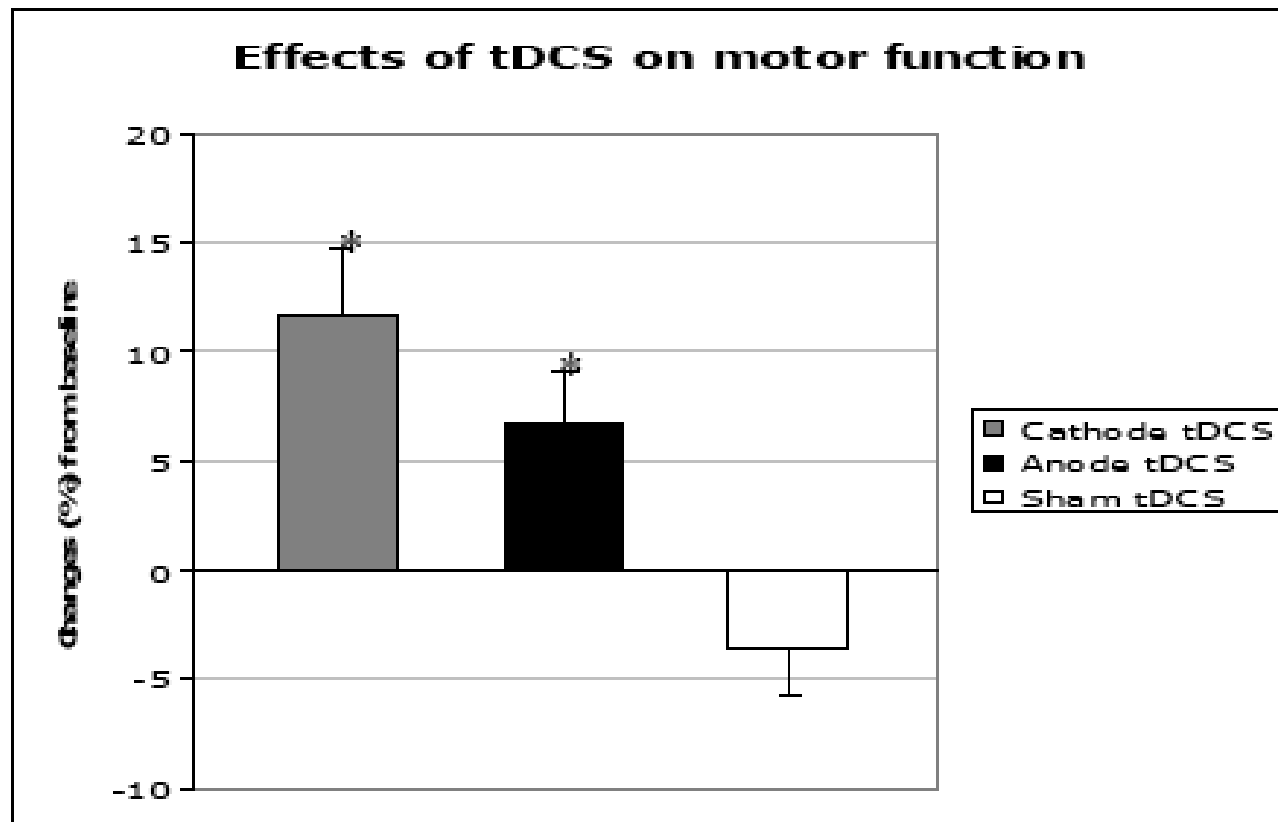


Transcranial direct current stimulation to improve motor function

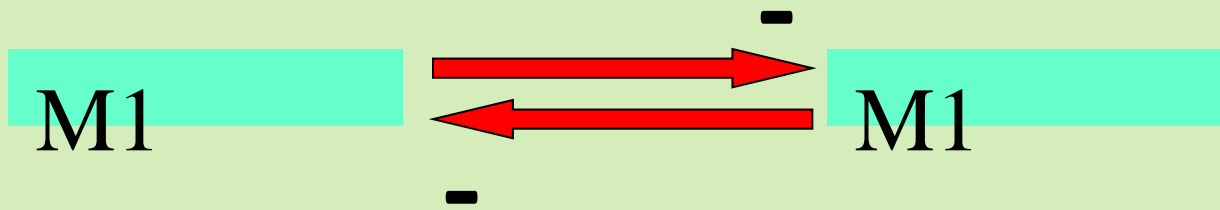
Elena Pavlova, Rehabveckan, 2015.05.20

tDCS reduces motor deficits in stroke



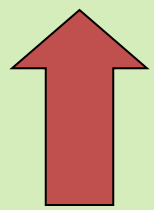
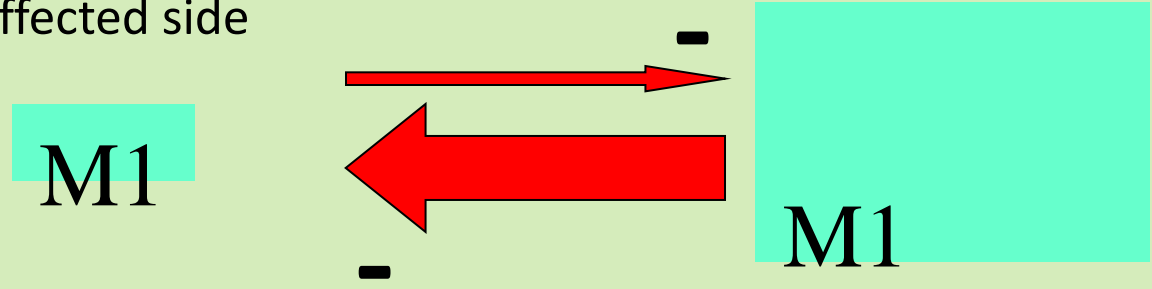
Application in stroke

Control

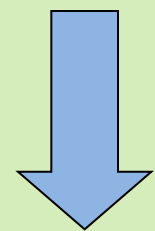


Affected side

Stroke



Anodal stimulation



Cathodal stimulation

PROJECTS

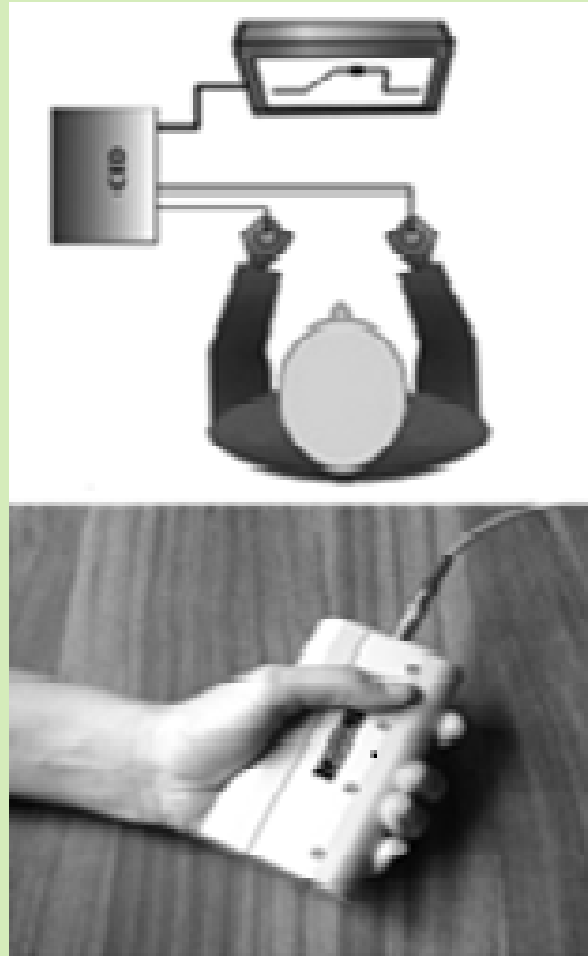
- 1. *Does transcranial direct current stimulation enhance the effect of hand motor training in patients with prior stroke?***
- 2. *Transcranial direct current stimulation of the premotor cortex aimed to improve hand motor function***

Transcranial direct current stimulation of the premotor cortex: effects on hand dexterity. [Brain Res.](#) 2014 Aug 12;1576:52-62.
- 3. *Transcranial direct current stimulation of the premotor cortex in comparison with primary motor cortex in stroke patients***
- 4. *Comparison of one-session tDCS effect on fine motor control in sub-acute and chronic stroke patients***
- 5. *Transcranial direct current stimulation of the premotor cortex: impact of personality***
- 6. *Optimising electrodes size for transcranial direct current stimulation***

Project 1: Does transcranial direct current stimulation enhance the effect of hand motor training in patients with prior stroke?

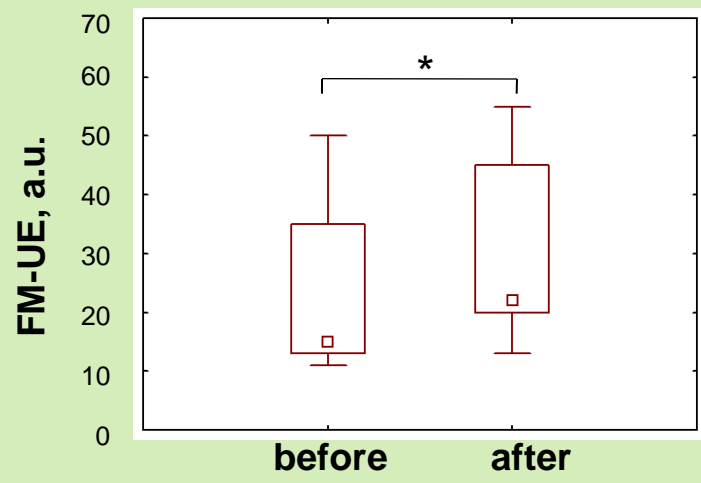
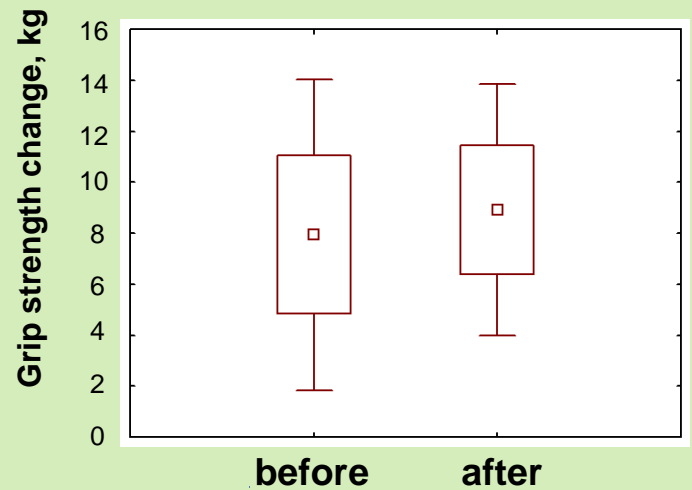
- **The goal of the study** is to investigate the effect of motor training (Visuomotor grip force tracking) combined with tDCS on hand motor function of chronic stroke patients
- *Baseline examinations:* neurological examination, quantification of sensory function, Upper Extremity Fugl-Mayer assessment and Box and Blocks tests. Everyday activities are assessed by Abilhand questionnaire
- *Matched random sampling* into Active and Sham groups. Two training sessions of twenty minutes combined with (active or sham) anodal tDCS (0,5mA) to the contralateral primary motor cortex (affected hemisphere) is performed daily during 20 consecutive days.
- *Outcome assessments:* Upper Extremity Fugl-Mayer assessment, Box and Blocks and Abilhand questionnaire

Performance of visuomotor grip force tracking task



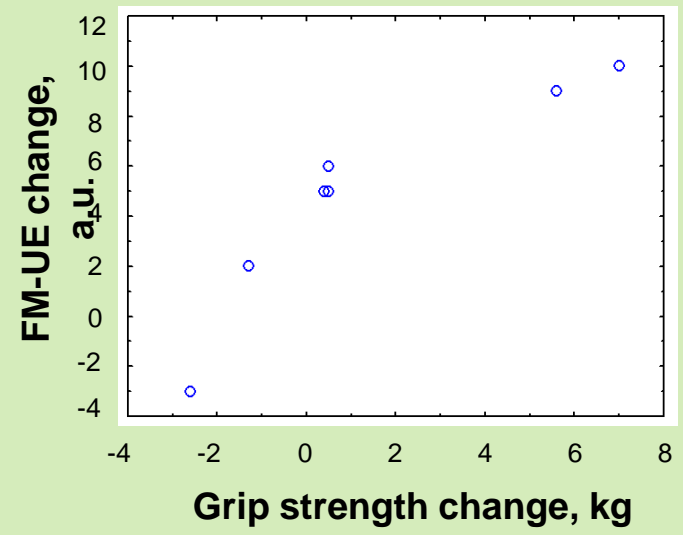
Maximal voluntary contraction

FM-UE before and after the treatment



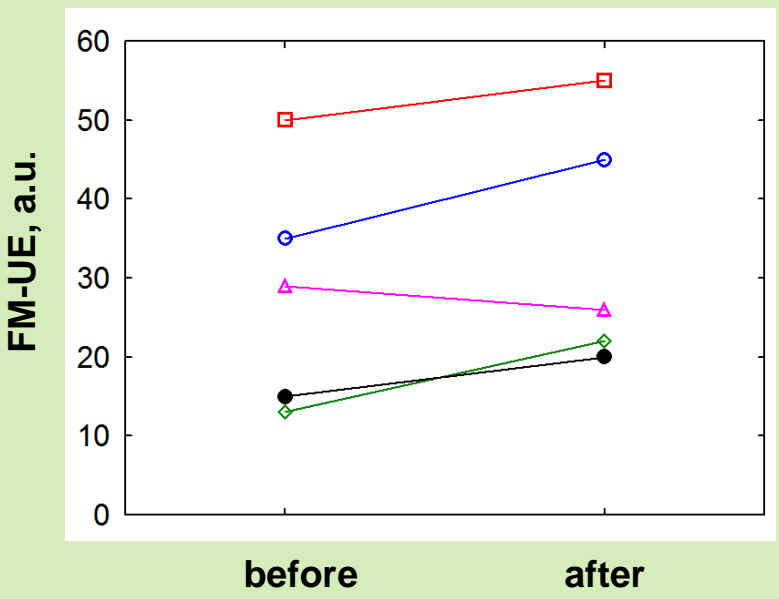
- Mean
- Mean \pm SE
- I Mean \pm 1.96*SE

- Median
- 25%-75%
- I Min-Max

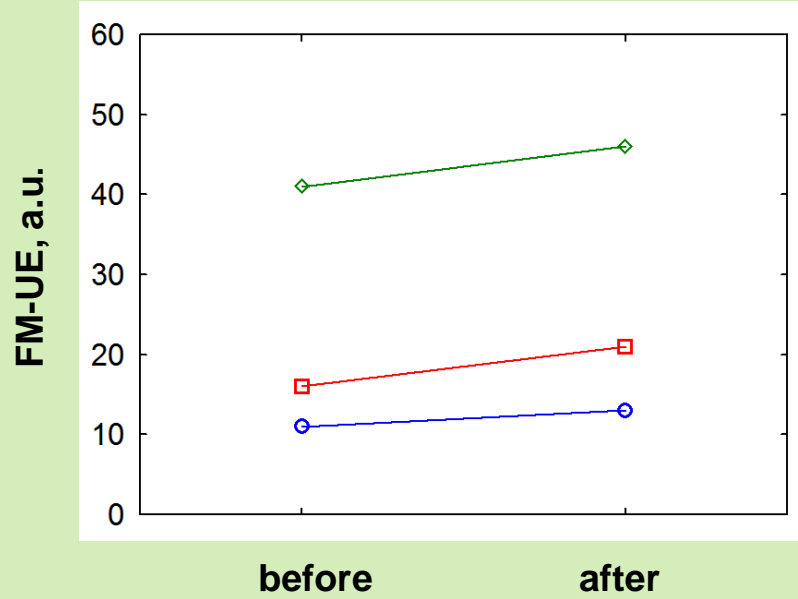


Upper Extremity Fugl-Mayer assessment score in individual patients before and after training

Active



Sham



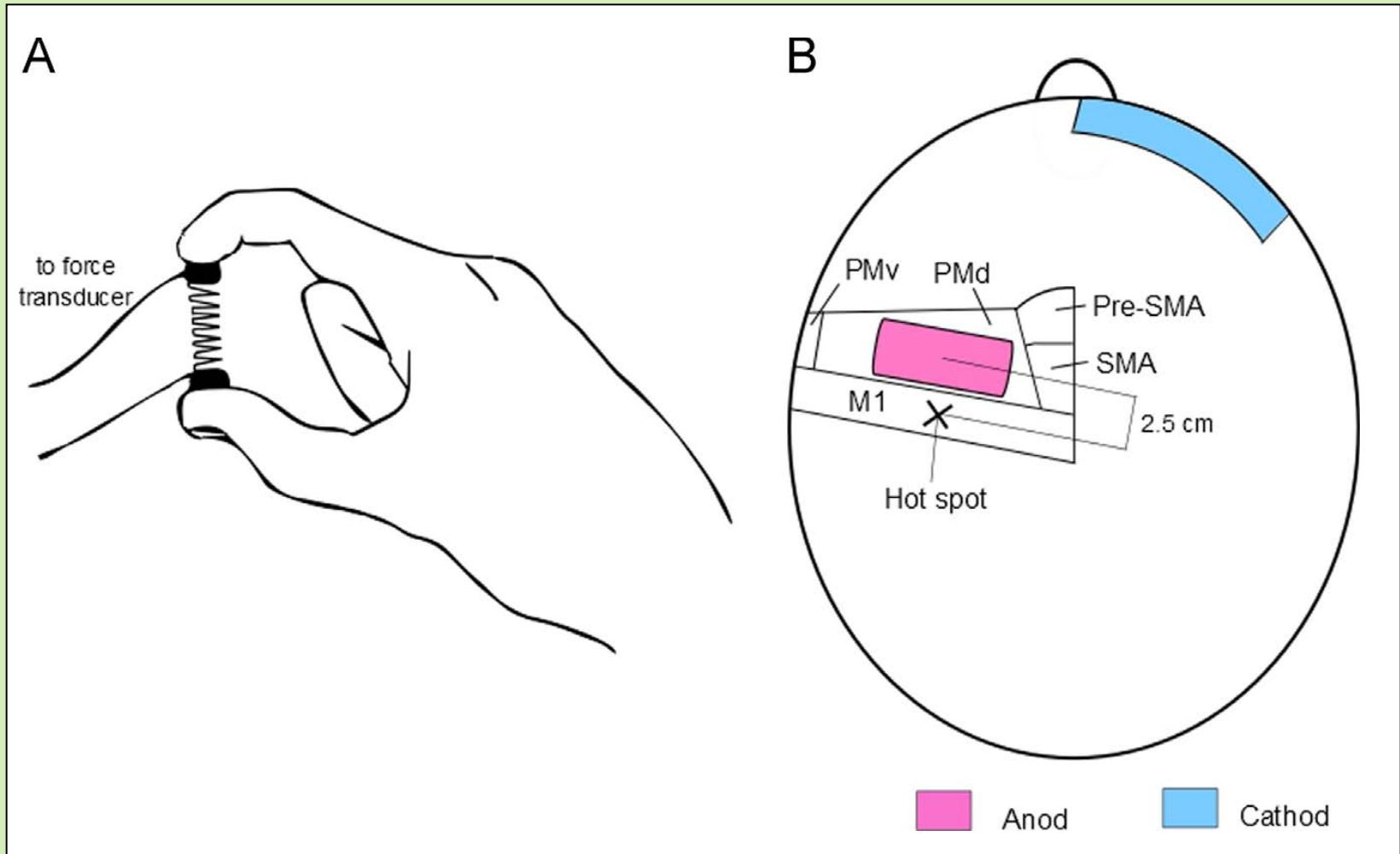
Conclusions project 1

- **Improvement in the hand function can be achieved in the chronic stage of stroke**
- **Can be non-specific to the trained task**
- **Shows high inter-individual variability**

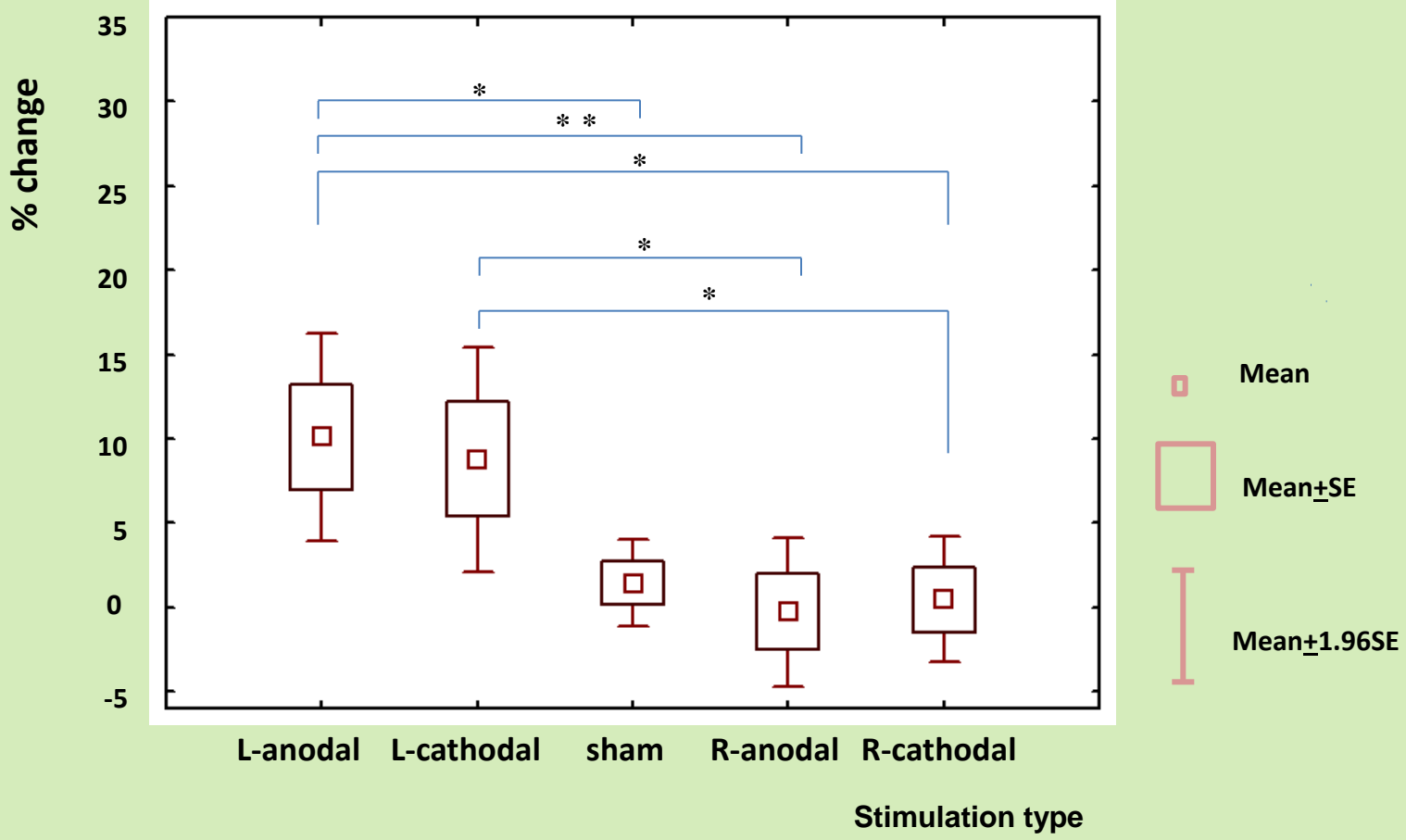
Project 2. Transcranial direct current stimulation of the premotor cortex aimed to improve hand motor function

- Cross-over, semi-balanced, randomized study
- Types of stimulation: **anodal** or **cathodal** stimulation of either right or left dorsal premotor cortex, and sham stimulation.
- Parameters of stimulation: 0.5mA, 10 minutes; electrodes: 2,5X6 cm
- One week interval between sessions
- Subjects were blind to experimental conditions
- The spring compression task (**Valero-Cuevas FJ et al. J Biomech. 2003 Feb;36(2):265-70**) was trained on a separate day. On the stimulation days, the test was performed for 10 minutes before and 10 minutes during tDCS sessions. 30 spring compressions were recorded during each interval.

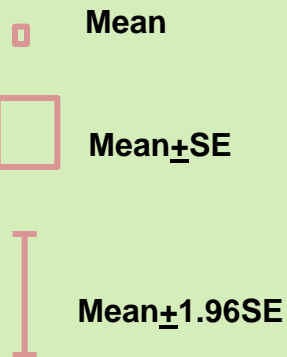
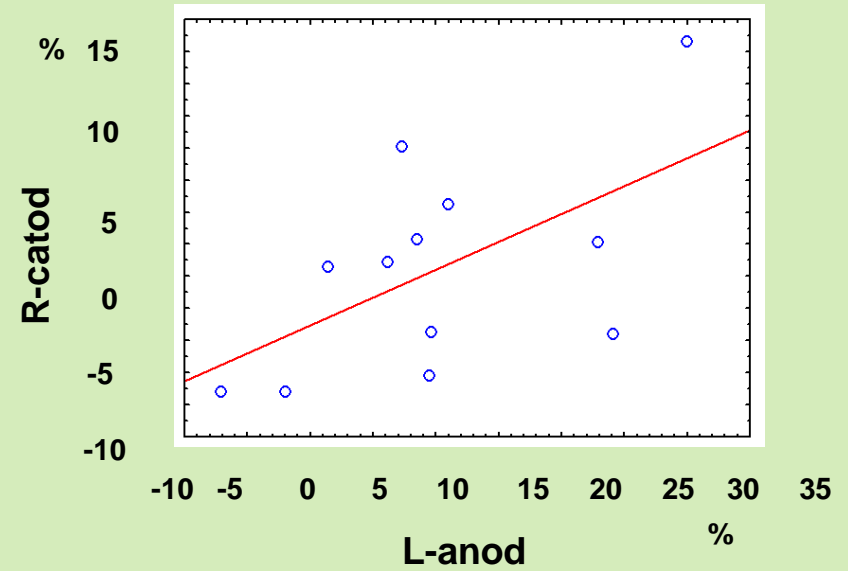
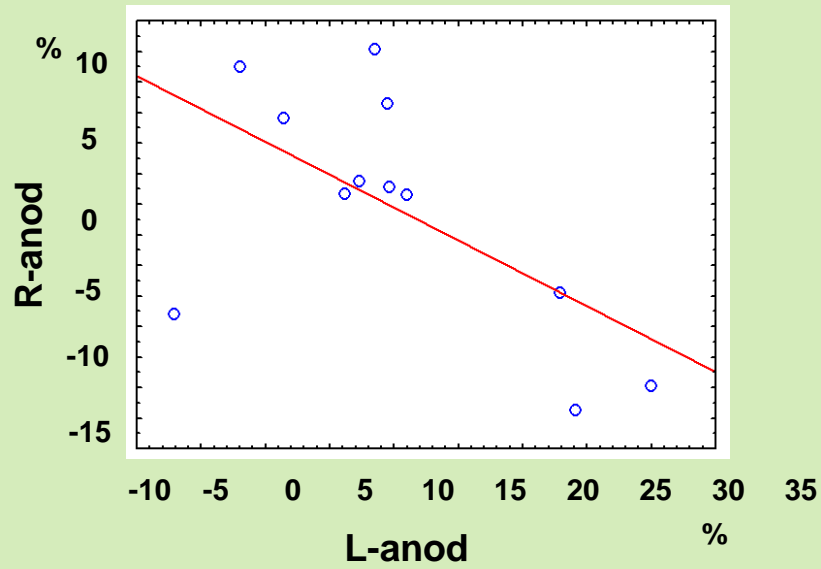
Performance of the spring compression task



Stimulation effect vs type of stimulation



Inter-hemispheric inhibition



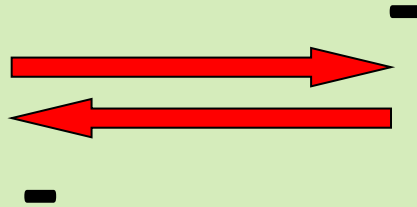
Anodal stimulation



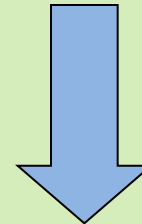
Premotor cortex



M1



Cathodal stimulation



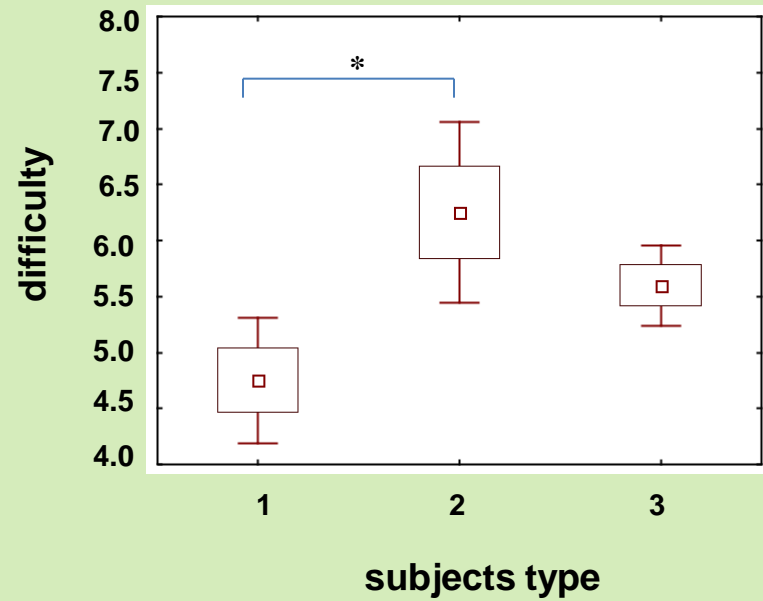
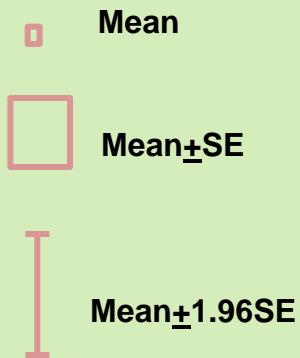
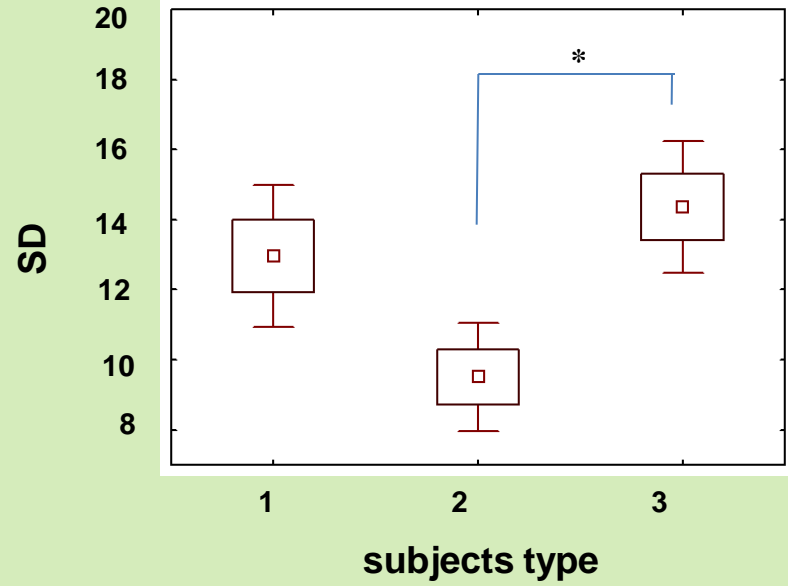
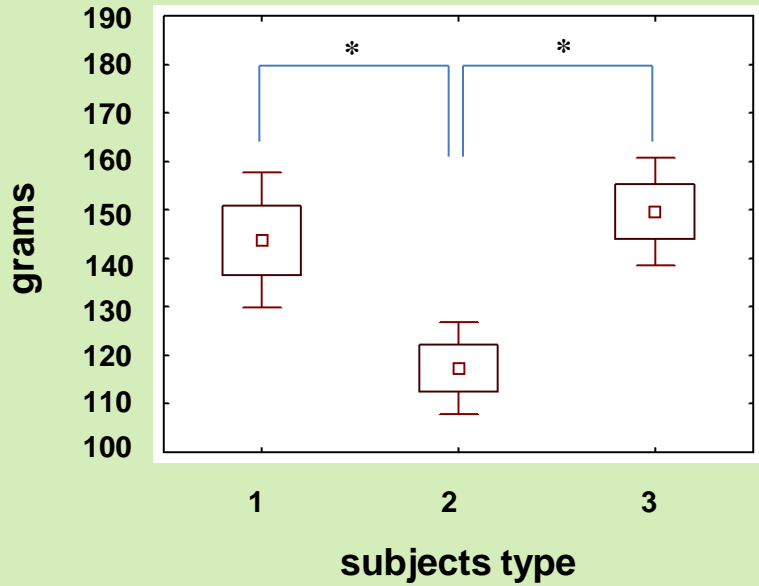
Premotor cortex



M1

Groups

- **group 1** - improvement in response to the L **cathodal** stimulation
- **group 2** - improvement in response to the L **anodal** stimulation
- **group 3** - others



Conclusions project 2

- Stimulation of the left but not the right premotor cortex improves the performance in healthy right-handed individuals
- Motor responses to the stimulation of the premotor cortex depend on the motor task performance
- These responses show presence of interhemispheric inhibition

Project 3. Transcranial direct current stimulation of the premotor cortex in comparison with primary motor cortex in stroke patients

- **The aim** of the present study is to investigate the effect of tDCS (both anodal and cathodal) of the unaffected and affected dorsal premotor cortex, anodal tDCS of the affected M1, cathodal tDCS of unaffected M1 and sham stimulation on performance of the spring compression test
- **The hypothesis** is that anodal stimulation of the affected premotor cortex will have greater effect on performance in stroke patients compared with other types of tDCS

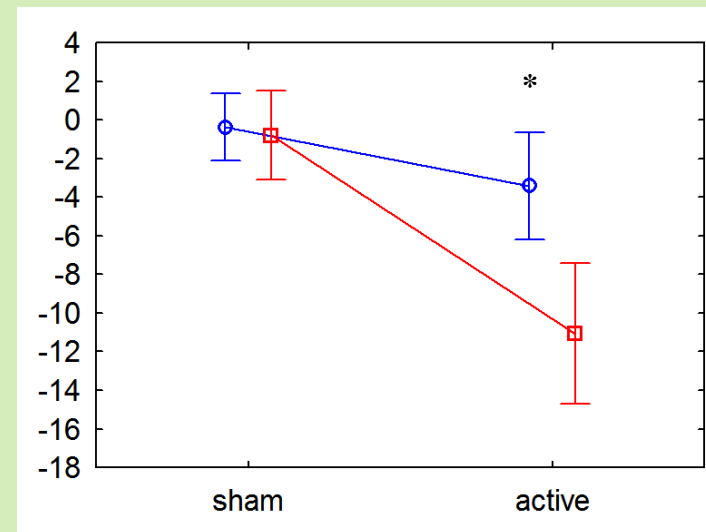
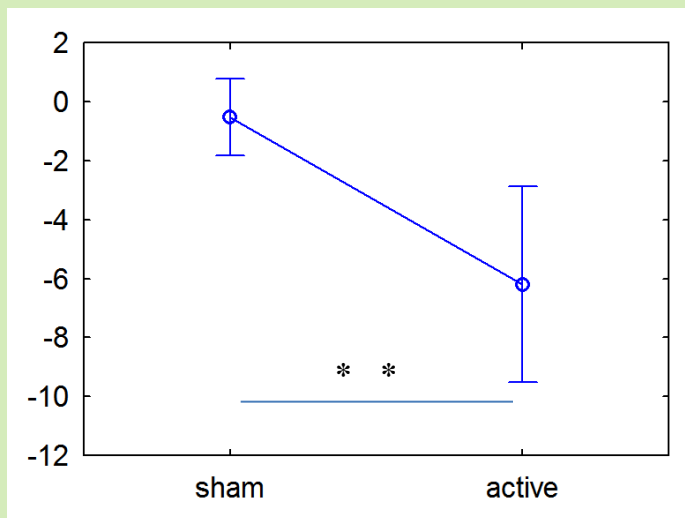
Project 4: Comparison of one-session tDCS effect on fine motor control in sub-acute and chronic stroke patients

Cross-over, balanced, randomised study on 12 sub-acute stroke patients,

Jebson-Taylor test

10 times training before tDCS

3 times baseline, 5 times during sham/acute tDCS, one week interval



— Sham first
— Active first

Conclusions project 3

- Significant improvement during anodal tDCS of the primary motor cortex on the affected side in sub-acute stroke patients is observed
- The size of the improvement depends on learning stage

Asknowlegments:

- Jörgen Borg, professor
- Michael Nitche, professor
- Min-Fang Kuo, researcher
- Alla Guekht, professor
- Påvel Lindberg, researcher
- Amirah Khan, student
- Gaia Valentina Pennati, physiotherapist
- Jeanette Plantin, physiotherapist
- Sigurd Ruschkowski, ingeneer
- Roman Semenov, PhD-student

Thank you for attention!