

Fig. 1. BFT of rectus femoris muscles.

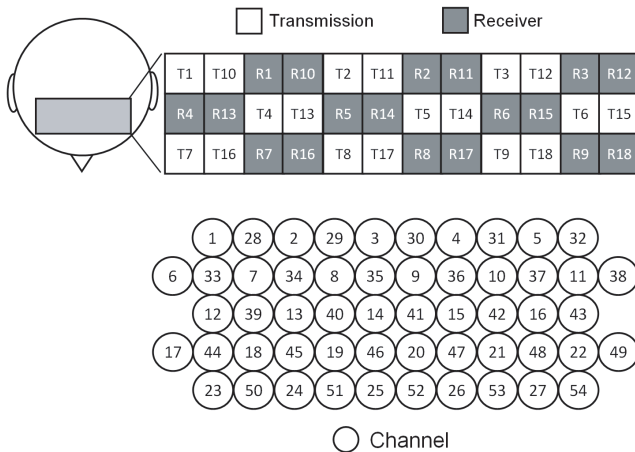


Fig. 2. Arrangement of channels between transmission and receiver probes.

the scalp. In this method, light transmission and receiver probes are attached to the scalp. Near infra-red at approximately 700–1000 nm has high penetrability of biological tissues and is irradiated from the light transmission probe. Scattered and reflected light on the cerebral cortex surface are detected via the light receiver probe.

There are two types of blood hemoglobin: oxygen-bound oxidized hemoglobin (Oxy-Hb) and oxygen-unbound deoxygenated hemoglobin (Deoxy-Hb), and the absorbance wavelength characteristics for each of these types are different. By utilizing these properties, blood flow is calculated from the attenuation level of detected light.

In NIRS, Oxy-Hb, Deoxy-Hb, and the total hemoglobin levels (Total-Hb) in the cerebral cortex are estimated from detected light (Villringer and Dirnagl, 1995; Villringer and Chance, 1997). Because changes in each hemoglobin level measured by NIRS are relative to the baseline level at the measurement's initiation, and the length

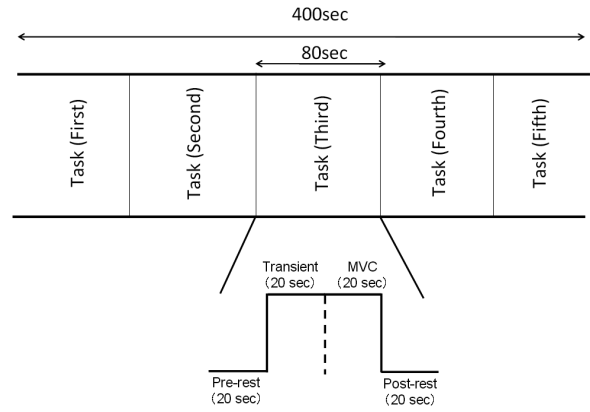


Fig. 3. Experimental protocol.

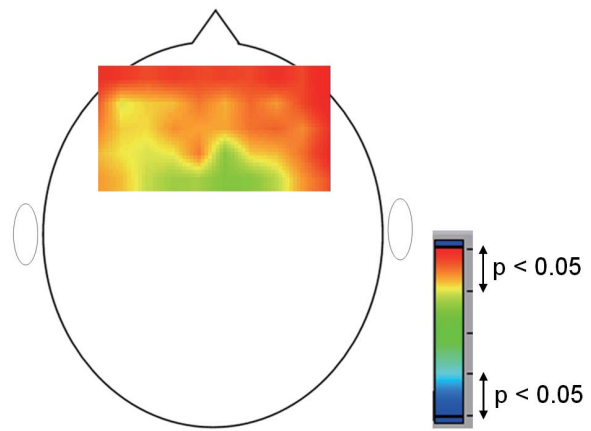


Fig. 4. Significant increase in Oxy-Hb was observed during the BFT task in warm color areas.

of the optical path of the near-infrared laser light varies depending on the physical characteristics of the subjects, it is difficult to simply compare the measured value among the subjects and calculate the mean.

3. Simultaneous Measurement of NIRS

We performed the following experiment to provide an example of the influence masticatory movement has on the brain. Using NIRS, BFT muscle activity and local cerebral blood flow were simultaneously measured. The influence of BFT on brain activity was evaluated.

The subject was a healthy 22-year-old male with no impediments to normal leg functioning, such as pain in the knee joint, calves, or rectus femoris muscles. The cerebral blood flow was recorded while BFT was performed. The experiment was fully explained to the subject beforehand, and written consent was obtained.

He performed BFT for 6 min 40 s (400 s). We ensured that experiment was not as a result of the environmental conditions; using an air conditioner, we adjusted the temperature to 25°C in the exercise room, which was large, quiet, and bright.

The subject sat back on a four-legged stool, and electromyographic electrodes located at intervals of several centimeters were applied to the venter of the rectus femoris