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Original Article

The effects of aroma massage and foot bath on psychophysiological response in stroke patients

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Abstract. [Purpose] This research aimed to examine the effects of back massage and foot bath with blended essential oil on psychophysiological response in stroke patients. [Subjects and Methods] The subjects were 14 adult stroke patients randomly divided into the experimental group (7 patients) and the control group (7 patients). Physical and psychological stress, mood state and sleep satisfaction was measured using evaluation instruments and body temperature was measured with infrared thermography (T-1000). [Results] Measurements included physical and psychological stress, and mood state of the experiment group became significantly lower than that of the control group. The body temperature and sleeping satisfaction of the experimental group became significantly higher than that of the control group. [Conclusion] The present study suggested that aroma therapy and foot bath that can be used as alternative physical therapy that offers an overall beneficial effect on psychophysiological response such as reduced stress, mood state and increased body temperature, sleeping satisfaction of stroke patients.

Key words: Massage, Foot bath, Psychophysiological response

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INTRODUCTION

Physical hypofunction such as reduced range of joint movements and spastic muscle paralysis caused by hemiplegia due to stroke brings about physical and mental distress that limits social activities and daily life performance[1)]. Such serious problems act as negative stress on self-esteem, lifestyle, and the quality of life of stroke patients[2)]. Therefore, effective intervention activities that allow stroke patients to perform independent movements and to cope with the stresses due to changed lifestyle and social biases are needed[3)]. The most common symptoms including the loss of comprehension ability, sudden communication difficulties, and damage to the motor and sensory nerves due to the stroke are psychological stressors along with depression, anxiety, anger, frustration, fear, and helplessness[4, 5)]. Mood state refers to the state that emotional changes or abnormalities have occurred as a result of stress, and internal stress due to physical paralysis after stroke, fear of human relationships, stress between individuals, and discomfort for hospital environment manifest themselves as mood state, which significantly influences disease recovery[6, 7)].

Sleep disorders after stroke can generally be induced by physical, psychological, and environmental factors[8)]. Since sleep deficiency can increase the possibility of accidents such as fracture due to a fall because of increased fatigue and anxiety, and become the cause of stress that adds the feeling of helplessness in life and depression, it is necessary to help the stroke patients achieve the appropriate amount of sleep. Maintaining body homeostasis by providing the opportunity to be

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Table 1. General and medical characteristics of study participants

Classification	Experimental group (n=7)	Control group (n=7)
Age (years)	64.3 ± 2.2	65.0 ± 5.0
Gender (male/female)	4/3	4/3
Height (cm)	168.9 ± 1.8	167.8 ± 2.9
Weight (kg)	64.4 ± 7.6	63.7 ± 7.1
Duration of illness (months)	13.0 ± 3.1	13.6 ± 1.4
Causes (infraction/ hemorrhage)	3/4	3/4

All data are expressed as means with standard deviation (M ± SD).

Table 2. Characteristics of essential oil

Type of essential oil	Scientific name	Efficacy
Juniper	Juniperus communis	Stress, insomnia, detoxification and others
Lavender	Lavendula species	Stress, insomnia, anxiety and others
Orange	Citrus sinensis	Nerve strengthening, stress, calming, pain relieving and others
Patchouli	Pogostemom cablin	Stress, anxiety, inflammation, and others
Rosemary	Rosmarinus officinalis	Stress, blood circulation, pain and others

comfortably stable through an appropriate amount of sleep and recovering individual's energy and well-being status can help recovery from the illness[9, 10].

Massage is a method of relieving the accumulated fatigue by stimulating the skin, and it makes it easier to fall asleep by stabilizing the mind through alleviating muscle stiffness[11]. Accordingly, research has been conducted to find out its effect, and stress reduction, fatigue recovery, pain relief, anxiety reduction, and sleep improvement have been reported as the effects of massage[12, 13]. The slow-stroke back massage among various massages is a massage method of stroking along the erector muscles on both sides of the spine to stimulate the parasympathetic nerves. It is used as a relaxation therapy for patients with anxiety disorders[14]. Previous studies on aromatherapy reported its effects on anxiety, depression, sleep, fatigue, stress[15]. Though the use of aromatherapy involving essential oils has increased recently, not only in daily life but also in the medical field, scientific data on its clinical effects are still insufficient[16].

Foot bath has been reported to provide an excellent effect on reducing stress along with sleep improvement by reducing pain through the effects of promoting blood circulation and inducing body relaxation response[17].

As such, back massage using essential oil and foot bath are used in real life since they are economical and safe to perform, but studies on the intervention effects of both back massage using essential oil and foot bath are difficult to find not only in domestic physical therapy societies but also in all academic disciplines. Accordingly, the present study attempted to find out the effects of both back massage using essential oil and foot bath on psychophysiological response, which is the stress, body temperature, mood state, and sleeping satisfaction of stroke patients.

SUBJECTS AND METHODS

The subjects of this study were 14 adult stroke patients randomly divided into the experimental group (7 patients, group treated with back massage using essential oil and foot bath) and the control group (7 patients). The subjects were informed that the experimental group would have both back massage and foot bath five times in one week with each session lasting for 30 minutes, and the control group would not have both back massage and foot bath during the same period. Both experimental and control group had general physical therapies five times in one week with each therapy session lasted for 30 minutes, and the subject selection criteria were as follows. Subjects were selected among the patients who were diagnosed with hemiplegia due to stroke within the last six months to two years and included those who did not have wound, flare, edema, or suppuration; those who were currently not taking hypertension medicine, antidepressants, and sleeping pills; and those who understood the purpose of this study and provided their written informed consent prior to participation in the study in accordance with the ethical standards of the Declaration of Helsinki. The subjects' characteristics are presented in Table 1.

There are currently more than 50 varieties of essential oils in use and the present study used juniper, lavender, orange, patchouli, rosemary, which are effective for sleeping by alleviating the mental fatigue of the nervous system according to the findings of previous studies, and the characteristics of each oil are presented in Table 2[18].

A relevant expert was commissioned to make the essential oils to be used in the intervention. Essential oil should be diluted before use since the chemical composition of essential oil is neutralized when it is used with a carrier oil. For the experimental group, ten drops of juniper, seven drops of lavender, five drops of orange, three drops of patchouli, and eight drops of rosemary were used, and for back massage, essential oil was blended to 3% of the whole volume with 50 ml of jojoba oil[16].

The back massage method used in the present study was the basic method of Swedish massage is composed of effleurage, petrissage, friction, tapotement, and vibration[19]. Back massage training was conducted by a highly skilled trainer. The back massage was performed in a comfortable condition that fits to the purpose of the present study by setting the room temperature at 22 °C and the humidity at 40–60%[14].

In the present study, the foot bath is defined as immersing the feet in water (40 °C) filled up to the ankle in the foot bath

for 30 minutes. Foot bath training was conducted in advance to ensure the accuracy and proficiency of the technique by creating a foot bath protocol to explain its entire process before the feet. Second, pour water into the foot bath tub. Third, the temperature of foot bath water was adjusted to 40 °C by using a water temperature gauge. Fourth, foot bath was performed sitting in a chair for 30 minutes with both feet in the foot bath tub. Fifth, both feet were towel dried after the foot bath and finished with foot lotion to prevent dryness[17].

To measure the stress, we used the instrument tools, which is composed of two areas of 15 items of physical stress and 15 items of psychological stress. The instrument was on a four-point Likert scale from zero point for 'never' to three points for 'always'. The reliabilities of physical stress and psychological stress measuring instruments measured with Cronbach's α were 0.887 and 0.881, respectively[20].

The body temperature was measured with infrared thermography (T-1000, Mesh, South Korea), and infrared thermography was performed in a room where external light and heat were blocked, the appropriate room temperature was maintained at 21–24 °C, there was no airflow, humidity was maintained at 45–60%, and there was little light reflection. Every infrared thermography was performed in the afternoon after the subject had adjusted to the examination room temperature by having the subject wait for 15–20 minutes half dressed in the examination room. The subject was photographed by each half of body so that the normal and paralyzed sides could be compared at the same time, which allowed the comparison of body temperature of the pain side, i.e., paralyzed side, and normal side and the unit was centigrade[21].

The measurement of current mood was conducted using the multiple affective adjective checklist (MAACL) to measure the mood state composed of 48 adjectives related to anxiety, depression, and hostility, and a higher score signifies the mood state is not good[22].

The sleep satisfaction scale is the visual analogue scale developed by Snyder-Halpern & Verran[23] to measure the sleep of hospitalized patients and it is composed of a total of eight items on sleep disturbance (interruption), sleep time, beginning of sleep, and sleep depth, and the reliability of the instrument measured by Cronbach's α was 0.800.

SPSS 20.0 for Windows was used for statistical analysis. As a statistical test method, the paired t-test was conducted to confirm the significant difference between before and after the experiment. Also, independent t-test were performed to analyze differences between groups. All statistical significance levels were set at α=0.05.

RESULTS

Physical stress and psychological test were significantly different control group ($p<0.01$) and experimental group ($p<0.001$) in comparison to before and after treatment. There was a significant difference after treatment (physical stress; $p<0.05$, psychological test; $p<0.01$) in comparison to between groups (Table 3). Body temperature and mood status were significantly different control group ($p<0.001$) and experimental group ($p<0.001$) in comparison to before and after treatment. There was a significant difference after treatment (body temperature; $p<0.05$, mood status; $p<0.01$) in comparison to between groups (Table 4). Sleep satisfaction was significantly different control ($p<0.01$) and experimental ($p<0.001$) in comparison to before and after treatment. There was a significant difference after treatment ($p<0.001$) in comparison to between groups (Table 4).

DISCUSSION

The present study attempted to find out the effects of back massage by blending and using essential oils and foot bath on psychophysiological response, which is the stress, body temperature, mood state, and sleeping satisfaction of stroke patients.

First, back massage and foot bath were found to reduce stress. Satou et al.[24] found significant decrease in psychological stress after aromatherapy massage using aroma oil on elderly patients under long-term hospitalization, and Chung & Choi[25] found that the effects of aroma massage on stress in women college students. In addition, the findings of the present study were consistent with previous research results in that Kim & Kim[26] found that aroma self-foot reflexology massage can be utilized as an effective intervention for stress and fatigue, and Effati-Daryani et al.[27] found that Lavender cream with foot bath can be used for reducing their stress, anxiety and depression. It seems that stress reduction is achieved by the promotion of metabolism and blood circulation due to the active aroma ingredients, relaxation of tense muscles while receiving the massage, stability of mind and body, and the foot bath. In addition, back massage and foot bath were found to minimize the stress of stroke patients since the stress was reduced significantly more for the experimental group than the control group.

Second, back massage and foot bath were found to increase the body temperature. Plakornkul et al.[28] found the body temperature increased on and around the neck, shoulder, and arm after Thai traditional massage, and Gholami-Motlagh et al.[29] found greater body temperature increase for the back, neck, and chest Swedish massage than leg, arm, and face Swedish massage. Furthermore, the findings of the present study were also consistent with previous studies in that Portillo-Soto et al.[30] found that the massage therapy increased skin temperature and calf blood flow, and Liao et al.[31] found that foot bath are an effective way to affect skin temperature change. It is thought that both back massage and foot bath using aroma oil would help provide an increase in body temperature by the effect of blood circulation.

Third, both back massage and foot bath were found to improve the mood state. Gholami-Motlagh et al.[29] found the massage therapy on the back, neck, and chest is distributed improved the mood state, and Effati-Daryani et al.[27] and Edge[32] found the physical and psychological stresses were alleviated when a foot bath was taken regularly every day. In addition, the

Table 3. Stress comparison according to the experimental conditions

	Group	Pre-treatment	Post-treatment	
Physical stress	A	37.0 ± 2.8	27.4 ± 4.3	***
	B	36.6 ± 3.9	31.6 ± 3.2	**
	t	2.154	4.250	
	p	0.061	0.05*	
Psycholo-emotional stress	A	28.9 ± 3.1	22.9 ± 2.8	***
	B	27.9 ± 2.6	25.7 ± 2.4	**
	t	2.410	5.012	
	p	0.074	0.01**	

All data are expressed as means with standard deviation (M ± SD).
A: experimental group; B: control group
A paired t-test was performed with respect to the differences in pre-post treatment (***p<0.001, **p<0.01, *p<0.05)
A independent t-test was performed with respect to the differences among groups (***p<0.001, **p<0.01, *p<0.05)

Table 4. Comparison of body temperature, mood state, sleep satisfaction according to the experimental conditions

	Group	Pre-treatment	Post-treatment	
Body temperature (℃)	A	35.2 ± 0.5	36.2 ± 0.4	***
	B	35.1 ± 0.5	35.9 ± 0.4	***
	t	0.251	2.143	
	p	0.071	0.05*	
Mood status	A	24.3 ± 3.1	19.3 ± 2.9	***
	B	23.7 ± 2.7	22.4 ± 2.6	***
	t	2.042	3.104	
	p	0.105	0.01*	
Sleep satisfaction	A	46.1 ± 6.4	59.4 ± 7.1	***
	B	45.9 ± 7.1	36.3 ± 5.3	**
	t	1.904	−10.471	
	p	0.120	0.001***	

All data are expressed as means with standard deviation (M ± SD).
A: experimental group, B: control group
A paired t-test was performed with respect to the differences in pre-post treatment (***p<0.001, **p<0.01, *p<0.05)
An independent t-test was performed with respect to the differences among groups (***p<0.001, **p<0.01, *p<0.05)

results of the present study were in agreement with previous studies in that Keiko et al.[33] found the activity of the autonomic nervous system was reduced and relaxation and comfort were significantly increased after the foot bath. It is thought that aroma back massage and foot bath improve mood state by the emotional stability and fatigue recovery induced by physical and psychological relaxation for fatigue and stress and normalized antagonism of the autonomic nervous system.

Fourth, the back massage and foot bath were found to improve sleeping satisfaction. Longworth[34] stated that slow back massage was effective for reducing patients' tension, fatigue, and sleep improvement due to the effect of inhibitory reflex of muscle spindles and palpation habituation by influencing the parasympathetic nerves, and Saeki[35] found that the foot bathe frequently applied to adult women as a nursing activity provided sleep improvement and comfort, and had physiological effect of relaxing the function of autonomic nervous system. Furthermore, the results of present study were consistent with the results of previous studies of Sung & Yochihara[17] who found significant effects of the foot bath on sleep onset, sleep maintenance, and sleep efficiency, and Tsuchie[36] who found the effectiveness of foot bath for sleep improvement by the improved blood circulation due to smooth metabolism caused by the stimulation on peripheral blood vessels when the foot is immersed in warm water. It is thought that aroma oil improves the quality of sleep by acting on the autonomous nervous system responsible for sleep and life rhythm, and the foot bath improves sleep satisfaction by maximally relaxing distal skin blood vessels and by the intervention that can increase the body temperature at the same time. Later, it will be necessary to analyze of physiological activity according to the absorption of the aroma oil used in this study and to evaluate the changes of body according to back massage and foot bath through electrophysiological method.

As discussed above, it was confirmed that the rehabilitation programs in hospital had significant effect on the psychophysiological response. The back massage using blended essential oils and foot bath can provide physical and psychological sense of well-being to stroke patients by increasing the body temperature and sleep satisfaction due to psychological effect of the aroma as well as stress and mood state reduction by muscle stimulation, relaxation and increased blood circulation through bodily contact, it can be used as the alternative physical therapy.

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