Several electroencephalographic (EEG) studies have shown that right- and left-handed persons show different cortical oscillation patterns during simple hand movements [1,2]. In the present EEG study different types of hand movements, active, passive and imagery have been compared within a group of right and left handed healthy persons. The passive hand movement was realized by functional electrical stimulation (FES) of the lower arm. Significant EEG changes were analyzed by calculating time-frequency maps of event-related de/synchronization (ERD/ERS) for 32 EEG channels recorded from sensorimotor and premotor areas. The obtained results might contribute to the development of handedness specific training paradigms for stroke patients, leading to faster rehabilitation success.

**Introduction**

**Subjects**

Sixteen healthy subjects (8 right-handers, 8 left-handers) participated in the study (mean age: 26.35 ± 4.2). They had normal or corrected to normal vision and were free from medication and any neurological disorders. The subjects gave written informed consent before the experiment. The study was approved by the ethics committee of the Medical University of Graz.

**Experimental Design**

The subjects performed three movement conditions with their right hand (RH) and left hand (LH): (i) voluntary active (A) hand grasping movement (ii) imagery (I) of the same hand movement (iii) passive movement (P), realized by Functional electrical stimulation (FES). FES was performed with a Microstim 8 stimulator (Krauth & Timmermann) and adapted producing a similar grasping movement like (i). Two electrodes were positioned at the forearm near the motor points of extensor muscles of the wrist (Figure 1A). Each movement type was proceeded 40 times (40 trials) with each hand. The timing of one trial is illustrated in figure 1C. EEG was recorded from 32 channels over motor cortical areas (Fig 1B). After the presentation of a fixation cross (second 0), an arrow occurred at second 2 indicating the affected hand and the start of the task. The arrow disappeared immediately and the remaining fixation cross indicated the task duration (from second 3 to 9). During this period subjects had to perform one of the three different tasks. For the passive movements the arrow indicated the beginning of FES.

![Figure 1](image1.png)

**Methods**

Significant differences were found between right- and left-handers in the cortical oscillation patterns.

**Results**

**Subjective**

Significant differences were observed as a function of frequency band (F(4,60)=6.28; p=0.004) and movement (F(1,15)=5.406; p=0.035). The significant interaction of condition x FB x movement (F(8,120=4.722; p=0.046) revealed stronger ERD activation during FES of the dominant hand for left-handers at 10 – 12 Hz. The group effect “handedness” also reached significance (F(1,15)=5.571; p=0.032).

**Conclusion**

The knowledge about the different ERD/ERS values for all conditions and frequency bands of specific regions of interest (C3, Cz, C4). The left panel shows the results of the right-handers, the right-panel the results of the left-handers.

The knowledge about the different ERD/ERS patterns during motor imagery and FES stimulation between right- and left-handers could be used to develop more specific and individually adapted training paradigms for stroke patients in the context of BCI.

**References:**


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