Measuring plasticity using non-invasive brain stimulation--a potential tool for the study of aging.

Joyce Gomes-Osman, PT, PhD
Assistant Professor
Departments of Physical Therapy and Neurology
University of Miami Miller School of Medicine
Cognitive Aging

Changes in brain structure + cognitive function

Neuroplasticity

Experimental models

Humans: On-line assessment

Humans: Imaging

Current Study

McKnight Registry

Cognitive performance
Long-lasting synaptic change
(learning/memory, neuroplasticity)

“Repeated activity of specific inputs leads to gradual formation of assemblies of interacting neurons within restricted neural circuits, which persists for some time after the cessation of the stimulus.”

Donald Hebb
Long-term potentiation: one paradigm to study neuroplasticity

(Christie et al., 2008)
Transcranial Magnetic Stimulation

- Electromagnetic Induction of electrical currents

(Bolognini et al, 2010)
Theta Burst Stimulation - non-invasive plasticity measurement

Baseline

Following iTBS

600 pulses over 192 s

LTP-like Plasticity

Bursts of 3 pulses at 50 Hz

8 s

2 s

200 ms

(Frontiers Synaptic Plasticity 2011; Brain Topography 2011; Eur J Neurosci 2012)
Theta Burst Stimulation- non-invasive plasticity measurement

(Gomes-Osman & Pascual-Leone, unpublished data)
Pilot study suggests iTBS-based plasticity decreases with age

(Modified from Freitas et al, 2011)
iTBS-based plasticity correlates with cognitive performance

(Fried & Pascual-Leone, in submission)
Questions

• What are “normal” and “non-normal” values for TMS-based assessment of plasticity?
• Is there a relationship between iTBS-plasticity and cognitive function (neuropsychological evaluation)?
• Does a greater “neuroplasticity reserve” confer any protection from the development of AD?
  – Responsiveness to training
Experimental Setup

McKnight Aging Registry

Participants: Oldest old individuals

Screening

Brain Plasticity Research Registry

iTBS Plasticity
Gait/Postural Control
Exercise Habits

Follow-up

Brain Plasticity Research Registry

iTBS Plasticity
Gait/Postural Control
Exercise Habits
Acknowledgements:
Dr. Kirk-Sanchez
Dr. Ralph Sacco
Dr. Clinton Wright
Maria Carolina Mendoza-Puccini

j.gomes@miami.edu