IMPACT OF ELECTRICAL STIMULATION ON REHABILITATION PROCESS IN PERIPHERAL FACIAL PARALYSIS

GÜZELANT YA, SARIFAKIOGLU AB, SARACOĞLU GV, CAN İ, ÜNAL A

Namik Kemal University School of Medicine, Department of Physical Medicine and Rehabilitation, Tekirdag - Namik Kemal University School of Medicine, Department of Public Health, Tekirdag - Namik Kemal University School of Medicine, Department of Neurology, Tekirdag, Turkey

ABSTRACT

Aim: The purpose of this study is to discuss the efficiency of electrical stimulation in the treatment of facial paralysis, and its contribution to the rehabilitation process and, its impact on recovery.

Material and methods: 18 cases were enrolled into the study who were diagnosed with facial paralysis and consulted within the first month, and have been receiving medical treatment. Home exercise program was given to all patients. The first group was followed-up with hospital rehabilitation program that included electrical stimulation, while the second group was organized to receive only home exercise program. Functional response to treatment was assessed by the House-Brackmann scale grading system.

Results: House-Brackmann scale scores of rehabilitation program and electrical stimulation patient group, were compared pre-and post-treatment, clinical improvement was observed more significantly in the 6th week. There was no significant difference between House-Brackmann scale scores in pre-treatment and the 6th week visits of the patients in home exercise program group (p = 0.16). However, the House-Brackmann scale scores were detected to be statistically significantly different between pre-and 6 months after the treatment in both of the treatment groups (p = 0.005).

Conclusion: As a result, the recovery time is faster in the patients treated with the rehabilitation group that includes electrical stimulation. Therefore electrical stimulation therapy is an acceptable effective method for the treatment of facial paralysis, nonetheless this should be investigated in larger patient groups, in future.

Key words: Bell palsy, physical therapy modalities, electric stimulation, exercise, massage.

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Introduction

Facial nerve (7th cranial nerve) has an important function on facial aesthetics by enabling the movements of mimic muscles, and it is the most damaged nerve among the cranial nerves after leaving the central nervous system. Eating, drinking and speaking difficulties are observed in peripheral facial nerve damages, as well as difficulties in expressing the feelings. Although viral infections, trauma, surgical interventions, diabetes, local infections, and congenital, toxic, tumoral and immune diseases are being investigated in the etiology of peripheral facial paralysis (PFP), the cause is often idiopathic. PFP incidence is between 11.5-40.2 in 100000. The incidence peaks in between the third and the fifth decades, and the sixth and seventh decades. Additionally, the recurrence rates range 2 to 7.3% in all idiopathic PFP patients.

Treating PFP in early period with a multidisciplinary approach are important for speeding the recovery process up. In addition to medical therapy, thermal heat modalities, electrical stimulation, exercise and massage are physical therapy methods of which the effectivenesses were shown.

The purpose of this study is to assess the contribution of the electrical stimulation to medical therapy and its impact on recovery process in peripheral facial paralysis cases.

Materials and methods

The patients who consulted to Physical Medicine and Rehabilitation outpatient clinic and diagnosed with PFP between 2011 and 2013 were examined retrospectively. Patients:

- Who do not have a diagnosis of cerebrovascular disease in history,
• Who were informed about PFP and protection methods, and the functions of the muscles which are being effected, who were recommended to massage on the condition that it is performed four times a day and for at least 10 minutes, who were educated about active movements of mimic muscles in front of the mirror and drinking water, eating and smiling, and activities affecting the daily life,
• Whose facial nerve states were evaluated clinically with House-Brackmann Scale (HBS) functional grading system (table 1) in pre-treatment period and in 1st and 6th months after treatment, were included to the study (11) (Table 1).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>Grade 1</td>
<td>Normal symmetric function</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Slight weakness noticeable on close inspection</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Obvious weakness, complete eye closure with effect is possible. Not disfiguring Synkinesis</td>
</tr>
<tr>
<td>Grade 4</td>
<td>Obvious weakness causing disfiguring. Severe Synkinesis, spasm</td>
</tr>
<tr>
<td>Grade 5</td>
<td>Only barely perceptible movement complete eye closure is not possible. No Synkinesis or spasm</td>
</tr>
</tbody>
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Table 1: House-Brackmann Facial paralysis grading system.

Demographic data, and antiviral, corticosteroid, gastroprotective treatments and physical therapy methods, and responses to the applied treatment of 18 cases who met all criteria, were assessed. The same home exercise program were given to both of the groups. Six patients were followed-up with only home exercise program, and 12 patients were followed-up with hospital rehabilitation program applied together with home exercise program. Rehabilitation program applied in hospital were constituted of infrared (IR), electrical stimulation (ES) and exercises.

IR were applied five days a week for 20 minutes. ES were applied to the motor points of eight muscles innervated by facial nerve (m. frontalis, m.corrugator supercilli, m. orbicularis oculi, m.levator labii alaque nasii, m. nasalis m. levator labii superioris, m.orbicularis oris, m. depressor labii inferioris) with Cefar compex theta 500 model electrotherapy device in rehabilitation mode with 100 milliseconds intermittent galvanic current for motor point treatment, 30 times as 3 rounds to each point, and at a current intensity as to obtain minimal contraction (Figure 1). ES was discontinued after the active movements started in mimic muscles, hot application and exercise were continued. Treatment program was applied in 20 sessions (Figure 1).

Figure 1: Motor stimulation points in face.

Statistical Analyses
All data were analyzed using the Statistical Package for the Social Sciences for Windows software version 17.0 (SPSS, Chicago, IL). Descriptive statistical analyses (mean, standard deviation, frequency and percentage values) of the data obtained from the records, were performed in the study. Wilcoxon Signed Rank Test was performed for within-group pre- and post-treatment comparisons, and Mann Whitney U and chi-square test were performed for between-groups comparisons. Data were assessed two-way in 95% confidence interval.

Results
Our case series was constituted of 18 patients. 66.7% of the patients were male (n=12). Left side was affected in 72.2% of the group (n=13). After the examinations targeted for PFP causes, one patient was diagnosed with PFP secondary to DM, and another one was diagnosed with PFP secondary to acoustic neuroma. Sixteen patients were diagnosed with idiopathic PFP because there were no explicator causes found. All patients had been received medical (corticosteroid, antiviral, gastroprotective medications) therapy. Recurrent PFP history was detected in four patients after medical histories were questioned. All patients described full recovery after previous PFPs. Unilateral facial nerve involvement history was present in one case, and contralateral facial nerve involvement was present in three (three patients had previous PFP twice and one patient had once, and they recovered without any sequela). There was a history of operation
because of otitis media two years ago in the medical history of a patient, when patient was consulted for PFP, there were no ear-related infection or other possible reasons detected and the patient was considered idiopathic. Systemic disease history was detected in 5 patients in total; diabetes (1), hypertension (1), ischemic heart disease (1), arrhythmia (1), lung cancer (1).

The mean physical therapy beginning periods of the patients were 29±3.5 (25-33). Twelve patients (66.7%) visited our clinic to receive the scheduled PFP rehabilitation treatment protocol. Six patients (33.3%) did not participate in the treatment program applied in clinic for various reasons, PFP exercise program to apply at home was given to them.

The average age of our patient group was 45.72±20.33. There was no significant difference between the ages of the patients in home exercise program (n=6) and rehabilitation program (n=12) (p=0.75).

HBS evaluations were performed in pre-treatment and 6th week post-treatment and long-term 6th month visits of the patients. There was no significant difference between the HBS evaluations performed in the visits performed in pre-treatment period (p=0.92), 6 weeks after the treatment (p=0.62) and 6 months after the treatment of the patients in home exercise program and rehabilitation program, either (p=0.75).

HBS evaluations were performed in the visits performed in pre-treatment period, 6 weeks after the treatment and 6 months after the treatment of the patients participated in rehabilitation program (n=12) (Figure 2).

Significant improvement was observed beginning from the 6th week in clinical recovery in the comparison between pre-treatment HBS, and 6th week (p=0.01) and the 6th month (p=0.05) HBSs of the patient group participated in rehabilitation program. A significant difference was also detected in between HBS obtained in 6 weeks after the end of the treatment and HBS obtained in the 6th month (p=0.06) (Figure 2).

Pre-treatment, and the 6th week after treatment and long-term 6th month HBS evaluations were performed of the patients treated with home exercise program (n=6) (Figure 3). There was no significant difference between the pre-treatment HBS and the 6th week HBS detected in this group (p=0.16). However it was determined that there was a significant difference between the pre-treatment HBS and the 6th month HBS (p=0.005). A significant improvement was detected on the 6th month in the comparison between the HBS obtained 6 weeks after the treatment and the HBS obtained on the 6th month (p=0.03) (Figure 3).

Discussion

Although PFP is a self-limited disease only 80% of the patients make a full recovery\(^{(7, 13, 14)}\). The permanent damages in the other 20% group are among the important pathologies that need to be treated and may cause emotional and social isolation of the patient\(^{(3, 23)}\). After the 12-month follow-up period, full recovery was observed in 15 cases and recovery with sequela was observed in five cases out of 18 patient (16 idiopathic, 1 DM, 1 acoustic neuroma) evaluated in this study. 13 out of 15 cases who made a full recovery, diagnosed with idiopathic PFP.
Choosing between the treatment methods is one of the important points together with the paralysis diagnosis. The most efficient treatment strategy is still controversial\(^\text{(6)}\). The treatment may be planned with the determination of the disease period, actual lesion site and the exact damage degree in the nerve. Although it is controversial, corticosteroid may be recommended as medical therapy after PFP was developed\(^\text{(22, 24)}\). In a randomized controlled study, Sullivan et al. were detected untreated patients shows 63% recover in three months and 85% recover in nine months\(^\text{(10)}\). They reported the recovery rates after corticosteroid treatment as 81% and 94% respectively. While antiviral therapy addition is recommended in severe cases, antiviral therapy was not shown to be superior to placebo in another randomized controlled study\(^\text{(9-22)}\). B12 was also recommended as a supportive therapy\(^\text{(10)}\). All patients evaluated in this study, received corticosteroid, antiviral and vitamin B12 treatment.

Physical methods are also being used in PFP treatment along with medical therapy. These include thermal therapies, electrical stimulation, exercise, massage, biofeedback and acupuncture therapy\(^\text{(21)}\).

Studies on the efficiency of the electrical stimulation in subacute and chronic period of PFP, may be seen in literature. These studies are especially mentioning the successful results of the long-term electrical stimulation in chronic cases\(^\text{(10, 16, 23, 24)}\). In the study performed by Hyvarinen et al. in PFP patients diagnosed between one year and 25 years, transcutaneous electrical stimulation was reported to be effective\(^\text{(10)}\). Superficial heat therapies are also known to be contributive in the treatment by allowing the ES to be applied at low-current intensity by increasing the skin resistance based on the increase in local circulation\(^\text{(21)}\).

Studies on early-stage PFP are limited, and the case counts are not adequate either\(^\text{(3)}\). Mosforth et al. reported that massage and ES applied patients recover faster but there is no difference in long-term follow-ups\(^\text{(15)}\). Alakram et al. applied hot application, massage and exercise program to one group and electrical stimulation to the other in their study with 16 patients who were diagnosed in the previous 30 days. They reported that there were improvements in both groups in the follow-ups performed with HBS, and ES is safe to be applied\(^\text{(1)}\). Ohtake et al. considered ED as active exercise in the meta-analysis on the effects of ES\(^\text{(18)}\).

Exercise is important for gaining the functionality back in PFP\(^\text{(4, 26)}\). On the other hand Nicastr et al. showed that positive results were seen in stage 5-6 patients but there was no difference in stage 1-2 patients according to HBS in their study evaluating the efficiencies of early-period exercise programs in PFP\(^\text{(17)}\).

In our study a rehabilitation program constituting of electrical stimulation, hot application and exercises aimed at mimic muscles in addition to the exercise program performed at home, was applied to 12 patients. Synkinesis was seen as a sequela in one patient in follow-up. Home exercise program was given to six patients. One patient in home exercise program group was evaluated with electroneuromyography (ENMG) because there was not sufficient improvement observed in HBS. Partial facial nerve damage was found on ENMG and surgery was not indicated.

Age is specified as a prognostic factor in PFP. Cha et al. reported that there was no difference between pediatric and adults cases\(^\text{(2-5)}\). In this study submitted by us, there was partial recovery observed in two patients, 12 and 71 years old. Although there are conflicting data on age in the literature, the prognosis of these two patients made us think that the age is important in prognosis though we do not have enough patients to discuss. Other factors affecting the prognosis include electromyography and axonal damage. Besides, the recovery may be inadequate in traumatic and iatrogenical nerve damage cases\(^\text{(15)}\).

Tumoral and traumatic causes of PFP mostly necessitate surgical approach, while surgical therapy rates in the patients diagnosed with idiopathic PFP is either very low or controversial. Therapeutic surgical intervention was not applied to the cases in this study.

Consequently, there was no difference observed in between the recovery rates of the patients given home exercise program in addition to medical therapy and the patients applied with rehabilitation program including ES in addition to the previous group. However the short-term recovery rate was seen to be more in the rehabilitation group including ES. Electrical stimulation in addition to the exercise in PFP treatment; appears to be able to minimize the muscle atrophy during the period needed for peripheral nerve regeneration in denervated muscles, protect muscle strength and prevent the trophic disorders\(^\text{(7-8, 14, 20)}\). Even though the spontaneous recovery make the evaluation of the effi-
ciencies of the physical therapies difficult, they are important in terms of speeding-up the recovery process and decreasing the psychosocial influence on the patient.

References

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