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Research Article

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Effects of Sympathetic Conversation on Electroencephalogram, Stress, Anxiety-Depression, and Muscle Tone in Chronic Stroke Patients*

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| Abstract |

PURPOSE: This study was conducted to identify the effects of sympathetic conversation on stress, anxiety and depression, and muscle tone in chronic stroke patients.
METHODS: Patients were randomly assigned to either an experimental group (EG, n=7) or control group (CG, n=7). Both groups participated in a pretest before intervention. Subjects were asked to undergo: 1) electroencephalogram, 2) Stress Response Inventory, 3) Hospital Anxiety and Depression Scale, 4) muscle tone and stiffness testing. After the pretest, EG received sympathetic conversation and CG received a simple explanation about stroke recovery and rehabilitation. Following the intervention, both groups were immediately administered a post test.
RESULTS: In EG, the electroencephalogram relative alpha power was significantly increased ($p<.05$), while the electroencephalogram relative gamma power was significantly decreased ($p<.05$). The Stress Response Inventory and Hospital Anxiety and Depression Scale scores decreased significantly in both groups ($p<.05$). In addition, muscle tone and stiffness decreased significantly in the EG ($p<.05$)
CONCLUSION: The results of the present study indicate that sympathetic conversation had a positive effect on stress, anxiety and depression, and muscle tone in patients with chronic stroke. Therefore, sympathetic conversation could be used to improve not only psychological problems in chronic stroke patients including stress and anxiety, but also physical conditions including muscle tone.

Key Words: Conversation, Electroencephalogram, Sympathetic, Stroke

Ⅰ. Introduction

The stroke incidence rate is increasing as the average life span and aging population increase (Lee, 2014; Rosenberg and Popelka, 2000). Stroke is a major cause of severe chronic disabilities (Kwon et al., 2016), and stroke patients require continuous long-term medical care and rehabilitation (Hu et al., 2009). Stroke rehabilitation

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methods consist of physical and psychological management (Törnbom et al., 2017). Physical management techniques include physical impairment care (Park and Lee, 2006; Roh, 2002), increasing functional ability (Madden et al., 2006; Seo, 2003), and improving activity of daily living (Park and Shin, 2010). In addition, it has been reported that community ambulation training has a positive effect on walking ability and depression in patients with chronic stroke (Kim et al., 2018). Methods of psychological management include increasing motivation (Kwon, 2003), reducing depression and stress (Kim et al., 2000; Moon and Cho, 2011), and improving quality of life (Jaracz and Kozubski, 2003; Kwok et al., 2006).

Recently, many studies have focused on not only physical function, but also psychological problems in patients with stroke (Carod-Artal and Egido, 2009; Kneebone and Dunmore, 2000; Laures-Gore and DeFife, 2013). This is because psychological factors greatly influence physical and functional activity (Geisser et al., 2003). Previous studies suggested that positive emotions have a major influence on functional capacity that can be measured by testing lifting, postural tolerance, and repetitive movement (Asante et al., 2007; Lakke et al., 2012). Other previous studies reported that negative emotions decreased muscle strength, and could have negative effects on physical function (Geisser et al., 2003; Papciak and Feuerstein, 1991; Robinson et al., 1992). In addition, it has been reported that emotional stimulation influences synaptic plasticity of the brain and descending tracts from the brain (LaLumiere et al., 2017).

A previous investigation also revealed that psychological stress influences augmentation of the upper trapezius, which is known to be altered by stress and psychological change (Sahrmann, 2002; Marker et al., 2016). Stroke often results in impairments of the upper extremities, including hand and finger function (Ranganathan, 2017). Because hand function is important to performing activities, recovery of hand function and skills is a major rehabilitation and health care challenge in stroke patients (Franck et al., 2017).

During the past few decades, many studies have identified a variety of brain waves by using electroencephalogram (EEG). Specifically, EEG enables researchers to observe frequency (α, β, θ, γ, δ), amplitude, and phase. By using EEG, researchers can identify a subject's emotional changes and mental reactions. In the EEG, the α-wave (8–13 Hz) indicates psychological relaxation and stable state, while the γ-wave (30–50 Hz) shows a stress state or nervous situation in adults. Moreover, the β-wave (13–30 Hz) indicates a psychologically excited condition or conscious behavior, while the θ-wave (4–8 Hz) indicates sleeping or meditation and the δ-wave (.1–4 Hz) shows pathological conditions such as brain tumors or epilepsy in normal adults. When a person feels happiness, pleasure or comfort, the α-wave increases, indicating a stable state. In contrast, when a person feels negative emotions or experiences stress, the α-wave in decreased (Hwang, 2012; Kim, 2001). The α -wave indicates “no stress” and “feeling happy” (Kwon, 2011). There have been studies related to emotion, relaxation and awareness, concentration, and cognition conducted using the characteristics of the α-wave (Kim, 2000; Kim, 2004; Lee, 2003). Additionally, the γ-wave is known to be increased under anxiety, nervous, or stress conditions (Kwon, 2008).

Conversation is important to psychological and emotional management because it enables formation of a good relationship (Hwang, 2012). It is well known that medical communication skills and communication patterns have important effects on quality of healthcare, patient perceptions, and clinical outcomes (Parry, 2008). In the hospital, therapists communicate with patients, which could be used as a part of treatment (Kim, 2014). Indeed, appropriate conversation has a positive effect on treatment satisfaction (Kim, 2014; Im et al., 2009), and the structure of conversation has been a central interest of scholars in several research traditions (Okamoto et al., 2002).

Sympathetic conversation is a conversational method that respects the personality and life of the patient. In sympathetic conversation, one receptively accepts the person's idea, and deeply understands their thoughts and emotions. Sympathetic conversation is an active communication skill in which emotional empathy and reaction is important (Choi, 2016; Jung, 2006). Choi (2016) studied the effects of sympathetic conversation on psychological factors in the elderly and found that it improved depression and positive emotions.

Sympathetic conversation is a communication method related to emotional empathy and reaction. Many previous studies have reported that in addition to physical problems, psychological and emotional factors are important to the rehabilitation of stroke patients, and communication with therapists is considered an important part of psychological care and clinical outcomes. However, no studies have investigated the effects of conversation on psychological factors or physical factors in stroke patients. Therefore, this study was conducted to identify the effects of sympathetic conversation on stress, anxiety and depression, muscle strength, and muscle tone in patients with chronic stroke.

Ⅱ. Methods

1. Subjects

A total of 14 chronic stroke patients who voluntarily agreed to this experiment were included in this study. Prior to the start of the study, all subjects understood its content and signed an informed consent form. This study complied with the ethical standards of the declaration of Helsinki, and was approved by the ethical committee of Daegu University (1040621-201707-HR-012-02). Subjects of this study were required to meet the following inclusion criteria. 1) Stress Response Inventory Score >50, 2) Hospital Anxiety and Depression Scale >15, 3) chronic stroke patients hospitalized for >6 months (Colomer et al., 2016), 4) Mini-Mental State Examination-Korean version (MMSE-K) scores of >26 (Go and Lee, 2016), 5) no increase or slight increase in muscle tone as defined by a Modified Ashworth Scale (MAS) score <3 on the paretic side (Colomer et al., 2016), 6) no musculoskeletal impairment of the upper extremities, 7) onset time > 1 year, 8) able to sufficiently participate in conversation. People were excluded from the study if they had other neurological conditions in addition to stroke, unstable cardiovascular disease, or other serious diseases that precluded participation (Pang et al., 2007).

2. Experimental procedure

This study employed a pre- and post-test design. Each subject was randomly assigned to either the experimental group (n=7) or control group (n=7). For randomization, sealed envelopes were prepared in advance and marked inside with A or B, indicating the experimental group or the control group, respectively. After assigning subjects to each group, the subjects agreed to participate in the experiment. In this study, the intervention and every test were performed in one day. The intervention was provided from 6 pm to 8 pm. Prior to the intervention, both groups participated in a pretest in the 90° chair sitting position. After both groups completed the pretest, the subjects included in the experimental group received sympathetic conversation in the sitting position with the same therapist for 3 min. Subjects included in the control group received a simple explanation about recovery from stroke and rehabilitation management in the sitting position for 3 min. Following the intervention, both groups immediately took a posttest in the 90° chair sitting position. The study flowchart is shown Fig. 1.

3. Intervention

The subjects who were included in experimental group received sympathetic conversation. This study basically followed sympathetic conversation form 1, which is a part

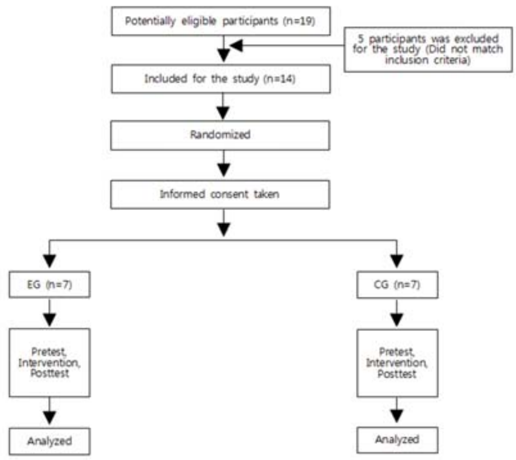

Fig. 1. Study flowchart
EG : sympathetic conversation
CG : simple explanation of stroke recovery and rehabilitation

Current mood	Positive	Researcher	You look like you are in good mood today.
		Subject	(answer)
		Researcher	So you feel great. I'm also happy.
		Subject	(answer)
	Negative	Researcher	You look down. Is anything the matter?
		Subject	(answer)
		Researcher	That's why you look so down. I'm sad to hear that.
		Subject	(answer)
Sleep	Positive	Researcher	Did you sleep well?
		Subject	(answer)
		Researcher	So you are in good condition.
		Subject	(answer)
	Negative	Researcher	Did you sleep well?
		Subject	(answer)
		Researcher	You didn't sleep very well last night. So you feel tried.
		Subject	(answer)
Meal	Positive	Researcher	Did you eat?
		Subject	(answer)
		Researcher	I'm happy to hear that.
		Subject	(answer)
	Negative	Researcher	Did you eat?
		Subject	(answer)
		Researcher	So you didn't eat meal. Would you want something to eat?
		Subject	(answer)
Hospital life	Positive	Researcher	How was your day today?
		Subject	(answer)
		Researcher	I'm happy to hear that. Being in a good mood is good for health.
		Subject	(answer)
	Negative	Researcher	How was your day today?
		Subject	(answer)
		Researcher	That's why you was upset. I'm sorry to hear that.
		Subject	(answer)

Fig. 2. Sympathetic conversation

of the sympathetic conversation program suggested by Choi (2016). The original sympathetic conversation program consisted of three parts morning, afternoon, and night (Choi, 2016). In the present study, current mood, sleep, meal, and hospital life were included in conversation in sequence for 3 min (Fig. 2). Subjects received sympathetic conversation with same therapist in a room without noise. The subjects who were included in the control group received a simple explanation of the recovery from stroke and rehabilitation management (O'Sullivan et al., 2013).

4. Measurement

All measurements were performed before and after the intervention. Every measurement proceeded in a room without noise and subjects were kept in a sitting position during measurement.

1) Brainwave change

Electroencephalogram signals were acquired using a four-channel EEG system (LXE3204, LAXTHA Inc., Korea) to see the brainwave change. After electrodes were placed on the subjects' heads, EEG signals were recorded from each channel through the EEG cable (LXEJ104, LAXTHA Inc., Korea) over 50 seconds. The EEG record was started when the stable wave lasted for 10 seconds without artifacts (Kwon, 2008). This study used data for 30 seconds between 10 seconds and 40 seconds after start of the recording. The EEG was measured in a room without noise while body movements were restricted. To obtain accurate results, carbonated and caffeinated drinks were restricted before the test (Hur, 2015). The area to which the electrodes were attached was cleaned with alcohol to minimize skin resistance (Kwon, 2008). Electrodes were attached to the head using the ten-twenty electrode system of the International Federation. The EEG system was equipped with four electrodes placed at the following positions related to stress areas: Fp1, Fp2, F3, F4 (Kwon, 2011). Electrodes were also attached to the mastoids (A1 + A2) as a reference (Al-Shargie et al., 2017) according to the international 10-20 system (Koessler et al., 2009). The system employed disc electrodes attached to the head using conductive EEG paste (ElefixZ-Z401CE, NIHON KOHDEN, Japan).

The sampling frequency was 256 Hz and the band pass filter was 4–50 Hz. Measured data were analyzed using TeleScan (Ver. 3.27, LAXTHA Inc.). This study only used α-waves and γ-waves from the extracted data. All frequencies between 4 Hz and 50 Hz represented 1.00 (100%), and α-waves and γ-waves were calculated based on the relative power of the selecting frequency (α-wave 8–13Hz, γ-wave 30–50 Hz) to the total frequency. The α-wave (8–13 Hz) indicates psychological relaxation and stable condition, while the γ-wave (30–50 Hz) indicates stress condition or nervous situation. The relative power is the relative percentage of the selected frequency. Upon EEG measurement, the absolute power can be changed greatly by variations in amplitude caused by subject skin and electrodes; therefore, this study used the relative power.

2) Stress Response Inventory

The Stress Response Inventory developed by Koh et al. (2000) measures reactions to emotional, physical, cognitive, and behavioral stress. The test-retest reliability of the Stress Response Inventory is high, ranging from .69 to .96. Accordingly, the Stress Response Inventory can be utilized as an effective measure of stress for research in stress-related fields (Koh et al., 2001). This scale consists of a total of 39 response items under seven subscales (Tension, Aggression, Somatization, Anger, Depression, Fatigue, Frustration). Moreover, there are six items under the tension subscale, four under the aggression subscale, three under the somatization subscale, six under the anger subscale, eight under the depression subscale, five under the fatigue subscale, and seven under the frustration subscale. Of the total items, eight were emotional types of responses, 11 were somatic, eight were cognitive, nine were behavioral, and three consisted of a mixture of cognitive and emotional elements. Of the eight response items of the cognitive type, four were under the depression subscale, two were under frustration, one was under tension, and one was under the fatigue subscale (Koh et al., 2001). The Stress Response Inventory is based on a 5-point scale in a Likert-type format with the following values: ‘Not at all’ (0 points), ‘Somewhat’ (1 point), ‘Moderately’ (2 points), ‘Very much’ (3 points), or ‘Absolutely’ (4 points) (Koh et al., 2001). The highest possible score is 156, and a higher score indicates higher stress. The test-retest reliability of the seven subscale scores and the total score was high, ranging from .69 to .96. (Koh et al., 2001). Internal consistency was computed, and Cronbach’s alpha for the seven subscales ranged between .76–.91 and .97 for the total score (Koh et al., 2001). This study employed the Stress Response Inventory for Koreans developed by Koh et al. (2000).

3) Hospital Anxiety and Depression Scale (HADS)

The HADS developed by Zigmond and Snaith (1983) is an effective tool that evaluates patient anxiety, depression, and emotional state. The reliability and validity of HADS has been confirmed by many researchers and is standardized in many countries. The HADS Internal consistencies (Cronbach alpha) are acceptable at .80 to .93 for anxiety and .81 to .90 for depression (Herrmann, 1997; Lisspers et al., 1997; Malasi et al., 1991; Oh et al., 1999). This study used the Korean-version of the HAD, for which the reliability and validity were confirmed by Oh et al. (1999). The Korean-version of the HADS reliability (Cronbach alpha) was .89 (anxiety) and .86 (depression). The HADS consists of 14 items, seven evaluating anxiety (HADS-A) and seven evaluating depression (HADS-D). Each of the items receives scores that vary from 0 to 3, with a total of up to 21 points for each scale. The highest score is 42, and a higher score indicates higher anxiety and depression.

4) Muscle tone

Muscle tone of the upper trapezius on the affected side was measured using MyotonPRO (Myoton AS, Tallinn, Estonia). The MyotonPRO device was employed to measure muscle tone or tension (Hz: Natural Oscillation

Table 1. General Characteristics of the Subjects (n=14)

	EG (n=7)	CG (n=7)	*t*	*p*
Age (years)	62.00±4.58$^{\alpha}$	61.00±2.16	.52	.61
Duration (months)	20.66±9.27	22.86±9.92	-.42	.67
Height (cm)	163.57±7.29	164.85±8.49	-.30	.76
Weight (kg)	61.28±7.06	63.28±12.71	-.36	.72
MMSE-K	27.28±1.25	27.57±1.27	-.42	.68
Gender (male/female)	5/2	4/3		
Type (hemorrhage/infarction)	4/3	5/2		
Paretic side (right/left)	3/4	2/5		

$^{\alpha}$Mean±SD
MMSE-K : Mini Mental State Examination-Korean
EG : experimental group
CG : control group
*p<.05

Frequency) and stiffness (N/m: Dynamic Stiffness), and the mean values were analyzed (Park et al., 2017). This device showed high to very high ICC values (.85–.94) (Pruyn et al., 2016). The measurement procedure involved pressing the device against the skin, after which the skin surface oscillation induced by the MyotonPRO was measured to verify the value of the mechanical variability (Bailey et al., 2013; Park et al., 2017). Muscle tone was measured only once in the sitting position. This study used the mean value of three taps, with a tap time of 15 ms. Measurement of the upper trapezius was conducted with subjects seated on a chair. Briefly, subjects leaned back and rested their arms on an armrest during measurement, and all subjects sat on the same chair. The upper trapezius muscle belly located midway from the acromion to the spinous process of C7 was palpated and measured (Park et al., 2017, Viir et al., 2006). An experimenter then drew a dot and placed the testing end of the MyotonPRO on the skin surface overlying the muscle belly and recorded the data (Marusiak et al., 2011).

5. Data analysis

Statistical analyses were conducted using SPSS version 24.0 (IBM Corporation, Armonk, NY, USA). An independent t-test was used to measure the homogeneity of the two groups, while the Shapiro-Wilk test was used to determine if data followed a normal distribution.

Comparisons of variables before and after intervention within each group were made using paired t-tests. Comparisons of pre- and post-test differences in variables between the experimental group and the control group were performed using the independent t-test. The statistical software SPSS 20.0 (SPSS, Chicago, IL, USA) was used for statistical analysis. The level of significance was .05.

Ⅲ. Results

A total of 14 subjects participated in this study (experimental group 7, control group 7). There was no significant difference in general characteristics between the two groups (p>.05) (Table 1).

The EEG relative alpha power was significantly increased in the experimental group after intervention (p<.05); however, there was no significant difference in EEG relative alpha power between groups (p>.05) (Table 2, 4). The EEG relative gamma power was significantly

Table 2. Comparison of EEG Relative Alpha Power after Intervention (units: %)

Group	Position	Pre	Post	*t*	*p*
EG	Fp1	.25±.15[α]	.32±.15	3.09	.02*
	Fp2	.26±.13	.33±.13	3.42	.01*
	F3	.30±.11	.38±.10	4.41	.00*
	F4	.30±.12	.37±.11	3.86	.00*
CG	Fp1	.34±.10	.34±.10	-.01	.99
	Fp2	.34±.10	.32±.15	-.57	.58
	F3	.34±.17	.35±.16	.14	.89
	F4	.40±.13	.41±.13	.21	.84

[α]Mean±SD
EG : experimental group
CG : control group
*p<.05

Table 3. Comparison of EEG Relative Gamma Power after Intervention (units: %)

Group	Position	Pre	Post	*t*	*p*
EG	Fp1	.23±.13[α]	.16±.1	-3.35	.01*
	Fp2	.21±.11	.17±.09	-5.59	.0*
	F3	.23±.14	.13±.07	-2.49	.04*
	F4	.22±.1	.17±.09	-4.4	.0*
CG	Fp1	.13±.08	.10±.04	-1.42	.2
	Fp2	.15±.09	.08±.05	-1.58	.16
	F3	.15±.13	.14±.12	-.7	.5
	F4	.14±.12	.08±.05	-1.62	.15

[α]Mean±SD
EG : experimental group
CG : control group
*p<.05

Table 4. Comparison of Change in EEG Relative Alpha Power of the EG and CG (units: %)

	Pre				Post				Changes			
Position	Fp1	Fp2	F3	F4	Fp1	Fp2	F3	F4	Fp1	Fp2	F3	F4
EG	.25±.15[α]	.26±.13	.30±.11	.30±.12	.32±.15	.33±.13	.38±.10	.37±.11	.07±.06	.06±.04	.07±.04	.07±.04
CG	.34±.10	.34±.10	.34±.17	.40±.13	.34±.10	.32±.15	.35±.16	.41±.13	-.00±.10	-.02±.09	.01±.22	.01±.13
t	-1.35	-1.14	-.47	-1.38	-.32	.11	.31	-.50	1.55	2.07	.69	1.09
p	.20	.27	.64	.19	.75	.91	.75	.62	.14	.06	.50	.29

[α]Mean±SD
EG : experimental group
CG : control group
*p<.05

Table 5. Comparison of change in EEG relative gamma power of the EG and CG (units: %)

	Pre				Post				Changes			
Position	Fp1	Fp2	F3	F4	Fp1	Fp2	F3	F4	Fp1	Fp2	F3	F4
EG	.23±.3[α]	.21±.11	.23±.14	.22±.10	.16±.10	.17±.09	.13±.07	.17±.09	-.06±.05	-.04±.02	-.09±.10	-.04±.02
CG	.13±.08	.15±.09	.15±.13	.14±.12	.10±.04	.08±.05	.14±.12	.08±.05	-.03±.06	-.06±.10	-.01±.05	-.06±.10
t	1.54	1.16	1.02	1.22	.08	1.99	-.12	2.26	-1.03	.43	-1.91	.44
p	.14	.26	.32	.24	.16	.06	.90	.04*	.32	.66	.07	.66

[α]Mean±SD
EG : experimental group
CG : control group
*p<.05

Table 6. Comparison of Stress Response Inventory (units: score)

	Pre	Post	Changes	*t*	*p*
EG	65.00±5.53[α]	61.85±5.14	-3.14±1.06	-7.77	.00*
CG	64.28±4.71	62.85±4.74	-1.42±.97	-3.87	.00*
t	.25	-.37	-3.13		
p	.79	.71	.00*		

[α]Mean±SD
EG : experimental group
CG : control group
*p<.05

Table 7. Comparison of Hospital Anxiety and Depression Scale (units: score)

	Pre	Post	Changes	*t*	*p*
EG	20.57±2.57[α]	19.42±2.43	-1.14±.69	-4.38	.00*
CG	20.14±2.19	19.57±2.14	-.57±.53	-2.82	.03*
t	.33	-.11	-1.73		
p	.74	.90	.10		

[α]Mean±SD
EG : experimental group
CG : control group
*p<.05

decreased in the experimental group after intervention ($p<.05$), but there was no significant difference in EEG relative gamma power between groups ($p>.05$) (Table 3, 5).

After intervention, the Stress Response Inventory score decreased significantly in the experimental group and the control group ($p<.05$), with changes in the experimental group being significantly larger than in the control group ($p<.05$) (Table 6).

Following intervention, the HADS score decreased significantly in the experimental group and the control group ($p<.05$), and there was no significant difference between groups ($p>.05$) (Table 7).

Muscle tone also significantly decreased in the experimental group ($p<.05$) following the intervention, but

Table 8. Comparison of Muscle Tone (Natural Oscillation Frequency) (units: Hz)

	Pre	Post	Changes	*t*	*p*
EG	20.55±2.60[α]	17.74±2.70	-2.81±1.20	-6.17	.00*
CG	18.30±2.15	18.32±2.57	.02±.64	.11	.91
t	1.76	-.41	-5.48		
p	.10	.68	.00*		

[α]Mean±SD
EG : experimental group
CG : control group
*p<.05

Table 9. Comparison of Muscle Stiffness (Dynamic Stiffness) (units: N/m)

	Pre	Post	Changes	*t*	*p*
EG	407.71±95.57[α]	329.71±78.22	-78.00±41.25	-5.00	.00*
CG	338.71±67.24	328.14±55.78	-10.57±23.99	-1.16	.28
t	1.56	.04	-3.73		
p	.14	.96	.00*		

[α]Mean±SD
EG : experimental group
CG : control group
*p<.05

no change was observed in the control group (p>.05). Changes in the experimental group were significantly larger than in the control group (p<.05) (Table 8).

Muscle stiffness was significantly decreased in the experimental group (p<.05) after the intervention, but there was no significant difference in the control group (p>.05). Changes in the experimental group were significantly larger than in the control group (p<.05) (Table 9).

Ⅳ. Discussion

In this study, the EEG relative alpha power was significantly increased in the experimental group after sympathetic conversation. However, there was no significant difference in this value observed in the control group. These results indicate that subjects in the experimental group felt positive emotions, and that the increased alpha power could be explained by increased pleasure, comfort, and relaxation (Hwang, 2012; Kim, 2001). In this study, the experimental group had a sympathetic conversation with a therapist. Prior studies have reported that alpha power could be affected by creativity-related demands (Fink and Benedek, 2014). Since conversation is more closely related to creativity-related demands than simple auditory stimulation, sympathetic conversation likely had a greater effect on the alpha power than intervention in the control group.

The EEG relative gamma power was significantly decreased in the experimental group after sympathetic conversation; however, there was no significant difference in the control group. Decreased gamma power indicates decreased anxiety, nervousness, and stress (Kwon, 2008), but there was no significant difference in changes between the experimental group and the control group. A previous study reported that auditory stimulation is related to alpha activity because of the cortical areas (Weisz et al., 2011).

In the present study, both groups received auditory stimulation during intervention from a therapist for three minutes, which might have positively affected the alpha power in both groups.

The Stress Response Inventory score was significantly decreased in both groups; however, changes after the intervention were significantly larger in the experimental group. The decreased stress after intervention in both groups could be explained by diverted attention effects. Prior researchers suggested that diverted attention could help decrease stress in stroke patients (Kalat, 2014). The finding that changes were significantly larger in the experimental group could be explained by the larger psychological effects of sympathetic conversation on stress. Therefore, decreased stress could be considered a part of the psychological effects, which appeared as increased alpha power in this study.

The HADS score decreased significantly in both groups, with larger changes being observed in the experimental group. The results of a previous study suggested that diverted attention could control negative emotions, including anxiety (Kalat, 2014). However, there was no significant difference in changes between groups. This study assumes that verbal stimulation might positively affect depression and anxiety in both groups.

Muscle tone and stiffness of the upper trapezius were significantly decreased in the experimental group, and changes were significantly larger in the experimental group than in the control group, which could be explained by stress effects on the upper trapezius. A prior study reported that the upper trapezius could be changed by stress and psychological effects (Marker et al., 2016; Sahrmann, 2002). Since the upper trapezius is a stress muscle, decreased stress after intervention might have influenced augmentation of the upper trapezius (Marker et al., 2016; Sahrmann, 2002).

The finding that changes were significantly larger in the experimental group could be explained by the larger psychological effects of sympathetic conversation compared to simple explanation without conversation and communication.

It should be noted that this study has several limitations. First, the sample size was small. Second, this study could not identify the long term effects and clinical effects of sympathetic conversation. Given these limitations, additional research investigating the long term effects or a follow-up study of the effects of sympathetic conversation, identifying clinical effects, and widening the subject range is needed.

Ⅴ. Conclusion

The results of the present study indicate that sympathetic conversation had a positive effect on stress, anxiety and depression, and muscle tone in patients with chronic stroke. Therefore, sympathetic conversation could be used to improve not only psychological problems including stress and anxiety, but also physical conditions including muscle tone in chronic stroke patients.

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