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A Study on the Effects of Depression Using the Weighting White Noise

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Abstract: In general, depression is a disease that appears negative emotions and changes negative emotions in brain function. About 15% of the population suffers from depressions and depression at least once during a lifetime. Delta waves are often found to increase in depressed patients than in the general population which cause negative emotions. The alpha waves increases in the left frontal lobe and the beta waves increases in the right frontal lobe. Depending on the brain waves, patients with depression have such characteristics. In this study we used a white noise for the symptoms of depression. Analysis of depression in a white noise is advantageous than the using EEG features. White noise weight has an effect on depression English.

Key words: Brainwaves, depression, closed eyes, alpha-wave, theta-wave, delta-wave

INTRODUCTION

Recently, a famous Korean comedian and entertainer dropped from all public activities due to his panic disorder and it brought interests in mental health problems including depression to the public. 'Anxiety' describes the mental status of a person with uneasy and nervous mind. In psychiatric term, it means that a person always has a worry about future events as well as a fear to current events. Mental problems with respect to depression include generalized depression, a specific phobia, social depression, panic disorder and more. Since depression is a common problem among mental disorders, about 1% people of the overall population suffer this symptom at least once in their lifetime (Anonymous, 2012).

This study analyzes the brainwaves of the patient with depression and compares their characteristics of those of normal people when the subjects were doing nothing and their eyes were closed. The study also tries to give some suggestions for overcoming depressions.

MATERIALS AND METHODS

Acoustic characteristics of brainwaves in a normal adult: Human brain has many parts called the cerebrum, forebrain, midbrain, cerebellum, myelencephalon (or hindbrain) and others. Among them, the cerebrum is divided into left brain and right brain. Right brain generally controls the sensitivity and feelings while left brain controls intelligence and rationality (Yoon *et al*., 2016). The brainwaves of normal adults (between the ages of 25 and 45) are mainly fast waves in low amplitude (18~32 Hz) and when their eyes are closed, alpha-waves are the basic one while beta-waves are restrained in both cases of eyes closed and open (Yeo *et al*., 2015). When they perceive something through their ears or whey they see variable objects, the energy of beta-waves including high beta-waves increases. Then, we focus on objects around us. When people hear some bothering sounds or under mental pressure (stress), the energy distribution of human brainwaves changes moving toward the high frequency range around beta-waves.

As people train themselves through meditation to go beyond their troubles and reach the spiritual realm of being delivered from worldly existence, the energy distribution of their brainwaves moves more toward the low frequency range around theta-waves. These characteristics of human brainwaves also happen when people fall in deep sleep or they have some abnormalities. Therefore, the movement of brainwave's energy distribution toward the low frequency range indicates the decrease in our physical activities (Bae *et al*., 2016; Kyon and Bae, 2014).

Table 1 shows the main characteristics of each brainwave of human beings (Fig. 1). The acoustic characteristics of brainwaves detected from the right brain of a normal male adult. To illustrate the changes in brainwaves in a certain period of time, Fig. 1 is illustrated in a three dimensional graph. The horizontal axis indicates time in a 5 sec period and the vertical axis indicates frequency. As the brainwaves move forward from back to

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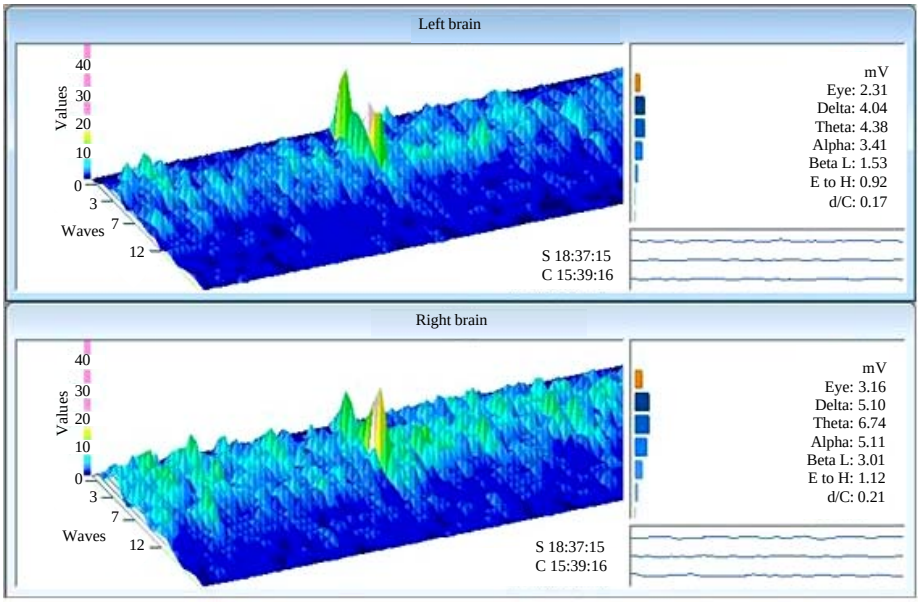

Fig. 1: The right brainwaves of a normal male adult

Table 1: Types and characteristics of human brainwaves

Types	Frequency bandwidth (Hz)	Physical status
Delta-wave (δ)	0.1-3	In deep sleep or with mental disorder
Theta-wave (θ)	4-7	In normal sleep
Alpha-wave (α)	8-12	Relaxed or in rest
SMR	12-15	Paying attention
Low beta-wave (Low β)	13-20	Focused or in activities
High beta-wave (High β)	21-30	Nervous/anxious or stressful

front, they are in high frequency range. Figure 1 tells us that a normal adult shows characteristics of brainwaves around alpha-waves and their energy distribution is wide and extensive. As time goes by we can detect a deep valley in the energy of brainwaves. It indicates that our brainwaves are resting at ordinary time (Pak *et al*., 2015).

RESULTS AND DISCUSSION

Brainwaves of a patient with depression were measured and compared to those of the person without any mental problem as shown in Table 2. Brainwaves from right brain controlling sensitivity and sensibility were measured in a ratio of voltage average. The energy of brainwaves are presented in the unit of mV (miliV, i.e., 1/1,000 of a volt) and its energy distribution is calculated in percentage.

First, the female patient with depression shows the energy distribution is relatively narrow in its range, mostly around delta-wave. This is a unique feature of brainwaves when people focus more on themselves and their thoughts than on their surroundings. It means that the

Table 2: Comparison of right brainwaves between the female patient and normal person when eyes close depression

Types	Normal person (mV)	Ratio (%)	Patient with depression (mV)	Ratio (%)
Delta-wave (δ)	6.94	23	19.69	41
Thera-wave (θ)	9.06	30	14.21	30
Alpha-wave (α)	10.27	34	9.38	20
Low beta-wave (Low β)	3.02	10	3.09	6
High beta-wave (High β)	0.91	3	1.58	3

patient with depression is self-centered and does not pay attention to other people. Figure 2 illustrates the neuro-spectrum of the female patient.

The white sound shows different characteristics according to four seasons and different sound sources. During the Winter, we hear the sound of wind and the sound of water flow in the streams. During the Spring, we hear raindrops, bird-chirpings and the sound of water flow in creeks. During the Summer, we hear louder sound from the waterfalls, bird-chirpings, insects and reptiles (Kyon and Bae 2014). During the Fall, we hear more powerful sound of all these. Especially, the sound of raindrops gets stronger along with the sound of waterfalls (Pak *et al*., 2015). Table 2 classifies various sounds heard from the white noise with respect to bandwidth.

An experiment was conducted to examine whether or not white sound can be effective in relieving symptoms of depression. Brainwaves and stress level were measured and analyzed for 10 subjects (in the age between 20~35) who identified themselves having symptoms of depression. The brainwaves were measured three times for three minutes with some intervals and at different

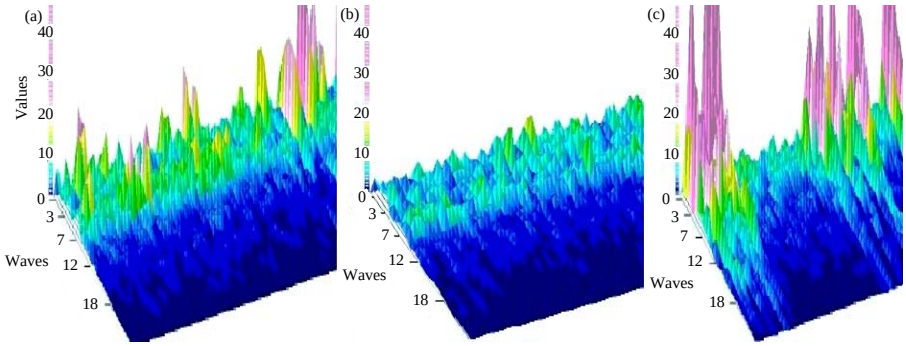

Fig. 2: Brainwaves of a male patient with depression: a) In silence; b) Listening to classical music and c) Listening to the white sound

Table 3: Classification and characteristics of various white sounds

Groups	Sound sources	Acoustic characteristics
A	Water flow in the valley	White noise in low bandwidth
A	Water flow in the stream	White noise in mid bandwidth
A	Waterfalls	White noise in broad bandwidth
B	Bugs	Pseudo-colored noise in modified high tone
B	Reptiles	Pseudo-colored noise in modified middle tone
C	Birds	Colored noise in modified high tone

conditions in order to trace changes. The first measurement was done while doing nothing and the subject was in silence with no sound, the second while listening to classical music and the third while listening to the white sound. Figure 2 illustrates the neuro-spectrums of 25 year old male patient with depression for those 3 cases.

Figure 2a shows that the brainwaves are mostly theta-waves and delta-waves when the subject was in silence with no sound at all. While, he was listening to classical music as in Fig. 2b, there is not much change and the spectrum shows no active movement. When the subject listened to the white sound as in Fig. 2c, the brainwaves changed spreading extensively between alpha-wave and beta-wave in high bandwidth. This change in the brainwaves confirms that listening to the white sound help us to relieve symptoms of depression and encourages us to activate our body and mind.

The results were also compared to each other according to different groups of white sounds as classified in Table 3. Group A represents the sound of water, namely white noise in low bandwidth but it did not have any positive effect in relieving symptoms of depression. Group B represents the sounds produced by bugs, reptiles and birds, namely pseudo-colored noise and this sound had an effect of moving brainwaves to high bandwidth by +13.5% when the patient listened to it. When the patient listened to a variety of sounds produced by different birds, the brainwaves of the patient were moved to high bandwidth by +47.5%. As a result, the most effective sound among various sounds from the white sound to relieve symptoms of depression, turned out to be the sound of bird-chirping during Spring, summer and fall. The sound is mainly located in high bandwidth and characterized as colored noise.

CONCLUSION

Among various white sounds, the sound of bird chirping is found as most effect in relieving symptoms of depression, since, it is mainly located in high frequency bandwidth and characterized as color noise.

ACKNOWLEDGEMENTS

This study examined whether or not listening to white sounds may be helpful in relieving the symptoms of depression. In order to find the characteristics of brainwaves for the patient with depression we analyzed the brainwaves of 10 patients with depression and compared them to those of normal people. Depression can be caused by various reasons and under various situations. Among treatments suggested by the previous studies, the treatment utilizing sound, the weighted white sound in particular, may be most beneficial in relieving symptoms of depression. Among various white sounds, the colored noise of bird chirpings covering mid-high bandwidth frequency considered the most effective one in relieving symptoms of depression, since, it showed the result of moving the brainwaves to high bandwidth by +47.5%.

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