

## Original Article

# Effects of Low Level Laser Therapy on Mucositis in Patients under Chemotherapy and Bone Marrow Transplantation

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## Abstract

**Background:** Oral mucositis is among the most important adverse effects of chemotherapy and bone marrow transplantation and prevention from this side effect is important to improve the situations in patients. Hence, in this study the main aim was to determine the effects of low-level laser therapy on mucositis in patients under chemotherapy and bone marrow transplantation.

**Materials and Methods:** In this randomized controlled clinical trial, 60 consecutive patients under chemotherapy and bone marrow transplantation in a training hospital in 2018 were enrolled and randomly assigned to receive either low-level laser therapy (630 and 780 nm) or off-laser. Finally, the frequency rate and severity of mucositis (grades 0 to 4 according to WHO severity index) were determined and compared across the groups.

**Results:** Mucositis was present in 30% and 56.7% in laser and control groups, respectively with statistically significant difference ( $p=0.037$ ). The severity of mucositis was same across the laser and control groups ( $p=0.785$ ).

**Conclusion:** Low-level laser therapy is an effective modality for preventing from mucositis in patients treated by chemotherapy and bone marrow transplantation. Accordingly, utilization of this safe and effective therapeutic method is recommended.

**Keywords:** Laser, Mucositis, Chemotherapy, Bone Marrow transplantation

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## Introduction

Oral mucositis is a common problem in cancer patients under treatment with either radiotherapy or chemotherapy especially with high-dose or combination treatment with frequency rate from 20

to 80 percent<sup>1-3</sup>. Oral washing with normal saline, sodium-carbonate, calcium-phosphate, and chlorhexidine are conventional treatments<sup>1-4</sup>. Regarding low efficacy of these routine therapeutic modalities, currently laser treatment is being considered<sup>5-8</sup>. It would affect the mitochondrial

respiratory chain leading to increased production of ATP and reactive oxygen species that result in fibroblast proliferation and collagen synthesis stimulating inflammatory responses and tissue healing<sup>6-10</sup>. Both conventional and infrared lasers are beneficial<sup>8-10</sup>.

Since oral mucositis is a general disabling condition<sup>11</sup> usually after short interval from therapy until two weeks later in many patients<sup>12, 13</sup> with different severities and clinical spectrum<sup>14,15</sup> and it is accompanied with increased infection susceptibility<sup>11, 12</sup> and oral pain<sup>13</sup> and may result in hospital admission<sup>15</sup>, in this study the aim was to determine effects of low level laser therapy on mucositis in patients under chemotherapy and bone marrow transplantation.

## Methods

In this randomized controlled clinical trial, 60 consecutive patients under chemotherapy and bone marrow transplantation in a training hospital in 2018 were enrolled. The inclusion criteria were age older than 18 years and possibility for being followed-up. Exclusion criteria were autoimmune diseases, severe major adverse effects, receiving other therapeutics, inability to respect the laser care guidelines, and over three times pause in the therapeutic course. Local ethical committee with ethical code of IR.SBMU.MSP.REC.1396.580 approved the study. Patients were randomly assigned to receive either low-level laser therapy (630 and 780 nm) or off-laser beside standard treatments. Treatment was three times weekly since first chemotherapy day until second transplantation day with energy density of 4 j/cm<sup>2</sup> for two minutes. The energy and density were same for all cases in intervention group. Glasses covered the eyes during laser therapy for safety issues. Finally, the frequency rate and severity of mucositis (grades 0 to 4 according to WHO severity index) was determined and compared across the groups by daily physical examinations. In addition, eating problems and weight reductions were recorded for all patients. The body mass index was measured weekly.

Data analysis among 60 patients including 30 subjects in intervention group and 30 cases in intervention group was done by SPSS version 13.0

software and the utilized tests were Independent-Sample-T, Fisher, and Chi-Square and the P values under 0.05 were considered statistically significant.

## Results

The mean (standard deviation) age was 39.03 (13.45) and 38.60 (11.62) years laser and control groups, respectively (p=0.894). There were 15 (50%) and 16 (53.3%) male subjects in laser and control groups, respectively (p=0.796). As shown in Figure-1, the transplantation type was allogeneic in 46.7% and 33.3% in laser and control groups, respectively (p=0.292). Number of sessions was 1, 2, 3, and 4 in 13.3%, 40%, 36.7%, and 10%, respectively.

Mucositis was present in 30% and 56.7% in laser and control groups, respectively with statistically significant difference (p=0.037). As shown in Figure-2 the severity of mucositis was same across the laser and control groups (p=0.785). Age, transplantation type, and number of sessions were not related to mucositis (p>0.05). However, the mucositis was more common among female subjects in laser group (53.3% versus 6.7%) with significant difference (p=0.014).

## Discussion

Mucositis is an important complication after bone marrow transplantation and chemotherapy and we assessed the efficacy of laser to improve this problem in patients. In current study, the efficacy of treatment for prevention of mucositis in laser group was approximately two-fold higher than laser-off group but the severity of mucositis was not significantly altered. Cauwels et al<sup>3</sup> reported significant efficacy for laser wavelength of 830 nm in pediatric samples. They also reported decreased pain in patients. Regarding some information biases, pain was not assessed in our study. Guatam and colleagues<sup>4</sup> similarly reported fewer incidences of mucositis in intervention versus control group. Another study by them<sup>5</sup> also established the efficacy of laser in reduction of mucositis. Aoton-Leite et al<sup>6</sup> demonstrated decreased severity of mucositis by laser-therapy. However, in our study, only the frequency rate of mucositis was decreased by laser therapy and the severity was alike across the groups.

Silva et al<sup>7</sup> also showed that laser therapy led to

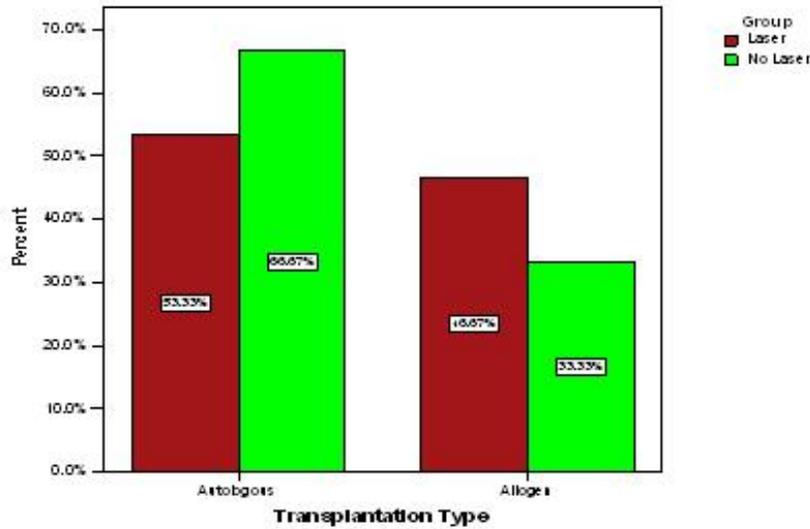


Figure 1. Type of transplantation across the groups.

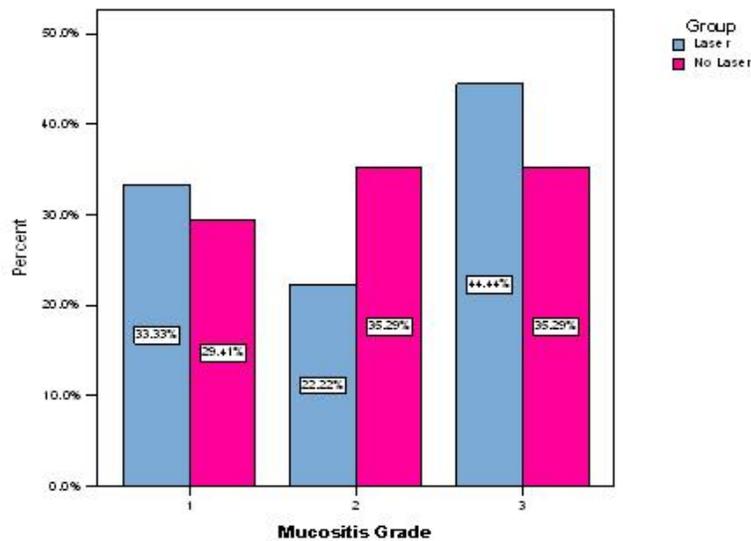


Figure 2. Severity of mucositis across the groups.

decreased severity of mucositis. However, due to some technical and design differences the severity was not significantly differed in our study. The study by Emamiet al<sup>16</sup> showed that mucositis was present in 31% and 41% in laser and placebo groups that is congruent with our results but unlike our study, the difference was not statistically significant. Gholizadeh et al<sup>17</sup> reported in a review article that low-potency laser would result in improved mucosal healing and increased collagen synthesis that result in

reduced inflammation and lower rate of mucositis. This article shows the background mechanism of our obtained results. In their review article, Jadaud et al<sup>18</sup> reported high efficacy and safety of low-potency laser to prevent mucositis. Oberoi et al<sup>19</sup> reported reduction in mucositis frequency and severity in 37 and 34 percent, respectively. However, in our study, only the frequency rate of mucositis was decreased and the severity of it showed no significant changes. Silva et

al<sup>20</sup> also reported reduced intensity of mucositis by low-potency laser. The cause of difference between the studies is different methods and types of utilization of laser across them. In a systematic review, He et al<sup>21</sup> showed 50 percent reduction in mucositis frequency that was also seen in our study however they also reported reduction in severity by 30 percent that was not established in current study.

## Conclusion

Low-level laser therapy is effective for prevention of mucositis in patients treated by chemotherapy and bone marrow transplantation. Accordingly, utilization of this safe and effective therapeutic method is recommended. However further studies with larger sample size and comparisons with other possible methods are required for better decision-making in this era.

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