Effects of Tactile Massage on Mothers of Children with Autism Spectrum Disorder: A Pilot Study

（自閉スペクトラム症児の母親へのタクティールマッサージの効果
に関する予備的研究）

大阪大学大学院
大阪大学・金沢大学・浜松医科大学・千葉大学・福井大学
連合小児発達学研究科
小児発達学専攻

上原　佳子

2017 年 8 月　博士学位論文

Effects of Tactile Massage on Mothers of Children with Autism Spectrum Disorder: A Pilot Study[1)]

Yoshiko Uehara[(1)(2)], Hiroshi Abe[(1)(3)] & Tomoko Hasegawa[(2)]

(1) United Graduate School of Child Development, Osaka University, Kanazawa University, Hamamatsu University School of Medicine, Chiba University and University of Fukui

(2) Department of Fundamental Nursing, Division of Nursing, Faculty of Medical Sciences, University of Fukui

(3) Department of Behavioral Science, Division of Medicine, Faculty of Medical Sciences, University of Fukui

Footnote

1) The present study was supported by JSPS KAKENHI Grant Number JP25350923, and Discretionary Funds of Life Cycle Medicine Promotion Department Chief at the Faculty of Medical Sciences, University of Fukui.

Abstract

This study aimed to use physiological/psychological indicators to investigate the effects of tactile massage on mothers of children with autism spectrum disorder. Under fixed room conditions, some of the 17 participants were treated with the tactile procedure (tactile massage) for 20 minutes on the first day and with the resting procedure (resting in a seated position) for 20 minutes on the next day, while the others were treated with the resting procedure on the first day and the tactile procedure on the next day. Salivary cortisol concentration, salivary secretory immunoglobulin A concentration, and heart rate variable frequency range analysis were used as physiological indicators, while the State-Trait Anxiety Inventory Form JYZ and the Profile of Mood States–Brief Form were used as psychological indicators. Our results revealed no marked differences in physiological indicators between participants treated with the tactile procedure and those treated with the resting procedure. However, tactile massage treatment led to significant improvements in the anxiety and mood psychological indicators.

Key Words: tactile massage, mothers of children with autism spectrum disorder, complementary and alternative medicine

抄録日本語訳

本研究は ASD 児の母親へのタクティールマッサージの効果を，生理的・心理的指標により検証することを目的とした。母親 17 名に、条件を一定に保った部屋で，同一対象者にタクティールマッサージを実施する[タクティール]と，安静座位を保つ[安静]を 20 分間、別日に実施した。生理的指標として、唾液コルチゾール濃度，唾液分泌型免疫グロブリン A 濃度 、心拍変動周波数解析、心理的指標として STAI と POMS を用いた。その結果、生理的指標では、〔タクティール〕〔安静〕間でそれぞれの効果に顕著な違いは見られなかったが、心理的指標では、〔タクティール〕の方が不安の軽減とネガティブな気分の改善に有意に効果があることが明らかになった。

キーワード

タクティールマッサージ，自閉スペクトラム症児の母親，補完代替療法

掲載学術雑誌名

日本生理心理学会機関誌 『生理心理学と精神心理学』第 34 巻 3 号

Complementary and Alternative Medicine (CAM) has recently been introduced and used together with Western medicine at medical institutions and healthcare facilities in order to improve patients' quality of life (QOL) and activities of daily living (ADL) (Imanishi & Imanishi, 2007). Tactile massage, a CAM treatment that was developed in Sweden in the 1960s as a care method for promoting the development of immature babies, has subsequently spread throughout the world. In Japan, tactile massage has been known as tactile care (Japan Sweden Care Institute Co., Ltd.). Tactile massage is a mixture of touching (touching the hands of an individual, placing a hand on the individual's shoulder or back) and massage (rubbing, pressing, or kneading the muscles/acupoints with a specific pressure). Tactile massage is a technique involving the "stroking" of the limbs and the back of the individual with soft and encompassing hands with intimacy (Makino et al., 2013) (Figure 1). It is an easy procedure for therapists to perform once the stroking force and method are mastered, as no special instruments or expertise are required. Therapists can perform tactile massage without concerns regarding excessive stimulation of the deep structures of the body (acupoints or muscles) or the flow of lymph fluid or blood. Therefore, the procedure can be performed safely without imposing any physical burden on the individual.

Figure 1

The effects of tactile massage have been reported in people of different ages with varying symptoms. These effects include the promotion of growth and development in immature babies; alleviation of stress and aggressiveness in senile elderly individuals

(Suzuki et al., 2010); improvements in ADL and QOL in patients with stroke (Olsson et al., 2004); blood glucose control in patients with diabetes (Andersson et al., 2004); improvement of QOL in patients with diabetes (Wändell et al., 2012); alleviation of morning sickness in pregnant women (Ågren & Berg, 2006); alleviation of symptoms in patients under treatment for headache, sleep disorders, or motor impairment (Andersson et al., 2009); and relaxation in adult women (Amano et al., 2012).

The skin-stroking stimulation provided by tactile massage has been reported to increase oxytocin levels and decrease cortisol levels in blood, indicating that the stress-alleviating effects of tactile massage are related to endocrine responses (Uvnäs-Moberg, 2000). These hormonal effects are also observed in therapists while they are engaged in tactile massage, indicating that tactile massage may lead to a reduction in the therapists' stress levels (Field, 2005; Uvnäs-Moberg, 2000).

Autism spectrum disorder (ASD) is characterized by deficits in personal interaction, communication, and behavior (Diagnostic and Statistical Manual of Mental Disorders, 5th Edition; American Psychiatric Association, 2013). Mothers of children with ASD face various difficulties in raising their children. These difficulties include learning to deal with the child's behavioral disorder and worrying about the child's future (Matsuoka et al., 2013). These stresses can then negatively affect the mother's health and increase her fatigue levels (Bekku & Yoshimura, 2008). Consequently, the daily life activities of mothers of children with ASD may be disturbed (Estes et al., 2009).

Furthermore, compared to mothers of typically developed children, mothers of children with ASD tend to be more stressed or depressed and have lower QOLs (Allik et al., 2006; Dabrowska & Pisula, 2010; Hastings, et al., 2005; Mori et al., 2009; Mugno et al., 2007; Nomura et al., 2010; Sakaguchi & Beppu, 2007). Previous studies have indicated that, in addition to the need for support for children with ASD, there is a need to support their mothers in order to alleviate their stress and improve their QOL.

However, no studies have ever been conducted to examine the physiological and psychological stress-alleviating effects of intervention with tactile massage or other CAM treatments in reducing stress in mothers of children with ASD.

Our aim is to support children with developmental disabilities by helping their mothers using CAM therapies. This study was intended to reveal the effects of stress palliation using tactile massage on mothers of children with ASD. In order to accomplish this goal, we used both physiological (endocrine and autonomic nervous system) and psychological (change in mood and anxiety) indicators.

Methods

Participants

The study participants were 17 mothers (mean age = 39.1, standard deviation [*SD*] = 5.3) of pre-school-aged or school-aged children with ASD of any severity level residing in prefecture A. The mean age of the participants' children was 7.8 years (*SD* = 4.2).

Nine of the children were in pre-school, 6 were in elementary school, and 2 were in junior high school in a school for special needs education. Fifteen of the children were boys and 2 were girls. The exclusion criteria for the study were ongoing treatments for skin diseases, cardiovascular diseases, autonomic nervous system diseases, endocrine diseases, hyperaphia of the skin, and menopause. The mean height of the participants was 160.4 cm (*SD* = 1.3), the mean weight was 60.3 kg (*SD* = 2.8), and the mean body mass index was 23.3 (*SD* = 0.9).

Study leaflets were distributed to the parents of children with ASD at a school for special needs education by teachers and at an outpatient clinic of a hospital by receptionists to recruit the participants. Written and oral explanations were provided to those who wanted to participate in the study. The potential participants were informed of the study objectives and methods, their freedom to join or refuse, and their freedom to withdraw their consent after inclusion in the study. They were also informed of their freedom to suspend the experiment and of the policies regarding protection of privacy. Those who signed the consent form were recruited as study participants.

Procedure

The experiment was initiated after approval by the Research Ethics Committee, University of Fukui (Ethical Review Board No. 25-11), and the Conflict of Interest Committee, University of Fukui (No. 973).

Seven participants were treated with the tactile procedure (tactile massage) on the first day and the resting procedure (resting in a seated position, no tactile massage) on the following day, while ten participants were treated with the resting procedure on the first day and the tactile procedure on the following day. As the menstrual cycle influences autonomic nervous activity (Matsumoto, 2013) and the concentrations of salivary substances (Izawa et al., 2007a), the experiment was performed during the 2-week follicular phase after the start of menstruation. Considering circadian changes in endocrine system indicators, the tactile and resting experiments were started between 10:00 and 15:00, and were performed at the same time for each participant. Both tactile and resting procedures lasted 20 minutes. In the experiment room, the temperature was set to approximately 25°C and the humidity was set to 60%. No one else was allowed into the experimental room and the environment was kept quiet. The study took place between June 2013 and March 2014.

The participants were asked to avoid dental treatment and alcohol consumption, and to keep their usual sleep hours on the night before the experiment. On the day of the experiment, the participants were instructed not to eat, drink, or brush their teeth for 1 hour prior to the start of the experiment. Immediately before the experiment, the participants were asked to excrete, to gargle with 50 mL of water, and to change into an examination gown. Their blood pressures, heart rates, and body temperatures were then measured. The experimenter asked the participants about the lengths of their sleep on the previous day and their current physical condition to ensure that they had no problems regarding their participation in the experiment.

Prior to the tactile/resting procedure, the participants completed a questionnaire regarding their psychological status. Their saliva samples were also collected and their heart rates were measured over a 5-minute period. The tactile/resting procedure was then carried out for 20 minutes. After the procedure, the participants again completed the questionnaire regarding their psychological status, submitted saliva samples, and had their heart rates measured over a 5-minute period. The order of the tactile and resting procedures was randomly assigned for each participant. Heart rate measurements and the tactile/resting procedures were carried out with the participants comfortably sitting in a relaxing chair. Conversation was minimized during the measurements and while the procedure was carried out.

During the tactile procedure, the participants received tactile massage on both hands for 20 minutes. In order to maintain the same level of tactile massage for all participants, the procedure was conducted in all participants by a researcher who was certified as a therapist after attending the Level I Tactile Care Course of the Japan Sweden Care Institute Co., Ltd., which is an organization promoting tactile massage in Japan. Tactile massage was performed using olive oil in accordance with the method of Suzuki et al. (2010) (Table 1). Using a slow rhythm and a weak steady pressure, the therapist thoroughly and lightly stroked the participant’s hand repeatedly from the wrist to the fingertip in an intimate manner. Prior to the experiment, a patch test was conducted to

Table 1

confirm that no participants were allergic to the olive oil used in the tactile massage.

Physiological Indicators

Endocrine and autonomic nerve indicators were used to provide physiological information. In order to obtain endocrine data, we measured the concentrations of cortisol and secretory immunoglobulin A in saliva. Salivary secretory immunoglobulin A, an immunological marker, changes with acute stress and is considered to be related to chronic stress (Izawa et al., 2007a). Salivary specimens were collected using a Salimetrics Oral Swab (Salimetrics LLC, Carlsbad, USA) and placed in a Swab Storage Tube (Salimetrics LLC, Carlsbad, USA). Saliva was collected according to the Salimetrics operation manual and preserved at -30°C until the time of analysis.

The concentration of cortisol in saliva was quantified using the Salivary Cortisol EIA Kit (Salimetrics LLC, Carlsbad, USA). The concentration of secretory immunoglobulin A was quantified using the Secretory Immunoglobulin A ELISA Kit (Immundiagnostik AG, Bensheim, Germany).

We used a heart rate variable frequency range analyzer to obtain information on the autonomic nervous system. Heart rate measurements and analyses were carried out using a Pulse Analyzer Plus (TAS9) (YKC, Tokyo, Japan), which used an electrode attached to the participant’s fingertip. In order to analyze the heart rate variable frequency range, we determined the number of low frequency heartbeats (LF, 0.04-0.15 Hz), the number of high frequency heartbeats (HF, 0.15-0.4 Hz), and the ratio of LF to

HF heartbeats (LF/HF). HF was used as an indicator for parasympathetic nerve activity and LF/HF was used as an indicator for sympathetic nerve activity. These values reflect the overall balance between sympathetic and parasympathetic nerve activities (Hayashi, 1999).

Psychological Indicators

Mood and anxiety tests were conducted to obtain psychological indicators. We used the Profile of Mood States–Brief Form (POMS-Brief Form) Japanese Version to assess each participant's mood, which was developed by McNair et al. (1992a, 1992b, 2003), is a scale for assessing mood. The scale can simultaneously assess 6 moods: 5 negative moods, which include "Tension-Anxiety", "Depression-Dejection", "Anger-Hostility", "Fatigue", and "Confusion"; and the positive mood of "Vigor". The Japanese version of POMS was prepared by Yokoyama (1994) and it consists of 65 items. Its abridged version (POMS-Brief Form), which consists of 30 items, was subsequently developed as a standard version (Yokoyama, 2005). In the POMS-Brief Form, the 5-level Likert Scale is used to respond to the questions. The total score for each mood item is then calculated. Higher scores in the test indicate stronger moods. A standardized score (range of 30-85) of between 40 and 60 indicates that the person is healthy. As the POMS-Brief Form can assess the participant's mood over a short period of time (Yokoyama, 2005), it was used in the present study to determine the participants' current moods.

We used the State-Trait Anxiety Inventory Form JYZ (STAI-JYZ) to assess the participants' anxiety levels. The STAI-JYZ is the latest Japanese version of the test (Hidano et al., 2000), which is a modified, improved version of the anxiety scale developed by Spielberger et al. (1970). This test incorporates Japan's cultural factors. The STAI-JYZ has been widely utilized in clinical and experimental studies of anxiety. This study examined short-term changes in anxiety as a result of tactile massage by assessing "how the participant was feeling at that moment." We only used the state anxiety items of the STAI-JYZ. The 4-level Likert scale is used in the STAI JYZ, and scores range from 20 to 80. Higher scores indicate higher anxiety levels. In a survey of female university students, a score of 55 or higher was considered to represent a state of intense anxiety (Hidano et al., 2000).

Data Analysis

Each participant's statuses (sleeping time, blood pressure, and body temperature) during the tactile procedure and the resting procedure were compared to assess the condition of the participants and the experimental environment on the day of study. We also compared each participant's status before the procedure to her status after the procedure and analyzed the rates of change ([post level - pre level]/pre level) of the physiological and psychological indicators obtained during both the tactile and resting procedures. For statistical analysis, we assessed paired differences for nonparametric variables (Wilcoxon's signed rank test) using IBM SPSS Statistics 19 for Windows.

Results

Conditions of Participants and Experimental Environment

On the day of study, the median systolic pressure was 118.0 mmHg in "tactile-treated" participants and 114.0 mmHg in "resting-treated" participants. The median diastolic pressure was 73.0 mmHg in "tactile-treated" participants and 72.0 mmHg in "resting-treated" participants. Median heart rate measured over 1 minute was 74.0 in "tactile-treated" participants and 69.0 in "resting-treated" participants. The median body temperature was 36.4°C in "tactile-treated" participants and 36.5°C in "resting-treated" participants. No significant differences were observed in any of the above items.

The median number of hours spent sleeping on the night before the study was 7.0 in "tactile-treated" participants and 6.0 in "resting-treated" participants. There were no significant differences in this measure. None of the participants had a poor health condition on the day of experiment.

The median temperature and humidity of the experiment room were 26.3°C and 51.0%, respectively, during the tactile procedure and 25.9°C and 58.0% during the resting procedure. There were no significant differences in these measures.

Changes in Physiological Indicators

We were unable to analyze cortisol levels for 3 participants and secretory immunoglobulin A levels in 4 participants owing to insufficient amounts of saliva collected. In addition, 1 participant was eliminated from analysis owing to the detection of arrhythmia, which was discovered during the study of autonomic nervous system indicators.

Figure 2 shows the results of the comparisons between pre- and post-procedure endocrine system indicators. The median Salivary cortisol levels significantly decreased from 0.12 μg/dl prior to tactile treatment to 0.07 μg/dl after the tactile procedure ($p < .05$). Cortisol levels also significantly decreased from 0.13 μg/dl prior to resting treatment to 0.09 μg/dl after the resting procedure ($p < .01$). The median Secretory immunoglobulin A concentration in saliva significantly increased from 0.62 mg/ml prior to tactile treatment to 0.73 mg/ml after the tactile procedure ($p < .05$). Salivary immunoglobulin A levels also significantly increased from 0.39 mg/ml prior to the resting treatment to 0.92 mg/ml after the resting procedure ($p < .05$).

Figure 2

Figure 3 shows the results of the comparisons between pre- and post-procedure autonomic nervous system indicators. The median HF value significantly increased from 129.9 ms^2 prior to tactile treatment to 169.0 ms^2 after the tactile procedure ($p < .05$). Median HF was 152.2 ms^2 prior to resting treatment and 194.4 ms^2 after the resting procedure. These two values were not significantly different. HF increased in 14 participants after tactile treatment (87.5%) and in 11 participants after the resting procedure (68.8%). Median LF/HF did not significantly change following the tactile or resting procedures: 0.50 prior to tactile treatment and 0.90 after the tactile procedure, and 0.77 prior to resting treatment and 1.02 after the resting procedure. LF/HF increased

Figure 3

in 9 participants after tactile treatment (56.3%) and in 12 participants after the resting procedure (75%).

Table 2 shows the results of the comparisons of the pre-to-post change rates of indicators in the tactile vs. resting procedures. Although salivary cortisol levels decreased and salivary immunoglobulin A levels increased in both groups, there were no significant differences in the post-treatment levels between the two procedures. Both of the autonomic indicators increased following both procedures, though there were no significant differences in any of the items measured.

Table 2

Changes in Psychological Indicators

Psychological indicators from all 17 participants were included in the analysis. Figure 4 shows the results of the pre-to-post comparison of the standardized POMS-Brief Form scores. The median pre-procedure scores did not deviate from the healthy range. In the "tactile-treated" participants, post-procedure scores for all 5 of the negative moods ("Tension-Anxiety", $p < .01$; "Depression-Dejection", $p < .01$; "Anger-Hostility", $p < .01$; "Fatigue", $p < .05$; and "Confusion", $p < .01$) significantly decreased compared to pre-procedure levels. In the "resting-treated" participants, the post-procedure scores for 3 ("Tension-Anxiety", $p < .01$; "Anger-Hostility", $p < .01$; and "Confusion", $p < .05$) of the 5 negative moods were significantly decreased compared to pre-procedure levels. No significant pre-to-post-procedure differences were observed in 2 of the moods ("Depression-Dejection" and "Fatigue"). No significant pre-to-post-procedure

Figure 4

differences were observed for the positive mood of "Vigor."

Figure 5 shows the pre-to-post comparison of the state-anxiety scores obtained using the STAI-JYZ. The median pre-procedure score was lower than 55 points, which represents intense anxiety. In "tactile-treated" participants, the median pre-procedure score was 44.0 points and the median post-procedure score was 32.0 points, which indicates a significant decrease following the procedure (p <.001). In the "resting-treated" participants, the median pre-procedure score was 42.0 points and the median post-procedure score was 40.0 points, which also indicates a significant decrease following the procedure (p < .01).

Figure 5

Table 2 shows the comparison between the pre-to-post changes in the indicators for participants undergoing tactile and resting treatments. The "tactile-treated" participants had significantly greater rates of change in the 4 POMS-Brief Form negative moods ("Tension-Anxiety", "Depression-Dejection", "Fatigue", and "Confusion") when compared to "resting-treated" participants (p < .05). The median pre-to-post change rate for the STAI-JYZ state-anxiety scores was significantly greater in "tactile-treated" participants (p < .01).

Discussion

Here we aimed to investigate the effects of stress palliation using tactile massage on mothers of children with ASD using physiological and psychological indicators. No significant differences were observed between “tactile-treated” and “resting-treated” participants in the number of hours spent sleeping on the night before the experiment. We also did not observe any significant differences in the participants’ blood pressures, heart rates, body temperatures, or the temperature or humidity of the experimental room on the days the procedures were performed. Therefore, we consider the experimental conditions to be homogenous between the two days.

Pre-to-post comparisons of physiological indicators of the endocrine system indicate that salivary cortisol decreased significantly and salivary secretory immunoglobulin A increased significantly in both “tactile-treated” and “resting-treated” participants. There were thus no significant differences in the rates of change of these variables between the two procedures. Salivary cortisol increases with acute psychological or physical stress and is related to chronic stress (Izawa et al., 2007a). Daily life events that cause negative moods may decrease salivary secretory immunoglobulin A levels, while events that cause positive moods may increase salivary secretory immunoglobulin A levels (Izawa et al., 2007b). Concurrent with the above observations, our results indicate that not only tactile massage, but also the resting condition, may be effective in alleviating physiological stress reactions.

In a study (Murata et al., 2009), the participants were treated with a relaxing stimulus immediately after the application of a stressful stimulus and changes in their stress-responding molecules were examined. The concentrations of salivary cortisol, which were increased with stress stimulation, did not return to their pre-stress level following “sitting,” but returned to pre-stress levels after “lying” or “lying and listening to music.” Furthermore, salivary secretory immunoglobulin A levels significantly increased after “lying” or “lying and listening to music.” “Sitting” did not lead to any significant changes in this variable. In another study (Takeda et al., 2008), aromatherapy, which is well known for its CAM effects, was compared with massage without essential oils with the participants in a lying resting position. The authors observed a decrease in salivary cortisol levels and an increase in salivary secretory immunoglobulin A levels, although the participants were in a lying resting position. No significant differences in these variables were observed between the lying resting position and aromatherapy or massage. These results indicate that even resting in a lying or supine position may alleviate physiological stress. As the relaxing chair used in the present study was able to recline and had an adjustable footrest to fit the individual’s preference, the participants were able to rest in a relaxing position. Consequently, salivary cortisol levels decreased and salivary secretory immunoglobulin A levels increased even after the resting procedure.

Pre-to-post comparisons of autonomic nervous system indicators suggest that HF significantly increases in “tactile-treated” participants. No significant differences were observed in “resting-treated” participants. In addition, no significant differences were found in LF/HF in either “tactile-treated” and “resting-treated” participants. As HF represents parasympathetic activity and LF/HF indicates sympathetic activity (Hayashi, 1999), tactile massage was considered to promote the parasympathetic nervous system with no effects on the sympathetic nervous system. This was consistent with the results of a study on the effects of tactile massage on healthy women (Suzuki et al, 2016). In a study on the effects of massage (other than tactile massage) on healthy individuals (Lindgren et al., 2010), the activities of both sympathetic and parasympathetic nervous systems were shown to decline. In this case, the massage may produce a compensatory effect to ensure balance in autonomic nervous system activities. We may have a similar effect in the present study. Another similar report (Kaneko & Koitabashi, 2006) examined the effects of massage on healthy individuals and reported an increase in parasympathetic activity and a decrease in sympathetic activity. There is currently no consensus among researchers concerning the effects of massage on the autonomic nervous system. The autonomic nervous system is affected by various external and internal factors, which may be difficult to strictly control during the experiment. The effects of tactile massage on the autonomic nervous system should be further examined in a follow-up to the present study.

The STAI-JYZ state-anxiety scores significantly decreased in both “tactile-treated” and “resting-treated” participants. However, the pre-to-post rate of change was significantly greater in “tactile-treated” participants than in “resting-treated” participants. This indicates that anxiety is reduced both by tactile massage and by resting in a seated position, though tactile massage may be more effective in alleviating psychological anxiety than resting in a seated position.

The scores for all 5 negative moods in the POMS-Brief Form were significantly decreased in “tactile-treated” participants. The scores for 3 of the moods were decreased in “resting-treated” participants. The pre-to-post change rate was significantly greater for 4 of the 5 negative moods in the “tactile-treated” participants compared to “resting-treated” participants. Our results indicate that tactile massage is more effective than resting in a seated position in reducing psychological negative moods.

In a study on the effect of tactile massage on STAI-JYZ in elderly women aged 75 years or older with mild dementia, the state anxiety scores significantly decreased following the procedure (Kikumoto & Kono, 2014). In studies in healthy female university students (Amano et al., 2012) and menopausal women (Kohno et al., 2013), scores on all 5 of the negative moods on the POMS-Brief Form were decreased following tactile massage. The results of the present study are consistent with those of previous studies, confirming the effects of tactile massage in positively changing mood and alleviating anxiety.

Human beings have emotionality, which is produced in crisis situations and used for self-preservation. There are two aspects to emotionality: “feelings,” which occur at the moment of the participant’s response, and “emotional responses,” which are expressed as physiological or behavioral reactions (Onaka, 2010). “Emotional responses” are expressed as reactions of the peripheral organs (facial expressions, behavior, and changes in the autonomic nervous system and endocrine system) and the brain. The mechanism underlying "emotional responses" is as follows: upon transmission of sensory stimulation from the outside to the brain, "feeling" and "emotional response" are produced, which are then transmitted back to the brain, further modifying "feelings" and "emotional responses" (Onaka, 2010).

For example, a study examined salivary secretory immunoglobulin A levels 30 minutes after participants were exposed to no odor, a pleasant odor, or an unpleasant odor, which induced good or bad feelings (Kim et al., 2009). Salivary secretory immunoglobulin A significantly increased only with exposure to a pleasant odor. The emotional responses of the participants differed depending upon the feelings induced by the odor. In the case of tactile massage, the somatosensory stimulation from the skin is transmitted to the brain, blood oxytocin levels increase, and blood cortisol levels decrease. In addition, the pleasant "feeling" experienced during tactile massage may feed back to the brain and potentially promote the reactions of the endocrine system as an "emotional response."

In the present study, which was conducted in mothers of children with ASD, tactile massage was more effective in alleviating anxiety and negative mood compared to resting in a seated position. Tactile massage also increased parasympathetic system activity in the autonomic nervous system, although its effects on stress reaction alleviation were no different from those observed in participants resting in a seated position. Thus, we may not have been fully able to capture the effects of the procedure on physiological and endocrine reactions. In a previous study (Suzuki et al., 2012), the participants received tactile massage regularly (2 times per week, total of 10 times). An endocrine system indicator (chromogranin A in saliva as an index of mental stress) was compared before and after the tactile massage at baseline, and the 5th and 10th sessions. A significant reduction in this endocrine system indicator was observed at the 10th session. This result suggests that regular tactile implementation might be more effective on physiological-endocrine responses than pinpoint implementation.

Tactile massage has the potential to become a very useful CAM, as adequate somatosensory stimulation of the skin can control the emotional responses of the brain and one's feelings. While the mothers of children with ASD were expected to have high levels of stress, the participants' stress levels were within a normal range as assessed using the index in this study. Further investigations with more participants are required to verify the effects of tactile massage. In addition, further similar studies in adult women and mothers of typically developing children are needed. We intend to carry out further verification experiments to examine the effects of regular long-term implementation of tactile massage.

References

Ågren, A., & Berg, M. (2006). Tactile massage and severe nausea and vomiting during Pregnancy－women's experiences. *Scandinavian Journal of Caring Sciences*, 20, 69-176.

Allik, H., Larsson, Jan-Olov & Smedje, H. (2006). Health-related quality of life in parents of school-age children with Asperger syndrome or high-functioning autism. *Health & Quality of Life Outcomes*. 4, 1-8.

Airosa, F., Andersson, S. K., Falkenberg, T., Forsberg, C., Nordby-Hornell, E., Ohlen, G., & Sundberg, T. (2011). Tactile massage and hypnosis as a health promotion for nurses in emergency care-a qualitative study. *BMC Complementary and Alternative Medicine*, 11, 83.

Amano, M., Hasegawa, T., Tonami, R., Uehara, Y., Sasaki, M. & Kitano, K. (2012). Evaluation of relaxation effects on hand tactile care. *Journal of Japan Society of Nursing and Health Care*, 14, 25-33. (in Japanese with English abstract)

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders: DSM-5. －5th ed.* Washington, DC, American Psychiatric Association Publishing.

Andersson, K., Wändell, P., & Törnkvist, T. (2004). Tactile massage improves glycaemic control in women with type 2 diabetes: a pilot study. *Practical Diabetes*

International, 21, 105-109.

Andersson, K., Törnkvist, L. & Wändell, P. (2009). Tactile massage within the primary health care setting. *Complementary Therapies in Clinical Practice,* 15, 158-160.

Bekku, N., & Yoshimura, H. (2008). A New Multidimensional Inventory for Easily Evaluating the Severity of the Behavioral Disorder in Children with Autism-A Possible Correlation between Severity of Autism and Positive/Negative Affect of Their Mother. *Journal of Japan Academy of Nursing Science*,28, 34-42.

Dabrowska, A. & Pisula, E. (2010). Parenting stress and coping styles in mothers and fathers of pre-school children with autism and Down syndrome. *Journal of Intellectual Disability Research*, 54, 266-280.

Estes, A., Munson, J., Dawson, G., Koehler, E., Zhou, X. H., & Abbott, R. (2009). Parenting stress and psychological functioning among mothers of preschool children with autism and developmental delay. *Autism*, 13, 375-387.

Field, T. (2005). *Touch and Massage in Early Child Development*. Japan: Johnson & Johnson Pediatric Institute, L.L.C.

Hastings, R.P., Kovshoff, H., Ward, N.J., Francesca degli Espinosa, F.D., Brown, T. & Remington, B. (2005). Systems Analysis of Stress and Positive Perceptions in Mothers and Fathers of Pre-School Children with Autism. *Journal of Autism and Developmental Disorders*, 35, 635-644.

Hayashi, H. (1999). *Heart Rate Variability Monitoring for Clinical Applications* (in

Japanese, translated by the author of this article). Japan: IGAKU-SHOIN Ltd.

Hidano, T., Fukuhara, M., Iwawaki, S., Soga, S., & Spielberger, C.D. (2000). *The manual of State －Trait Anxiety Inbentory －Form JYZ* (in Japanese, translated by the author of this article). Japan: JITSUMUKYOIKU-SHUPPAN Co. Ltd.

Imanishi, Jiro, & Imanishi, Junichi (2007). Why is integrative Medicine Needed? *Biotherapy*, 21, 373-380. (in Japanese with English abstract)

Izawa, S., Shirotsuki, K., Sugaya, N., Ogawa, N., Suzuki, K. & Nomura, S.(2007a). The Comparison of Salivary Cortisol Immunoassay Kits: Correlations between Salivary and Plasma Cortisol Concentrations and Comparison of Immunoassay Methods. *Japanese Journal of Complementary and Alternative Medicine*. 4, 91-101. (in Japanese with English abstract)

Izawa, S., Urara, H., Kodama, M., & Nomura, S. (2007b). The effects of daily events and moods on secretory immunoglobulin A in saliva. *Japanese Journal of Physiological Psychology and Psychophysiology*. 25, 237-244. (in Japanese with English abstract)

Kaneko, Y. & Koitabashi, K. (2006). Fundamental Studies of Physiologic and Psychological Responses by Purposeful Touch. *The Japanese Journal of Nursing Research*. 39, 469-480. (in Japanese with English abstract)

Kikumoto, Y. & Kono, Y. (2014). Evaluation of the effectiveness of tactile care to dementia elderly: Examination using an anxiety scale and saliva amylase activity.

Bulletin of Kio University. 11, 29-37. (in Japanese)

Kim, Yeon-Kyu, Nishimura, T., Lee, Sang-Il, & Watanuki, S. (2009). CHARACTERITICS OF SALIVARY SECRETORY IMMUNOGLOBULIN A(s-IgA) RESPONSES TO PLEASANT AND UNPLEASANT OLFACTORY STIMULI. *Japanese journal of physiological anthropology*. 14, 67-74. (in Japanese with English abstract)

Kohno, Y., Koizumi, Y., Sakai, K., Kyuji, K., Okayama, M., Sakai, K., Tsubomoto, T., Hashimoto, S. & Hukumi Kitamoto, H. (2013). Physiological and Psychological Effects of Tactile Care in Postmenopausal Women. *Journal of Japanese Society of Nursing Research.* 36, 29-37. (in Japanese with English abstract)

Lindgren, L., Rundgren, S., Winsö, O., Lehtipalo, S., Wiklund, U., Karlsson, M., Stenlund, H., Jacobsson, C. & Brulin, C. (2010). Physiological responses to touch massage in healthy volunteers. Autonomic Neuroscience: *Basic and Clinical*. 158, 105-110.

Makino, K., Suzuki, M., Kikuchi, K., Kimoto, A. & Nakagomi, T. (2013). Factor Structure and Related Factors Regarding Positive Sense towards Care among Practitioners of Tactile Care. *Journal of Japanese Society for Dementia Care*,12, 354-366. (in Japanese with English abstract)

Matsumoto,T.(2013). Autonomic Nervous System Activity and Women's Psychosomatic Health: Premenstrual syndromediand autonomic nervous system activity evaluated by heart rate variability and salivary chromogranin A. *Journal of Japanese Society of Psychosomatic Obstetrics and Gynecology*. 18, 211-224. (in Japanese)

Matsuoka, S., Tamaki, A., Hatsuda, M., & Nishiike, E. (2013). Difficulties Experienced by Mothers of Children with Pervasive Developmental Disorders and Their Psychological Support. *Journal of Japan Academy of Nursing Science*. 3, 12-20. (in Japanese with English abstract)

McNair, D. M., Lorr, M. & Droppleman, L. F. (1992a). *Profile of Mood States*. San Diego, Educational and Industrial Testing Service.

McNair, D. M., Lorr, M. & Droppleman, L. F. (1992b). *POMS Manual*. Tront, Multi-Health Systems Inc.

McNair, D. M. & Heuchert JWP. (2003). *Profile of Mood States Technical Update*. Tront, Multi-Health Systems Inc.

Mori, K., Ujiie, T., Smith, A. & Howlin, P. (2009). Parental stress associated with caring for children with Asperger's syndrome or autism. *Pediatrics International*, 51, 364-370.

Mugno, D., Liliana, R., D'Arrigo, V. G. & Luigi, M. (2007). Impairment of quality of life in parents of children and adolescents with pervasive developmental disorder. *Health & Quality of Life Outcomes*, 5,22-29.

Murata, T., Uno, M., Ishigami, H. & Kurachi, M. (2009). Stress Evaluation by the Stress Response Material in the Saliva and Effect by Bruxism. *The Journal of Gifu Dental*

Society. 35, 135-148. (in Japanese with English abstract)

Nomura, K., Kaneko, K., Honjou, S., Yoshikawa, T., Ishikawa, M., Matsuoka, Y. & Tsujii, M. (2010). Depression in Mothers Who Has Children with High-Functioning Pervasive Developmental Disorders. *Psychiatria et neurologia paediatrica japonica*, 50, 429-438. (in Japanese)

Onaka, T. (2010). Emotion. Kondou, Y., Ogawa, S., Kikumizu, T.,Yamada, K. &Tomihara, K. (Eds.), *The ethology of a brain and hormones*. (in Japanese,translated by the author of this article). Japan: Nishimurasyoten

Sakaguchi, M. & Beppu, S. (2007). Structure of Stressors in Mothers of Preschool Children with Autism. *The Japanese Journal of Special Eductaion*, 45,127-136. (in Japanese with English abstract)

Spielberger, C. D., Gorsuch, R. L. & Lushene, R. E. (1970). *Manual for the State−Trait Anxiety Inventory （Self−Evaluation Questionnaire）*. Palo Alto, California: Consulting Psychologists Press.

Suzuki, M., Tatsumi, A., Otsuka, T., Kikuchi, K., Mizuta, A., Makino, K., Kimoto, A., Fujiwara, K., Abe, T., Nakagomi, T., Hayashi, T. & Saruhara T. (2010). Physical and psychological effects of 6-week tactile massage on elderly patients with severe dementia. *American Journal of Alzheimer's Disease and Other Dementias*. 25, 680-686.

Suzuki, M., Miura, M., Suzuki, H., Kimoto, A., Emukai, Y. & Hayashi, T. (2012).

Effects on Improvement of the Care Burden and Stress and Recovery of Health of the Soft Massage (Tactile Massage) for the Family Caregiver of the Elderly People with Dementia. *The Japanese Journal of Nursing research.* 45, 589-602. (in Japanese with English abstract)

Suzuki, M., Kimoto, A., Nakajima, R., Hasegawa, T., & Nakagomi, T. (2016). Effects of tactile care on psychology and physiology Evaluation using electroencephalograms and heart rate variability. *The journal of Japan Society for Early Stage of Dementia.* 9, 32-40. (in Japanese with English abstract)

Takeda, H., Tsujita, J., Kaya, M., Takemura, M. & Oku, Y. (2008). Differences Between the Physiologic and Psychologic Effects of Aromatherapy Body Treatment. *The Journal of Alternative and Complementary Medicine*. 14, 655-661.

Uvnäs Moberg, K. (2000). The Oxytocin Factor. Japan: Shobunsya.

Wändell, P. E., Carlsson, A. C., Gafvels, C., Andersson, K., & Tornkvist, L. (2012). Measuring possible effect on health-related quality of life by tactile massage or relaxation in patients with type 2 diabetes. *Complementary Therapies in Medicine*, 20, 8-15.

Yokoyama, K.& Araki, S. (1994). *Nihonban POMS Tebiki.* Japan: Kanekoshobo.

Yokoyama, K. (2005). *POMS Tansyukuban Tebikitojireikaisetu*. Japan: Kanekoshobo.

Figure & Table

Figure 1. Tactile massage on the hands.

Table 1. The Tactile Care Technique.

Figure 2. The comparison between pre- and post-procedure endocrine system indicators.

Figure 3. The comparison between pre- and post-procedure autonomic nervous system indicators.

Table 2. The comparison of the pre-to-post change rates of physiological and psychological indicators in the “tactile” vs. “resting” procedures.

Figure 4. The pre-to-post comparison for the standardized POMS-Brief Form scores.

Figure 5. The comparison between pre- and post-procedure the state-anxiety scores obtained using the STAI-JYZ.

Figure 1. Tactile massage on the hands.

Table 1

The Tactile Care Technique.

1.The nurse tells the subject that it is time for tactile massage and to get in a comfortable posture.
2. The nurse wraps both hands in a towel before removing one towel to effleurage the hand and turn the palm up
3. The nurse rubs organic olive oil on the subject after warming the oil in her palm.
4. For finger effleurage, the nurse lightly strokes the side of the hand slowly.
5. The nurse wraps her hand around each finger while performing effleurage in a slow circular motion starting from the base of the finger to the tip of the finger
6. The nurse strokes the hand making small clockwise circles on the palm and puts the hands together before stroking the sides of the fingers.
7. The nurse lets her hands slide around the wrists while performing effleurage in a circular motion.
8. The nurse carefully wraps the subject’s hand in a towel and moves to the next hand.
9. The nurse repeats the same procedure for the other hand until the end of the tactile massage after which she thanks the subject.

（Suzuki et al.，2010）

Note. This technique is a hand technique of the Level I Tactile Care Course of the Japan Sweden Care Institute Co., Ltd.

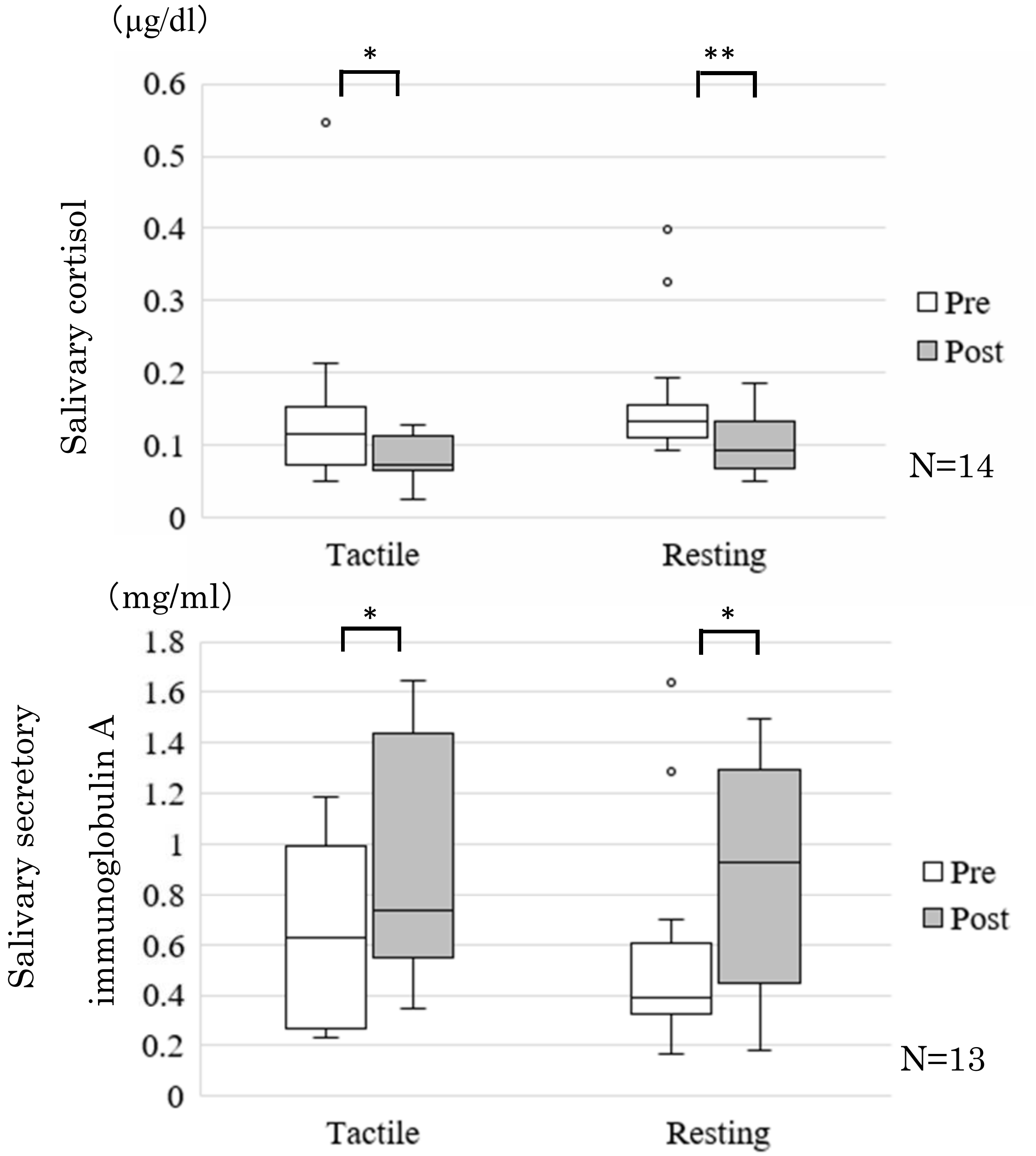

Figure 2. The comparison between pre- and post-procedure endocrine system indicators.
Note. Wilcoxon signed-rank test, * $p<.05$, ** $p<.01$.

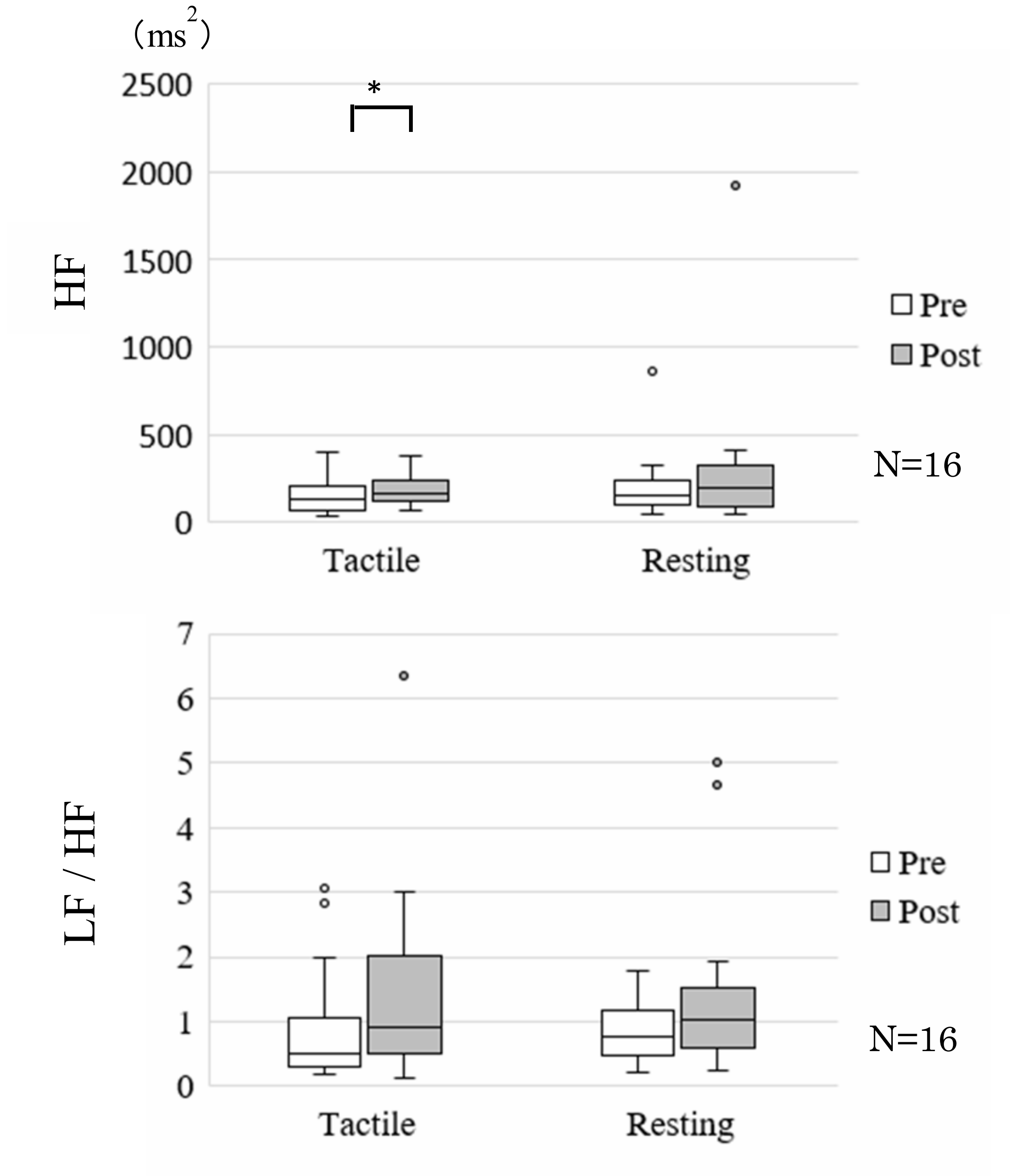

Figure 3. The comparison between pre- and post-procedure autonomic nervous system indicators.

Note. HF, high frequency; LH/HF, low frequency/high frequency

Wilcoxon signed-rank test, * *p*<.05.

Table 2

The comparison of the pre-to-post change rates of physiological and psychological indicators in the "tactile" vs. "resting" procedures.

Measure	Tactile	Resting	*p* value
Physiological Indicators			
Salivary cortisol	−0.34	−0.34	*ns*
Salivary secretory immunoglobulin A	0.60	1.01	*ns*
high frequency	0.25	0.15	*ns*
low frequency/high frequency	0.69	0.64	*ns*
Psychological Indicators			
POMS "tension-anxiety"	−0.13	−0.08	$p<.05$
"depression-dejection"	−0.07	0.00	$p<.05$
"anger-hostility"	−0.05	−0.07	*ns*
"fatigue"	−0.09	0.00	$p<.05$
"confusion"	−0.09	−0.06	$p<.05$
"vigor"	0.05	0.00	*ns*
STAI state-anxiety	−0.22	−0.07	$p<.01$

Note. Change rate = (post level-pre level)/pre level

Wilcoxon signed-rank test

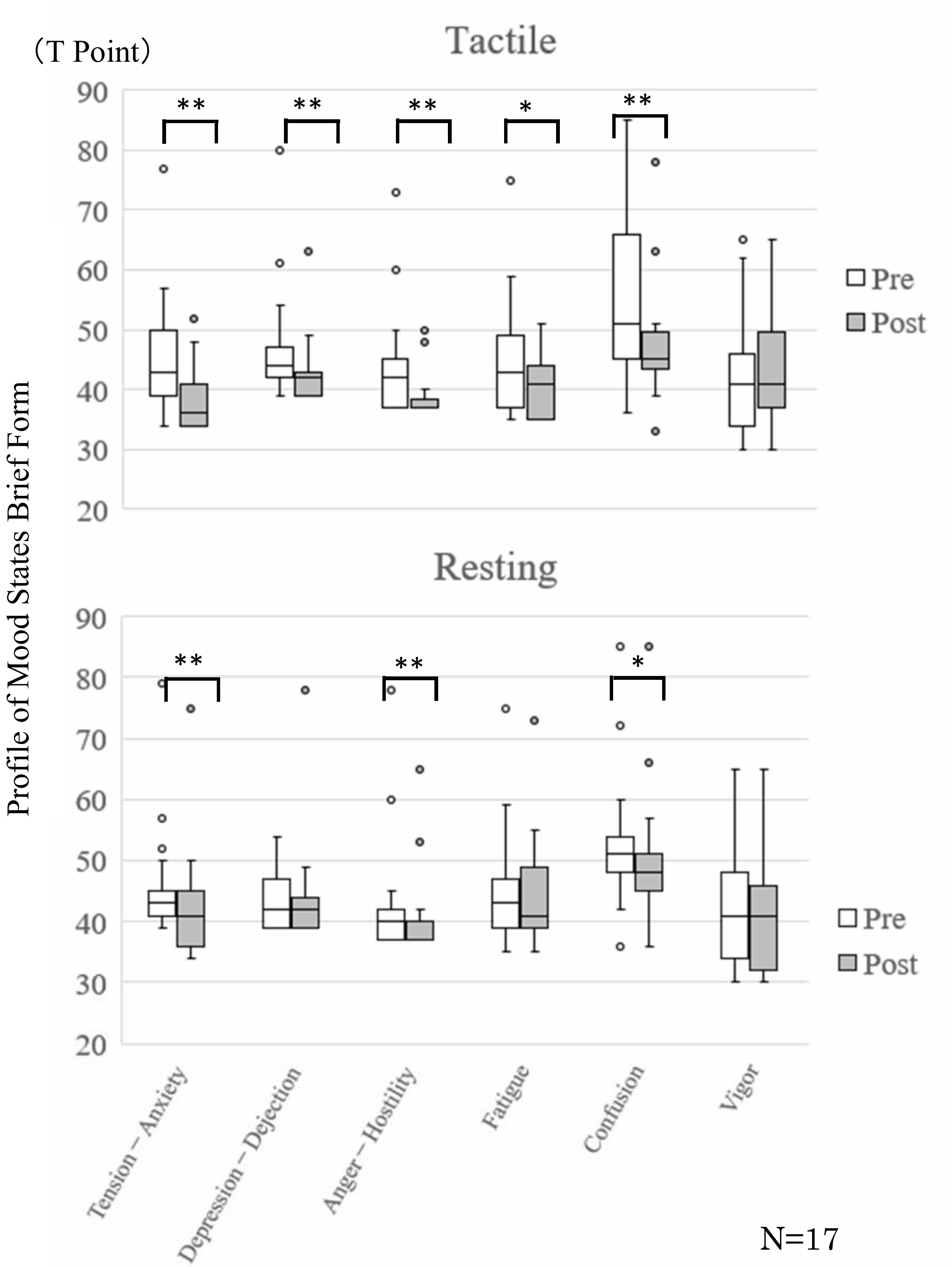

Figure 4. The pre-to-post comparison for the standardized POMS-Brief Form scores.
Note. Wilcoxon signed-rank test, * p<.05, ** p<.01.

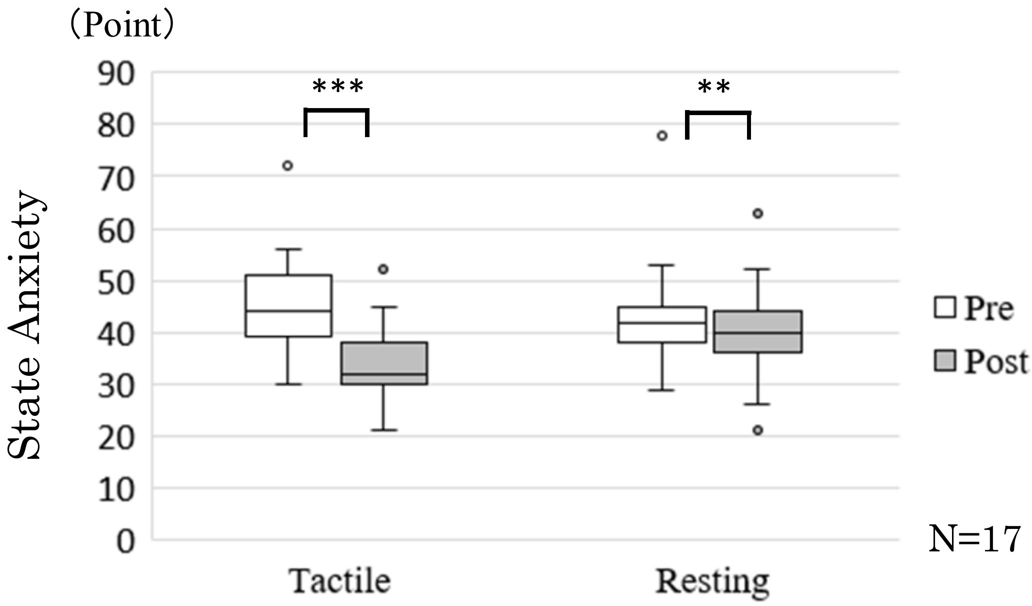

Figure 5. The comparison between pre- and post-procedure the state-anxiety scores obtained using the STAI-JYZ.
Note. Wilcoxon signed-rank test, ** p<.01, *** p<.001.