



Biophysical skin measurements to evaluate the effectiveness of photobiomodulation therapy in the prevention of acute radiation dermatitis in breast cancer patients

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Abstract

Purpose The purpose of this study was to evaluate objectively the effectiveness of photobiomodulation therapy (PBMT) for the prevention of acute radiation dermatitis (ARD) by using biophysical skin measurements.

Methods A randomized, placebo-controlled trial with 120 breast cancer patients who underwent an identical radiotherapy (RT) regimen post-lumpectomy was performed (TRANSDERMIS trial). Patients were randomized to receive PBM (808 nm CW/905 nm pulsed, 168 mW/cm², spot size 19.6 cm², fluence 4 J/cm²) or placebo treatments from the first day of RT (2×/week). Biophysical skin measurements were collected to assess the skin pigmentation and barrier function. Measurements were collected at the first day of RT, a RT dose of 40 Gray (Gy), and the end of RT (66 Gy).

Results The incidence of moist desquamation was significantly higher in the control than in the PBMT group at the end of RT (30 vs. 7%, respectively, odds ratio = 6, $p = 0.004$). The biophysical skin measures showed that the mean percentage change from the baseline transepidermal water loss (TEWL), erythema, and melanin values was significantly higher in the control than in the PBMT group at the end of RT ($p < 0.05$). Logistic regression analysis revealed that the risk on moist desquamation was significantly increased for patients with a large (> 800 cc) breast volume (odds ratio = 4, $p = 0.017$).

Conclusions This is the first randomized controlled trial demonstrating by objective measurements that PBMT is effective in reducing the incidence of moist desquamation in breast cancer patients undergoing RT. Additionally, a large breast volume is an important risk factor for the development of moist desquamation.

Keywords Breast cancer · Photobiomodulation therapy · Radiotherapy · Skin toxicity · Radiation dermatitis · Objective skin evaluation

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