

Measuring Brain Blood Flow Change by fNIRS during an Out-of-Body Experience

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Abstract: In an out-of-body experience (OBE) a person feels his consciousness leaves his own body. *Dao-jiao Nei-dan-fa* (*tao* method) can induce a meditative OBE. The author used near infrared spectroscopy (fNIRS) to measure a body parameter change during OBE. The veteran subject (male, 71y) showed remarkable decrease of brain blood flow in his prefrontal brain area.

Keywords: out-of-body experience, OBE, near infrared spectroscopy, fNIRS, brain blood flow, prefrontal area, *tao*

1. Introduction

In an out-of-body experience (OBE) a person feels his consciousness has apparently left his own body. There are various viewpoints about OBE¹⁾; for example, 1) consciousness exists independently from the body; 2) the problems of spatial recognition; and 3) there is brain dysfunction. However, not many scientific studies have been made yet.

OBEs often occur spontaneously in near-death states caused by accidents or illnesses, and they are also caused by nervous system diseases. Additionally, OBEs can be induced by training. For example, *Dao-jiao Nei-dan-fa* (*tao* method) has a meditative method which leads to OBE. In the present study, the author induced OBE by *tao* techniques and measured brain blood flow change using near infrared spectroscopy (fNIRS).

fNIRS is the newest non-invasive method being developed in Japan for measuring body changes, especially associated with the brain. fNIRS can be used to measure only the cerebral cortex near the surface of the head (depth: 2-3 cm) and its spatial resolution is 2-3 cm. Moreover, fNIRS measurements are made as easily as EEG measurements and the measurements can be done while subjects are standing or sitting.

The present study was a preliminary study with a veteran subject, but the results were remarkable.

2. OBE Training in the Tao Method

The *tao* method is a training system to train the mind and body simultaneously. It consists of 5 stages:

1) breathing stage; 2) energy stage; 3) *Chi* stage; 4) real consciousness stage; and 5) the stage of integrated real consciousness to the space. Trainees learn and train at each stage for 5 to 7 years.

Training for meditative OBE is done in the 4th stage (real consciousness). In this stage, trainees train deeply and make an effort to decrease their *posteriori* consciousness. When the activity of the *posteriori* consciousness becomes weak, their *priori* consciousness is activated. Then, consciousness begins to leave from the body.

In the present study, brain blood flow was measured during the whole process of an OBE. The process consisted of 5 steps: 1) relaxation; 2) concentration of all consciousness on a deep part of the brain; 3) departure of consciousness; 4) traveling of the consciousness; and 5) return of the consciousness.

3. Methods

Date and Place: The experiment was done at the Bio-Emission Laboratory of the International Research Institute (IRI) on May 2, 2009.

Subject: One of the authors (I001, male, 71y) who is a veteran trainee of the *tao* method was the subject.

Measurement of Brain Blood Flow: Brain blood flow was measured with the Foire-3000 (Shimadzu, Japan) with near infrared rays of wave lengths, 780nm, 805nm, and 830nm. Foire-3000 is the same machine as OMM-3000²⁾. Five light emitting probes and 4 light receiving probes were arranged alternatively in a 3x3 square. Measurement area was the prefrontal area of the subject's brain (**Fig. 1**). Subject sat on a chair during the experiment.

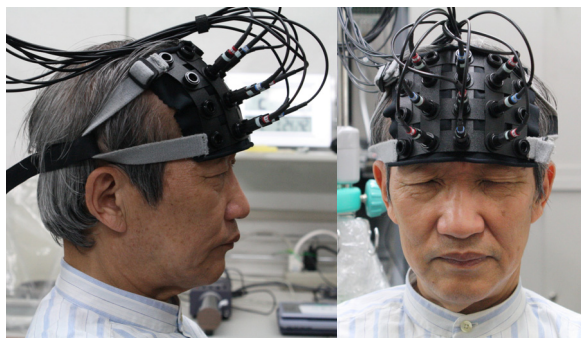


Fig. 1 Attachment of Probes

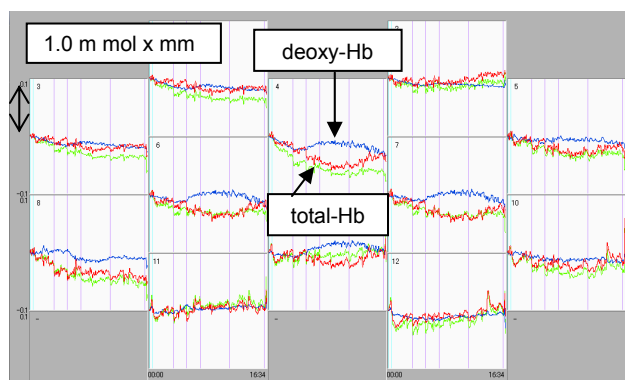


Fig. 2 Brain Blood Flow Change During 16-min Experiment

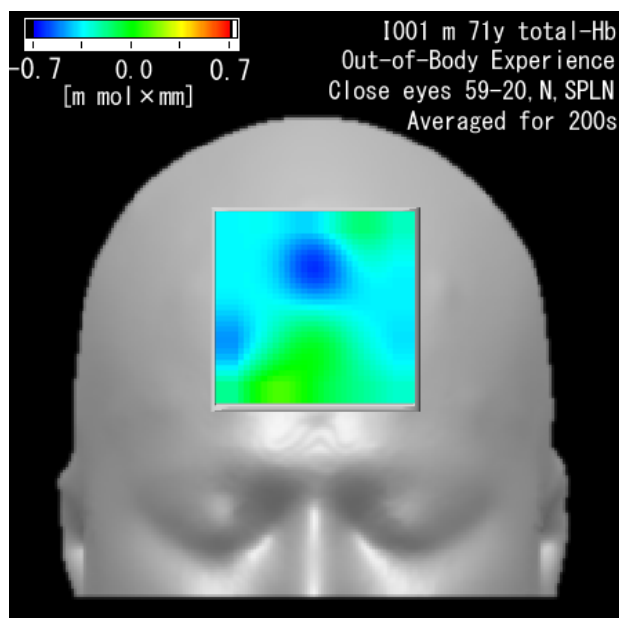


Fig. 3 Change of 200-second Average of Total Hemoglobin during OBE
Dark spots show decrease of brain blood flow.

Procedure: After attachment of probes, recording of measurements was started when brain blood flow became stable. Task sequence in the experiment consisted of preparation (about 4 min), OBE (about 6 min) and closing (about 5 min).

Data Analysis: About 20 s after the start of OBE state, the change of total hemoglobin was averaged for 200 s (59 points, 20 times) with spline interpolation.

4. Results

Fig. 2 shows the change of brain blood flow during the whole process of the experiment (about 16 min). **Fig. 3** shows an instantaneous map of the change of the 200-second average of total hemoglobin during OBE. Brain blood flow clearly decreased at the prefrontal area during the OBE.

5. Discussion

Before the experiment, the authors had planned to compare the collected data with data of taichi³⁾ and guessing^{4,5)}, therefore the prefrontal area was measured. It is necessary to measure other areas in further studies. For example, the connection areas of the parietal and temporal lobes should be measured because Blanke et al.⁶⁾ reported OBEs can be caused by applying electric stimuli to the connection areas. Moreover, there is a possibility that brain blood flow increases at deep areas, for example, Singh et al.⁷⁾ made PET measurements of the brain during yoga and reported that brain activity increased in the bilateral sensory-motor area, and decreased in a wide range of deep neural substrates of the bilateral brain hemisphere such as the inferior and medial frontal lobes, temporal lobes, parts of the limbic system, and cerebellum. Further studies should be done from various viewpoints.

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