Heart Rate and Electroencephalogram Changes Caused by Finger Acupressure on Planta Pedis

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Abstract Preliminary experiments were carried out to investigate the feasibility of using an electroencephalogram and heart rates to evaluate the efficacy of finger acupressure on the key points of planta pedis (both soles). Continuous electroencephalograms were recorded from 19 electrodes based on the International 10–20 electrode placement system on 22 university students (21±2.3 years). Spectral power changes were obtained at each electrode site. The power of the α, frequency range (8–10 Hz) increased slightly during acupressure although no statistical significance was observed, while heart rates decreased in all subjects (p<0.05). Cerebral cortex asymmetry in the spectral power changes was not clearly observed during the right and left sole acupressure. This preliminary study suggests that a classification of subjects is necessary in understanding brain wave data during acupressure on soles. J Physiol Anthropol 26(2): 257–259, 2007 http://www.jstage.jst.go.jp/browse/jpa2
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Introduction

Acupressure is an ancient Chinese healing technique that uses the fingers to place physical pressure on key points of the surface of the body. Although there is little scientific consensus on the evidence which supports the efficacy of acupressure against a placebo, many practitioners and scientists have reported various cases using acupressure (Heazell et al., 2006; Hsieh et al., 2004; Stern et al., 2001). Wang et al., (2005) studied the anxiolytic effect of acupressure on parents before their children's surgery. Tsay et al., (2003) reported the effectiveness of acupoints massage in improving the quality of sleep and life of end-stage renal disease patients. Other authors tried to investigate the effects of acupressure on sedation or the depth of anesthesia using electroencephalographic indexes (Litscher, 2004; Dullenkopf et al., 2004).

This paper describes the evaluation method of acupressure effects on the key points of both soles by using heart rates and an electroencephalogram (EEG). The changes in the spectral power of brain waves and heart rates are compared.

Methods

Subjects

A total of 22 university students (11 males and 11 females) served as subjects. The mean age was 21 (SD=2.3) years. All subjects reported being free of neurological and/or psychiatric disorders and gave their written consent to participate.

Stimuli and procedure

The experiment was carried out in a temperature-controlled (24.0±2°C), dimly lit room with 5±5% humidity. Subjects sat on a reclining chair with eyes closed and were instructed to breathe naturally throughout the experiment. After 15–20 minutes resting time, the recording procedure was started (Fig. 1). The time schedule was: (1) five minutes resting time; (2) five minutes acupressure for the right sole; (3) five minutes acupressure for the left sole and (4) five minutes resting time for recordings. Acupressure was performed by a registered nurse.

Recording and data analysis

The electrocardiogram (Lead I) was recorded and digitized at 1 kHz. Each QRS complex was detected, and the instantaneous heart rate was determined. An EEG was recorded from 19 electrodes based on the 10–20 electrode placement system (Fig. 2), referred to linked earlobes, with a forehead ground and impedance at 10 kΩ or less. The electrical activity was filtered (0.016–100 Hz), digitized, and stored on a disk. After excluding eye-movement artifacts, the spectral power of the continuous EEG of 32.768 seconds in each period was
Results and Discussion

Figure 3 shows the average change in heart rates in all subjects during the experiment. Heart rates began to decrease when the nurse depressed the acupoints on the right sole and remained low during the entire period of acupressure. Heart rates appeared to increase gradually after the acupressure.

Figure 4 shows the variation of six spectral components recorded at Pz in Subject A. All components in the resting condition before acupressure remained low. Five components except for the $\gamma$ frequency range increased during acupressure. The largest increase was observed in the $\alpha_1$ frequency range when the acupoints on the right sole were pressed, while the power decreased when the left sole acupoints were pressed. The $\gamma$ band power remained unchanged throughout the experiment. The average $\alpha_1$ band power variation in all subjects (Pz) is shown in Fig. 5. The power increased slightly during acupressure for the right sole, decreased for the left sole and remained low in the resting condition following acupressure. However, no statistical significance was observed by one-way ANOVA. Certain tendencies were not observed in the other five spectral components.

Acupressure on key points along meridians has been considered to have a certain relationship with the biological body through the autonomic nervous system (Long and Mackay, 2003). The effects of acupressure are, however,
different among individuals, environmental conditions as well as the locations of the pressure points. Wang et al., (2005) used the midpoints between two eyebrows in parents in the preoperative holding area before their children’s surgery. They reported that the heart rate, blood pressure, and EEG did not significantly differ between the study and control groups though the study group reported less anxiety. On the other hand, Felhendler and Lisander (1999) reported that pressure on appropriate acupoints can significantly reduce heart rates and mean arterial blood pressure. Litscher (2004) also demonstrated similarities in EEG during acupressure and general anesthesia.

In this study, heart rates and EEG were measured during acupressure on both soles. Heart rate responses were almost the same in all subjects during acupressure, while EEG responses varied between individuals. The decrease in heart rates during acupressure indicates a relationship between the pressure points on soles and the autonomic nervous system. Cerebral cortex asymmetry in the spectral power change was not clearly observed during the right and the left sole acupressure. Because EEG variance is usually large among subjects, averaging all subjects seems to blur a certain level of perspective. Considering the individual taste for acupressure on soles, a classification of subjects may be necessary in understanding the EEG responses.

Conclusions

Acupressure on the key points on both soles decreased heart rates in all subjects, while the EEG responses in spectral power varied according to the individual. A certain classification of subjects based on, for instance, variation in autonomic nervous activity is one of our future objectives.

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References


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