

## Case Report

### Photobiomodulation: A Novel Treatment Approach for the Management of Radiation Induced Oral Mucositis - A Case Report

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#### ABSTRACT:

Oral mucositis (OM) is the most frequent and debilitating acute inflammation which is extremely symptomatic associated with head and neck cancer (HNC) treatment. It is one of the earliest complication and severe OM negatively impacts the quality of life of patients undergoing HNC treatment. Photobiomodulation (PBM-previously known as Low Level Laser Therapy) is a well-tolerated, consolidated and effective therapy for the treatment and prevention of severe OM. Here we present the case report of a 10 year old male patient who underwent radiotherapy and chemotherapy for nasopharyngeal carcinoma and presented with Grade 3 Oral mucositis which was managed by 5 sessions of photobiomodulation. This case report confirms the effectiveness of photobiomodulation therapy in the management of OM increasing the quality of life and a reduction in the severity of OM.

**Keywords:** Oral Mucositis, Photobiomodulation, Radiotherapy, Chemotherapy

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#### INTRODUCTION

Chemotherapy (CT) and Radiotherapy (RT) in the head and neck region have severe side-effects such as mucositis, dysphagia, dysgeusia, radiation dermatitis, xerostomia, and head and neck lymphedema [1]. Eighty percent of patients receiving a high dose of CT prior to hematopoietic stem cell transplantation (HSCT) manifest oral mucositis whereas patients receiving head and neck RT have an 80% risk of the same [2]. Mucositis is defined as a series of inflammatory and/ or ulcerative changes of the oral and/ or gastrointestinal tract resulting in severe discomfort that can impair speech and ability to chew/ swallow. In addition it can also cause xerostomia which can predispose to opportunistic infections [3].

Photobiomodulation (PBM) therapy is as a form of light therapy mainly visible, infrared and near infrared light which is absorbed by endogenous chromophores inside the tissue which triggers biological reactions that are non-thermal or non-cytotoxic leading to physiological changes. This is mainly through the photochemical interaction between the Laser light and the tissue [4]. The mechanism of action of PBM is predominantly related to an action on cytochrome c oxidase in the mitochondrial respiratory chain by facilitating electron transport. This results in an increased transmembrane proton gradient, which drives adenosine triphosphate (ATP) production, which increases the functions of cellular metabolism. PBM enhances wound repair and tissue regeneration by

acting on different phases of injury resolution, including inflammation, proliferation, and remodeling phases [5].

Among all conservative treatment approaches for the treatment of OM, the use of PBM has recently shown significant promise for supportive cancer care. The International Society of Oral Oncology and the Multinational Association of Supportive Care in Cancer (MASCC) recommends the use of Photobiomodulation for the prevention of oral mucositis in patients having head and neck cancer and for patients before undergoing hematopoietic stem cell transplant [6]. Researchers and clinicians have proposed different protocols for the prevention and treatment of oral mucositis, dysphagia, dysgeusia, hyposalivation or xerostomia, Radiation dermatitis, trismus, osteonecrosis, head and neck lymphedema and voice speech alteration due to local inflammation over the past few years [7].

**CASE REPORT**

A 10 year old boy who underwent concomitant CT and RT for Nasopharyngeal Squamous cell carcinoma (Stage 3 – T3 N1M0) was referred to the Dental, Clinical, Oral and Maxillofacial department for the management of OM. Carcinoma was diagnosed two months before and treatment plan included concurrent chemo radiation followed by adjuvant Cisplatin-5FU therapy. OM severity increased during the RT course. Based on the examination taking into consideration factors like severity of OM, dysgeusia, and oral dryness a diagnosis of Grade 3 OM (World Health

Organization scale for assessing oral mucositis) was made. Clinically the patient presented with erythematous and erosive lesions on lateral border of tongue, buccal mucosa and labial mucosa. Epithelial atrophic areas with thinning of mucosa were observed on the complete palatal region. There was associated ipsilateral lymph node involvement (4\*2.5cm) with induration and tenderness. Severe accumulation of dental plaque was seen on the teeth due to difficulty of the patient in maintaining the oral hygiene due to the pain factor. The intensity of pain was measured by VAS scale and the problems with swallowing, speech, mastication, sleep and appetite were measured using Likert scale and both corresponded to values of 9/10 and 9/10 respectively .PBM was initiated and the procedure was performed for 5 consecutive days. The patient was also instructed to use mouth wash (0.12% chlorhexidine) to improve the oral hygiene. For Photobiomodulation, Diode laser (660nm wavelength Novolase laser) was used with power output of 100mW and energy of 12 Joules (Dose 4-6 J \* 2 rounds). Safety goggles were worn by the clinician, assistant and the patient. The procedure was performed for 5 days. The severity of OM started to reduce from the third day and complete remission of the lesions on the mucosa was appreciated by the end of 5th day. The intensity of pain measured by VAS scale and the problems with swallowing, speech, mastication, sleep and appetite measured using Likert scale both corresponded to values of 5/10 and 5/10 respectively on the 3<sup>rd</sup> day and completely subsided on the 5<sup>th</sup> day.

Figure 1: Oral Mucositis at different stages of treatment



Figure 2: Clinical presentation of lateral borders of tongue before and after therapy



## DISCUSSION

Oral complications induced by RT and/or CT present an important clinical challenge, which affects the quality of life and also these complications might also delay cancer therapy or compromise the compliance of the patients for completion of the treatment [8]. Multiple mechanisms have been proposed for the onset of mucositis, including DNA damage, production of the reactive oxygen species and epithelial atrophy, bacterial translocation, and profound inflammation [9]. Scientific evidences including meta-analysis and systematic reviews suggest and support the efficacy of Photobiomodulation in the management of oral mucositis for patients undergoing chemotherapy or chemoradiotherapy [10,11,12]. Also The Multinational Association of Supportive Care in Cancer and the International Society of Oral Oncology recommends the preventive use of Photobiomodulation for patients receiving head and neck radiotherapy. The preventive use of photobiomodulation is not just limited to OM, but also includes prevention of xerostomia, dysgeusia, radiation dermatitis and trismus. This case report shows that Photobiomodulation can effectively and safely reduce the severity of oral mucositis, oral dryness, and dysgeusia in just five sessions. Photobiomodulation can be considered as an effective and relatively fast approach compared to other conventional treatment modalities to enhance the quality of life of cancer patients presenting with severe oral complications.

## REFERENCES

- Silva, G.B.; Sacono, N.T.; Othon-Leite, A.F.; Mendonça, E.F.; Arantes, A.M.; Bariani, C.; Duarte, L.G.; Abreu, M.H.; Queiroz-Júnior, C.M.; Silva, T.A.; et al. Effect of low-level laser therapy on inflammatory mediator release during chemotherapy-induced oral mucositis: A randomized preliminary study. *Lasers Med. Sci.* **2015**, *30*, 117–126
- Kuffler, D.P. Photobiomodulation in promoting wound healing: A review. *Regen. Med.* **2016**, *11*, 107–122.
- Rogers, S.N.; Ahad, S.A.; Murphy, A.P. A structured review and theme analysis of papers published on 'quality of life' in head and neck cancer: 2000–2005. *Oral Oncol.* **2007**, *43*, 843–868.
- Bensadoun, R.J.; Nair, R.G. Low-Level Laser Therapy in the Management of Mucositis and Dermatitis Induced by Cancer Therapy. *Photomed. Laser Surg.* **2015**, *33*, 487–491.
- Karu, T.I. Multiple roles of cytochrome c oxidase in mammalian cells under action of red and IR-A radiation. *IUBMB Life* **2010**, *62*, 607–610.
- Migliorati, C.; Hewson, I.; Lalla, R.V.; Antunes, H.S.; Estilo, C.L.; Hodgson, B.; Lopes, N.N.; Schubert, M.M.; Bowen, J.; Elad, S. Mucositis Study Group of the Multinational Association of Supportive Care in Cancer/International Society of Oral Oncology (MASCC/ISOO). Systematic review of laser and other light therapy for the management of oral mucositis in cancer patients. *Support. Care Cancer* **2013**, *21*, 333–341.
- Zecha, J.A.; Raber-Durlacher, J.E.; Nair, R.G.; Epstein, J.B.; Elad, S.; Hamblin, M.R.; Barasch, A.; Migliorati, C.A.; Milstein, D.M.; Genot, M.T.; et al. Low-level laser therapy/photobiomodulation in the management of side effects of chemoradiation therapy in head and neck cancer: Part 2: Proposed applications and treatment protocols. *Support. Care Cancer* **2016**, *24*, 2793–2805.
- Demez, P.H.; Moreau, P.R. The generalists' perception of quality of life in head and neck cancer. *B-ENT* **2015**, *11*, 163–171.
- Sonis, S.T. A biological approach to mucositis. *J. Support. Oncol.* **2004**, *2*, 21–32
- Clarkson, J.E.; Worthington, H.V.; Furness, S.; McCabe, M.; Khalid, T.; Meyer, S. Interventions for treating oral mucositis for patients with cancer receiving treatment. *Cochrane Database Syst. Rev.* **2010**, *4*, CD001973.
- Bjordal, J.M.; Bensadoun, R.J.; Tuner, J.; Frigo, L.; Gjerde, K.; Lopes-Martins, R.A. A systematic review with meta-analysis of the effect of low-level laser therapy (LLLT) in cancer therapy-induced oral mucositis. *Support. Care Cancer* **2011**, *19*, 1069–1077.
- Prasad B, SV S, Yavagal PC, Yavagal C, Mangalekar SB, Basannavar AA. Efficacy of LASER Photobiomodulation in the Management of Cancer Treatment Induced Oral Mucositis: A Systematic Review. *Annals of the Romanian Society for Cell Biology.* **2021** May 28;25(6):5259-78.