

DIFFERENTIAL EFFECTS OF SUSTAINED MANUAL PRESSURE STIMULATION ACCORDING TO SITE OF ACTION

Pavel Hok^a, Jaroslav Opavský^b, René Labounek^{a,c}, Martina Šlachťová^b, Miroslav Kutín^{d,e}, Zbyněk Tüdös^f, Petr Kaňovský^a, Petr Hlušík^a

^a*Department of Neurology, Faculty of Medicine and Dentistry, Palacký University and University Hospital Olomouc*

^b*Department of Physiotherapy, Faculty of Physical Culture, Palacký University Olomouc*

^c*Department of Biomedical Engineering, University Hospital Olomouc*

^d*KM KINEPRO PLUS s.r.o.*

^e*Department of Physiotherapy, Faculty of Health Sciences, Palacký University Olomouc*

^f*Department of Radiology, Faculty of Medicine and Dentistry, Palacký University and University Hospital Olomouc*

Introduction: The central effects of sustained pressure stimulation remain poorly understood despite the use of manual pressure stimulation in many physiotherapeutic techniques, such as reflex locomotion therapy. Previously, we have shown that modulation of task-related activation in the pontomedullary reticular formation (PMRF) and cerebellar cortex occurs within minutes after the stimulation of a specific site at the lower limb (Hok et al., 2017). We hypothesized that the stimulation site would specifically influence brain networks engaged by the sensory input.

Methods: Thirty healthy volunteers (mean age 24.2) underwent two randomized fMRI sessions involving manual pressure stimulation applied either at the right lateral heel according to reflex locomotion therapy, or at the right lateral ankle (control site). Participants were scanned during the intermittent stimulation delivered according to a block design. A flexible analytic approach using finite impulse response function model was used as non-canonical hemodynamic response was expected.

Results: Both stimulation sites engaged an extensive network consisting of bilateral primary and secondary sensorimotor cortices (for both lower and upper limbs), insular cortices, thalami and brainstem. These could be separated into areas with positive or negative blood oxygenation level-dependent (BOLD) response, both characterized by onset and offset responses with prominent rapid adaptation. In some task-positive sites, including the brainstem, a more pronounced sustained activation could be observed. However, significant within-subject voxel-wise differences were detected in the contralateral inferior parietal, posterior temporal and primary sensorimotor cortex.

Conclusion: Sustained pressure stimulation of the foot is associated with extensive activation of sensorimotor networks marked by onset and offset responses with rapid adaptation. Heel stimulation tended to be associated with more sustained response in certain brain areas, including the brainstem. Site-specific differences were observed in the contralateral primary sensorimotor, posterior temporal and inferior parietal cortices.

Acknowledgments: This work was supported by grant of the Czech Science Foundation (GACR) [grant number 14-22572S].

References:

Hok, P., Opavský, J., Kutín, M., Tüdös, Z., Kaňovský, P., Hlušík, P., 2017. Modulation of the sensorimotor system by sustained manual pressure stimulation. *Neuroscience* 348, 11–22.