



ARAŞTIRMA / RESEARCH

Clinical and morphometric examination of acupuncture effect in Bell's palsy sequelae

Bell paralizisi sekeline akupunktur etkisinin klinik ve morfometrik incelenmesi

Canan Ertemoğlu Öksüz¹, Ahmet Kalaycıoğlu², Ahmet Yıldırım³, Özlem Uzun¹, Şahi Nur Kalkışım¹, Nihat Burak Zihni⁴, Cavit Boz³

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

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Abstract

Purpose: The aim of present study was to evaluate clinical and morphometric differences and to determine the improvement in facial movements in pre- and post-acupuncture treatments of patients with Bell's palsy sequelae.

Materials and Methods: A total of 40 patients with Bell's palsy sequelae (20 acupuncture group-20 control group) were included in this study. The acupuncture group consisted of Bell's palsy sequelae and scheduled for acupuncture therapy (12 sessions). The control group consisted of Bell's palsy sequelae, being kept on the waiting list. The detailed medical histories were obtained from all patients. Morphometric measurements were performed based on determined anatomical points on both affected and unaffected sides of the faces in resting and smiling positions. At the end of the study clinical evaluations and morphometric measurements were repeated and results were analyzed statistically.

Results: The significant difference was observed in the headache symptoms of the acupuncture group patients in terms of clinical evaluations. In acupuncture group, there was statistically significant difference in pre- and post-treatment values of the affected side in the resting and smiling positions. There were significant changes in clinical symptoms and facial movements in the affected side of the face in the acupuncture group patients.

Conclusion: Acupuncture therapy may be considered to have a significant therapeutic effect on changes in facial movements especially in clinical and morphometric aspects of Bell's palsy sequelae.

Keywords: Bell's palsy, facial paresis, idiopathic facial paralysis, morphometric measurement, facial nerve

Öz

Amaç: Bu çalışma Bell paralizisi sekeli olan hastaların akupunktur tedavisi öncesinde ve sonrasında klinik ve morfometrik farklılıkları değerlendirmek ve fasyal hareketlerdeki iyileşmeyi belirlemek için yapılmıştır.

Gereç ve Yöntem: Bu çalışmaya Bell paralizisi sekeli olan 40 hasta (20 akupunktur grubu-20 kontrol grubu) dahil edildi. Akupunktur grubu Bell paralizisi sekeli olan ve akupunktur tedavisi (12 seans) alacak olan hastalardan oluşturuldu. Kontrol grubu ise Bell paralizisi sekeli olan ve bekletilen hastalardan oluşturuldu. Tüm hastaların detaylı tıbbi öyküleri alındı. Morfometrik ölçümler dinlenme ve gülümseme pozisyonlarında yüzlerin hem etkilenmiş hem de etkilenmemiş taraflarındaki belirlenmiş anatomik noktalara göre uygulandı. Çalışmanın sonunda klinik değerlendirmeler ve morfometrik ölçümler tekrarlandı ve sonuçlar istatistiksel olarak analiz edildi.

Bulgular: Akupunktur grubu hastalarının baş ağrısı semptomlarında klinik değerlendirmeler açısından anlamlı farklılık gözlemlendi. Akupunktur grubunda, dinlenme ve gülümseme pozisyonlarında etkilenmiş tarafın tedavi öncesi ve sonrası değerlerinde istatistiksel olarak anlamlı farklılık vardı. Ayrıca akupunktur grubundaki hastaların yüzün etkilenmiş taraflarındaki klinik semptomlarda ve fasyal hareketlerde önemli değişiklikler vardı.

Sonuç: Akupunktur tedavisinin Bell paralizisi sekelineki fasyal hareketlerin değişiminde özellikle de klinik ve morfometrik açıdan önemli terapötik etkiye sahip olduğu düşünülebilir.

Anahtar kelimeler: Bell paralizisi, fasyal parezi, idiyopatik fasyal paralizi, morfometrik ölçüm, fasyal sinir

Yazışma Adresi/Address for Correspondence: Dr. Canan Ertemoğlu Öksüz, Karadeniz Technical University, Health Sciences Institute, Department of Anatomy, Trabzon, Turkey. E-mail: cananertem61@hotmail.com
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INTRODUCTION

Peripheral facial paralysis (PFP) is caused by peripheral damage to the facial nerve and is one of the main causes of impairment of mimic muscle functions¹. It can have many different causes. However, no cause identified in approximately two-thirds of cases, and these are known as idiopathic PFP, or Bell's palsy^{2,3,4}. Bell's palsy is a peripheral, self-limiting, lower motor neuron paralysis, typically of unknown cause and, acute onset, affecting all muscles in one half of the face^{3,4}.

The treatment of Bell's palsy is controversial, but may include corticosteroids, antiviral drugs, acupuncture and physiotherapy^{3,4}. Acupuncture is a therapeutic modality applied by inserting needles made of gold, silver or steel into specific points on the body^{5,6,7,8}. Since there is insufficient evidence concerning the use of acupuncture in Bell's palsy, its effectiveness is still controversial. The World Health Organization (WHO) states that while acupuncture exhibit a therapeutic effect in Bell's palsy, further evidence is still required. However, recent studies have reported positive results^{3,7,8,9}.

The main objective in the treatment of Bell's palsy is to provide facial symmetry and to restore the ability to smile¹⁰. Acupuncture can also be used as a therapeutic technique for this purpose. This study therefore, investigated clinical and morphometric differences pre- and post- acupuncture treatments in patients with Bell's palsy sequelae.

In this context, the objective of the present study was to demonstrate the therapeutic effect of acupuncture on Bell's palsy sequelae, to contribute to treatment methods and the literature, and to report that acupuncture may be considered a viable therapeutic technique with a positive effect on the healing process in patients with Bell's palsy sequelae.

MATERIALS AND METHODS

This study was carried out by the Karadeniz Technical University (KTU) Faculty of Medicine, Anatomy Department and, Neurology Departments and the Trabzon Acupuncture Center, Trabzon, Turkey. The study group consisted of patients with Bell's palsy sequelae presenting to the Neurology Department. Written informed consent was received from all patients and from the parents of patients aged under 18 before participation. The research

was conducted in line with the WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects.

Approval for the study protocol was obtained from the General Directorate of Health Services of the Turkish Ministry of Health (77979112-020-E.1300) and from the KTU Medical Faculty Scientific Research Ethics Committee (24237859-408).

The study involved 40 patients (22 female, 18 male) aged 15-71 with Bell's palsy sequelae, diagnosed with Bell's palsy three months previously, and who had completed clinical treatment. Patients were randomly assigned into two groups. Participants were numbered based on order of presentation, and these data were entered onto a computer. The first 20 patients represented the acupuncture group and the remaining 20 the control group. The acupuncture group consisted of patients diagnosed with Bell's palsy, with persisting sequelae and scheduled for acupuncture treatment. The control group consisted of patients diagnosed with Bell's palsy, with persisting sequelae but not scheduled for acupuncture treatment, being kept on the waiting list.

Inclusion criteria in the acupuncture and control groups were as follows: diagnosis of Bell's palsy made three months previously, completion of clinical treatment, persisting sequelae, and age 15 years or more. Exclusion criteria were presence of central facial paralysis, peripheral facial paralysis other than Bell's palsy, facial paralysis resulting from causes such as trauma, otitis media and neoplasia, previous receipt of acupuncture treatment for Bell's palsy, past or current malignant tumors, severe conditions requiring medical intervention (e.g. severe hypertension, uncontrolled diabetes, severe neurological or psychiatric disorders, liver or kidney dysfunction, or systemic diseases inappropriate for treatment with acupuncture), pregnancy or lactation.

Intervention

Patients in the acupuncture group were treated with electroacupuncture and Nogier ear acupuncture over 12 sessions (three times per week for - four weeks) at the Trabzon Acupuncture Center. Electroacupuncture therapy was administered using a Hwato SDZ III digital electroacupuncture device, a Schwa-Medico Pointoselect digital DT point detector and disposable, sterilized, stainless steel acupuncture needles (Hua Long sterile

acupuncture needles) of various sizes. Acupuncture was performed by a university professor who was both a medical doctor and an anatomist and also licensed to practice acupuncture by the Turkish

Ministry of Health. Acupuncture was applied with patients in the supine position. The selected electroacupuncture points and regions involved are shown in Table 1.

Table 1. Electroacupuncture points and regions

Electroacupuncture Points	Regions	Electroacupuncture Points	Regions
St 2 (Si Bai)	Affected side of face	Ex-HN3 (Yin Tang)	Midline
St 6 (Jia Che)	Affected side of face	Ex-HN5 (Tai Yang)	Affected side of face
St 4 (Di Cang)	Bilateral of face	LI 4 (He Gu)	Bilateral extremity
St 7 (Xia Guan)	Bilateral of face	LI 10 (Shou San Li)	Bilateral extremity
St 36 (Zu San Li)	Bilateral extremity	GB 14 (Yang Bai)	Bilateral of face
Du 20 (Bai Hui)	Midline	He 7 (Shen Men)	Dominant Extremity
Du 24 (Shen Ting)	Midline	Lv 2 (Xing Jian)	Dominant Extremity
P 5 (Jian Shi)	Dominant extremity	Lv 3 (Tai Chong)	Dominant Extremity
P 6 (Nei Guan)	Dominant extremity	Ren 24 (Cheng Jiang)	Midline
SJ 17 (Yi Feng)	Affected side of face		

During the study period, patients in the control group maintained their daily routines without receiving any other treatment, including herbal remedies.

Assessment

Written informed consent and detailed medical histories were obtained from patients selected in line with the inclusion and exclusion criteria at the time of first admission to hospital. Morphometric measurements were performed based on determined anatomical points on both the affected and unaffected sides of the faces. Patients in the acupuncture group received acupuncture treatment, while those in the control group remained on the acupuncture waiting list. All patients' medical histories and morphometric measurements were repeated at the end of the study. For morphometric measurements, the patients were seated in a chair, looking straight ahead, during the procedures. The patient and the applicator sat face- to- face. Pre- and post- acupuncture treatments measurements were taken first from the affected and then the unaffected sides of the face based on specified anatomical points using, digital caliper (with a measurement capacity of 0-200 mm, 0.01 mm sensitivity) and recorded. Measurements were performed from a fixed point to a mobile point on the face. The points used for morphometric measurements are shown in Table 2.

The digital caliper was first placed on the fixed point and then extended to the mobile point and the distance between the two was measured¹¹. Measurements were performed in both resting and smiling positions. They were repeated three times, and the mean values were recorded in millimeters (mm). Measurements were taken using the same instrument and by the same researcher in order to avoid variability.

Statistical analysis

Statistical analysis was performed on SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA) software. A p-value of <0.05 was considered statistically significant. Mean values and standard deviations of all measured parameters were given, and normal distribution was evaluated using the Shapiro-Wilk test. We used the paired-t test to compare within-group (pre-treatment and post-treatment values) for the variables of TR-CL_{Affected}, LC-CL_{Affected}, MC-AN_{Affected}, TR-CL_{Unaffected}, LC-CL_{Unaffected}, MC-AN_{Unaffected}, TR-CL(IM), LC-CL(IM), MC-AN(IM). Additionally, the independent-t test was used for between-group (control and acupuncture) effects in the same variables. Paresis, skin rash, headache, tinnitus, hearing loss, hyperacusia, dizziness, pain behind ear, ageusia, xerophthalmia, lacrimation and crocodile tears variables which was used to measure patients' clinical symptoms and contains binary outcomes were also analyzed by the Mc-Nemar test.

Table 2. Points used for morphometric measurements

Fixed Points	Mobile Points
Tragus: TR	Commissura Labiorum: CL
Lateral Canthus of the eye: LC	Alae Nasi: AN
Medial Canthus of the eye: MC	

Measured distances on the affected and unaffected sides of the face¹¹ are as follows;

(TR-CL)_{Affected} / (TR-CL)_{Unaffected}: The distance between Tragus and Commissura Labiorum

(LC-CL)_{Affected} / (LC-CL)_{Unaffected}: The distance between Lateral Canthus of the eye and Commissura Labiorum

(MC-AN)_{Affected} / (MC-AN)_{Unaffected}: The distance between Medial Canthus of the eye and Alae Nasi

The following formula was used to determine the incompetence of movement (IM) of each distance measured¹¹:

IM=Affected Side of Face - Unaffected Side of Face / Unaffected Side of Face x 100

RESULTS

Forty patients (22 female, 18 male) with Bell's palsy sequelae aged 15-71 were enrolled in this research.

The mean of age of the acupuncture group patients was 40.15±16.19, and the mean age of the control group patients was 42.70±16.97. The groups' baseline characteristics (sex, side of paresis, and duration of diagnosis) are presented in Table 3.

Table 3. Baseline characteristics of the participants in the groups

		Acupuncture group (n=20)	Control group (n=20)
		n (%)	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%)

Table 4. Evaluation of pre- and post-treatment clinical symptoms of Bell's Palsy in groups

	Acupuncture Group (n=20)			Control Group (n=20)		
	Pre-Treatment n (%)	Post-Treatment n (%)	P-value	Pre-Treatment n (%)	Post-Treatment n (%)	P-value
Paresis	6 (30%)	5 (25%)	1.000	5 (25%)	5 (25%)	1.000
Skin Rash	1 (5%)	1 (5%)	1.000	2 (10%)	2 (10%)	1.000
Headache	8 (40%)	3 (15%)	0.063	8 (40%)	9 (45%)	1.000
Tinnitus	7 (35%)	5 (25%)	0.500	5 (25%)	6 (30%)	1.000
Hearing Loss	4 (20%)	4 (20%)	1.000	3 (15%)	3 (15%)	1.000
Hyperacusia	3 (15%)	2 (10%)	1.000	2 (10%)	2 (10%)	1.000
Dizziness	3 (15%)	2 (10%)	1.000	5 (25%)	5 (25%)	1.000
Pain Behind Ear	5 (25%)	1 (5%)	0.125	9 (45%)	9 (45%)	1.000
Ageusia	7 (35%)	4 (20%)	0.250	7 (35%)	7 (35%)	1.000
Xerophthalmia	10 (50%)	9 (45%)	1.000	11 (55%)	11 (55%)	1.000
Lacrimation	7 (35%)	5 (25%)	0.500	7 (35%)	7 (35%)	1.000
Crocodile Tears	7 (35%)	4 (20%)	0.250	1 (5%)	2 (10%)	1.000

Table 5. Distribution of changes in headache symptoms in groups

	Headache Difference			Total n (%)
	Negative Effect n (%)	No Effect n (%)	Positive Effect n (%)	
Acupuncture Group (n=20)	-	15 (37.5%)	5 (12.5%)	20 (50%)
Control Group (n=20)	1 (2.5%)	19 (47.5%)	-	20 (50%)
Total	1 (2.5%)	34 (85%)	5 (12.5%)	40 (100%)

$\chi^2=6.295$ (Fisher's Exact Test); **P-value=0.047**, P-value<0.05 statistical significance

Table 6. Comparison of pre-treatment and post-treatment morphometric and IM measurements at resting position of acupuncture and control groups

Measurements	Acupuncture Group (n=20) Mean±SD	Control Group (n=20) Mean±SD	P-value
TR-CL _{Affected} / PrT	110.79±6.28	110.79±7.08	0.999
TR-CL _{Affected} / PoT	108.78±5.37	110.66±9.26	0.438
P-value	0.005	0.916	
LC-CL _{Affected} / PrT	74.80±6.65	70.44±6.64	0.045
LC-CL _{Affected} / PoT	72.84±4.43	69.79±6.85	0.103
P-value	0.091	0.681	
MC-AN _{Affected} / PrT	36.41±2.58	37.86±3.45	0.140
MC-AN _{Affected} / PoT	35.95±2.73	36.68±3.06	0.429
P-value	0.601	0.126	
TR-CL _{Unaffected} / PrT	107.59±6.06	110.52±7.24	0.174
TR-CL _{Unaffected} / PoT	107.20±6.52	108.97±8.51	0.466
P-value	0.548	0.038	
LC-CL _{Unaffected} / PrT	70.12±4.56	70.10±5.98	0.990
LC-CL _{Unaffected} / PoT	70.34±6.76	68.12±8.17	0.355
P-value	0.824	0.478	
MC-AN _{Unaffected} / PrT	36.07±2.15	37.74±3.56	0.080
MC-AN _{Unaffected} / PoT	35.84±2.15	36.97±3.08	0.186
P-value	0.665	0.126	
TR-CL(IM) / PrT	1.66±5.64	0.93±4.11	0.645
TR-CL(IM) / PoT	1.43±4.68	1.79±3.97	0.796
P-value	0.839	0.090	
LC-CL(IM) / PrT	4.93±9.81	-0.68±7.07	0.072
LC-CL(IM) / PoT	2.91±8.63	5.13±16.75	0.601
P-value	0.316	0.100	
MC-AN(IM) / PrT	-0.74±5.59	2.57±9.67	0.193
MC-AN(IM) / PoT	0.33±6.72	-0.30±8.62	0.799
P-value	0.569	0.024	

TR: Tragus; CL: Commissura Labiorum; LC: Lateral Canthus of the eye; MC: Medial Canthus of the eye; AN: Alae Nasi; IM: Incompetence of Movement; PrT: Pre-Treatment; PoT: Post-Treatment. P-value<0.05 statistical significance.

Pre-treatment and post-treatment evaluations of 12 different clinical symptoms of Bell's palsy answered in dichotomous form are shown in Table 4. The only statistically significant difference was observed in the headache symptoms of the patients in the acupuncture group. Based on this finding, a new variable (pre-treatment and post-treatment headache difference) was created by subtracting the pre-treatment headache result from the post-treatment result. This variable was analyzed with chi-square test and results are shown in Table 5. In this variable, 1 was coded as "positive effect", 0 as "no effect" and -1 as "negative effect". By meaning the "positive effect", is that patient has headache before the acupuncture treatment but after the acupuncture treatment this symptom was removed. By meaning the "negative effect", is that patient has no headache before the acupuncture treatment but after the acupuncture treatment this symptom was

occured. The existing headache symptoms of five patients who received acupuncture treatment resolved after treatment. In the control group, one patient complained of headache at the second evaluation (post-treatment) but reported no headache at the first. This difference was statistically significant ($p < 0.05$) (Table 5).

Morphometric measurements

Descriptive statistics and comparisons of the morphometric measurements and IM, and pre-treatment and post-treatment measurements of the unaffected and affected sides in the resting position within and between groups are presented in Table 6.

Comparison of morphometric measurements in the resting position in the two groups revealed a statistically significant difference between pre-treatment and post-treatment measurements of the

TR-CL distance in the affected side within the acupuncture group ($p = 0.005$). No significant changes were determined in pre-treatment and post-treatment morphometric measurements in the affected side within the control group patients. A significant difference was determined between the pre-treatment and post-treatment measurements of the TR-CL distance in the unaffected side and MC-AN (IM) within the control group. In addition, there was significant difference in pre-treatment LC-CL distance in the affected side between groups ($p=0.045$). Descriptive statistics and comparisons of the morphometric measurements and IM, and pre-treatment and post-treatment measurements of the unaffected and affected sides in the smiling position within and between groups are presented in Table 7. Comparison of the morphometric measurements taken in the smiling position of the

acupuncture and control groups revealed a significant difference between pre-treatment and post-treatment values for the LC-CL distance in the affected side within the acupuncture group ($p = 0.014$). There were also significant differences in terms of pre-treatment and post-treatment measurement of the TR-CL distance in the affected side of the face within the control group ($p = 0.008$). The comparison of IM measurements in the smiling position of the groups revealed a significant change between pre- and post-treatment TR-CL (IM) and LC-CL (IM) values within the acupuncture group, but no significant change in pre-treatment and post-treatment IM measurements within the control group. In addition, significant differences were determined in pre-treatment and post-treatment of MC-AN distance in the unaffected side between groups ($p=0.037$, $p=0.004$).

Table 7. Comparison of pre-treatment and post-treatment morphometric and IM measurements at smiling position of acupuncture and control groups

Measurements	Acupuncture Group (n=20) Mean±SD	Control Group (n=20) Mean±SD	P-value
TR-CL _{Affected} / PrT	104.61±9.82	105.07±9.33	0.878
TR-CL _{Affected} / PoT	102.35±7.34	103.45±9.76	0.690
P-value	0.263	0.008	
LC-CL _{Affected} / PrT	69.63±7.41	65.17±6.94	0.057
LC-CL _{Affected} / PoT	67.20±6.29	64.65±8.24	0.277
P-value	0.014	0.574	
MC-AN _{Affected} / PrT	34.74±2.65	35.52±3.29	0.414
MC-AN _{Affected} / PoT	34.73±2.73	34.96±2.66	0.787
P-value	0.852	0.337	
TR-CL _{Unaffected} / PrT	97.42±6.75	101.60±9.01	0.105
TR-CL _{Unaffected} / PoT	98.02±7.01	99.97±8.67	0.440
P-value	0.350	0.066	
LC-CL _{Unaffected} / PrT	60.76±5.00	62.08±5.71	0.444
LC-CL _{Unaffected} / PoT	61.64±5.03	60.77±6.16	0.628
P-value	0.158	0.173	
MC-AN _{Unaffected} / PrT	32.67±2.03	34.59±3.38	0.037
MC-AN _{Unaffected} / PoT	33.02±1.65	35.09±2.46	0.004
P-value	0.524	0.523	
TR-CL(IM) / PrT	5.42±10.53	5.82±7.04	0.889
TR-CL(IM) / PoT	2.10±9.80	6.48±8.44	0.138
P-value	0.009	0.410	
LC-CL(IM) / PrT	11.90±14.79	8.60±12.86	0.456
LC-CL(IM) / PoT	6.54±15.55	10.20±14.17	0.442
P-value	0.003	0.265	
MC-AN(IM) / PrT	4.85±8.78	5.01±11.10	0.960
MC-AN(IM) / PoT	2.31±7.61	2.92±9.67	0.827
P-value	0.273	0.226	

TR: Tragus; CL: Commissura Labiorum; LC: Lateral Canthus of the eye; MC: Medial Canthus of the eye; AN: Alae Nasi; IM: Incompetence of Movement; PrT: Pre-Treatment; PoT: Post-Treatment. P-value<0.05 statistical significance.

DISCUSSION

Bell's palsy is a disease with physical, social and psychological effects caused by dysfunction of the facial nerve. Most patients recover spontaneously within three weeks. However, approximately 30% may experience sequelae such as paresis, contracture, facial spasm or synkinesis^{12,13,14}. Symptoms of Bell's palsy sequelae are commonly described as synkinesis, contractures, spasm and crocodile tears syndrome, and are rarely described as tears, taste and hearing disorders¹⁵.

Corticosteroids, antiviral drugs, physiotherapy, Botulinum toxin A, surgery and acupuncture are alternative therapies for Bell's palsy aimed at accelerating the healing process and reducing the risk of complications. Corticosteroids have been shown to be effective in the treatment of Bell's palsy due to their potent anti-inflammatory effects^{4,13}. However, studies have also reported that corticosteroids and antiviral agents are more effective in the acute phase of Bell's palsy¹⁶.

Acupuncture is a low-risk and safe modality in the treatment of various diseases, including Bell's palsy, and no evidence of damages has been reported¹⁷. It is therefore used safely as a complementary therapy in both children and adults^{4,13,16}. The majority of the available literature shows that acupuncture treatment is also effective in the treatment of Bell's palsy¹⁸.

Comparison pre-treatment and post-treatment clinical symptoms of groups in this study revealed no change in the rate of clinical symptoms within the control group, but changes were observed within the acupuncture group. Our research is compatible with Yaltrık et al.'s study of the effects of electrical stimulation in the treatment of Bell's palsy in terms of changes in the prevalence of crocodile tear syndrome¹⁹. We also observed a statistically significant difference between pre-treatment and post-treatment headache symptoms within the acupuncture group ($p < 0.05$, Table 4 and Table 5, respectively). This suggests that there is a greater probability of a decrease in headache symptoms in patients receiving acupuncture therapy than in the control group. Based on these results, it may be concluded that acupuncture therapy has an ameliorative effect on the clinical symptoms of Bell's palsy. In a clinical pilot study compared traditional and combined acupuncture for treating headache and retro-auricular pain in facial

palsy. It concluded that acupuncture treatment, whether traditional or combined, was effective to reduce headache and retro-auricular pain in facial palsy and also there was no difference between traditional and combined groups²⁰. Our research is compatible with Ahn et al.'s research of the effects of acupuncture treatment in facial palsy in terms of changes in headache and retro-auricular pain²⁰.

In one study comparing acupuncture with conservative therapy, it was reported that acupuncture treatment resulted in a shorter time and in a higher rate of recovery²¹. Another study examined clinical efficacy of thread-embedding acupuncture in fifty-six patients with Bell's palsy sequelae. The authors concluded that thread-embedding acupuncture was effective and safe in treatment of Bell's palsy sequelae¹⁵. One study examined functional magnetic resonance images to investigate the effect of acupuncture on the functional connectivity of the brain in 28 patients with Bell's palsy and 20 healthy controls. The results showed that the effect of acupuncture treatment stimulated significant connectivity changes in Bell's palsy patients²².

For all interested in facial palsy reconstruction, it is essential to evaluate the facial movements including distance and direction. The authors developed facial measurement systems that provide simple, time-consuming, meaningful and accurate measurement^{23,24}. The most important aim of treatment for patients with facial paralysis is to provide facial symmetry and to restore the ability to smile. Morphometric measurement techniques are used to evaluate this. However, there are no generally agreed and widely used measurement techniques. Simple techniques can be used to measure changes in facial movements and symmetry pre-treatment and post-treatment¹⁰.

Comparisons of morphometric measurements performed in the resting position in the present study indicated that while there was a significant change in the pre-treatment and post-treatment morphometric measurements of the affected side within the acupuncture group and between groups, no significant change occurred in the affected side within the control group. A significant change in morphometric measurements was only observed in the unaffected sides of control group patients ($p < 0.05$, Table 6). In addition, there was significant difference in the affected side between groups (Table 6).

When the morphometric measurements from the acupuncture and control group patients in the smiling position were compared, while a significant change was determined between pre-treatment and post-treatment values in the affected sides within the acupuncture and control groups, no significant change occurred in the unaffected sides ($p < 0.05$, Table 7). A significant change in IM was observed in acupuncture group patients and there was significant difference in the unaffected side between groups (Table 7).

The results of the present study indicated similar trends to those of earlier reports in terms of morphometric measurements of facial movements. Previous studies have reported statistically significant improvements in facial movements in patients with Bell's palsy^{10,11,25,26}. To summarize, although there was a significant change in facial movements in the affected side of the face in the acupuncture group, no significant change occurred in the affected side in the control group. Acupuncture therapy may therefore be considered to have a positive effect on changes in facial movements in Bell's palsy sequelae.

Since only 10-15% of patients with Bell's palsy experience sequelae, and since the disease is not common in our region, we were unable to enroll a large patient group. Times to diagnosis of Bell's palsy were therefore dissimilar between the groups. In addition, the acupuncture group could not be blinded due to the therapy received.

The clinical and morphometric results of this research suggest that acupuncture therapy has a beneficial effect on Bell's palsy sequelae. Although the etiology and treatment of Bell's palsy, which is frequently encountered in the clinical setting, are still uncertain, the condition can be improved with acupuncture. We conclude that acupuncture therapy may be regarded as an effective and reliable method, especially in the treatment of Bell's palsy, and may contribute to patient recovery by assisting that treatment.

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