LETTER

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Letter

Treatment of facial nerve palsies with laser and endermotherapy: a report of two cases

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Abstract
Facial nerve palsy involves paralysis of unknown origin caused by trauma, infectious disease or metabolic disorders. The aim of this study was to employ low-level laser therapy (LLLT) in the recovery of two patients with facial nerve palsies due to trauma and Bell’s palsy (BP), respectively. LLLT was used with a gallium aluminum arsenide laser (780 nm) in the first case and in the second case LLLT (660 nm and 808 nm) was used synergistically with a vacuum therapy device. No medication was administered during laser treatment and vacuum therapy. The treatments resulted in complete recovery and normal facial expression in both patients including improved facial movement and facial symmetry at rest. With this result in mind, we believe LLLT and combined vacuum therapy may be an alternative treatment to decrease the recovery time of facial expression in normal patients with facial nerve palsies and BP.

Keywords: low-level laser therapy, vacuum therapy, facial nerve palsies

(Some figures may appear in color only in the online journal)

1. Introduction
Facial nerve injuries may occur after fracture of the temporal bone, which can cause trauma to the peripheral facial nerve. The diagnosis of this type of fracture can be made with computed tomography. Lesions associated with this trauma can lead to rupture of the ossicular chain, or hematomympanum, with leakage of cerebrospinal fluid in patients with ototinoliquorrhea and even causing changes in the temporomandibular joint. The diagnosis of facial nerve palsies is complex, especially because it requires the exclusion of all other possible causes, including neurological diseases. However, this diagnosis is important for proper treatment to be indicated for effective results.

Currently, facial nerve injury diagnosed as idiopathic peripheral facial palsy or Bell’s palsy (BP) has the characteristic of presenting total involvement of the affected hemiface, differing from central facial paralysis, which affects only the lower portion of the face. In BP, the eyelid and eye are affected, preventing eyelid obliteration and lubrication of the eye, and leading to dryness of the eyeball. BP is a fairly common type that occurs predominantly in adults and affects the facial nerve (VII cranial nerve) [1]. The motor branch of the facial nerve controls the facial muscles, facial mimicry, release of tears and saliva. This nerve also controls taste perception in the anterior two-thirds of the tongue through the sensory branch.

BP is an acute peripheral paralysis of the facial nerve with sudden onset and of unknown origin. Primary infection or reactivation of the herpes simplex virus (HSV) is suggested as a possible cause of BP in some but not all patients. Studies in patients who developed BP had urine collected which showed the presence of the human HSV virus (HSV 1 and 2).
BP is diagnosed through the exclusion of all other causes; in particular, other neurological diseases need to be excluded, as well as schwannomas. Steroid use is the most indicated therapy to date, and recovery rates are close to 90%. In addition, patients with BP may benefit from additional antiviral drugs [2].

Physiotherapy modalities are used to treat BP, which include electrotherapy, massage, facial exercises, electrical stimulation and thermal shock. Facial exercises may help to improve facial function and may shorten the recovery time of BP, although evidence for this is low [3]. Electrotherapy can also be used to treat BP to increase muscle and nerve function, while thermal methods and massage aim to reduce edema, increase blood flow and increase oxygenation of affected tissues [4]. However, all these physiotherapy methods related to BP have questionable efficacy [5].

A study by Anders et al., in 1993, has shown that low-level laser therapy (LLLT) at well-defined parameters increased the rate of rat facial nerve regeneration following crush injury [6]. A clinical study conducted in Japan by Yamada et al in 1995 suggested that LLLT would be an appropriate alternative treatment for peripheral facial paralysis patients not responding to corticosteroids. In addition, the same study indicated that LLLT would be an ideal adjunctive treatment for patients with peripheral facial paralysis not manageable by corticosteroid therapy [7]. Recent studies have shown that LLLT has significantly benefited the recovery of patients with BP [5, 8]. LLLT has been shown to be an accelerator of neural regeneration and has been reported as a valuable clinical work tool in the treatment of a variety of neural diseases, such as trigeminal neuralgia, paraesthesia, dental hypersensitivity and postherpetic pain [9].

LLLT of peripheral facial nerve palsies can also be performed with a device that combines low-level laser and vacuum therapy. Vacuum therapy, also known as endermotherapy, is a non-invasive mechanical therapy consisting of sucking the skin and subcutaneous tissue through negative pressure to increase local blood flow and stimulation of lymphatic drainage [10]. As a result, vacuum therapy increases the blood circulation and oxygenation of connective tissue and is used for esthetic treatments such as those for cellulite [10] and redistribution of the subcutaneous adipose tissue [10]. Then, vacuum therapy may treat BP by restoring facial movements with the activation of suction circulation through suction cups, which improves the circulatory system, promotes the anti-inflammatory effect, increases muscle tone and stimulates nerve regeneration.

In this study, we present clinical cases of patients with facial nerve palsies who were treated with LLLT and endermotherapy presenting positive clinical results to obtain functional neuromuscular restoration of their face.

2. Materials and methods

All the experiments were conducted upon approval of the ethics committee for studies in human beings of Irmandade da Santa Casa de Misericordia de São Carlos, decision number 3.244.307. Informed consent was obtained from all the participants of this study according to the guidelines of the local clinical research ethics committee. Both clinical cases involved facial nerve palsies, where the patient of clinical case 1 had an idiopathic injury (BP) and the patient of clinical case 2 had post-traumatic injury.

2.1. Clinical case 1

The clinical case report below was a 50-year-old Caucasian male, presenting with right facial paralysis (BP) after a hypertensive peak event, who was treated with LLLT. The total treatment lasted 2 months with the application of LLLT with infrared wavelength (780 nm), device with power around 70 mW for 60 s, dose of 105 J cm², 4.2 J of total energy per point and the diameter of the laser application tip measuring 0.04 cm² (table 1). There were two sessions per week. The application points on the face can be seen in figure 1. We can also see the symmetry restoration and facial expression before and after treatment in figure 2.

2.2. Clinical case 2

The following case report involves laser treatment combined with endermotherapy on a 29-year-old Caucasian male patient presenting with a major complaint of right-sided facial paralysis due to trauma after falling, with a medical diagnosis of facial nerve and cochlear vestibular nerve injury. The patient also reported unilateral deafness. The treatment was performed with the Vacumlaser appliance (MMOptics, São Carlos, SP, Brazil) seen in figure 3(a). Total treatment time lasted 3 months. Applications were performed with a medium (60 mm) and small (40 mm) size suction cup combined with irradiation of two low-power laser outputs with wavelength...
Table 1. Dosimetry parameters used for treatments.

<table>
<thead>
<tr>
<th>Device</th>
<th>Power</th>
<th>Wavelength</th>
<th>Time</th>
<th>Application</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twin laser (MMoptics)</td>
<td>70 mW</td>
<td>780 nm</td>
<td>60 seg/point</td>
<td>In touch</td>
<td>4.2 J per point</td>
</tr>
<tr>
<td>Vacumlaser (MMoptics)</td>
<td>600 mW divided into six laser spots around the active tip</td>
<td>660 nm (3ª) e 808 nm (3ª)</td>
<td>3 min per region</td>
<td>In touch</td>
<td>≤108 Jª per region</td>
</tr>
</tbody>
</table>

ª(3) active tip—infrared or red.
ª ≤108 J discounting lost energy according to the spot distance from the tissue surface that varies with the size of the suction cup.

660 nm and 808 nm. For superficial sliding of the suction cup on the skin, vegetable oil was used to avoid damage to the skin. Laser application and vacuum therapy were performed throughout the facial nerve path (frontal, maxillary and mandibular region) for a duration of 3 min per region (table 1) in MP9 mode and with a pressure of approximately 150 mbar (figure 3(b)). We can see the restoration of smile symmetry and facial expression before and after treatment in figure 4.

3. Discussion

In this paper, we present two clinical cases treated with LLLT that show effective results in the treatment of facial nerve palsies. Our findings corroborate the reports of other authors, demonstrating that LLLT can be indicated in the treatment of morbidities that require stimulation of nerve regeneration (trigeminal neuralgia, paraesthesia and BP, among others) [5, 7, 11, 12].

The exact mechanism of photobiomodulation on damaged nervous tissue is not yet well known. One of the most defended hypotheses for cutaneous and subcutaneous nervous/muscle tissue action with LLLT is the increased enzyme activity involved in the mitochondrial respiratory chain, such as cytochrome oxidase and adenosine triphosphatase (ATP), leading to an increase in ATP production in mitochondria [13]. Other hypotheses argue that the synthesis of DNA, pro-collagen and collagen production increases [13]. A clinical study evaluating the effects of LLLT therapy on nerve tissue injuries has shown increased myelin production and nerve function [14].
Our study is the first case study in the literature showing a new system that promotes the synergistic application of laser and endermotherapy in the treatment of facial nerve palsies. The positive results from LLLT and vacuum therapy can be assessed from the photos of clinical cases 1 and 2, showing neuromuscular restoration after treatment. Our clinical results suggest that LLLT and vacuum therapy has a beneficial effect on nerve regeneration, as LLLT produced changes in the facial muscles of patients in order to recover their normal functions. Particularly for clinical case 2, we believe that the use of low-power laser vacuum therapy applied to the patient’s pre-auricular region may have increased the peripheral irritation of the inner ear [15]. Vacuum therapy would bring greater oxygenation of this region to the face, favoring the repair of the labyrinth tissues responsible for the patient’s hearing and balance. Based on the discussed results, laser therapy may be a viable approach to nerve regeneration and may have clinical relevance. In order to statistically confirm our findings and the feasibility of LLLT in the treatment of facial nerve palsies, further investigation with larger patient numbers is required. However, LLLT and vacuum therapy are potentials non-invasive therapeutic approaches to treat facial nerve palsies in diabetic or hypertensive patients who cannot be treated with corticosteroids.

4. Conclusion

As we can see from the clinical cases presented, we consider that LLLT associated with endermotherapy can have a beneficial effect on facial nerve palsy treatment, since the results here are presented as facial restoration of facial symmetry after this treatment. Our results corroborate other publications in the literature, indicating that low-power laser therapy has clinical relevance in terms of nerve regeneration.

Acknowledgments

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Conflict of interest

The authors declare no conflicts of interest.

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