



Voltage Value of 2-Electrode 4D Brain ECVT of Human Brain during Stress and Relaxed Conditions

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4D Brain ECVT is the latest non-invasive brain imaging instrument. In this research, the human brain activity in the prefrontal area during stress and relax conditions was recorded using the instrument, along with measurements of blood pressure, heart rate, and breathing frequency. Research data shows that under stress the value of the voltage versus time is irregular compared to the relaxed state. The same is also indicated by the data of blood pressure, heart rate, and breathing frequency. Through this study, it was concluded that 2-Electrode 4D Brain ECVT can be an alternative instrumentation to record the activity of the human brain.

Keywords: 2-Electrode 4D Brain ECVT, stress, relax

1. INTRODUCTION

The ECVT basic principle is the detection of permittivity distribution inside a volume using external electric field. Permittivity distribution is based on the capacitance value of the electrode pairs located on the sensor [1].

4D Brain ECVT is the latest brain imaging instrument that can detect anatomical abnormalities or functional activity of the human brain non-invasively. Until now, 4D Brain ECVT has been used to assess the activity of the human brain when given a variety of stimuli [2,3,4].

Stress is a condition in which a person feels a conflict with the environment, so he experiences homeostasis imbalance of the body which will cause

changes in the frequency of breathing, heart rate, and blood pressure.

This study aims to measure the value of the voltage generated by the human brain in the left prefrontal cortex in a state of stress and relax with the use of 2-Electrode 4D Brain ECVT, and see the difference in the pattern against the time.

2. METHODS

A. Experiment Subject

The study was conducted on a man aged 29 years, right-handed. Based on his medical history and physical examination, he did not show signs of brain abnormality.

B. 4D Brain ECVT

4D Brain ECVT device used in this study consists of three main parts (Figure 1), namely (a) Data Acquisition System (DAS), (b) 2-electrode capacitance sensor and (c) computer.

The capacitance sensor consists of a pair of electrodes, each of which serves as a transmitter (source electrode) and the receiver (receiver electrode). DAS is used to measure the voltage signal and converts it into data capacitance. In addition, DAS also regulates input voltage and measures the output of each pair of electrodes. DAS was used in this research has rate 250 frame/second. While the computer is used as a control system.

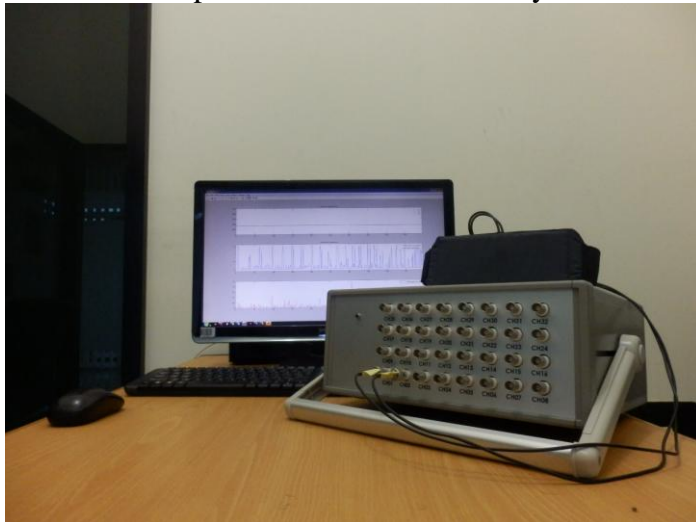


Figure 1. 4D Brain ECVT main parts: computer, capacitance sensor, and DAS

C. Experiment

The experiment was carried out in a special room with a comfortable condition. 2-Electrode 4D Brain ECVT sensor measuring 7 cm x 16 cm placed on FP1 area of 10-20 international system (Figure 2) which represents the left prefrontal cortex area.

The subject was stimulated to achieve a state of stress and relax with guided imagery techniques conducted by a psychologist. The 2-Electrode 4D Brain ECVT recording was performed for 360 seconds, started right when stressed or relaxed condition has been reached. In addition to recording brain activity using 4D Brain ECVT, the subject's blood pressure, frequency of breathing and heart rate were also measured every minute for three times (figure 3).

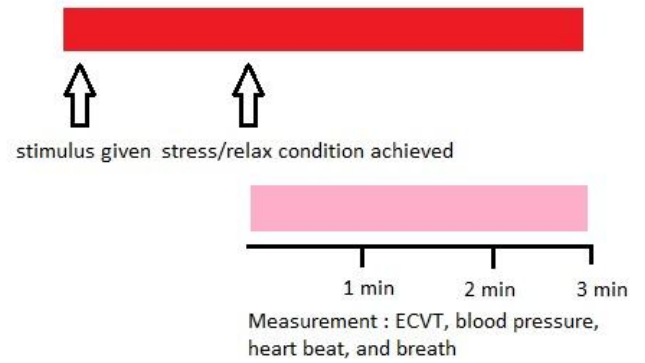


Figure 3. Data collection scheme



Figure 2. Electrode position

3. RESULT AND DISCUSSION

Figure 4, 5, 6, 7, and 8 are described the voltage sensors on relax and stress conditions, heart rate, breathing frequency, and blood pressure. For the relax condition, heart rate, breathing frequency and blood pressure tend to be stable and their values are smaller than stress condition, this correspond to the value of voltage sensors on that condition. While for the stress conditions, the voltage sensor is more fluctuating. These are in line with the increase of the value of the frequency of breath, heart rate, and blood pressure in compared to relax condition

From these results, the increasing value and voltage fluctuation of ECVT sensor under stress conditions probably due to the irregularity of the electrical activity in the brain.

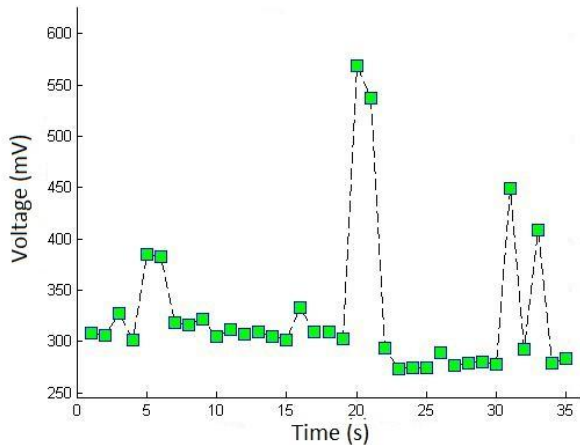


Figure 4. ECVT signal during relax conditions

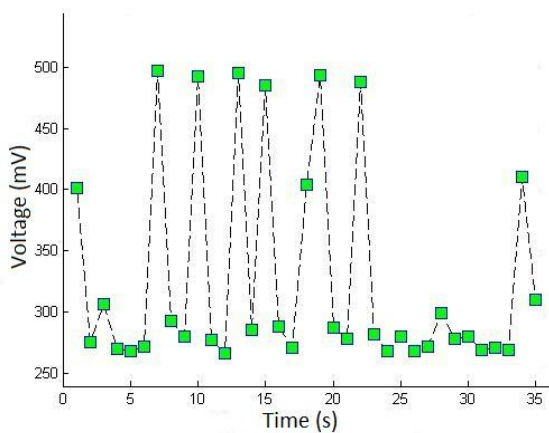


Figure 5. ECVT Signal during stress conditions

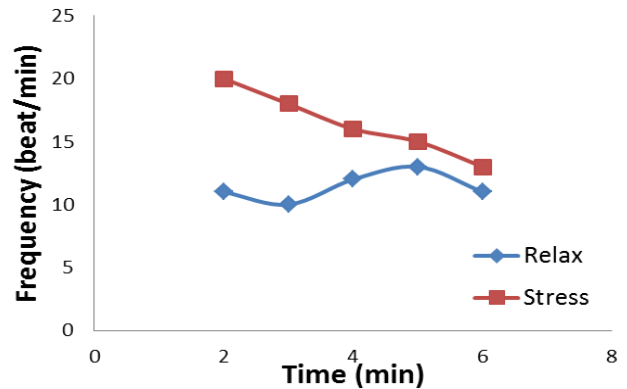


Figure 7. Frequency of breathing

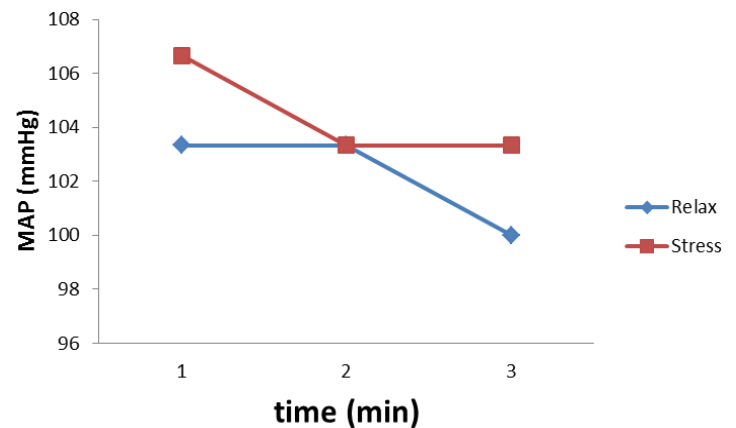


Figure 8. Mean Arterial Pressure (MAP)

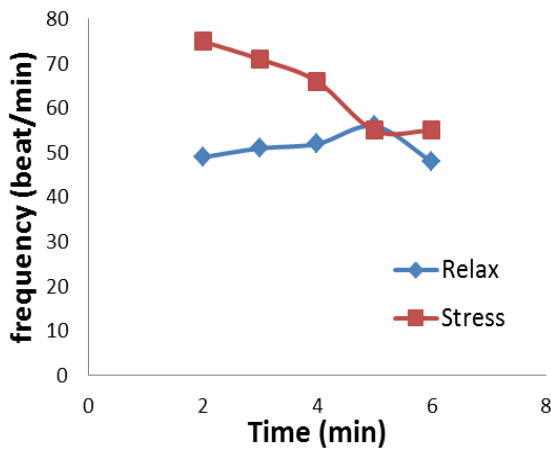


Figure 6. frequency of heart rate

4. CONCLUSION

Research shows that there are differences in the pattern of voltage values between the stress and relax condition. 2 electrodes 4D Brain ECVT can be an alternative instrument for imaging of human brain activity.

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