J Acupunct Meridian Stud 2019;12(4):122—130

Available online at www.sciencedirect.com

Journal of Acupuncture and Meridian Studies

journal homepage: www.jams-kpi.com

Research Paper

The Efficacy of Acupuncture in the Treatment of Bell's Palsy Sequelae

Canan Ertemoğlu Öksüz [1,*,†], Ahmet Kalaycıoğlu [2], Özlem Uzun [1], Şahi Nur Kalkışım [1], Nihat Burak Zihni [3], Ahmet Yıldırım [4], Cavit Boz [4]

[1] *Karadeniz Technical University, Department of Anatomy, Health Sciences Institute, Turkey*
[2] *Biruni University, Department of Anatomy, Faculty of Medicine, Turkey*
[3] *Karadeniz Technical University, Department of Biostatistics, Health Sciences Institute, Turkey*
[4] *Karadeniz Technical University, Department of Neurology, Faculty of Medicine, Turkey*

Available online 1 April 2019

Received: Oct 5, 2018
Revised: Feb 4, 2019
Accepted: Mar 25, 2019

KEYWORDS
acupuncture;
Bell's palsy sequelae;
electromyography;
facial paralysis;
grading scales

Abstract
This study was planned to evaluate the effectiveness of acupuncture treatment for the treatment Bell's palsy sequelae. In this study, forty patients with Bell's palsy sequelae were randomly allocated to either the acupuncture or the control group. The clinical outcomes before and after treatment were assessed using the following assays: the facial nerve compound motor action potential and HouseeBrackmann (HB) and Sunnybrook (SB) grading scales. Agreement analysis was performed between the SB and HB grading scales. There was significant difference between pretreatment and posttreatment compound motor action potential values of the patients within the acupuncture group ($p = 0.036$). In pretreatment and posttreatment SB and HB scores, significant differences within the two groups were observed. However, the significance level in the improvement rate in the acupuncture group was higher than that of the control group. General agreement between the SB and HB scores of groups was an acceptable value, and weighted agreement between the scales was a moderate agreement. In this study, we found that acupuncture treatment is effective in improving Bell's palsy sequelae. Acupuncture can be used as a safe method in the treatment of Bell's palsy sequelae.

* Corresponding author. Karadeniz Technical University, Vocational School of Health Science, Turkey.
E-mail: cananertem61@hotmail.com (C.E. Öksüz).
† Department of Anatomy, Health Sciences Institute, Vocational School of Health Science, Karadeniz Technical University, 61080, Trabzon, Turkey.

pISSN 2005-2901 eISSN 2093-8152
https://doi.org/10.1016/j.jams.2019.03.001

1. Introduction

Bell's palsy is an acute onset, idiopathic peripheral lower motor neuron paralysis affecting all facial expression muscle groups in one side of the face only. The disease results in physical, social, and psychological effects by causing facial nerve dysfunction. In most research studies, Bell's palsy is thought to resolve spontaneously within three weeks, and most patients heal spontaneously within that time [1-3]. After this period, most cases are thought to involve sequelae such as paresis, contracture, facial spasm, or synkinesis [1]. Corticosteroids and antiviral drugs are widely used in the acute stage of the disease to accelerate the healing process and reduce the risk of complications [4]. However, because the traditional form of treatment is not an effective option in patients with sequelae, the medical treatment of sequelae of Bell's palsy is limited to treatments such as botulinum toxin type A, surgery, and physiotherapy [5].

Acupuncture is a low-risk and safe therapeutic method in various diseases, including Bell's palsy, and there is no evidence of any deleterious effects [6]. It is, therefore, safely used as a complementary treatment in both children and adults [2,4,7]. Electroacupuncture is particularly widely used in the treatment of Bell's palsy [8].

Owing to the importance of facial symmetry in terms of perceived attractiveness and its effect on interpersonal communication, patients exhibiting no improvement after antiviral and steroid therapy and who develop sequelae may receive electroacupuncture therapy to bring about the best possible and earliest improvement and to halt complications [1,9].

Thus, we designed this study to investigate whether acupuncture is effective and safe in treatment of Bell's palsy sequelae and evaluated its effectiveness in terms of functional and electrophysiological findings.

2. Materials and methods

2.1. Study design and participants

This study was conducted at the Karadeniz Technical University Medical Faculty Anatomy Department and Neurology Department and the Trabzon Acupuncture Center, Turkey. Participants who applied to the Neurology Department of Medical Faculty were recruited to study. Written informed consent was received from each patient and parents of patients younger than 18 years before participation in the study.

The study protocol was approved by the Karadeniz Technical University Medical Faculty ethical committee (24237859-408).

Permission for the study protocol was accepted by General Directorate of Health Services, Republic of Turkey, Ministry of Health of Turkey (77979112-020-E.1300).

We followed the World Medical Association (WMA) Declaration of Helsinki—Ethical Principles for Medical Research Involving Human Subjects.

2.1.1. Inclusion and exclusion criteria for participants

Inclusion criteria for participants were as follows: diagnosed with Bell's palsy at least three months before screening; clinical treatment completed; persisting sequelae; and aged 15 years or older. Exclusion criteria for participants were as follows: patients with central facial paralysis; peripheral facial paralysis other than Bell's palsy; facial paralysis resulting from causes such as trauma, otitis media, and neoplasia; previously received acupuncture treatment for Bell's palsy; past or current malignant tumors; serious conditions requiring medical intervention (e.g., severe hypertension, uncontrolled diabetes, severe neurological or psychiatric disorders, liver or kidney dysfunction, systemic diseases inappropriate for treatment with acupuncture); pregnant or lactating women patients; and patients who did not provide informed consent.

2.1.2. Sample size

To determine the sample size, data obtained from a pilot study ($n = 18$) were subjected to statistical power analysis. This was performed using free G*Power (Heinrich Heine University Düsseldorf, Germany) software with an effect size of 0.85 (using Cohen's criteria), alpha value $= 0.05$, and power $= 0.80$, and a minimum sample size of 11 was determined. This represents the minimum sample size required to determine significance based on the criteria determined between electromyography (EMG) measurements before and after treatment in patients receiving acupuncture. With the enrollment of a similar number of participants for the control group, we determined that the study could be performed with 22 patients with Bell's palsy. Therefore, the size of the sample is found to be sufficient by the power analysis. Because the study was a follow-up study, sample size was planned to enroll 40 patients with Bell's palsy to avoid possible case losses.

2.1.3. Allocation, randomization, and blinding

Patients with Bell's palsy who wanted to participate in the study were screened according to eligibility criteria and interview on the first visit and were randomized to the acupuncture or the control (no-acupuncture waiting list) group. The acupuncture group consisted of patients diagnosed with Bell's palsy, with persisting sequelae and scheduled for acupuncture treatment, while the control group comprised patients diagnosed with Bell's palsy, with persisting sequelae but not scheduled for acupuncture treatment and kept on the waiting list.

Random numbers generated on the computer were used to determine into which group participants would be assigned. It was decided that the first 20 random numbers generated would represent the control group patients and the final 20 numbers, the acupuncture group patients. Randomization was subsequently achieved by cases numbered according to their order of arrival at the hospital being assigned to the group corresponding to those numbers. Randomization was performed by an independent researcher who was not included in the exclusion—inclusion process, treatment, and assessment procedures of this study.

The outcome assessors were blinded to the group assignments. To avoid unblinding of the assessment of outcome, patients were informed not to talk about anything related to their treatments and groups with the assessors.

2.2. Intervention

Acupuncture treatment was performed by a professor who was both medical doctor and anatomist and also was licensed to practice acupuncture treatment from the Republic of Turkey, Ministry of Health. Acupuncture protocol was based on a literature review and acupuncture textbook and atlases [10-12].

A no-acupuncture waiting list group was used as the control group because sham acupuncture could not be used as a physiologically ineffective placebo.

Patients in the acupuncture group were treated by electroacupuncture and Nogier ear acupuncture three times per week for 4 weeks (for a total of 12 sessions over 4 weeks) following the details of the Standards for Reporting Interventions in Clinical Trials of Acupuncture 2010 checklist. During this period, the control group patients were asked to continue with their routine daily lives without receiving any other treatment, including herbal medications.

Acupuncture treatment was applied, with participants in a supine position using disposable, sterilized, stainless steel needles (Hualong sterile acupuncture needles, Shanghai, China) of various sizes. The selected electroacupuncture points [11,12] are shown in Fig. 1.

2.3. Outcome measures

The protocol of assessment was as follows. The first assessments were applied to all participants on the first day of the study. Detailed medical history was taken from participants (the date of onset of paralysis, treatment received and duration, presence of systemic disease, continuous use of medication, and so on). The acupuncture group received acupuncture treatment, and control group waited for no treatment. At the end of 12 sessions, assessments of all participants were repeated. The treatments and assessments of participants were conducted on different days.

2.3.1. Primary outcome measures

The primary outcome measure was participants' electrophysiological assessment which was assessed by EMG. The facial nerve compound motor action potential (CMAP) amplitude (mV) values were used at electrophysiological assessment. The procedures were performed using a Nihon Kohden MEB- 9102 K (Nihon Kohden Corporation, Shinjuku-ku, Tokyo, Japan) EMG device with patients resting in a supine position by applying supramaximal stimulation. Stimulations were applied with the cathode electrode in front of the tragus and the anode electrode 3 cm above the cathode electrode. During recording, the active electrode was placed over the nasal muscle, the reference electrode over the contralateral nasal muscle, and the ground electrode over the forehead.

Also, functionally, patients' paralysis degrees were evaluated using the House—Brackmann (HB) and

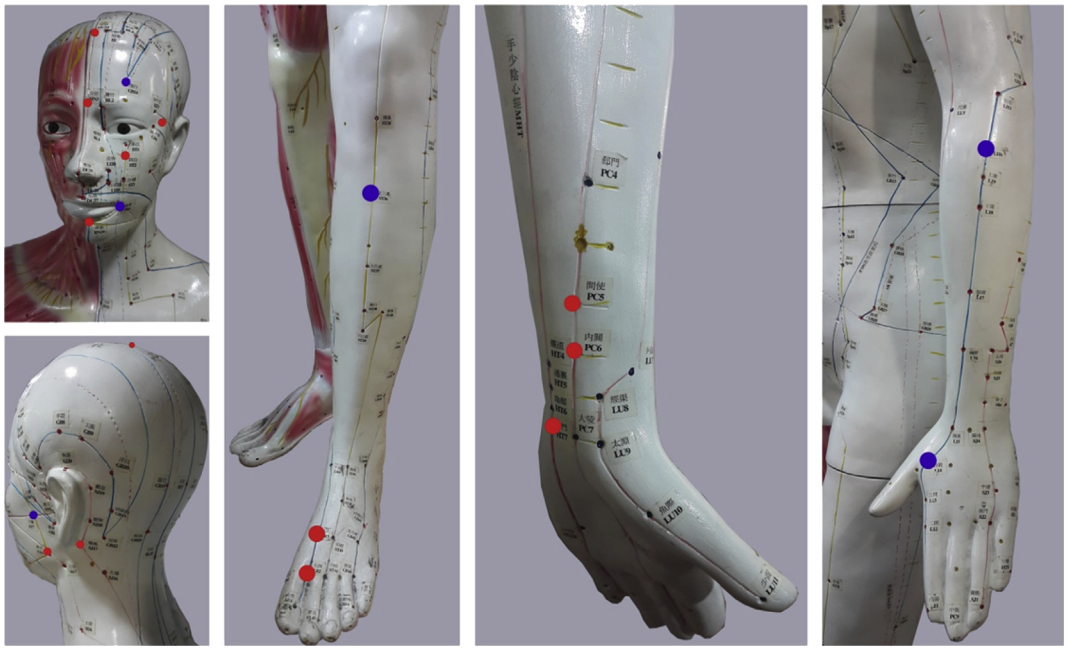

Figure 1 The electroacupuncture points in the acupuncture group. Twenty-five needles were inserted at each session. The unilateral (affected side) ST 2, ST 6, TE 17, Ex-HN5 and unilateral (dominant extremity) PC 5, PC 6, HT 7, LR 2, LR 3 and bilateral ST 4, ST 7, ST 36, LI 4, LI 10, GB 14 and midline GV 20, GV 24, Ex-HN3, CV 24 were used for electroacupuncture treatment. Red dots represent unilateral and midline electroacupuncture points in the acupuncture group, and blue dots represent bilateral electroacupuncture points in the acupuncture group.

Sunnybrook (SB) grading systems. The HB (Grade I, normal; Grade VI, total paralysis) and SB (0, normal; 100, total paralysis) grading systems are used to determine the degree of facial paralysis, thus permitting monitoring of clinical changes at subsequent follow-ups.

To avoid variation during CMAP amplitude measurements, these were performed on the same device by a single researcher. To prevent potential variations during grading system assessments, the scales were evaluated by the same researcher.

2.3.2. Secondary outcome measures

Agreement analysis was also performed between the SB and HB grading scales. For this, patients' pretreatment SB and HB scales ($SB_{Pretreatment}$, $HB_{Pretreatment}$) were used. $SB_{Pretreatment}$ scores (0-100) were converted into HB scores (I-VI) using the Kanerva et al.'s [13] study that explained HB I corresponds to SB 100; HB II to SB 70 to 99; HB III to SB 43 to 69; HB IV to SB 26 to 42; HB V to SB 13 to 25; and HB VI to SB 0 to 12.

2.4. Statistical analyses

Statistical Package for Social Sciences, version 22.0 (IBM Corporation, Armonk, New York), software was used for statistical analysis. We used the paired *t* test to compare within-group values. The independent *t* test was used for between-group comparisons. In addition, the significance of variation in HB scores before and after treatment was analyzed using the marginal homogeneity (MH) test.

A p value < 0.05 was considered statistically significant. Statistical analysis was performed by an independent researcher who was not included in the exclusion—inclusion process, treatment, and assessment procedures of this study to eliminate bias.

3. Results

3.1. Participants and baseline characteristics of participants

A total of 54 patients were interested in participating in this study, and 40 patients (22 female and 18 male) were enrolled in the study (Fig. 2). Twenty patients were assigned to the acupuncture group, and 20 patients were assigned to the control group. All the participants in the study completed the treatment protocol. In other words, 40 participants (100%) completed the study without protocol violations.

The basic demographic characteristics of the groups (sex and side of paresis) and the analysis of factors known to affect the recovery of Bell's palsy (duration of diagnosis, recurrent facial paralysis story, facial paralysis story in the family, and received treatment after diagnosis) are presented in Table 1. The number of male and female patients in the groups was equal. Except for one patient who completed physiotherapy treatment in the acupuncture group, all patients who had completed their clinical treatment were treated with corticosteroids in the acute stage (Table 1). In other words, all patients in this study completed their clinical treatment. Because we intended to investigate Bell's palsy sequelae, patients presenting in the first three months were not included in the study.

There were no significant differences between groups with respect to baseline outcomes (age, body mass index, $SB_{Pretreatment}$, $HB_{Pretreatment}$). The mean of age of the patients was 41.43 ± 16.45 years (Table 2).

3.2. Primary outcome measures

3.2.1. Changes in electrophysiological values

The within- and between-group changes in the pretreatment and posttreatment CMAP amplitude values of the patients in the acupuncture and control groups are presented in Table 3.

Comparison of CMAP amplitude values of the groups revealed a significant difference between pretreatment and posttreatment CMAP values of patients within the acupuncture group ($p = 0.036$) (Table 3).

3.2.2. Changes in grading scale scores

The within- and between-group changes in the pretreatment and posttreatment SB and HB scale scores for groups are shown in Table 4.

Significant differences within both groups were observed in the changes in the pretreatment and posttreatment SB and HB scores ($p < 0.05$) (Table 4).

MH test analysis results of pretreatment and posttreatment HB scores in the groups are presented in Table 5. These findings revealed a significant difference between acupuncture and control group patients' pretreatment and posttreatment HB scores ($p < 0.05$). However, the significance level in the improvement rate of the acupuncture group was higher than that of the control group (Table 5). The proportion of patients having HB scores greater than pretreatment HB III in the acupuncture group was 45%, decreasing to 5% after treatment. In the control group, the proportion of patients having HB scores greater than pretreatment HB III was 35%, and this decreased to 20% after treatment.

To show more significant improvement in HB scores of the acupuncture group patients, each patient's pretreatment score was subtracted from the posttreatment score to elicit a new variable, $HB_{Difference}$, and a variable value range between 0 and III was observed (Table 6). A value of 0 was graded as "no change," while values of I, II, and III were classified as "improvement," eliciting another new variable (categorized $HB_{Difference}$). Chi-square analysis for this variable obtained revealed a significant difference in improvement in HB scores of the acupuncture group compared with the control group (Table 7). In other words, acupuncture group patients exhibited significantly higher positive responses to healing than patients in the control group ($p = 0.011$).

3.3. Secondary outcome measures

3.3.1. Agreement analysis of the grading scales

The agreement between these new HB scores obtained by converting $SB_{Pretreatment}$ scores to HB scores and true $HB_{Pretreatment}$ scores was investigated using generalized kappa ($\kappa_{general}$) values, while the effect on changes

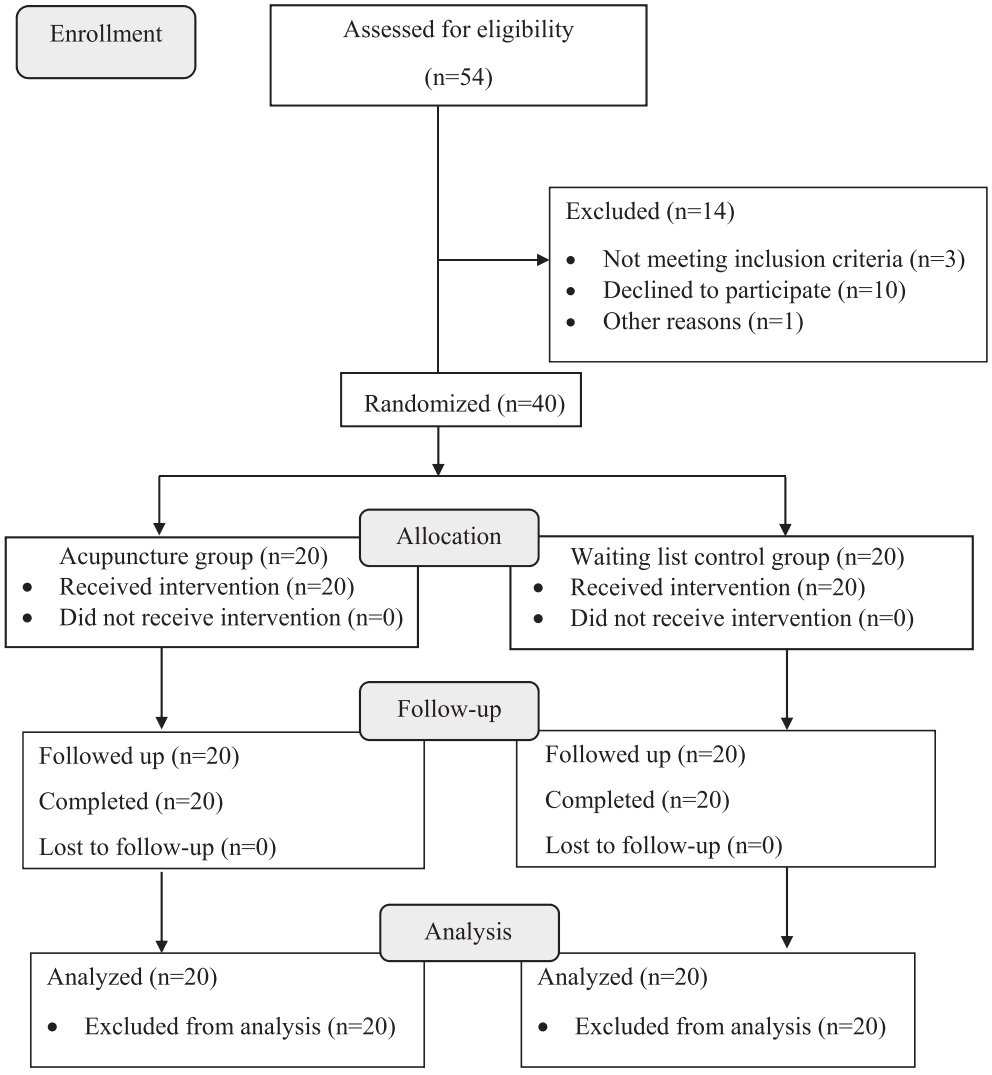

Figure 2 Flowchart of participants' progress during the study.

Table 1 Basic demographic characteristics of the participants in the groups.

Demographic characteristics		Acupuncture group (n = 20) n (%)	Control group (n = 20) n (%)
Sex	Female	11 (55.0%)	11 (55.0%)
	Male	9 (45.0%)	9 (45.0%)
Side of paresis	Right	4 (20.0%)	11 (55.0%)
	Left	16 (80.0%)	9 (45.0%)
Duration of diagnosis, month	3-6	8 (40.0%)	18 (90.0%)
	7-12	3 (15.0%)	2 (10.0%)
	Over 12	9 (45.0%)	0 (0.0%)
Received treatment after diagnosis	Corticosteroid	6 (30.0%)	13 (65.0%)
	Physiotherapy	1 (5.0%)	-
	Corticosteroid + physiotherapy	12 (60.0%)	5 (25.0%)
	Corticosteroid + vitamins	1 (5.0%)	2 (10.0%)
Facial paralysis story in the family		4 (20.0%)	2 (10.0%)
Recurrent facial paralysis story		4 (20.0%)	2 (10.0%)

Table 2 Baseline outcome characteristics of the groups.

Outcome characteristics	Acupuncture group (n = 20)			Control group (n = 20)			*P*
	Min	Max	Mean ± SD	Min	Max	Mean ± SD	
Age	16	71	40.15 ± 16.19	15	68	42.70 ± 16.97	0.630
BMI	17.99	44.92	29.08 ± 6.86	19.57	40.63	28.82 ± 6.39	0.904
$SB_{Pretreatment}$	4	87	38.30 ± 28.32	5	81	42.35 ± 25.25	0.636
$HB_{Pretreatment}$	2	6	3.25 ± 1.16	1	5	2.95 ± 1.23	0.434

BMI = body mass index; HB = House–Brackmann; SB = Sunnybrook; SD = standard deviation.

Table 3 Differences in the changes of the pretreatment and posttreatment electrophysiologic outcome measures in both groups.

Electrophysiologic outcome		Acupuncture group (n = 20)			Control group (n = 20)			*p*
		Min	Max	Mean ± SD	Min	Max	Mean ± SD	
CMAP amplitude, mV	Pretreatment	0.00	2.79	0.89 ± 0.69	0.00	2.90	0.98 ± 0.80	0.676
	Posttreatment	0.21	2.67	1.05 ± 0.69	0.11	3.53	1.11 ± 0.94	0.832
	p	**0.036**			0.051			

CMAP = compound motor action potential; SD = standard deviation.
$P < 0.05$ statistical significance.

Table 4 Changes in SB and HB scale scores before and after treatment in both groups.

Scoring scales		Acupuncture group (n = 20)			Control group (n = 20)			*p*
		Min	Max	Mean ± SD	Min	Max	Mean ± SD	
SB	Pretreatment	4	87	38.30 ± 28.32	5	81	42.35 ± 25.25	0.636
	Posttreatment	12	91	53.10 ± 27.92	5	95	58.00 ± 28.35	0.585
	P	**0.000***			**0.000***			
HB	Pretreatment	2	6	3.25 ± 1.16	1	5	2.95 ± 1.23	0.434
	Posttreatment	1	6	2.30 ± 1.13	1	5	2.45 ± 1.32	0.701
	P	**0.000***			**0.015**			

HB = House–Brackmann; SB = Sunnybrook; SD = standard deviation.
* $p < 0.01$ high statistical significance. $p < 0.05$ statistical significance.

Table 5 Pretreatment and posttreatment HB scores in acupuncture and control groups.

HB scores			Groups	Pretreatment						Total
				I	II	III	IV	V	VI	
				n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Posttreatment	I	n (%)	Acupuncture	0 (0.0%)	4 (20.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (20.0%)
			Control	3 (15.0%)	2 (10.0%)	1 (5.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (30.0%)
	II	n (%)	Acupuncture	0 (0.0%)	3 (15.0%)	3 (15.0%)	2 (10.0%)	1 (5.0%)	0 (0.0%)	9 (45.0%)
			Control	0 (0.0%)	2 (10.0%)	1 (5.0%)	2 (10.0%)	0 (0.0%)	0 (0.0%)	5 (25.0%)
	III	n (%)	Acupuncture	0 (0.0%)	0 (0.0%)	1 (5.0%)	5 (25.0%)	0 (0.0%)	0 (0.0%)	6 (30.0%)
			Control	0 (0.0%)	0 (0.0%)	4 (20.0%)	1 (5.0%)	0 (0.0%)	0 (0.0%)	5 (25.0%)
	IV	n (%)	Acupuncture	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
			Control	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (10.0%)	0 (0.0%)	0 (0.0%)	2 (10.0%)
	V	n (%)	Acupuncture	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
			Control	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (10.0%)	0 (0.0%)	2 (10.0%)
	VI	n (%)	Acupuncture	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.0%)	1 (5.0%)
			Control	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total		n (%)	Acupuncture	0 (0.0%)	7 (35.0%)	4 (20.0%)	7 (35.0%)	1 (5.0%)	1 (5.0%)	20 (100.0%)
			Control	3 (15.0%)	4 (20.0%)	6 (30.0%)	5 (25.0%)	2 (10.0%)	0 (0.0%)	20 (100.0%)

HB = House–Brackmann; MH = marginal homogeneity.
For acupuncture group, standard MH statistic = 3.528; $p = 0.000$, $p < 0.01$ high statistical significance. For control group, standard MH statistic = 2.50; $p = 0.012$, $p < 0.05$ statistical significance.

Table 6 Evaluation of $HB_{Difference}$ in acupuncture and control groups.

$HB_{Difference}$		Acupuncture group (n = 20)	Control group (n = 20)	Total
0	n (%)	5 (12.5%)	13 (32.5%)	18 (45.0%)
I	n (%)	12 (30.0%)	4 (10.0%)	16 (40.0%)
II	n (%)	2 (5.0%)	3 (7.5%)	5 (12.5%)
III	n (%)	1 (2.5%)	0 (0.0%)	1 (2.5%)
Total	n (%)	20 (50.0%)	20 (50.0%)	40 (100%)

HB = House–Brackmann.

Table 7 Analysis and distribution of categorized $HB_{Difference}$ in both groups.

Categorized $HB_{Difference}$		Acupuncture group (n = 20)	Control group (n = 20)	Total
No change	n (%)	5 (12.5%)	13 (32.5%)	18 (45.0%)
Improvement	n (%)	15 (37.5%)	7 (17.5%)	22 (55.0%)
Total	n (%)	20 (50.0%)	20 (50.0%)	40 (100.0%)

HB = House–Brackmann; SD = standard deviation.
$\chi^2 = 6.495$; SD = 1; $p = 0.011$, $p < 0.05$ statistical significance.

between classes was investigated using weighted kappa ($\kappa_{weighted}$) values [14], and the results are presented in Table 8. Agreement of the kappa values obtained was determined using Altman's table [15].

Kappa analysis of agreement between the SB and HB scores of all patients constituting the acupuncture and control group revealed general agreement between the SB and HB scoring scales of 0.2918 [95% confidence interval (CI): 0.1031- 0.4805], an acceptable value. Weighted agreement between the scales was determined at 0.5062 (95% CI: 0.3788-0.6336), a moderate agreement (Table 8).

3.4. Adverse events

In the acupuncture group, no serious acupuncture treatment–related adverse events (pain, bleeding, bruising, nausea and vomiting, and so on) were observed.

4. Discussion

This study was performed to investigate the effectiveness of acupuncture treatment in Bell's palsy sequelae.

Although the effectiveness of acupuncture in the treatment of facial paralysis has been confirmed by the World Health Organization, its active use in treatment is still controversial [1,2]. Studies concerning the efficacy of acupuncture in the treatment of Bell's palsy are therefore still being performed. In addition, despite criticism of acupuncture treatment in terms of randomization and blinding deficiencies, the majority of the current literature has shown that it is effective in the treatment of Bell's palsy [16].

Because previous studies have reported that acupuncture treatment has a positive effect on facial nerve functioning even long after the onset of facial paralysis and that electroacupuncture is widely used in the treatment of Bell's palsy [4,8], the purpose of our study was to investigate the effects of acupuncture treatment on sequelae of Bell's palsy.

Various topographic and electrophysiological evaluations can be used to determine the prognosis of Bell's palsy and to plan treatment. Electrophysiological tests are widely used to establish both prognosis and treatment protocols [17].

In one study investigating EMG values, acupuncture treatment was applied to a patient with sequelae of 20-year facial paralysis, and analysis of pretreatment and posttreatment EMG signals revealed improvement in facial movements [18]. Another study examined EMG signals before and after acupuncture treatment in a patient diagnosed with Bell's palsy approximately one month previously and reported improved symmetry in facial movements and described acupuncture treatment as effective in Bell's palsy [19].

Comparison of pretreatment and posttreatment CMAP values between and within the acupuncture and control

Table 8 Comparison of $HB_{Pretreatment}$ scores and converted HB scores from $SB_{Pretreatment}$ scores.

$HB_{Pretreatment}$ scores		Converted HB scores from $SB_{Pretreatment}$ scores						Total n (%)
		I n (%)	II n (%)	III n (%)	IV n (%)	V n (%)	VI n (%)	
I	n (%)	0 (0.0%)	1 (2.5%)	2 (5.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (7.5%)
II	n (%)	0 (0.0%)	9 (22.5%)	2 (5.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	11 (27.5%)
III	n (%)	0 (0.0%)	0 (0.0%)	5 (12.5%)	4 (10.0%)	1 (2.5%)	0 (0.0%)	10 (25.0%)
IV	n (%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (2.5%)	5 (12.5%)	6 (15.0%)	12 (30.0%)
V	n (%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (2.5%)	1 (2.5%)	1 (2.5%)	3 (7.5%)
VI	n (%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (2.5%)	1 (2.5%)
Total	n (%)	0 (0.0%)	10 (25.0%)	9 (22.5%)	6 (15.0%)	7 (17.5%)	8 (20.0%)	40 (100.0%)

HB = House–Brackmann; SB = Sunnybrook.
$\kappa_{(general)} = 0.2918$ (95% confidence interval: 0.1031-0.4805) standard $error_{(general)} = 0.0963$; $\kappa_{(weighted)} = 0.5062$ (95% confidence interval: 0.3788-0.6336) standard error $_{(weighted)} = 0.065$.

groups revealed statistically significant changes in pretreatment and posttreatment CMAP values within the acupuncture group ($p < 0.05$, Table 3). There was no significant difference in the pretreatment and posttreatment CMAP values within the control group and between the groups. On the basis of these findings, and in agreement with the previous literature, it may be concluded that acupuncture treatment has a positive healing effect in patients with Bell's palsy sequelae.

Grading scales are frequently used to measure facial nerve functions and to determine the course of healing and effectiveness of treatment. HB and SB are widely used to evaluate facial paralysis in clinical practice [20,21]. HB is the scale most widely used in the evaluation of facial nerve because it is simple and easy to apply. However, its practicality is limited by the fact that it shows only large-scale effects [20-22]. The SB scoring scale assesses paralysis in evaluating symmetry during rest and voluntary movements. This system is sensitive in assessing facial improvement and has been reported to possess high reliability [22]. We, therefore, analyzed agreement between HB and SB in this study.

In one study of the effectiveness of acupuncture treatment in Bell's palsy sequelae, 26 patients with sequelae of Bell's palsy received acupuncture treatment, while other 13 patients with Bell's palsy sequelae were placed on the waiting list without acupuncture, and changes in grading scales were assessed at the end of eight weeks. Significantly better results were reported in terms of the SB scale in the acupuncture group than in the waiting list group. The authors concluded that acupuncture treatment was safe and partially effective in Bell's palsy sequelae [4]. In another study of the effectiveness of acupuncture treatment, 49 patients with Bell's palsy treated with conventional methods but exhibiting no improvement after three weeks received electroacupuncture, and changes in patients' mimetic functions were investigated. At the end of electroacupuncture, facial functions were reported to have returned to normal in all cases, and the authors concluded that electroacupuncture effectively restored the functions of muscles affected by facial paralysis [1].

Changes in facial movements and HB values before and after acupuncture treatment were examined in a patient with chronic Bell's palsy in a previous study. The individual's HB IV before treatment improved to HB III after treatment, and acupuncture was described as effective in improving facial functions even in chronic Bell's palsy [23].

In another study involving a patient diagnosed with Bell's palsy and treated with corticosteroid therapy and antiviral agents but exhibiting no response to treatment after six weeks, the affected side of the face healed completely after acupuncture treatment. The authors concluded that further clinical and electrophysiological studies were needed to demonstrate the effectiveness of acupuncture in Bell's palsy sequelae [9]. Despite a lack of high-quality randomized controlled studies and clinical evidence of the effectiveness of acupuncture in treating Bell's palsy, the results of current research suggest that acupuncture plays an important role and is effective in the treatment of Bell's palsy [6]. One study examined functional connection changes on magnetic resonance images before and after acupuncture treatment in 17 patients with Bell's palsy and 22 healthy controls. The findings showed that acupuncture exhibited therapeutic effects in Bell's palsy [24]. One meta-analysis compared the effectiveness of acupuncture with other therapies in the treatment of Bell's palsy in 14 randomized controlled studies. It concluded that acupuncture treatment was effective in Bell's paralysis but that insufficient evidence was available to support the efficacy and reliability of the technique. It, therefore, concluded that care was needed in interpreting the results [2]. Another study investigated the application of holistic therapy in the treatment of patients with Bell's palsy in a university hospital in Korea. The authors recommended corticosteroid use within 72 h of onset of symptoms and also reported using complementary treatment such as acupuncture and herbal remedies. Although no guidelines currently support the use of acupuncture in the treatment of facial paralysis, the authors emphasized that holistic therapy may and should be used to make good deficiencies in treatment but that more evidence is required on the subject [25].

One study compared the HB and SB grading scales that are frequently used in Bell's palsy by evaluating facial functions. The authors reported that the grading results were generally compatible and that a conversion table for the scales had been obtained. They emphasized the need for a more sensitive facial evaluation system in both clinical practice and in research [13].

Based on the statistical analysis applied to show more pronounced healing in terms of the HB grading scale in patients receiving acupuncture treatment, the level of positive response to healing was statistically significantly higher in the acupuncture group than in the control group ($p < 0.05$, Tables 6 and 7). In addition, agreement analysis of the $SB_{Pretreatment}$ and $HB_{Pretreatment}$ scale scores revealed acceptable general agreement between the SB and HB scales of 0.2918 (95% CI: 0.1031- 0.4805), while weighted agreement between the two scales was determined at 0.5062 (95% CI: 0.3788-0.6336). In other words, patients' $SB_{Pretreatment}$ and $HB_{Pretreatment}$ scale results were partially compatible (Table 8). In terms of agreement analysis, our results are similar to those of the study by Kanerva et al. [13].

This study is important because it provides some positive evidence suggesting the effectiveness of acupuncture treatment on Bell's palsy sequelae.

In conclusion, the essential element in treatment for patients with Bell's palsy is to establish facial symmetry [26]. Acupuncture treatment is a modality used for that purpose. Our study was, therefore, intended to determine the effectiveness of acupuncture treatment in sequelae of Bell's palsy by investigating pretreatment and posttreatment electrophysiological and grading scale variations in patients with Bell's palsy sequelae. The electrophysiological and grading scale results show that acupuncture is effective in the treatment of Bell's palsy sequelae.

We conclude that acupuncture can be used in the treatment of Bell's palsy, concerning how much is still unknown in terms of both etiology and treatment. We think that acupuncture treatment may be regarded as an effective and safe method, particularly in the treatment of patients with persisting Bell's palsy sequelae and can have a positive effect on healing in patients with such sequelae.

Financial support

This study was supported by Karadeniz Technical University Scientific Research Projects Coordination Unit, Turkey (Project ID: 5701).

References

[1] Bokhari SZH, Zahid SS. Acupuncture treatment of facial palsy. J Ayub Med Coll Abbottabad 2010;22:70—3.
[2] Li P, Qui T, Qin C. Efficacy of acupuncture for Bell's palsy: A systematic review and meta-analysis of randomized controlled trials. PLoS One 2015;10:1—14.
[3] Sassi FC, Toledo PN, Mangilli LD, et al. Electromyography and facial paralysis. Applications of EMG in clinical and sports medicine. Available at: http://cdn.intechopen.com/pdfs/25835.pdf [Date accessed: 02 November, 2017].
[4] Kwon HJ, Choi JY, Lee MS, et al. Acupuncture for the sequelae of Bell's palsy: A randomized controlled trial. Trials 2015;16:246—53.
[5] Kwon HJ, Kim JI, Lee MS, et al. Acupuncture for sequelae of Bell's palsy: A randomized controlled trial protocol. Trials 2011;12:71—6.
[6] Wu SH, Tai CJ. Current research in acupuncture treatment for Bell's palsy. J Acupun Tradit Med 2017;1:1—4.
[7] Xia F, Han J, Liu X, et al. Prednisolone and acupuncture in Bell's palsy: Study protocol for a randomized, controlled trial. Trials 2011;12:158—62.
[8] Liu Z, He J, Guo S, et al. Effects of electroacupuncture therapy for Bell's palsy from acute stage: Study protocol for a randomized controlled trial. Trials 2015;16:378—84.
[9] İnanç BB. Bell Palsy and Acupuncture Treatment. J Clin Anal Med 2013;4:426—8.
[10] Hecker HU, Steveling A, Peuker ET, et al. Practice of Acupuncture: Point Location-Techniques-Treatment Options-TCM Basics. 3rd ed. Stuttgart: Thieme; 2006.
[11] Wertsch GJ, Schrecke BD, Küstner P. Akupunkturatlas, Verlagsgesellschaft. WVB Biologisch-Medizinische; 1984.
[12] Lian YL, Chen CY, Hammes M, Kolster BC. In: Ogal Hanhs P, Stör Wolfram, editors. The Seirin Pictorial Atlas of Acupuncture: An illustrated manual of acupuncture points. Cologne: Konemann; 2000.
[13] Kanerva M, Jonsson L, Berg T, et al. Sunnybrook and House-Brackmann systems in 5397 facial gradings. Otolaryngol Head Neck Surg 2011;144:570—4.
[14] Kappa as a measure of concordance in categorical sorting. Available at: http://vassarstats.net/kappa.html [Date accessed: 20 November, 2017].
[15] Altman DG. Practical Statistics for Medical Research. London: Chapman and Hall; 1991. p. 404—7.
[16] Zhao Y, Feng G, Gao Z. Advances in diagnosis and non-surgical treatment of Bell's palsy. J Otol 2015;10:7—12.
[17] Bayındır T, Tan M, Selimoğlu E. Bell paralizisinde tanı ve tedavi yöntemleri. KBB-Forum 2011;10:18—30.
[18] Fabrin S, Soares N, Regalo SCH, et al. The effects of acupuncture on peripheral facial palsy sequelae after 20 years via electromyography. J Acupunct Meridian Stud 2015;8:245—8.
[19] Fabrin S, Esposto DS, Milan MB, et al. Acupuncture technique applied to the facial nerve branches in Bell's palsy. J Neurol Transl Neurosci 2016;4:1064—5.
[20] Pourmomeny AA, Zadmehr H, Hossaini M. Measurement of facial movements with photoshop software during treatment of facial nerve palsy. J Res Med Sci 2011;16:1313—8.
[21] Reitzen SD, Babb JS, Lalwani AK. Significance and reliability of the House-Brackmann grading system for regional facial nerve function. Otolaryngol Head Neck Surg 2009;140:154—8.
[22] Lee HY, Park MS, Byun JY, et al. Agreement between the facial nerve grading system 2.0 and the House-Brackmann grading system in patients with Bell palsy. Clin Exper Otorhinolaryngol 2013;6:135—9.
[23] Wong CL, Wong VCN. Effect of acupuncture in a patient with 7-year-history of Bell's palsy. J Alter Complement Med 2008;14:847—53.
[24] Bian Y, He X, Hu S, et al. Functional connectivity modulation by acupuncture in patients with Bell's palsy. Eviden Based Complement Alter Med 2016;2016:1—10.
[25] Lee SMK, Lee S, Park JH, et al. A close look at an integrative treatment package for Bell's palsy in Korea. Complement Therapies Clin Pract 2017;26:76—83.
[26] Manktelow RT, Zuker RM, Tomat LR. Facial paralysis measurement with a handheld ruler. Plastic Reconstr Surg 2008;121:435—42.