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Original Article

Diode Laser versus Topical Triamcinolone Acetonide Agent in the Pain Reduction of Minor Recurrent Aphthous Stomatitis

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Abstract

Background: Recurrent aphthous stomatitis (RAS) is characterized by the painful ulcerations of the oral mucosa, which impacts on the patient swallowing, so an effective therapeutic strategy mostly addresses the pain reduction as well as ulcer healing process; however, no specific therapeutic modality has been validated as gold standard therapy yet. **Objective:** The objective of the study was to determine the efficacy of 810-nm diode low-level laser therapy (LLLT) and compare with the application of topical triamcinolone acetonide in Orabase agent in respect to pain threshold reduction in patients with minor RAS. **Patients and Methods:** Twenty patients with minor recurrent aphthous stomatitis were enrolled in the study and were randomly divided into two equal groups: Group "A" treated with 810-nm diode LLLT, with an estimated energy density of 30–37.5 J/cm^2, and Group "B" treated with topical triamcinolone acetonide; a questionnaire was handed to all these patients and it was returned back after 7 days to record their pain perception threshold on the Visual Analog Scale (VAS) score on daily basis. **Results:** The mean VAS pain score of the laser group was 6.94 ± 0.32 initially and was decreased significantly to 2.14 ± 0.47 on day 3, with $P = 0.001$; while the mean VAS pain score of the triamcinolone group was 7.13 ± 0.38 initially and was decreased significantly to 2.16 ± 0.14 on day 3, with $P = 0.001$. However, in the intergroup comparison, the mean value of VAS pain perception threshold in the laser group (2.98 ± 0.32) was significantly lower than that of the triamcinolone group (3.40 ± 0.14) from day 1 to day 3, with $P = 0.012$. **Conclusions:** Both low-level diode laser and triamcinolone therapies showed a significant early and lasting pain threshold reduction in patients with minor RAS; however, in comparison between the two modalities, it goes more statically significant in favor of the low-level diode laser therapy up to day 3.

Keywords: Diode laser, minor recurrent aphthous stomatitis, triamcinolone

Introduction

Recurrent aphthous stomatitis (RAS) is a common condition characterized by the recurring episodes of ulcers of the oral mucosa. RAS are characterized by typically small, rounded, or ovoid ulcers with a circumscribed margin, erythematous halo, and a yellow or gray floor, and are mainly found on the nonkeratinized mucosa of the lips, cheeks, floor of the mouth, and sulci or ventrum of the tongue. They are severely painful, especially during the swallowing of acidic foods, and can become secondarily infected at any time.[1,2] RAS affects approximately 20% of the general population, with a greater prevalence in higher socioeconomic status, and nonsmokers. Its etiology is not clear suggesting several predisposing factors including genetic predisposition association with human leukocyte antigen (HLA) antigens, stress, various drugs such as captopril, phenobarbital, propionic acid, and piroxicam; some nutritional deficiencies; diet; hormonal and immunological disorders; and some hematological deficiencies such as iron, Vitamin B12, and folic acid deficiencies.[3,4]

Three clinical presentations

Minor aphthous ulcers (Mikulicz ulcers) are about 80%–85% that occur mainly in the 10–40-year age group, often cause minimal symptoms, and are usually 2–4 mm in diameter; they heal in 7–10 days and recur at variable intervals. Major aphthous ulcers (sutton ulcers) (10%) are >1 cm in diameter,

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recur more frequently, last longer and are more painful, and they heal slowly over 10–40 days. Herpetiform ulceration is often extremely painful and recurs so frequently that may be virtually continuous; it increases in size and coalesce to leave large-ragged ulcers that heal within 10 days or longer.[5] The treatment for RAS is symptomatic and was provided to minimize the pain, speed the healing time, decrease the number and size of the ulcer, and to prolong disease-free periods. Current option methods include systemic and topical corticosteroids, cauterization, mouth rinses containing active enzymes, laser treatments, and a combination therapy. The therapeutic laser has been applied for more than 30 years. The primary clinical effect of laser–tissue interaction resulted from tissue absorption, which was then converted to an energy which minimizes the pain sensation, reduces the size of the lesion, thus speeding up the epithelialization process.[6]

Pain is the major symptom that starts in the first 24 h as a tingling or mild irritant sensation, and then ascends and peaks during the first 3–4 days, although the disease is of self-limiting nature, the pain which leads to impaired oral food and fluid intake, and subsequent dehydration may be debilitating.[7] Therefore, the patient-reported outcomes will measure the improvement in patient's quality of life and reduction in it's morbidity by means of Visual Analog Scale (VAS).[8]

As it is a painful condition, it causes a functional disability; hence, a fundamental therapy modality is needed which mostly addresses pain alleviation and ensures almost the ordinary functions during the attacks.[9]

Low-level laser therapy (LLLT) and topical steroids (triamcinolone acetonide) can be used as treatment modality with mild difference in the clinical effects between the two methods.

Many doctors, especially the dentists, have addressed recommended topical steroid agents as a favorable therapeutic modality for RAS, in order to reduce both the pain score and the duration of ulceration.[2]

The prime cause for the application of LLLT in the treatment of RAS was to provide immediate pain alleviation through enhanced adenosine triphosphate (ATP) synthesis leading to a hyperpolarization status which in turn blocks the pain stimuli conduction and thus will decrease the pain reception threshold, and also, it has a great lessening effect in the activity of C fibers, thus altering the pain perception threshold.[10]

The use of LLLT involves the use of specific laser wavelengths ranging from visible red to near infrared with the tissue, which is based on its analgesic, anti-inflammatory, and biostimulating effects, that low-power lasers may enhance reepithelialization by increasing respiratory metabolism which in turn upregulates the mitotic activity, collagen synthesis, and epithelial proliferation; thus, it stimulates and improves healing process and minimizes the pain perception.[11,12] However, there are different types of lasers which have been addressed to relieve pain sensation and promote wound healing, such as CO_2 laser, Nd: YAG laser, and diode laser. Diode laser is mainly for photobiomodulation in a low-level laser mode, yet the type of laser which has maximum effect in RAS treatment is still a matter of debate; in addition, the comparison with other treatment modalities has not been well settled in the literature up to date.[13-15]

The use of the diode laser as the treatment of choice for oral soft-tissue therapy is reliable because we obtained acceptable healing of the lesions with minimal adverse effect. Thus, in oral soft-tissue surgery, the use of 810-nm diode lasers is suggested to be the best choice.[16]

As the light energy emerges from the diode laser, it is highly absorbed by the soft tissues while it is poorly absorbed by the teeth and bone simultaneously,[17] so it is suggested that diode laser treatment in oral aphthous enhances soft-tissue healing.[18]

It is worth mention that many therapists have been utilizing topical agents such as Debacterol (chemical cauterizing agent), or topical steroid agents as triamcinolone acetonide for the treatment of RAS, and the maximum achievement that can be obtained is to avoid local traumatic precipitation, minimize the pain, and shorten the duration of ulceration through the local immune response suppressing secondary infection prevention.[2] However, few studies have been compared LLLT effect to the topical application of triamcinolone acetonide.[19]

Therefore, this study was aimed to evaluate and compare the efficacy of low-level diode laser versus topical triamcinolone acetonide in Orabase in the treatment of RAS.

Patients and Methods

After the institute committee board approval and patients' consent taken, this was a prospective randomized controlled clinical trial conducted at the otolaryngology outpatient clinic of Al-Yarmouk Teaching Hospital, from March to November 2017.

Patient selection

Twenty patients with minor recurrent aphthous stomatitis were enrolled in this study after completing the follow-up schedule. The diagnosis was based on the clinical aspects, detailed history regarding the general health, past medical history, and the presence of associated systemic disease and drug history. Then, they were subjected to thorough otorhinolaryngeal examination with concentration on the oral cavity, particularly on the size, site, and number of ulcers at time of presentation.

Inclusion criteria include (1) patients with minor RAS, (2) patients with duration of onset of symptoms of <2 days before presented to outpatient clinic, and (3) patients who have not started any type of ulcer treatments prior to the study. While those patients with major and herpetiform aphthous stomatitis, and patients receiving any type of medication that may alter the disease course during the study, as well as those whom were noncompliant with the follow-up schedule, were excluded from the study.

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Grouping

The patients were divided into two groups, with each group consists of ten randomly picked patients as follows: Group A – ten patients were submitted to LLLT using diode laser in the noncontact mode and Group B – ten patients received topical application of 0.1% triamcinolone acetonide.

Patient assessment

A his questionnaire included all the important patients details regarding full name, age, gender, occupation in addition to questions about the frequency of recurrence, and any relevant important predisposing factors. The pain threshold perception was assessed using VAS and its score was calculated as follows: 0 as no pain, 1–3 as mild pain, 4–6 as moderate, and 7–9 as severe pain perception, whereas 10 is the worst pain possible, so the pain score was evaluated, recorded, and scheduled on the first time initially before the intervention then 20 min post intervention, after that the VAS score questionnaire was handed over to all the patients to be filled on a daily basis for 7 days and it has to be returned back on the 7th day follow-up.

Scheme of the work

Group A

The laser unit used in the study was diode laser (trademark DIOMED 15), which is gallium, aluminum, arsenide that emits a wavelength of 810 nm, 20 nm, and a power output: 0.5–15 W in continuous, pulsed, or repeated pulses. Visible diode laser of wavelength 635–660 nm and 4 mW is used as the aiming beam. After explaining the procedure to the patients and obtaining verbal consent from each patient, then the patients were made to sit on the ENT chair by comfortably wearing the protective goggles (>5 OD); the laser device was set on the following parameters: power output 2 W in continuous wave with the use of 600 μm flexible fiber optic and a handpiece in the noncontactlal mode; the distance from the tip of the fiber optic to the ulcer surface was set to 8–10 mm; the estimated irradiance was ranged from 2 to 2.5 W/cm^2, and the energy density was made on 30–37.5 J/cm^2, which lies between the ranges of the LLLT. Energy density is calculated using the formula: energy density (J/cm^2) = (power [watt]/spot size [cm^2]) × time of radiation(s). Then, without the use of anesthesia, the ulcer surface was irradiated for 15 s by continuous scanning movement to ensure covering the whole surface. This session was repeated twice; then, at the end of the laser intervention session, all patients were instructed not to take any medication for 7 days.

Group B

Topical triamcinolone acetonide (0.1%) "Kenalog in Orabase®" was applied on the ulcer surface to form a thin film covering; then after 20 min, the pain perception threshold was recorded; the patient was advised to use the medicine three times a day after meal and once before sleep for the next 3 days.

Data collection

After the questionnaires were returned back by the patients, data were collected, and statistical analysis was done. Analysis of the data was carried out using the Statistical Packages for the Social Sciences version 24 software (SPSS, IBM Corp., Armonk, New York, USA). Data were presented in terms of frequency, percentage, mean, standard deviation, and range (minimum–maximum) values. The statistical significance of the difference of different means (quantitative data) was tested using Student's *t*-test for the difference between two independent means or paired *t*-test for difference of paired observations (or two dependent means). The statistical significance of the difference of different percentages (qualitative data) was tested using Pearson's Chi-square test (χ^2-test) with application of Yate's correction or Fisher's exact test whenever applicable. Statistical significance was considered if the value was $P \leq 0.05$.

Tables, column charts, and histograms were used to explain the results.

Results

The patients' age participated in the study ranges from 15 to 49 years, with a mean age of 27.15 years in Group A; 24.8 years and in Group B; 29.5 years, as shown in Table 1.

Pain Visual Analog Scale score assessment

The initial mean VAS pain threshold perception value of the laser group was 6.9 ± 0.3 (in the range 5–9), which decreased significantly in the immediate postirradiation score to 4.8 ± 0.4 (in the range 3.5–6.5) with $P = 0.001$. In addition, there was a significant reduction in the mean VAS pain reception threshold score to 2.98 ± 0.24 (ranged from 1.5–4), from day 1 to day 3 post irradiation with $P = 0.001$, while the corresponding score from day 4 to day 7 was 0.79 ± 0.53 (in the range 0.5–2.0).

In the group of patients who had received topical triamcinolone, the pain score thats assessed by the VAS showed that significant differences between the mean values from initial pretreatment to immediate posttreatment reading were 7.13 ± 0.38 (in the range 5–8.5) and 5.19 ± 0.36 (in the range 4–8), respectively, with $P = 0.001$. Also, the remaining values were statistically significant as it was reduced to 3.40 ± 0.22 (in the range 2.5–5.5), from day 1 to day 3, with $P = 0.001$, whereas those from day 4 to day 7, the value was 0.84 ± 0.34 (in the range 0.6–2.5).

Intergroup comparison

Although the mean value of pain perception assessed by VAS in both the laser and topical triamcinolone groups revealed a statistically significant results, the mean VAS value of pain

Table 1: Age and gender distribution of the study groups

Groups	Patients number	Mean age	Gender distribution	
			Male (%)	Female (%)
Laser group	10	24.8	3 (30)	7 (70)
Topical triamcinolone group	10	29.5	6 (60)	4 (40)

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perception for those patients whom received laser treatment was 2.98 ± 0.32 (in the range 1.5–4.5), and it was significantly lower than that of the topical triamcinolone group (3.40 ± 0.14) ranged from 2.5 to 5, from day 1 to day 3, with $P = 0.012$, whereas it was statistically nonsignificant in the initial and immediately after the treatment, as $P = 0.297$ and 0.093, respectively, it was noticed from day 4 to day 7 in the both study groups, the pain threshold perception was negligible, and there were no remarkable differences between the both groups, as these values were statistically nonsignificant, as $P = 0.69$. Table 2 shows the mean pain score value comparison between laser and triamcinolone groups.

Discussion

LLLT and topical steroids (triamcinolone acetonide) can be used as treatment modality regarding pain reduction with mild difference in the clinical effects between the two methods.

The results of this randomized controlled clinical trial showed a significant early and sustained pain reduction after both LLLT and topical 0.1% triamcinolone acetonide application; however, in the first 3 days of the treatment, an exposure to a single sitting of the low-level diode laser therapy was found to be more statistically significant and superior in pain reduction than those with 3-day application of topical 0.1% triamcinolone acetonide in patients with minor aphthous stomatitis, and these findings were to be almost consistent with the results of other studies.

De Souza *et al*., in their study, compared the effect of low-level diode laser with a topical corticoid agent (triamcinolone acetonide) and found that 75% of the patients reported a reduction in pain in the same session after the laser treatment.[19]

Albrektson *et al*. conducted a randomized single-blinded placebo-controlled trial and they found that LLLT reduced the pain for patients with RAS compared with placebo ($P < 0.0001$).[20]

In Aggarwal *et al*.'s study, they reported that a single session of LLLT had an instantaneously significant and rapid relief of pain threshold perception when compared with topical 1% triamcinolone acetonide therapy.[21]

Table 2: Comparison of mean values of Visual Analog Scale in both the laser and topical triamcinolone groups

	Laser group	Topical triamcinolone group	*P*
VAS initial	6.91±0.32 (6.5-7.4)	7.13±0.3 (6.7-7.5)	0.297
VAS after intervention	4.82±0.14 (4.1-5.7)	5.19±0.36 (4.8-6.5)	0.093
VAS day 1	3.79±0.32 (2.9-4.6)	4.54±0.27 (3.6-5.4)	0.025*
VAS day 2	3.01±0.25 (3.3-4.8)	2.31±0.25 (2.8-4.2)	0.011*
VAS day 3	2.16±0.16 (3.1-4.3)	3.37±0.14 (2.0-3.1)	0.015*
VAS day 1-day 3	2.98±0.24 (3.2-4.1)	3.40±0.22 (1.8-3.2)	0.012*

*Significant difference between two independent means using Student's *t*-test at 0.05 level. VAS: Visual Analog Scale

In contrast to these results, Salman *et al*., in their study, found that the difference of pain perception in patients treated by either method was statistically nonsignificant according to the control group.[22]

Hence, low-level diode laser therapy is shown to be a feasible modality of treatment of RAS which is easy to perform, and its application is feasible but in competition with other forms of treatment modalities.

Conclusions

According to the VAS score pain threshold perception and its duration, this study showed that both the low-level 810 nm (30–37.5 J/cm^2) diode laser therapy and the topical triamcinolone agent are significantly efficient therapeutic modalities in the early pain reduction of minor RAS, however, in comparison between the two modalities, it goes more statistically significant in favor of the low-level diode laser therapy up to day 3.

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Conflicts of interest

There are no conflicts of interest.

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