arterial disease and leg ulcers. The patient, a 65-year-old male, had paraplegia and lower-limb lymphoedema with leg ulceration for 18 years, as well as arterial disease. The patient was referred to the lymphoedema/vascular service in 2013. Duplex ultrasound indicated superficial femoral occlusion. The arterial disease was treated with an angiogram and angioplasty, and when the blood supply was improved, the lymphoedema was treated. Emphasis was placed on self-care and reducing the need for community nurse involvement. Selfcare included compression bandaging, use of FarrowWrap, low-level light therapy, and ulcer dressings. Outcomes were measured using a telemedicine software programme. The patient's lymphoedema was reduced, leg ulcers healed, and quality of life transformed.

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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.

Zecha JA, Raber-Durlacher JE, Nair RG, Epstein JB, Elad S, Hamblin MR, Barasch A, Migliorati CA, Milstein DM, Genot MT, Lansaat L, van der Brink R, Arnabat-Dominguez J, van der Molen L, Jacobi I, van Diessen J, de Lange J, Smeele LE, Schubert MM, Bensadoun RJ

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PURPOSE: There is a large body of evidence supporting the efficacy of low-level laser therapy (LLLT), more recently termed photobiomodulation (PBM) for the management of oral mucositis (OM) in patients undergoing radiotherapy for head and neck cancer (HNC). Recent advances in PBM technology, together with a better understanding of mechanisms involved and dosimetric parameters may lead to the management of a broader range of complications associated with HNC treatment. This could enhance patient adherence to cancer therapy, and improve quality of life and treatment outcomes. The mechanisms of action, dosimetric, and safety considerations for PBM have been reviewed in part 1. Part 2 discusses the head and neck treatment side effects for which PBM may prove to be effective. In addition, PBM parameters for each of these complications are suggested and future research directions are discussed. **METHODS:** Narrative review and presentation of PBM parameters are based on current evidence and expert opinion. **RESULTS:** PBM may have potential applications in the management of a broad range of side effects of (chemo)radiation therapy (CRT) in patients being treated for HNC. For OM management, optimal PBM parameters identified were as follows: wavelength, typically between 633 and 685 nm or 780-830 nm; energy density, laser or light-emitting diode (LED) output between 10 and 150 mW; dose, 2-3 J (J/cm²), and no more than 6 J/cm² on the tissue surface treated; treatment schedule, two to three times a week up to daily; emission type, pulsed (<100 Hz); and route of delivery, intraorally and/or transcutaneously. To facilitate further studies, we propose potentially effective PBM parameters for prophylactic and therapeutic use in supportive care for dermatitis, dysphagia, dry mouth, dysgeusia, trismus, necrosis, lymphedema, and voice/speech alterations. **CONCLUSION:** PBM may have a role in supportive care for a broad range of complications associated with the treatment of HNC with CRT. The suggested PBM irradiation and dosimetric parameters, which are potentially effective for these complications, are intended to provide guidance for well-designed future studies. It is imperative that such studies include elucidating the effects of PBM on oncology treatment outcomes.

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Low level laser therapy/photobiomodulation in the management of side effects of chemoradiation therapy in head and neck cancer: part 1: mechanisms of action, dosimetric, and safety considerations.

Zecha JA, Raber-Durlacher JE, Nair RG, Epstein JB, Sonis ST, Elad S, Hamblin MR, Barasch A, Migliorati CA, Milstein DM, Genot MT, Lansaat L, van der Brink R, Arnabat-Dominguez J, van der Molen L, Jacobi I, van Diessen J, de Lange J, Smeele LE, Schubert MM, Bensadoun RJ

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PURPOSE: There is a large body of evidence supporting the efficacy of low level laser therapy (LLLT), more recently termed photobiomodulation (PBM), for the management of oral mucositis (OM) in patients undergoing radiotherapy for head and neck cancer (HNC). Recent advances in PBM technology, together with a better understanding of mechanisms involved, may expand the applications for PBM in the management of other complications associated with HNC treatment. This article (part 1) describes PBM mechanisms of action, dosimetry, and safety aspects and, in doing so, provides a basis for a companion paper (part 2) which describes the potential breadth of potential applications of PBM in the management of side-effects of (chemo)radiation therapy in patients being treated for HNC and proposes PBM parameters. **METHODS:** This study is a narrative non-systematic review. **RESULTS:** We review PBM mechanisms of action and dosimetric considerations. Virtually, all conditions modulated by PBM (e.g., ulceration, inflammation, lymphedema, pain, fibrosis, neurological and muscular injury) are thought to be involved in the pathogenesis of (chemo)radiation therapy-induced complications in patients treated for HNC. The impact of PBM on tumor behavior and tumor response to treatment has been insufficiently studied. In vitro studies assessing the effect of PBM on tumor cells report conflicting results, perhaps attributable to inconsistencies of PBM power and dose. Nonetheless, the biological bases for the broad clinical activities ascribed to PBM have also been noted to be similar to those activities and pathways associated with negative tumor behaviors and impeded response to treatment. While there are no anecdotal descriptions of poor tumor outcomes in patients treated with PBM, confirming its neutrality with respect to cancer responsiveness is a critical priority. **CONCLUSION:** Based on its therapeutic effects, PBM may have utility in a broad range of oral, oropharyngeal, facial, and neck complications of HNC treatment. Although evidence suggests that PBM using LLLT is safe in HNC patients, more research is imperative and vigilance remains warranted to detect any potential adverse effects of PBM on cancer treatment outcomes and survival.

Anti-inflammatory and lymphangiogenetic effects of low-level laser therapy on lymphedema in an experimental mouse tail model.

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The aim of the present study was to investigate the therapeutic mechanism of low-level laser therapy (LLLT) in the mouse tail lymphedema model. Six-week-old female mice were classified into the laser treatment group, sham treatment group, and surgical control group (10 mice per group). LLLT was administered daily for 10 min from the surgical day to 11 days (12 times). Macrophage activation and lymphatic vessel regeneration were evaluated through immunohistochemical staining with anti-F4/80 and anti-LYVE-1 antibodies, respectively, at 12 days post-procedure. Quantitative real-time polymerase chain reaction (qPCR) was performed to measure messenger RNA (mRNA) expression of vascular endothelial growth factor A, B, C, R1, R2, and R3 (VEGF-A, VEGF-B, VEGF-C, VEGFR1, VEGFR2, and VEGFR3) at 12 days post-procedure. Student's t and one-way ANOVA tests were performed for statistical analyses. Significance was defined as $p < 0.05$. The thickness of the tail rapidly increased until 6 days in the laser and sham groups. The mice in the laser group showed a significantly decreased thickness compared with the sham group at 10 and 12 days. Immunohistochemistry assay revealed that LLLT reduced inflammation and induced new lymphatic vessel growth. qPCR showed that expressions of VEGFR3 were ($p = 0.002$) increased in the laser group. These results suggest that LLLT has anti-inflammatory and lymphangiogenetic effects for the management of lymphedema.

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In vitro study on the safety of near infrared laser therapy in its potential application as postmastectomy lymphedema treatment.

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Clinical studies demonstrated the effectiveness of laser therapy in the management of postmastectomy lymphedema, a discomforting disease that can arise after surgery/radiotherapy and gets progressively worse and chronic. However, safety issues restrict the possibility to treat cancer patients with laser therapy, since the effects of laser radiation on cancer cell behavior are not completely known and the possibility of activating postmastectomy residual cancer cells must be considered. This paper reports the results of an in vitro study aimed to investigate the effect of a class IV, dual-wavelength (808 nm and 905 nm), NIR laser system on the behavior of two human breast adenocarcinoma cell lines (namely, MCF7 and MDA-MB361 cell lines), using human dermal fibroblasts as normal control. Cell viability, proliferation, apoptosis, cell cycle and ability to form colonies were analyzed in order to perform a cell-based safety testing of the laser treatment in view of its potential application in the management of postmastectomy lymphedema. The results showed that, limited to the laser source, treatment conditions and experimental models used, laser radiation did not significantly affect the behavior of human breast adenocarcinoma cells, including their clonogenic efficiency. Although these results do not show any significant laser-induced modification of cancer cell behavior, further studies are needed to assess the possibility of safely applying NIR laser therapy for the management of postmastectomy lymphedema.

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<http://www.ncbi.nlm.nih.gov/pubmed/?term=26355716>

Complex decongestive physical therapy and low-level laser therapy for the treatment of pediatric congenital lymphedema: a case report.

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[Purpose] We report the case of a pediatric patient with congenital lymphedema treated with complex decongestive physical therapy and low-level laser therapy. [Subjects and Methods] The patient was a 2 year-old girl who had lymphedema in the left upper limb since birth. Complex decongestive physical therapy and low-level laser therapy were administered for 7 sessions. [Results] The circumferences of the middle of the forearm, elbow joint, wrist, and hand of the left upper limb decreased 0.5, 3, 0.5, and 2 cm, respectively. The moisture content of the left upper limb decreased 70 mL (6.66%), while moisture ratio increased by 0.007%. [Conclusion] Complex decongestive physical therapy and low-level laser therapy are effective for reducing lymphedema in pediatric patients.

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Effect of low-level laser therapy on pain and swelling in women with breast cancer-related lymphedema: a systematic review and meta-analysis.

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PURPOSE: This study aims to examine literature on effectiveness of low-level laser therapy (LLLT) in reducing limb volume and pain in adults with breast cancer-related lymphedema (BCRL). **METHODS:** PubMed, PEDro, CINAHL, and Cochrane databases were searched using (lymphedema OR edema OR swelling) AND (breast cancer OR mastectomy) AND (laser OR low-level laser therapy OR LLLT OR cold laser). Intervention studies or meta-analyses reporting LLLT for BCRL were included in the search. Pooled effect sizes (ES) and 95 % confidence intervals (CI) were calculated for volume and pain. No limitations were placed on length of follow-up, publication year, or language. Final search was conducted on October 16, 2014. **RESULTS:** Nine studies met criteria for inclusion. Within-group pooled ES for volume (six studies) was -0.52 (-0.78, -0.25), representing a 75.7-ml reduction in limb volume after LLLT. Between-group pooled ES for volume (four studies) was -0.62 (-0.97, -0.28), representing a 90.9-ml greater reduction in volume with treatment including LLLT versus not including LLLT. Within-group pooled ES for pain reduction (three studies) was -0.62 (-1.06, -0.19), pain reduction of 13.5 mm (0-100 mm VAS). Between-group pooled ES for pain reduction (two studies) was non-significant at -1.21 (-4.51, 2.10). **CONCLUSION:** Moderate-strength evidence supports LLLT in the management of BCRL, with clinically relevant within-group reductions in volume and pain immediately after conclusion of LLLT treatments. Greater reductions in volume were found with the use of LLLT than in treatments without it. **IMPLICATIONS FOR CANCER SURVIVORS:** LLLT confers clinically meaningful reductions in arm volume and pain in women with BCRL.

J Cancer Surviv 2014 Nov 29

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Is there a link between LE treatment and breast cancer reoccurrence?

Denise de Vries, Neil Piller, Rachel Dawson, Jan Rice

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The treatment of lymphoedema encompasses many modalities, from bandaging, compression garments, intermittent compression therapy (ICT), low level laser, a range of vibration-based and a range of manual lymphatic drainage (MLD) strategies, self/partner massage, exercise and activity, all generally forming part of what is often called complex physical therapy.

Many of the treatments, including MLD, compression devices and low level laser are known to increase lymph flow from and through the affected extremity (Williams, 2010; Lacomba et al, 2010; Bridenbaugh et al, 2003). However, there are occasional rumours that these lymph flow enhancing treatments can spread cancer cells and contribute to disease progression. For MLD (which is evidenced to strongly facilitate lymph flow [Williams, 2010]), it is clear that there are no indications of disease progression (Godette et al, 2006), and no real reason to withhold lymph flow enhancing treatments, even when there is loco regional tumour, on the assumption of an adverse outcome (Pinell et al, 2008). Without going into the detail, one of the key necessities for a metastatic spread is the presence of a suitable microenvironment for the tumour cells (if they escape from the site of the primary tumour through the action of a lymphoedema treatment into the venous or lymphatic system), rather than changes in rates of movement through variation in flow or pressure (Ruitler et al, 2001). It is tumour biology rather than host anatomy which is the key factor in tumour metastasis (Godette, 2006)

In the Lymphoedema Assessment Clinic at Flinders Medical Centre, the majority of patients are treated with a combination of low level laser and MLD.

To determine if there is any relationship between these treatments which are aimed at facilitating lymph flow and cancer re-occurrence rates, the authors undertook an analysis of this group of patients.

Results: The results show that there is no significant difference between the proportions of cancer re-occurrence in both groups (i.e. the proportion of re-occurrence of cancer is about the same).

Conclusion Treatment of lymphoedema consisting primarily of low level laser and MLD does not impact on cancer re-occurrence rates.

2011

https://www.researchgate.net/publication/288772635_Is_there_a_link_between_LE_treatment_and_breast_cancer_reoccurrence

A pilot randomized trial evaluating low-level laser therapy as an alternative treatment to manual lymphatic drainage for breast cancer-related lymphedema.

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Purpose/Objectives: To examine the impact of advanced practice nurse (APN)-administered low-level laser therapy (LLLT) as both a stand-alone and complementary treatment for arm volume, symptoms, and quality of life (QOL) in women with breast cancer-related lymphedema. **Design:** A three-group, pilot, randomized clinical trial. **Setting:** A private rehabilitation practice in the southeastern United States. **Sample:** 46 breast cancer survivors with treatment-related lymphedema. **Methods:** Patients were screened for eligibility and then randomized to either manual lymphatic drainage (MLD) for 40 minutes, LLLT for 20 minutes, or 20 minutes of MLD followed by 20 minutes of LLLT. Compression bandaging was applied after each treatment. Data were collected pretreatment, daily, weekly, and at the end of treatment. **Main Research Variables:** Independent variables consisted of three types of APN-administered lymphedema treatment. Outcome variables included limb volume, extracellular fluid, psychological and physical symptoms, and QOL. **Findings:** No statistically significant between-group differences were found in volume reduction; however, all groups had clinically and statistically significant reduction in volume. No group differences were noted in psychological and physical symptoms or QOL; however, treatment-related improvements were noted in symptom burden within all groups. Skin improvement was noted in each group that received LLLT. **Conclusions:** LLLT with bandaging may offer a time-saving therapeutic option to conventional MLD. Alternatively, compression bandaging alone could account for the demonstrated volume reduction. **Implications for Nursing:** APNs can effectively treat lymphedema. APNs in private healthcare practices can serve as valuable research collaborators. **Knowledge Translation:** Lasers may provide effective, less burdensome treatment for lymphedema. APNs with lymphedema certification can effectively treat this patient population with the use of LLLT. In addition, bioelectrical impedance and tape measurements can be used to assess lymphedema.

Oncol Nurs Forum 2013 Jul 1 40(4) 383-93

<http://www.ncbi.nlm.nih.gov/pubmed/?term=23803270>

Low-level laser therapy in secondary lymphedema after breast cancer: systematic review.

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Complex physical therapy is the main treatment for the secondary lymphedema after breast cancer. The low-level laser therapy (LLLT) has been used in order to stimulate lymphangiogenesis, encourage lymphatic motility, and reduce lymphostatic fibrosis. However, these factors could also favor the development of recurrence and metastasis. The objective of this study is to discuss the use of LLLT in the treatment of lymphedema after breast cancer. This study utilized a systematic review on the use of LLLT in the treatment of lymphedema after breast cancer. Evaluating quality of articles was conducted through the PEDro scale. Of the 41 articles identified, four were considered to be of high methodological quality (score ≥ 5). The low-level laser in the axillary region was performed in all studies. The control group was not similar across studies. The results presented showed that there was a reduction in limb volume in the group subjected to low-power laser when compared with other treatments. No studies have evaluated the risk of metastasis or relapse in the irradiated areas. Because no studies have included the complex physical therapy as the comparison group, we cannot claim that laser treatment is the best efficacy or effectiveness in lymphedema treatment after breast cancer. No studies have evaluated the hypothesis that the LLLT can increase the risk of recurrence or metastasis. Therefore, the questions about the safety of this procedure in cancer patients remain.

Lasers Med Sci 2012 Nov 29

<http://www.ncbi.nlm.nih.gov/pubmed/?term=23192573>

Cancer-related lymphedema risk factors, diagnosis, treatment, and impact: a review.

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PURPOSE Cancer-related lymphedema (LE) is an incurable condition associated with lymph-involved cancer treatments and is an increasing health, quality of life (QOL), and cost burden on a growing cancer survivor population. This review examines the evidence for causes, risk, prevention, diagnosis, treatment, and impact of this largely unexamined survivorship concern. **METHODS** PubMed and Medline were searched for cancer-related LE literature published since 1990 in English. The resulting references (N = 726) were evaluated for strength of design, methods, sample size, and recent publication and sorted into categories (ie, causes/prevention, diagnosis, treatment, and QOL). Sixty studies were included. Results Exercise and physical activity and sentinel lymph node biopsy reduce risk, and overweight and obesity increase risk. Evidence that physiotherapy reduces risk and that lymph node status and number of malignant nodes increase risk is less strong. Perometry and bioimpedance emerged as attractive diagnostic technologies, replacing the use of water displacement in clinical practice. Swelling can also be assessed by measuring arm circumference and relying on self-report. Symptoms can be managed, not cured, with complex physical therapy, low-level laser therapy, pharmacotherapy, and surgery. Sequelae of LE negatively affect physical and mental QOL and range in severity. However, the majority of reviewed studies involved patients with breast cancer; therefore, results may not be applicable to all cancers. **CONCLUSION** Research into causes, prevention, and effect on QOL of LE and information on LE in cancers other than breast is needed. Consensus on definitions and measurement, increased patient and provider awareness of signs and symptoms, and proper and prompt treatment/access, including psychosocial support, are needed to better understand, prevent, and treat LE.

J Clin Oncol 2012 Oct 20 30(30) 3726-33

<http://www.ncbi.nlm.nih.gov/pubmed/?term=23008299>

A systematic review of the effect of low-level laser therapy in the management of breast cancer-related lymphedema.

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PURPOSE: The purpose of this study was to review the effect of low-level laser therapy (LLLT) in the management of breast cancer-related lymphedema (BCRL). **METHODS:** A systematic review of seven databases for clinical trials for LLLT in the management of BCRL published between 1990 and 2011 was performed. **RESULTS:** A total of eight studies on 230 patients were found. The methodological qualities of the selected studies were assessed with the Physiotherapy Evidence Database scale, and the studies were categorized according to Sackett's levels of evidence. Five studies were graded at evidence level II. Two studies were graded at evidence level III, and the remaining study was graded at evidence level V. **CONCLUSIONS:** There is moderate to strong evidence for the effectiveness of LLLT for the management of BCRL from five small studies of acceptable methodological quality. A dose of 1-2 J/cm² per point applied to several points covering the fibrotic area can reduce limb volume following BCRL. Further well-designed, large-scale studies are required to determine more precisely how effective LLLT may be in BCRL.

Support Care Cancer 2012 Aug 9

<http://www.ncbi.nlm.nih.gov/pubmed/?term=22875413>

Changes in tissue water and indentation resistance of lymphoedematous limbs accompanying low level laser therapy (LLLT) of fibrotic skin.

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Our goal was to determine effects of low-level-laser-therapy (LLLT) on skin water and tissue indentation resistance (TIR) in patients with arm (N = 38) or leg (N = 38) lymphoedema. Skin water was determined from tissue dielectric constant (TDC) measurements and TIR determined from measurements of force resulting from tissue indentations of 3-4 mm. A limb-location with fibrosis was identified by palpation and treated with an LLLT device for one minute at each of five points within a 3 cm² area. TDC and TIR at these sites and corresponding sites on the contralateral limb were measured prior to LLLT (pre-LLLT), immediately after LLLT (post-LLLT) and after a manual lymphatic drainage (MLD) session (post-MLD). Results, from arms and legs, showed that post-LLLT values of TIR and TDC were significantly less than pre-LLLT. TIR values remained significantly reduced at post-MLD whereas TDC values were not significantly different from pre-LLLT values. On follow-up visit, 17 previously LLLT treated legs were sham treated with an inactive LLLT unit and measurements replicated. A TIR and TDC change-pattern similar to that obtained with the active LLLT was obtained, but sham-related reductions in TIR and TDC immediately post sham-treatment were significantly less than achieved with the prior active LLLT treatment.

Lymphology 2011 Dec 44(4) 168-77

<http://www.ncbi.nlm.nih.gov/pubmed/?term=22458118>

Treatment of Lymphedema Praecox through Low Level Laser Therapy (LLLT).

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A 15-year-old girl with right lower extremity lymphedema praecox was treated through Low Level Laser Therapy (LLLT), by means of a GaAs and GaAlAs diodes laser-therapy device. Treatment sessions were totally 24, each cycle containing 12 every other day 15-minute sessions, and one month free between the cycles. The treatment was achieved to decrease the edema and no significant increase in circumference of involved leg was found following three months after the course of treatment. Although LLLT can be considered a beneficial treatment for Lymphedema Praecox, any definite statement around its effectiveness needs more studies on more cases.

J Res Med Sci 2011 Jun 16(6) 848-51

<http://www.ncbi.nlm.nih.gov/pubmed/?term=22091317>

[Topical problems of the diagnosis and rehabilitative treatment of lymphedema of the lower extremities].

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The present review of the literature data highlights modern approaches to and major trends in diagnostics and conservative treatment of lymphedema of the lower extremities based on the generalized world experience. Patients with lymphedema of the lower extremities comprise a "difficult to manage" group because the disease is characterized by steady progression and marked refractoriness to various conservative therapeutic modalities creating problems for both the patient and the attending physician. Modern methods for the diagnosis of lymphedema are discussed with special reference to noninvasive and minimally invasive techniques (such as lymphoscintigraphy, computed tomography, MRT, laser Doppler flowmetry, etc.). During the last 20 years, combined conservative therapy has been considered as the method of choice for the management of different stages and forms of lymphedema of the lower extremities in foreign clinics. The basis of conservative therapy is constituted by manual lymph drainage (MLD), compression bandages using short-stretch materials, physical exercises, and skin care (using the method of M. Foldi). Also reviewed are the main physiotherapeutic methods traditionally widely applied for the treatment of lymphedema of the lower extremities in this country. Original methods for the same purpose developed by the authors are described including modifications of cryotherapy, pulsed matrix laserotherapy, hydro- and balneotherapy. Mechanisms of their therapeutic action on the main pathogenetic factors responsible for the development of lymphedema (with special reference to lymph transport and formation) are discussed. The principles of combined application of physiotherapeutic methods for the rehabilitative treatment of patients presenting with lymphedema of the lower extremities are briefly substantiated. Special emphasis is laid on their influence on major components of the pathological process.

Vopr Kurortol Fizioter Lech Fiz Kult 2010 Jul-Aug (4) 42-8

<http://www.ncbi.nlm.nih.gov/pubmed/?term=21089207>

Treatment of Post-Mastectomy Lymphedema with Laser Therapy: Double Blind Placebo Control Randomized Study.

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BACKGROUND: In post-mastectomy patients, lymphedema has the potential to become a permanent progressive condition and become extremely resistant to treatment. Thus, it can result in function impairment and decrease quality of life. The aim of this study was to evaluate the effect of low level laser therapy (LLLT) on limb volume, shoulder mobility, and hand grip strength. **MATERIAL AND METHODS:** Fifty women with breast cancer-related lymphedema were enrolled in a double-blind, placebo controlled trial. Patients were randomly assigned to active laser (n = 25) and placebo (n = 25) groups and received irradiation with Ga-As laser device that had wavelength of 904 nm, power of 5 mW, and spot size of 0.2 cm² over the axillary and arm areas, three times a week for 12 wk. The total energy applied at each point was 300 mJoules over seven points, giving a dosage of 1.5 joules/cm² in the active group. The placebo group received placebo therapy in which the laser had been disabled without affecting its apparent function. Limb circumference, shoulder mobility, and grip strength were measured before treatment and at 4, 8, and 12 wk. **RESULTS:** The two groups had similar parameters at baseline. The reduction of limb volume tended to decline in both groups. The trend being more significantly pronounced in active LLLT group than placebo at 8 and 12 wk, respectively (P < 0.05). Goniometric data for shoulder mobility and hand grip strength were statistically significant for LLLT group than for placebo. **CONCLUSION:** Laser treatment was found to be effective in reducing the limb volume, increase shoulder mobility, and hand grip strength in approximately 93% of patients with postmastectomy lymphedema.

J Surg Res 2010 Apr 18

<http://www.ncbi.nlm.nih.gov/pubmed/?term=20538293>

The short-term effects of low-level laser therapy in the management of breast-cancer-related lymphedema.

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BACKGROUND: Breast-cancer-related lymphedema (BCRL) is a chronic disease, and currently there is no definitive treatment for it. There are some therapeutic interventions targeted to decrease the limb swelling and the associated problems. Low-level laser therapy (LLLT) has been used in the treatment of post-mastectomy lymphedema since 2007 in the US. The aim of this study is to review our short-term experience with LLLT in the treatment of BCRL. **METHOD:** Seventeen BCRL patients referred to our lymphedema program between 2007 and 2009 were enrolled in this study. All patients had experienced at least one conventional treatment modality such as complex physical therapy, manual lymphatic drainage, and/or pneumatic pump therapy. LLLT was added to patients' ongoing therapeutic regimen. All patients completed the full course of LLLT consisting of two cycles. The difference between sums of the circumferences of both affected and unaffected arms (DeltaC), pain score, scar mobility, and range of motion were measured before and after first and second cycles of LLLT sequentially. **RESULTS:** All patients were female with a median age of 51.8 (44-64) years. DeltaC decreased 54% (15-85%) and 73% (33-100%), after the first and second cycles of LLLT, respectively. Fourteen out of seventeen experienced decreased pain with motion by an average of 40% (0-85%) and 62.7% (0-100%) after the first and second cycle of LLLT, respectively. Three patients had no improvement in pain after LLLT. Scar mobility increased in 13 (76.4%) and shoulder range of motion improved in 14 (82.3%) patients after LLLT. One patient developed cellulitis during LLLT. **CONCLUSION:** Patients with BCRL received additional benefits from LLLT when used in conjunction with standard lymphedema treatment. These benefits include reduction in limb circumference, pain, increase in range of motion and scar mobility. Additionally, two cycles of LLLT were found to be superior to one in this study.

Support Care Cancer 2010 May 6

<http://www.ncbi.nlm.nih.gov/pubmed/?term=20445997>

Physiotherapy treatments for breast cancer-related lymphedema: a literature review.

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Breast cancer is the second most frequent cancer among women. Surgery is part of the therapeutic process to prevent metastases, but it can also cause some complications, including lymphedema. Physiotherapy contributes to its treatment, using different techniques that have been developed over the years. This systematic literature review aims to present physiotherapy modalities applied for lymphedema therapy. The literature review was conducted using textbooks and Lilacs, Pubmed and Scielo databases, from 1951 to 2009. Physiotherapy resources used for lymphedema treatment include complex decongestive therapy (CDT), pneumatic compression (PC), high voltage electrical stimulation (HVES) and laser therapy. The analyzed literature shows that better results are obtained with combined techniques. CDT is the most used protocol, and its association with PC has demonstrated efficacy. The new techniques HVES and laser present satisfactory results.

Rev Lat Am Enfermagem 2009 Sep-Oct 17(5) 730-6

<http://www.ncbi.nlm.nih.gov/pubmed/?term=19967225>

The diagnosis and treatment of peripheral lymphedema.

Piller N, Carati C

Lymphology 2009 Sep 42(3) 146-7

<http://www.ncbi.nlm.nih.gov/pubmed/?term=19938271>

Managing postmastectomy lymphedema with low-level laser therapy.

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OBJECTIVE: We aimed to investigate the effects of low-level laser therapy (LLLT) in managing postmastectomy lymphedema. **BACKGROUND DATA:** Postmastectomy lymphedema (PML) is a common complication of breast cancer treatment that causes various symptoms, functional impairment, or even psychosocial morbidity. A prospective, single-blinded, controlled clinical trial was conducted to examine the effectiveness of LLLT on managing PML. **METHODS:** Twenty-one women suffering from unilateral PML were randomly allocated to receive either 12 sessions of LLLT in 4 wk (the laser group) or no laser irradiation (the control group). Volumetry and tonometry were used to monitor arm volume and tissue resistance; the Disabilities of Arm, Shoulder, and Hand (DASH) questionnaire was used for measuring subjective symptoms. Outcome measures were assessed before and after the treatment period and at the 4 wk follow-up. **RESULTS:** Reduction in arm volume and increase in tissue softening was found in the laser group only. At the follow-up session, significant between-group differences (all $p < 0.05$) were found in arm volume and tissue resistance at the anterior torso and forearm region. The laser group had a 16% reduction in the arm volume at the end of the treatment period, that dropped to 28% in the follow-up. Moreover, the laser group demonstrated a cumulative increase from 15% to 33% in the tonometry readings over the forearm and anterior torso. The DASH score of the laser group showed progressive improvement over time. **CONCLUSION:** LLLT was effective in the management of PML, and the effects were maintained to the 4 wk follow-up.

Photomed Laser Surg 2009 Oct 27(5) 763-9

<http://www.ncbi.nlm.nih.gov/pubmed/?term=19878027>

Efficacy of pneumatic compression and low-level laser therapy in the treatment of postmastectomy lymphoedema: a randomized controlled trial.

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Objective: To compare the long-term efficacy of pneumatic compression and low-level laser therapies in the management of postmastectomy lymphoedema. **Design:** Randomized controlled trial. **Setting:** Department of Physical Medicine and Rehabilitation of Cukurova University, Turkey. **Subjects:** Forty-seven patients with postmastectomy lymphoedema were enrolled in the study. **Interventions:** Patients were randomly allocated to pneumatic compression (group I, n=24) and low-level laser (group II, n=23) groups. Group I received 2 hours of compression therapy and group II received 20 minutes of laser therapy for four weeks. All patients were advised to perform daily limb exercises. **Main measures:** Demographic features, difference between sum of the circumferences of affected and unaffected limbs (triangle upC), pain with visual analogue scale and grip strength were recorded. **Results:** Mean age of the patients was 48.3 (10.4) years. triangle upC decreased significantly at one, three and six months within both groups, and the decrease was still significant at month 12 only in group II (P = 0.004). Improvement of group II was greater than that of group I post treatment (P = 0.04) and at month 12 after 12 months (P = 0.02). Pain was significantly reduced in group I only at posttreatment evaluation, whereas in group II it was significant post treatment and at follow-up visits. No significant difference was detected in pain scores between the two groups. Grip strength was improved in both groups, but the differences between groups were not significant. **Conclusions:** Patients in both groups improved after the interventions. Group II had better long-term results than group I. Low-level laser might be a useful modality in the treatment of postmastectomy lymphoedema.

Clin Rehabil 2009 Feb 23(2) 117-24

<http://www.ncbi.nlm.nih.gov/pubmed/?term=19164399>

A systematic review of common conservative therapies for arm lymphoedema secondary to breast cancer treatment.

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Secondary arm lymphoedema is a chronic and distressing condition which affects a significant number of women who undergo breast cancer treatment. A number of health professional and patient instigated conservative therapies have been developed to help with this condition, but their comparative benefits are not clearly known. This systematic review undertook a broad investigation of commonly instigated conservative therapies for secondary arm lymphoedema including; complex physical therapy, manual lymphatic drainage, pneumatic pumps, oral pharmaceuticals, low level laser therapy, compression bandaging and garments, limb exercises and limb elevation. It was found that the more intensive and health professional based therapies, such as complex physical therapy, manual lymphatic drainage, pneumatic pump and laser therapy generally yielded the greater volume reductions, whilst self instigated therapies such as compression garment wear, exercises and limb elevation yielded smaller reductions. All conservative therapies produced improvements in subjective arm symptoms and quality of life issues, where these were measured. Despite the identified benefits, there is still the need for large scale, high level clinical trials in this area.

Ann Oncol 2007 Apr 18(4) 639-46

<http://www.ncbi.nlm.nih.gov/pubmed/?term=17018707>

Low-level laser therapy in management of postmastectomy lymphedema.

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The aim of this paper was to study the effects of low-level laser therapy (LLLT) in the treatment of postmastectomy lymphedema. Eleven women with unilateral postmastectomy lymphedema were enrolled in a double-blind controlled trial. Patients were randomly assigned to laser and sham groups and received laser or placebo irradiation (Ga-As laser device with a wavelength of 890 nm and fluence of 1.5 J/cm²) over the arm and axillary areas. Changes in patients' limb circumference, pain score, range of motion, heaviness of the affected limb, and desire to continue the treatment were measured before the treatment and at follow-up sessions (weeks 3, 9, 12, 18, and 22) and were compared to pretreatment values. Results showed that of the 11 enrolled patients, eight completed the treatment sessions. Reduction in limb circumference was detected in both groups, although it was more pronounced in the laser group up to the end of 22nd week. Desire to continue treatment at each session and baseline score in the laser group was greater than in the sham group in all sessions. Pain reduction in the laser group was more than in the sham group except for the weeks 3 and 9. No substantial differences were seen in other two parameters between the two treatment groups. In conclusion, despite our encouraging results, further studies of the effects of LLLT in management of postmastectomy lymphedema should be undertaken to determine the optimal physiological and physical parameters to obtain the most effective clinical response.

Lasers Med Sci 2006 Jul 21(2) 90-4

<http://www.ncbi.nlm.nih.gov/pubmed/?term=16673054>

Treatment of postmastectomy lymphedema with low-level laser therapy: a double blind, placebo-controlled trial.

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BACKGROUND: The current study describes the results of a double blind, placebo-controlled, randomized, single crossover trial of the treatment of patients with postmastectomy lymphedema (PML) with low-level laser therapy (LLLT). **METHODS:** Participants received placebo or one cycle or two cycles of LLLT to the axillary region of their affected arm. They were monitored for reductions in affected limb volume, upper body extracellular tissue fluid distribution, dermal tonometry, and range of limb movement. **RESULTS:** There was no significant improvement reported immediately after any of the treatments. However, the mean affected limb volume was found to be significantly reduced at 1 month or 3 months of follow-up after 2 cycles of active laser treatment. Approximately 31% of subjects had a clinically significant reduction in the volume of their PML-affected arm (> 200 mLs) approximately 2-3 months after 2 cycles of treatment. There was no significant effect of placebo treatment, or one cycle of laser treatment, on affected limb volume. The extracellular fluid index of the affected and unaffected arms and torso were reported to be significantly reduced at 3 months after 2 cycles of laser therapy, and there was significant softening of the tissues in the affected upper arm. Treatment did not appear to improve range of movement of the affected arm. **CONCLUSIONS:** Two cycles of laser treatment were found to be effective in reducing the volume of the affected arm, extracellular fluid, and tissue hardness in approximately 33% of patients with postmastectomy lymphedema at 3 months after treatment.

Cancer 2003 Sep 15 98(6) 1114-22

<http://www.ncbi.nlm.nih.gov/pubmed/?term=12973834>

The use of low level light therapy in the treatment of head and neck oedema

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Low level laser therapy (LLLT) has been used in conjunction with other therapies such as intermittent pneumatic compression, manual / medical lymphatic drainage (MLD) and kinesiotaping for the treatment and management of limb lymphoedema. Evidence from practice and small scale studies demonstrates that LLLT can greatly influence outcomes and improve quality of life (QoL) in these groups of patients (Piller and Thelander, 1998). However, these studies have been conducted specifically on breast cancer-related lymphoedema (BCRL) of the arms. This article aims to provide evidence for the benefits if its wider use including its role in the holistic care of a patient with head and neck oedema and the benefits observed by inclusion of LLLT as initial treatment for those with this type of oedema.

Lymphoedema 2013

https://hadhealth.com/assets/articles/JOL_8-1LED%20LEEWgCarroll.pdf

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