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NOTE

Effects of a Relaxation Chair for Stress Relief in Healthy Adults: A Randomized Study

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Abstract: The study aimed to examine the physiological and psychological effects of a recently manufactured relaxation chair in healthy adults. This study performed a randomized crossover-controlled trial. I compared two chairs, the relaxation chair and a normal chair as the control condition. Twenty young male adults participated in this study. Results showed that immunoglobulin A, an indicator of anti-stress activity, increased significantly after sitting on the relaxation chair ($P<0.05$), although the CgA was not significantly different among the four conditions of both chairs. Additionally, each Profile of Mood States score of Anger-Hostility, Confusion-Bewilderment, Tension-Anxiety, and the Total Mood Disturbance subscales decreased significantly, showing the greatest decrease after participants sat on the relaxation chair ($P<0.05$). Furthermore, the visual analogue scale score for comfort increased significantly after sitting on the relaxation chair, compared to the other three conditions, respectively ($P<0.05$). Moreover, using the State-Trait Anxiety Inventory, the state anxiety scores significantly decreased after sitting on the relaxation chair ($P<0.05$) among the four conditions, and the trait anxiety scores significantly decreased after sitting on the relaxation chair, related to each pre-condition of both chairs ($P<0.05$). These results indicate that sitting on the relaxation chair can temporarily alleviate physical and psychological stress in healthy adults.

Keywords: *Anti-stress effects, Human, Intervention, Relaxation chair*

1. INTRODUCTION

Patients tend to exhibit mood disorders and negative emotions in the clinical setting, and are also more susceptible to stress in relation to disease progression and treatment. Review articles have demonstrated the positive effects of relaxation interventions such as massage, music, progressive muscle relaxation, and yoga on stress in humans [1-4]. These interventions can be applied in a brief and non-invasive way to the target population. However, these stress-relieving interventions require an additional workload on the part of health care providers. In clinical practice, therefore, these interventions are not always timely and effective for the target population. The time available to provide stress-relieving care to patients is also limited in practical terms. It is necessary to consider intervention methods that are not only useful for alleviating patient stress, but can be applied without increasing the workload of healthcare professionals.

In this study, we focused on a recently manufactured relaxation chair designed for comfort effects. Although some studies have been conducted on anti-stress effects of similar chairs on humans [5-9], the effects of this relaxation chair have not been determined. If sitting on this relaxation chair can relieve physical or psychological stress, the chair could be applied as a relief intervention for patients with physical stress such as fatigue and malaise, or mental stress such as anxiety and mood disorders. Therefore, we decided to examine the effects of the relaxation chair on multiple dimensions, using psychological and physiological indices, each of which has proven reliable and valid. Because the experimental index is a more useful estimation of psychological and physiological response of a multiple index than a single index [10-12]. Thus, this study aimed to examine how sitting on the relaxation chair with multi-dimensional functions effects the physiological and psychological aspects in healthy adults, compared to sitting on a normal chair with backrest as a control.

2. MATERIALS AND METHODS

2.1 Participants

Participants were recruited via informational posters on bulletin boards at a university's campus. The inclusion criterion was being pain-free prior to the start of this study. None of the participants had a history of neurological disorders, cardiovascular disease, external injuries, or respiratory or autonomic dysfunction, nor they had been on smoking and medication recently. The participants ate at least 3 hours before the experiment and drank 500 mL of mineral water at least 2 hours before.

2.2 Relaxation Chair

This study used the relaxation chair (PA-MR30J-B, Osaka) manufactured by Proassist Ltd. in Japan (Figure 1(A)). The chair is equipped with multiple functions, such as a slow swaying movement, music called "Musicure® [13]" created by Niels Eje and Inge Mulvad Eje for stress relief and positive mental stimulus and emitted through built-in audio equipment, and high-frequency vibrations to massage the participant's back.

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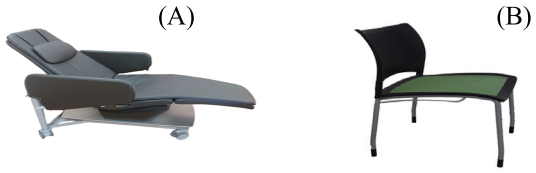

Figure 1: Relaxation chair (A) and Normal chair (B)

This relaxation chair is specifically designed as a health appliance to provide users with comfort. By contrast, the normal chair was not equipped with any rubbing or squeezing functions for humans like a traditional massage chair. Thus, the normal chair was a simple chair with a backrest, as shown in Figure 1 (B).

2.3 Executive task using Uchida-Kraepelin test scores

This study used the Uchida-Kraepelin test (Nisseiken, Inc, Tokyo, Japan) [14] to equate the psychological attention conditions before participants were seated in each chair. The Uchida-Kraepelin test which is a simple arithmetic test measures task performance speed and task performance accuracy. The test was conducted for a total of 30 minutes; 15 minutes in the first half and 15 minutes in the second half, with a 5-minute break in between. Participants were instructed to add 2 single digits and answer using only single digits as fast as possible. The results were evaluated from the right-number of calculations.

2.4 Measurements

The efficacy was quantitatively evaluated by measuring immunoglobulin A (IgA) and chromogranin A (CgA) in saliva as indicators of acute stress, a visual analogue scale (VAS) for comfort, the State-Trait Anxiety Inventory-Form (STAI) for anxiety [15], and emotions estimation using the Profile of Mood States second version (POMS) [16].

The amounts of IgA secretion rate and CgA secretion were measured using an enzyme-linked immune-sorbent assay kit and an enzyme immunoassay kit by Yanaihara Research Laboratory in Japan, respectively. Since IgA secretion rate decreases under stressful conditions and CgA secretion increases under stressful conditions [17, 18]. They are regarded as useful biomarkers for acute stress studies.

The VAS for comfort estimation was a 10-cm linear scale with no numerical markings, ranging from "very uncomfortable" (0) to "very comfortable" (10). Participants evaluated their level of comfort by drawing a line on the VAS scale with a pen.

The brief Japanese version of the POMS was used to evaluate participants' moods or emotions. The POMS comprises a list of 35 questions, and classifies eight subscales, designed to assess anger-hostility (AH), confusion–bewilderment (CB), depression–dejection (DD), fatigue–inertia (FI), tension–anxiety (TA), vigor–activity (VA), friendliness (F), and total mood disturbance (TMD). Participants evaluated their moods and emotions on a five-point scale, ranging from "not at all" (0 points) to "quite frequently" (4 points). Each score indicates an increase in their mental and emotional activities. The STAI was used to evaluate participant's anxiety because we considered the possibility that the burden of this experiment affected their anxiety level. The STAI comprises 40 anxiety items grouped in two dimensions of state and trait. The STAI was used to measure anxiety states on the pre- and post-conditions for both chairs, respectively.

2.5 Study design and procedure

This study was designed as a randomized crossover-controlled trial (Figure 2). This study conducted in an experimental room (temperature 26.8±2.7°C; humidity 28.3±3.5%) between 10:00 and 15:00 because stress biomarkers in saliva are affected by diurnal variation. Participant's medical history was checked and vital signs were examined for abnormalities. After the medical interview, the IgA and CgA amounts were measured during the pre-experimental condition. Their pre-experimental psychological statuses were also evaluated using the POMS, VAS, and STAI. Next, as shown in Fig. 2, participants were randomly allocated either the relaxation chair or the normal chair, and were required to sit in the allocated chair for 20 minutes. At the end of the first session, participant rated their psychological state using the POMS, VAS, and STAI, and their IgA and CgA samples were measured after the first session. To avoid any carry-over effect or habituation, we provided a 30-min interval between sessions. For the second session, participants were assigned to the chair that they did not used in the first session. Sampling data were collected before and after sitting on each chair.

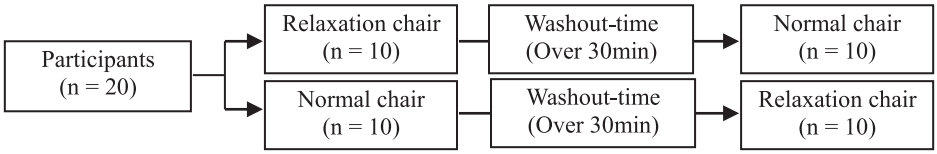

Figure 2: Study design and procedure

2.6 Statistical Analysis

Data were analyzed using IBM SPSS Version 23.0 for Windows (Tokyo, Japan). All data were expressed as mean ± standard deviation of the mean. All statistical analyses, except the Uchida-Kraepelin performance test, were performed using the repeated measures analysis of variance. The Uchida-Kraepelin performance test scores were analyzed with a paired-t test because it was performed only before participants sat in each chair. The criterion for statistical significance was set at 0.05.

2.7 Ethical considerations

The study was approved by the ethics committee of the Institutional Review Board, Kansai University of Social Welfare in Japan (Approval No. 30-0541). Participants provided written informed consent to participate after receiving an explanation of the study-purpose and procedures.

3. RESULTS

3.1 Characteristics data and Uchida-Kraepelin performance test scores

Twenty young male adults (aged: 21.25 ± 0.7 yrs; height 172.2 ± 4.7 cm; weight 67.1 ± 10.9 kg) participated in this study. And the Uchida-Kraepelin-test scores showed no significant difference between the two chairs (relaxation chair 638.3 ± 226.4 scores, normal chair 654.2 ± 222.0 scores, $t=-0.473$, $P=0.642$). None of the subjects demonstrated anything unusual or had any adverse events. The results are summarized in Table 1.

3.2 Immuno-response and acute stress response in saliva

Figure 3 shows that the Salivary IgA rate significantly increased after sitting on the relaxation chair, compared with before sitting on either the relaxation chair or normal chair (Relaxation chair: Pre-condition 171.1 ± 99.9 μg/min, Post-condition 271.3 ± 189.4 μg/min; Normal chair, Pre-condition 181.3 ± 110.8 μg/min, Post-condition 218.6 ± 145.3 μg/min, $F=4.860$, $P=0.011$). However, the CgA was not significantly different among the four conditions of both chairs (Relaxation chair: Pre-condition 2.1 ± 2.1 pmol/mL, Post-condition 1.9 ± 1.0 pmol/mL, Normal chair: Pre-condition 1.8 ± 1.2 pmol/mL, Post-condition 1.6 ± 1.2 pmol/mL; $F=0.951$, $P=0.388$).

3.3 Subjective estimation using the VAS

The VAS score for comfort after sitting on the relaxation chair significantly increased between the scores for comfort before sitting on the relaxation chair, before sitting on the normal chair, and after sitting on the relaxation chair, respectively (Relaxation chair: Pre-condition 3.5 ± 1.9 cm, Post-condition 7.4 ± 1.9 cm; Normal chair; Pre-condition 3.8 ± 2.3 cm, Post-condition 4.2 ± 2.5 cm; $F=19.577$, $P<0.001$) (Figure 4).

3.4 Anxiety evaluation using the STAI

The state anxiety score after sitting on the relaxation chair significantly increased between the scores before sitting on the relaxation chair, before sitting on the normal chair, and after sitting on the relaxation chair, respectively (Relaxation chair: Pre-condition 38.9 ± 6.5 scores, Post-condition 32.4 ± 9.3 scores, Normal chair:

Table 1: Summary data of this study's results

Variable	Relaxation chair		Normal chair		*F*	*P*
	Pre	Post	Pre	Post		
Salivary immuno-response and acute stres						
immunoglobulin A (μg/min)	171.1 ± 99.9	271.3 ± 189.4	181.3 ± 110.8	218.6 ± 145.3	4.860	0.011
chromogranin A (pmol/mL)	2.1 ± 2.1	1.9 ± 1.0	1.8 ± 1.2	1.6 ± 1.2	0.951	0.388
Subjective estimation for comfort						
Visual analogue scale score	3.5 ± 1.9	7.4 ± 1.9	3.8 ± 2.3	4.2 ± 2.5	19.577	0.000
Anxiety Inventory Form						
State Anxiety	38.9 ± 6.5	32.4 ± 9.3	37.5 ± 8.0	39.4 ± 9.4	10.836	0.000
Trait Anxiety	41.5 ± 8.8	36.4 ± 10.5	40.3 ± 8.6	41.1 ± 9.0	6.904	0.003
Emotions estimation using the POMS						
Anger-Hostility (AH)	43.2 ± 6.1	40.6 ± 4.8	42.8 ± 6.7	43.6 ± 6.6	4.863	0.004
Confusion–Bewilderment (CB)	49.0 ± 8.8	43.9 ± 6.1	47.7 ± 7.2	47.7 ± 8.4	5.324	0.003
Depression–Dejection (DD)	47.9 ± 7.1	46.0 ± 5.9	46.9 ± 5.7	48.3 ± 7.9	1.990	0.147
Fatigue–Inertia (FI)	45.6 ± 8.6	42.1 ± 6.0	45.8 ± 8.2	46.1 ± 8.7	2.555	0.064
Tension–Anxiety (TA)	45.3 ± 9.2	40.0 ± 7.6	43.0 ± 8.2	42.3 ± 7.9	4.661	0.019
Vigor–Activity (VA)	54.6 ± 9.8	55.5 ± 13.5	55.6 ± 10.0	52.9 ± 12.7	0.782	0.509
Friendliness (F)	62.1 ± 12.7	61.8 ± 14.2	64.0 ± 10.7	63.0 ± 14.1	0.736	0.535
Total Mood Disturbance (TMD)	8.1 ± 16.7	0.2 ± 13.8	6.3 ± 13.3	8.3 ± 16.0	5.714	0.002

POMS: Profile of Mood States second version

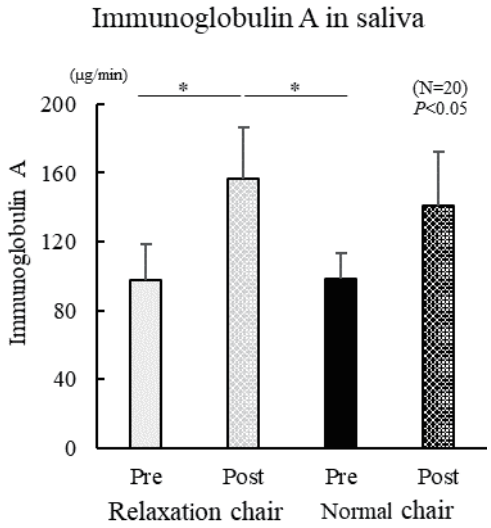

Figure 3: Changes of the immunoglobulin A in saliva among the four conditions

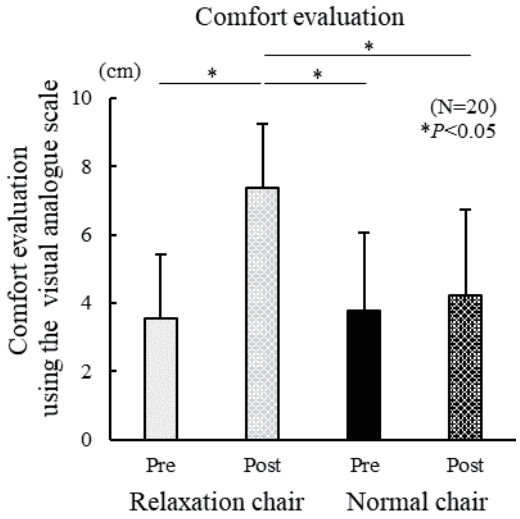

Figure 4: Changes of subjective comfort estimation by using the visual analogue scale

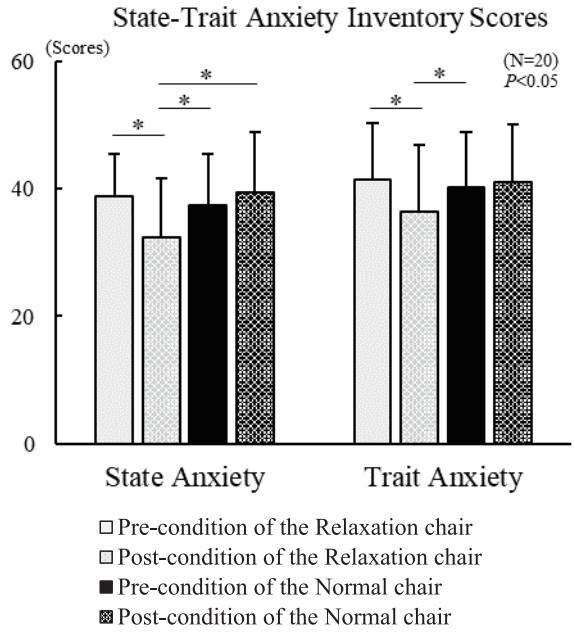

Figure 5: Scores of the State-Trait Anxiety inventory for each session of the relaxation chair and the normal chair

Pre-condition 37.5 ± 8.0 scores, Post-condition 39.4 ± 9.4 scores, $F = 10.836$, $P < 0.001$) (Figure 5). In addition, the trait anxiety score after sitting on the relaxation chair significantly increased between the trait anxiety scores before sitting on the relaxation chair and before sitting on the normal chair (Relaxation chair: Pre-condition 41.5 ± 8.8 scores, Post-condition 36.4 ± 10.5 scores, Normal chair: Pre-condition 40.3 ± 8.6 scores, Post-condition 41.1 ± 9.0 scores, $F = 6.904$, $P = 0.003$).

3.5 Psychological evaluations with the POMS

The POMS results are shown in Figure 6. Each data of the AH, CB, TA, and TMD subscales significantly differed between the conditions (Figure 6). Namely, each subscale score of AH and TMD under the post condition of sitting on the relaxation chair significantly decreased among the four conditions, respectively. Also, the CB subscale score under the post condition of the relaxation chair significantly decreased between the pre-condition scores of both chairs. Furthermore, the TA subscale score under the post condition of the relaxation chair was significantly lower than that under the pre-condition of the relaxation chair. Conversely, there were no significant differences of the DD, FI, VA, and F subscales among the four conditions.

4. DISCUSSION

The present study used a randomized controlled trial to show how sitting on a relaxation chair effects the physiological and psychological aspects in healthy adults, compared to sitting on a normal chair as the control. The findings of this study reveal that positive physical and psychological effects were induced by sitting on the relaxation chair, compared with sitting on the normal chair. In fact, the IgA secretion rate in saliva significantly increased, while the IgA secretion in saliva decreased by stress loading [17, 18]. The subjective comfort estimation using the VAS increased significantly by sitting on the relaxation chair. In addition, each negative score of the AH, CB, TA, and TMD subscales of the POMS significantly decreased by sitting on the relaxation chair. Moreover, the state and trait scores of the STAI significantly decreased by sitting on the relaxation chair, exclusively. These results indicate that sitting on the relaxation chair used in this study could temporarily relieve not only physical stress, but also psychological

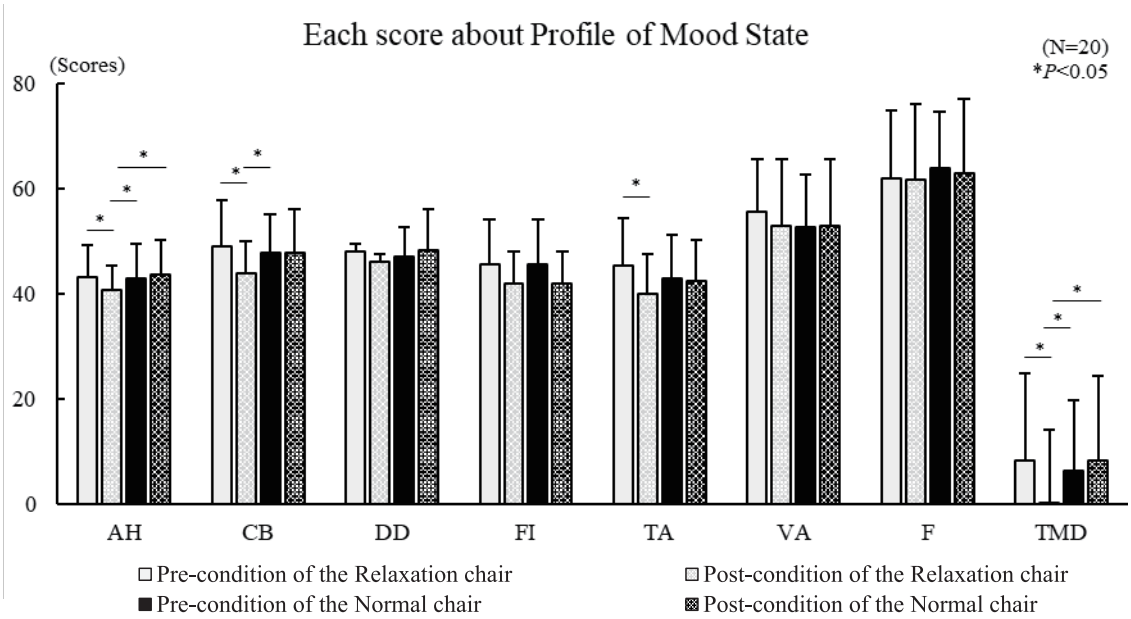

Figure 6: Profile of mood state scores for each condition

AH: Anger-Hostility; CB: Confusion–Bewilderment; DD: Depression–Dejection; FI: Fatigue-Inertia; TA: Tension–Anxiety; VA: Vigor–Activity; F: Friendliness; TMD: Total Mood Disturbance

stress in healthy young male adults, suggesting that this relaxation chair could be applicable to humans with stress.

The current study used some indices to examine the physiological and psychological effects of a recently manufactured relaxation chair in healthy adults. Significant differences in salivary IgA were observed with sitting in the relaxation chair, whereas no significant changes were observed in CgA. The reason for this is not clear, but it has been shown that CgA tends to reflect mental stress. On the other hand, IgA reflects both physical and mental stress. In other words, although both indicators are the same saliva-derived biomarker, their characteristics as indicators may have caused differences in their responses. In addition, the fact that no significant changes in salivary IgA were observed before and after sitting in the normal chair suggests that the relaxation chair can clearly induce a physical stress-relieving effect despite the short duration of 20 minutes spent in the chair. Additionally, all data of VAS, POMS, and STAI for sitting in the relaxation chair showed significant positive effects, although no effect was observed for any of the indicators for the normal chair. Therefore, sitting in this relaxation chair for 20 minutes is a brief and easily administered intervention that could provide positive physical and psychological well-being without the need for support from others.

Although the anti-stress mechanisms underlying the use of the relaxation chair remain unclear, this chair has multiple functions, such as a vibration sensation for the back, music for healing, and reclined position to provide comfort. Rieck et al. recently revealed that the SolTec TM Lounge chair, which is equipped with micro-vibration, music, and porcelain stimulation functions, could relieve tension in the seated individual and provide a high sense of resting effects [19], although their chair was very similar to the relaxation chair used in the current study. Also, these results correspond with Mackereth et al.'s study findings that sitting in a massage chair for 20 minutes contributes not only to relieving physiological stress, such as discomfort and pain, but also psychological stress such as anxiety and tension [9]. Zullino et al. have reported that a chair producing vibration for the back not only improves muscle tone but also relieves psychological tension due to anxiety [8]. Additionally, these results agree in part with previous findings that sitting in a rocking chair can improve depressive symptoms and mood discomfort [6]. Furthermore, systematic reviews demonstrate significant anxiety reduction in STAI scores with music intervention in patients [2, 7]. Thus, we consider that the anti-stress effect of this relaxation chair would be expressed by the synergistic functions of multiple sensory stimuli.

The current study has some limitations. First, since the effect of sitting on the relaxation chair was measured only for a short duration of 20 minutes, the long-term effect is not clear. Second, the study population should be expanded to include a wider range of age in both men and women, although this study included only young men as participants. Finally, further studies should include large-scale trials with both middle-aged and advanced-age adults to determine broader clinical implications.

5. CONCLUSION

Acute physiological stress based on IgA in saliva was significantly inhibited after participants sat on the relaxation chair for 20 minutes. Additionally, positive emotions were induced and expressions of negative emotions were inhibited while sitting on the relaxation chair. These findings thus indicate that sitting on the relaxation chair could temporarily relieve physical and psychological stress in healthy adults. Therefore, sitting on this relaxation chair for 20 minutes can provide positive physical and psychological well-being as a brief and easily administered intervention.

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