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A Study on the Physical Reaction to Affirmative Image Recollection

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【Abstract】 This was a study in which healthy subjects would evoke images of past self-affirmative experiences and feelings. The purpose was to measure the effects they had on the body and mind, and evaluate what effects sex differences had. Subjects were healthy college students divided into an experimental group and a control group. The subjective response showed a significantly higher score among the females than among the males. It also showed an affirmative image recollection. In the EEG test biological responses could not be observed, neither among the males nor among females. Brain waves represent the state of brain activity and are affected by endogenous and exogenous factors, where its mean can indicate the index of relaxation. A factor that may have exerted an influence on the outcome of this study is the fact that the examiner was a female, and females can generally evoke images more readily than males. I.e., the degree of relaxation may have been higher among the females.

【Key words】 Affirmative Image, Sex difference, EEG, Subjective Response

I INTRODUCTION

From ancient times both in the East and the West, imagination and suggestion (images) had been closely associated with medicine and nursing. However, with advances in modern medicine, their effects were refuted due to poor scientific evidence[1]. After the subsequent period of "technology is panacea", the importance of not only the physical but also the mental state and the balance between the body and the mind has been recognized, and images have been used as a therapy in the nursing and sport fields. Images affect brain waves, blood pressure, muscle activity, sweating, and immunological functions. It has also been clarified that the frame of mind affects the state of disease. In other words, holistic medicine that provides care from both the physical and the mental aspects has become important. Images are markedly affected by the past living experience of each person and have functions and roles that allow adaptation to the living environment. In this study, healthy subjects evoked images of past self-affirmative experience and feelings, and their effects on the body and mind, and sex differences in these effects were evaluated.

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II METHODS

The subjects were healthy college students aged 18 - 22 years. They were divided into the experimental group, 11 males and 12 females, and the control group, 8 males and 10 females. After the students had silently read prints on the purpose and methods of this study, answers were obtained from all of them. Experiments were performed in the electroencephalography (EEG) room. After application of an electroence phalograph, the students sat in an armchair and closed their eyes and took a rest. The experimental group rested for 5 minutes and was then asked to evoke images of pleasant or happy matters in their past. The control group rested for 5 minutes (rest①) and later again rested for 2 minutes (rest②).

EEG was performed according to the international standard electrode method (10-20 electrode system) with disc electrodes placed at 8 sites ($F_3, F_4, T_3, T_4, P_3, P_4, O_1$ and 0_2) and reference electrodes at the bilateral earlobes using a 16-channel electroencephalgraph (NEC SYNAFIT 1000) twice (immediately after the 5-minute rest and after image evocation) in each subject. Obtained brain waves were simultaneously A/D converted, and power spectrum analysis was performed by fast Fourier transform according go the "EEG analysis program" reference) using a personal computer (NEC PC 9801 VM2). The sampling frequency was 256/second. One interval was 4 seconds, and the absolute power spectrum values in 10 intervals were added and averaged, and the mean spectrum for 40 seconds was obtained. In this study, the ratio of the square root of the mean spectrum of each band was compared to the spectrum of all bands, i.e., the power ratio was used. Subjective responses to images were evaluated by two types of questionnaires before initiation and immediatily after the experiment. Scoring was done with respect to 7 items used in autogenic training and 20 items concerning situational anxiety in the Kangaku version STAI questionnaire. The mean score was used for analysis. For statistical analysis, the t-test was performed, and $p<0.05$ was considered to be significant.

III RESULTS

Comparison of EEG's sex difference between rests and after image evocation in the experimental group are shown in Figure 1. Among the males, the EEG power ratio significantly increased ($p<0.05$) on the δ wave band on T3 and on the θ_1 wave band at F_3 and P_4 after rest and on the α_1 wave band at T_4 after image evocation. Among the females, the EEG power ratio showed no significant differences after rest or image evocation. Comparison of EEG's sex difference between rest① and rest② in the control group are shown in Figure 2. Among the males, the power ratio on the θ_1 band at P_3, significantly increased ($p<0.05$) after rest①. Among the females, the power ratio on the δ wave and θ_1 wave bands at P_3, the θ_1 wave band at P_4, and the δ wave band at O_2, significantly increased ($p<0.05$) after rest②.

The subjective score based on the autogenic training table is shown in Table 1. Among the experimental group, the score before the experiment did not significantly differ from that after the experiment among the males. Among the females, the score after the experiment was significantly higher ($p<0.001$) than that before the experiment. In the control group, the score after the experiment was significantly higher ($p<0.05$) than that before the experiment among both males and females. Comparison between the males and females showed a significantly higher score in the females than in the males, both before the experiment ($p<0.05$) and after the experiment ($p<0.001$). In the control group, no significant

	δ		θ_1		θ_2		α_1		α_2		α_3		β_1		β_2		β_3	
	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female
after rest F_3 after image evocation			↑ *															
after rest F_4 after image evocation																		
after rest T_3 after image evocation	↑ *																	
after rest T_4 after image evocation							* ↑											
after rest P_3 after image evocation																		
after rest P_4 after image evocation			↑ *															
after rest O_1 after image evocation																		
after rest O_2 after image evocation																		

Fig. 1 Comparison of EEG's sex difference between rest and after image evocation in the experimental group

	δ		θ_1		θ_2		α_1		α_2		α_3		β_1		β_2		β_3	
	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female
after rest (1) F_3 after rest (2)																		
after rest (1) F_4 after rest (2)																		
after rest (1) T_3 after rest (2)																		
after rest (1) T_4 after rest (2)																		
after rest (1) P_3 after rest (2)		* ↑	↑ *	* ↑														
after rest (1) P_4 after rest (2)				* ↑														
after rest (1) O_1 after rest (2)																		
after rest (1) O_2 after rest (2)		* ↑																

Fig.2 Comparison of EEG's sex difference between rest ① and rest ② in the control group

differences were observed between the males and females.

The subjective response score with respect to the situational anxiety items is shown in Table 2. In the experimental group, the males showed no significant differences between the scores before and after the experiment. Among the females, the score after the experiment was significantly higher ($p<0.001$) than that before the experiment. In the control group, no significant differences were observed between the scores before and after the experiment or between the scores in the males and females.

Ⅳ DISCUSSION & CONCLUSION

To create an image a process of thinking is required that produces and utilizes the 5 senses (visual, auditory, gustatory, and tactile senses) and other senses such as sense of motion or position. In other words, images are a communication medium that connects sensitive emotions and the body[2]. Images produce a preparatory state for behavior and has an expectant characteristic. This expectant characteristic makes various perceived changes and fluctuations stable and prepares mental activities for adaptation to the situation, facilitation adaptation to the environment. In general, behavior is controlled by the feedback between behavior and sensation[3]. Images have physical effects such as induction of muscle activity, an increase in blood pressure, changes in brain waves, and an increase in sweating[4]. Thus, images markedly affect the body. It is important to live a healthy comfortable life and to evoke images of affirmative situations and states that are desirable for promoting recovery from disease. Images were referred to as "a variable constantly present in every element of health"[5]. Maintenance of health in terms of both the body and mind is important. The definition of images is difficult. However, images are not mere pictures drawn in the brain but are considered plans to obtain information from environments with various possibilities[6]. Images are induced by stimulation and reflect past experience. The function of images primarily depends on the right hemisphere of the brain. During evocation of images, α wave inhibition on the right side, indicating activation of the right hemisphere function, was reported[7]. An EEG study on differences in brain waves between the right and left hemispheres showed marked inhibition of α waves in the right hemisphere during evocation of visual images and marked inhibition of α waves in the left hemisphere during evocation of linguistic images[8]. After these studies, the guided affective imagery was developed from autogenic training. The guided affective imagery is used as a supportive method in which the autonomic nerve system and other physiological mechanisms are controlled by changing the state of consciousness[9]. This therapy is used as a

Table 1. The subject score based on the autogenic training

	Experimental Group				Control Group			
	Male(n=11)		Female(n=12)		Male(n=8)		Female(n=10)	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
After rest rest①	3.4±0.1		3.7±0.1		3.5±0.2		3.5±0.1	
After image evocation rest②	3.5±0.1		4.1±0.1		3.7±0.2		3.9±0.1	

* P<0.05 ** P<0.01

Table 2. The subject response score with respect to the situational anxiety items

	Experimental Group				Control Group			
	Male(n=11)		Female(n=12)		Male(n=8)		Female(n=10)	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
After rest rest①	33.2±1.4		34.3±2.0		34.3±2.4		36.2±2.0	
After image evocation rest②	33.6±1.6		38.6±2.2		36.5±2.1		37.6±1.6	

** P<0.01

complementary method for acute or chronic pain control, a relaxation method, and a diversion method, or for promotion of the effects of hypnotherapy and treatment of stress factors[10]. In the nursing field, Johnson et al.[11] used image therapy when explaining treatment and management methods to patients and obtained good responses, resulting in a decrease in hospitalization days. Other image evaluation studies such as on images and increased α waves[12] or measurement of serial changes in respiration and EEG α waves[13] also suggested the usefulness of this therapy. Biofeedback therapy is a type of image therapy recently developed[14]. In this therapy, images are evoked, and biological responses such as brain waves, electromyograms, blood flow, skin temperature, heart rate, and blood pressure are measured. By being aware of these responses, the health condition is controlled to attain a desirable state. However, there have been only a few concrete nursing studies on the effects of images.

Affirmative images induce relaxation, and relaxation of the body and mind induced α waves indicating a semi-awake state. Brain waves represent the state of brain activity and are affected by endogenous and exogenous factors. In particular, the consciousness level (sleep and arousal) and age (development and aging) markedly change brain waves. Brain waves are also affected by the mental state (such as anxiety), external stimuli such as light and sound, the state of body fluid such as the blood glucose level, electrolytes, and hormones, blood oxygen in the brain, the partial pressure of carbon dioxide, or drugs[15]. Brain waves during arousal at rest with the eyes closed in adults are characterized by α waves or low-amplitude waves that are predominant in the occipital region. During NREM sleep, spindle waves and high-amplitude δ waves are characteristic. During REM sleep, a mixture of low-amplitude waves with various frequencies are observed. Therefore, in the tense state, α waves are inhibited, and the occurrence rate of β waves is increased. With relief of the tension, the occurrence rate of α waves, which indicates the degree of relaxation, increases[16]. EEG is generally performed during arousal at rest with the eyes closed. Therefore, in this study, EEG records were obtained under these conditions and used as a parameter of the degree of relaxation.

At rest, δ waves and θ waves, indicating sleeping tendency, were observed. In normal adults, δ waves do not occur during arousal at rest. The occurrence of δ waves in this study may be due to a mixture of electromyograms such as ocular movements. In the males in the experimental group, the power ratio of the δ wave band was significantly lower after image evocation than at rest, suggesting stimulation by image evocation. After image evocation, α waves appeared in the right side of the head among the males. Since α waves appeared in the right side of the head among the males, and α waves generally occur mainly in the occipital region, extending to the temporal bone, it can not be concluded from the results in this study that image evocation increased the degree of relaxation.

In the control group, the power ratio of the δ wave band was higher after rest② than after rest ①, suggesting an increase in sleeping tendency with time of rest. In the control group, δ waves and θ waves increased after rest① in the males and after rest② among the females. Among the females, sleeping tendency appeared to have increased with time, resulting in a mixture of electromyograms. It was reported that the somesthetic sense and representative images disappear after image training, and brain waves change to α waves and then to a deeper level[17]. In other words, a sense of unity and harmony between the body and mind develops.

However, in this study, the subjects did not reach such a state, and biological responses could not be observed. This study is making suggestions about reconsideration of the image period and the definition of relaxation. As pleasant and happy experiences in the subject's past does not necessarily mean relaxation, but could also be pleasant stimulation.

The questionnaire used in autogenic training revealed more marked relief of tension in the females than in the males in both the experimental and control groups. This may be because the examiner was a female, and the females could become used to the atmosphere in the experimantal room earlier. Since females generally can evoke images more readily than males[18], the degree of relaxation may have been higher in the females in this study.

Concerning situational anxiety, the females in the experimental group showed a high score. Images markedly differ among individuals and depend on individual living experience.

In this study, only instructions about the content of images were given, and no induction to evoke affirmative images was performed. Therefore, evocation of images or affirmative images may have been difficult for some students. As human beings are holistic creatures, with a lot of anxiety inside, it is important to measure physical as well as mental condition.

Frequent use of images such as visual, auditory, and tactile images facilitates the processing of mental images. Persons who can readily evoke affirmative images were suggested to be excellent in control of efferent nerves of the autonomic nerve system that directly affect the body[19]. However, the ability to evoke images markedly differs among individuals partly due to different past experience. Young students' experiences are not as significant as adults'. Therefore we should have knowledge about their background, for instance, their upbringing, family stuation etc., before we start the image experiment. In this study, we did not induce the subjects to evoke affirmative images but let them evoke images by themselves. Therefore, affirmative images may have been difficult to evoke. In addition, the subjects may have entered the sleep state by rest. For these reasons, the effects of images on the body and mind could not be accurately evaluated. Further concrete studies are necessary on the effecs of images by the induction method, the types of images, and their effects on the body and mind.

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