Clinical effect of low level laser therapy on healing of recurrent aphthous ulcer and oral ulceration in Behcet’s disease

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ABSTRACT

Background: As the exact etiology of recurrent aphthous ulcer (RAU) remains unknown, therapeutic measures are challenging and difficult. Low level laser therapy use is based on the concept that certain doses of specific wavelengths can turn on or off certain cellular components or functions as well as aid in healing and reducing pain and swelling of oral lesions. The aim of this study was to evaluate the clinical effect of low energy Gallium-Arsenide semiconductor diode laser, 904 nm, on the healing process of recurrent aphthous ulceration and oral ulceration in Behcet’s disease.

Patients and Methods: This study was performed on 47 patients, age range 12-58 years, with RAU lesions irradiated by laser into two doses (in alternative day), and divided into Control group: RAU patients without any treatment. Group one: RAU in Behcet’s disease irradiated with 1.5 Joule laser. Group two: RAU only, irradiated with 1.5 Joule laser. The results obtained account for duration of lesions, size measurement, pain symptoms, and presence of erythema in three visits.

Results: It was shown that no difference in the healing process of RAU and oral ulcer in Behcet’s disease when compared with the control group after low level laser therapy; however when the lesion is less than 24 hours old, it was healed faster than control group. In addition to that, pain symptoms disappear soon after laser therapy, or it regains in low intensity. In RAU, healing process was reduced to a couple of days in initial stage of ulcer, however, a non significant clinical difference was observed on healing process of RAU and oral ulceration in Behcet’s disease after LLLT in comparison with non treated RAU lesions. There was no statistical significant difference on healing process of RAU and oral ulceration in Behcet’s disease after LLLT. Pain disappear soon after LLLT and this is temporary which recur in the next visit but in milder form.

Conclusion: Dose and other parameters at which low level laser therapy (LLLT) is implemented influence effectiveness of the therapy

Keywords: Aphthous, ulcer, Behcet, laser (J Coll Dentistry 2005; 17(2) 36-40)

INTRODUCTION

Aphthous ulcers are among the most common oral lesions in general population with a frequency of up to 20% and recurrence rates as high as 50%, with higher prevalence in high socio-economic classes. The ulcers, which usually occur on non keratinized oral mucosa, can cause considerable pain and may interfere with eating, speaking and swallowing. Clinically the lesions are confined to the oral mucosa and begin with prodromal burning any time from 2 to 48 hours before an ulcer appears. During this initial period a localized area of erythema develops. Within hours, small white papules form, ulcerates, and gradually enlarges over the next 48 to 72 hours. (1)

Recurrent aphthous ulcer (RAU) is classified on the basis of ulcer size and number as minor, major and herpetiform. The cause of RAU is idiopathic in most patients.

The most likely precipitating factors are local trauma and stress; other associated factors include nutritional deficiencies, food allergies, genetic predisposition, immune disorders, the use of certain medications, HIV infection and systemic diseases. (1,2,3) One of the systemic disease is Behcet's disease, which is a complex, chronic, multisystem disease characterized by oral and genital aphthae, pustular vasculitis, cutaneous lesions and ocular, gastrointestinal and vascular manifestation. Virtually all patients with Behcet's disease suffer recurrent aphthous ulceration which is one of the first-occurring major manifestations of Behcet's disease and shows the highest mean recurrence rate and the longest mean duration period. (4,5)

The primary goals of therapy of RAU are relief of pain, reduction of ulcer duration and restoration of normal function. Current treatments are palliative and focused on pain reduction and accelerate healing process. (3,6) These factors necessitate the research of new methods of treatment without the use of...
Medicines. One of the most effective methods is physical therapy using a low intensity laser radiation. Dentists have been administering low level laser therapy (LLLT) to their patients as an aid in healing, reducing pain and swelling, and controlling oral infections for at least the past three decades. The research shows that LLLT works, but out of the thousands of studies that exist using LLLT, few represented good evidence-based research. It is virtually impossible to hurt a treatment site using LLLT, with the worst case scenario being that nothing happens after treatment.\(^{(7,8)}\)

The oral aphthous ulceration is one of these mucous membrane diseases was treated by LLLT and many attempt was done to show the efficacy of certain dose of soft laser on the healing process.\(^{(9-11)}\)

**MATERIALS AND METHODS**

Materials: laser apparatus, which is GaAs infrared diode laser (optodent) with handpiece diode cap carrying the optic fiber beam for treatment of specific points of the oral cavity. The specifications of this device are listed in table 1.

<table>
<thead>
<tr>
<th>Table 1: The specification of Optodent laser device:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of laser</strong></td>
</tr>
<tr>
<td>Laser diode peak power</td>
</tr>
<tr>
<td>Laser diode average power</td>
</tr>
<tr>
<td>Average power (in optic fiber)</td>
</tr>
<tr>
<td>Wavelength</td>
</tr>
<tr>
<td>Impulse width</td>
</tr>
<tr>
<td>Impulse frequency</td>
</tr>
</tbody>
</table>

Subjects: Forty seven patients were collected from the Behcet's disease clinic at Baghdad teaching hospital and from private dental clinics at period (December 2003 -July 2004), only 35 gave analyzable data. All patients were informed about the nature of this treatment and their agreement was taken before laser irradiation. The patients were requested to refrain from the use of any medicaments throughout the trial.

Control group: similar in respect to age, sex, and ethnic with other groups. They were 12 patients with RAU only and should not have other systemic disease in which RAU is a part of its findings, and should not take any treatment or medications during the period of study.

The study sample consists of:

The first group: included 12 patients of Behcet's disease and have typical RAU lesions. These patients fulfilled the ISG (international study group) criteria for diagnosis of Behcet's disease. They were irradiated with continuous mode laser with energy 1.5 J (time: 5 min).

The second group: included 11 patients suffering from RAU only, they were otherwise healthy. They irradiated by continuous mode laser with energy 1.5 J (time: 5 min).

In each visit patients were examined clinically to evaluate healing process, duration and size of ulcers, presence of erythema around the lesions. Pain recorded as prescribed by patient himself. The recurrence rate of aphthosis at the same site after laser treatment was negligible. The irradiated groups were given two doses for each lesion in alternative day. The optic fiber end of laser device applied directly perpendicular to the ulcerative lesion in a manner does not traumatized the area (figure 1).

Data were collected, tabulated and statistically analyzed using Student’s T test, Z proportion test, ANOVA test ad Chi-Square. Non significance was considered when \( P > 0.05 \), significant, \( P \leq 0.05 \) and highly and significant \( P < 0.01 \).

**RESULTS**

**Clinical observations:**

The Control Group:

The healing process was observed regarding to duration of ulcer, size (in millimeters), presence of pain, and presence of erythema in three session and this data is in table 2.

The Study Groups :

1) Group one: twelve Behcet’s disease patients with 20 RAU lesions were treated by
1.5 J of laser, the mean duration of these lesions after two doses of laser irradiation was 5 ± 3.16 days, in two lesions (with less than 24 hours duration), signs and symptoms disappeared when irradiated by 1.5 J LLLT. The mean size of ulcer slightly reduced in second visit after one dose of laser irradiation but it is increased again in third visit after two doses of laser.

The pain sensation, about 17 lesions (85% of cases) experience pain relief soon after laser irradiation but this is temporary relief and pain regain but in low intensity in next visit (60%). The presence of erythema around the ulcerative lesion was decreased in second visit after one dose of laser irradiation (40%) and still the same percentage in third visit after second dose of laser irradiation.

2) Group two: twenty one RAU in 11 patients were irradiated by 1.5 J of laser. The mean duration of lesion after two doses of laser irradiation was 3.75± 3.89 days. The mean size of ulcer has been reduced. Five lesions with duration less than 24 hours showed no signs and symptoms in second visit after irradiation by 1.5 J LLLT (fig. 2 a,b), while ulcerative lesions with duration more than 24 hours did not show any clinical changes. The pain sensation is disappearing soon after laser irradiation in 15 lesion (71.4% of cases) also this is a temporary relief and pain regain in low intensity in next visit (33.3%). The presence of erythema around the ulcer was decreased from 95.2% in first visit to 25% after two doses of laser irradiation.

Statistical analysis among different groups (tables 3) did not show any significant differences in duration and size in different groups (control, RAU in Behcet’s disease with 1.5 J laser irradiation, and RAU with 1.5 J laser irradiation) for each visit (first, second, and third) also there is no significant relation between the presence of pain and erythema in different groups in each visit except in pain in third visit.

Table 2: Statistical analysis of control group (RAU with out treatment) according to duration, size, pain and erythema.

<table>
<thead>
<tr>
<th>Visit</th>
<th>Duration (days)</th>
<th>Size (mm)</th>
<th>pain</th>
<th>erythema</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean SD</td>
<td>Mean SD</td>
<td>No.%</td>
<td>No.%</td>
</tr>
<tr>
<td>1st</td>
<td>5.58 5.28</td>
<td>3.08 2.64</td>
<td>11</td>
<td>91.70%</td>
</tr>
<tr>
<td>2nd</td>
<td>6.67 6.18</td>
<td>2.92 2.39</td>
<td>6</td>
<td>50.00%</td>
</tr>
<tr>
<td>3rd</td>
<td>5.83 3.12</td>
<td>1.67 1.03</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

p.value(1st & 2nd visit) NS, p.value(2nd & 3rd visit) NS, p.value(1st & 3rd visit) NS

Table 3: Statistical analysis among different groups according to duration, size, pain and erythema in third visit.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Duration (days)</th>
<th>Size (mm)</th>
<th>pain</th>
<th>Erythema</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean SD</td>
<td>Mean SD</td>
<td>No.%</td>
<td>No.%</td>
</tr>
<tr>
<td>Control</td>
<td>5.83 3.13</td>
<td>1.76 1.03</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Group-1</td>
<td>5.0  3.10</td>
<td>3.5  2.7</td>
<td>3</td>
<td>60.00</td>
</tr>
<tr>
<td>Group-2</td>
<td>3.75 3.89</td>
<td>1.85 1.56</td>
<td>2</td>
<td>16.70</td>
</tr>
<tr>
<td>P.value</td>
<td>NS</td>
<td>NS</td>
<td>S</td>
<td>NS</td>
</tr>
</tbody>
</table>

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DISCUSSION

In present study, LLLT (Ga-As diode laser at 904 nm wavelength, continuos mode) was used, in treatment of RAU depending on its biomodulation effect (biostimulation or bioinhibition) which has been used clinically for pain reduction and wound healing (8,12-16).

The low energy laser stimulate DNA-RNA-protein system and rise mitotic activity of cell (17,18). This occur through modification of cellular homeostasis of the mitochondria promoting a cascade of events in the respiratory chain of cytochromes, cytochrome oxidase and flavin dehydrogenase that permit absorption of light (13,19), that lead to increase in mitochondrial content of ATP, transmembrane potential and pH and changes in ultrastructure of organelles. These changes in mitochondria promote cell division (12,20). This results in a rapid and more epithelialization and regeneration of mucous membrane in the area of the lesion (20,21).

Generally, the results showed that the mean duration of ulcer between different groups has no significant differences in all visits. This explain that laser radiation at dose 1.5 J in single dose or couple dose did not significantly affected the normal time of healing of RAU, same finding was reported by Howell et al (1988) who used He-Ne LLLT to treat RAU (9).

The variation in size and duration showed no significant differences between groups since laser therapy does not induce re-epithelialization and this agree with the findings of Mass et al,1993 (22), and disagree with Abd El-Sattar and Saudi, 2002 (10) who stated a reduction in lesion size and duration after LLLT.

Pain sensation is the most important symptom in RAU and oral ulceration in Behcet’s disease patients. There was disappearance in pain sensation soon after laser irradiation in high percentage of lesions in two study groups, this mean LLLT can reduce the pain temporarily for few hours and the pain reappear but in mild intensity in some patients. This reduction in pain was also observed by Abd El-Sattar and Saudi (10).

The analgesic effect of laser irradiation have been explained by many studies as the restoration of the sodium pump necessary to maintain the negative resting potential of neuronal membranes (18,23). During inflammation, the normal resting potential of nerve fiber is decreased leading to hypersensitivity (13). LLLT inhibits a range of nociceptive signals arising from peripheral nerves including neuronal discharges elicited by chemical irritation of inflammation (13,24) because the laser light can increase the activity of the ATP-dependant Na-K pump and in this case laser increases the potential difference across the cell membrane moving the resting potential further from the firing threshold, thus, decreasing nerve endings sensitivity (23,25).

Erythema occurs due to inflammatory reaction and highly vascularization of the lesions (1,26). The clinical observation of erythematus halo around the ulcerative lesion was decreased in all cases of study groups. This is indicating a decrease in the inflammatory reaction in the ulcerative area. In other words, the inflammatory cell infiltration was less prominent (27, 28). But comparing these
two study groups with control group, the result shows no significant differences between them. The interpretation of controversial results in LLLT it was concluded that dose and other parameters at which LLLT is implemented have a significant influence effectiveness of the therapy (12, 14, 16, 29). However, the complexity of wound healing and vast biochemical mediators and cellular factors that modulate the process makes it unscientific to compare results when different lasers are used in the experiments along with varied tissue molecules like mucosa, different animal models, and different culture media.

REFERENCES