Complementary Therapies in Medicine 43 (2019) 306–310

Contents lists available at ScienceDirect

Complementary Therapies in Medicine

journal homepage: www.elsevier.com/locate/ctim

Effects of laser acupuncture in a patient with a 12-year history of facial paralysis: A case report

Gil Ton[a], Li-Wen Lee[b], Yi-Hung Chen[a], Cheng-Hao Tu[a], Yu-Chen Lee[a,b,*]

[a] Graduate Institute of Acupuncture Science, China Medical University, Taichung 40402, Taiwan
[b] Department of Acupuncture, China Medical University Hospital, Taichung 40402 Taiwan

1. Introduction

Facial paralysis is a common condition and 1 in 60 individuals will be affected over the course their life.[1] The incidence varies between 11.5–53.3 cases per 100,000 person years in different populations.[2] One-third of affected patients experience inadequate recovery, which typically results in physical and social impairments.[3] Idiopathic facial paralysis or Bell's palsy occurs in more than two-thirds of patients. In addition to the idiopathic type of paralysis, facial palsy can be caused by viral or bacterial infections, benign or malignant tumors of the head or neck and also by traumatic facial palsy, which includes iatrogenic facial nerve injuries and trauma caused by external force, resulting in intracranial bleeding, temporal bone fractures or soft tissue injuries.[4]

Signs and symptoms of both peripheral and central types of facial paralysis are almost identical and include the loss of facial expression and hemifacial weakness; the peripheral type also includes pain in the postauricular region and alternation of taste, which can be accompanied by numbness of cheek and mouth.[2,3] A peripheral type is a lower motor neuron lesion deficit usually involving only one side of the face, while a central type is usually an upper motor neuron lesion deficit causing weakness of the lower face only.[5] The prognosis of each condition varies greatly; it is good overall for the peripheral type, with 70% of all cases recovering spontaneously,[3] whereas central types of facial paralysis usually have poorer recovery.[6] The management of facial paralysis due to trauma combines both medical and surgical options; oral steroids are the primary medication due to their local anti-inflammatory effects. Surgical interventions differ depending on the type of injury and the injured segment of the facial nerve.[7]

Low-level laser therapy (LLLT) has shown favorable outcomes in preclinical and clinical studies in the regeneration of peripheral nerves.[8,9] Laser acupuncture therapy (LAT) is defined as the stimulation of traditional acupoints with low-intensity, non-thermal laser irradiation.[10] The patient described in this case report presented with a long-term, severe type of facial paralysis that had failed to improve with any other interventions, which led us to consider this innovative approach, combing a modern, advanced laser technology with ancient Chinese medicine knowledge. This case report details the effects of LAT in chronic facial paralysis. The article follows the CARE (CAse REport) guidelines.[11]

2. Case presentation

A 52-year-old man presented to the Acupuncture Department of China Medical University Hospital with a severe left-sided facial paralysis caused by a traumatic brain contusion 12 years earlier. He was unable to close his left eye, he had saliva drooling and speech difficulties. The man had been hospitalized in the Emergency Department of Taichung Armed Forces General Hospital after a traffic accident on December 12, 2006. A computed tomography brain scan diagnosed subdural hemorrhage following the injury with open intracranial hemorrhage. After his discharged from hospital with right limb weakness, left-sided facial palsy, left-sided hearing impairment, speech and language deficits, the patient began a rehabilitation program. In October 2010, as his symptoms of mental ability in conjunction with alerted level of consciousness, unsteady gait and saliva drooling had worsened, he presented to China Medical University Hospital's outpatient neurology department. Upon medical examination, computed tomography brain scan showed ventriculomegaly and suspected hydrocephalus (Fig. 1). He was hospitalized and underwent cerebral shunt surgery to remove the swelling of the brain. He was discharged from China Medical University hospital with right limb weakness, left-sided facial palsy, left-sided hearing impairment and speech and language deficits. A few days after hospital discharge, he began a rehabilitation program, which included physical and occupational therapies, as well as acupuncture. He also attended follow-up appointments in the Neurosurgery Department. His medical history also included benign prostatic hyperplasia. His Western medications are detailed in Table 1.

During the first two years after the surgery, he received acupuncture treatments in our department, mainly for pain relief, an unsteady gait and left-sided facial paralysis. He was treated by several traditional Chinese medicine (TCM) doctors using various treatment methods, none of which resulted in any obvious improvement in his left-sided

* Corresponding author at: Graduate Institute of Acupuncture Science, China Medical University, 2 Yuh-Der Road, Taichung City, 40402, Taiwan.
E-mail addresses: u106304101@cmu.edu.tw (G. Ton), u100030057@cmu.edu.tw (L.-W. Lee), yihungchen@mail.cmu.edu.tw (Y.-H. Chen), lordowen@mail.cmu.edu.tw (C.-H. Tu), d5167@mail.cmuh.org.tw (Y.-C. Lee).

https://doi.org/10.1016/j.ctim.2019.02.015
Received 26 December 2018; Received in revised form 23 January 2019; Accepted 21 February 2019
Available online 27 February 2019

Fig. 1. Patient's computed tomography brain scan showed ventriculomegaly and suspected hydrocephalus. Encephalomalacias can be seen in the right temporal lobe and frontal lobe, which are an old brain tissue damage; probably due to previous brain contusion. Another post contusion encephalomalacia can be seen in the left frontal lobe.

facial paralysis. After living with his condition for 12 years, the patient visited the Chief Doctor of the Acupuncture Department of China Medical University Hospital, who suggested that he try LAT for his paralysis. An assessment of facial nerve function demonstrated left-sided facial paralysis with a noticeable left-sided asymmetrical, drooping corner of the mouth and only partial closure of his left eye, despite maximal effort (Fig. 2). The patient described his speech difficulties, saliva drooling and his inability to eat solid foodstuffs. His level of facial muscle stiffness was relatively low, with a score of 2 out of 5 (1 = no stiffness to 5 = very stiff) and House-brackmann facial nerve grading system score was 5 out of 6 (severe). We assessed the patient using the Sunnybrook facial nerve grading system (SB) at the beginning, in the middle and at the end of the treatment sessions; Facial Disability Index (FDI) at the beginning and end of treatment; Vertical palpebral distance was measured at the beginning middle and end of treatment. Photographs were taken after every treatment to monitor the patient's recovery process (Table 1.). We administered a total of 30 LAT sessions over 17 weeks, delivered as 2–3 treatments per week in the first 12 weeks, then once-weekly for the remaining 5 weeks. The patient attended the clinic for a follow-up appointment after the first 4 weeks. We used a gallium-aluminum-arsenide (GaAIAs) laser pen manufactured by RJ Laser, Germany (Table 2). The laser was applied for 30 s to deliver 3 J of energy as a pulsed wave (Noiger E) at each acupoint on the affected side. The laser was also applied for 60 s to each distal point in the limbs, delivering 6 J of energy as a pulsed wave (Noiger B) (Table 2). The patient and investigator both wore protective goggles to prevent any disturbance of visual perception during laser irradiation. Notwithstanding, LLLT is considered to be a very safe treatment; there are no published reports of side effects.[12] The most significant and noticeable improvement during the LAT sessions was the patient's progressive ability to close his left eye (Fig. 3). After the 10th treatment, there was a noticeable extended movement of the left eyelid. After the 22nd treatment, the patient could fully close his left eye and this improvement persisted at follow-up (Fig. 4). From the 10th treatment, the patient reported that his left eye was shedding fewer tears and he no longer used an eye cover before falling asleep. Moreover, he reported an improvement of his facial muscles, giving him the ability to eat solid food, e.g., he was able to bite into an apple without the problems he experienced before LAT. He also reported that his mouth drooling had ceased and his family members were noticing more clarity in his speech. SB scores improved from a baseline of 32 to 46 in the middle of treatment and to 58 at the last session. His FDI physical subscale score was improved from 55 at baseline to 85 after the final LAT session; the FDI social subscale was improved from 28 to 52, respectively. His vertical palpebral distance measurement was improved from 0.5 mm at the start of LAT to 0.6 mm midway through the treatment sessions and to 0.8 mm at the last session, while the total vertical space in his left eye from the upper to lower eyelid was 0.9 mm. It is important to mention that the patient did not receive any other treatments during LAT and 4 weeks of follow-up. Moreover, we issued no lifestyle recommendations such as facial muscle exercises during the treatment course. No side effects or unanticipated events were observed.

3. Discussion

The face is the most obvious part of the body and an important aspect of a person's identity. Although the prognosis of facial paralysis is on the whole favorable, inadequate recovery can occur, especially in non-idiopathic cases, resulting in long-term physical and social impairments.[13] With a patient's increasing age, prognosis is poorer, probably because aging diminishes the capacity for neural regeneration.[14] Facial paralysis without progressive improvement in symptoms can consider the use of invasive treatments such as surgical decompression or botulinum toxin injections, especially when facial spasm or involuntary muscle contractions are involved.[6] However, the benefits of these interventions remain controversial. [2,6]

In TCM, facial paralysis is a condition caused by a wind type of pathogen. If the paralysis is a central type and occurs after a stroke, it is said to be due to internal wind, while a peripheral type of paralysis is attributed to external wind.[15] Wind in TCM underlies Bi-Syndrome, in which there is blockage of *qi* and blood in the channels of the face. *Qi*, according to ancient Chinese concepts, is considered to be a vital force or energy of the body, generating physiological function in the channels and internal organs. According to TCM principles, blockage leads to an imbalance of *qi* and blood circulation in the body, which eventually leads to a diseased state. In facial paralysis, blockage of *qi* and blood leads to malnourishment of the tendons and facial distortion.[16] Besides the use of stainless steel acupuncture needles, several other treatment modalities are used in acupuncture; moxibustion, cupping and electroacupuncture are different methods of external therapy involving the stimulation of acupoints. Moxibustion involves the burning of dried mugwort at acupoints, which increases or stimulates the *qi* flow in the channels. It is commonly used to treat weak or fatigued patients, as well as problems relating to aging.[17] TCM contends that applying moxibustion in facial paralysis regulates the flow of *qi* in the affected region and harmonizes *qi* and blood flow in the body.

LLLT is a healing method that uses light energy in a similar way to moxibustion, but without a thermal effect, to stimulate acupoints. Specifically, this form of phototherapy (also known as photobiomodulation) uses photons in order to stimulate bodily biological processes. LLLT has several known physiological effects, including reductions in inflammation and itching, relief of pain, promotion of circulation and regeneration of tissue. Initially, LLLT was mainly used to assist the healing of wounds and for pain relief. Nowadays, LLLT appears alongside mainstream treatments, especially in the fields of physical therapy, rehabilitation, sports medicine, dentistry and acupuncture, treating a wide range of diseases such as stroke, myocardial infarction, and neurodegenerative disorders.[18,19] A 2008 systematic review of the evidence supported the use of LAT in the treatment of myofascial pain, postoperative nausea and vomiting, and for the relief of chronic tension headache.[20] Recent clinical studies of LLLT in acute Bell's palsy have also shown positive results.[8,21] LLLT has shown beneficial therapeutic effects in pediatric Bell's palsy[22] and in chronic, long-term cases of Bell's palsy in which electrophysiological

Table 1
Timeline of laser acupuncture therapy for a 52-year-old patient with chronic facial paralysis.

Medical history: lagophthalmos, dysarthria, mouth drooling and difficulty eating solid foods.																	
Time points (week)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Treatment sessions (number)	1,2,3	4,5	/	6,7,8	9,10	11,12,13	14,15	16,17,18	19,20	21,22	23,24	25	26	27	28	29	30
Informed consent	✓																
Medication:																	
Baclofen	10 mg/tab																
Madopar	200/50 mg tab																
Piracetam	1200 mg/tab																
Quetiapine	25 mg/tab																
Tamsulosin	0.2 mg/tab																
Therapy: Laser acupuncture therapy (Table 2).																	
Outcome assessments:																	
FDI	✓																✓
S-B	✓								✓								✓
VPD	✓								✓								✓
Photograph																	

FDI, Facial Disability Index; S-B, Sunnybrook Facial Nerve Grading System; VPD, Vertical Palpebral Distance.

Fig. 2. Picture A shows patient's left side facial asymmetry and drooping corner of the mouth. Picture B shows patient's partial closure of left eye despite maximal effort.

Table 2
Parameters of the laser device and acupuncture points in the treatment.

Laser device	gallium-aluminum-arsenide (GaAlAs) infrared laser (RJ laser, Germany)
Wavelength	810 nm
Power density	200mW/cm^2
Probe aperture	0.03 cm^2
Output power	maximum 200 mW
Treatment dose	3/6 Joules per point. 45 J/cm^2 in total
Type of application	Contact
Frequency	Nogier E for local points, Noiger B for distal points
Time	30 seconds for local points, 60 seconds for distal points.
Acupuncture points	Affected side: ST4, ST6, ST7, SJ17, BL2, GB14, SI18. Both sides: LI4, ST36

examinations have demonstrated partial axonal degeneration.[23]

This case study demonstrates dramatic improvements in severe sequelae of chronic facial paralysis following noninvasive, pain-free LAT. The patient was treated in our acupuncture clinic and received no other interventions from us or any other clinicians, as according to the patient. We did not issue him with any facial exercise instructions. After the fifth week of LAT, his left eye started to show slight improvements and after the 10th week, he could fully close both eyes, marking a major improvement in his quality of life. From weeks 12 to 17, he was treated once-weekly and was followed-up for 4 more weeks without any further LAT sessions, during which time his successful outcomes persisted (Fig. 4). The likelihood to regain normal facial function 3 months after the onset of symptoms is low[3] and there is minimal change in the facial condition thereafter.[24] We therefore speculated that almost 6 months of treatment and follow-up is sufficient time to determine therapeutic success.

From week 5 onwards, facial muscle strength improved, which led to improvements in his speech and mouth drooling. We deliberately targeted local acupoints on the affected side for the following reasons:

Fig. 3. Patient's progressive ability to close his left eye while administrated a total of 30 LAT sessions.

Fig. 4. Picture A shows a noticeable change after the tenth treatment (week 5). Picture B shows the patient's left eye in the end of follow up (week 21).

first, the majority of our selected points belong to the Yang Ming channels. The stomach channel and the large intestine channel both disperses in the anterolateral region of the face. According to TCM principles on the selection of acupoints, the location where the channel passes through is where treatment should be given.[25] Second, the facial nerve is predominantly motor in function.[5] The motor fibers that control facial expression are found in the temporal branch, the zygomatic branch, the buccal branch and the mandibular branch. In this patient, the acupoints that were used in the face covered all of these branches in order to promote circulation of *qi* and blood throughout the area. A recent clinical study using LAT stimulation on local acupoints including ST6, ST7 and the distal point of LI4, which were also used in our study, improved maximal mouth opening and pain scores in patients with resistant temporomandibular disorder.[25] These acupoints are located parallel to the masseter muscle, an important facial muscle for opening the mouth and for chewing. It appears that in our patient, local stimulation of these acupoints improved the range of movement in his facial muscles, similarly to the reported improvements in the patients with temporomandibular disorder.

In our study, we used a pulsed light treatment and Noiger E was applied on acupoints on the affected facial side while Noiger B was applied on the limbs where are the distal acupoints. According to Weber et al, the organism is a vibrating system and is part of universal diverse fields.[26] Thus, each bodily tissue has its own magnitude and an appropriate frequency should be applied according to the disease in that tissue.[26] Noiger B is the appropriate frequency for chronic conditions of nutritive visceral organs, while Noiger E is used in diseases of the central and peripheral nervous systems.

Different laser parameters may influence clinical outcomes; these include the type of wavelength, power output and duration of irradiation, the type of wave (continuous or pulsed) and, in the case of pulsed waves, which frequency to use.[27] Moreover, additional parameters such as the color of the patient's skin and hair, angulation of the laser beam, type of tissue and number of treatments all need to be considered when applying LAT and assessing its efficacy. In this study, we followed the specifications issued by the World Association of Laser Therapy (WALT) to describe our intervention and we followed their dose recommendations in general,[28] However, there are no recommended doses for treatment in facial paralysis. To our knowledge, this is the first report of LAT in chronic facial paralysis. The acupoints were selected according to much clinical experience in the use of stainless acupuncture needles – in an absence of familiarity with laser application. This prevented us from considering any previous case studies or clinical trials on this topic. While the clinical results of this case report are certainly promising, it is impossible to ascertain LAT efficacy in chronic facial paralysis from the results of only one case. We did not anticipate spontaneous recovery with LAT in this chronic, central type of paralysis, after so many years of unsuccessful treatment with other modalities. We therefore did not subject the patient to electrophysiological examinations. However, as we did not use any other interventions besides LAT in this patient, the results appear to strongly support the contention that LAT improves long-term complications of facial paralysis.

4. Conclusion

We found that LAT improved long-term sequelae of facial palsy. This case report provides strong support for the use of LAT for subacute and chronic cases of paralysis that fail to respond to other treatment modalities. LAT is a fast, noninvasive, pain-free method that is easy for the physician to apply and easy for the patient to undergo. These characteristics, combined with the safety features of LAT makes it a promising complementary therapy for chronic facial paralysis. The significant improvement in this case warrants large-scale prospective studies to confirm our findings.

Consent

A copy of the written consent for publication of this case report is available from the Editor-in-Chief of this journal.

Conflicts of interest

None.

Acknowledgments

The authors are very grateful to Dr. Liao Hsien-Yin from the Department of Acupuncture in China Medical University Hospital, Taichung, Taiwan, for providing the laser device used in this study. We would like to thank Dr. Michael Weber, President of the European TCM Laser Academy and also Hsu Sheng Feng from the Graduate Institute of Acupuncture Science, China Medical University, Taichung, Taiwan, for critically reviewing the manuscript. We also thank Ms. Iona MacDonald for the English proofreading for this manuscript.

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