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**CASE REPORT**

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# Low power laser photobiomodulation therapy in radiotherapy-induced oral complications: a case report

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**ABSTRACT**

Oropharyngeal cancer is one of the most common malignant tumors in the head and neck, and among its most frequent complications is oral mucositis, a common result of radiotherapy treatments in this region. Despite its high incidence, no consensus has yet been reached on its therapeutic management. In this context, photobiomodulation with low power laser is presented as a promising alternative, since it does not produce significant adverse effects and facilitates both healing and analgesia in the affected areas, thus improving the patient's quality of life. During the clinical examination of this case report, ulcers were observed on the jugal mucosa on both sides, as well as a lesion with fibrinoleukocytic coating on the posterior right lateral border, which, together with the patient's clinical record, allowed establishing the diagnosis of oral mucositis. For the management of this condition, low power laser photobiomodulation was applied in a total of five sessions, aimed at reducing pain, favoring ulcer healing and treating hyposalivation. At the end of the therapeutic cycle, the patient no longer had ulcers in the oral cavity, the patient reported having recovered his/her sense of taste and there was evidence of an improvement in salivary production. These results highlight the efficacy of photobiomodulation, since it not only relieves the symptoms almost immediately, but also, being a minimally invasive procedure with no known adverse effects, it becomes a valuable tool for the management of oral complications in oncologic patients.

**Keywords:** laser therapy; dentistry; oral mucositis; case report.

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## INTRODUCTION

Despite advances in cancer therapy, high rates of systemic and oral side effects persist, significantly affecting patients' quality of life (1, 2). Among the most common types of head and neck cancer is oropharyngeal cancer, which can not only affect nutrition and speech, but also pose a life-threatening risk (3, 4). Conventional treatments include surgery, chemotherapy and radiotherapy, the latter being of local approach that, although effective, can damage both the skin and mucous membranes, leading to complications such as mucositis, stomatitis, and other radiation-induced lesions (5, 6). In this context, photobiomodulation has emerged as a promising therapeutic alternative. This technique uses non-ionizing optical radiation that, without causing thermal damage, triggers beneficial physiological changes. Evidence supports its efficacy in both the prevention and treatment of oral mucositis in patients undergoing radiotherapy for head and neck cancer, as well as in those undergoing chemotherapy or hematopoietic stem cell transplantation (7, 8).

Photobiomodulation therapy has established itself as a therapeutic option aligned with new health trends, standing out for its lack of adverse effects and its application in various pathologies. This therapy not only relieves symptoms but also helps to improve quality of life (9). Disseminating its benefits in the treatment of pathologies secondary to radiotherapy is crucial, as it represents an excellent therapeutic alternative that could be specially implemented in the public sector for patients experiencing side effects after oncological treatments.

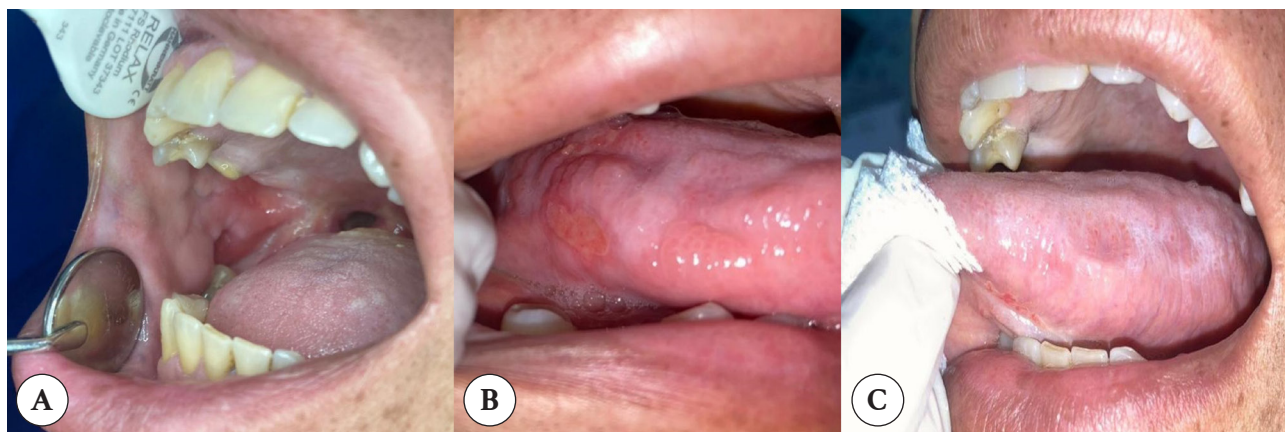
In this regard, the purpose of this case report is to demonstrate the benefits of photobiomodulation therapy in the management of oral complications induced by radiotherapy. For its development and dissemination, approval was obtained from the

Ethics Committee of the Faculty of Dentistry at the Universidad Nacional de Asuncion under identification code P004-24, along with the patient's consent.

## CASE PRESENTATION

A 52-year-old male patient visited the Oral Pathology Clinic of the Faculty of Dentistry at the Universidad Nacional de Asuncion, Paraguay. He reported the presence of lesions in the oral cavity that caused pain, difficulty speaking and problems with food intake. He was accompanied by his attending medical oncologist, who reported a diagnosis of right tonsil carcinoma, extending to the soft palate and uvula, classified as stage IVa (T4a N2a M0). The main treatment consisted of radiotherapy with a total dose of 66 Gy, administered in 30 sessions of 2.2 Gy each, and ended at the time the patient was seen. In the consultation, he reported ulcers on the buccal mucosa and on the lateral edge of the tongue, as well as xerostomia, odynophagia, complete loss of taste, and difficulty to eat.

The intraoral clinical examination revealed the presence of ulcers accompanied by erythematous areas on the right buccal mucosa, along with a healing lesion on the right lateral surface of the tongue and whitish areas compatible with scars on the left lateral edge (Figure 1). The absence of the uvula, the isthmus of the fauces and the right tonsil was also observed, as a result of the five-month radiotherapy treatment, along with a significant reduction in tumor neoformation and signs compatible with the characteristics of the treated carcinoma. Based on the anamnesis and findings of the intraoral clinical examination, a diagnosis of grade 3 mucositis was established according to the World Health Organization (WHO) classification, accompanied by secondary hyposalivation, dysgeusia, and difficulty in swallowing solid foods.



**Figure 1.** Intraoral photograph: A) ulcers on the right buccal mucosa; B) ulcers in the process of healing on the right lateral surface of the tongue; C) white scar plaques on the left lateral surface of the tongue.

To evaluate salivation, sialometry strips made of Whatman® No. 45 filter paper were used. The technique involved placing a strip of paper in the sublingual caruncles, instructing the patient to keep his tongue down and close his mouth. The procedure was performed while the patient was seated, keeping his chin slightly tilted downward for 5 minutes. A secretion of 1 cm/min was considered normal. The assessment of the sense of taste was conducted through qualitative tests with bitter, sweet and salty flavors.

Low-power laser therapy was selected as the treatment approach, using a DMC® Therapy EC device with a power output of 100 mW and two wavelengths: 808 nm for infrared and 660 nm for red laser. The patient's prognosis is favorable, provided that an adequate treatment plan is followed. The therapeutic protocol was designed considering clinical objectives to improve salivation and reduce oral symptoms, combining intraoral and extraoral applications.

The extraoral protocol consisted of applying 1 joule (J) of infrared light per point, distributed across 9 points over the parotid region and 3 points in the submaxillary area bilaterally. Before starting the treatment, thermal water was applied throughout the oral cavity to relieve the feeling of dryness and prepare the tissues for the established protocol.

The intraoral protocol included the application of 0.3 J of red light at different points. First, 4 points were treated in the mucosa of the upper and lower lips. Then, 9 points were applied to each buccal mucosa. Finally, the tongue was divided into several zones: 12 points on the dorsal surface, 6 points on each side edge and 4 points on the ventral surface.

To reduce pain and promote ulcer healing, 0.3 J of red light was applied to the periphery of the lesions and 1 J of infrared light in the center. This process was conducted in 5 sessions, with a frequency of once a week (Figure 2).



**Figure 2.** Low-power laser application: A) extraoral area with infrared light application; B) intraoral area with red light application.

After the first two treatment sessions, the patient showed improvement in dysgeusia, reporting the ability to perceive sweet flavors, although

hyposalivation persisted. As for the ulcerated lesions in the different points of the cavity, some remitted and others are in the process of healing (Figure 3).



**Figure 3.** Remission of ulcerated lesions in the buccal mucosa and the right lateral edge of the tongue.

In the third session of the treatment, the patient's clinical improvement was confirmed, as he reported more than a 50% recovery of his sense of taste, managing to perceive flavors clearly. The ulcerated lesions had completely remitted, although a plaque was observed on the dorsal surface of the tongue compatible with saburral tongue, probably attributable to hyposalivation, a symptom that, according to the patient, had not improved.

During the fourth session, the patient reported a complete recovery of his sense of taste, along with an improvement in salivation, which was reflected in the reduction of the lingual plaque.

In the last session, sialometry was performed to assess saliva production, obtaining a result of 3.5 cm in 5 minutes, demonstrating significant improvement. This recovery restored the patient's comfort by increasing salivary production, ensuring proper taste perception and resolving the ulcerated lesions (Figure 4).



**Figure 4.** Post-treatment follow-up after 5 laser therapy sessions: A) improvement of saburral tongue; B) remission of ulcerated lesions and clinical improvements of oral cavity coloration due to increased salivation; C) result of sialometry 3.5 cm.

Progress was assessed both during the sessions and in subsequent follow-ups. The patient reported excellent tolerance to laser application, without experiencing any side effects or adverse reactions during the treatment.

## DISCUSSION

Among the various therapeutic modalities used to treat cancer, radiotherapy, chemotherapy, and chemoradiotherapy cause direct damage to the tissues of the oral cavity, leading to complications such as oral mucositis, dysgeusia, infections, and xerostomia (10, 11). These complications pose a significant challenge in clinical management, as they severely impact the patient's quality of life. In this context, photobiomodulation therapy emerges as an effective alternative, as it accelerates the healing process, alleviates pain, promotes tissue regeneration, and strengthens the immune response. This is because it provides energy that interacts with tissues at the cellular level, generating positive effects on both the tissue and the cell (12, 13).

Various topical agents have been used for the prevention and treatment of oral mucositis, including chlorhexidine, chamomile and amifostine. However, evidence regarding their effectiveness and tolerance remains limited (14). In this context, the introduction of low-power laser therapy as a treatment option has demonstrated short-term benefits in the treatment of oral mucositis, such as pain reduction, increased patient comfort, and a minimally invasive approach. Nevertheless, to ensure the safety and effectiveness of the treatment, it is essential to have professionals trained in laser use who adhere to proper safety guidelines (15-17).

Despite advances, the lack of case studies and comparative case-control studies makes it challenging to objectively assess the efficacy of low-power laser therapy compared to other treatments. However, it is inferred that this technique offers advantages over other conventional treatments. For instance, although cryotherapy has proven effective in the early stages of mucositis, its routine use is limited due to the adverse effects it can generate in the oral cavity.

Similarly, saline rinses are not recommended due to their potential allergenic effects (18, 19). Several studies confirm that low-power laser therapy not only alleviates the symptoms of oral mucositis, but also reduces duration, severity and pain, as well as the need for analgesics. Most importantly, no side effects have been reported with its application (20-23).

Among the advantages of photobiomodulation therapy, its rapid action and broad spectrum of effects at both the cellular and tissue level stand out. Its primary benefits originate in the cellular respiratory chain, leading to increased vascularization, modulation of the immunoinflammatory response, and accelerated repair of treated tissues (24, 25). Nonetheless, although its effects on cellular and tissue regeneration are clear, its widespread use presents certain limitations depending on the area of application. Although it is indicated for treating various conditions, it is crucial to assess its actual efficacy, especially when used as a primary treatment in fields such as periodontics or oral surgery, where it is often employed as a complementary therapy (26). In addition, a major limitation is the cost of treatment, which usually falls on the patient.

In the present case, the application of low-power laser therapy showed a remarkable clinical and symptomatic improvement. This result aligns with the findings reported in other studies, which have also shown the benefits of laser therapy in cases of oral mucositis and other pathologies, further consolidating its efficacy in the treatment of oral lesions (27-30).

## CONCLUSIONS

This case report concludes that photobiomodulation therapy accelerates the healing process and improves the patient's clinical symptoms, providing almost immediate relief. As a minimally invasive procedure with no reported adverse effects or collateral damage, it serves as an important tool for the treatment of oral complications in oncology patients.

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