C. SCHNEIDER, F. ALLEN DEMERS, V.H. FLAMAND, H. MASSÉ-ALARIE, L.D. BEAULIEU. ***Neurostimulation to influence the brain and improve motor and cognitive function in aging.*** *Gerontechnology 2016;15(suppl):164s*; doi:10.4017/gt.2016.15.s.734.00 **Purpose** Human aging is characterized by a progressive decline of cognitive and perceptual abilities with slowing down of central processing and motor control issues. Neurophysiological studies showed for example less brain motor activation[1], less interhemispheric dialogue[2] and compensation of brain function for motor control[3]. The transfer to brain of sensory signals from the body is impaired and proprioceptive perception and sensorimotor integration are insufficient for proper functioning of cognitive and motor networks. Our laboratory specializes in non-invasive neurostimulation (NS), i.e. repetitive peripheral magnetic stimulation that massively recruits proprioceptive afferents that supply brain with the missing or altered sensory information and up-regulate the fronto-parietal mechanisms of brain adaptation[4]. Thus, NS ought to improve sensorimotor abilities and reduces pain[4] because it influences brain plasticity and reactivate networks not working properly in older people with overt loss of autonomy. The common purpose of our randomized placebo-controlled studies using NS is to alter the course of functional loss in aging and improve autonomy and quality of life. **Method** NS was administrated by means of an air film cooled figure-of-eight coil (7cm outer diameter, each wing) connected to a rapid-rate magnetic stimulator (Magstim Inc): the repetitive magnetic stimuli (biphasic waveform, 400µs pulse width) were delivered over muscles at a theta-burst frequency, i.e. 5-Hz bursts of three 50-Hz pulses each and at an intensity producing palpable contraction with visible movements. Intermittent paradigms (2s ON, 8s OFF) during 190s were used to mimic cyclical activation/ relaxation of muscle fibres. Double blind randomized and controlled designs enabled to test brain, clinical, and functional outcomes at pre- and post-NS (n=55, 26 women, aged 69±13 years). **Results & Discussion** Overall, NS projects with brain-lesioned elders[4-6] and in chronic low back pain[7] showed 20% increase of brain excitability, 25% improvement of function and 30% decrease of pain. These after-effects after one session persisted if NS sessions were replicated[6] or combined with a task-oriented therapy[7]. Our ongoing studies in elders with Parkinson's disease or 'learned non-use' showed significant improvements of gait and posture control (no more freezing, even for turning back while walking), 30% increase of muscle strength and no more failure at sit-to-stand mobility task. The talk introduces NS as adjuvant to aging rehabilitation acting on brain plasticity. Altering the course of function loss will reduce sedentariness that worsens decline[5], and improve participation and quality of life of elders.

References

1. Oliviero A, Profice P, Tonali PA, Pilato F, Saturno E, Dileone M, Ranieri F, Di Lazzaro V. Effects of aging on motor cortex excitability. Neuroscience Research 2006;55(1):74-77; doi:10.1016/j.neures.2006.02.002
2. Hortobagyi T, del Olmo MF, Rothwell JC. Age reduces cortical reciprocal inhibition in humans. Experimental Brain Research 2006;171(3):322-329; doi:10.1007/s00221-005-0274-9
3. Schneider C, Beaulieu LD, Masse-Alarie H, Flamand VH. Brain motor control of the ankle dorsiflexors: differences in aging. Personal Communication, September 21, 2016
4. Beaulieu LD, Schneider C. Repetitive peripheral magnetic stimulation to reduce pain or improve sensorimotor impairments: a literature review on parameters of application and afferents recruitment. Neurophysiologie Clinique 2015;45(3):223-237; doi:10.1016/j.neucli.2015.08.002
5. Beaulieu LD, Massé-Alarie H, Brouwer B, Schneider C. Noninvasive neurostimulation in chronic stroke: a double-blind randomized sham-controlled testing of clinical and corticomotor effects. Topics Stroke Rehabilitation 2015;22(1):8-17; doi:10.1179/1074935714Z.0000000032
6. Allen Demers F, Schneider C. Improvement of motor function and mobility 35 years after cerebral aneurysm: multiple sessions of neurostimulation of paretic muscles. Personal Communication, September 21, 2016
7. Massé-Alarie H, Flamand VH, Moffet H, Schneider C. Peripheral neurostimulation and specific motor training of deep abdominal muscles improves motor control of postural adjustment in chronic low back pain. Clinical Journal of Pain 2013;29(9):814-823; doi:10.1097/AJP.0b013e318276a058

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