Effects of Scalp Massage on Physiological and Psychological Indices *1

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We examined the effects of scalp massage in reducing stress and augmenting comfort by using physiological and psychological indices. Scalp massage was found to significantly decrease the cortisol level in saliva and significantly increase the level of secretory immunoglobulin A (sIgA). In a test that used the Visual Analogue Scale (VAS), scalp massage was found to lower physical fatigue scores while increasing relaxation scores. Scalp massage also lowered the scores related to negative feelings in the Profile of Mood States-Short Form (POMS-SF). The salivary stress biomarkers and VAS and POMS-SF tests suggested that scalp massage is effective for improving comfort and reducing stress.

Key words : stress, comfort, scalp massage, physiological index, psychological index, cortisol, secretory immunoglobulin A (sIgA), Visual Analogue Scale (VAS), Profile of Mood States-Short Form (POMS-SF), negative feelings

1. Introduction

When we feel pain or numbness, we rub the part of the body unconsciously. Massage may have started spontaneously in the natural course of events, and has been used as a folk remedy and to assist medical care. Today massage is attracting attention not only in the field of medicine but also in aesthetics as kneading and rubbing improve blood and lymphatic circulation and ease psychological tension. Hand and facial massage have been reported effective for keeping these body parts in good shape1 and activating autonomic nerves2. There have been studies showing that the act of putting on makeup had good effects on both the mind and body of the person, including psychological and brain science studies on the effects of fragrance, putting on makeup and body esthetics3. These studies employed objective indices, such as those related to brain science and immunology, as well as psychological indices to eliminate factors other than individual differences.

Today in Japan, scalp massage is daily practiced mainly in beauty salons. In the salons, scalp massage is defined as a practice of softening the scalp by using all kinds of massage skills to alleviate customers’ anxiety about their hair, which may have thinned due to aging and/or stress. Scalp massage improves blood circulation, and thus the relationship between hair density and blood circulation has been investigated4. Changes in the quality of hair were also in-

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vestigated in terms of tension increase and the thickness of the hair cuticle\textsuperscript{11}. Unlike body massage, scalp massage, which does not require customers to take off clothes, is an easy-to-provide service in beauty salons, which mainly provide hair dyeing and hair permanent treatment services. There have been few studies on the physical and psychological aspects of scalp massage. In this study the authors investigated the relaxation effects of a short scalp massage by measuring and analyzing physiological and psychological indices before and after the scalp massage.

2. Experimental Methods

2.1. Subjects

The subjects were 30 healthy female adults (age: 28–58 years old, average age: 42.1 ± 8.3 years old), who expressed their consent in writing after hearing an explanation of the test methods.

2.2. Experimental procedure

One hour after lunch, the subjects filled in the answer sheets for the Visual Analogue Scale (VAS) and Profile of Mood States-Short Form (POMS-SF) tests for psychological evaluation. They rinsed their mouths and took a 15-minute rest before saliva was collected. They received a 30-minute scalp massage during which the heartbeat was monitored via a heartbeat meter installed on the left hand. After the massage, the heartbeat meter was removed, and saliva was collected. The subjects took the VAS and POMS-SF tests again. They were interviewed for 5 minutes, and the replies were recorded for qualitative analysis (Fig. 1 (A)).

The scalp massage involved shampooing and rinsing the hair with fragrance-free products for 10 minutes, giving pre-massage for 3 minutes and 30 seconds, relaxing massage for 5 minutes (to relax the muscles and smooth the bloodstream and lymphatic flow), lift-up massage for 5 minutes (to relieve stiffness in the frontalis, temporal and occipitofrontalis muscles, which had undergone contraction and descent), washing the hair with fragrance-free products again, and giving additional massage for 3 minutes and 30 seconds (Fig. 1 (B)). In addition, we carried out the all massage with the same people to maintain the same experimental conditions.

2.3. Physiological evaluations

The cortisol and secretory immunoglobulin A (sIgA) levels in saliva were measured as indices related to psychological stresses. The heart rate was monitored with a heartbeat meter (Pulsocoach neo HR-40 : Japan Precision Instruments, Inc.) attached to the left hand forefinger at intervals of 8 seconds during scalp massage. Datasets from 24 persons, for whom heartbeat could be monitored for a continuous 30 minutes, were used for the analysis.

The temperature on the skin surface at the forehead, cheeks and palms was measured by using a handy-type infrared thermometer (IT-340 : HORIBA, Ltd.) when saliva was collected before and after scalp massage.

2.4. Psychological evaluations

In the VAS test, the subjects answered “the degree of wakefulness”, “Sentiment”, “Concentration”, “Physical fatigue”, “Feelings”, “Volition” and “Degree of relaxation”. In the POMS-SF test, their psychological states were evaluated for “Tension-Anxiety”, “Depression-Dejection”, “Anger-Hostility”, “Vigor-Activity”, “Fatigue-Inertia” and “Confusion-Bewilderment” on six scales, and the Total Mood Distance score was calculated. The subjects were also interviewed after scalp massage, and the recorded words were used for qualitative analysis of psychological effects.

2.5. Saliva component measurement

2.5.1. Saliva collection method

Saliva was sampled using the swab method. Swab (Salimetrics Oral Swab : Salimetrics, LLC) was inserted under

\[\text{Fig. 1} \quad \text{(A) Experimental procedure and (B) Procedure of scalp massage.}\]
the tongue, left for two minutes, removed from the mouth and kept in a preservation tube (Swab Storage Tube : Salimetrics, LLC). The saliva was collected by centrifugation and cryopreserved at −20°C until cortisol and sIgA measurements.

2.5.2. Measuring methods
Cortisol and sIgA levels were measured by using a high sensitivity salivary cortisol EIA kit (Salimetrics, LLC) and a salivary secretory IgA indirect EIA kit (Salimetrics, LLC), respectively.

2.6. Statistical analysis
To ensure normality, the mean scores of the indices before and after scalp massage were examined by conducting the Wilcoxon singed-rank test. The difference was considered to be significant for levels lower than 5%. In the figure, “***” denotes less than 5%, “**” denotes less than 1%, and “*” denotes less than 0.1%.
We also showed the correlation between each VAS index and the T score of each POMS item in the Spearman’s rank correlation coefficient.

3. Experimental Results
3.1. Physiological evaluations
The cortisol level in saliva was reduced to less than half by scalp massage from 3.27 ± 2.84 ng/mL to 1.37 ± 0.98 ng/mL (Fig. 2). The sIgA level increased more than five times from 21.6 ± 13.3 μg/mL to 110.2 ± 45.1 μg/mL (Fig. 3). Scalp massage was shown to have reduced the cortisol level and increased the sIgA level in saliva.
The mean heart rate of 24 subjects slowed down during scalp massage from around 70 beats/min at the start of the massage to around 66 beats/min by the end of the operation. In particular, a sudden reduction from 68–69 beats/min to 66–67 beats/min was observed during the latter pre-massage period of around 13 minutes, showing a significant reduction in mean heart rate in 80 seconds between the periods 11 minutes and 16 minutes after the start (Fig. 4).
The temperature of the skin was increased by scalp massage at all parts measured (forehead, cheeks, and palms) (Fig. 5).

![Fig. 2](image1.png) **Cortisol levels in saliva.*** *p < 0.001.*

![Fig. 3](image2.png) **sIgA levels in saliva.*** *p < 0.001.*

![Fig. 4](image3.png) **Changes in mean heart rate.*** *p < 0.001.*

![Fig. 5](image4.png) **Temperature of the skin surface.**
□ : Before massage, ■ : After massage.
** : *p < 0.01, *** : *p < 0.001.*
3.2. Psychological evaluations

The VAS test showed significant changes to “awakened” (Wakefulness), “good” (Sentiment), “light body” (Physical fatigue), and “relaxed” (Degree of relaxation), suggesting that scalp massage had reduced stress and improved comfort. No changes were observed in indices that were not directly related to stress, such as feelings and volition (Fig.-6).

In the POMS-SF test, scalp massage was shown to have reduced the scores significantly for the indices that expressed negative feelings, such as “Tension–Anxiety”, “Depression–Dejection”, “Anger–Hostility”, “Fatigue–Inertia” and “Confusion–Bewilderment”, suggesting that scalp massage is effective for mitigating these negative feelings. The score for “Vigor–Activity” was likely to have not changed because the subjects were healthy and gave high scores even before they received scalp massage (Fig.-7).

Highly negative Spearman’s rank correlation coefficients were shown between “Degree of relaxation” and “Tension–Anxiety” (\( \rho = -0.456 \)) and “Depression–Dejection” (\( \rho = -0.476 \)) before scalp massage. After the massage, the negative correlations disappeared, and negative correlation was observed between “Physical fatigue” and “Vigor–Activity” (\( \rho = -0.576 \)) as well as positive correlations between ”Vigor–Activity” and “Feelings” (\( \rho =0.526 \)), “Volition” (\( \rho =0.640 \)), and “Sentiment” (\( \rho =0.471 \)) and also between ”Physical fatigue” and ”Fatigue–Inertia” (\( \rho =0.476 \)), suggesting that the scalp massage improved comfort.

We classified the words mentioned by the subjects into those related to feelings, effects, and operation environment. Most frequently mentioned words are shown in Table-1 in the descending order. Frequently used words included those that suggested mitigation of stress, such as “sleepy”, “feels good”, “relaxed”, and “refreshed/refreshing”. Although not shown in the table, “felt no tension” was also frequently heard.

![Fig.-6 VAS score change after scalp massage.](image)

* : \( p < 0.05 \), *** : \( p < 0.001 \).

![Fig.-7 Mean POMS-SF test scores before and after scalp massage.](image)

\( \square \) : Before, \( \blacksquare \) : After. ** : \( p < 0.001 \).
Table 1 Frequently mentioned words in descending order.

<table>
<thead>
<tr>
<th>Words showing feelings</th>
<th>Words indicating the effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleepy</td>
<td>Stiffness (necks, shoulders)</td>
</tr>
<tr>
<td>43</td>
<td>11</td>
</tr>
<tr>
<td>Relaxed</td>
<td>Scalp</td>
</tr>
<tr>
<td>32</td>
<td>10</td>
</tr>
<tr>
<td>Feels good</td>
<td>good circulation</td>
</tr>
<tr>
<td>31</td>
<td>5</td>
</tr>
<tr>
<td>Clearly</td>
<td>(of the blood)</td>
</tr>
<tr>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Warming</td>
<td>Effects</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Like, Preference</td>
<td>Glossy (hairs)</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Be surprised</td>
<td>Hair restorations,</td>
</tr>
<tr>
<td>2</td>
<td>thinning hair</td>
</tr>
<tr>
<td>Easy</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>Words showing the environment</td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td>Massage</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Be full of vigor</td>
<td>Shampoos</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Vitality</td>
<td>Chairs</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Bright</td>
<td>Beauticians</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

4. Discussion

The relationship between the cortisol and sIgA levels in saliva before and after scalp operation is shown in Fig. 8. No correlation was observed between cortisol and sIgA levels either before (empty diamonds) or after (dark squares) scalp massage. As shown in the figure, the plots (empty diamonds) before massage spread flat at low sIgA levels and varying cortisol concentrations. After the massage, cortisol levels decreased while sIgA levels increased, resulting in a vertically aligned plot. Nakane mentioned that cortisol and sIgA are related to fatigue caused by stress and to comfort related to relaxation, respectively. The values suggest that the subjects were highly stressed and felt little comfort before the scalp massage and felt less stressed and more comfortable after the service. These data and the results of reduced stress and improved comfort of the VAS test suggest that these physiological indices can be used as objective psychological indices for showing stress and comfort.

The temperature of the skin rose with scalp massage at all parts measured, suggesting that scalp massage raised the overall body temperature. Unlike the temperature at the body core, which is constant, the temperature of the skin fluctuates according to the ambient temperature and other factors. The temperature of the skin depends on the bloodstream circulating through the skin tissue and is high under high blood circulation and drops when the blood circulation falls. Blood circulation depends on expansion and contraction of blood vessels, and this vasomotor action is involved in changes of the skin temperature. It has been reported that psychological stressors, such as uneasiness and tension, activate sympathetic nerves, induce contraction of peripheral blood vessels, and lower the temperature on the palms. We will carry out the measurement of the bloodstream in future and confirm this discussion. In this study, words that implied reduced stress and increased comfort, such as “sleepy”, “feels good”, and “relaxed”, were frequently heard from the subjects after the massage, suggesting that parasympathetic nerves became dominant after the scalp massage, expanding peripheral blood vessels, raising the skin temperature, and slowing the heartbeat.

In beauty salons, scalp massage has been performed mainly to control hair loss and thinning of hair attributable to thinned epicranial aponeurosis due to aging and contraction of capillaries. It has been reported that the density and tension of hair was increased by massaging the scalp over a period of a half year and there was correlation between increases in hair density and increases in the steady bloodstream in the scalp and between the springiness of the hair and the thickness of the cuticle. In this study, the subjects did not mention any words related to “hair fostering” but only words that implied “good bloodflow” a few times, likely because they received scalp massage just once and not over a long term and could not feel the effects of hair restoration.

Hans Selye, a former professor of Montreal University, established the concept of “stress” in the field of medicine. He defined stress as “the nonspecific response of the body to any demand for change, whether it is caused by or results in pleasant or unpleasant conditions” and that the demand is the stressor. He emphasized that stress is not a disease itself and does not always cause disease and said that “stress is the spice of life”. Stress is unavoidable and is
not good or bad itself. The authors believe it is important to find and cultivate our own capabilities by using the agreeable sensation of removing stress. Aesthetic therapy is a good approach, and particularly scalp massage is likely to be effective. We will continue qualitative psychological investigation of the effects by analyzing the words of the subjects by using the Modified Grounded Theory Approach (M-GTA) and investigate the relationships among scalp massage, stress and comfort.

5. Conclusions

Scalp massage has been frequently covered by the mass media as practices of “scalp care” and “head spa” for preventing the hair from thinning but not always with a scientific basis. In this study, we investigated the effects of scalp massage not on preventing hair thinning but on relieving people from stress and increasing comfort, which are effects known for massage of the other parts of the body, such as the back and legs, because the effects of scalp massage have been little investigated. Our physiological and psychological investigations using salivary stress biomarkers and VAS and POMS-SF tests suggested that scalp massage is effective for improving comfort and reducing stress.

References

3) T. Saruwatari, 27th Symposium for Engineers on Colloid and Surface Industry, 23–25, 2010
頭皮マッサージの生理的，心理的指標に及ぼす効果*1

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頭皮マッサージのストレスや快適感に及ぼす影響を生理学的指標，心理学的指標を用いて検討した。その結果，頭皮マッサージにより，唾液中のコルチゾール濃度は有意に低下し，分泌性免疫グローブリン A 濃度は有意に上昇した。Visual Analogue Scale（VAS）を用いた検討では頭皮マッサージの前後で身体的疲労の軽減，リラックス度の上昇が認められ，POMS 短編版ではネガティブな感情を示す指標の低下が認められた。ストレスに関連した唾液成分濃度の測定および VAS や POMS 短編版の結果から，頭皮マッサージにはストレスを軽減させる作用や快適性を向上させる作用があることが示唆された。