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Research Article

The effect of low level diode laser in treatment of recurrent apthous stomatitis (case study)

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Abstract

Objective: Recurrent Aphthous Stomatitis (RAS) is a common, painful, and recurrent oral condition characterized by ulcer formation. Its pathogenesis is multifactorial, involving genetic, immunological, and environmental factors. conventional methods like topical anesthetics, such as benzocaine. Mouth rinses containing hydrogen peroxide, chlorhexidine, or dexamethasone. Corticosteroid ointments, such as fluocinonide, beclomethasone, or hydrocortisone hemosuccinate, primarily focus on symptom relief rather than cure. Low-level laser therapy (LLLT) has emerged as a promising treatment modality, offering minimal invasiveness and effective healing.
Case Presentation: A 28-year-old female patient presented with a painful ulceration (6*5mm) with edematous border on the lateral surface of her tongue, after clinical examination (ulcer duration and frequency, the number of ulcers present, their shape and size, location, and specific characteristics such as the edges, base, and the condition of the surrounding tissues). and the medical history of the patient diagnosed as Recurrent Aphthous Stomatitis. The condition is treated by using low-level diode laser therapy. using a diode laser 980 nm with the power set at 1W, a non-contact laser application. The distance between the laser probe's tip and the ulcer surface was meticulously maintained at 10mm. A single laser treatment session consisted of four 30-second applications, separated by a 15-second interval. The cumulative laser application time amounted to approximately 120 seconds.
Conclusion: Low-level diode laser therapy significantly reduces pain, lesion size, and edema in RAS patients, while improving patient satisfaction, functional ability, and reducing Interleukin-1 beta (IL1β), Transforming Growth Factor-beta 1 (TGFβ-1) serum levels.

Keywords: Recurrent Aphthous Stomatitis, LLLT, biostimulation.

1. Introduction

Recurrent Aphthous Stomatitis (RAS) is a common, painful, and often debilitating condition characterized by recurrent episodes of oral ulceration without a clearly defined pathogenesis. Three clinical subtypes of RAS have been established based on the magnitude, number, and duration of outbreaks: minor, major, and herpetiform [1]. The etiology of RAS is not clear; however, several factors are known to predispose an individual to the disease. The primary predisposing factors include genetic factors, infections, decreased

immune system integrity, and deficiencies in folic acid, iron, or vitamin B12. Additional predisposing factors include stress, trauma, hormonal factors, and endocrine imbalance [2]. The diagnosis of RAS is based on patient history and clinical symptoms. There is no specific diagnostic test for RAU, though discarding possible underlying systemic causes is essential. It is prudent to request a complete series of laboratory tests, including a complete blood count and evaluation of iron, vitamin B12, and folic acid [3]. Conventionaltreatment modalities have ranged from topical agents to systemic medications, focusing on symptom relief rather than cure. The introduction of low-level diode laser therapy, particularly at a wavelength of 980 nm, offers a new avenue for managing RAS, combining the benefits of minimal invasiveness with effective healing, pain reduction and may influence the inflammatory response by reducing the concentrations of certain cytokines, including interleukin-1 beta (IL-1β), tumor necrosis factor-alpha (TNF-α) [4,5]. Recent advancements in LLLT have highlighted its efficacy in reducing pain, ulcer size, and healing time in RAS patients. LLLT acts through photobiomodulation (PBM), stimulating cellular and tissue repair mechanisms, modulating inflammation, and promoting wound healing. The specific use of a 980 nm diode laser has been shown to offer a promising treatment modality, with studies demonstrating significant improvements in clinical outcomes for RAS patients [5]. One of the new interventions in oral medicine is low-level diode laser therapy. This non-invasive method, known as LLLT, has demonstrated the potential to boost the immune system, enhance tissue healing, and alleviate pain in various medical and dental contexts [6]. LLLT uses a coherent and monochromatic laser beam with a specific wavelength and power to deeply penetrate tissues. The laser's photons are absorbed by proteins, triggering biochemical reactions that encourage cell proliferation, tissue regeneration, and improved blood flow. LLLT speeds up wound healing, collagen production, and epithelial cell differentiation while providing pain relief by reducing pain-related stimuli. Although LLLT has multiple biological effects, its precise immunomodulatory mechanism is still not fully understood [7]. This therapy is safe, non-invasive, and shows great promise for a range of medical applications like wound healing. It fosters epithelial cell differentiation and collagen production [8] and pain relief. The analgesic effects of PBM are due to the reduction of inflammation, increased endorphin release, and modulation of nerve conduction. It is used to treat conditions like arthritis and neuropathic pain [9].

This study aimed to evaluate the clinical effectiveness of using a low-level diode laser for treating recurrent aphthous stomatitis. By exploring LLLT's impact on the healing process, pain reduction, and recurrence of lesions ,This study aimed to better understanding of the role this novel therapy in managing RAS.

1. Case presentation

A 28-year-old female patient visited the Al-Mamoon Specialized Dental Center seeking dental care. Two days ago,she suffered from a painful ulceration on the lateral left border of her tongue. Upon questioning about her medical, dental, and family history, it revealed a family history of recurrent oral ulceration.

Following this, an intraoral examination was conducted to assess the site (middle part of the lateral left surface of the tongue) , size (The size of the ulceration was measured to be 6x5 mm), shape, and texture of the ulcer base (red border and yellow floor). Then, an extra oral examination, including palpation of cervical lymph nodes (no mass or pain), was also performed. The evaluation of pain intensity was accomplished using the Visual Analog Scale (VAS) score,(It is measures pain intensity and consists of a 10cm line, with two end points from 0 to 10, where 0 = no pain, 1-3 = mild, 4-6 = moderate and 7-10 = severe pain) where the patient reported a pain degree of 9.

The Function and satisfaction scores, ranging from 0 to 100, were also evaluated and categorized as poor (0-25), fair (26-50), good (51-75), and excellent (76-100). The patient reported poor function and satisfaction. An initial diagnosis of recurrent aphthous stomatitis was established.

Saliva samples were collected pre-treatment for assessment of serum concentrations of IL1β and TGFβ-1 using the enzyme-linked immunosorbent assay (ELISA-Shanghai YL Bioteck Co.)

The treatment was scheduled using the diode laser. The patient provided informed written consent before the treatment procedure. The local ethics committee approved the research (1374, Project Number: 161), which was conducted in accordance with the ethical guidelines outlined in the 1964 Declaration of Helsinki and its subsequent revisions. A dual-wavelength (810nm and 980nm) diode laser (Quick Lase England, UK), 12W dual 4 [810nm 50% + 980nm 50%], was utilized along with fiber optics (FC 400µm single file multimode). The wavelength was set at 980nm. Laser output power was set at 1W, operating in continuous mode. The distance between the laser probe's tip and the ulcer surface was meticulously maintained at 10mm. A single laser treatment session consisted of four 30-second applications, separated by a 15-second interval rest without radiation. The cumulative laser application time amounted to approximately 120 seconds with a total of 165 sec single treatment session.

The patient was recalled on days 1, 3, and 7 to assess healing progress and for saliva collection (for theIL1β and TGFβ-1 screening). By day 7, the patient's pain intensity had reduced to 0, and the ulcer size had decreased to 2 mm with no edema, as shown in Table 1 and Figure 1. There was also an improvement in the patient's satisfaction and function scores, along with a reduction in IL1β and TGFβ-1 serum levels.,

Table 1: Clinical evaluation scores

	Pain VAS	Size mm	Edema	Function	Satisfaction	IL1β	TGFβ-1
Pre treatment Follow up	9	6*5mm	1	20	20	1.272 pg/L	1.318 pg/L
Day 1	5	5*4mm	1	70	75	1.136 pg/L	1.156 pg/L
Day 3	1	3*1mm	0	85	90	0.904 pg/L	0.967 pg/L
Day 7	0	2mm	0	97	100	0.868 pg/L	0.851 pg/L

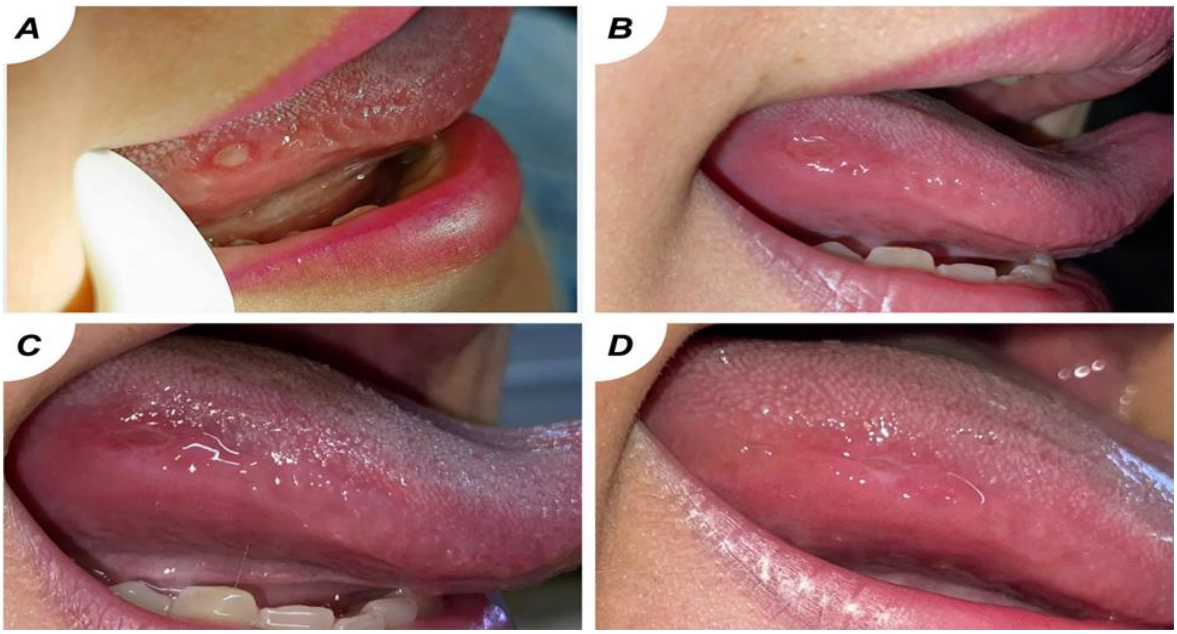

Figure 1: aphthous ulcer; A: before treatment; B: one day after treatment; C: three days after treatment; D: seven days after treatment.

4. Discussion

Low-level laser therapy (LLLT), applying the diode laser, is an emerging therapeutic method for a variety of medical conditions, including the RAS. LLLT works by delivering specific wavelengths of light to targeted tissues, which then absorb the light energy, leading to a series of cellular responses. This process can enhance cell proliferation, reduce pain, and decrease inflammation (10). Findings of this case report align with a meta-analysis by Radithia et al (11), Farista et al (12) in their study, which demonstrated that low-level laser therapy significantly reduces pain scores and healing time in patients with recurrent aphthous stomatitis (RAS).

Soliman et al. (13) and Ghali et al.(14) highlighted the remarkable improvements in healing time, pain reduction, and lesion size associated with diode laser treatment

The significant increase in patient satisfaction reflects the efficacy of LLLT in providing rapid and sustained relief from the symptoms of recurrent aphthous stomatitis since the RAS is associated with poor quality of life and demonstrated by research (15). Balakrishnan et al (16) examined the impact of LLLT on TGF-beta-1 concentrations in gingival crevicular fluids. They observed a significant decrease in TGF-beta1 concentrations from baseline at day 1, continuing through days 7 as well as 30.

The observed reductions in IL-1β as well as TGFβ-1concentrations could be attributed to a number of mechanisms of LLLT. Also, another study by Oton-Leite et al. (17) applied LLLT for treating oral mucositis and noted a tendency towards decreased concentrations of IL-1beta and TGF-beta in laser-cured group compared to the control. LLLT inhibits the production of pro-inflammatory cytokines, reducing the inflammatory response, which aligns with the observed decreases in IL1β and TGFβ-1. Additionally, LLLT enhances cellular repair mechanisms, accelerating healing and reducing sources of inflammation by stimulating ATP production and other growth factors. Improved microcirculation and blood flow from LLLT help clear inflammatory mediators more efficiently, supporting tissue healing and reducing cytokine levels. Moreover, LLLT modulates the immune response, balancing pro- and anti-inflammatory cytokines to control inflammation and promote faster symptom resolution. In conclusion, the significant reductions in IL1β and TGFβ-1 levels observed in our study,

The efficacy of LLLT in managing RAS by targeting and reducing inflammation. This dual benefit of pain relief and inflammation control makes LLLT a superior therapeutic option for patients with recurrent aphthous stomatitis (18, 19).

5. Conclusion

LLLT significantly reduces pain, lesion size, and edema, greatly improves satisfaction and functional ability, and reduces IL-1β and TGFβ-1 levels in patients with recurrent aphthous stomatitis.

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تاثير ليزر الدايود المنخفض المستوى في علاج التهاب الفم القلاعي المتكرر

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الخلاصة

الهدف: التهاب الفم القلاعي المتكرر (RAS) هو حالة فموية شائعة ومؤلمة ومتكررة تتميز بتكوين القرحة. التسبب في المرض متعدد العوامل، بما في ذلك العوامل الوراثية والمناعية والبيئية. تركز العلاجات التقليدية في المقام الأول على تخفيف الأعراض بدلاً من العلاج. في الآونة الأخيرة، ظهر العلاج بليزر الدايود منخفض المستوى (LLLT) كطريقة علاجية واعدة، حيث يوفر الحد الأدنى من التدخل والشفاء الفعال.

عرض دراسة الحالة: مريضة تبلغ من العمر 28 عامًا تعاني من تقرح مؤلم على السطح الجانبي للسانها، وتم تشخيصها على أنها التهاب الفم القلاعي المتكرر. لقد عالجنا الحالة باستخدام دايود ليزر منخفض المستوى.

الاستنتاجات: العلاج بالليزر دايود منخفض المستوى يقلل بشكل كبير من الألم وحجم الآفة والوذمة لدى مرضى RAS، مع تحسين رضا المرضى والقدرة الوظيفية