

Treatment of Burning Mouth Syndrome with a Low-Level Energy Diode Laser

Hui-Wen Yang, D.D.S., M.D.S., Ph.D.^{1,2} and Yu-Feng Huang, D.D.S., M.S.D., Ph.D.^{1,2}

Abstract

Objective: To test the therapeutic efficacy of low-level energy diode laser on burning mouth syndrome. **Background:** Burning mouth syndrome is characterized by burning and painful sensations in the mouth, especially the tongue, in the absence of significant mucosal abnormalities. Although burning mouth syndrome is relatively common, little is known regarding its etiology and pathophysiology. As a result, no treatment is effective in all patients. Low-level energy diode laser therapy has been used in a variety of chronic and acute pain conditions, including neck, back and myofascial pain, degenerative osteoarthritis, and headache. **Methods:** A total of 17 patients who had been diagnosed with burning mouth syndrome were treated with an 800-nm wavelength diode laser. A straight handpiece was used with an end of 1-cm diameter with the fiber end standing 4 cm away from the end of handpiece. When the laser was applied, the handpiece directly contacted or was immediately above the symptomatic lingual surface. The output used was 3 W, 50 msec intermittent pulsing, and a frequency of 10 Hz, which was equivalent to an average power of 1.5 W/cm^2 ($3 \text{ W} \times 0.05 \text{ msec} \times 10 \text{ Hz} = 1.5 \text{ W/cm}^2$). Depending on the involved area, laser was applied to a 1-cm^2 area for 70 sec until all involved area was covered. Overall pain and discomfort were analyzed with a 10-cm visual analogue scale. **Results:** All patients received diode laser therapy between one and seven times. The average pain score before the treatment was 6.7 (ranging from 2.9 to 9.8). The results showed an average reduction in pain of 47.6% (ranging from 9.3% to 91.8%). The burning sensation remained unchanged for up to 12 months. **Conclusion:** Low-level energy diode laser may be an effective treatment for burning mouth syndrome.

Introduction

BURNING MOUTH SYNDROME IS CHARACTERIZED by burning and painful sensations of the mouth, especially of the tongue, in the absence of significant mucosal abnormalities. It is a relatively common intraoral disorder affecting women seven times more frequently than men.¹ The prevalence of burning mouth syndrome in the general population ranges from 2.5% to 5.1%,^{2–4}

Although burning mouth syndrome is relatively common, it is also often misunderstood by clinicians, in part because of confusing terminology. The literature is replete with synonyms to describe this phenomenon such as “stomatodynia,” “stomatopyrosis,” and “oral dysesthesia.” “Glossodynia” and “denture sore mouth” connote burning sensation limited to the tongue and denture-bearing areas, respectively.

Low-level laser therapy has been used in a variety of chronic and acute pain conditions, including neck, back and myofascial pain,^{5–8} degenerative osteoarthritis,^{9–12} and

headache.¹³ Here we describe an approach for using low-level laser therapy for burning mouth syndrome.

Study Design

Patients with a diagnosis of burning mouth syndrome¹⁴ were recruited at the Oral Medicine Clinic at the Oral Medicine Center, Chung Shan Medical University Hospital, Taichung City, Taiwan, between October 2008 and October 2009 under the approved Institutional Review Board protocol. All patients complained of burning, stinging, pain, and a “salty taste” on the tongue without any mucosal abnormality. They were otherwise healthy and not taking any medications for systemic diseases. None of participants was a current or previous smoker.

Low-level energy diode laser, K-Laser with a wavelength of 800 nm (Eltech srl), was applied directly to the symptomatic areas. A straight handpiece was used with an end of 1 cm diameter and the laser fiber 4 cm away from the end of the handpiece (Fig. 1). When the laser was applied, the

¹Oral Medicine Center, ²College of Oral Medicine, Chung Shan Medical University Hospital, Taichung City, Taiwan.



FIG. 1. Diode laser machine with a straight handpiece.

handpiece was in direct contact or immediately above the painful tongue surface (Fig. 2). The output used was 3 W with 50 msec intermittent pulsing and a frequency of 10 Hz, which is equivalent to 1.5 W/cm^2 ($3 \text{ W} \times 0.05 \text{ msec} \times 10 \text{ Hz} = 1.5 \text{ W/cm}^2$). Depending on the involved area, laser was applied for 70 sec to a 1-cm^2 area until the entire involved area was covered; i.e., an energy density of 105 J/cm^2 was applied ($1.5 \text{ W/cm}^2 \times 70 \text{ sec} = 105 \text{ J/cm}^2$). Patients received the laser treatment once a week. Overall pain and burning discomfort, before and after treatment, was assessed by a 10-cm visual analogue scale (VAS). Each patient was required to score his or her burning discomfort with a VAS at the end of each visit. The therapeutic course was ended when patients felt they no longer required the treatment, and the VAS of the final visit was used for analysis. After termination of the laser therapy, all patients were instructed to return for follow-up once every month to once every 3 months.

Results

Seventeen patients with a diagnosis of burning mouth syndrome were recruited, 4 men and 13 women. The mean age was 50.6 y, ranging from 31 to 75 y. The average treatment course was 2.6 visits (range, 1–7 visits).

Average pain score before treatment was 6.7, more towards the right end of the VAS (range, 2.9–9.8). The average pain score after laser treatment fell to 3.5, shifting towards the left end of the VAS (range, 0.6–7.8). When analyzing the percent reduction in the pain score for each patient, the average percent pain reduction after treatment was 47.6%



FIG. 2. Laser handpiece in direct contact or immediately above the involved area for treatment.

(ranging from 9.3% to 91.8% reduction), with pain intensity being halved after treatment. Although still present, the pain after treatment was much lower and more acceptable to the patients. No discomfort or side effects were reported during or after laser treatments. All patients were followed up once a month to once every 3 months for up to 12 months, and none of them reported change on the pain and/or burning level after termination of laser therapy.

Discussion

For the patient in whom no clear causative factor for pain emerges during evaluation and in whom empiric measures have failed, potential therapies include those used in the treatment of other poorly understood chronic pain conditions. Amitryptiline (75–150 mg daily) and doxepin (75–150 mg daily) are the most commonly prescribed antidepressants. Although these medications have yielded slight to marked improvement in about 20% of patients, therapeutic efficacy can be limited by the drug-associated xerostomia.¹⁵ Koblenzer and Bostrom¹⁶ reported the efficacy of pimozone alone or in combination with either fluoxetine or a tricyclic antidepressant in three patients with burning mouth syndrome. The newer serotonin uptake inhibitors typically cause less xerostomia and therefore may be more beneficial than tricyclics in patients with burning mouth syndrome. The benzodiazepine chlordiazepoxide led to complete remission in 15% and some relief in 52% of treated patients.¹⁵ Topical capsaicin provided complete remission in one patient and moderate benefit in another with burning mouth syndrome.¹⁷ Concurrent use of topical local anesthetics may be helpful in improving tolerance to the burning that may occur with initial application.¹⁸ Recently, lingual nerve block was tested on burning mouth syndrome without success.¹⁹

Infrared laser therapy for five consecutive days improved symptoms in patients with burning mouth syndrome.²⁰ Low-level energy diode laser showed several effects that can be helpful in reducing the burning sensation. The laser shows a significant analgesic effect, mainly by increasing the secretion of endorphin,²¹ blocking the depolarization of c-fiber,^{22,23} increasing action potential,^{23,24} and decreasing the production of bradykinin.²³ In addition, diode laser may

reduce inflammation by increasing production of PG-I₂²⁵ and PG-E₂,²⁶ increasing blood vessel formation.²⁷ Although no "sham-treatment" group was included as a control, at least half of the patients recruited in this study were tested without laser emission before actual laser treatment. No patients reported change in the pain intensity. As a result, we only treated the patients with laser irradiation in order to solve patients' discomfort and improve their quality of life.

In summary, we demonstrated the effectiveness of low-level energy diode laser treatment on treating burning mouth syndrome patients with satisfactory results. Further studies, including long-term follow-up and a larger number of patients, will be conducted to confirm the therapeutic mechanisms of the diode laser.

Author Disclosure Statement

No competing financial interests exist.

References

- Lamey, P.J., and Lewis, M.A. (1989). Oral medicine in practice: burning mouth syndrome. *Br. Dent. J.* 167, 197–200.
- Locker, D., and Grushka, M. (1987). Prevalence of oral and facial pain and discomfort: preliminary results of a mail survey. *Comm. Dent. Oral Epidemiol.* 15, 169–172.
- Basker, R., Sturdee, D., and Davenport, J. (1978). Patients with burning mouths. A clinical investigation of causative factors, including the climacteric and diabetes. *Br. Dent. J.* 145, 9–16.
- Zakrzewska, J.M., Forssell, H., and Glenney, A. (2005). Interventions for the treatment of burning mouth syndrome. *Cochrane Database Syst. Rev.* Jan 25, CD002779.
- Hakguder, A., Birtane, M., Gurcan, S., Kokino, S., and Turan, F. (2003). Efficacy of low level laser therapy in myofascial pain syndrome: an algometric and thermographic evaluation. *Lasers Med. Sci.* 33, 339–343.
- Gur, A., Karakoc, M., Cevik, R., Nas, K., Sarac, A., and Karakoc, M. (2003). Efficacy of low power laser therapy and exercise on pain and functions in chronic low back pain. *Lasers Med. Sci.* 32, 233–238.
- Gur, A., Sarac, A., Cevik, R., Altindag, O., and Sarac, S. (2004). Efficacy of 904 nm gallium arsenide low level laser therapy in the management of chronic myofascial pain in the neck: a double-blind and randomize-controlled trial. *Lasers Med. Sci.* 35, 229–235.
- Simunovic, Z. (1996). Low level laser therapy with trigger points technique: a clinical study on 243 patients. *J. Clin. Laser Med. Surg.* 14, 163–167.
- Cho, H., Lim, S., Kim, S., et al. (2004). Effect of low-level laser therapy on osteoarthritis in rabbit. *In Vivo* 18, 585–591.
- Fulga, C., Fulga, I., and Predescu, M. (1994). Clinical study of the effect of laser therapy in rheumatic degenerative diseases. *Rom. J. Intern. Med.* 32, 227–233.
- Kucharska, E., and Batko, B. (1997). Biostimulating laser therapy as one method of treating bone and joint diseases. *Przegl. Lek.* 54, 112–114.
- Gur, A., Cosut, A., Sarac, A., Cevik, R., Nas, K., and Uyar, A. (2003). Efficacy of different therapy regimes of low-power laser in painful osteoarthritis of the knee: a double-blind and randomized-controlled trial. *Lasers Med. Sci.* 33, 330–338.
- Ebneshahidi, N., Heshmatipour, M., Moghaddami, A., and Eghtesadi-Araghi, P. (2005). The effects of laser acupuncture on chronic tension headache—a randomized controlled trial. *Acupunct. Med.* 23, 13–18.
- Grushka, M., Epstein, J.B., and Gorsky, M. (2002). Burning mouth syndrome. *Am. Fam. Physician* 65, 615–620.
- Gorsky, M., Silverman, S.J., and Chinn, H. (1991). Clinical characteristics and management outcome in the burning mouth syndrome. An open study of 130 patients. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endodontic* 72, 192–195.
- Koblenzer, C.S. and Bostrom, P. (1994). Chronic cutaneous dysesthesia syndrome: a psychotic phenomenon or a depressive symptom? *J. Am. Acad. Dermatol.* 30, 370–374.
- Epstein, J.B., and Marcoe, J.H. (1994). Topical application of capsaicin for treatment of oral neuropathic pain and trigeminal neuralgia. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endodontic* 77, 135–140.
- Formaker, B.K., Mott, A.E., and Frank, M.E. (1998). The effects of topical anesthesia on oral burning in burning mouth syndrome. *Ann. N. Y. Acad. Sci.* 855, 776–780.
- Greteau-Richard, C., Dubray, C., Aublet-Cuvelier, B., Ughetto, S., and Woda, A. (2010). Effect of lingual nerve block on burning mouth syndrome (stomatodynia): a randomized crossover trial. *Pain [Epub Jan 16]*.
- Cekic-Arambasin, A., Durdevic-Matic, A., Mravak-Stipetic, M., and Bilic, A. (1990). Use of soft laser in the treatment of oral symptoms. *Acta Stomatologica Croatica* 24, 281–288.
- Zarković, N., Manev, H., Perić, D., et al. (1989). Effect of semiconductor GaAs laser irradiation on pain perception in mice. *Lasers Surg. Med.* 9, 63–66.
- Wakabayashi, H., Hamba, M., Matsumoto, K., and Tachibana, H. (1993). Effect of irradiation by semiconductor laser on responses evoked in trigeminal caudal neurons by tooth pulp stimulation. *Lasers Surg. Med.* 13, 605–610.
- Jimbo, K., Noda, K., Suzuki, K., and Yoda, K. (1998). Suppressive effects of low-power laser irradiation on bradykinin evoked action potentials in cultured murine dorsal root ganglion cells. *Neurosci. Lett.* 240, 93–96.
- Tsuchiya, K., Kawatani, M., Takeshige, C., Sato, T., and Matsumoto, I. (1993). Diode laser irradiation selectively diminishes slow component of axonal volleys to dorsal roots from the saphenous nerve in the rat. *Neurosci. Lett.* 161, 65–68.
- Tam, G. (1999). Low power laser therapy and analgesic action. *J. Clin. Laser Med. Surg.* 17, 29–33.
- Shimizu, N., Yamaguchi, M., Goseki, T., et al. (1995). Inhibition of prostaglandin E2 and interleukin 1-beta production by low-power laser irradiation in stretched human periodontal ligament cells. *J. Dent. Res.* 74, 1382–1388.
- Bossini, P., Fangel, R., Habenschus, R., et al. (2009). Low-level laser therapy (670 nm) on viability of random skin flap in rats. *Lasers Med. Sci.* 24, 209–213.

Address correspondence to:
Yu-Feng Huang, D.D.S., M.S.D., Ph.D.
College of Oral Medicine
Chung Shan Medical University
110 Jiang-Guo N. Road, Section 1
Taichung City
Taiwan
E-mail: whuang@csmu.edu.tw

