

Brain Activation when using an EMG Controlled Prosthetic Hand (Prof. H. Yokoi and Prof. T. Arai)

1. This study focus on the measure of the effects due to the use of the EMG controlled Prosthetic hand developed at our laboratory. In order to measure those changes, we use a functional Magnetic Resonance Imaging (fMRI) device. The fMRI use for measurement purposes in a non-invasive form is wide spread in different disciplines, like medicine, rehabilitation and sports. However, the fMRI environment is surrounded by strong magnetic forces, which affects the EMG acquisition process; also, no metallic parts can be put inside the room. In order to overcome such difficulties we use the system as showed in Fig.1. This study aims to the development of an easier to use myoelectric prosthetic hand that allows a more natural control of the device to the amputee's based on the data acquired from the fMRI.

2. FMRI measurement experiment using myoelectric upper limb prosthesis

We perform a series of experiments involved in the comparison between healthy subjects and an amputee. We used a Siemens 1.5T MRI device for the measurement, and the statistical parametric mapping (SPM2) version 2000 for the image processing. The experiment follows the next conditions:

[1]To hold and object with the myoelectric prosthetic hand using only the EMG signal acquired from the right hand. When the system use only the EMG signal to interact with the myoelectric hand, we found the activation of the motor area (M1) related to the hand, but no activation whatsoever related to the somatosensory area related to the right hand.(figure 1)

[2]Use electrical stimulation to provide tactile feedback (left upper arm) from the hand together with the EMG signal (right hand) discrimination to control the myoelectric hand to hold an object. In this case our experiments show how the motor area related to the right hand is activated accordingly, but even though the stimulation is performed on the left arm, the somatosensory area for the right hand is activated, for both the amputee and the healthy subjects.

Keywords: fMRI, EMG, Prosthetic hand, FES

References

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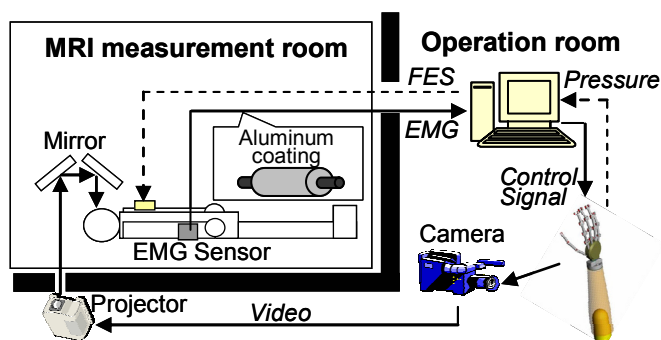


Fig.1 fMRI measurement system for using EMG prosthetic hand.

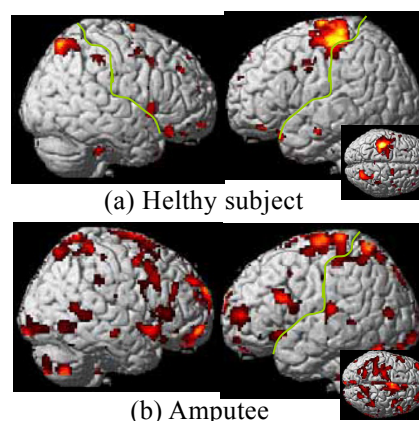


Fig.2 fMRI data in condition II.