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Abstract Topic: Robots, Aids and Devices.

I. Backgrounds and aims

We describe a hybrid Brain-Machine Interface (hBMI), designed for improving DMD (Duchenne Muscular Dystrophy) patients' autonomy. We assess relevance of our hBMI with 2 DMD patients performing the virtual driving task shown in figure 1. To adapt our hBMI to patients motricity, it allows hand movement (real or intentional) detection by processing signals from electroencephalography (EEG), electromyography (EMG), and joysticks.

It allows using different applications, by controlling an object (real or virtual) trajectory through movements of right hand, left hand, or both hands simultaneously. Right and left hand movements result in respectively a left and right rotation, whereas both hands movements move the object forward [1], [2].

Figure 1: Karting driving task

II. Method

Patients (men, 20/28 years) realized home-based experiments, using a portable equipment, thanks to a collaboration with Lille University Hospital and *Centre Hélène Borel* (Lille, France).

As shown in figure 2 (Left) patient is seating in front of a computer displaying the task and recording 12 EEG signals from the primary motor cortex. Figure 2 (Right) shows EMG electrodes location over each hand.

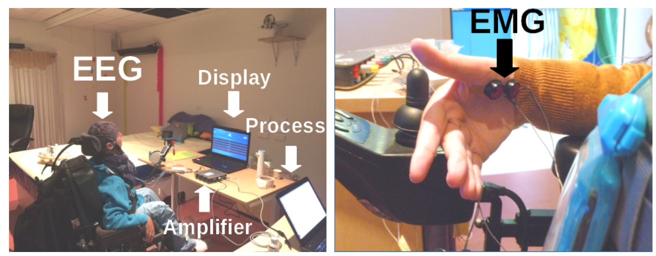

Figure 2: (Left): Hybrid BMI experiment overview. (Right): EMG location

Patients instruction was to make 2 laps, by making hands movements detected in real time by processing EMG signals in OpenVIBE software [3].

III. Results

Figure 3 compares patients performing times (in seconds) to those of 10 healthy subjects performing the same task. Patients performances look quite similar to those of healthy subjects, suggesting that our hBMI is relevant for DMD patients. Moreover, we observe a learning effect between the two laps, expecting improvement with training.

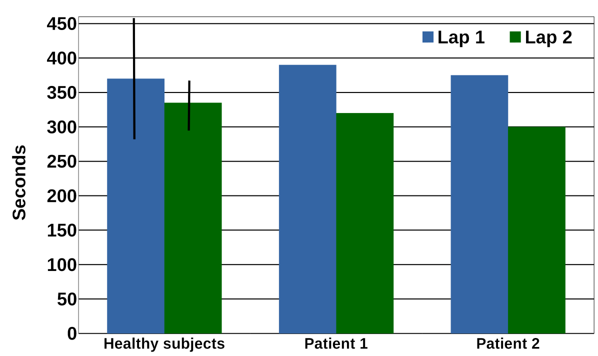

Figure 3: Lap times (seconds) for healthy subjects and DMD patients

IV. CONCLUSIONS

After this conclusive preliminary study, we plan further experiments including more DMD patients. Offline EEG processing enables to identify motor-related patterns [4], necessary to detect movements at the cerebral level, and to propose an interface adapting to patient motricity.

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