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The Effects of Symmetrical Self-performed Facial Muscle Exercises on the Neuromuscular Facilitation of Patients with Facial Palsy

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Abstract. [Purpose] The present study was designed to evaluate the effect of symmetric self-performed facial muscle exercises on the facial muscle function of patients with facial palsy. [Subjects] The subjects were 26 persons (men=12, women=14) who suffered from facial palsy and were treated by western-oriental medical treatment. [Methods] We educated patients to conduct symmetric self-performed facial muscle exercises three times per day for four weeks by themselves to facilitate neuromuscular function. We evaluated them before and after the exercise period using Yanagihara's Unweighted Grading System and the House-Brackmann Grading System. [Results] After 4 weeks' symmetric self-performed facial muscle exercises, patients showed a significant improvement in facial palsy. The control group also showed a significant improvement. According to both Yanagihara's Unweighted Grading System and the House-Brackmann Grading System, the intervention group showed a greater improvement of scores than the control group. [Conclusion] These results suggest that adding symmetric self-performed facial muscle exercises to the western-oriental medical treatment is a more effective treatment than western-oriental medical treatment alone for recovery from facial palsy.
Key words: Facial palsy, Symmetric self-performed facial muscle exercises, Neuromuscular facilitation

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INTRODUCTION

Facial palsy (FP) also generally called Bell's palsy is a peripheral neurological disease that causes unilateral facial muscle paralysis due to disorder of cranial nerves such as the trigeminal (CNV), vestibulocochlear (CNVIII), or glossopharyngeal (CNIX) nerve[1,2)]. It has a wide range of causes including trauma, infection, neoplasm, and congenital and metabolic factors[3,4)]. Diabetes, hypertension, arteriosclerosis, infection, sarcoidosis, parotid-nerve tumors, eclampsia, and amyloidosis can also contribute to the onset of FP[5,6)]. FP occurs in 15–30 out of 100,000 persons[5,7)] of any age, but commonly between the ages of 30 and 70. Both sides and sexes are equally afflicted with FP[2)]. According to Peitersen[8)], 85% of patients recover facial function within 3 weeks and 15% recover within 3–5 months. As for sequelae of the disease, 71% of patients regain normal function, however, 29% retain slight (12%), mild (13%), or severe (4%) paralysis. FP patients have difficulty with facial functions such as closing the eyes, eating, drinking, speaking, and performing activities for oral hygiene. Besides, marked disfigurement of the face even at rest usually is a major influence on the patients' psychosocial well-being, and personal or social interactions. Symmetric self-performed facial muscle exercises (SSFEs) have been used in the rehabilitation of FP to regain symmetric facial movement and to reduce or eliminate functional problems. Because patients use a mirror to watch their face, they can easily monitor their movements and are aware of the difference between where they intend to contract and where the movement occurs. Patients can concentrate on targeted facial muscles selectively and correct movement patterns without associated movement during SSFEs[9)]. In addition, patients can conduct SSFEs at anytime and anywhere without cost. Recently, the facial muscle exercises of patients with FP have been vigorously investigated in the field of medical therapy, western-oriental medical therapy, electrotherapy, and physical therapy[10,11)]. However, studies which have shown the efficacy of SSFEs are still rare. Therefore, we prescribed SSFEs for patients with FP, and investigate the effect of SSFEs on facial function. To evaluate facial function, we used Yanagihara's Unweighted Grading System (Y-system) and the House-Brackmann Grading System (HB-system). The Y-system

Table 1. General characteristics of participants

Group	Age[a]	Sex(n)	Time lag of FP onset[a] (d)	Side of involvement
Control	49.21 ± 13.60	M=4 F=10	1.36 ± 0.50	L=3 R=11
SSFEs	46.25 ± 15.78	M=8 F=4	1.42 ± 0.51	L=4 R=8

[a], mean ± standard deviation; M, male; F, female; L, left; R, right

assesses the level of paralysis in the different situations, whereas the HB-system focuses on facial movement as a whole[12].

SUBJECTS AND METHODS

Twenty-six (men=12, women=14) FP patients who were being treated with western-oriental medical therapy participated in this study (Table 1). They received written and verbal explanations about the purposes and procedures of the study. All of the participants gave us their written consent before the start of the experimental procedures. Patients were divided into two groups (SSFE group=12, control group=14). The control group were treated with western-oriental medical therapy only. The SSFEs group were educated and guided by a skillful physical therapist on how to perform SSFEs in front of a mirror. We instructed them to conduct SSFEs without the voluntary movement of the uninvolved side to avoid distortion of the movement. A resistance was applied only to the isolated movement without causing mass action or synkinesis. By using a mirror during SSFEs, patients could get the visual feedback. When patients needed it, strapping was applied to the face to maintain the symmetry of the face. We encouraged the patients to continue SSFEs and checked at their homes or at their workplaces regularly. Patients exercised three times per a day, every day for four weeks. Using the Y-system and the HB-system, the most widely used assessments of facial nerve function in FP, and acoustic neuroma surgery and others[12–14] (Table 2, 3), we assessed patients' facial functions twice, once before and once after the 4 weeks of intervention. We analyzed the data using Wilcoxon's signed rank test and the Mann-Whitney U Test to compare the Y-system and the HB-system scores at baseline with those after the 4 week intervention and to evaluate differences between groups, sex, and sides of involvement. Possible correlations between the Y-system and the HB-system were determined by Pearson correlation coefficients. SPSS for Windows (version 12.0) was used for the analysis in this study. The protocol for the study was approved by the Committee of Ethics in Research of the University of Yongin, in accordance with the terms of Resolution 5-1-20, December 2006.

RESULTS

We enrolled 26 patients (men=12, women=14) in our study. The demographic data of the patients are given in Table 1. Aged subjects (47.8 ± 14.4) participated in this study. Seven subjects had FP on the left, and 19 on the right. After 4 weeks, patients showed a significant improvement of FP in both groups. According to the Y-system, both groups showed a significant increase of scores (Table 4). The HB-system scores also showed a significant decrease in both groups (Table 4). The change of scores in the SSFEs group between baseline and after 4 weeks was greater than the change in the control group (Table 5). We also analyzed the difference in scores between the Y-system and the HB-system according to age, sex, and paralyzed side (Table 6). As for age, patients in their 30–40's showed the most improved results, though all ages showed a significant difference ($p<0.05$). Both men and women showed a significant improvement. Men scored 12.42 ± 2.75 to 34.08 ± 4.23 ($p<0.01$) on the Y-system and 4.17 ± 0.58 to 1.92 ± 0.90 on the HB-system ($p<0.01$). Women scored 12.21 ± 7.20 to 29.29 ± 7.32 ($p<0.01$) on the Y-system and 4.00 ± 0.88 to 2.07 ± 0.83 ($p<0.01$) on the HB-system. FP on the right side showed greater improvement on the Y-system (12.95 ± 5.97 to 30.89 ± 7.13 $p<0.001$) and the HB-system (4.11 ± 0.81 to 2.21 ± 0.79 $p<0.001$) than the left side on the Y-system (10.57 ± 3.82 to 33.14 ± 4.10 $p<0.05$) and the HB-system (4.00 ± 0.58 to 1.43 ± 0.79 $p<0.05$), though both sides showed significant difference after the 4-week intervention program. Pearson's correlation coefficient for the Y-system and the HB-system was –0.854 ($p<0.001$). There was a high correlation between the Y-system and the HB-system.

DISCUSSION

This is the first study to examine the effect of SSFEs on FP patients receiving western-oriental medical treatment. Our patients showed a significant improvement after 4 weeks' SSFEs, a result that strongly supports the efficacy of SSFEs for FP patients. Also the scores of the Y-system were highly correlated with those of the HB-system ($r=–0.854$ $p<0.001$) as previously reported[12]. When considering improvement including incomplete recovery, both the SSFEs group and the control group showed significant change in scores of FP evaluations in this study ($p<0.01$). However, for complete recovery, approximately 42% of patients in the SSFEs group scored normal on the HB-system and approximately 67% scored over 35 points on the Y-system, while in the control group only 28% obtained a normal grade on the HB-system and were over 35 points on the Y-system. Also, the change in scores were significantly greater for the SSFEs group than for the controls (HB-system $p<0.01$, Y system $p<0.05$). Hence, the improvement

Table 2. Yanagihara's unweighted grading system

	Scale of five rating				
	total paralysis	severe paralysis	moderate paralysis	slight paralysis	normal
At rest	0	1	2	3	4
Wrinkle forehaed	0	1	2	3	4
Wrinkle nasal root	0	1	2	3	4
Closure of eye lightly	0	1	2	3	4
Closure of eye tightly	0	1	2	3	4
Closure of eye on the involved side only	0	1	2	3	4
Blowing out cheeks	0	1	2	3	4
Whistle	0	1	2	3	4
Grin	0	1	2	3	4
Depress lower lip	0	1	2	3	4

Table 3. The House-Brackmann grading system

Grade	Description	Characteristics
I	Normal	Normal facial function in all areas
II	Mild dysfunction	Gross: slight weakness noticeable on close inspection, may have very slight synkinesis At rest: normal symmetry and tone Motion: forehead - moderate to good function, eye - complete closure with minimum effort, mouth-slight asymmetry
III	Moderate dysfunction	Gross: obvious but not disfiguring difference between the two sides; contracture and/or hemifacial spasm At rest: normal asymmetry and tone Motion: forehead - slight to moderate movement. eye - complete closure with effort mouth-slightly weak with maximum effort
IV	Moderately severe dysfunction	Gross: obvious weakness and/or disfiguring asymmetry At rest: normal asymmetry and tone Motion: forehead-none eye - incomplete closure mouth-asymmetric with maximum effort
V	Severe dysfunction	Gross: only barely perceptible motion At rest: asymmetry Motion: forehead - none eye - incomplete closure mouth - slight movement
VI	Total paralysis	No movement

Table 4. Recovery on the Y-system and the HB-system

	Group	Baseline[a]	After 4 weeks[a]
Y-system	Control	13.43 ± 6.71	29.71 ± 5.81**
	SSFEs	11.00 ± 3.49	33.58 ± 6.79**
HB-system	Control	3.79 ± 0.70	2.14 ± 0.86**
	SSFEs	4.42 ± 0.67	1.83 ± 0.83**

[a], mean ± standard deviation; **, $p<0.01$.

Table 5. Score change between groups on the Y-system and the HB-system

	SSFEs group[a]	Control group[a]
Y-system	22.58 ± 5.21	16.29 ± 6.11**
HB-system	–2.58 ± 0.79	–1.64 ± 1.15*

[a], mean ± standard deviation; *, $p<0.05$; **, $p<0.01$.

Table 6. Recovery on the Y-system and the HB-system according to age

	age	Baseline[a]	After 4 weeks[a]
Y-system	10–30s	14.25 ± 6.92	33.88 ± 4.16*
	40–50s	11.55 ± 3.88	31.18 ± 7.33**
	60–70s	11.29 ± 6.16	29.29 ± 7.11*
HB-system	10–30s	4.00 ± 0.93	2.25 ± 0.89*
	40–50s	4.18 ± 0.60	1.73 ± 0.79**
	60–70s	4.00 ± 0.82	2.14 ± 0.90*

[a], mean ± standard deviation; *, $p<0.05$; **, $p<0.01$.

of FP in the SSFEs group was greater than that in the control group. According to previous studies investigating the effect of conventional western medicine by electrical treatment and massage on FP, electrotherapy and massage showed a significant effect on the recovery of FP[15,16]. In one study, the facial grading scale changed from 32 to 54.5 points after three months, but the education of selective facial muscle functions resulted in a better score improvement from 33 to 66 points[15]. These results suggest that facial muscle training is more effective than electrotherapy or massage. Our results, showing greater recovery of FP by SSFEs than by western-oriental medical treatment only, are in accordance with this. In addition, facial muscle education is more effective in terms of time and cost. Danielidis et al.[17] studied the age-related recovery of FP in 250 patients. Complete recovery was seen in 79% of teenagers, 83% in their 20s, and 82% in their 30s. The recovery rate of facial muscle functions decreased as age increased with those in their 40s, 50s, 60s, and 70s showing recovery rates of 74%, 68%, 60%, and 54%, respectively. Considering the age of the patients in this study, it could be expected that they would show quite a high recovery rate, approximately 80–60%. Cha et al.[18] reported that adults between 46 to 60 years old had the highest recovery rate, 90.8%, in their study. In this study, those in their 40–50s showed the highest recovery rate and it was followed by those in their 10–30s and the 60–70s age group. FP needs early treatment to have an optimal effect on the prognosis. Early treatment within one week after onset leads to complete recovery in 88% of patients, and treatment within 2 weeks and within 2–3 weeks leads to complete recovery in 83% and 61% of cases, respectively[15]. Our early start of treatment within 1 week after onset of FP might have led to a better prognosis for facial muscles function. Recovery from FP typically starts 2–3 weeks after onset and 71% of patients completely recover within 2–3 months[8]. As all participants in the present study started early treatment 1–2 days after onset, we assumed that they would show optimal prognosis and recovery. In our study, we made evaluations at baseline and after 4 weeks of intervention. Based on related previous studies about self-performed facial exercise, it may be possible to assume a long-term effect of SSFEs after onset. Some researchers taught self-performed facial muscle exercise to subjects with FP and encouraged them to exercise regularly as a home program[11,17]. Participants who conducted self-performed facial exercise showed a greater improvement than those who did not. Interestingly, participants in Beurskens and Heymans' study[11] also showed a significant improvement even when they were chronic cases, suggesting that a structured home program including SSFEs could greatly contribute to the clinical efficacy of treatments for patients with FP. According to Finsterer[19], approximately 15% of FP patients experience permanent neurological damage, and 5% suffer from a serious complication. One patient in the present study who had facial surgery did not completely recover facial muscle function. A previous study reported that early treatment can lead to almost complete recovery even in severe cases[20], and the patient's recovery was sufficient enough for her to be content with her facial muscle function from an aesthetic aspect. In another study, 22% of FP patients who were receiving corticosteroids showed incomplete recovery, while 26% of patients without medication showed incomplete recovery after 6 months[21]. This result implies that steroid medication may not be effective for FP. A previous study[22] divided face area into three parts horizontally centered on the eyes, nose, and mouth, then used the proprioceptive neuromuscular facilitation method including stretching, maximum resistance, and verbal stimuli for each part. After 15 days, 20% of the control group scored a normal grade and 22% of the treatment group scored a normal grade on the HB-system. In the present study, 4 out of 14 in control group scored a normal grade on the HB-system and 5 out of 12 in the SSFEs group scored a normal grade after 4 weeks of intervention. As for the Y-system, 4 out of 14 in the control group and 8 out of 12 in the SSFEs group obtained ≥35 points (total score=40). Considering these results and the features of the Y-system and the HB system, it is evident that SSFEs were more effective for selective muscle functions. In particular, a SSFEs program has an advantage over the general proprioceptive neuromuscular facilitation method in that a SSFEs program can be conducted at anytime and anywhere without cost and the help of a therapist. Li et al.[23] investigated the effect of western medical therapy using prednisone, vitamin B1, vitamin B12, and dibazole, and oriental medical therapy using acupuncture and moxibustion, and combined treatment on FP. After 4 weeks, 28.1%, 41%, and 31% of patients in the respective groups had completely recovered. In our study, we compared a SSFEs group with a control group receiving western-oriental medical therapy only. According to our results, adding SSFEs to western-oriental medical therapy enhanced recovery of facial muscle functions. In summary, in the present study, patients with FP were treated with western-oriental medical therapy and SSFEs and the effect on their facial muscle function was evaluated. SSFEs were beneficial to the recovery of facial muscle function of the FP patients. In future studies, various forms of exercise of facial expression muscles to promote facial muscle functions will be need to be investigated.

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