

Comparison of skin cleaning materials

-Examination of skin sense, brain waves and skin surface environment after skin cleaning-

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Abstract: The purpose of this study was to determine the effects of steam towel application on skin cleansing and pain relief by comparing it with conventional skin cleansing materials. The survey participants included eight male university students (22–26 years of age) who had no cognitive or physical problems. The researchers were required to reduce the burden on the survey participants, visually monitor the participants, and be relatively common in each part of the body in terms of skin sensation. The their inside skin from wrist to elbow. The materials to be evaluated were as follows: a steam towel, a hot towel heated using a steamer, a conventional hand-drawn(squeezed) towel, and a cotton towel wrapped in non-woven paper crafted by a local vendor. Intervention method: The skin temperature and humidity levels were measured by connecting the Shinei KK's thin-walled THP-728 to a network-type thermo-hygrometer TRH-7X. In addition, skin sensation was measured using the SD method. EEG measurements were taken by a neurologist familiar with this technique. The steam towel kept the temperature higher than the other materials for 90 s after application. The humidity was highest for the squeezed towel. The steam towel yielded the second-lowest humidity levels after the hot towel. EEG results are as follows: SV analysis revealed that the steam towel and cotton towel increased the θ wave in the right somatosensory cortex and attenuated the slow β wave compared with the other materials. These changes seemed to correspond with the mild and warm feelings identified by the subjective psychological test. The image evaluation results are as follows. The skin sensation image after wiping was more positive after using the steam towel than that after using the other materials in the following emotional categories: tension/relaxation, excitement/sedation, light/darkness, and general evaluation. The vaporization time for the steam towel was shorter than that for the hot towel when plotted against the skin surface humidity levels after wiping. A steam towel that does not elicit a negative reaction can be applied to patient care.

Keyword: Steamed towel, EEG, THP-728, SD method

Introduction

Body cleansing is a cleansing technique aimed at achieving the same refreshing feeling and cleansing as bathing. A towel that contains sufficiently warm water and that has excess water squeezed out by hand is generally used for wiping the skin. If the moisture is not immediately dried off after wiping with this wet towel, the skin temperature will lose its heat of vaporization and drop by 0.5°C (Fukai, 2001). Therefore, even if the temperature of the squeezed towel is appropriate, the subject will feel cold after body cleansing.

In the 1960s, cleaning with a hot towel containing hot water was introduced as a cleaning care method and a

labor-saving measure to eliminate the labor shortage of nurses; this method spread throughout the country (Kawashima, 1985). Hot towel contains too much water that is unsuitable for wiping due to long steaming time. Miwaki et al. (2006) reported 66% of nurses' responses: That is, they said that hot towels could save a lot of time in preparing a patient-friendly wipe. This proved that there was no cleaning material to guarantee patient comfort corresponding to their busyness.

In a study on hot towels, Yoshikawa described the effect of a compress to warm the skin. Yoshikawa et al. (2002) applied a hot towel to the back of seven people and placed an electric warm pack on the towel to prevent its

temperature from decreasing. The results showed that blood flow in the back was tripled after the warming up; the skin temperature increased by 5.88°C and returned to the reference value after 20 minutes. This study also reported that there were individual differences in blood pressure pulse variability. When assessing comfort, feelings of pleasure and discomfort in the subjects were unclear.

Since the moisture contained in steamed towels causes the skin temperature to drop after wiping or hot compressing, the authors have devised a steamed cloth containing approximately 20 ml of boiling water and have been evaluating this cloth since 2005. A subjective evaluation of the effect of using this steamed cloth on healthy university students revealed a clear usefulness, physical effect, and psychological effect (Shimizu and Kosaka et al., 2008). Therefore, a steamed cloth made by evaporating a small amount of boiling water on a dry towel has a positive effect psychologically, and less energy is consumed through evaporation of the moisture left on the skin, making it comfortable for weaker individuals. Steam cloths can bring unprecedented relaxation.

A steamed cloth is comprised of a small amount of hot water absorbed by a dry towel to generate steam. The steam cloth minimizes the consumption of the vaporization energy due to the moist condition of the skin after cleansing and can provide a refreshing feeling for frail elderly people and patients with severe conditions such as cancer. Furthermore, because it minimizes the use of water, steamed cloths can be used in disasters and in areas with little water. Therefore, it is important to measure body surface temperature and somatosensory sensation by skin stimulation via electroencephalogram (EEG) and subjective evaluation, to clarify the vapor deposition effect, and to provide basic knowledge for the clinical application of steamed cloths.

In nursing care, many studies have empirically selected a cleaning method that was subjectively assessed by the patients. In this study, the skin stimulation response was measured quantitatively using brain waves, body surface temperature was measured using a thermal imaging camera (Thermo vision; CHINO), and humidity was measured to quantitatively explain the basis of the effect of steam cloth. Measuring skin sensations by EEG (electroencephalogram; EEG) is considered somatosensory, and Park M. (2005) and others have measured the degree of discomfort of sanitary napkins. If the effect and safety of steamed cloths are clarified, even frail patients can be easily refreshed, and steam cloths can be used at disaster sites in Japan and abroad.

The purpose of this study was to clarify the effect of steamed cloths applied for human skin cleansing and pain relief by comparing materials conventionally used for skin cleansing.

Methods

Measurement sample;

Measurements were performed using a steamed cloth, a steamer-heated steaming towel, a conventional hand-drawn towel, and a non-woven cotton towel developed by a local vendor. Each preparation protocol is shown in Table 1. Dry towels were used as reference samples.

The steamed cloth weighed 37 g, which included 20 ml of water on a 17-g cotton towel. The steamed cloth was prepared by applying hot water (80 to 90°C) to a dry towel and remove the rough heat to implement when the surface becomes 50°C or less. The steamed towel was prepared by rolling a towel, soaking it in water, and heating it with a steamer; the steamed towel is used at a temperature of 50°C or less when in contact with the skin. The conventional hand squeezed towels were soaked in hot water of approximately 50°C and then squeezed to remove excess water. The paper towel consisted of a towel wrapped with batting and non-woven fabric on the outside.

Participants

The survey collaborators included eight male university students who had no cognitive or physical problems and were 22 to 26 years old. The researcher was required to reduce the burden on the survey collaborators, to be able to visually check the collaborators, and to be relatively common in each part of the body in terms of skin sensation. The upper arm.

The measurement conditions of the research collaborators were as follows: body temperature, 36.0°C; respiratory rate, 16 to 20 breaths/min; pulse, 60 to 90 beats/min; blood pressure, 110 to 134/60 to 90 mmHg; peripheral oxygen concentration (SpO₂), 95 to 99%. The measurements were taken at rest.

Stimuli

Wipe practitioner was only one person of nurses in order to achieve the stability of the technology. The intervention nurse was a 44-year-old female with six years of practical experience, education, research, and clinical knowledge. At the time of the intervention, the study was conducted after the study leader provided an explanation and guidance.

Table 1. Materials that were measured

Material	Water content	Material weight	Operating temperature	Creation and implementation method
Steamed cloth	20 ml	Cotton/37 g (towel 17 g)	Approximately 45–50°C	Apply 80–90°C boiling water to the dry towel Use with rough surface and below 50°C
Hot towel	50 ml	Cotton/200 g	Approximately 45–50°C	Roll the towel soaked in water and heat with a steamer. 50°C or less at the time of skin contact
Squeezed towel	70 ml	Cotton/200 g	Approximately 45–50°C	Towel was squeezed after soaking in hot water at approximately 50°C
Paper towel	50 ml	Cotton, non-woven towel/40 g	Approximately 45–50°C	Towel squeezed by soaking batting and outer nonwoven material in hot water of approximately 50°C

Procedure

Measurement system;

The data on skin temperature and humidity were collected by connecting Shinei KK's thin-walled THP-728 to a network-type thermo-hygrometer TRH-7X to measure the temperature and humidity of the skin surface. Moreover, the image of skin sensation used the semantic differential (SD) method.

The TRH-7X collected analog data two to seven times per second from the sensor probe. The data were digitized with the TRH-7X conversion software and imported into a CSV with a personal computer, and then within 1 second three to five electrical data points were adopted, plotted, and visualized along the time axis. In this research stage, we organized and visualized the data by hand, but for the continuous data collection in the future, we developed software to unify and visualize the number of times of data to be adopted. Thermo-hygrometer data acquisition software (NSD-0025) was used (Fig. 1-2).

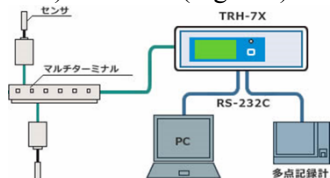


Fig. 1 Sensor probe THP-728 Fig. 2 Temperature / humidity measurement system

EEG measurement;

The EEG measurement was performed by a neuromedicine physician familiar with the procedure. There were seven EEG collaborators in their twenties. Each patient was seated in a comfortable chair at rest, and their left upper limb was cleaned. The environment of the EEG laboratory was as follows: humidity: 54.2%, EEG dark room temperature: 27.4°C. The procedure was

performed in the following order: No. 1: dry cloth, No. 2: steamed cloth, No. 3: steamed towel, No. 4: paper towel, No. 5: squeezed towel (water temperature: 52.0°C). The EEG was measured for 2 minutes after wiping. For the analysis of the worst spectrum (PS), the recorded EEGs were extracted eight times for 5 seconds for each channel, Fourier-transformed, and averaged. The β , α , and slow β band peak values and their frequencies were measured. In addition, this study defined a change in PS that lasted 0.5 Hz or more as a stable change (SV). The Student's t test was used for the statistical analysis.



Fig. 3 Attaching the sensor probe Fig. 4 EEG measurement

Subjective evaluation (semantic differential method);

The subjective evaluation of the skin sensation measured the image using the SD method. To measure emotional or emotional contents received from various objects and express it in multiple dimensions 1). The SD method uses approximately 15 to 30 bipolar adjective pair scales. For each scale, the impressions of the various objects are assessed, and the resulting data are subjected to a factor analysis to extract the major dimensions that make up the impression. Using this method, researchers can capture the outline and structure of an impression with fewer dimensions 2). This research measured somatosensory sensations using an EEG and the SD method because the main sensitivity dimensions of evaluability, dynamics, and competence extracted by the SD method can be extracted across various cultural spheres and objects. This is because 1) there is a high possibility of having a unique intracerebral base in each dimension, and 2) the main dimensions that compose the impression have different intracerebral bases.

Data analysis

The data were analyzed descriptively by each expert on the measurement results by the equipment.

Ethical procedures

We received approval from the ethics committee of the researcher for this study. (Heisei24-051)

Results

i) Temperature

The steamed cloth kept the temperature higher than the other samples for 90 seconds after the procedure.

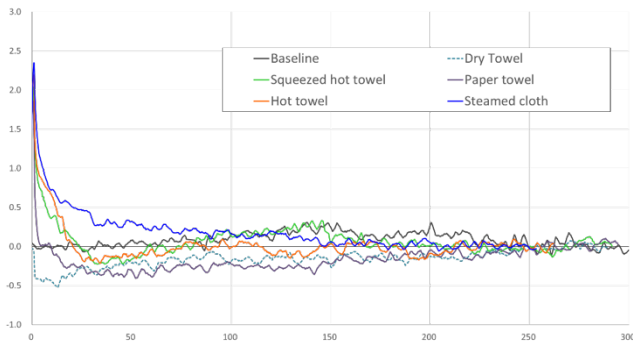


Fig. 5 Change in skin temperature after wiping over a 5-min period

ii) Humidity

The squeezed towel had the highest humidity, followed by the paper towel and steamed cloth

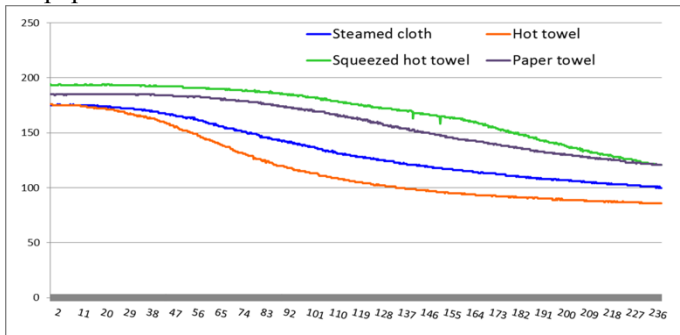


Fig. 6 Changes in skin humidity after wiping over a 4-min period

iii) EEG

The SV analysis revealed that the steamed towel and paper towel increased the θ wave in the right somatosensory cortex and attenuated the slow β wave compared to at rest. These changes seemed to correspond to the mild and warm feelings reported in the subjective psychological test.

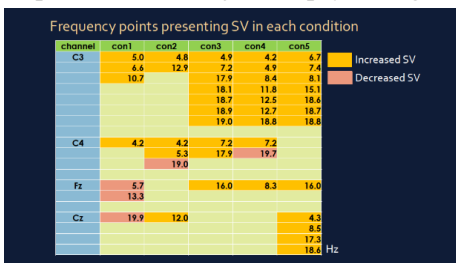


Fig. 7 Changes in the steamed cloth (C2) and paper towel (C4)

iv) Image evaluation results

The skin sensation image after wiping was more positive for the steamed cloth than for the other samples in any of the emotional evaluations, including tension/relaxation, excitement/sedation, light/darkness, and the general evaluation. The vaporization time for the steamed cloth was shorter than that for the steamed towel based on the graph of skin surface humidity after wiping.

The evaluation stage of the image adjective pairs used an ordinal scale, and the association was examined. The

subjective image wave of the steamed cloth was strongly correlated with that of the paper towel. The same results were obtained from the brain wave and SD methods, and both the steamed cloth and paper towel had a warm and relaxing effect in terms of sensibility and somatic sensation. Other wet samples may be more prone to activation than the samples evaluated in this study. The steamed cloth maintains a high skin temperature and does not leave moisture on the skin, resulting in little heat of vaporization and no energy generated for vaporization.

SD Method Questionnaire

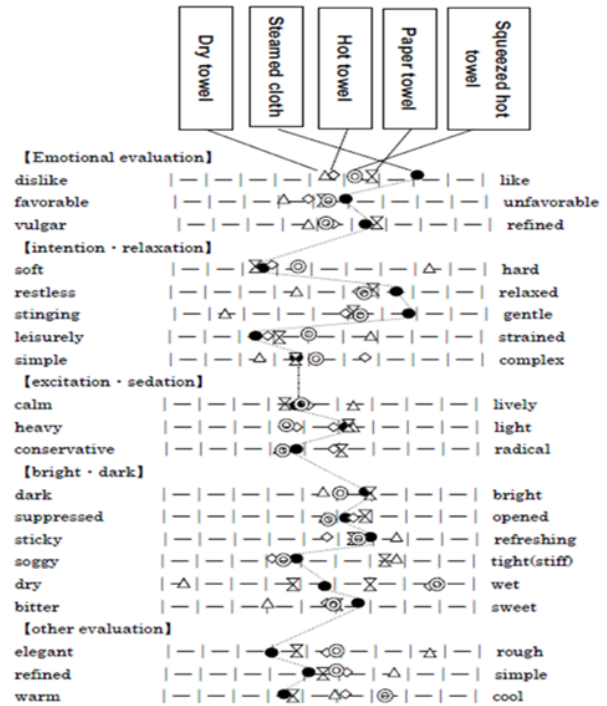


Fig. 8 Skin sensation image for the SD method

Discussion

The temperature of the skin surface after being wiped was decreased for steamed towels, squeezed towels, and paper towels that were sufficiently moist. This is described as a "cold sensation" by the subjects whose skin was wiped.

The moisture content on the skin surface was the lowest with the steamed towels. This was thought to be caused by the high temperature of the water contained in the steamed towel. Thus, for steamed towels, the moisture attached to the skin surface was vaporized due to the high temperature of the contained moisture in the towel.

According to the EEG, the increase in the θ wave in the right somatosensory cortex and the decrease in the slow β wave with the steamed cloth and paper towel seemed to correspond to the mild and warm feelings in the image evaluation. Was done. These images were noted to cause a feeling of relaxation. Negative images were unlikely to be

reported after the steamed cloth was applied because the skin temperature did not decrease after wiping and the humidity was not relatively high; in this case, the subject only feels a warm perception without a cooling sensation. Yoshikawa et al. (2002) reported that when a hot pack was applied to the back, sufficient moisture adhered to the skin, resulting in equivalent feelings of positive pleasure and discomfort. However, with the steamed cloth, the skin moisture is quickly vaporized after wiping, which suppresses the decrease in skin temperature, and the influence of this sensation may have caused psychological affirmation. Therefore, the skin sensation image of the steamed cloth was more elegant, refined, and warm than any other sample, and a relaxed image was formed. A steamed cloth that does not elicit a negative reaction can be applicable for care technology.

Paper towels give a feeling of relaxation similar to a steamed cloth because the nonwoven fabric surface does not promote discomfort due to a cold feeling, which is experienced with steamed towels or squeezed towels because of the weave and water repellency. Inferred. Further work must be performed to understand the differences between non-woven fabric and cotton.

The validity of the SV analysis of EEGs must be continuously examined.

COI

There are no conflicts of interest in this study.

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