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Evaluation of Low Level Laser Therapy with Different Types on Recurrent Aphthous Stomatitis: A Randomized Control Study

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Abstract : Recurrent aphthous stomatitis (RAS) is the most frequent ulcerative lesion of the oral cavity which is associated with pain. Low level laser therapy (LLLT) has been evaluated forits effectiveness in pain reduction and acceleration of ulcer healing. The purpose of this study was to determine the effect of LLLT on RAS in addition to, compare the effect of Helium Neonlaser (He-Ne) and Gallium Aluminum Arsenidelaser (Ga-Al-As)on pain modulation and healing process in RAS. A total of 45 patients of both sexes, with RAS were included in the current study. The patients were divided randomly into three groups(15 patients in each group); group A (He-Ne, 632 nm, 1.56 mW, 1.22 J/cm2), group B (Ga-Al-As, 830 nm, 50 mW, 6.3 J/cm2) and group C (medical treatment group). Both pain and size of ulcer diameter were evaluated before and after treatment by three days. The results showed significant reduction in pain scores in group A and B (P < 0.05) while non-significant reduction was recorded in group C (P= 0.21) with percentage of improvement 82.53 %, 61.72 % and 6.6 % respectively. However ulcerdiameter results represented that the percentages of improvement were 86.27%, 65.01% and 10.41% for group A, Band C respectively. He-Ne laser is effective than Ga-Al-As laserin management of RAS. Keywords : Recurrent aphthous stomatitis, LLLT, Ulcer size, Pain.

Introduction

Recurrent aphthous stomatitis (RAS), canker sores or Aphthous ulcer is the most common ulcer in oral cavity. The prevalence of RAS ranges from 5-60% of the population all over the world^{1,2}. It is characterized by recurrent, painful, multiple or a single shallow, ovoid or round ulcer as well as, it usually appears as erythematous haloes with grey or yellow floors. RAS has three clinical forms which are minor, major and herpetiformis¹. The exact etiology of this lesion is unknown, but it may be related to autoimmune condition. In addition, there are some precipitating factors that have a role in the etiology of Aphthous as; genetic factors, trauma, stress, deficiency in vitamin B1,B2 ,B6 or B12, cessation of smoking or systemic diseases. Moreover thermal injury or chemical irritation may contribute to develop RAS^{34,5,6}. The manifestations range from mild to severe, however it causes moderate to severe pain and burning sensation that may interfere with the person ability to eat, ingest food, drink, or speech⁷. Healing process duration differs according to the RAS form. As it lasts up to 7-14 days in minor form, 15 days in the Herpetiform form, while in the sever form it may take about 20-30 days^{1,8}.

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Numerous treatment modalities have been used to control RAS lesions. Many drugs have been described as topical corticosteroid, antibiotics and topical anesthetics. Recently laser therapy has been used to managethese cases⁹.Laser is defined as "an acronym for Light Amplification by Stimulated Emission of Radiation "¹⁰.Low-level laser therapy (LLLT) is also known as 'soft laser therapy' or bio-stimulation. It is usually settled in wave length of 650-1200 nm. He-Ne laser (633nm) and Ga-Al-As laser (780-820-870nm)are types of low level lasers¹¹.Several studies reported the benefits of LLLT on pain reduction in addition to promote healing process in RAS by different mechanisms^{2,12}.Maiya et al., ¹³succeeded to demonstrate the effectiveness of He-Ne laser in management of RAS. Recently, Albrektson et al., ¹⁴ represented also that Ga-Al. As laser has beneficial effect in the healing of recurrent aphthous ulcers.

To our knowledge there is no study has been conducted to compare the effect of LLLT with different types (He-Ne and Ga-Al-As laser) on pain modulation and healing process in RAS. Therefore, the aim of this study was to assess and to compare the efficacy of different types of LLLT on reduction of pain and ulcer size in the cases of recurrent Aphthous ulcers.

Methods

Subjects

Of 50 eligible patients, 45 patients of both sexes, with recurrent aphthous stomatitis (RAS) in their oral cavity, accepted to participate in the current study, fig 1. Patients were referred by the teaching hospital of the college of Dentistry, Cairo University. The participants with the following inclusive criteria were enrolled in this study; (1) Aged 20-40 years; (2) Patients had pain and redness at the ulcer site; and (3) Enrolment of the patients within 2 days after the appearance of ulcer. Exclusion criteria included patients presenting with chronic non healing ulcers or any systemic diseases that might be a cause of RAS, or smokers.



Figure 1. The Participants Flow Chart

The study was conducted in the out-patient clinic of the faculty of Physical Therapy, Cairo University, after the approval of the Postgraduate Institutional Ethical Committee at faculty of Physical Therapy, Cairo University. Each patient was informed about the procedure and technique, and his/her consent was obtained.

Participants who had fulfilled the eligibility criteria were randomized to three groups (15 patients in each group); group A (He-Ne laser group), group B (Ga-Al-As laser group) and group C (control group).

Measurement procedures

Both pain and size of ulcer were evaluated at the baseline, and after three days post treatment.

Pain measurement

The patients were asked to grade their pain by using visual analogue scale (VAS). VAS is a horizontal 10 cm line with 0 represented no pain and 10 is used to describe maximum pain¹⁵.

Size of ulcer measurement

A calibrated periodontal probe was used to measure the ulcer's size while the patients were placed in a comfortable sitting position. The probe is a long, tapered, rod like tool that is calibrated in millimeters with a tip^{16}

Treatment procedures

He-Ne laser therapy

Helium-neon laser (ASA srl laser system)was applied to group (A) with the following parameters: as 632 nm, 1.22 J/cm2 and 1.56 mW.¹³

Ga-Al-AsLaser Therapy

Ga-Al-As laser device (Doctor Smile Diode Laser, Italy)with 830 nm, 6.3 J/cm2, power output of 50 mW was applied to group (B).¹⁷

Prior to the application of laser therapy the patient and the therapist wore a protective eyewear. Patient was placed in comfortably sitting position. Laser therapy was conducted for one sitting that consisted of four sessions. Treatment lasted for 45 seconds, with a gap of about 30-60 seconds between each session. Total laser application time was about three minutes. Non-contact mode was used with a distance of 2-3 mm between the laser tip and the ulcer surface. The laser beam was applied in a continuous sweeping and circular motion.²

Medical Treatment

Patients received Salivex-L Paint 10ml (Anthraquinone glycosides 500 mg + Salicylic acid 100 mg + Lidocaine hydrochloride 60 mg) every 6 hours per day for group C.

Data Analysis

Data were analyzed with Statistical Package of Social Science (SPSS) version 22.0. The data were compiled together and they were evaluated. Means, standard deviations, paired t-test, ANOVA test and P values were calculated. Statistical significance was set at P < 0.05. Percentage of improvement was calculated using the formula of post-pre/pre*100.

Results

The study comprised of a total of 45 patients, of which 22 were males and 23 were females. All the patients completed the study. Table 1 shows the distribution of sex and age among groups and it represents that there were no significance differences between the patients' sex and age with P=0.92 and 0.80 respectively.

The statistical analyses of the pre and post measurements of ulcer diameter for all groups are represented in table 2. The results shows that there were significant reduction differences between the baseline and after 3 days post treatment diameter measurements for group A and B with P< 0.05, while there was no significance difference between measurements in control group with P= 0.21. The percentages of improvement were 86.27%, 65.01% and 10. 41% for He-Ne group, Ga-Al-As group and control group respectively.

In table 3 the mean of reduction in the VAS scores are demonstrated. The results of pain scores showed significant reduction between the pre and post measurements in group A and B (P< 0.05) with percentage of improvement 82.53%, 61.72% respectively. In addition to, no significance difference was observed in group C measurements (P= 0.32) and the percentage of improvement was 6.6%.

Variables	Groups		
	Group A	Group B	Group C
Gender			
Male	8	7	7
Female	7	8	8
Age	29.07±6.05	29.40±6.631	27.87±7.13

Table 1 . Demographic data of the patients

Table 2. Statistical analysis of ulcer diameter in all groups

Variables	Groups	Pre	Post
Mean± SD	Group (A)	5.90±1.23	0.81±0.39*
	Group (B)	5.63±1.29	1.97±0.54*
	Group (C)	5.57±1.49	4.99±1.43

 \pm SD : standard deviation , *Significant (P < 0.05) improvement between the pre and post measurements

Table 3. Statistical analysis of VAS scores in all groups

Variables	Groups	Pre	Post
Mean± SD	Group (A)	6.47±1.06	1.13±0.64*
	Group (B)	6.27±1.39	2.40±1.06*
	Group (C)	6.07±1.56	5.67±1.45

 \pm SD : standard deviation , *Significant (P < 0.05) improvement between the pre and post measurements







Fig 3 .VAS pain score in all groups

Fig 2,represents the statistical analysis of ulcer diameter among groups where, there was no significance difference among the baseline measurements of all groups with P=0.77. Moreover the post treatment measurements demonstrated significance difference among groups with P<0.001.

The results of pain scores by VAS concluded that the pre measurements among groups were not significant with P= 0.89, while after three days the post measurements showed significant difference among groups (P< 0.001), Fig 3.

Discussion:

The current study provides evidence that a single session of LLLT is effective in management of RAS than conventional medical treatment, as the results showed significant reduction of pain score and ulcer diameter with the application of LLLT in group A and B than group C.

Recently, LLLT was suggested to be one of the important treatment modalities for wound repair processes and pain control.^{18,19} Clinical and laboratory studies explained different mechanisms through which LLLT can accelerate wound healing. These mechanisms includes: local vasodilatation and increased of blood flow¹⁰, cellular bio-stimulation²⁰, in addition to analgesic and anti-inflammatory effects.²¹

Moreover, researchers claimed that LLLT is effective in pain reduction and they provided some explanations such as: the role of LLLT in increasing the production of opioid peptides²², decreasing the histamine release²³, reducing the prostaglandin and bradykinin production^{22,23}, increasing local circulation and oxygen supply²³, as well as blocking of the action potential generation in the primary afferent neuron.²⁴

The results also showed that He-Ne laser was more effective than Ga- Al-Ar in management of both pain (82.53% and 61.72% respectively) and ulcer diameter (86.27% and 65.01% respectively).

It was shown that He-Ne laser exerts analgesic, anti-inflammatory and regenerative effects in managing chronic RAS^{12,14,25}. Many investigators examined the effect of He-Ne laser in management of RAS ulcer. Earlier, Kitchen and Bazin²⁶stated that He-Ne laser (632 nm, 1.56 mW and 1.22J/cm²) was effective in controlling pain and healing of recurrent aphthous ulcers. Furthermore, Maiya et al¹³ examined He-Ne laser with the same parameter on thirty patients complaining from minor RAS and they recorded its efficacy in reducing pain, lesion size and healing time, whileAnand et al²⁷ applied the same parameters on patients suffering from major RAS and they reported that lesions healed completely within 3-4 days with reduction ofpain and lesion recurrence.

De Souza et al²⁸conducted a comparative study between the effect of He-Ne laser and conventional medical treatment on RAS, where both treatments were applied until the disappearance of the lesions. The results showed that He-Ne laser is superior to medical treatment in its analgesic and healing effects with regard to RAS. Recently, Aggarwal et al²also confirmed the effectiveness of He-Ne laser in relieving pain and reducing the healing time of patients suffering from aphthous ulcers.

On the other hand, several researchers preferred using Ga-Al-As laser to control pain and promote healing process in patient suffering from RAS. Earlier, Rocha Junior et al²⁹ examined the effects of Ga-Al-As laser with a wavelength of 830 nm, 50 mW power output and a dose of 6.3 J/cm² on ten patients with recurrent aphthous ulcers and the results showed significance reduction in pain as well as healing time. Furthermore Ga-Al-As laser was diagnosed for its efficacy in preventing recurrence of minor RAS. As, kjuhn et al¹⁷ reported that a single sitting of 830 nm Ga-Al-As laser can effectively reduce the healing time, pain severity, size, and recurrence of the lesion in patients with minor RAS. Recently, the same results were supported by Albrektson et al¹⁴ who tested the same parameters of Ga Al As semiconductor laser but for three consecutive days.

According to our results, He-Ne laser appeared to be superior to Ga-Al-As laser in management of RAS. This is in consistence with the findings of the study that conducted by Reddy, as he reported that the biomechanical and biochemical analysis of healed wounds determined that He-Ne laser resulted in greater healing effects than Ga-Al-As laser.³⁰

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It is suggested that the LLLT wavelength have an important role in the results related to RAS treatment.³¹Furthermore, it is concluded that He-Ne laser would accelerate wound healing with significant collagen fibers production and deposition^{32,33}, combined with rapid neovascularization and re-epithelization.³⁴As well as, the results may be attributed to the He-Ne and Ga-Al-As laser photochemical interaction with cells, as it was suggested that the absorption of radiation emitted by He-Ne laser at 632 nm begins at the components of respiratory chain, whereas it starts at the membrane level with the radiation emitted by the Ga-Al-As laser at 830 nm, which leads to photochemical response of the tissue.³⁰Earlier, Sommer et al³⁵ concluded that high significant biological effects were expected with predominant dose values of LLLT, i.e. up to 5 J/cm2. Moreover, it is suggested that higher doses reduce cell proliferation as well as itmay damage cell membrane.³⁶

In addition to, Reddy reported that the differences in coherent properties of lasers may also affect healing process, as it is known that the radiation emitted by the He-Ne laser has more coherence in its nature than that of the radiation emitted by the Ga-Al-As laser, and he added that these specific differences in the absorption of radiation by tissue and discrepancies in coherence properties may explain some of the variations between the He-Ne and Ga-Al-As lasers in promoting wound healing.³⁰Furthermore, we also suggest that the results may be affected by patient's cooperation.

The current study may be limited by the small sample size, which limits generalization. Therefore, large sample size is recommended.

Conclusion:

Based on the finding of this study, it is concluded that LLLT is effective than medical treatment in reducing pain and promote healing of RAs. Furthermore He-Ne laser was observed to be superior to Ga-Al-As Laser in management of RAS. Further studies are needed to evaluate the influence of LLLT with different wavelength, output powers and energy densities.

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Conflict of interest

The authors have no conflicts of interest to disclose.

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