



Multi Wavelength Low Level Lasers Transmeatal Irradiation (MWLLTI) for Motion Sickness

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Abstract

This was a case report which described the background, method, and test results of the effect of 3 wavelength lasers transmeatal irradiation treatment on motion sickness, using combined lasers with an output of 2.5 mW @ 532 nm + 10.0 mW @ 808 nm + 2.0 mW @ 1064 nm for transmeatal irradiation treatment. 10 patients aged 50 ± 25 were treated with MWLLTI at a dose of 104 Joule in total for both ears per day for 15 consecutive days. It was found that MWLLTI stimulation was effective in motion sickness treatment.

Subject Area

Otorhinolaryngology

Keywords

Low Level Laser Therapy, Multi Wavelength Low Level Laser Transmeatal Irradiation, Motion Sickness

1. Introduction

Motion sickness is a syndrome that happens when someone is subjected to certain kinds of motion [1]. Persons who response to a motion stimulus severely during travel may suffer from motion sickness. According to an investigation conducted via questionnaire survey about the motion sickness in China [2], motion sickness takes a high portion even in the young passenger populations; it is estimated about over 10%. The syndrome symptoms range from uncomfortable feelings to completely incapacitating illness. Usually, these symptoms will occur within several minutes when experiencing motion and can sustain for several hours after their cessation.

The pathogenesis of motion sickness is not clearly understood, but it is thought that the vestibular end-organs, the semicircular canals and otolith organs play an important role in causing motion sickness [3].

Over-the-counter medications such as cinnarizine/stugeron and prescription medications such as dramamine dimenhydrinate, scopolamine bonine/antivert and promethazine are readily available. Cinnarizine is not available in the United States, as it is not approved by the FDA [4]. All these medications often have side effects; however, over 75% patients do not know the toxic and side effects about the medicines they take.

Low level laser therapy (LLLT) is a laser source treatment that uses light of a monochromatic wavelength to promote tissue regeneration, to reduce inflammation, and to relieve pain. Unlike many other medical laser procedures, such as operative lasers, LLLT emits no heat, sound, or vibration. Instead of producing a thermal effect, it is thought that LLLT works by stimulating photochemical reactions in cells. Although the exact mechanism of biological action is unknown, several theories have been proposed and include increased mitochondrial ATP production, enhanced cellular proliferation, increased cellular oxygenation, increased serotonin and endorphin production, stimulation of angiogenesis, and suppression of inflammatory cytokines [5].

In recent years, the use of LLLT has extended beyond the realms of pain and wound healing, and recent research supports its potential benefits in retinal disease, stroke, neurodegeneration, neuromuscular disorders, and memory and mood disorders. LLLT can exert effective, reproducible, and meaningful changes in the normal and dysfunctional nervous tissue. This may highlight the value of LLLT as a novel and useful paradigm to treat visual, neurological, and psychological conditions, and support that neuronal energy metabolism could constitute a major target for neurotherapeutics of the eye and brain [6].

LLLT irradiation refers to the use of red-beam or near-infrared lasers with a wavelength of 600 - 1100 nm and an output power of 1 - 500 mW [7]. However, not only oxyhemoglobin and deoxyhemoglobin have a strong absorption in green region on the wavelength axis, but also cytochrome C oxidase has the same behavior [8]. From the first law of photochemistry, the Grotthuss-Draper law states that light must be absorbed by a compound in order for a photochemical reaction to take place. Thus, this case report proposed to use combined tri-lasers, especially 532 nm, 808 nm as well as 1064 nm lasers, to treat the motion sickness conditions. LLLT is safe and has been used to treat both tinnitus [9] and allergic rhinitis [10].

2. Case Report

For a rapid identification of effectiveness of LLLT for a motion sickness, an initial trial of a small sampling test was done. Although no ethics committee was organized, informed consent was obtained from each participant (volunteers) prior to the start of the treatment. The volunteers are listed in **Table 1**.

Patients. 10 patients aged 50 ± 25 among them 2 males, and 8 females. Motion sickness past history is over 8 years at least. The oldest female patient aged 75 suffered the disease (bus sickness) over 60 years. All the patients are treated with MWLLTI.

Laser irradiation. The transmeatal laser medical device (manufactured by YouRay Hestia Co. Ltd.) is employed to do the irradiation treatment. The wavelength of the tri-wavelength lasers are 532 nm, 808 nm, and 1064 nm respectively. The correspondent average output power is 2.5 mW @ 532 nm, 10.0 mW @ 808 nm, and 2.0 mW @ 1064 nm. The lasers are formed by using a semiconductor laser diode 808 nm to pump a laser crystal Nd:YVO₄ to produce a 1064 nm laser output then a nonlinear crystal KTP is utilized to double the 1064 nm laser to have a second harmonic generation 532 nm laser output. All the lasers are packaged in earplug, and are combined into one light beam and then expanded to a circular spot with a diameter of 6 mm at a distance of 8 mm via an objective lens. In this way, it is very simple and convenient to do the MWLLTI. **Figure 1** shows the setup of MWLLTI at 532 nm, 808 nm, and 1064 nm. All the lasers are working in pulsed mode at a frequency of 300 Hz, with duration of 20%.

Table 1. Volunteers list.

Number	Age	Gender	Remark
1	75	Female	YouRay Hestia Co. Ltd. Staff's Relative
2	72	Female	YouRay Hestia Co. Ltd. Staff's Relative
3	73	Male	YouRay Hestia Co. Ltd. Staff's Relative
4	41	Female	YouRay Hestia Co. Ltd. Staff's Relative
5	25	Female	YouRay Hestia Co. Ltd. Staff
6	69	Male	YouRay Hestia Co. Ltd. Staff's friend
7	49	Female	YouRay Hestia Co. Ltd. Staff's friend
8	40	Female	YouRay Hestia Co. Ltd. Staff's friend
9	38	Female	YouRay Hestia Co. Ltd. Staff's friend
10	32	Female	YouRay Hestia Co. Ltd. Staff's friend



Figure 1. MWLLTI treatment.

When targeting the cochlea with laser light, it is essential to make sure that a sufficient amount of light reaches the target. Indeed, LLLT includes secondary effects through systemic mechanisms, but the energy at target is decisive for the biological effect [11]. A dose of 60 min (2 earplugs) per day gives energy of 18 J of 532 nm irradiation, 72 J of 808 nm irradiation, and 14 J of 1064 nm irradiation to the cochlea and the blood. A course of treatment takes 15 consecutive days and 60 min per day. Therapeutic evaluation protocols were set as immediately after the 15 days treatment, all the patients were tested by a bus ride.

It was found that MWLLTI stimulation was safe and effective in motion sickness treatment. All of the volunteers were recovered. This effect remained for 2 weeks after the end of the treatment.

3. Discussion

According to our knowledge, this is the first report about using MWLLTI to treat motion sickness successfully. The mechanism remains unclear. More samples may be needed to be treated to verify the further effectiveness. Multi wavelength low level lasers transmeatal irradiation is more beneficial as a new method for management of motion sickness.

Conflicts of Interests

No competing financial conflicts exist.

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