



Effect of delayed photobiomodulation therapy on neurosensory recovery in patients with mandibular nerve neurotmesis following traumatic mandibular fracture: A randomized triple-blinded clinical trial

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Highlights

- Photobiomodulation is an effective treatment for nerve neurotmesis following a traumatic mandibular fracture.
- It improves light, and sharp touch sensations, and two-point discrimination tests.
- Photobiomodulation can be used even for late neurosensory impairment.

Abstract

Introduction

There is a possibility of neurotmesis of the inferior alveolar nerve (IAN) in mandibular fractures, which leads to neurosensory impairment. In this study, we aimed to investigate the efficacy of photobiomodulation therapy (PBMT) in patients with neurotmesis following trauma and mandibular fracture.

Materials and Methods

This triple-blind randomized trial was carried out on patients who suffered neurotmesis of the IAN following mandibular angle and body fracture at least for 6 months. In the intervention group, laser irradiation was applied with a low-level GaAlAs diode laser (continuous wave of 810 nm wavelength, power of 200 mW, and energy density of 12–14 J/cm²). In the control group, the laser probe was turned off and placed on the affected area. LLLT was done for 12 sessions (2 times/week for 6 weeks). Light touch sensations, two-point discrimination, thermal discrimination (cold and warm stimulus), electric pulp test (EPT), and oral health impact profile (OHIP)-14 questionnaire were performed before the intervention, immediately after each PBMT session, and after 3, 6, 9 and 12 months.

Results

In both groups, 3 and 23 patients were female and male, respectively. The results showed significantly improved light (cotton swab), light (wooden cotton swab), and sharp (dental needle) touch sensations, and two-point discrimination test in the PBMT group after the 10th, 11th, 10th, and 10th session, respectively. Two-way repeated measure ANOVA revealed that the trend of light touch sensation with cotton swab and two-point discrimination test was statistically significant (p -value = 0.002 and 0.001, respectively). The results of OHIP-14 test showed a significantly higher mean in the PBMT group 3 months after PBMT. There was no statistically significant difference in EPT and thermal discrimination tests regarding the patients' group.

Conclusion

PBMT could be an effective treatment for late post-traumatic nerve neurotmesis following a traumatic mandibular fracture.

Introduction

Mandibular fracture is one of the most common maxillofacial fractures following trauma, occurring in 62 to 83% of maxillofacial fractures [1,2]. They contain orbital, zygomaticomaxillary complex, nasal complex, Le Fort, and mandible fractures [3]. These fractures can lead to deformity and asymmetry in the face, pain, swelling, malocclusion, and neurosensory disturbance of the lower lip and chin [4]. Neurosensory disturbance

may present as paraesthesia or dysesthesia in this area [5].

In mandibular fractures with high displacement, there is a possibility of neurotmesis (complete transection) of the inferior alveolar nerve (IAN), which leads to neurosensory impairment and long-term or permanent anesthesia of the lower lip, chin, and lower incisors [6]. Several surgical and non-surgical treatments have been introduced to accelerate the recovery of neurosensory disturbance. Non-surgical treatments include prescription of corticosteroids and vitamin B12; also, surgical treatments include nerve microsurgery and grafting [7].

It is generally believed that micro-neurosurgery is indicated for the treatment of complete nerve trunk discontinuity. This method requires an expert surgeon and advanced equipment and is a costly treatment that is not available to all patients and their definite effect has not been proven.

Recently, numerous studies have examined the usefulness of photobiomodulation therapy (PBMT) on improving the neurosensory state of the lingual nerves, infraorbital nerve, and IAN [[8], [9], [10]]. PBMT has been reported to be effective in improving neurosensory function in surgical injuries, and after sagittal split osteotomy of the mandible [10]. Because PBMT is a non-invasive procedure, its ability to restore nerve function without surgical intervention is an advantage. PBMT can stabilize the membrane of the neurons and decrease pain transmission by decreasing the production of inflammatory mediators in the arachidonic acid pathway, the peripheral release of opioids, release of local b-endorphin, and synthesis of more adenosine triphosphate [11].

Chronic nerve injury occurs when there is no spontaneous nerve recovery with medical or surgical intervention. In this phase, the acute inflammatory mediators and tissue remodeling are passed. Our question was whether it is possible that PBMT affects the late neurosensory disturbance. It is worth mentioning that so far, no study has been done to specifically investigate the effect of PBMT on improving late neurosensory impairment following neurotmesis. These patients suffer from the most severe type of nerve damage.

In this study, we aimed to investigate the effect of late PBMT to accelerate neurosensory recovery in patients with complete nerve transection 6 months after trauma and mandibular fracture.

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Trial design

This triple-blind, randomized trial was carried out on patients who suffered neurotmesis (complete nerve trunk discontinuity) of the inferior alveolar nerve following mandibular angle and body fracture. Open reduction and internal fixation were performed according to AO (Association of Osteosynthesis) Principles of internal fixation [12]. Neurosensory impairment persists at least 6 months after open reduction and internal fixation (ORIF). Patients were referred to Shariati Hospital, affiliated...

Results

At first, 91 patients were eligible. Thirty-one participants had a systemic or neuromuscular disease or refused to participate, so they were excluded. The remaining 60 patients were randomly assigned to two groups. After completion of the study, 26 patients were analyzed in each group (Fig. 2).

The mean ($\pm$ SD) age was 36.23 ± 11.51 in the control and 35.69 ± 13.44 in the PBMT group (p -value = 0.877). In both groups, 3 patients were female (11.5%) and the rest were male (23, 88.5%)...

Discussion

In this study, we investigated the effect of PBMT to accelerate neurosensory recovery in patients with complete nerve transection following trauma and mandibular fracture. The results of both Mann–Whitney U test and two-way repeated measure ANOVA showed PBMT had a statistically significant beneficial effect on the recovery of light touch

sensations with a cotton swab and two-point discrimination test after the 10th session. OHIP-14 test was significantly better in the PBMT group 3 months after...

Conclusion

PBMT might be beneficial in nerve healing and improvement of light touch sensations with a cotton swab, two-point discrimination, and OHIP-14 test in patients with nerve neurotmesis following a traumatic mandibular fracture. PBMT could be an effective treatment for late post-traumatic neurosensory injuries....

Author Statement

Behzad Salari: Visualization, Validation, Investigation, Funding acquisition, Project administration, Resources, Supervision, Methodology, Writing - review & editing.

Nariman Nikparto: Visualization, Investigation, Data curation, Writing - review & editing.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest....

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