Rehabilitation of Reaching Movement after Stroke using a Hybrid Robotic System and paired with the motor intent

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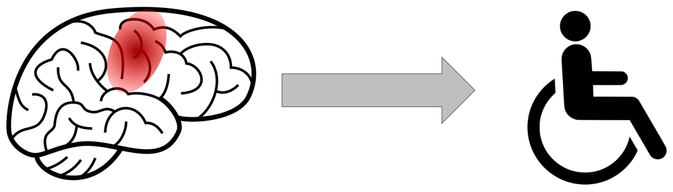
INTRODUCTION



Motor impairment is the most typical consequence after **stroke** [1], [2]

Hybrid Robotic System
Functional Electrical Stimulation
+
Robotic Device

Brain state-dependent afferent stimulation

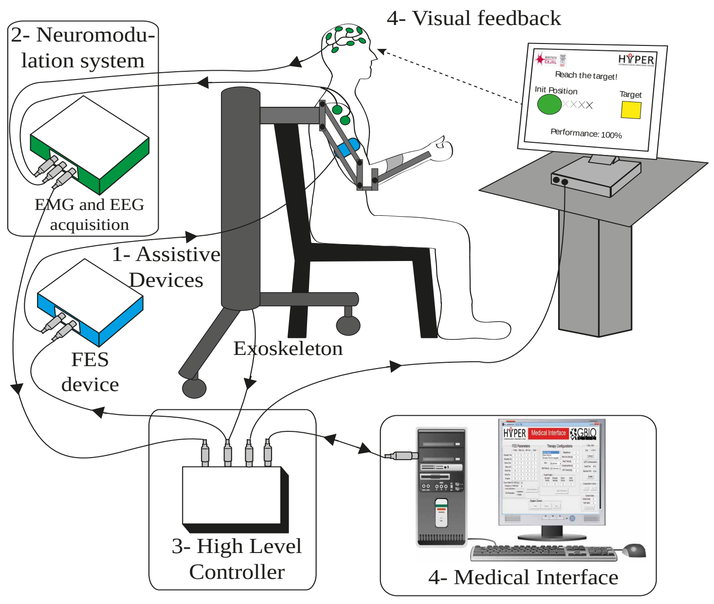
Recent studies propose improvements in motor recovery after stroke by coupling specific movement-related brain states with afferent feedback but further research is needed [3], [4], [5]

Longitudinal study: FES paired with motor intent during reaching task supported by upper limb exoskeleton

Neurophysiological, clinical and kinematic ASSESSMENT

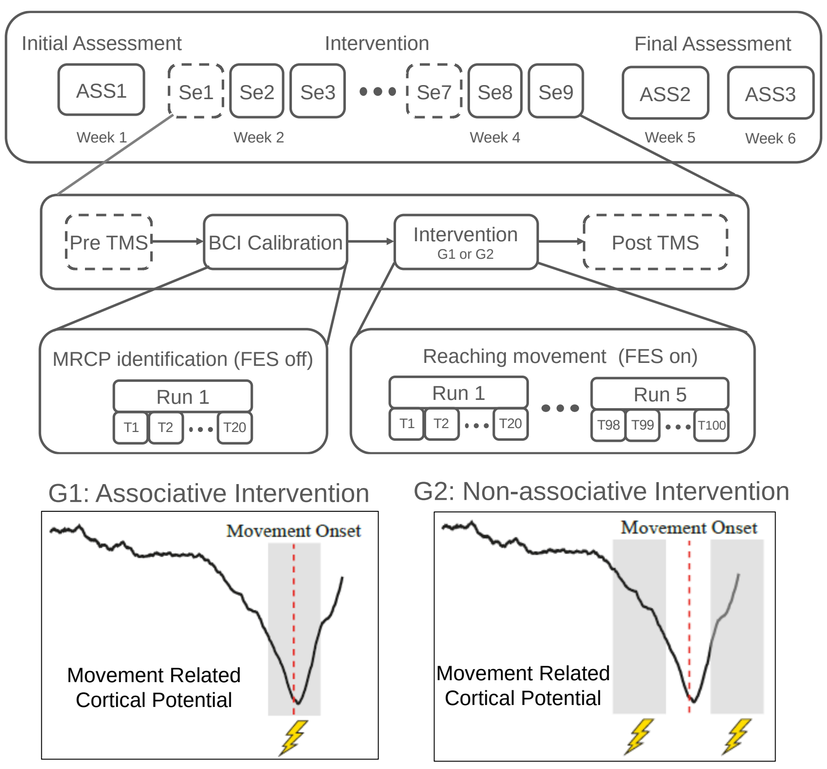
MATERIALS AND METHODS

System overview [5]



- Assistive devices: Armeo Spring + FES
- FES adaptive control strategy based on FEL [5]
- Target: anterior deltoids, triceps and wrist extensors
- Reaching task guided by Visual Feedback

Longitudinal study protocol



Assessment

Experimental setup

Kinematics

Range of Movement (**ROM**)

Neurophysiology

p-p Motor Evoked Potentials (**MEPs**) of the target muscles

Clinical

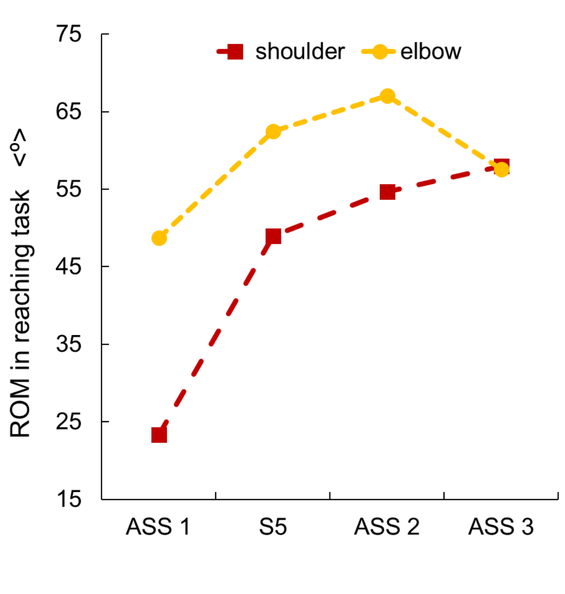
Box and Block test and **QuickDASH**

RESULTS

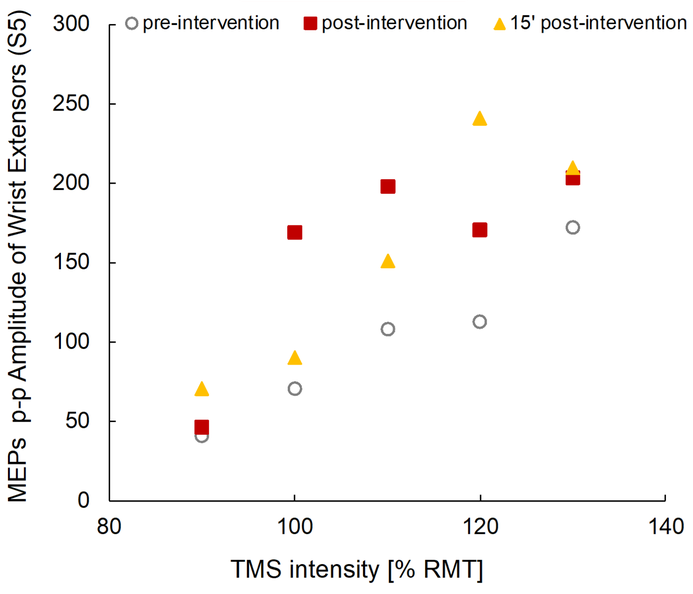
Case Study

- 37 years
- Ischemic stroke
- Left Hemisphere
- 5 months post-lesion
- ARAT score: 57
- FIM score: 118
- Associative protocol

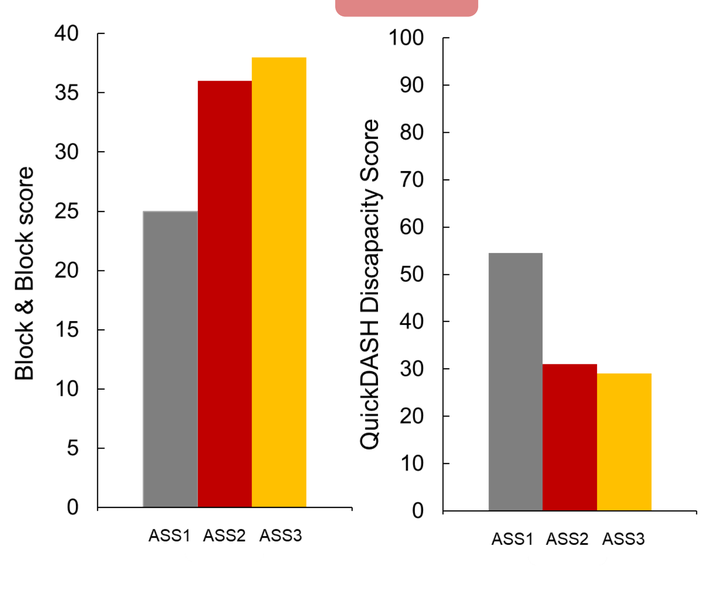
Kinematics



Neurophysiology



Clinical



CONCLUSIONS

- The **hybrid robotic platform**, which usability was validated in prior studies [6], improved **functional recovery** in this stroke case study.
- **Paired FES** with motor intent (MRCP) protocol can **induce corticospinal plasticity and functional improvement** as it already has been demonstrated [4].
- The **sample size must be increased**, including the non-associative group, to determine the effects of the paired FES in long term study in upper limb.
- The **protocol** here applied along with **traditional therapies** performed by the patient in the center **must be considered when interpreting** the results.

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