

# Low-Level Laser Therapy: A Literature Review of the Prevention and Reduction of Oral Mucositis in Patients Undergoing Stem Cell Transplantation

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**BACKGROUND:** Oral mucositis (OM) is a highly debilitating complication of high-dose chemotherapy and total body irradiation used in conditioning regimens for hematopoietic stem cell transplantation (HSCT). Research has studied low-level laser therapy (LLLT) as an alternative treatment for OM because of its anti-inflammatory activity, biomodulation, and analgesic effects.

**OBJECTIVES:** This study reviews evidence on the effectiveness of LLLT using diode lasers on the prevention and reduction in severity of OM in patients with cancer undergoing HSCT.

**METHODS:** A literature search was performed in PubMed®, CINAHL®, Scopus®, and MEDLINE® databases. Six randomized controlled trials and one cohort study met the inclusion criteria.

**FINDINGS:** The data demonstrate promising outcomes for reducing the incidence and severity of OM using LLLT. Larger, tightly controlled clinical trials are needed in the future.

## KEYWORDS

oral mucositis; low-level laser therapy; hematopoietic stem cell transplantation

## DIGITAL OBJECT IDENTIFIER

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**ORAL MUCOSITIS (OM), DEFINED AS THE INFLAMMATION AND BREAKDOWN** of the oral mucosa, is a major treatment-related complication in the oncology population that is characterized by erythema, ulcerations, and pain (Elad et al., 2020). In patients receiving hematopoietic stem cell transplantations (HSCTs), high-dose chemotherapies with or without total body irradiation (TBI) are used as conditioning regimens. Administering these regimens prior to HSCT has direct toxic effects to the cells that comprise the epithelium, connective tissue, extracellular matrix, and vasculature of the oral mucosa (Fulton, 2016). As a result, 60%–85% of patients undergoing HSCT experience the debilitating complication of OM. Comparatively, mucositis develops in about 20%–40% of patients receiving conventional chemotherapy (Oberoi et al., 2014; Peng et al., 2020). Receiving higher doses of chemotherapy, such as those used in conditioning regimens, cell-cycle-phase-specific chemotherapy, fractionated radiation therapy, or chemotherapy combined with radiation therapy, is associated with increased risk of developing OM. Some chemotherapeutics, such as 5-fluorouracil, melphalan, hydroxyurea, and methotrexate, have a higher potential to cause OM (Fulton, 2016). In addition, almost all patients with head and neck cancer receiving radiation therapy develop OM because of the direct insults from radiation therapy targets near or involving the oral cavity (Fulton, 2016; Oberoi et al., 2014; Peng et al., 2020). Symptoms vary from mild changes in sensation to severe oral pain, followed by a sequela of complications. The World Health Organization (WHO, 1979) categorizes the severity of mucositis into the following four grades:

- Grade 1: Mucosa is a normal color without mucositis.
  - Grade 2: Erythema and ulcers are present, but solid diet is tolerated.
  - Grade 3: Ulcers require a modification in diet to semisolid or liquid diet.
  - Grade 4: Deep ulceration is present, with the need for nutritional support.
- The severity of mucosal damage peaks 6–12 days post-HSCT, with resolution of uncomplicated mucositis during the following 1–1.5 weeks (Fulton, 2016).

OM can be detrimental to patients undergoing HSCT. With a loss of oral mucosal integrity, patients encounter an increased incidence of secondary