MEDICAL AND HEALTH SCIENCES

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The application of non-invasive brain stimulation to improve paretic handgrip performance in chronic stroke patients

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STROKE

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- Stroke is one of the leading causes of long-term disability
- An estimated 77% of stroke survivors experience impairment of the upper limb which severely affects function

77%

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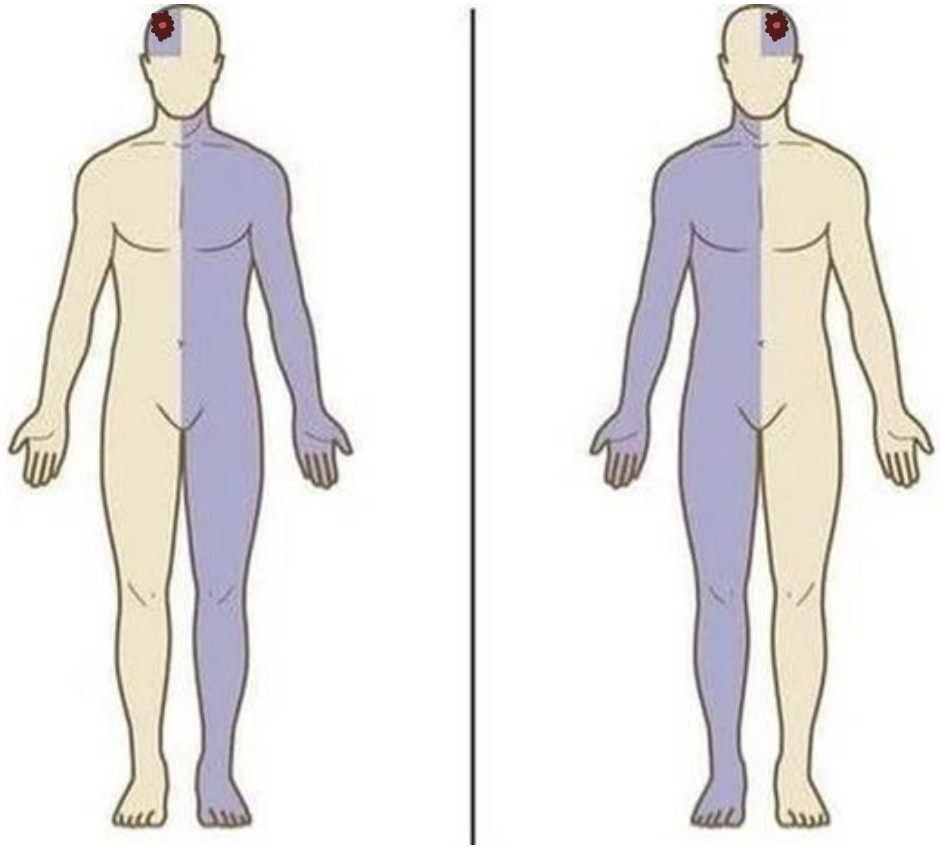

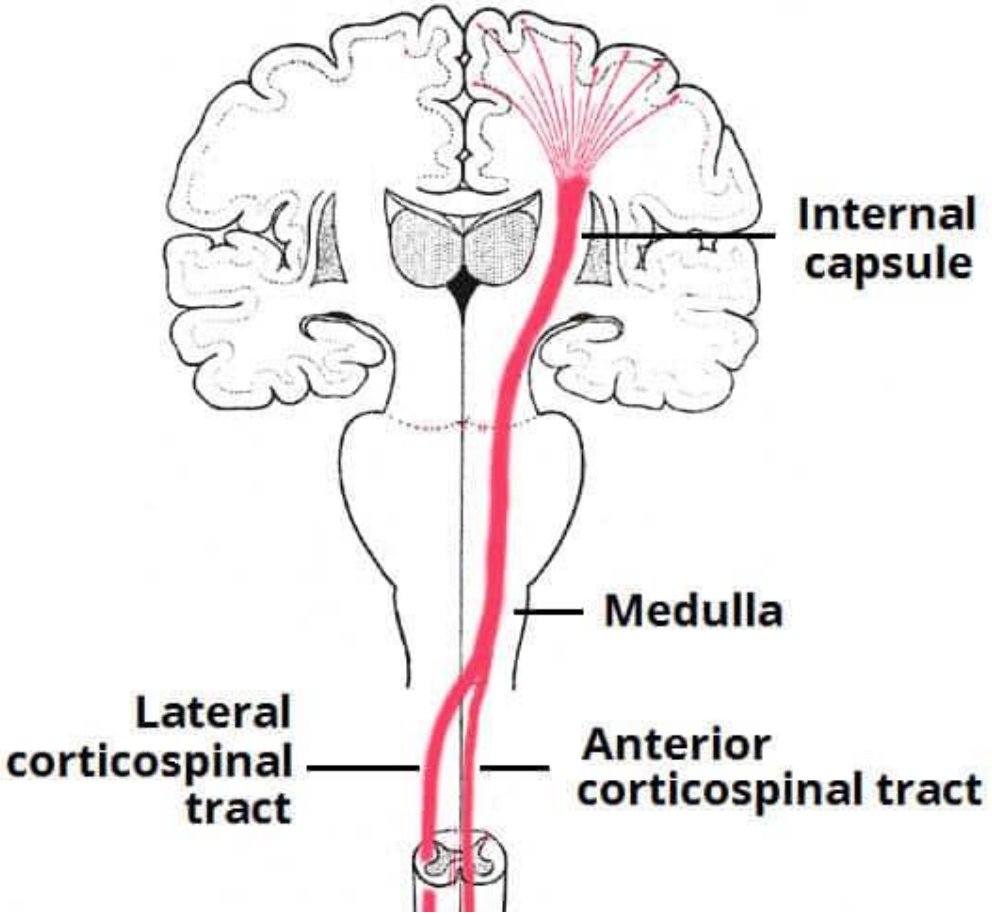

Transcranial Magnetic Stimulation

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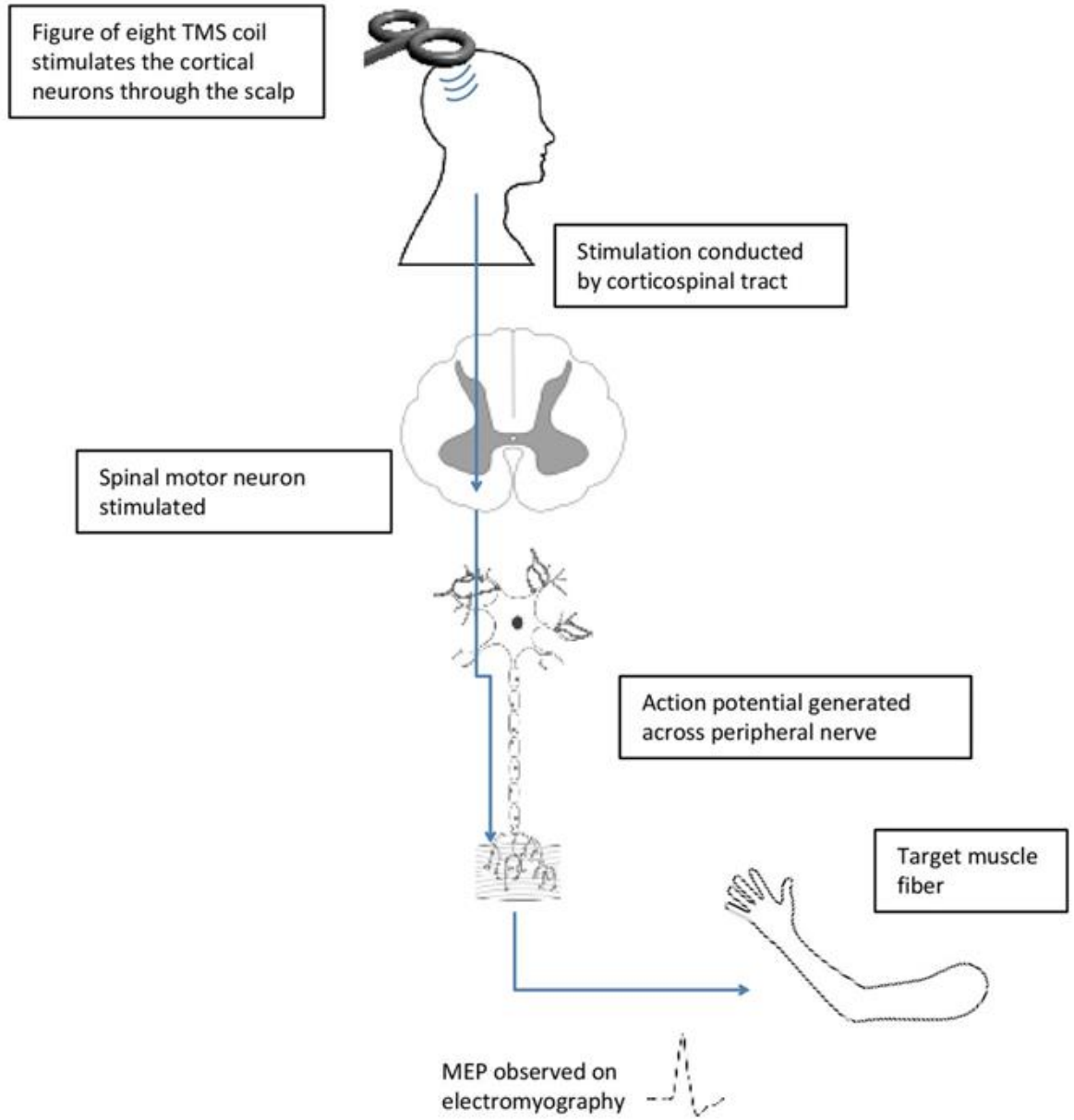

Habib 2018

Biomarker: Motor Evoked Potential

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Transcranial magnetic stimulation:

CST intact → MEP+

CST not intact → MEP-

Non-invasive brain stimulation

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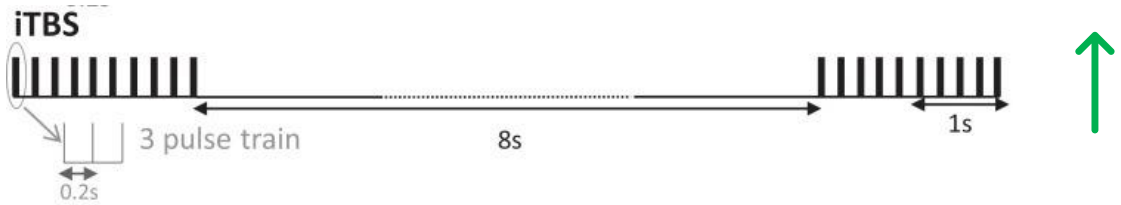
- Safe
- Neuromodulatory
- Improve paretic upper limb performance

TBS



Klomjai 2015

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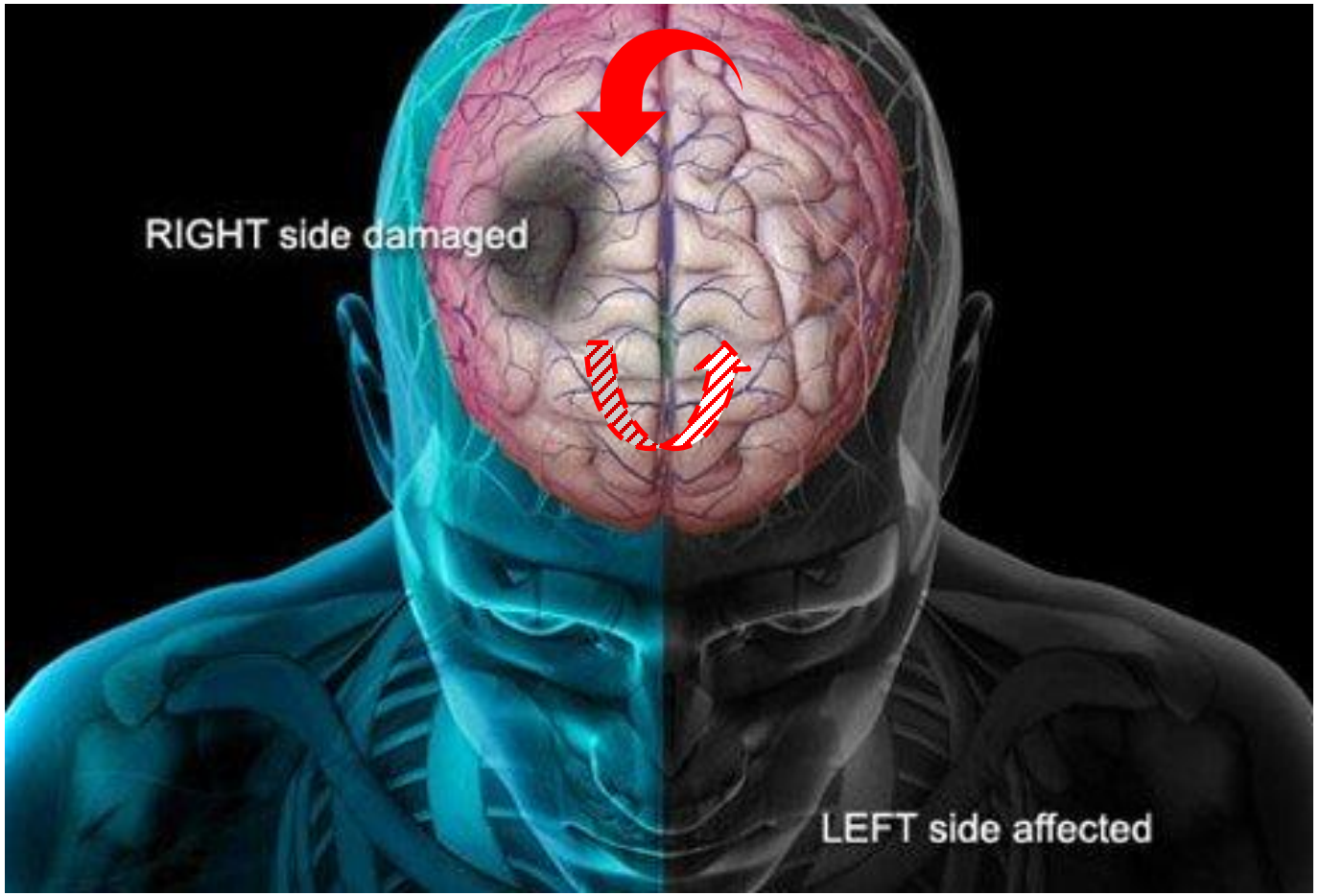

Murase 2002

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Murase 2002

Bimodal balance recovery model

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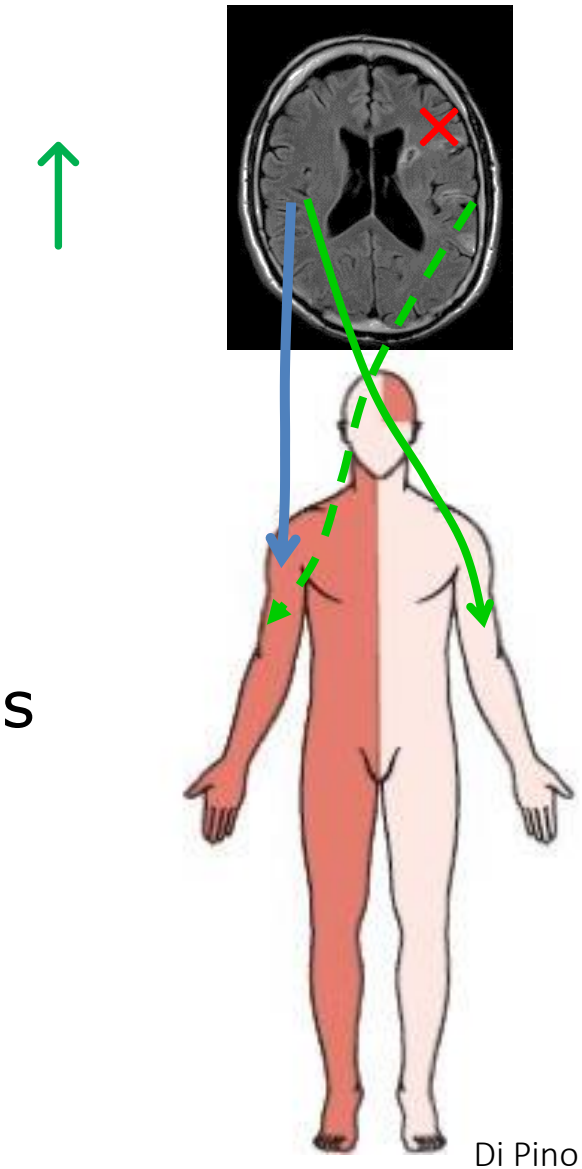
Ipsilateral connections



Di Pino 2017, Sankarasubramanian 2017, Bestmann 2010, McCambridge 2018

CROSS – Chronic stroke study

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- 2 sessions (Real and Sham intervention)
- Randomised
- Assessor and participants-blind
- Interventional pilot study of contralesional M1 facilitation in chronic stroke patients

Objective: To test the effects of iTBS applied to the contralesional M1 on paretic hand grip performance.

Interventional pilot study

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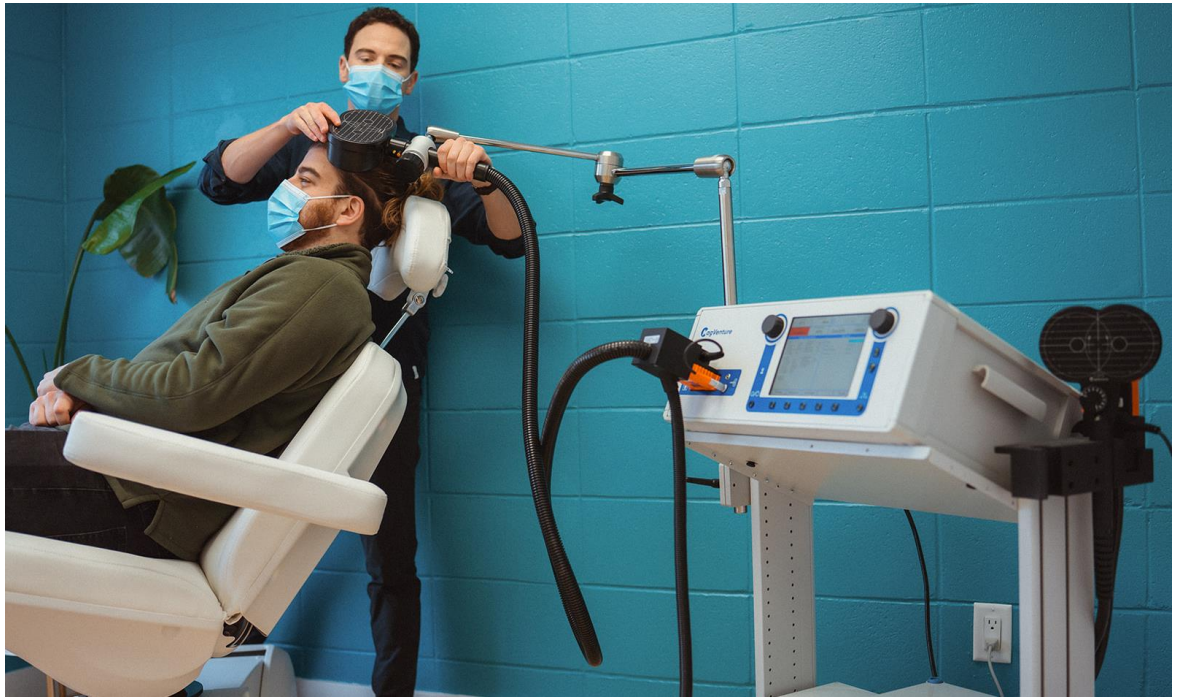
Selection criteria

- 18 years and older
- Chronic
- MEP- and MEP+ both
- UE-FM score less than 53/66
- No contraindication to NIBS



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MEP-

iTBS application over the contralesional M1 will improve paretic handgrip performance compared to sham stimulation in MEP- patients

MEP+

iTBS application over the contralesional M1 will have no effect on paretic handgrip performance compared to sham stimulation in MEP+ patients

Study design

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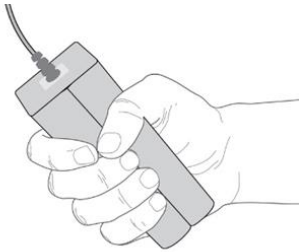
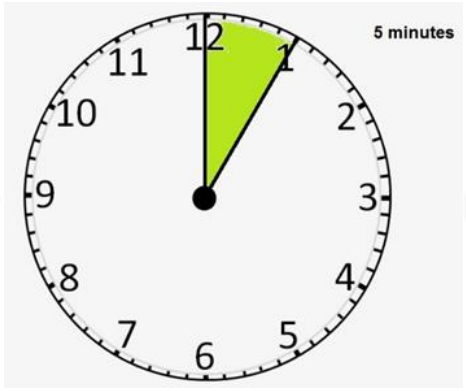
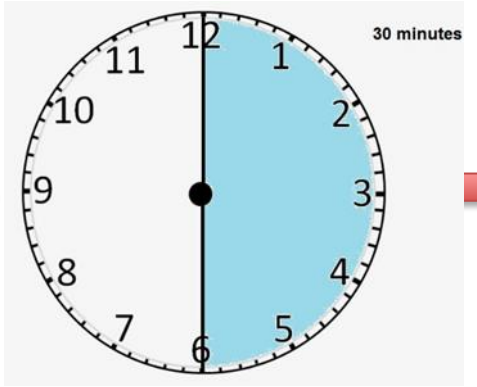
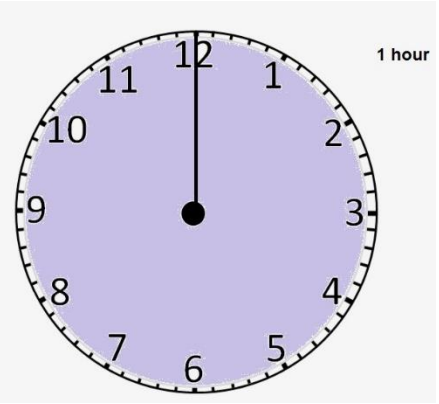
Baseline assessments



OR







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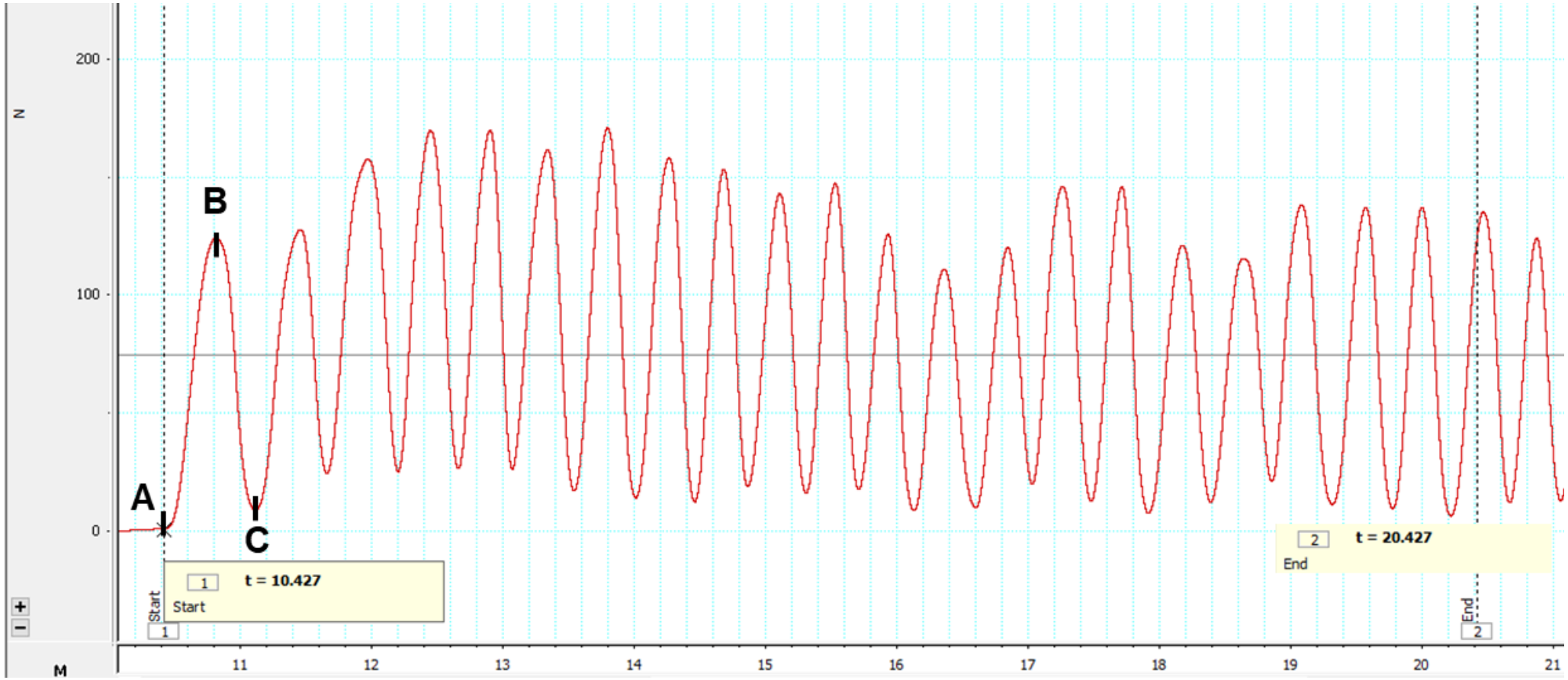

A-B = Total force squeezed and Rate of force production

B-C = Rate of force release

Results

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- 9 MEP- and 10 MEP+ chronic stroke patients
- 5 were women (26%)
- MEP- patients had a mean age of 57 and average FM score of 15
- MEP+ patients had a mean age of 66 and average FM score of 38

Corticomotor excitability

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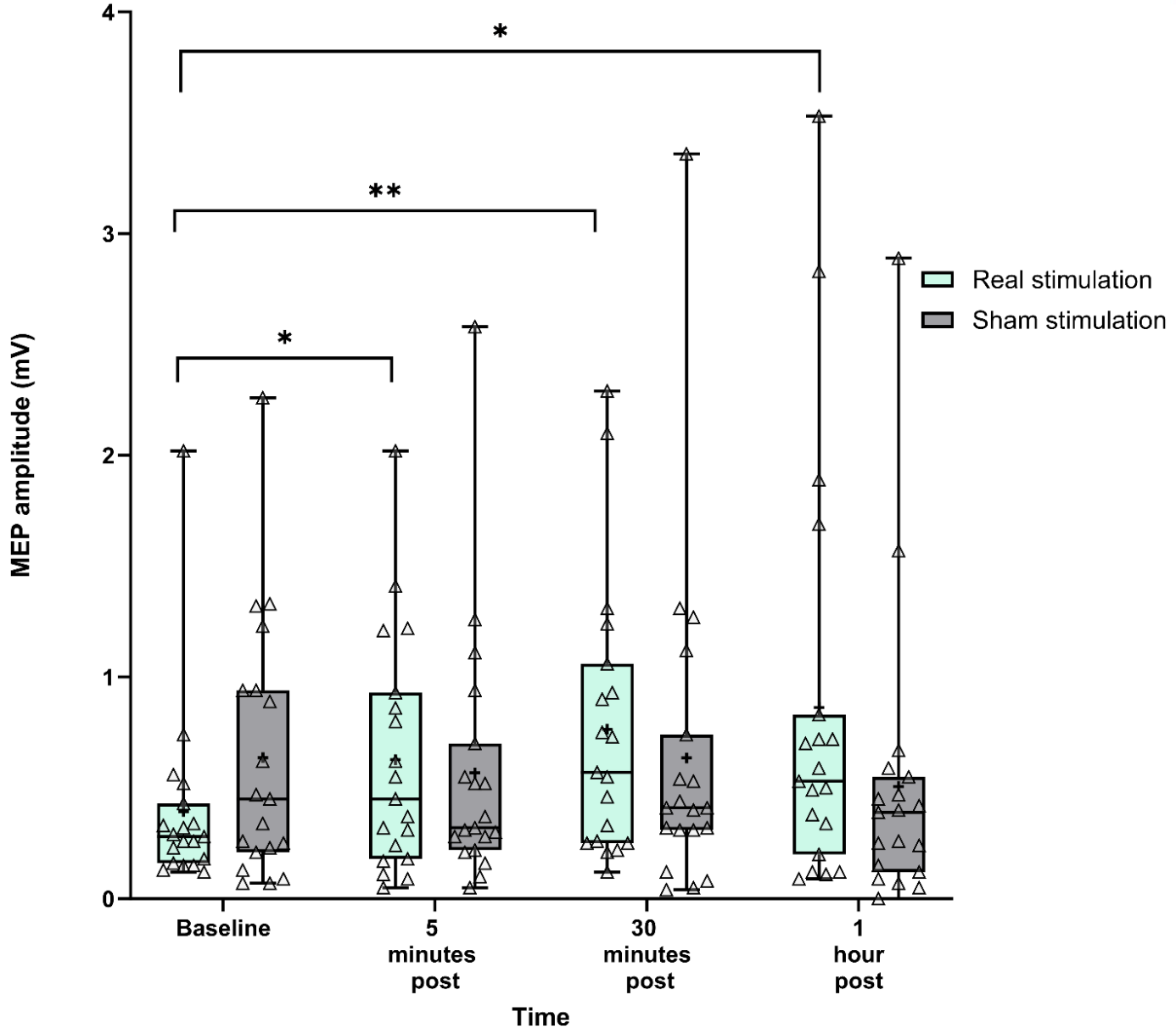
Significant time*stimulation interaction

p = 0.019



N = 19

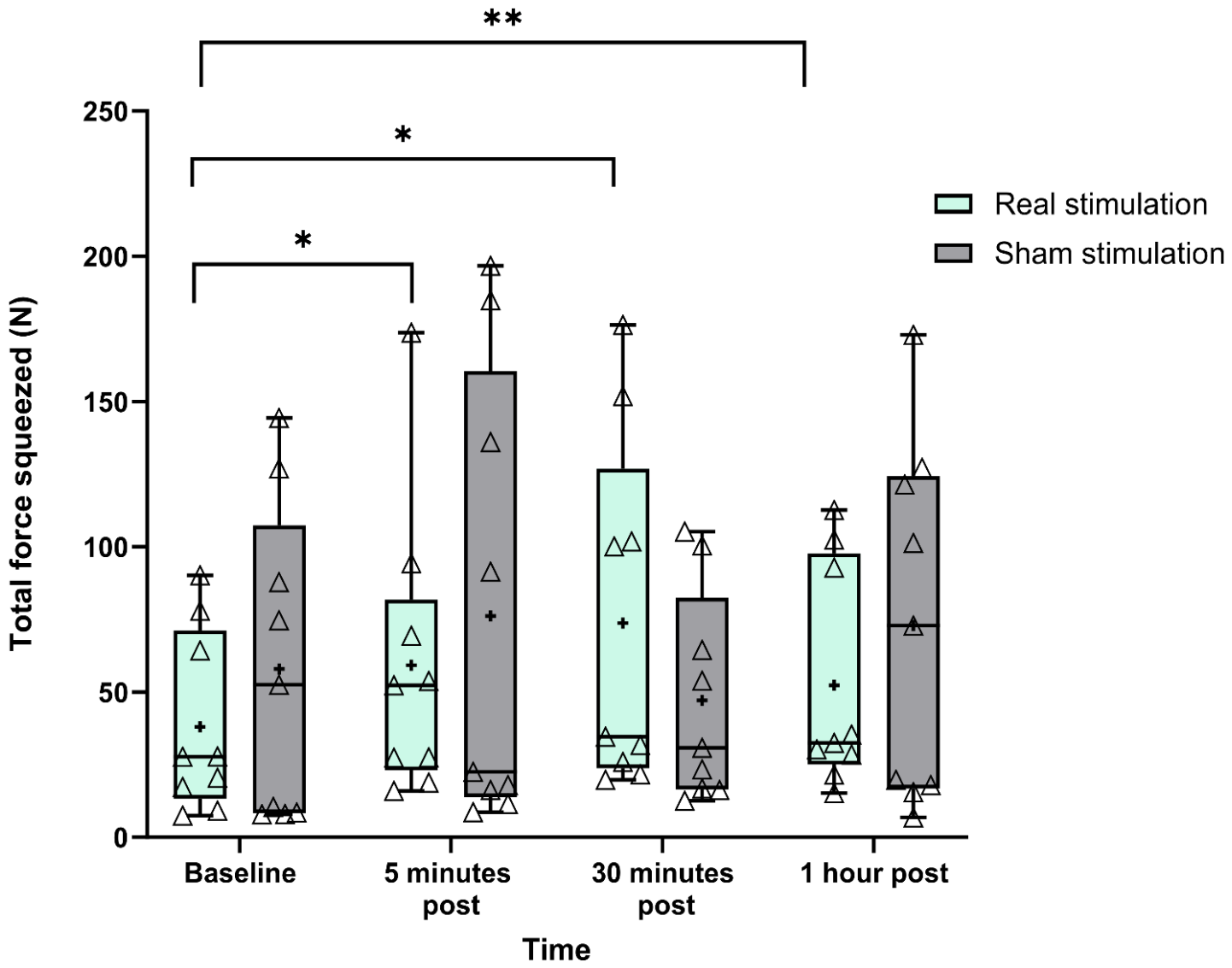
Handgrip performance

Force squeezed

MEP-

Significant time*stimulation interaction

p = 0.048



N = 9

Handgrip performance
Rate of force production
MEP-

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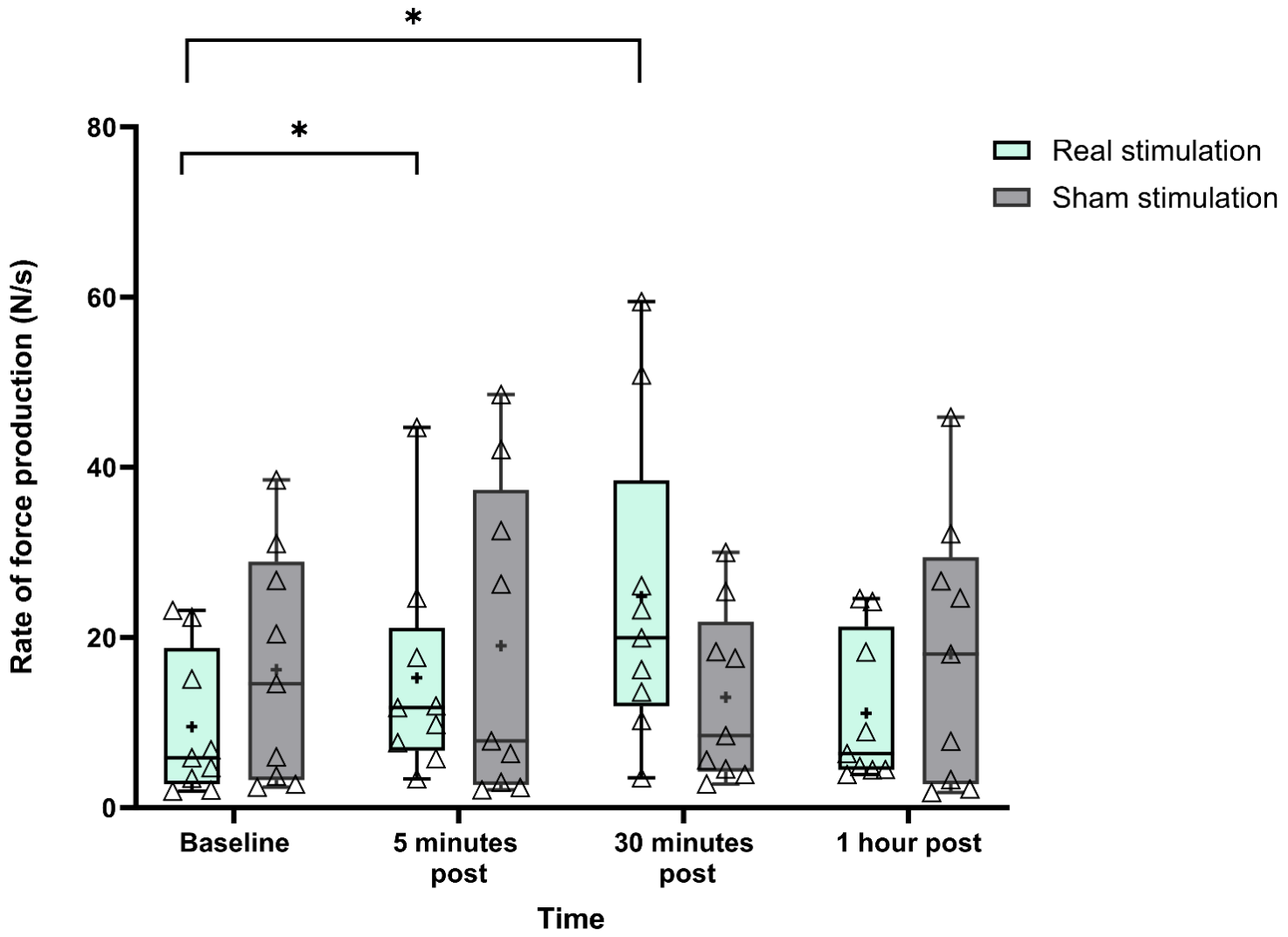
Significant time*stimulation interaction

p = 0.012



N = 9

Conclusions

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- Our results support our main hypotheses and are in line with the BB model
- Strength and rate of force production improved only in MEP- and not MEP+ patients
- Our findings encourage implementation of **precision Medicine**
- **One-size-does-not-fit-all**
- NIBS application should be tailored according to individual stroke patients

Acknowledgments

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- Professor Cathy Stinear, Department of Medicine
- Professor Winston Byblow, Department of Exercise Sciences
- Dr. Harry Jordan, Department of Medicine

Neurology Research Group

The University of Auckland Doctoral Scholarship

Stroke Foundation

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