THE EFFECT OF LOW LEVEL LASER THERAPY ON ACUTE HEADACHE SYNDROMES

Steven Amolis* and John Kues†
*University of Cincinnati Family Medicine Department, 331 Bethesda Avenue, Cincinnati, Ohio 45267, U.S.A.
†Cincinnati Family Medicine, 3462 Madison Road, Loveland, Ohio 45140, U.S.A.

A study on the effect of low level laser therapy on acute headache syndromes was undertaken. Ten patients with acute vascular headache or occipital neuralgia were treated with low power laser over tenderness points in the distribution of the second cervical and trigeminal nerves. Each tenderness point was stimulated for 30–60 s with low level laser therapy. There was a statistically significant decrease in headache when measured at 15 min. Although not statistically significant, low level laser therapy also appears to have a beneficial effect on associated autonomic symptoms.

Key words: Occipital neuralgia Low level laser therapy Vascular headache

Introduction

The effect of low level laser therapy (LLLT) has been scientifically quantified primarily in chronic pain syndromes. The present study was designed as a pilot study to assess the effectiveness of LLLT on acute pain, specifically acute vascular headaches (migraine and cluster), and occipital neuralgia.

Acute vascular headaches and occipital neuralgia often present with tender zones (trigger points) corresponding to the distribution of the second cervical and trigeminal nerves. Management of these headache syndromes is often difficult. An accepted form of therapy used in the treatment of occipital neuralgia is the use of occipital nerve blocks, often used in conjunction with steroids. Some headache and pain centers have incorporated into the above technique additional nerve blocks of certain branches of the trigeminal nerve. This appears to be effective as well in vascular headache and has been used by the University of Cincinnati Headache Center with notable success.

When a suitably selected patient receives a nerve block, the results are almost immediately apparent. Nausea disappears within a few minutes. The patient will often feel a flushing of the upper extremities, probably attributable to a parasympathetic response. Within 10–15 min the patient has 95% relief of his or her headache, photophobia or other concomitant symptoms.

LLLT is painless, non-invasive, has both local and systemic effects and has thus far been essentially free of side-effects. Its effect on neuronal activity in vivo and in vitro has been well-documented.

The Walker studies have also shown prolonged raised levels of 5HIAA (a serotonin metabolite) in patients receiving good analgesia.

Methods

Patients presenting with acute headache to the University of Cincinnati Emergency Department or Family Practice Outpatient Department were chosen for the study, and then screened by the principal investigator.

Inclusion criteria were as follows:

- Generalized headache syndrome compatible with occipital neuralgia or vascular headache.
- Tender areas over the emerging root of C2, the greater or lesser occipital nerves, the supraorbital, zygomaticotemporal, or zygomaticofacial nerves (Figures 1 and 2).
- Associated nausea, photophobia or autonomic symptoms.
- Acute onset of headache with current duration of symptoms being less than 10 h.
- Minimal or no use of drug therapy prior to seeking medical help for the current episode, e.g. not more than 1 dose of over-the-counter medication.

Patients were excluded from the study if they had a history of prolonged use of narcotic analgesics or non-steroidal anti-inflammatory agents. They were also excluded if they had either a psychiatric illness or other severe concomitant systemic illness.
LLLT was administered with a Med 107 laser (Lasotronic AG, P.O. Box CH-6302, Zug, Switzerland). This laser is a < 7 mW; < 18.2 mW/cm², visible red 670 nm pocket laser with a spot size of 1 mm. It was chosen over other low power lasers because of its small size, ease of use and portability. A continuous beam dose was applied for 30-40 s over each tender zone, with care taken to avoid laser exposure to the retina. The spot size was 1 mm in diameter, giving a power density of less than 0.89 W/cm².

Pain, nausea and photophobia were measured pre- and post-treatment using a visual analogue scale rating each symptom from 0-10. Post-treatment measurements were taken at 15 min. If adequate relief was not present at this point, orthodox treatment was administered to the patient. ('Adequate' here refers to the patients' own level of comfort).

Results

The results of the study are tabulated in Table 1. Three men and seven women with headaches were treated: six had occipital neuralgia, two had migraine, and one patient had cluster headache. Their ages ranged between 23 and 40 years. Headache pain, nausea, and photophobia were measured before and after the laser treatment. The small sample size and the ordinal nature of the data necessitated the use of a nonparametric technique for data analysis. The Wilcoxon signed-ranks test for matched-pairs was used to compare the pre- and post-treatment scores for the three measures.

Table 1 shows the pre- and post-treatment scores for headache, nausea, and photophobia for each of the 10 patients in the study. Six patients reported a reduction in headache after treatment, z = 2.20, p < 0.05. No patients reported a post-treatment increase in headache. The mean reduction in headache score was 3.1, S.D. = 3.35.

Five patients reported pre-treatment nausea scores above zero. Three of these patients reported post-treatment nausea scores of zero, z = 1.6, p = n.s. The average reduction for the five patients with pretreatment nausea was 3.8, S.D. = 4.15.

Three patients reported pre-treatment photophobia scores above zero. Two of these patients reported post-treatment photophobia scores of zero, z = 1.34, p = n.s. No patients reported an increase in photophobia.

Comparisons of patients with different types of headache and different gender were not calculated due to the small sample size.

Discussion

There is a statistically significant improvement in headache in patients in this study. Occipital neuralgia appears more amenable to LLLT than does migraine or cluster headache, however we caution against coming to this conclusion due to the small number of this group.

The failure to find statistical significance in reductions of nausea and photophobia is largely due to the make-up of the original sample. While all 10 patients reported headache scores in the pre-treatment measurement, only five patients reported nausea and three patients reported photophobia in the pre-treatment measure. Since the statistical calculations were performed on all 10 patients, regardless of their pre-treatment score, it was not possible to show improvement when so few patients identified themselves as having the symptom pre-treatment. However, it is difficult to ignore the fact that three of the five patients who initially reported nausea had a reduction of their nausea score in the post-treatment measure. Likewise, two of three patients who reported photophobia in the pre-treatment measure reported no photophobia in the post-treatment measure.

It is tempting here to postulate that much of the researched symptom complex is related to cervical nerve irritation. The second cervical nerve root appears to be more vulnerable than other cervical nerves to irritation. Irritation will classically present.

Table 1.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Type of headache</th>
<th>Pre-treatment score</th>
<th>Post-treatment score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Headache</td>
<td>Nausea</td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td>F</td>
<td>Occipital neur.</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>M</td>
<td>Occipital neur.</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>M</td>
<td>Cluster</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>28</td>
<td>F</td>
<td>Occipital neur.</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>31</td>
<td>M</td>
<td>Migraine</td>
<td>8</td>
<td>5</td>
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<tr>
<td>6</td>
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<td>F</td>
<td>Occipital neur.</td>
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<tr>
<td>7</td>
<td>29</td>
<td>F</td>
<td>Occipital neur.</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>34</td>
<td>F</td>
<td>Occipital neur.</td>
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<td>0</td>
</tr>
<tr>
<td>9</td>
<td>32</td>
<td>F</td>
<td>Migraine</td>
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<td>0</td>
</tr>
<tr>
<td>10</td>
<td>35</td>
<td>F</td>
<td>Occipital neur.</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>
with signs of occipital neuralgia. However this syndrome may also masquerade as migraine or cluster headache. Gayral and Neuwirth explained in detail the pathogenic mechanisms of the oto-neuro-ophthalmologic signs and symptoms of involvement of the posterior cervical sympathetic system. The spinal tract and the nucleus of the trigeminal nerve descends and become continuous with the substantia gelatinosa in the upper part of the cervical cord. There is both physiologic and anatomic communication between C2 and the trigeminal nerve at this point. The autonomic symptoms experienced during headache may also have an anatomic basis. The cervical plexus communicates with the vagus nerve and the superior sympathetic ganglion has direct communication with the first four cervical roots.

The pathophysiology of migraine is still subject to extensive research. Dallesso in his article aptly describes accompanying neuronal, vascular and chemical (serotonergic and other) changes that occur during migraine.

It is our feeling that in many headache syndromes there is a degree of overlap in the above-mentioned anatomic versus biochemical hypotheses. However, only some patients with true classical migraine headache will have tender trigger points in the C2 or trigeminal nerve distribution. Injections into these points will usually relieve the headache. This may explain the varying degree of success in this study and in previous studies using occipital nerve blocks. Research in this area is currently ongoing at the University of Cincinnati Headache Center.

It is also of interest to note that these trigger points correspond to acupuncture points: Gall bladder 7, 14, 19, 20, Bladder 9, 10 and Stomach 2 and 7. These points are often used by acupuncturists to treat headaches.

Although only a pilot study, the statistical difference in the level of headache following L.I.L.T suggests that a large study is warranted. A double blind placebo (e.g., laser look-alike) controlled study, possibly with a larger e.g., 15 mW low power laser would appear to be a logical next step. It would also be interesting to do a comparison study using lidocaine (± steroid) injections.

Acknowledgements

With grateful appreciation to the University of Cincinnati Departments of Emergency Medicine and Family Medicine for the use of their facilities. Sincerest thanks to Judith Walker, M.D. for her help and support with this project, and to Felix Kramer, Lasotronic Ag, Switzerland for his loan of the low power laser.

References