



Low Level Laser Therapy (LLLT) for oral mucositis

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Low Level Laser Therapy (LLLT) for oral mucositis

One of the major dose-limiting side-effects of chemotherapy drugs is oral mucositis. The clinical manifestation is loss of the mucosal lining leading to an extremely sore throat and ulceration.

Oral mucositis can affect up to 100% of patients undergoing high-dose chemotherapy and hematopoietic stem cell transplantation (HSCT), 80% of patients with malignancies of the head and neck receiving radiotherapy, and a wide range of patients receiving chemotherapy.

Low Level Light Therapy (LLLT) is a safe, low intensity (non-thermal) light therapy treatment. It improves tissue repair, immune response, reduces inflammation and pain in a wide range of medical conditions.

How does it work ?

There are hundreds of different cell types in the body, each performing different functions, they all contain lots of mitochondria, (cellular power plants) which generate most of the cell's supply of energy (ATP). Mitochondria are also involved in a range of other cellular processes, including signalling, differentiation, inflammation, cell survival, cell death and are consequently implicated in many diseases.

Mitochondria in stressed or ischaemic tissues produce nitric oxide (mtNO) which binds to cytochrome c oxidase, competitively displacing oxygen. This causes increased oxidative stress and reduced ATP, leading to inflammation and poor cellular function.

Light of the correct wavelength (generated by low intensity lasers and LED's), when applied to stressed tissues, is absorbed by cytochrome c oxidase. The light displaces the mtNO thereby reducing oxidative stress and increasing ATP production; this reduces inflammation and increases cell metabolism.

The subsequent cascade of downstream metabolic effects have been shown to include increased exchange of Ca²⁺, secretion of growth factors, activation of enzymes & other secondary messengers.

Within hours and sometimes minutes following LLLT, increases in cellular activity have been shown in vitro and in vivo in neutrophils, macrophages, fibroblasts, mast cells, endothelial cells and keratinocytes. Reduced inflammatory markers including prostaglandin E2, interleukin 1 β and TNF α have also been seen in many studies.

A recent systematic review found that LLLT reduces pain, severity and duration of chemotherapy and radiotherapy induced Oral Mucositis.

Mitochondria in stressed cells produce Nitric Oxide (mtNO) which displace oxygen in cytochrome c oxidase leading to increased oxidative stress (inflammation & necrosis) and reduced production of ATP.

The following 34 abstracts show consistent evidence that LLLT reduces pain and ulceration in chemotherapy and radiation therapy patients.

A systematic review with meta-analysis of the effect of low-level laser therapy (LLLT) in cancer therapy-induced oral mucositis.

Bjordal JM, Bensadoun RJ, Tuner J, Frigo L, Gjerde K, Lopes-Martins RA

Centre for Evidence-Based Practice, Bergen University College-HiB, Moellendalsvn. 6, 5009, Bergen, Norway, jmb@hib.no.

PURPOSE: The purpose of this study is to review the effects of low-level laser therapy (LLLT) in the prevention and treatment of cancer therapy-induced oral mucositis (OM). **METHODS:** A systematic review and meta-analysis of randomised placebo-controlled trials of LLLT performed during chemotherapy or radiation therapy in head and neck cancer patients. **RESULTS:** We found 11 randomised placebo-controlled trials with a total of 415 patients; methodological quality was acceptable at 4.10 (SD +/- 0.74) on the 5-point Jadad scale. The relative risk (RR) for developing OM was significantly ($p = 0.02$) reduced after LLLT compared with placebo LLLT ($RR = 2.03$ (95% CI, 1.11 to 3.69)). This preventive effect of LLLT improved to $RR = 2.72$ (95% CI, 1.98 to 3.74) when only trials with adequate doses above 1 J were included. For treatment of OM ulcers, the number of days with OM grade 2 or worse was significantly reduced after LLLT to 4.38 (95% CI, 3.35 to 5.40) days less than placebo LLLT. Oral mucositis severity was also reduced after LLLT with a standardised mean difference of 1.33 (95% CI, 0.68 to 1.98) over placebo LLLT. All studies registered possible side-effects, but they were not significantly different from placebo LLLT. **CONCLUSIONS:** There is consistent evidence from small high-quality studies that red and infrared LLLT can partly prevent development of cancer therapy-induced OM. LLLT also significantly reduced pain, severity and duration of symptoms in patients with cancer therapy-induced OM.

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[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21660670](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21660670)

Low-power laser in the prevention of induced oral mucositis in bone marrow transplantation patients: a randomized trial.

Antunes HS, de Azevedo AM, da Silva Bouzas LF, Adao CA, Pinheiro CT, Mayhe R, Pinheiro LH, Azevedo R, D'Aiuto de Matos V, Rodrigues PC, Small IA, Zangaro RA, Ferreira CG.

Section of Dentistry, Instituto Nacional de Cancer (INCA), Rio de Janeiro.

Brazil We investigated the clinical effects of low-power laser therapy (LPLT) on prevention and reduction of severity of conditioning-induced oral mucositis (OM) for hematopoietic stem cell transplantation (HSCT). We randomized 38 patients who underwent autologous (AT) or allogeneic (AL) HSCT. A diode InGaAlP was used, emitting light at 660 nm, 50 mW, and 4 J/cm², measured at the fiberoptic end with 0.196 cm² of section area. The evaluation of OM was done using the Oral Mucositis Assessment Scale (OMAS) and the World Health Organization (WHO) scale. In the LPLT group, 94.7% of patients had an OM grade (WHO) lower than or equal to grade 2, including 63.2% with grade 0 and 1, whereas in the controls group, 31.5% of patients had an OM grade lower than or equal to grade 2 ($P < .001$). Remarkably, the hazard ratio (HR) for grades 2, 3, and 4 OM was 0.41 (range, 0.22-0.75; $P = .002$) and for grades 3 and 4 it was 0.07 (range, 0.11-0.53; $P < .001$). Using OMAS by the calculation of ulcerous area, 5.3% of the laser group presented with ulcers of 9.1 cm² to 18 cm², whereas 73.6% of the control group presented with ulcers from 9.1 cm² to 18 cm² ($P = .003$). Our results indicate that the use of upfront LPLT in patients who have undergone HSCT is a powerful instrument in reducing the incidence of OM and is now standard in our center.

Blood 2007 Mar 109 (5) 2250-55

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=PureSearch&db=pubmed&details_term=17053058%5BUID%5D](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=PureSearch&db=pubmed&details_term=17053058%5BUID%5D)

Evaluation of low-level laser therapy in the prevention and treatment of radiation-induced mucositis: A double-blind randomized study in head and neck cancer patients.

Carvalho PA, Jaguar GC, Pellizzon AC, Prado JD, Lopes RN, Alves FA

Stomatology Department - Hospital A.C. Camargo, Sao Paulo, Brazil.

The purpose of this prospective study was to determine the effect of the low-level laser in the prevention and treatment of mucositis in head and neck cancer patients. A total of 70 patients with malignant neoplasms in the oral cavity or oropharynx were evaluated. The patients were randomized into two low-level laser therapy groups: Group 1 (660nm/15mW/3.8J/cm²/spot size 4mm²) or Group 2 (660nm/5mW/1.3J/cm²/spot size 4mm²) starting on the first day of radiotherapy. Oral mucositis was assessed daily and weekly using the NCI and WHO scales. Oral pain was scored daily with a visual analogue scale before laser application. The patients in Group 1 had a mean time of 13.5days (range 6-26days) to present mucositis grade II, while the patients in Group 2 had a mean time of 9.8days (range 4-14days) (both WHO and NCI p=0.005). In addition, Group 2 also presented a higher mucositis grade than Group 1 with significant differences found in weeks 2 (p=0.019), 3 (p=0.005) and 4 (p=0.003) for WHO scale and weeks 2 (p=0.009) and 4 (p=0.013) for NCI scale. The patients in Group 1 reported lower pain levels (p=0.004). Low-level laser therapy during radiotherapy was found to be effective in controlling the intensity of mucositis and pain.

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[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21911312](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21911312)

Low-energy He/Ne laser in the prevention of radiation-induced mucositis. A multicenter phase III randomized study in patients with head and neck cancer.

Bensadoun RJ, Franquin JC, Ciais G, Darcourt V, Schubert MM, Viot M, Dejou J, Tardieu C, Benezery K, Nguyen TD, Laudoyer Y, Dassonville O, Poissonnet G, Vallicioni J, Thyss A, Hamdi M, Chauvel P, Demard F

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Use of the low-energy helium-neon laser (LEL) appears to be a simple atraumatic technique for the prevention and treatment of mucositis of various origins. Preliminary findings, and significant results obtained for chemotherapy-induced mucositis in a previous phase III study, prompted a randomized multicenter double-blind trial to evaluate LEL in the prevention of acute radiation-induced stomatitis. Irradiation by LEL corresponds to local application of a high-photon-density monochromatic light source. Activation of epithelial healing for LEL-treated surfaces, the most commonly recognized effect, has been confirmed by numerous in vitro studies. The mechanism of action at a molecular and enzymatic level is presently being studied. From September 1994 to March 1998, 30 patients were randomized. Technical specification: 60 mW (25 mW at Reims, 1 patient), He-Ne, wavelength 632.8 nm. The trial was open to patients with carcinoma of the oropharynx, hypopharynx and oral cavity, treated by radiotherapy alone (65 Gy at a rate of 2 Gy/fraction, 5 fractions per week) without prior surgery or concomitant chemotherapy. The malignant tumor had to be located outside the tested laser application areas (9 points): posterior third of the internal surfaces of the cheeks, soft palate and anterior tonsillar pillars. Patients were randomized to LEL or placebo light treatment, starting on the first day of radiotherapy and before each session. The treatment time (t) for each application point was given by the equation : $t(s) = \text{energy (J/cm}^2) \times \text{surface (cm}^2\text{)} / \text{Power (W)}$. Objective assessment of the degree of mucositis was recorded weekly by a physician blinded to the type of treatment, using the WHO scale for grading of mucositis and a segmented visual analogue scale for pain evaluation. Protocol feasibility and compliance were excellent. Grade 3 mucositis occurred with a frequency of 35.2% without LEL and of 7.6% with LEL ($P < 0.01$). The frequency of "severe pain" (grade 3) was 23.8% without LEL, falling to 1.9% with LEL ($P < 0.05$). Pain relief was significantly reduced throughout the treatment period (weeks 2-7). LEL therapy is capable of reducing the severity and duration of oral mucositis associated with radiation therapy. In addition, there is a tremendous potential for using LEL in combined treatment protocols utilizing concomitant chemotherapy and radiotherapy.

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[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=10423050](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=10423050)

Low-level infrared laser therapy in chemotherapy-induced oral mucositis: a randomized placebo-controlled trial in children.

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BACKGROUND: Oral mucositis (OM) is one of the most frequent complications of chemotherapy for which there is no standard therapy; treatment is mostly conservative. This study was conducted to determine whether low-intensity laser therapy (LLLT) can reduce the duration of chemotherapy-induced OM. **PROCEDURE:** A placebo-controlled randomized trial was carried out using LLLT or placebo (sham treatment). Children and adolescents with cancer receiving chemotherapy or hematopoietic stem-cell transplantation between October 2005 and May 2006 were eligible as soon as they developed OM. Patients received intervention for 5 days. The LLLT group was treated with laser GaAlAs, wavelength (lambda): 830 nm (infrared), power: 100 mW, dose: 4 J/cm, and placebo group underwent sham treatment. The grade of OM was clinically assessed by the National Cancer Institute, Common Toxicity Criteria scale. **RESULTS:** Twenty-one patients developed OM and were evaluable for analysis; 18 (86%) patients had a diagnosis of leukemia or lymphoma and 3(14%) had solid tumors. The mean age was 8.2 (+/-3.1) years. Nine patients were randomized in the laser group and 12 in the placebo-control group. Once OM was diagnosed, the patients had daily OM grading assessments before laser or sham application and thereafter until complete healing of the lesions. On day 7 after OM diagnosis, 1/9 of patients remained with lesions in laser group and 9/12 of patients in the placebo-control group ($P=0.029$). In the laser group, the mean of OM duration was $5.8+/-2$ days and in the placebo group was $8.9+/-2.4$ days ($P=0.004$). **CONCLUSIONS:** Our study has shown evidence that laser therapy in addition to oral care can decrease the duration of chemotherapy-induced OM. **Our results confirm the promising results observed in adult cancer patients and should encourage pediatric oncologists to use laser therapy as first-line option in children with chemotherapy-induced OM.**

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cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=19125084](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=19125084)

Severity of Oral Mucositis in Patients Undergoing Hematopoietic Cell Transplantation and an Oral Laser Phototherapy Protocol: A Survey of 30 Patients.

Eduardo FD, Bezinelli L, Luiz AC, Correa L, Vogel C, Eduardo CD

Hospital Israelita Albert Einstein, Unit of Bone Marrow Transplantation, School of Dentistry, University of Sao Paulo, Sao Paulo, Brazil.

Abstract Background Data and Objective: Oral mucositis (OM) is one of the worst cytotoxic effects of chemotherapy and radiotherapy in patients undergoing hematopoietic cell transplantation (HCT), and it causes severe morbidity. Laser phototherapy has been considered as an alternative therapy for prevention and treatment of OM. The aim of this study was to describe the incidence and severity of OM in HCT patients subjected to laser phototherapy, and to discuss its effect on the oral mucosa.

Patients and Methods: Information concerning patient age and gender, type of basic disease, conditioning regimen, type of transplant, absence or presence of pain related to the oral cavity, OM grade, and adverse reactions or unusual events were collected from 30 patients undergoing HCT (allogeneic or autologous). These patients were given oral laser phototherapy with a InGaAIP laser (660 nm and 40 mW) daily. The data were tabulated and their frequency expressed as percentages.

Results: In the analysis of those with OM, it was observed that 33.4% exhibited grade I, 40% grade II, 23.3% grade III, and 3.3% grade IV disease. On the most critical post-HCT days (D+5 and D+8), it was observed that 63.3% of patients had grade I and 33.3% had grade II disease; no patients had grade III or IV disease in this period. This severity of OM was similar to that seen in other studies of laser phototherapy and OM. **Conclusion:** The low grades of OM observed in this survey show the beneficial effects of laser phototherapy, but randomized clinical trials are necessary to confirm these findings.

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cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18699729](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18699729)

Amelioration of oral mucositis pain by NASA near-infrared light-emitting diodes in bone marrow transplant patients.

Hodgson BD, Margolis DM, Salzman DE, Eastwood D, Tarima S, Williams LD, Sande JE, Vaughan WP, Whelan HT

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PURPOSE: This study seeks to investigate the use of extra-orally applied near-infrared phototherapy for the reduction of oral pain secondary to chemotherapy- and radiation therapy-induced mucositis in adult and pediatric hematopoietic stem cell transplant (HSCT) patients. **METHODS:** Eighty HSCT patients were divided into regular (R) and low (L) risk groups, then to experimental (E) and placebo (P) groups, resulting in four groups (ER, EL, PR, PL). Experimental subjects received 670 (+/-10) nm gallium-aluminum-arsenide light-emitting diode device for 80 s at approximately 50 mW/cm(2) energy density and power exposure of 4 J/cm(2). Placebo patients received the same procedures, but with a placebo phototherapy (identical device but <5 mW/cm(2) energy density). Patients received their respective light therapy once per day starting on the day of the HSCT (day 0) and continued through day +14. Blinded evaluators examined the patients three times per week and scored their oral tissues and patient-reported pain assessments at each evaluation utilizing the WHO, NCI-CTCAE, and OMAS scales. **RESULTS:** Analysis of the mean scores at each observation demonstrate that the extra-oral application of phototherapy resulted in a significant reduction in patient-reported pain between the ER and PR patients ($p < 0.05$) at day +14 when graded via the WHO criteria. The ER and EL patients were improved in almost all other categories and assessment scales, but the differences were not statistically significant. **CONCLUSION:** Phototherapy demonstrated a significant reduction in patient-reported pain as measured by the WHO criteria in this patient population included in this study. Improvement trends were noted in most other assessment measurements.

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cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21725826](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21725826)

Chemotherapy-induced oral mucositis in a patient with acute lymphoblastic leukaemia.

Rimulo AL, Ferreira MC, Abreu MH, Aguirre-Neto JC, Paiva SM

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BACKGROUND: Oral mucositis is the main complication of chemotherapy and radiotherapy used in the treatment of cancer. Phototherapy has proven effective in the treatment of mucositis, as it accelerates the tissue healing process and has both analgesic and anti-inflammatory properties. **CASE REPORT:** This paper reports the case of a paediatric patient with oral mucositis stemming from chemotherapy employed for the treatment of acute lymphoblastic leukaemia. **TREATMENT:** The lesions were treated daily with a light-emitting diode (LED). **FOLLOWUP:** Remission of the lesions occurred after 10 days of treatment. **CONCLUSIONS:** LED was effective in the treatment of mucositis, as it diminished pain symptoms and accelerated the tissue repair process.

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[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&doct=Citation&list_uids=21473846](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&doct=Citation&list_uids=21473846)

Low level laser therapy in oral mucositis: a pilot study.

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AIM: The goal of this pilot study was to investigate the capacity of pain relief and wound healing of low level laser therapy (LLLT) in chemotherapy-induced oral mucositis (OM) in a paediatric oncology population group. **STUDY DESIGN AND METHODS:** 16 children (mean age 9.4 years) from the Gent University Hospital - Department Paediatric Oncology/haematology, suffering from chemotherapy-induced OM were selected. During clinical investigations, the OM grade was assessed using the WHO classification. All children were treated using a GaAlAs diode laser with 830 nm wavelength and a potency of 150 mW. The energy released was adapted according to the severity of the OM lesions. The same protocol was repeated every 48 hrs until healing of each lesion occurred. Subjective pain was monitored before and immediately after treatment by an appropriate pain scale and functional impairment was recorded. At each visit, related blood cell counts were recorded. **RESULTS:** After 12 mths, records were evaluated and information about treatment sequence, treatment sessions and frequencies related to the pain sensation and comfort were registered. Immediately after beaming the OM, pain relief was noticed. Depending on the severity of OM, on average, 2.5 treatments per lesion in a period of 1 week were sufficient to heal a mucositis lesion. **CONCLUSIONS:** LLLT, one of the most recent and promising treatment therapies, has been shown to reduce the severity and duration of mucositis and to relieve pain significantly. In the present study similar effects were obtained with the GaAlAs 830nm diode laser. It became clear that using the latter diode device, new guidelines could be developed as a function of the WHO-OM grades i.e. the lower the grade, the less energy needed. Immediate pain relief and improved wound healing resolved functional impairment that was obtained in all cases.

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cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21473845](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21473845)

Laser phototherapy as a treatment for radiotherapy-induced oral mucositis.

Lino MD, Carvalho FB, Oliveira LR, Magalhaes EB, Pinheiro AL, Ramalho LM

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Oral mucositis is a harmful side effect of radiotherapy (RT) on the head and neck region. There are encouraging reports on the beneficial aspects of the use of laser light on the treatment of oral mucositis. This paper reports the efficacy of laser phototherapy (LPT) on the treatment of oral mucositis in a patient undergoing RT after surgical removal of a squamous cell carcinoma with osseous invasion of the maxilla. Palatal and commissural lesions were treated with lambda660 nm, 40 mW, slashed circle=4 mm², in contact mode, 5 x 2.4 J/cm² per point, 14.4 J/cm² per session. For treating the lesion on the patient's nasal mucosa, LPT (slashed circle=4 mm², lambda780 nm, 70 mW, 3 x 2.1 J/cm² per point, 6.3 J/cm² per session, contact mode) was used on the external area of the nose. A single dose (2.4 J/cm²) with the lambda660 nm laser, as described before, was applied on the entrance of each nostril. LPT was used 3 times/week during 4 weeks. **Treatment results indicate that the use of LPT on oral mucositis was effective and allowed the patient to carry on the RT without interruption.** However, long-term and controlled clinical trials are necessary to establish both preventive and curative protocols using LPT.

Braz Dent J 2011 22(2) 162-5

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21537592](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21537592)

The Prevention of Induced Oral Mucositis with Low-Level Laser Therapy in Bone Marrow Transplantation Patients: A Randomized Clinical Trial.

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1 Hematopoietic Stem Cell Transplant Unit, Araujo Jorge Hospital, Goias Fight Cancer Association , Goiania, Goias, Brazil .

Abstract Background Data and Objective: Patients who have received high doses of chemotherapy, either alone or in combination with total body irradiation often cite oral mucositis (OM) as the most debilitating side effect. The aim of this study was to investigate the clinical effects of low-level laser therapy (LLLT) on the prevention of conditioning-induced OM in hematopoietic stem cell transplantation (HSCT). **Methods:** We randomized 42 patients who underwent autologous or allogeneic HSCT. A low-level InGaAlP diode laser was used, emitting light at 660 nm, 40 mW, and 4 J/cm². An evaluation of OM was carried out using the World Health Organization scale. **Results and Conclusion:** In the LLLT group, 57.1% of patients had an OM grade 0, 9.6% had grade 1, and 33.3% had grade 2, whereas in the control group, only 4.8% of patients were free of OM (grade 0). **Our results indicate that the preventive use of LLLT in patients who have undergone HSCT is a powerful instrument in reducing OM incidence.**

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[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=20969443](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=20969443)

A randomized controlled trial of visible-light therapy for the prevention of oral mucositis.

Elad S, Luboshitz-Shon N, Cohen T, Wainchwaig E, Shapira MY, Resnick IB, Radiano R, Lubart R, Or R

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The objective of this study was to assess the efficacy of a novel visible-light therapy (VLT) device for the prevention of oral mucositis in hematopoietic stem cell transplantation (HSCT) patients. A VLT-device suitable for intra-oral use was applied to 20 patients undergoing HSCT. The study design was placebo-controlled, randomized and double-blind. Oral mucositis was assessed using the OMAS and WHO scales. Oral pain and acceptance levels were scored by the patient using a 10-step scale. Patients were evaluated once a week until day 21 post-HSCT. Mucositis rate, severity and pain score were compared. At the third visit, 1 week post-HSCT, mucositis rates were significantly lower in the treatment group (for both WHO and OMAS $p=0.02$). Mucositis was also less severe in the treatment group (for WHO $p=0.01$; for OMAS $p=0.01$). Furthermore, the patients in the treatment group reported lower pain levels ($p=0.04$). The treatment was well tolerated and highly accepted, with no reports of adverse events related to the device. **These findings suggest that the VLT-device is safe and effective for the prevention of oral mucositis in patients undergoing HSCT.**

Oral Oncol 2010 Dec 15

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cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21163686](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21163686)

Efficacy of low-level laser therapy and aluminum hydroxide in patients with chemotherapy and radiotherapy-induced oral mucositis.

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This study evaluated the efficacy of low-level laser therapy (LLLT) and aluminum hydroxide (AH) in the prevention of oral mucositis (OM). A prospective, comparative and non-randomized study was conducted with 25 patients with head and neck cancer subjected to radiotherapy (RT) or radiochemotherapy (RCT). Twelve patients received LLLT (830 nm, 15 mW, 12 J/cm²) daily from the 1st day until the end of RT before each sessions during 5 consecutive days, and the other 13 patients received AH 310 mg/5 mL, 4 times/day, also throughout the duration of RT, including weekends. OM was measured using an oral toxicity scale (OTS) and pain was measured using the visual analogue scale (VAS). EORTC questionnaires were administered to evaluate the impact of OM on quality of life. The LLLT group showed lower mean OTS and VAS scores during the course of RT. A significant difference was observed in pain evaluation in the 13th RT session ($p=0.036$). In both groups, no interruption of RT was needed. The prophylactic use of both treatments proposed in this study seems to reduce the incidence of severe OM lesions. However, **the LLLT was more effective in delaying the appearance of severe OM.**

Braz Dent J 2010 21(3) 186-92

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21203698](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21203698)

Use of 660-nm Diode Laser in the Prevention and Treatment of Human Oral Mucositis Induced by Radiotherapy and Chemotherapy.

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1 Photobiology and Lasertherapy Center, Vale do Paraiba University , Sao Jose dos Campos, SP, Brazil .

Abstract Objective: The aim of this multidisciplinary study was to evaluate quantitatively and qualitatively the effect of a 660-nm diode laser in the prevention and treatment of human oral mucositis (OM) in patients suffering from head and neck cancer who had undergone radiotherapy and chemotherapy. **Background Data:** OM is a severe oral lesion resulting from the toxic effects of treatment for cancer in the head and neck region. Low-level laser therapy is indicated to prevent and treat this oral complication and may be used alone or in association with conventional drug treatment, producing pain relief and wound repair.

Methods: This study included 72 patients with head and neck cancer treated at the Cancer Hospital of Mato-Grosso, Brazil, and divided into a control group (C; n = 36) and a laser group (L; n = 36). Laser therapy was performed in combination with radiotherapy and chemotherapy twice a week using a diode laser ($\lambda = 660$ nm, power = 30 mW, spot size = 2 mm, energy = 2 J per point). **Results:** Statistically significant differences were observed between the two groups. Patients in group L usually did not present with OM or pain, but all patients in group C presented with OM ranging from Level I to III associated with pain. This difference was significant from week 1 on, increased until week 4 and remained stable up to week 7. **Conclusion:** **Laser therapy was effective in preventing and treating oral effects induced by radiotherapy and chemotherapy, thus improving the patient's quality of life.**

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Laser Phototherapy as Topical Prophylaxis Against Radiation-Induced Xerostomia.

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Abstract The common consequences of radiotherapy (RT) to the head and neck are oral mucositis, xerostomia, and severe pain. The aim of this study was to verify how laser phototherapy (LPT) used for oral mucositis could influence xerostomia symptoms and hyposalivation of patients undergoing RT. Patients were divided into two groups: 12 individuals receiving three laser irradiations per week (G1) and 10 patients receiving one laser irradiation per week (G2). A diode laser (660 nm, 6 J/cm², 0.24 J, 40 mW) was used until completely healing of the lesions or the end of the RT. At the first and last laser sessions, whole resting and stimulated saliva were collected, and questionnaires were administered. According to Wilcoxon and Student statistical test, xerostomia for G1 was lower than for G2 ($p < 0.05$), and salivary flow rate was no different before and after RT, except for stimulated collection of G2, which was lower ($p < 0.05$). Our results suggest that LPT can be beneficial as an auxiliary therapy for hypofunction of salivary glands.

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cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=19814701](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=19814701)

Evaluation of low-level laser therapy in the prevention and treatment of radiation-induced mucositis: A double-blind randomized study in head and neck cancer patients.

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Stomatology Department - Hospital A.C. Camargo, São Paulo, Brazil.

Abstract

The purpose of this prospective study was to determine the effect of the low-level laser in the prevention and treatment of mucositis in head and neck cancer patients. A total of 70 patients with malignant neoplasms in the oral cavity or oropharynx were evaluated. The patients were randomized into two low-level laser therapy groups: Group 1 (660nm/15mW/3.8J/cm²/spot size 4mm²) or Group 2 (660nm/5mW/1.3J/cm²/spot size 4mm²) starting on the first day of radiotherapy. Oral mucositis was assessed daily and weekly using the NCI and WHO scales. Oral pain was scored daily with a visual analogue scale before laser application. The patients in Group 1 had a mean time of 13.5days (range 6-26days) to present mucositis grade II, while the patients in Group 2 had a mean time of 9.8days (range 4-14days) (both WHO and NCI p=0.005). In addition, Group 2 also presented a higher mucositis grade than Group 1 with significant differences found in weeks 2 (p=0.019), 3 (p=0.005) and 4 (p=0.003) for WHO scale and weeks 2 (p=0.009) and 4 (p=0.013) for NCI scale. **The patients in Group 1 reported lower pain levels (p=0.004).** Low-level laser therapy during radiotherapy was found to be effective in controlling the intensity of mucositis and pain.

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<http://www.ncbi.nlm.nih.gov/pubmed/21911312>

The Impact of low power laser in the treatment of conditioning-induced oral mucositis: a report of 11 clinical cases and their review.

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We have investigated the clinical effects of low power laser therapy (LPLT) on the treatment of conditioning-induced oral mucositis (OM) in patients submitted to hematopoietic stem cell transplantation (HSCT). The evaluation of OM was done using the Oral Mucositis Assessment Scale (OMAS) and World Health Organization (WHO) scale. In the context of a randomized placebo-controlled trial with 38 patients for the evaluation of preventive LPLT, eleven individuals were submitted to allogeneic (AL) HSCT and developed oral mucositis grade 4 (WHO) or a total area of OM of 12 cm (OMAS) and due to that were treated with LPLT with the purpose of symptom relief. The irradiation used was a diode InGaAlP, emitting light at 660 nm, 50 mW and 8 J/cm² measured at the end of fiber optic with 0.196 cm² of section area during the treatment. The tip of the laser device touched the oral mucosa and patients recovered on average 6 days (3-12 days) from the beginning of the laser application. Our results have indicated that the use of LPLT in HSCT patients is a powerful instrument in the treatment of overt OM and is now a standard procedure in this group of patients in our hospital.

Med Oral Patol Oral Cir Bucal 2008 Mar 13(3) E189-92

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18305441](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18305441)

Low-level laser therapy in the prevention and treatment of chemotherapy-induced oral mucositis in young patients.

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OBJECTIVE: A pilot clinical study was conducted to evaluate the efficacy and feasibility of low-level laser therapy (LLLT) in the prevention and treatment of chemotherapy (CT)-induced oral mucositis (OM) in young patients. **BACKGROUND DATA:** Besides compromising the patient's nutrition and well-being, oral mucositis represents a portal of entry into the body for microorganisms present in the mouth, which may lead to sepsis if there is hematological involvement. Oncologic treatment tolerance decreases and systemic complications may arise that interfere with the success of cancer treatment. LLLT appears to be an interesting alternative to other approaches to treating OM, due to its trophic, anti-inflammatory, and analgesic properties.

MATERIALS AND METHODS: Patients undergoing chemotherapy (22 cycles) without mucositis were randomized into a group receiving prophylactic laser-irradiation (group 1), and a group receiving placebo light treatment (group 2). Patients who had already presented with mucositis were placed in a group receiving irradiation for therapeutic purposes (group 3, with 10 cycles of CT). Serum granulocyte levels were taken and compared to the progression of mucositis. **RESULTS:** In group 1, most patients (73%) presented with mucositis of grade 0 ($p = 0.03$ when compared with the placebo group), and 18% presented with grade 1. In group 2, 27% had no OM and did not require therapy. In group 3, the patients had marked pain relief (as assessed by a visual analogue scale), and a decrease in the severity of OM, even when they had severe granulocytopenia.

CONCLUSION: The ease of use of LLLT, high patient acceptance, and the positive results achieved, make this therapy feasible for the prevention and treatment of OM in young patients.

Photomed Laser Surg 2008 Aug 26(4) 393-400

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cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18754720](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18754720)

Low energy Helium-Neon laser in the prevention of oral mucositis in patients undergoing bone marrow transplant: results of a double blind randomized trial.

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PURPOSE: To evaluate the efficiency of Helium-Neon (He-Ne) laser in the prevention of oral mucositis induced by high dose chemoradiotherapy before autologous bone marrow transplantation (BMT). **METHODS AND MATERIALS:** Between 1993 and 1995, 30 consecutive patients receiving an autologous peripheral stem-cell or bone marrow transplant (BMT) after high dose chemoradiotherapy were randomized to possibly receive prophylactic laser to the oral mucosa after giving informed consent. Chemotherapy consisted of cyclophosphamide, 60 mg/kg intravenously (I.V.) on day (d)-5 and d-4 in 27 cases, or melphalan 140 mg/kg I.V. on d-4 in three cases. Total body irradiation (TBI) consisted of 12 Gy midplane dose in six fractions (4 Gy/day for three days). He-Ne laser (632.8 nm wavelength, power 60 mW) applications were performed daily from d-5 to d-1 on five anatomic sites of the oral mucosa. Oral examination was performed daily from d0 to d + 20. Mucositis was scored according to an oral exam guide with a 16 item scale of which four were assessed by the patients themselves. Mean daily self assessment scores for oral pain, ability to swallow and oral dryness were measured. A daily mucositis index (DMI) and a cumulative oral mucositis score (COMS) were established. Requirement for narcotics and parenteral nutrition was recorded. **RESULTS:** The COMS was significantly reduced among laser treated (L+) patients ($p = 0.04$). The improvement of DMI in L+ patients was also statistically significant ($p < 0.05$) from d + 2 to d + 7. Occurrence and duration of grade III oral mucositis were reduced in L+ patients ($p = 0.01$). Laser applications reduced oral pain as assessed by patients ($p = 0.05$) and L+ patients required less morphine ($p = 0.05$). Xerostomia and ability to swallow were improved among the L+ patients ($p = 0.005$ and $p = 0.01$, respectively). Requirement for parenteral nutrition was not reduced ($p = \text{NS}$). **CONCLUSION:** Helium-Neon laser treatment was well tolerated, feasible in all cases, and reduced high dose chemoradiotherapy-induced oral mucositis. Optimal laser treatment schedules still needs to be defined.

Int J Radiat Oncol Biol Phys 1997 Jul 1 38(4) 697-703

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=9240635](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=9240635)

Low-energy laser therapy for prevention of oral mucositis in hematopoietic stem cell transplantation.

Jaguar GC, Prado JD, Nishimoto IN, Pinheiro MC, de Castro DO Jr, da Cruz Perez DE, Alves FA

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Aim: To evaluate the clinical effects of laser therapy on the prevention and reduction of oral mucositis in patients who underwent hematopoietic stem cell transplantation (HSCT). **Patients and methods:** From January 2003 to September 2004, 24 patients received prophylactic laser therapy (L+ group). The applications started from the beginning of the conditioning regimen up to day +2. The oral assessment was performed daily until day +30. This group was compared with historical controls, namely 25 patients, who did not receive laser therapy (L- group). **Results:** All patients developed some grade of mucositis. However, the L- group presented initial mucositis by 4.36 days, whereas the L+ group presented it in 6.12 days ($P = 0.01$). The maximum mucositis occurred between day +2 and day +6 with healing by day +25 in the L- group and between day +2 and day +7 with healing by day +14 for the L+ group ($P = 0.84$). Laser therapy also reduced the time of oral pain from 5.64 to 2.45 days ($P = 0.04$), and decreased the consumption of morphine ($P = 0.07$). **Conclusion:** This study suggests that laser therapy can be useful in oral mucositis to HSCT patients and improve the patient's quality of life. However, controlled randomized trials should be performed to confirm the real efficacy of laser therapy.

Oral Dis 2007 Nov 13(6) 538-43

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=17944669](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=17944669)

The use of low-energy laser (LEL) for the prevention of chemotherapy- and/or radiotherapy-induced oral mucositis in cancer patients: results from two prospective studies.

Genot-Klastersky MT, Klastersky J, Awada F, Awada A, Crombez P, Martinez MD, Jaivenois MF, Delmelle M, Vogt G, Meuleman N, Paesmans M

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BACKGROUND: Low-energy laser (LEL) treatment has been suggested as an effective and safe method to prevent and/or treat oral mucositis induced by chemotherapy and/or radiotherapy; however, it has not gained wide acceptance so far. **MATERIALS AND METHODS:** We conducted two clinical trials testing the LEL technique: firstly, as a secondary prevention in patients with various solid tumors treated with chemotherapy who all developed severe mucositis after a previous identical chemotherapy and, secondly, as therapeutic intervention (compared to sham illumination in a randomized way) in patients with hematological tumors receiving intensive chemotherapy and having developed low-grade oral mucositis. **RESULTS:** We entered 26 eligible patients in the first study and 36 were randomized in the second study. The success rate was 81% (95%CI = 61-93%) when LEL was given as a preventive treatment. In the second study, in patients with existing lesions, the therapeutic success rate was 83% (95%CI = 59-96%), which was significantly different from the success rate reached in the sham-treated patients (11%; 95%CI = 1-35%); the time to development of grade 3 mucositis was also significantly shorter in the sham-treated patients ($p < 0.001$). **CONCLUSION:** Our results strongly support the already available literature, suggesting that LEL is an effective and safe approach to prevent or treat oral mucositis resulting from cancer chemotherapy.

Support Care Cancer 2008 Dec 16(12) 1381-7

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18458964](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18458964)

[Laser therapy in the prevention and treatment of mucositis caused by anticancer chemotherapy]

Ciais G, Namer M, Schneider M, Demard F, Pourreau-Schneider N, Martin PM, Soudry M, Franquin JC, Zattara H

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The appearance of mucositis is a frequent and painful secondary effect of anticancer chemotherapy. Patients who develop oral toxicity during the first course of treatment will almost assuredly show identical side effects during each subsequent course unless the drugs are changed or the doses are lowered. In the absence of an efficacious antidote or preventive prophylaxis for such lesions to date, this report presents the results of a preliminary retrospective non-randomized study of the effect of soft-laser treatments on mucositis in cancer patients receiving combination chemotherapy, including 5-fluorouracil. Iatrogenic mucositis was observed during 43% of 53 chemotherapy cycles in the case control population. Curative laser therapy reduced the time to repair lesions and the rate of therapeutic modifications. **For patients who received soft-laser therapy as a preventive measure, the incidence of oral complications was reduced to 6% during 101 cycles of chemotherapy.** All of these patients, even those who have encountered mucositis before receiving preventive laser therapy, terminated their cancer therapy as originally scheduled. Well designed and carefully controlled trials will be necessary to define the place of helium-neon laser therapy in the repair and prevention of oral complications due to cancer chemotherapy.

Bull Cancer 1992 79(2) 183-91

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=1392157](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=1392157)

Literature news.

Sardella A

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AIM: To evaluate the clinical effects of laser therapy on the prevention and reduction of oral mucositis in patients who underwent hematopoietic stem cell transplantation (HSCT).
Patients and methods: From January 2003 to September 2004, 24 patients received prophylactic laser therapy (L+ group). The applications started from the beginning of the conditioning regimen up to day +2. The oral assessment was performed daily until day +30. This group was compared with historical controls, namely 25 patients, who did not receive laser therapy (L? group).
RESULTS: All patients developed some grade of mucositis. However, the L? group presented initial mucositis by 4.36 days, whereas the L+ group presented it in 6.12 days ($P = 0.01$). The maximum mucositis occurred between day +2 and day +6 with healing by day +25 in the L? group and between day +2 and day +7 with healing by day +14 for the L+ group ($P = 0.84$). Laser therapy also reduced the time of oral pain from 5.64 to 2.45 days ($P = 0.04$), and decreased the consumption of morphine ($P = 0.07$).

CONCLUSION: This study suggests that laser therapy can be useful in oral mucositis to HSCT patients and improve the patient's quality of life. However, controlled randomized trials should be performed to confirm the real efficacy of laser therapy.

Minerva Stomatol 2008 Jan-Feb 57(1-2) 77-8

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18427375](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18427375)

LED phototherapy to prevent mucositis: a case report.

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OBJECTIVE: The purpose of this case report was to evaluate the efficacy of phototherapy using light-emitting diodes (LEDs) to prevent oral mucositis in a Hodgkin's disease patient treated with the ABVD (doxorubicin [Adriamycin], bleomycin, vinblastine, and dacarbazine) chemotherapy regimen. **BACKGROUND DATA:** Mucositis is a common dose-limiting complication of cancer treatment, and if severe it can lead to alterations in treatment planning or suspension of cancer therapy, with serious consequences for tumor response and survival. Therefore, low-power lasers and more recently LEDs, have been used for oral mucositis prevention and management, with good results. **MATERIALS AND METHODS:** In this study, a 34-year-old man received intraoral irradiation with an infrared LED array (880 nm, 3.6 J/cm², 74 mW) for five consecutive days, starting on chemotherapy day 1. In each chemotherapy cycle, he received the ABVD protocol on days 1 and 15, and received LED treatment for 5 d during each cycle. To analyze the results, the World Health Organization (WHO) scale was used to grade his mucositis, and a visual analogue scale (VAS) was used for pain evaluation, on days 1, 3, 7, 10, and 13 post-chemotherapy.

RESULTS: The results showed that the patient did not develop oral mucositis during the five chemotherapy cycles, and he had no pain symptoms. **CONCLUSION:** LED therapy was a safe and effective method for preventing oral mucositis in this case report. However, further randomized studies with more patients are needed to prove the efficacy of this method.

Photomed Laser Surg 2008 Dec 26(6) 609-13

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=19025412](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=19025412)

Light-emitting diode therapy in chemotherapy-induced mucositis.

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BACKGROUND AND OBJECTIVE: Mucositis is the most common oral complication of cancer chemotherapy, which causes pain on mastication and swallowing, impairs patients' ability to eat and take oral drugs and may determine interruption of the treatment. The aim of this study was to evaluate the effect of light-emitting diode (LED) therapy on chemotherapy-induced mucositis in hamsters. **STUDY DESIGN/MATERIALS AND METHODS:** Animals of both experimental (Group I; n = 32) and positive control (Group II; n = 32) groups received intraperitoneal injections of 5-fluorouracil on days 0 and 2. All animals had their right and left cheek pouch irritated by superficial scratching on days 3 and 4. In Group I, LED irradiation (630 nm +/- 10 nm, 160 mW, 12 J/cm²) was applied during 37.5 seconds at days 3, 4, 6, 8, 10, 12, and 14. In Group II, mucositis was induced, but LED therapy was not performed. The oral mucosa was photographed from day 4 to 14 at 2-day intervals. Photographs were randomly scored according to the severity of induced mucositis (0 to 5). In the negative control group (Group III; n = 6), no mucositis was induced. Biopsies of the cheek pouches of 8 animals (Group I and Group II) were surgically obtained on days 5, 9, 13 and 15 and processed for histological examination. **RESULTS:** The statistical analysis showed significant differences between irradiated and non-irradiated groups (P<0.05). However, muscular degeneration was observed in 18% of the samples of Group I. **CONCLUSION:** It may be concluded that the LED therapy protocol established for this *in vivo* study was effective in reducing the severity of oral mucositis, although the oral lesions were not completely prevented.

Lasers Surg Med 2008 Nov 40(9) 625-33

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18951429](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18951429)

Improvement in quality of life of an oncological patient by laser phototherapy.

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OBJECTIVE AND BACKGROUND DATA: Common side effects of radiotherapy (RT) to the head and neck include oral mucositis, xerostomia, and severe pain. The aim of this study is to report improvement in the quality of life of an oncological patient by laser phototherapy (LPT).

CLINICAL CASE AND LASER PHOTOTHERAPY PROTOCOL: The patient, a 15-year-old girl diagnosed with mucoepidermoid carcinoma, underwent surgical excision of a tumor of the left palatomaxilla. After that, she was subjected to 35 sessions of RT (2 Gy/d). Clinical examination revealed the spread of severe ulcerations to the jugal mucosa, gums, lips, hard palate, and tongue (WHO mucositis score 3). She had difficulty in moving her tongue and she was unable to eat any solid food. Oral hygiene orientation and LPT were performed throughout all RT sessions. A continuous diode laser, 660 nm, 40 mW, 6 J/cm², 0.24 J per point in contact mode, with spot size of 0.04 cm² was used in the entire oral cavity. A high-power diode laser at 1 W, 10 sec per cm of mucositis, approximately 10 J/cm², was used in defocused mode only on ulcerative lesions. After the first laser irradiation session, decreases in pain and xerostomia were reported; however, a more significant improvement was seen after five sessions. At that point although the mucositis score was still 2, the patient reported that she was free of pain, and consequently a palatine plate could be made to rehabilitate the entire surgical area. Seventeen laser irradiation sessions were necessary to eliminate all oral mucositis lesions. **CONCLUSION:** Normal oral function and consequent improvements in the quality of life of this oncologic patient were observed with LPT.

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[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18800946](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18800946)

Efficacy of He-Ne Laser in the prevention and treatment of radiotherapy-induced oral mucositis in oral cancer patients.

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OBJECTIVE: The objective of this study was to evaluate the efficacy of low-level lasers for the prevention and treatment of radiotherapy-induced oral mucositis in oral cancer patients.

MATERIAL AND METHODS: Twenty-four hospitalized patients with oral cancer, scheduled to undergo radiotherapy at KMC, Manipal, were enrolled in the present study and assigned to laser (Group I)/control group (Group II). They were treated using He-Ne laser ($\lambda = 632.8\text{nm}$, output = 10 mW and energy density = 1.8 J/cm²). Patients were subjected to treatment using laser scanner for 8 days and subsequently were treated using laser probe at 6 anatomic sites in the oral cavity for 5 minutes each. The patients were evaluated on each day of treatment for pain severity (NRS), functional impairment (FIS), and oral mucositis (RTOG) and were followed until the end of cancer treatment. Statistical analysis was done using SPSS version 10. **RESULTS:** Laser therapy applied prophylactically during radiotherapy can reduce the severity of oral mucositis, severity of pain, and functional impairment.

Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008 Feb 105(2) 180-6, 186.e1

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18230388](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18230388)

Effect of low level helium-neon (He-Ne) laser therapy in the prevention & treatment of radiation induced mucositis in head & neck cancer patients.

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BACKGROUND & OBJECTIVES: Oral mucositis is a common debilitating complication of radiotherapy occurring in about 60 per cent of cancer patients. Considerable buccal toxicity of radiotherapy or chemotherapy in cancer patients to become discouraged and can affect their quality of life. In addition, such toxicity can alter the treatment plan. At present, there is no clinically appropriate prophylaxis efficacious antidote for mucositis. The low level laser (LEL) appears to be a simple, non-traumatic technique for the prevention and treatment of radiation induced mucositis. Therefore the present study was carried out to find out the effect of low-level helium-neon (He-Ne) laser in the prevention and treatment of radiation induced mucositis in head and neck cancer patients. **METHODS:** The patients with carcinoma of oral cavity with stages II-IV being uniformly treated with curative total tumour dose of 66 Gy in 33 fractions over 6 wk were selected for the study. The patients were divided based on computer generated randomization into laser (study group) and control groups with 25 patients in each group. Both study and control groups were comparable in terms of site of the lesion, stage of the cancer and histology. The study group patients were treated with He-Ne laser (wavelength 632.8 nm and output of 10mW) and control group patients were given oral analgesics, local application of anaesthetics, 0.9 per cent saline and povidine wash during the course of radiotherapy. **RESULTS:** All patients tolerated the laser treatment without any adverse effect or reactions. The result showed a significant difference in pain and mucositis ($P<0.001$) between the two groups. At the end of radiotherapy (after 6 wk) mean pain score and mucositis grade were significantly lower ($P<0.001$) in the study group compared to control. **INTERPRETATION & CONCLUSION:** The low-level He-Ne laser therapy during the radiotherapy treatment was found to be effective in preventing and treating the mucositis in head and neck cancer patients. Further studies need to be done on a larger sample to find the mechanism.

Indian J Med Res 2006 Oct 124(4) 399-402

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=17159259](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=17159259)

Low-level laser for prevention and therapy of oral mucositis induced by chemotherapy or radiotherapy.

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PURPOSE OF REVIEW: Oral mucositis is a common morbid condition associated with chemotherapy or radiotherapy for which there is no standard prophylaxis or treatment. There is increasing evidence that the use of low-level laser can reduce the severity of mucositis associated with chemotherapy or radiation therapy. The purpose of this review is to examine the available evidence for it. **RECENT FINDINGS:** For most approaches commonly used to prevent or treat chemotherapy-associated or radiotherapy-associated oral mucositis, a recent panel of experts could not find sufficient levels of evidence to recommend or suggest their use. As for low-level laser therapy, the results are difficult to assess and compare because of interoperator variability and because clinical trials are difficult to conduct in that field. Nevertheless, there is accumulating evidence in support of low-level laser therapy. **SUMMARY:** On the basis of literature data, it is reasonable to conclude that the evidence that low-level laser therapy may be useful in decreasing the severity of chemotherapy-associated or radiotherapy-associated mucositis is substantial, even though there have been few controlled studies in the field of prevention.

Curr Opin Oncol 2005 May 17(3) 236-40

[http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?
cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=15818167](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=15818167)

Helium-neon laser effects on conditioning-induced oral mucositis in bone marrow transplantation patients.

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BACKGROUND. Oral mucositis is a common complication of bone marrow transplantation (BMT) conditioning therapy. Sequelae consist of increased risk for infection, moderate to severe pain, compromised oral function, and bleeding. This study investigated helium-neon laser treatment for prevention of conditioning-induced oral mucositis in BMT patients. Patterns and severity of mucositis for specific conditioning drug regimens also were analyzed. **METHODS.** Twenty patients received laser radiation to their oral mucosa, either left or right of midline. The contralateral side was sham-treated and served as a control. Mucositis severity was scored independently by two modified versions of the Oral Mucositis Index Scale (OMI-A and OMI-B) and the Eastern Cooperative Oncology Group (ECOG) Oral Toxicity Scale; pain severity was scored by subjects on a visual analogue scale (VAS). Cumulative scores were analyzed for differences between the laser-treated and sham-treated sides. **RESULTS.** Oral mucositis and pain scores were significantly lower for the treated versus the untreated side by OMI-A and B ($P < 0.005$) and VAS ($P = 0.027$) criteria, respectively. Ulcerative lesions occurred in all patients bilaterally; severity increased until Day +6, and lesions resolved by Day +21. Mucositis was more severe for patients conditioned with busulfan/carboplatin/thiotepa than for patients conditioned with busulfan/cyclophosphamide/etoposide. **CONCLUSIONS.** Helium-neon laser treatment was well-tolerated and reduced the severity of conditioning-induced oral mucositis in BMT patients.

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Patients with moderate chemotherapy-induced mucositis: pain therapy using low intensity lasers.

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BACKGROUND: Intensive cancer therapy normally affects malignant and normal cells with high replication rates. Cells in the gastrointestinal tract are therefore commonly affected by cytotoxins. This often results in the development of chemotherapy-induced oral mucositis (COM). COM is the inflammatory response of the oral mucous membrane to the chemotherapy drugs. Low level laser therapy (LLLT) has proved to be effective in treating and repairing biologically damaged tissue and to reduce pain. LLLT has also proven to be an efficient method for the prevention of oral mucositis.

OBJECTIVE: To investigate the effect of LLLT on pain relief among patients who have developed COM. **METHOD:** The study was performed as a clinical test with a sample consisting of 13 adult patients receiving oncology treatment. The patients were treated during a 5-day period, and the pain was measured before and after each laser application. The laser used was an AsGaAl, with a wavelength of 830 nm and a potency of 250 mW. The energy given was 35 J cm(-2).

ANALYSIS: The results were analysed using the Wilcoxon test. **RESULTS:** There was a significant ($P = 0.007$) 67% decrease in the daily average experience of pain felt before and after each treatment, confirming that LLLT can relieve pain among patients who have developed COM. **STUDY LIMITATIONS:** The low number of COM patients at the hospital did not allow a control group to be included in the study, and therefore the results contain a potential placebo effect.

IMPLICATIONS FOR NURSING CARE: The most important benefit the authors consider to be the value for the patients of better and quicker treatment with a drastic reduction in painful mucositis.

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NASA light-emitting diodes for the prevention of oral mucositis in pediatric bone marrow transplant patients.

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OBJECTIVE: The purpose of this study was to determine the effects of prophylactic near-infrared light therapy from light-emitting diodes (LEDs) in pediatric bone marrow transplant (BMT) recipients. **BACKGROUND DATA:** Oral mucositis (OM) is a frequent side effect of chemotherapy that leads to increased morbidity. Near-infrared light has been shown to produce biostimulatory effects in tissues, and previous results using near-infrared lasers have shown improvement in OM indices. However, LEDs may hold greater potential for clinical applications. **MATERIALS AND METHODS:** We recruited 32 consecutive pediatric patients undergoing myeloablative therapy in preparation for BMT. Patients were examined by two of three pediatric dentists trained in assessing the Schubert oral mucositis index (OMI) for left and right buccal and lateral tongue mucosal surfaces, while the patients were asked to rate their current left and right mouth pain, left and right xerostomia, and throat pain. LED therapy consisted of daily treatment at a fluence of 4 J/cm² using a 670-nm LED array held to the left extraoral epithelium starting on the day of transplant, with a concurrent sham treatment on the right. Patients were assessed before BMT and every 2-3 days through posttransplant day 14. Outcomes included the percentage of patients with ulcerative oral mucositis (UOM) compared to historical epidemiological controls, the comparison of left and right buccal pain to throat pain, and the comparison between sides of the buccal and lateral tongue OMI and buccal pain. **RESULTS:** The incidence of UOM was 53%, compared to an expected rate of 70-90%. There was also a 48% and 39% reduction of treated left and right buccal pain, respectively, compared to untreated throat pain at about posttransplant day 7 ($p < 0.05$). There were no significant differences between sides in OMI or pain. **CONCLUSION:** Although more studies are needed, LED therapy appears useful in the prevention of OM in pediatric BMT patients.

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Pilot study of laser effects on oral mucositis in patients receiving chemotherapy.

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PURPOSE: The purpose of this study was to examine the effectiveness of laser therapy in the prevention and/or healing of chemotherapy-induced oral mucositis lesions. This study also evaluated the ease and feasibility of the laser therapy and the impact of the treatment on improving the patient's quality of life. **PATIENTS AND METHODS:** Fifteen patients with an episode of prior chemotherapy-induced grade 3 or 4 mucositis with 5-fluorouracil continuous infusion consented to participate in this study. All patients were provided with standardized mouth care instructions at the initiation of chemotherapy treatments. Enrolled patients received laser therapy treatments 24 hours before the chemotherapy and then recommenced weekly with evenly distributed exposure to the standardized designated areas by one operator during the entire cycle of chemotherapy at the same doses until the mucositis resolved or the chemotherapy cycle was completed. Intraoral perfusion was measured by laser Doppler technology. Patients were assessed for response to laser therapy according to standardized mucositis grading criteria by evaluating development of lesions, extent and duration of lesions, and time to healing. The effect of laser therapy on ability to continue planned chemotherapy, the reduction in dose, delays, and ability to maintain planned dose intensity were assessed. The impact of laser therapy on pain control was evaluated using the visual analogue score. A quality-of-life survey was completed by each patient at the initiation of chemotherapy and then weekly throughout the chemotherapy. **RESULTS:** Eleven of 15 patients experienced grade 0 mucositis, three patients experienced grade 1 to 2 mucositis, and one patient experienced grade 3 to 4 mucositis. Fourteen patients completed the lasertherapy as planned, and none of the patients withdrew from the laser therapy treatments because of noncompliance. One patient continued to experience grade 4 mucositis that necessitated an interruption in the planned chemotherapy regimen and, consequently, the laser treatment. Patients tolerated the laser therapy very well and did not report any increased discomfort. No significant changes in perfusion were observed as a result of laser therapy. **DISCUSSION:** In this pilot study, laser therapy significantly reduced the incidence and the severity of mucositis in chemotherapy patients. The laser therapy does not appear to promote wound healing by affecting the intraoral perfusion, as assessed by Doppler measurements. The mechanisms involved in the mediating of the observed effects remain unknown at this time. Continued research is warranted to determine the optimal laser wavelength and parameters.

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Effects of Low Level Laser Therapy on Oral Mucositis Caused by Anticancer Chemotherapy in Pediatric Patients

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Background: Oral mucositis is a common complication of anticancer chemotherapy. The sequelae of this consist of an increased risk of infection, moderate to severe pain, compromised oral function, and bleeding. This study was performed to evaluated the effects of the He-Ne laser and the Ga-Al-As laser on oral mucositis caused by anticancer chemotherapy in pediatric patients.

Methods: There were 3 cases of osteosarcoma and 6 cases of leukemia. All patients received He-Ne laser (632.8 nm wavelength, power 60 mW) application on 400□600 Hz scanning for 5□20 minutes and Ga-Al-As laser (904 nm wavelength, power 40 mW) application by fiberoptic hand piece placed in immediate proximity to the tissue without direct contact with it for 30 seconds per point for 5 days per week. During the application patients wore wavelength-specific dark glasses and were instructed to keep their eyes closed.

Results: The mean number of treatments with oral intake was 4.89 ± 0.64 . The mean number of total treatments was 9.44 ± 2.59 . There were no significant side effects during and after the laser treatments.

Conclusions: He-Ne laser and Ga-Al-As (IR) laser treatment were well tolerated and reduced the severity and duration of chemotherapy-induced oral mucositis in pediatric oncologic patients.

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Pilot study of laser effects on oral mucositis in patients receiving chemotherapy.

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PURPOSE: The purpose of this study was to examine the effectiveness of laser therapy in the prevention and/or healing of chemotherapy-induced oral mucositis lesions. This study also evaluated the ease and feasibility of the laser therapy and the impact of the treatment on improving the patient's quality of life. **PATIENTS AND METHODS:** Fifteen patients with an episode of prior chemotherapy-induced grade 3 or 4 mucositis with 5-fluorouracil continuous infusion consented to participate in this study. All patients were provided with standardized mouth care instructions at the initiation of chemotherapy treatments. Enrolled patients received laser therapy treatments 24 hours before the chemotherapy and then recommenced weekly with evenly distributed exposure to the standardized designated areas by one operator during the entire cycle of chemotherapy at the same doses until the mucositis resolved or the chemotherapy cycle was completed. Intraoral perfusion was measured by laser Doppler technology. Patients were assessed for response to laser therapy according to standardized mucositis grading criteria by evaluating development of lesions, extent and duration of lesions, and time to healing. The effect of laser therapy on ability to continue planned chemotherapy, the reduction in dose, delays, and ability to maintain planned dose intensity were assessed. The impact of laser therapy on pain control was evaluated using the visual analogue score. A quality-of-life survey was completed by each patient at the initiation of chemotherapy and then weekly throughout the chemotherapy. **RESULTS:** Eleven of 15 patients experienced grade 0 mucositis, three patients experienced grade 1 to 2 mucositis, and one patient experienced grade 3 to 4 mucositis. Fourteen patients completed the lasertherapy as planned, and none of the patients withdrew from the laser therapy treatments because of noncompliance. One patient continued to experience grade 4 mucositis that necessitated an interruption in the planned chemotherapy regimen and, consequently, the laser treatment. Patients tolerated the laser therapy very well and did not report any increased discomfort. No significant changes in perfusion were observed as a result of laser therapy. **DISCUSSION:** In this pilot study, laser therapy significantly reduced the incidence and the severity of mucositis in chemotherapy patients. The laser therapy does not appear to promote wound healing by affecting the intraoral perfusion, as assessed by Doppler measurements. The mechanisms involved in the mediating of the observed effects remain unknown at this time. Continued research is warranted to determine the optimal laser wavelength and parameters.

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