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Short Communication

The role of photobiomodulation therapy for supportive care during head and neck cancer treatment

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ABSTRACT

Radiotherapy and chemotherapy are frequently employed in patients with head and neck cancer (HNC), causing significant side effects that impair life quality and prognosis by interfering with the cancer treatment regimen. There is a large body of evidence supporting the efficacy of low-level laser therapy (LLLT), also known as Photobiomodulation (PBM), when used for the prevention and/or treatment of oral mucositis in patients undergoing radiotherapy for head and neck cancer or high-dose chemotherapy regimens. This could enhance patients' quality of life, adherence to the prescribed cancer therapy, and treatment outcomes while reducing the cost of cancer care and hospitalization.

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1. Introduction

In recent years. There is a large body of evidence supporting the efficacy of Various forms of phototherapies or light therapy for a vast array of clinical applications in the supportive care of head & neck cancer receiving Radiotherapy with or without chemotherapy.¹

Dr. Endre Mester played a crucial role in studying the biological effect of low-level laser treatment in wound healing & hair growth, used the term photo biostimulation but later it was recognized that apart from biostimulation, it also modifies certain pathophysiological processes such as inflammation, pain leading to the term photobiomodulation (PBM).²

Photobiomodulation Therapy (PBMT) also known as low-level laser Therapy(LLLT) is a non-invasive Non-ionizing, nonthermal, Optical Radiation in Visible & Near-Infrared spectral range.

It Stimulates & promotes positive tissue processes (wound healing, regeneration, immune responses) and mitigates negative tissue processes (inflammation, pain, aberrant immune responses).³ Photobiomodulation Therapy (PBMT) is a novel invasive light energy extensively utilized in cancer treatment in supportive care to enhance the quality of life of the patients and minimize adverse effects thereby affecting the prognosis by preventing the interruption of the onco-therapy.

The PBMT has shown promising results in alleviating common complications of oncotherapy that include mucositis, xerostomia, trismus, dysgeusia, oral pain, wound healing and others improving patients' overall quality of life.

Photobiomodulation (PBM) is a safe, nonpharmacological method which can modulate various metabolic processes via the absorption of energy by chromophores.⁴

Photodynamic therapy(PDT) focuses on eliminating infections such as bacteria, fungi and virus as well as various types of tumors. PDT is used as a targeted treatment for

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various cancers, using photosensitizing agent activated by light to selectively destroy cancer cells, it can be applied locally to relieve symptoms in palliative care in advanced cancer cases.

2. Mechanism of Action

photobiomodulation (PBM) is a safe, nonpharmacological method which can modulate various metabolic processes via the absorption of energy by chromophores⁴ The principle of operation is the transfer of incident photonic energy to a cellular target therapy is the mitochondrion, which responds to the absorption of red to near-infra-red (IR) wavelengths of light by an increase in activity of the electron transport respiratory chain. This results in an increase in the production of ATP, as well as nitric oxide (NO), These changes result in fibroblast proliferation, and collagen synthesis, reduce inflammation, as well as motivation angiogenesis and tissue repair, and increase cell metabolism⁴ there are complex downstream effects on gene expression (NF-κB and AP-1), which give rise to many changes beneficial to cellular metabolism [B8] there is the increased production of pro-collagen and growth factors including, for example, vascular endothelial growth and fibroblast growth factors. There is an increase in cellular motility and rate of division, which further promotes wound resolution.⁵

The mechanism of the pain relief caused by PBM includes modulation of the inflammatory process, alteration of excitation and nerve conduction in peripheral nerves leading to pain control through membrane cell depolarization, blocking the nervous impulse and fast axonal flow and stimulation of release of endogenous endorphins and Enkephalin.⁴

Common side effects like inflammation, ulceration, edema, pain, fibrosis, and neurological and muscular injury are thought to be involved in the pathogenesis of RT, HSCT, CT, or CRT-induced complications in patients treated for cancer, all these side effects can be effectively managed by PBMT.⁶

3. Supportive Care in Cancer Management

PBM has the potential to become a new preventive and/or therapeutic option for a broad range of acute and chronic side effects associated with cancer therapy. PBM has been taken up in the general treatment guidelines developed by the MASCC/ISOO, the European Society for Medical Oncology (ESMO), the National Institute for Health and Care Excellence (NICE) (4, 262, 263) and the World Association of Photobiomodulation Therapy (WALT).^{6,7} However, to ensure its maximum impact it is essential to understand proper dosage & safety protocols associated with the treatment. The dosage for pain relief is generally higher than that needed for biostimulation.

For cancer supportive care, PBM parameters usually fall within the red or near-infrared wavelength range of 400-1200nm with a power density ranging from 5-15mw/cm². The duration of application may vary depending on the treatment site with a minimal treatment of 20-30seconds per spot.⁷

Moreover, a reduction in the number and duration of hospitalizations, reduction of enteral or parenteral nutrition, and reduction of the use of morphine have been found. PBM in the daily clinical oncology practice setting may eventually reduce the incidence, duration, and severity of these devastating effects. PBM therapy used for OM in Head and neck cancer patients did not result in immediate adverse events. However, one cohort study reported an immediate burning sensation in 15% of patients, but no persistent symptoms were noted.⁸

However the author has found promising results in an ongoing nonrandomized prospective clinical trial for the prevention & management of oral mucositis, trismus, and pain, maintaining the swallowing & speech quality during oncotherapy thereby improving their quality of life. none of the patients had any interruption in cancer therapy, hence improving the prognosis. more research is needed to standardize & optimize PBM protocols and validate its effectiveness.

4. Conclusions

PBM is cost-effective, safe therapy for pain relief, reducing inflammation & improving wound healing. The non-invasive, non-ionizing, nonpharmacological, sustainable nature of this technology holds great potential in supportive cancer care. Future Investigations are needed to establish PBM as a valuable therapeutic option for managing cancer therapy-related complications.

PBM is entering a new era of maturity and evidence-based clinical use that should allow PBM to be fully considered as a part of mainstream medicine.

5. Source of Funding

None.

6. Conflict of Interest

None.

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