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Original Research Paper

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THE EFFECTIVENESS OF LOW-LEVEL LASER THERAPY IN THE TREATMENT OF RECURRENT APHTHOUS STOMATITIS.

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ABSTRACT

Introduction: Recurrent aphthous stomatitis (RAS) is one of the most common conditions affecting the oral cavity and can be detrimental to quality of life. Management of this condition is not always straightforward and conventional treatment options are questionable in their effectiveness. **Objective:** To clinically assess the effectiveness of low-level laser therapy (LLLT) on recurrent aphthous ulcers for reduction of pain, lesion size and complete healing time and to compare those results with those of a control group. **Materials and Methods:** A total of 28 patients who presented with two separate aphthous ulcers were enrolled in the study. Each lesion was randomly assigned to either the active treatment group (LLLT) or control group. Lesions in the LLLT group were treated in a single sitting using a diode laser, divided into three sessions. Lesions in the control group were subjected to similar treatment without activating the laser unit. Each patient was evaluated for three outcomes: pain (as measured by mean reduction in VAS score), lesion size (mm) and complete healing at the following intervals: immediate post-LLLT and one day, two days and three days follow-up. **Results:** Complete resolution of the ulcers in the LLLT group was 3.25 + 1.15 days, compared to 9.05 + 2.21 days in the control group. There was also a statistically significant ($p<0.05$) reduction in both pain and lesion size in the LLLT group when compared to the control group. **Conclusion:** LLLT was effective in reducing pain and healing time for the treatment of RAS.

KEYWORDS : aphthous ulcers, oral ulcers, low level laser therapy, diode lase

INTRODUCTION

Aphthous ulcers, commonly known as canker sores, are the most prevalent recurrent lesions of the oral cavity (Vaseemuddin, 2017). The lesions typically present as single or multiple lesions that are rounded or ovoid, typically shallow, covered by a white pseudomembrane that is enveloped by an erythematous halo (Akerzoul & Chbicheb, 2018). The lesions most commonly occur on the non-keratinized oral mucosa (Porter et al., 2000). The usual course of progression of these lesions is to cause moderate to intense pain and to heal within 7-10 days.

Recurrent aphthous stomatitis (RAS) is a pathological condition that is characterized by the appearance of recurrent aphthous ulcerations. There are three main clinical presentations of RAS: minor, major and herpetiform. Minor RAS, the most common form, is characterized by small, recurrent and round ulcerations that heal within 7-10 days without leaving any scars. Major RAS is characterized by painful ulcers greater than 5mm in diameter that heals within 6 weeks, frequently with scarring. Herpetiform RAS is described as clusters of small ulcerations that heal in approximately 10 days (Akerzoul & Chbicheb, 2018).

The etiology of RAS is unknown but is speculated to be multifactorial with many triggers or precipitating factors. Among these factors are genetic predisposition, local trauma, medications, allergy, hormonal changes, stress and immunological abnormalities (Najeeb et al., 2016).

Due to the unknown etiology, it is often difficult to find a definitive cure and current treatment options are palliative. Among the current treatment options are topical analgesics and anesthetic agents, corticosteroids, antibiotics, multivitamins, cauterization, and a variety of combined therapies (Walsh, 1997). However, none of the conventional treatments has been shown to be effective in preventing or even decreasing the incidence of these lesions.

Prior studies have shown that low-level laser therapy (LLLT) has the potential to treat aphthous ulcers and related lesions. LLLT, also known as 'soft laser therapy' or 'biostimulation' is a non-destructive energy that occurs at the periphery of the target tissue. The normal power output for a LLLT device used in therapy is in the range of 0.1 – 0.6 watts (Walsh, 1997). Since a laser provides better inflammatory responses, pain reduction and biostimulating effects, such as an increase of cell metabolism and tissue regeneration, laser therapy constitutes an attractive alternative treatment option for lesions of the oral cavity, including RAS (Babu et al, 2015; Yarak & Okamoto, 2010). Based on this rationale, the present study was conducted with the aim of evaluating the effectiveness of LLLT in treating aphthous ulcers.

MATERIALS AND METHODS

A total of 28 patients were enrolled in the study. Each patient presented with at least two separate aphthous ulcers in the oral cavity. Patients presenting with only one ulceration, those already undergoing treatment for aphthous ulcers, or those reporting no pain with their lesions were excluded from the study. Informed consent was obtained from each patient prior to treatment

The following parameters were assessed prior to treatment: 1) Pain, using the Visual Analogue Scale (VAS), which assesses pain on a scale of 1 -10, with 10 being the most painful and 2) the size of the ulcer, as measured by a periodontal probe.

The laser unit utilized in the current study was the 'AMD Picasso Lite+ Diode Laser.' In each patient, one of the ulcers was randomly allocated to be treated with LLLT by using the diode laser unit. The parameters were set at an output power of 0.5 W and a wavelength of 810 nm.

Prior to starting the treatment, each patient was seated and protective eyewear was worn by the patient, the dentist and the assistant. The treatment was completed entirely in one sitting. Each sitting consisted of three sessions of low-level laser applications, lasting about 45 seconds, each with a gap of 15 seconds between each session, for a total laser application time of about 165 seconds.

The application of the laser was done in the non-contact mode with a distance of 2-3 mm between the laser fiber optic tube and the lesion surface. The laser beam was applied in a continuous motion so as it completely cover the entire surface of the ulcer. For ulcers in the control group, the same technique was applied without actually activating the unit.

The pain scores and lesion size were evaluated immediately post-LLLT, at one day, two days, and three days follow-up. During this time, patients were asked not to use any home remedies or medications and to note down any side-effects, such as pain, bleeding or burning sensations.

The data was compiled together and statistical analysis was completed using either Student's t-test and the paired t-test.

RESULTS

The study enrolled 28 patients (age rage 21-69, 15 males, 13 females). Evaluation in the reduction of pain was assessed by comparing the VAS scores at each follow-up interval with the baseline (pre-LLLT application) VAS scores. The mean reduction in VAS scores was then calculated for both groups. The LLLT group showed a statistically significant ($p < 0.05$) reduction in pain as compared to the control group at all follow-up intervals (Table 1).

Table 1: Change in VAS scores from baseline values

Follow-up	Change in VAS scores from baseline values	
	LLLT group	Control group
Immediate post-LLLT	4.23 + 0.97 ($p < 0.05$)	0.22 + 0.46 ($p > 0.05$)
1 day follow-up	4.55 + 1.67 ($p < 0.05$)	0.21 + 0.38 ($p > 0.05$)
2 day follow-up	5.31 + 1.74 ($p < 0.05$)	0.55 + 0.89 ($p > 0.05$)
3 day follow-up	5.02 + 1.31 ($p < 0.05$)	1.02 + 0.71 ($p > 0.05$)

The second parameter evaluated was the mean reduction in the size of the ulceration. The LLLT group showed a statistically significant reduction in lesion size as compared to the control group at all follow-up intervals, except for immediate post-LLLT (Table 2).

Table 2: Change in lesion size from baseline values

Follow-up	Change in lesion size (mm) from baseline values	
	LLLT group	Control group
Immediate post-LLLT	No change	No change
1 day follow-up	0.55 + 0.61 ($p < 0.05$)	0.15 + 0.28 ($p > 0.05$)
2 day follow-up	1.45 + 0.88 ($p < 0.05$)	0.26 + 0.32 ($p > 0.05$)
3 day follow-up	2.89 + 1.11 ($p < 0.05$)	0.67 + 0.51 ($p > 0.05$)

Finally, the complete healing time of each ulcer was recorded. Complete resolution of ulcers in the LLLT group was observed to be 3.25 ± 1.15 days, compared to 9.05 ± 2.21 days in the control group. In comparison with the control group, the complete healing time for the LLLT group was found to be statistically significant, with a p value of < 0.05.

DISCUSSION

RAS is a common oral condition and although most cases have spontaneous healing within 14 days, treatment is often indicated to alleviate pain and reduce the duration and severity of symptoms, which can cause patients pain during eating, swallowing, speaking and wearing of dental prostheses (Ghali & Abdulhamed, 2022).

An array of treatment options is available for the management of aphthous ulcers, with the primary goals being a reduction in pain, healing time, number and size of the lesion(s). To date, it is still widely accepted that the first-line therapy for patients with RAS is a topical corticosteroid, even though the evidence of their efficiency is underwhelming. Laser therapy is widely used in medical settings due to its beneficial therapeutic effects, such as analgesia, anti-inflammation and wound healing but is not currently a mainstay for treatment of aphthous ulcers in dentistry.

The results of our study indicated that LLLT was successful in reducing the pain intensity and size of aphthous ulcers. According to a similar study conducted by Aggarwal et al. (2014), the healing time in the laser group was 3.05 ± 1.10 days as compared to 8.90 ± 2.45 days in the control group. Another study by Khademi et al. (2009) found similar improvements in healing time and pain intensity when compared between an LLLT group and placebo group, which was comprised of separate sets of patients. As pain is subjective and its perception varies between individuals, one main advantage of the present study was the split mouth design, which eliminated the subjective variation of pain assessment between patients.

Clinical and laboratory evidence exploring the biological effects of LLLT supports its use to promote pain relief and wound healing. It is well-known that LLLT causes immediate analgesia in painful oral lesions. Several suggested mechanisms for pain reduction from LLLT have been proposed but the real underlying mechanism has yet to be determined. Furthermore, it is likely that a combination of mechanisms is responsible for the effect of LLLT on pain perception (Ghali & Abdulhamed, 2022). One proposed mechanism is the modulation of pain perception by alteration of nerve conduction via the release of endogenous opioids, such as endorphins and enkephalins (Chow et al, 2004). These chemicals induce analgesia by interfering with the processing of pain and preventing pain information from gaining access to the limbic structures that mediate pain. Another mechanism of pain relief from LLLT is related to enhanced ATP synthesis in the mitochondria of neurons. When ATP synthesis is reduced, the result is a slight depolarization, which decreases the threshold for triggering the firing of an action potential. In contrast, an increase in ATP synthesis, which is caused by LLLT, will cause a hyperpolarization and obstruction of stimuli, thereby decreasing the induction of pain stimuli (Manaf, 2007). The mechanism of increased ATP synthesis after LLLT is based on the absorption specific wavelengths by photoreceptors in mitochondrial components, specifically in the electron transport (respiratory) chain (Karu, 1989; Yu et al., 1997). In addition, the inhibition of prostaglandin E2 (PGE2) and interleukin-1 beta also help in alleviating the pain.

LLLT has also been shown to increase blood flow to local tissues and promote capillary vasodilation, both of which are known to promote wound healing (Walsh, 1997). When delivered in appropriate dosage, energy of the photons from the LLLT is translated into photochemical and biological effects. These effects include the stimulation and proliferation of lymphocytes, mast cells, macrophages and fibroblasts. These potential biostimulating effects on underlying and surrounding cells, along with increased collagen organization, and promotion of growth factors and cytokines amount to enhanced wound healing (Smith, 2005). The activation of mast cells by LLLT is of considerable importance since mast cells release of pro-inflammatory cytokines, which promotes leukocyte infiltration of tissues. The increased proliferation and maturation of fibroblasts allows for the formation and remodeling of components of the extra-cellular matrix, including collagen synthesis (Laakso et al., 1993).

CONCLUSION

Based on the findings of the present study, we conclude that LLLT is a fast, safe and effective modality for the treatment of aphthous ulcers. It provides immediate pain relief and should be offered to patients as a first-line therapy. Further studies with larger sample sizes are warranted to compare the efficacy of LLLT compared to other available treatment modalities.

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