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Nozomi DONOYAMA[1)※], Norio OHKOSHI[2)], Toyomi SATOH[3)]

[1)] Course of Acupuncture and Moxibustion, Department of Health, Faculty of Health Sciences, Tsukuba University of Technology
[2)] Neurology, Department of Health, Faculty of Health Sciences, Tsukuba University of Technology
[3)] Department of Obstetrics and Gynecology, Institute of Clinical Medicine, Graduate School of Comprehensive Human Sciences, University of Tsukuba

Summary

Objective: The aim of this preliminary study was to assess whether traditional Japanese massage therapy confers benefits to body and mind not only in healthy women but also cancer survivors.

Design: A case control study

Settings/Location: Tsukuba University of Technology, Ibaraki, Japan

Subjects: Five women who underwent surgery for uterine cervical or endometrial cancer (stage 1a1－2a; cancer survivors group) and five healthy women of the same generation (healthy women group) were recruited. All had chronic muscle stiffness of the neck and shoulder and wanted to receive massage therapy.

Interventions: All participants received traditional Japanese massage therapy consisting of eight 40-min massage sessions over 4 weeks.

Outcome Measures: Visual analogue scale (VAS) to assess the severity of the subjective symptom of muscle stiffness in the neck and shoulder; salivary cortisol, secretory immunoglobulin A (s-IgA), and chromogranin A (CgA) from saliva; state anxiety, trait anxiety, and depression.

Results: Regarding immediate changes in variables by therapy, there were significant differences between the cancer survivors group and the healthy women group in VAS, s-IgA, and CgA. VAS, salivary cortisol, and state anxiety scores decreased, and s-IgA and CgA increased in both groups. After the four weeks of sessions, there were significant differences between the cancer survivors group and the healthy women group in VAS, CgA, and depression. VAS, trait anxiety, and depression scores decreased in both groups.

Conclusions: These results imply that traditional Japanese massage therapy may confer physical and psychological benefits to cancer survivors as well as to healthy women.

※Corresponding author
Course of Acupuncture and Moxibustion, Department of Health, Faculty of Health Sciences, Tsukuba University of Technology
4-12-7 Kasuga, Tsukuba, Ibaraki 305-8521, Japan
TEL: +81 29-858-9631
E-mail: donoyama@k.tsukuba-tech.ac.jp

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Further studies with a larger sample size are needed.

Keywords: traditional Japanese massage therapy, cancer survivors, healthy women, physical and psychological benefits

I INTRODUCTION

Since 1981, cancer has been the leading cause of death among Japanese, with both associated incidence rate and death rate showing increases[1]. By 2020, it is estimated that the incidence of cancer in Japan will reach approximately 850,000. The age-standardized rate for males is expected to peak around 2010 and then decline, while that for females is expected to continue increasing, with uterine, breast, and colon cancers showing marked increases[2]. However, early detection and progressive treatment options are also expected to improve the survival rate of Japanese cancer patients[3]. With this increasing survival rate, interest has been turning away from radical treatment options towards ensuring a better quality of life to cope with the disease[4]. Thus, it is important that individuals living with or recovering from cancer receive both physical and psychological care.

It is suggested that massage therapy may help improve the physical and psychological symptoms suffered by cancer patients[5)-7)]. Massage is one of the most commonly used complementary and alternative medicine (CAM) therapies for cancer[8], conferring both physical and emotional benefits[9]. In our previous study[10], traditional Japanese massage therapy was shown to alleviate symptoms and state anxiety among patients with lower back pain, paresthesia, vertigo, and fibromyalgia pain, while increasing the concentration of secretory immunoglobulin A in saliva (s-IgA). Moreover, in studies of healthy women with chronic neck and shoulder stiffness who were not undergoing any form of medical treatment[11), 12)], traditional Japanese massage therapy was shown to reduce the intensity of neck and shoulder stiffness, anxiety, and salivary cortisol concentration, while increasing s-IgA concentration level. These results imply that traditional Japanese massage therapy alleviates both physical and psychological symptoms, releases mental stress, and enhances the immune system of both healthy women and those with various diseases. We also confirmed that neck and shoulder stiffness could be improved by 40-min traditional Japanese massage intervention over four days[11]. Determining whether traditional Japanese massage therapy could confer similar benefits to body and mind not only in healthy women but also cancer survivors was therefore also of interest to us. To address this research question, this preliminary study compared the effectiveness of traditional Japanese massage therapy among women who had undergone surgery for uterine cervical or endometrial cancer and healthy women.

II MATERIALS AND METHODS

1. Participants

The study design was a case control study. Five primary uterine cervical or endometrial

cancer (stage I a1 - II a) survivors (cancer survivors group, CSG) were recruited by a gynecological oncologist from a neighboring university hospital. Inclusion criteria were: i) within 2 years since primary uterine cervical or endometrial cancer excision, total hysterectomy; ii) considered to be in remission since the surgery; iii) considered to have a favourable prognosis; iv) suffering from chronic muscle stiffness of the neck and shoulder; and v) desire for massage therapy (Table 1).

In addition, five healthy women were recruited randomly from a list of about 150 volunteers registered as subjects for massage training or massage experiments at Tsukuba University of Technology (healthy women group, HWG). Inclusion criteria were: i) female in the fifth decade of life, the same age group as the CSG; ii) suffering from chronic muscle stiffness of the neck and shoulder; iii) having no disease requiring medical intervention; iv) desire for massage therapy, especially those hoping to overcome the influence of sexual hormones as suggested in a recent study[13] showing that salivary cortisol levels are affected by menstrual cycle, v) at least more than 2 years post-menopause; and vi) no current symptoms of menopause.

The mean age ± standard deviation (SD) of the CSG was 53.6 ± 11.6 years old and mean body mass index (BMI) ± SD was 21.2 ± 1.5. In HWG, the mean age ± SD and mean BMI ± SD were 57.6 ± 2.1 years old and 21.8 ± 1.1, respectively. All participants provided informed consent, were screened for conditions of chronic muscle stiffness of the neck and shoulder, and the absence of related medical diseases was confirmed by a medical doctor.

To measure salivary contents on the first and last (eighth) days of the study, participants were asked to avoid strenuous exercise within half a day before the experiment and eating and drinking within 2 hr of participation.

2. Procedure

All participants received eight massage sessions, each lasting 40 min and provided twice a

Table 1 Characteristics of study pin the cancer survivors

ID	Age	Diagnosis	Stage	Pelvic lymphadenectomy	Paraaortic lymphadenectomy	Post-operative therapy
1	56	endometrial cancer	II a	-	-	-
2	37	endometrial cancer	II a	+	-	-
3	56	uterine cervical cancer	I a1	-	-	-
4	69	endometrial cancer	I b	+	+	-
5	50	uterine cervical cancer	I a1	+	-	-

week at 3-day intervals for 4 consecutive weeks. Massage therapy was performed on the entire body except the face, head, and abdomen, focusing on the neck and specific points of shoulder stiffness. Massage therapy techniques consisted of standard versions of traditional Japanese massage, mainly kneading with lesser amounts of stroking and pressing. Massage was performed through clothing, with the intensity of stimulation applied being within each subject's range of comfort. Participants were asked to lie on one side while the therapist stroked, kneaded, and pressed the neck, shoulder, back, lower back, arm, hand, leg and foot on the corresponding side; the procedure was then repeated on the opposite side. Finally, the participant lay down in a prone position for several minutes, and the entire body except the head was stroked, kneaded, and pressed. This massage procedure is the same as that described in detail in our previous studies[11,12]. The traditional Japanese massage therapy was performed by a female therapist holding a national massage practitioner license and with 17 years of treatment experience. In addition, the participants also underwent rest intervention as a control; they were required to lie on the massage table for 40 min resting without massage.

This study was approved by the Medical Ethics Committee of Tsukuba University of Technology and was performed according to the ethical standards set forth in the Helsinki Declaration of 1964 and its amendment of 2000.

3. Measures

1) Physical measures

a) Visual analogue scale (VAS) was used to assess the severity of the subjective symptom of muscle stiffness in the neck and shoulder. A sheet of paper (width 100 mm × height 40 mm) was given to the participant and it was explained that the left edge of the paper represented no symptoms and the right edge the most serious symptoms that the participant could imagine. The participant was then asked to indicate how serious the degree of neck and shoulder stiffness was at that time and to record it as a check on the paper. The length from the left edge to the check was measured and treated as the VAS score.

b) To collect saliva, a swab was removed from a Salivette® (Sarstedt, Aktiengesellschaft & Co., Germany), chewed gently by the participant 60 times for one minute in synch with a metronome, then returned to the Salivette®. It was sealed and frozen in a freezer on the same night. The following morning, the Salivette® samples were delivered to an assay company (SRL Inc., Tsukuba, Japan) where assays were conducted to determine concentration levels of salivary cortisol, secretory immunoglobulin A (s-IgA), and chromogranin A (CgA) using a γ-cortisol assay, enzyme immunoassay (EIA) s-IgA test, and enzyme-linked immunosorbent assay (ELISA), respectively.

2) Psychological measures

a) State anxiety and trait anxiety were measured using the Japanese version of the State Trait Anxiety Inventory created by Spielberger, Gorsuch and Leshene[14], a four-phase self-report Likert scale. The state anxiety inventory is used to assess the degree of anxiety felt at a specific time while the trait anxiety inventory is used to assess susceptibility to long-term feelings of

anxiety in stressful situations. Each scale consists of 20 items, the scores of which are totalled. Obtained total scores range from 20–80, with a higher score indicating stronger state/trait anxiety. The normal range of trait anxiety score among healthy Japanese women is 34–44; high range is 45–54[14].

b) To measure depressive condition, the Japanese version of the Self-rating Depression Scale (SDS) created by Zung, a four-point Likert scale, was used[15]. The expected score range is 20–80, with a higher score indicating stronger depression. Mean score among healthy Japanese is 39.2[16].

VAS scores, salivary samples, and state anxiety scores were measured at pre-/post-rest intervention, pre-/post-first massage session, and pre-last (eighth) massage session. Trait anxiety and depression scores were measured at pre-first and pre-last massage sessions.

4. Statistical analysis

Demographic and baseline scores of the study variables were tested using an unpaired (independent samples, 2-tailed) t-test to assess the comparability between CSG and HWG. Two-factor repeated measures analysis of variance (ANOVA) and a paired (repeated samples, 2-tailed) t-test were used to determine whether there were differences between CSG and HWG and within groups. Data were analyzed using SPSS 15.0.

Ⅲ RESULTS

There were no significant differences in age ($t\ (df=8)=0.760$, $p=0.469$) or BMI ($t\ (df=8)=0.766$, $p=0.466$) between CSG and HWG.

The results of rest intervention (control) are shown in Table 2. There were significant differences between CSG and HWG in s-IgA ($F=10.6$, $p=0.012$) and state anxiety ($F=22.4$, $p=0.001$). After rest intervention, s-IgA concentration levels increased significantly ($t\ (df=4)=3.2$, $p=0.033$) while state anxiety scores decreased significantly ($t\ (df=4)=5.7$, $p=0.005$) in HWG.

To assess immediate changes in variables after traditional Japanese massage therapy, pre- and post-first massage session values were compared between CSG and HWG and within groups (Table 3). There were significant differences between CSG and HWG in VAS ($F=16.6$, $p=0.001$), s-IgA ($F=6.1$, $p=0.026$), and CgA ($F=4.7$, $p=0.046$). Baseline VAS and CgA values in CSG were significantly lower than those in HWG (VAS $t\ (df=8)=3.9$, $p=0.004$; CgA $t\ (df=8)=3.2$, $p=0.013$). Post-massage session VAS scores were significantly decreased in both groups (CSG $t\ (df=4)=6.5$, $p=0.003$; HWG $t\ (df=4)=4.7$, $p=0.009$), while post-massage session s-IgA levels significantly increased in HWG ($t\ (df=4)=3.8$, $p=0.019$) and increased in CSG ($t\ (df=4)=2.7$, $p=0.052$). The post-massage session state anxiety score in CSG showed a significant decrease ($t\ (df=4)=5.7$, $p=0.005$).

To assess the 4-week cumulative effects of massage therapy, pre-first massage session values and pre-last massage session values were compared between CSG and HWG and within groups (Table 4). There were significant differences between CSG and HWG for VAS ($F=12.4$, $p=0.008$), CgA ($F=6.4$, $p=0.036$), and depression ($F=8.6$, $p=0.019$). Baseline values of VAS and CgA in

Table 2 Results of rest intervention (control): Cancer survivors vs healthy women (2-factor repeated measures analysis of variance ANOVA and t-test)

	Time		Effect			
	pre	post	Group		Time × Group	
	mean ± SE	mean ± SE	F	p	F	p
Value	(95% CI)	(95% CI)				
Visual Analogue Scale			2.3	0.174	2.2	0.184
Cancer survivors group (n=4) #1	47.5±9.2	32.3±10.0				
t(df=7)=2.3 (p=0.056)	(25.7-69.3)	(8.5-56.0)				
Healthy women group (n=5)	75.8±8.2	75.6±9.0				
	(56.3-95.3)	(54.4-96.8)				
Cortisol (μg/dL)			0.9	0.371	0.1	0.76
Cancer survivors group (n=5)	0.236±0.038	0.216±0.048				
	(0.149-0.323)	(0.105-0.327)				
Healthy women group (n=5)	0.264±0.038	0.254±0.048				
	(0.177-0.351)	(0.143-0.365)				
s-IgA (μg/mL)			10.6	0.012 *	0.7	0.415
Cancer survivors group (n=5)	170.7±57.7	604.8±263.0				
	(37.6-303.8)	(-1.7-1211.3)				
	t(df=4)=3.2 *					
Healthy women group (n=5)	278.0±57.7	1023.7±263.0				
	(144.9-411.1)	(417.2-1630.2)				
CgA (pmol/mL)			0.1	0.713	0.0	0.998
Cancer survivors group (n=5)	1.37±0.77	1.67±0.74				
t(df=8)=2.4 *	(-0.40-3.15)	(-0.03-3.38)				
Healthy women group (n=5)	3.98±0.77	4.27±0.74				
	(2.20-5.75)	(2.57-5.98)				
State Anxiety			22.4	0.001 **	0.0	0.865
Cancer survivors group (n=5)	39.4±4.1	33.8±3.9				
	(29.9-48.9)	(24.9-42.7)				
	t(df=4)=5.7 **					
Healthy women group (n=5)	34.6±4.1	29.4±3.9				
	(25.1-44.1)	(20.5-38.3)				

*$p<0.05$ **$p<0.01$

Rest intervention (control): 40-minutes rest on the massage table without massaging

1: One of the five cancer survivors was unable to evaluate the degree of muscle stiffness in her neck and shoulders at pre-rest intervention.

Table 3 Comparison of immediate changes in variables between cancer survivors and healthy women after 40-min massage intervention (2-factor repeated measures analysis of variance ANOVA and t-test)

	Time		Effect			
	pre	post	Group		Time × Group	
	mean ± SE	mean ± SE	F	p	F	p
Value	(95% CI)	(95% CI)				
Visual Analogue Scale			16.6	0.001 **	2.3	0.152
		t(df=4)=6.5 **				
Cancer survivors group (n=5)	40.4±6.4	11.6±6.4				
	(26.9–53.9)	(−1.9–25.1)				
t(df=8)=3.9 **		t(df=4)=4.7 **				
Healthy women group (n=5)	76.0±6.4	28.0±6.4				
	(62.5–89.5)	(14.5–41.5)				
Cortisol (μg/dL)			0.7	0.411	0.0	0.970
Cancer survivors group (n=4) #1	0.208±0.048	0.175±0.048				
	(0.104–0.311)	(0.072–0.278)				
Healthy women group (n=5)	0.248±0.043	0.212±0.043				
	(0.156–0.340)	(0.120–0.304)				
s-IgA (μg/mL)			6.1	0.026 *	0.8	0.382
		t(df=4)=2.7 (p=0.052)				
Cancer survivors group (n=5)	149.8±103.2	362.6±103.2				
	(−68.9–368.5)	(143.8–581.3)				
		t(df=4)=3.8 *				
Healthy women group (n=5)	311.1±103.2	709.2±103.2				
	(92.3–529.8)	(490.4–927.9)				
CgA (pmol/mL)			4.7	0.046 *	0.6	0.460
Cancer survivors group (n=5)	1.00±1.11	1.93±1.11				
	(−1.35–3.34)	(−0.42–4.28)				
t(df=8)=3.2 *						
Healthy women group (n=5)	2.55±1.11	5.16±1.11				
	(0.21–4.90)	(2.82–7.51)				
State Anxiety			0.7	0.412	0.1	0.723
		t(df=4)=5.7 **				
Cancer survivors group (n=5)	38.6±4.2	27.0±4.2				
	(29.8–47.4)	(18.2–35.8)				
Healthy women group (n=5)	33.6±4.2	25.0±4.2				
	(24.8–42.4)	(16.2–33.8)				

*$p<0.05$ **$p<0.01$

#1: Due to the insufficient saliva volume of one of the five cancer survivors at the pre-first massage session and another cancer survivor at the pre-last massage session, only three samples were compared.

Table 4 Comparison of cumulative changes in variables between cancer survivors and healthy women during massage sessions (2-Factor Repeated-Measures Analysis of Variance ANOVA and t-test)

			Time		Effect			
			pre-first	pre-last (8th)	Group		Time × Group	
			mean ± SE	mean ± SE	F	p	F	p
Value			(95% CI)	(95% CI)				
Visual Analogue Scale					12.4	0.008 **	0.0	0.960
Cancer survivors group	(n=5)	t(df=8)=3.9 **	40.4±6.4	19.6±10.4				
			(25.6-55.2)	(-4.4-43.6)				
Healthy women group	(n=5)		76.0±6.4	55.8±10.4				
			(61.2-90.8)	(31.8-79.8)				
Cortisol (μg/dL)					0.1	0.800	0.1	0.800
Cancer survivors group	(n=3) #1		0.203±0.066	0.230±0.061				
			(0.041-0..365)	(0.082-0.378)				
Healthy women group	(n=5)		0.248±0.051	0.248±0.047				
			(0.123-0.373)	(0.133-0.363)				
s-IgA (μg/mL)					0.2	0.670	0.0	0.945
Cancer survivors group	(n=5)		149.8±62.5	167.4±85.7				
			(5.6-294.0)	(-30.2-365.1)				
Healthy women group	(n=5)		311.1±62.5	335.5±85.7				
			(166.9-455.3)	(137.9-533.1)				
CgA (pmol/mL)					6.4	0.036 *	1.1	0.332
Cancer survivors group	(n=5)	t(df=8)=3.2 *	1.00±0.35	1.94±1.08				
			(0.20-1.79)	(-0.56-4.44)				
Healthy women group	(n=5)		2.55±0.35	4.81±1.08				
			(1.76-3.35)	(2.31-7.31)				
Trait Anxiety					5.2	0.052	0.1	0.807
			t(df=4)=1.7 (p=0.051)					
Cancer survivors group	(n=5)		47.2±4.2	43.2±4.1				
			(37.4-57.0)	(33.8-52.6)				
Healthy women group	(n=5)		41.2±4.2	36.2±4.1				
			(31.4-51.0)	(26.8-45.6)				
Depression					8.6	0.019 *	0.5	0.497
Cancer survivors group	(n=5)		39.2±2.8	36.4±2.8				
			(32.8-45.6)	(29.9-42.9)				
				t(df=4)=6.1 **				
Healthy women group	(n=5)		38.0±2.8	33.4±2.8				
			(31.6-44.4)	(26.9-39.9)				

*$p<0.05$ **$p<0.01$

#1: Due to the insufficient saliva volume of one of the cancer survivoes at the pre-first massage session, only four samples were compared.

CSG were significantly lower than those in HWG (VAS t (df = 8) = 3.9, p = 0.004; CgA t (df = 8) = 3.2, p = 0.013). The pre-last massage session score of depression in HWG was significantly lower than that obtained at the pre-first massage session (t (df = 4) = 6.1, p = 0.004). In CSG, the pre-last massage session score of trait anxiety (43.2), which is within the normal range, was lower than that obtained for the pre-first massage session (47.2), which is within the high range (t (df = 4) = 1.7, p = 0.163).

Ⅳ DISCUSSION

In both CSG and HWG, the severity of the subjective symptom (muscle stiffness of the neck and shoulder) assessed by the participants themselves using VAS was significantly lower after each massage session and after the 4 weeks of massage, although the latter was not statistically significant. This implies that massage therapy can improve the physical subjective symptom of muscle stiffness of the neck and shoulder immediately and cumulatively, although further studies with a larger sample size are needed to determine statistical significance.

After a 40-min rest intervention without massage practice (control), there were significant differences between CSG and HWG regarding s-IgA and state anxiety. In HWG, post-rest intervention levels of s-IgA were significantly higher and those for state anxiety were significantly lower than those obtained at pre-rest intervention. In some studies other than those specifically focusing on massage therapy[17)-20)], various types of relaxation were shown to result in a significant increase in s-IgA concentration among healthy individuals. Thus, merely lying down and resting without massaging may also have had a relaxing effect on the healthy participants, partly enhancing immune function and improving mood. After each massage session, s-IgA levels tended to increase, almost to a significant level, in both the CSG and HWG.

A previous study of patients with cancer[21)] demonstrated that massage therapy results in increased numbers of natural killer cells and lymphocytes. The present study may also have implications for the use of traditional Japanese massage therapy to enhance immune function in cancer patients. In addition, the post-massage session state anxiety score was significantly lower in CSG, consistent with the result of massage therapy studies of breast cancer patients[21)] and psychiatric inpatients[22)] as well as our previous traditional Japanese massage therapy studies of healthy women[11), 12)].

After 4 weeks of traditional Japanese massage therapy, the trait anxiety score, as a cumulative effect, was lowered. Especially notable, the pre-first massage trait anxiety score of CSG was 47.2, which is within the high anxiety range, whereas the pre-last massage score was 43.2, which is within the normal range. These results imply that traditional Japanese massage therapy may have not only short-term benefits on psychological well-being[23)] but also long-term benefits for cancer survivors. The depression score was also lowered, but was statistically significant only in HWG. In the present study, pre-first massage session depression scores in the two groups were within the Japanese normal range.

Previous studies[24)-26)] have demonstrated that patients with cancer commonly experience

anxiety and depression, which have also been associated with somatic symptoms in cancer patients[27]. These findings confirm that somatic symptoms may persist in cancer patients, indicating a relationship with concomitant psychopathology and the need for psychiatric intervention. Many studies suggest that massage therapy can relieve physical and psychological symptoms in people living with cancer[21), 28), 29)]. Our results also imply that traditional Japanese massage therapy may help to maintain and encourage positive mental health among cancer survivors as well as alleviate subjective symptoms like muscle stiffness.

The limitations of this study should be noted. Since it was difficult to recruit cancer survivors with the same diagnosis and the same conditions within a small city in Japan, the sample size was small. Due to the lack of samples, certain important points could not be addressed. Furthermore, some of the statistical results may be considered unstable. For example, many studies[30)-32)] including our previous study[12)] demonstrated that salivary cortisol concentrations are significantly lowered after massage, suggesting that massage therapy may release psychological stress. However, in the present study, there were no statistically significant differences between the groups despite the lower salivary cortisol level. According to a review of nine studies on salivary cortisol levels after massage sessions[33)], a reduction in salivary cortisol was evident following a single massage treatment, yet levels returned to initial values when assessed at a later time-point. On the other hand, in other studies in which either part-body[34)] or whole-body[35)] effleurage massage was given, no effects on cortisol level were demonstrated. It was suggested, however, that more intense massage might be more effective than massage using light pressure. In line with this, studies comparing the intensity of different massage therapies by examining electroencephalogram and heart rate values have shown that moderate pressure is more effective than light pressure[36)]. This has also been shown with regards to weight gain in preterm infants[37)]. However, cortisol levels were not measured in either of these studies. Traditional Japanese massage, used in the present study, consists mainly of kneading, which is thought to apply direct stimulation mainly to muscles, and is performed at a higher intensity than Western massage. Further studies should seek to confirm these findings.

We also observed an increase, although not significant, in CgA immediately after the massage sessions. Salivary CgA is an index for psychosomatic stressors[38), 39)] with CgA concentration level tending to rise upon psychological stress[40)]. On the other hand, cortisol is a major steroid hormone secreted by the adrenal cortex via reactions in the hypothalamus-pituitary-adrenal axis and autonomic nervous system, with salivary cortisol commonly used as an index of stress[41)]. Therefore, if the decrease in cortisol and increase in CgA are actually synchronized, further discussion is needed because there may be certain therapeutic characteristics of traditional Japanese massage therapy. Kitagawa et al.[42)] demonstrated that CgA levels increased after music therapy and suggested that this was due to the 'eustress' (stress condition of pleasure) state induced in participants, a state which traditional Japanese massage therapy may also induce.

At present, it is difficult to predict the overall physical and psychological effects of massage in

women who have undergone surgery with lymphadenectomy for uterine cervical or endometrial cancer. Additionally, in the present study, measurements were derived from saliva samples, which can be easily aquired, without causing distress for the participants. However, more accurate results might have been obtained if the white blood cell count, differential white blood cell count, or lymphocyte subsets could be obtained as immunological markers from blood samples, and likewise if adrenalin or dopamine could be measured as stress markers, also obtained from blood samples. Further studies should therefore be conducted using suitable methods of measurement and more participants.

In conclusion, although this preliminary study was small and provides limited evidence, its findings suggest that traditional Japanese massage therapy can confer physical and psychological benefits to not only healthy women but also cancer survivors. Traditional Japanese massage therapy may therefore be a useful modality in view of the expected increase in cancer survivors.

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VI AUTHOR DISCLOSURE STATEMENT

No competing financial interests exist.

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