

Master Thesis Project

Cross-over effect of muscle fatigue and brain activity

Rehabilitation exercises are mostly performed unilaterally and it has been shown that a unilateral exercise reduces the performance of the contralateral homologous muscle or limb [1–6]. During a unilateral task, the muscle activity can irradiate in the non-exercising muscles [3] and task-dependant changes have been shown in the ipsilateral primary motor cortex to an active arm [7–10].

This master project aims at investigating neural and muscular mechanisms underlying unilateral contractions over the contralateral (non-exercising) homologous muscle, muscle group or limb.

Surface electromyographic (sEMG) techniques, to measure the muscle electrical activity, and electroencephalography (EEG) to investigate changes in brain electrical activity will be used.

If you are interested, please contact Clémence Doix

Tel: (+43) 0512 507 45871

email: Aude-Clemence.Doix@uibk.ac.at

Raum: HG-116

1. Doix A-CM, Lefèvre F, Colson SS. Time course of the cross-over effect of fatigue on the contralateral muscle after unilateral exercise. *PLoS One*. 2013;8: e64910. doi:10.1371/journal.pone.0064910
2. Zijdwind I, Zwarts MJ, Kernell D. Influence of a voluntary fatigue test on the contralateral homologous muscle in humans? *Neurosci Lett*. 1998;253: 41–44.
3. Zijdwind I, Kernell D. Bilateral interactions during contractions of intrinsic hand muscles. *J Neurophysiol*. 2001;85: 1907–1913.
4. Todd G, Petersen NT, Taylor JL, Gandevia SC. The effect of a contralateral contraction on maximal voluntary activation and central fatigue in elbow flexor muscles. *Exp Brain Res Exp Hirnforsch Expérimentation Cérébrale*. 2003;150: 308–313. doi:10.1007/s00221-003-1379-7
5. Rattey J, Martin PG, Kay D, Cannon J, Marino FE. Contralateral muscle fatigue in human quadriceps muscle: evidence for a centrally mediated fatigue response and cross-over effect. *Pflüg Arch Eur J Physiol*. 2006;452: 199–207. doi:10.1007/s00424-005-0027-4
6. Martin PG, Rattey J. Central fatigue explains sex differences in muscle fatigue and contralateral cross-over effects of maximal contractions. *Pflüg Arch Eur J Physiol*. 2007;454: 957–969. doi:10.1007/s00424-007-0243-1
7. Hortobágyi T, Taylor JL, Petersen NT, Russell G, Gandevia SC. Changes in segmental and motor cortical output with contralateral muscle contractions and altered sensory inputs in humans. *J Neurophysiol*. 2003;90: 2451–2459. doi:10.1152/jn.01001.2002
8. Muellbacher W, Facchini S, Boroojerdi B, Hallett M. Changes in motor cortex excitability during ipsilateral hand muscle activation in humans. *Clin Neurophysiol Off J Int Fed Clin Neurophysiol*. 2000;111: 344–349.
9. Perez MA, Cohen LG. Mechanisms underlying functional changes in the primary motor cortex ipsilateral to an active hand. *J Neurosci Off J Soc Neurosci*. 2008;28: 5631–5640. doi:10.1523/JNEUROSCI.0093-08.2008
10. Stedman A, Davey NJ, Ellaway PH. Facilitation of human first dorsal interosseous muscle responses to transcranial magnetic stimulation during voluntary contraction of the contralateral homonymous muscle. *Muscle Nerve*. 1998;21: 1033–1039.