Cold laser for oral ulcers: A pilot study

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Abstract

Introduction: Most common form of oral ulcers is recurrent aphthous stomatitis (RAS). It occurs in three forms minor, major and herpetiform ulcers. They are extremely painful ulcer, and there are no established causes or treatment for it. Various causes such as vitamin deficiencies, stress, micro-trauma, has been hypothesized for the etiology of RAS. Treatment with cold lasers is commonly known as low-level laser therapy (LLLT). They are used as adjuvant treatment in the various disorders such as arthritis, tennis elbow, chronic wounds, burns, peripheral nerve regeneration. In this study, we are using cold lasers for the treatment of the oral ulcers.

Materials and Methods: A total of 12 subjects with RAS in the age group of 16-50 years of both genders were included in the study. After taking informed consent, they were treated with LLLT (0.63 nm, 10 mW, continuous wave). Area of the ulcer was determined, and the duration of the laser treatment was calculated. On an average, the treatment duration was 10-18 s/day. Subjects were treated daily until the ulcers healed. Efficacy of the treatment was based on assessment pain scores (measured using visual analog scale) measured every day after therapy.

Results: Total of 12 subjects underwent treatment. The average size of the ulcer was 8 mm² with a range of 8-35 mm². The average pain score (visual analog scale) on the 1st, 2nd, 3rd day, and 5th were 6.9, 6.4, 4.9, and 2.3 respectively.

Conclusion: LLLT is known to cause vasodilatation by releasing nitric oxide at base of the ulcers. This increase in blood supply drains out of the metabolic substances, which cause tissue destruction and pain. It also favors the production of growth factors which causes healing of the ulcer and tissue repair. The observation that pain in the ulcers is same on the 2nd day could suggest that LLLT augments the natural process of healing. Further comparative and follow-up studies are required to prove further efficacy of LLLT on RAS.

Introduction

Treatment with cold lasers is commonly known as low-level laser therapy (LLLT). LLLT is treatment in which the energy output is low so that the temperature of the treated tissue does not rise above the normal body temperature.

The action of LLLT is best described by its ability to get absorbed at the tissue surface and to transfer the light energy into the cellular systems. This energy is utilized by the mitochondria and for activation of several substrates and enzymes. This process is called photobiomodulation. The several changes that are observed are an increase in adenosine triphosphate production, release of nitric oxide (NO) and increase in the tissue temperature and hence capillary dilatation. There is also increase in nerve conduction, local blood flow, increased macrophages, and fibroblastic activation. Overall benefits of these are a decrease in pain, rapid wound healing, and stabilization of immune reactions, thus improved physiological functioning. There are no noted side effects on LLLT as of now. LLLT is used as adjuvant treatment in various disorders such as arthritis, tennis elbow, chronic wounds, burns, peripheral nerve regeneration. In this study, we used LLLT in the management of painful oral ulcers called aphthous ulcers.
Aphthous ulcers are a common form of oral ulcers also called as recurrent aphthous stomatitis (RAS). It occurs in three forms minor, major and herpetiform ulcers. Minor ulcer is a mild form of ulcer, but still painful enough to restrict the normal activity of the individual. Major ulcers are usually large and extremely painful. Herpetiform ulcers are tiny pin like multiple ulcers with severe pain. They generally stay as chronic, painful ulcers which do not respond to any treatment. It takes around 7-14 days for the ulcer to heal completely in case of major and minor forms of ulcer and even longer up to 30 days in herpetiform ulcers.

They are most commonly seen on tongue and lips, but can occur anywhere in the mouth. Generally the patient becomes aware of the ulcer due to the onset of severe pain, but the onset of the ulcer and its progression is unnoticed. Pain is most debilitating factor in this ulcer. Various causes such as vitamin deficiencies, stress, and micro-trauma have been hypothesized for the etiology of RAS. Several modalities of treatments such as local application of steroids, multivitamin capsules, are being used which give temporary symptomatic relief.

Materials and Methods

Twelve subjects with RAS in the age group of 16-50 years of both genders were included in the study. The study protocol was explained and written informed consent was taken. The subjects were advised not to take any medication during the study period and report on the 1st day of appearance of ulcers. Detailed history pertaining to the ulcers was taken, and clinical examination was done.

LLLT was given with a laser device having the following specifications: 630 nm wavelength and continuous energy with output energy density of 10 mW/cm²/s. Laser device consists of a console and a laser probe. The console shows digital display of laser specifications, energy output duration, and it has a calibration port. The laser probe is connected to the console which emits laser. The matrix laser system continuous wave radiating head (LOK03) has to be calibrated and sterilized before every usage. Calibration of the laser probe is done by connecting it with calibrated port on the device console. Sterilization is done by keeping the probe inside a tight container with formaldehyde tablets for 8 h at room temperature.

The ulcer size was measured on the 1st day of treatment with LLLT. The size was recorded in cm². The laser dose was calculated in terms of duration of the therapy based on the size of the ulcer to achieve an energy density of 10 mW/cm².

Subjects were treated every day until the ulcers healed, and pain subsided. The average duration of the treatment was 10-18 s/day. Pain was subjectively measured every day after the therapy by visual analog scale (VAS). VAS consists of 10 scale pain measurements marked from 1 to 10, with “1” being least pain and “10” being the most severe imaginable unbearable pain.

Results

Total of 12 subjects underwent treatment. The average pain score (VAS) on the 1st, 2nd, 3rd day, and 5th day were 6.9, 6.4, 4.9, and 2.3 respectively. On average, pain subsided by about 5th day for all subjects and ulcer healed by 6th day. Most of the subjects reported same or increased pain on the 2nd day. However, a drastic reduction in pain was noted on the 3rd day. Details are shown in the Table 1.

Of the 12 patients, 7 had a minor form of ulcers, 2 had major form of ulcers and 3 had herpetiform ulcers. The pain was relieved around the 4th day, and healing occurred on the 6th day in minor and herpetiform ulcers. The pain was relieved around the 7th day in and healing occurred around 10th day in major form of ulcer [Graph 1].

Discussion

All Subjects were asked to come on the 1st day of the ulcer onset so as to maintain uniformity in the treatment. The duration was very minimal and was easily acceptable to all patients.

Laser was administered directly (at a distance of ~1 cm) to the ulcer area and thus was more focused on the local wound area.

LLLT is known to cause vasodilatation by releasing NO at the base of the ulcers. This increase in blood supply drains out of the metabolic substances which cause tissue destruction and pain. This causes a reduction in pain. Further, there is increased production of growth factors which promotes healing of the ulcer and tissue repair.

Table 1: Average pain score during the treatment

<table>
<thead>
<tr>
<th>Day</th>
<th>Average pain score (n=12)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>6.9</td>
</tr>
<tr>
<td>2</td>
<td>6.4</td>
</tr>
<tr>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>5</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Graph 1: Average pain score during the treatment
The observation that pain in the ulcers is increased/same on the 2nd day and reduces by 3rd day could suggest that LLLT augments the natural process of healing. During the natural process of healing inflammatory phase is marked by pain due to rise in exudate levels and removal of microorganisms. The pain subsides as the healing progresses into the proliferative phase. Further, comparative and follow-up studies are required to prove efficacy of LLLT on RAS.

Most of the studies suggest stress could be one of the major contributing factors in the development of RAS. There is no well described or definitive role of microorganisms in the pathogenesis of the ulcer. Stress triggers the pathogenetic process toward the development of the ulcer. This is supported by a study done by Lucas et al., which suggests that there is a reversal of pro-inflammatory and anti-inflammatory cytokines on exposure to stressful condition/RAS. Because of this ulcers, continue to increase in size despite removal of stressful events. When LLLT is given, an increase in NO production and activation of enzymes, tend to stabilize the tissues and control the pathological destruction. Further, there is earlier conversion to favorable physiological mechanisms. Thus, LLLT seems to give early relief from pain and accelerate normal wound healing process.

A further study with a larger sample size and more histopathological studies at different stages or duration of ulcer period are needed to establish overall benefits of LLLT in RAS.

References