Phototherapy 660 nm for the prevention of radiodermatitis in breast cancer patients receiving radiation therapy: study protocol for a randomized controlled trial.

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BACKGROUND: Breast neoplasms are the second most common type of cancer worldwide, and radiation therapy is a key component of their treatment. Acute skin reactions are one of the most common side effects of radiation therapy, and prevention of this adverse event has been investigated in several studies. However, a clinically applicable, preventative treatment remains unavailable. It has been demonstrated that application of a low-power laser can promote tissue repair. Therefore, the aim of this trial is to evaluate the effectiveness of an indium gallium aluminum phosphorus (InGaAlP) laser operated at 660 nm in preventing radiodermatitis in women undergoing adjuvant radiotherapy for breast cancer. METHODS/DESIGN: This is a two-arm, randomized controlled trial. A total of 52 patients undergoing radiotherapy for breast cancer (stages I to III) will be enrolled. Patients will be randomly assigned to an intervention group to receive laser therapy (n = 26) or a control group to receive a placebo (n = 26). The laser or placebo will be applied five days a week, immediately before each radiotherapy session. Skin reactions will then be graded weekly by a nurse, a radiotherapist, and an oncologist (all of whom will be blinded) using the Common Toxicity Criteria (CTC) developed by the National Cancer Institute and the Acute Radiation Morbidity Scoring Criteria developed by the Radiation Therapy Oncology Group. Patients will also answer a modified visual analogue scale for pain (a self-evaluation questionnaire). Primary and secondary outcomes will be the prevention of radiodermatitis and pain secondary to radiodermatitis, respectively. DISCUSSION: The ideal tool for preventing radiodermatitis is an agent that mediates DNA repair or promotes cell proliferation. Application of a low-power laser has been shown to promote tissue repair by reducing inflammation and inducing collagen synthesis. Moreover, this treatment approach has not been associated with adverse events and is cost-effective. Thus, the results of this ongoing trial may establish whether use of a low-power laser represents an ideal treatment option for the prevention of radiodermatitis. TRIAL REGISTRATION: ClinicalTrials.gov identifier: NCT02003599. Registered on 2 December 2013.

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Letter: light-emitting diode photomodulation and radiation dermatitis.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21605258

Should we use light-emitting diode photomodulation to minimize radiation-induced dermatitis?

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A randomized, controlled, double-blind study of light emitting diode photomodulation for the prevention of radiation dermatitis in patients with breast cancer.

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BACKGROUND AND OBJECTIVES: Radiation dermatitis occurs in a majority of patients with breast cancer who receive radiation therapy (RT), causes significant pain, and may necessitate treatment delay. Light emitting diode (LED) photomodulation has been reported to minimize radiation dermatitis. This study sought to further evaluate the efficacy of LED photomodulation in lessening radiation dermatitis. MATERIALS & METHODS: After surgery, patients with breast cancer received LED photomodulation or sham treatments in conjunction with three-dimensional conformal RT. Reactions were evaluated using standardized photographs graded according to National Cancer Institute criteria. RESULTS: In the LED treatment group (n=18), no patients had grade 0 reactions, six (33.3%) had grade 1 reactions, 12 (66.7%) had grade 2 reactions, and none had a grade 3 reaction. In the sham treatment group (n=15), one (6.6%) patient had a grade 0 reaction, four (26.7%) had grade 1 reactions, 9 (60.0%) had grade 2 reactions, and one (6.7%) had a grade 3 reaction. Two (11.1%) patients in the LED treatment group and one (6.7%) in the control group had to interrupt treatment. Differences between groups were not statistically significant. CONCLUSION: LED photomodulation did not reduce the incidence of radiation-induced skin reactions or interruptions in therapy. .

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21070458

LED photoprevention: reduced MED response following multiple LED exposures

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Abstract
BACKGROUND AND OBJECTIVES:
As photoprotection with traditional sunscreen presents some limitations, the use of non-traditional treatments to increase skin resistance to ultraviolet (UV) induced damage would prove particularly appealing. The purpose of this pilot study was to test the potential of non-thermal pulsed light-emitting diode (LED) treatments (660 nm) prior to UV exposure in the induction of a state of cellular resistance against UV-induced erythema.

STUDY DESIGN/MATERIALS AND METHODS:
Thirteen healthy subjects and two patients with polymorphous light eruption (PLE) were exposed to 5, 6, or 10 LED treatments (660 nm) on an EXPERIMENTAL anterior thigh region. Individual baseline minimal erythema doses (MED) were then determined. UV radiation was thereafter performed on the LED EXPERIMENTAL and CONTROL anterior thigh areas. Finally, 24 hours post-UV irradiation, LED pre-treated MED responses were compared to the non-treated sites.

RESULTS:
Reduction of erythema was considered significant when erythema was reduced by >50% on the LED-treated side as opposed to CONTROL side. A significant LED treatment reduction in UV-B induced erythema reaction was observed in at least one occasion in 85% of subjects, including patients suffering from PLE. Moreover, there was evidence of a dose-related pattern in results. Finally, a sun protection factor SPF-15-like effect and a reduction in post-inflammatory hyperpigmentation were observed on the LED pre-treated side.

CONCLUSIONS:
Results suggest that LED based therapy prior to UV exposure provided significant protection against UV-B induced erythema. The induction of cellular resistance to UV insults may possibly be explained by the induction of a state a natural resistance to the skin via specific cell signaling pathways and without the drawbacks and limitations of traditional sunscreens. These results represent an encouraging step towards expanding the potential applications of LED therapy and could be useful in the treatment of patients with anomalous reactions to sunlight.

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Treatment of radiation-induced dermatitis with light-emitting diode (LED) photomodulation.

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BACKGROUND AND OBJECTIVE: Light-emitting diode (LED) photomodulation increases dermal collagen and reduces inflammation. This study evaluated the use of LED photomodulation in the prevention of radiation-induced dermatitis in breast cancer. MATERIALS AND METHODS: Patients (n=19) were treated with LED photomodulation (Gentlewaves, Light BioScience, LLC, Virginia Beach, VA) after each of a series of intensity-modulated radiation treatments (IMRT). Skin reactions were monitored weekly with National Cancer Institute (NCI) criteria. Age-matched controls (n=28) received IMRT without LED photomodulation. RESULTS: In LED-treated patients, 18 (94.7%) had grade 0 or 1 reaction and 1 (5.3%) had grade 2 reaction. Among controls, 4 (14.3%) had a grade 1 reaction, 24 (85.7%) had a grade 2 or 3 reaction. One LED-treated patient (5.3%) and 19 controls (67.9%) had to interrupt treatment. CONCLUSION: LED photomodulation treatments immediately after IMRT reduces the incidence of NCI grades 1, 2, and 3 skin reactions in patients with breast cancer treated by radiation therapy (RT) postlumpectomy.

Lasers Surg Med 2007 Feb 39(2) 164-8

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=17311276

Modification of late dermal necrosis in the pig by treatment with multi-wavelength light.

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Low-level light from a multi-wavelength light source has been used to prevent late X-ray-induced dermal necrosis in the pig. Skin fields, measuring 4 cm x 4 cm on the flank, were irradiated with graded doses of X rays and the incidence of late dermal necrosis at 10-16 weeks after irradiation was scored. The control skin sites were irradiated only with 250 kV X rays but the test skin sites were subsequently exposed to low-level light. Local light exposure was from an array of gallium aluminium arsenide diodes, which produced wavelengths of 660, 820, 880 and 950 nm, pulsating at 5 kHz. Light treatment was given three times a week, from 6-16 weeks after X irradiation. Each treatment session was 1 min, which was equivalent to energy density of 1.08 Jcm-2. Light treatment increased the ED50, the dose which causes dermal necrosis in 50% of the irradiated skin fields, from 20.10 +/- 0.12 Gy to 21.94 +/- 0.30 Gy. This difference, although small, was highly significant ($p < 0.001$) and was equivalent to a dose modification factor (DMF) of 1.09. The effect of light treatment was minimal at incidence levels of less than the 50% but greater at higher levels of effect. These findings suggest that low-level light, when applied appropriately, may be useful in the prevention of late X-ray-induced damage to the dermis.

Br J Radiol 1993 Feb 66(782) 145-9

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=8457828

Allergic contact dermatitis and Langerhans cells: comments on recent developments.

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Among the most interesting medical developments of the twentieth century is the revelation that the skin is an organ of major immunologic importance (about 95 percent of resident cells in the epidermis [keratinocytes and Langerhans cells] can serve immunologic functions). Allergic contact-type dermatitis and its underlying mechanism, allergic contact-type sensitization, have been a highly useful model in uncovering the facts that are the basis for this statement. The comments in this article deal with a few randomly selected findings that have been reported in the literature during the past twenty years. They include the probable role of the Birbeck granules in the process of antigen presentation by Langerhans cells; photomodulation of important immunologic reactions by ultraviolet radiation; a previously unrecognized form of contact allergy, apparently present only at clinically active sites of atopic dermatitis (and engendered by small protein antigens rather than by small molecular ["simple chemical"] compounds); and the first factual evidence that epidermal Langerhans cells may be subject to control by intraepidermally located parts of the peripheral nervous system.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=8299387

Prevention of X-ray-induced late dermal necrosis in the pig by treatment with multi-wavelength light.

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Low-level light from a multi-wavelength array of light sources has been used to prevent late X-ray-induced dermal necrosis in the pig. Skin fields, measuring 4 x 4 cm on the flank, were irradiated with a single dose of 23.4 Gy of X-rays. This X-ray dose was associated with the development of a 100% incidence of dermal necrosis, 10-16 weeks after irradiation. These irradiated skin sites were subsequently exposed to light of 660, 820, 880, and 950 nm wavelengths from a gallium aluminium arsenide multiple wavelength multidiode cluster probe (Biotherapy Medical Laser, 3ML), three times a week, from 4 to 16 weeks or 6 to 16 weeks after X-irradiation. The skin fields were exposed to the light pulsating at either 2.5 Hz or 5 kHz. With light pulsating at 5 kHz, energy densities of 0.22, 0.54, 1.08 2.16, 4.32, and 10.8 J/cm2 were used. Treatment with light pulsating at 2.5 Hz, 6-16 weeks after X-irradiation, or treatment with light pulsating at 5 kHz, 4-16 weeks after X-irradiation, did not have a significant effect on the incidence or the latency for the development of ischemic dermal necrosis irrespective of the exposure time to light at each treatment. With light pulsating at 5 kHz, no effect of light dose was observed. However, the overall incidence of dermal necrosis was significantly reduced ($P = 0.001$) to 52% in the X-irradiated fields receiving treatment with 5 kHz light, 6-16 weeks after X-irradiation.(ABSTRACT TRUNCATED AT 250 WORDS)

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Radiation damage of lips and its treatment by low-intensity laser irradiation

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Acute radiation reactions and injuries of lips skin and mucous membrane occur after radiation treatment of lips cancer. We denote such reactions and injuries of lips skin and mucous membrane by common term- after radiation heilit. Medicinal treatment is not effective enough in the solution of this problem. So we created the method, which can allow to cure afterradiation heilit only by low-intensity laser irradiation fully and without complications.

Proc. SPIE 1984, Advanced Laser Dentistry, 245 (April 17, 1995)

http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=1014720