



# Repetitive somatosensory stimulation in focal hand dystonia: a study on inhibitory circuitry plasticity of the somatosensory system and primary motor cortex

Lorenzo Rocchi

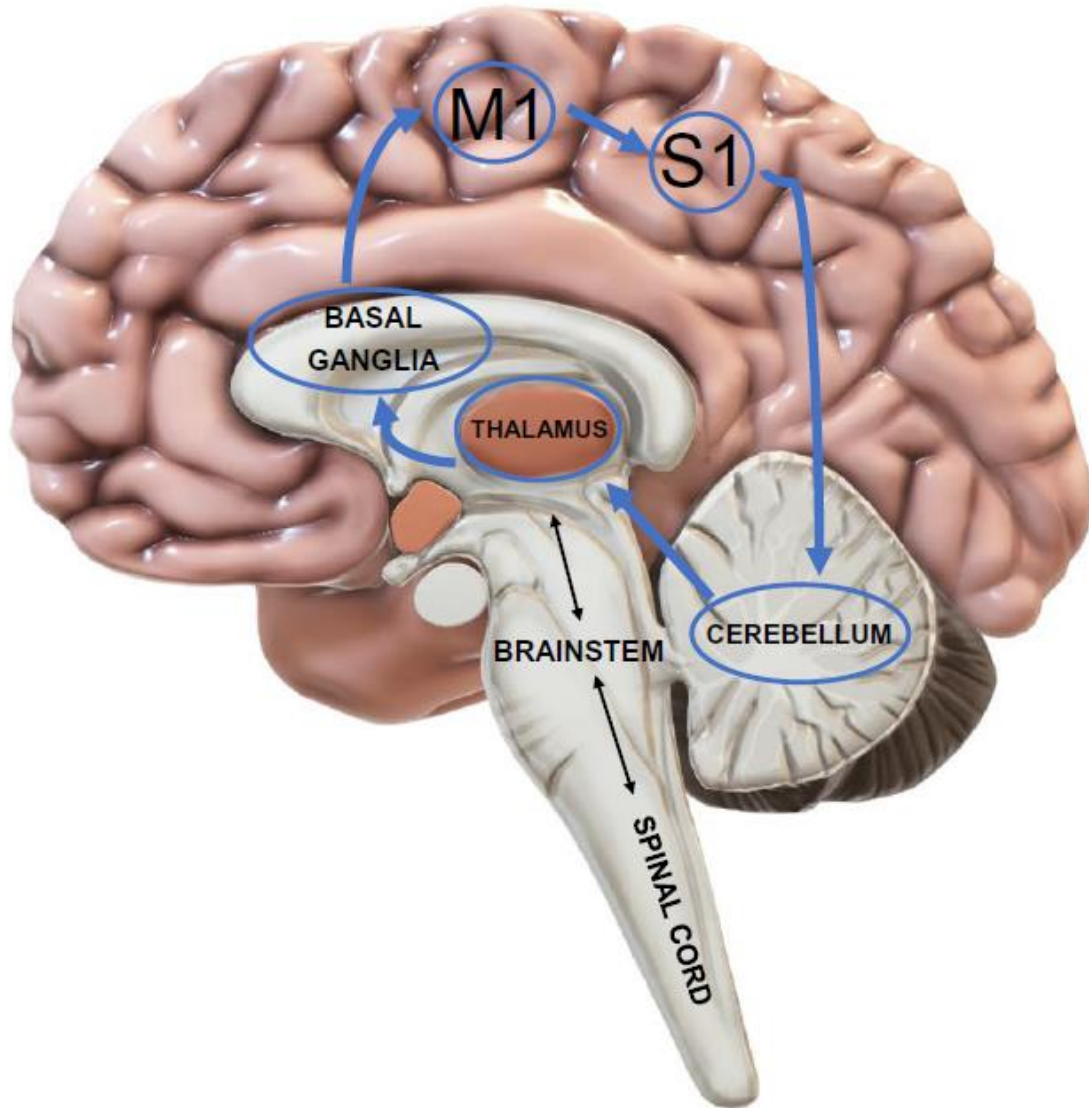
*Department of Human Neurosciences, Sapienza University of Rome, Italy*

# Background



- Dystonia is a syndrome characterized primarily by unwanted muscle spasms giving rise to involuntary movements and abnormal postures
- Many forms of dystonia (idiopathic, genetic, associated with CNS lesions, etc.)
- Limited therapeutic options
- Pathophysiology unclear, but loss of inhibition in motor control seems plausible
- Inability to suppress undesired movements when a voluntary movement is performed

# Background



- Dystonia as a network disorder
- Multiple parallel/interacting pathophysiological processes

Alterations in inhibition/sensory function



Abnormal synaptic plasticity

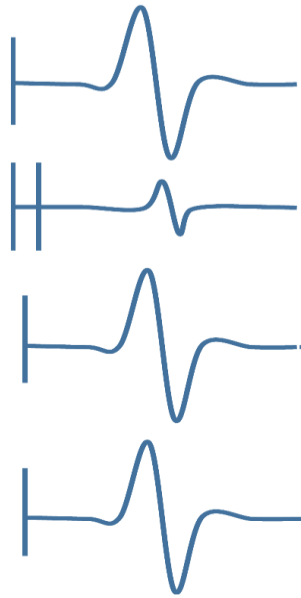


Deranged sensorimotor integration



Dystonia

# Background

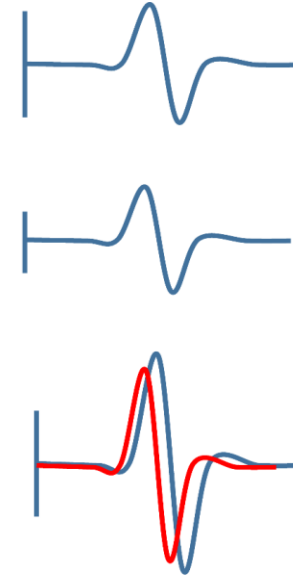


Single pulse SEP

ISI 5 ms

ISI 20 ms

ISI 40 ms

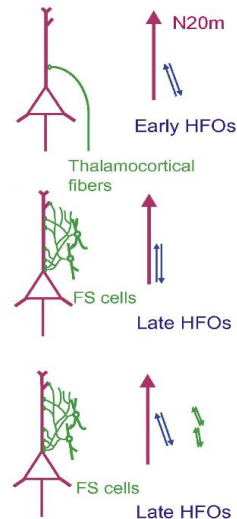
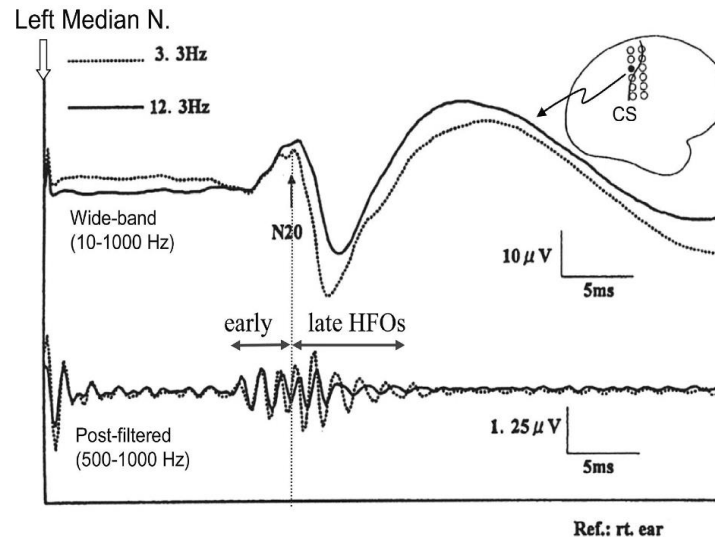


Median nerve only

Ulnar nerve only

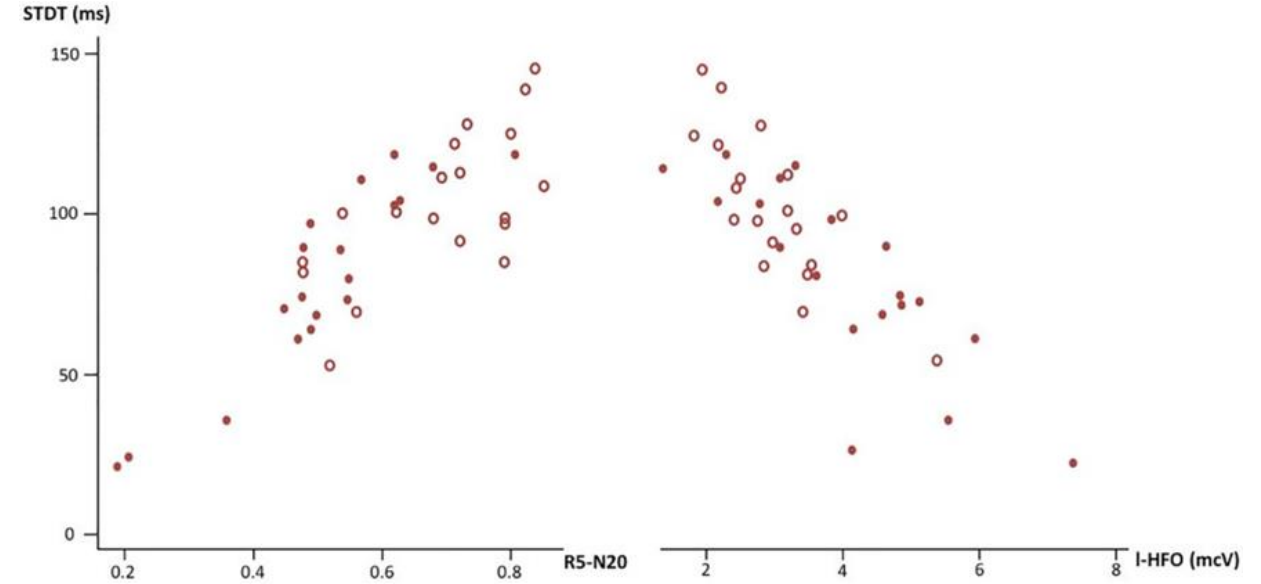
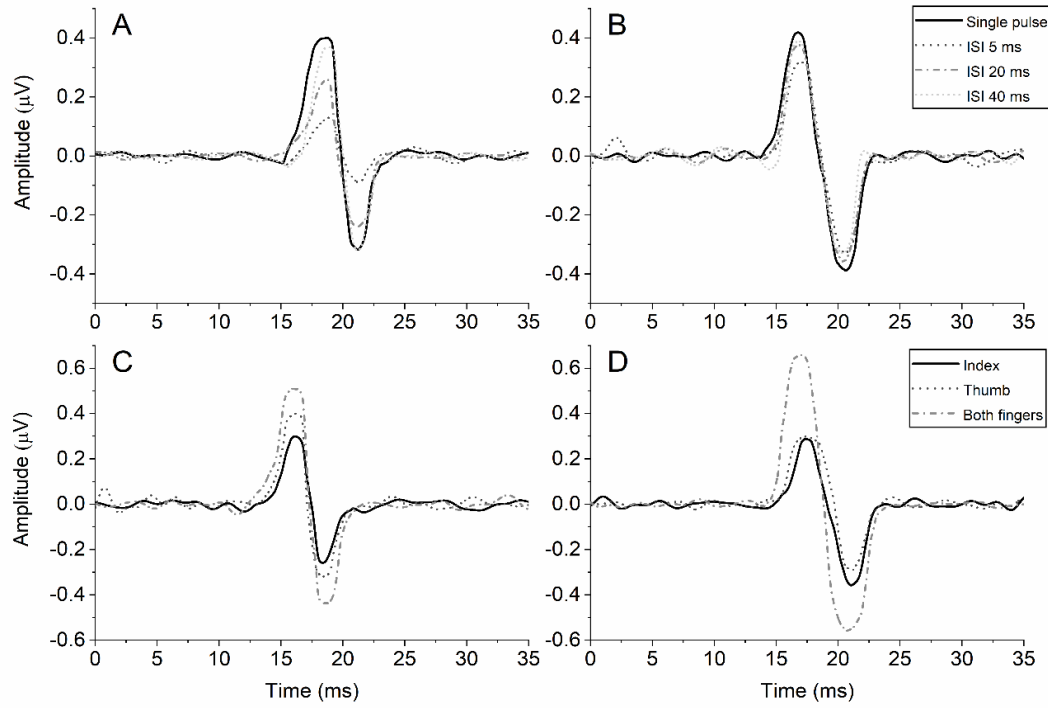
Median + ulnar nerves

Less than the sum of the two



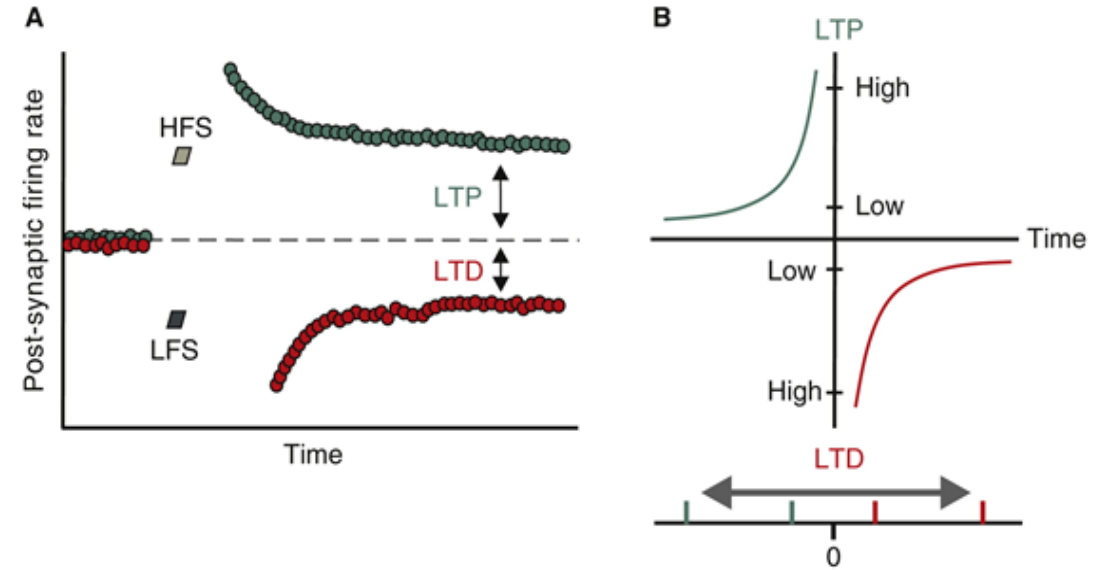
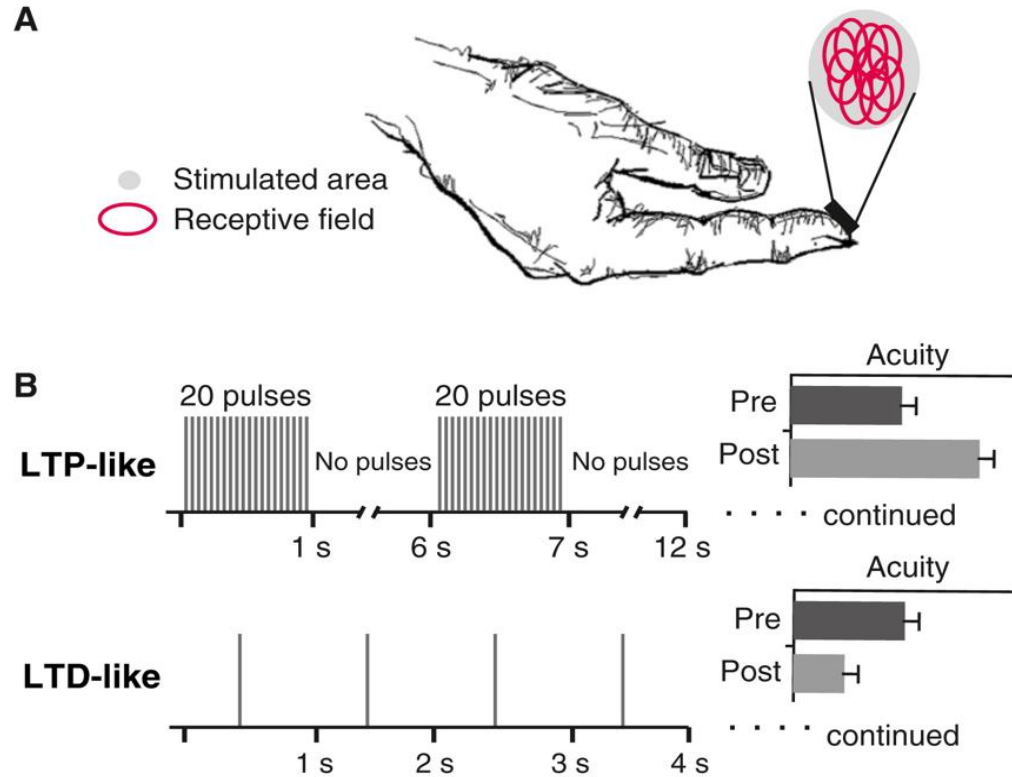
- Paired-pulse somatosensory evoked potentials (PP-SEP)
- Early/late high-frequency oscillations (e-HFO, l-HFO)
- Somatosensory evoked potentials spatial inhibition ratio (SIR)

# Background



- Cervical dystonia associated with decreased PP-SEP suppression, less SIR and smaller HFO area
- Correlation between PP-SEP with an interstimulus interval of 5 ms, I-HFO area and somatosensory temporal discrimination values

# Background

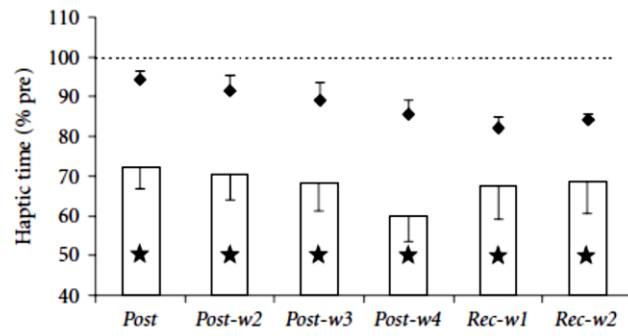


RSS: repetitive somatosensory stimulation

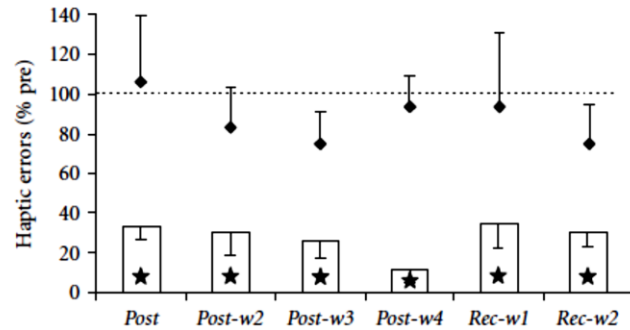
- High-frequency RSS (HF-RSS): 20 Hz frequency, long-term potentiation like (LTP-like) effects
- Low-frequency RSS (LF-RSS): 1 Hz frequency, long-term depression like (LTD-like) effects



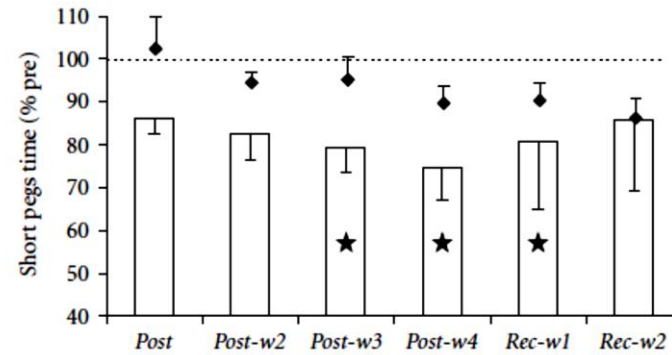
# Background



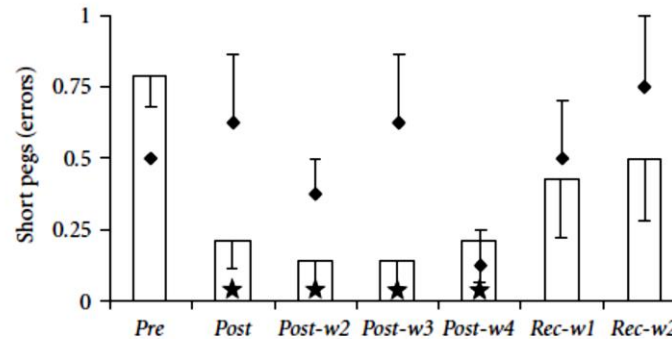
(a)



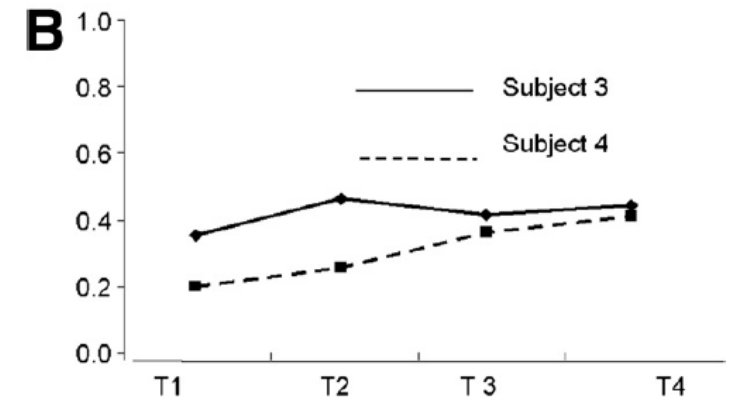
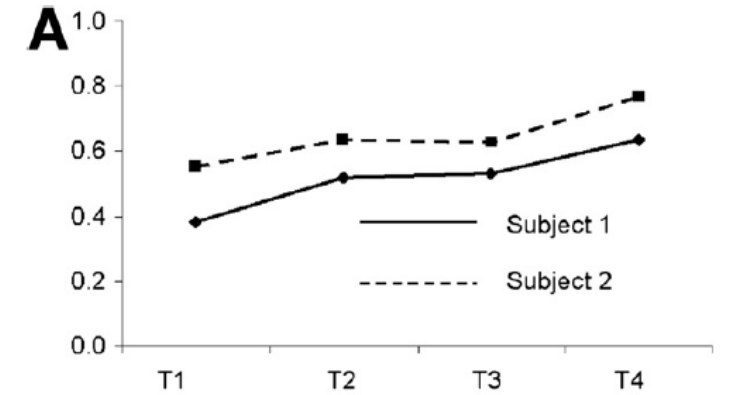
□ Target group  
◆ Control group



(a)

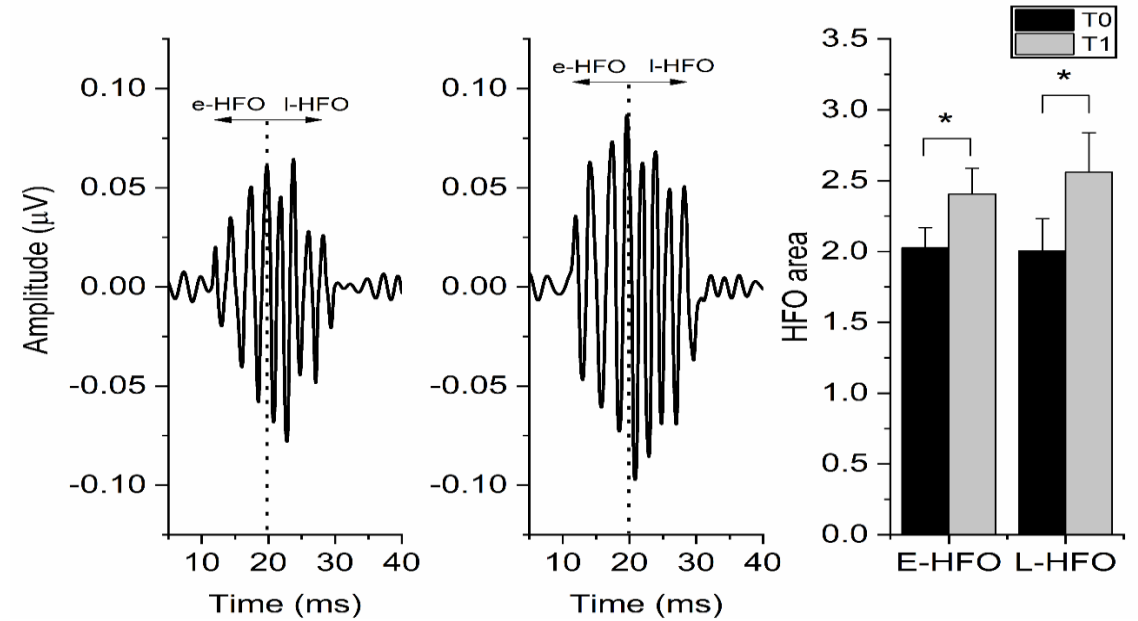
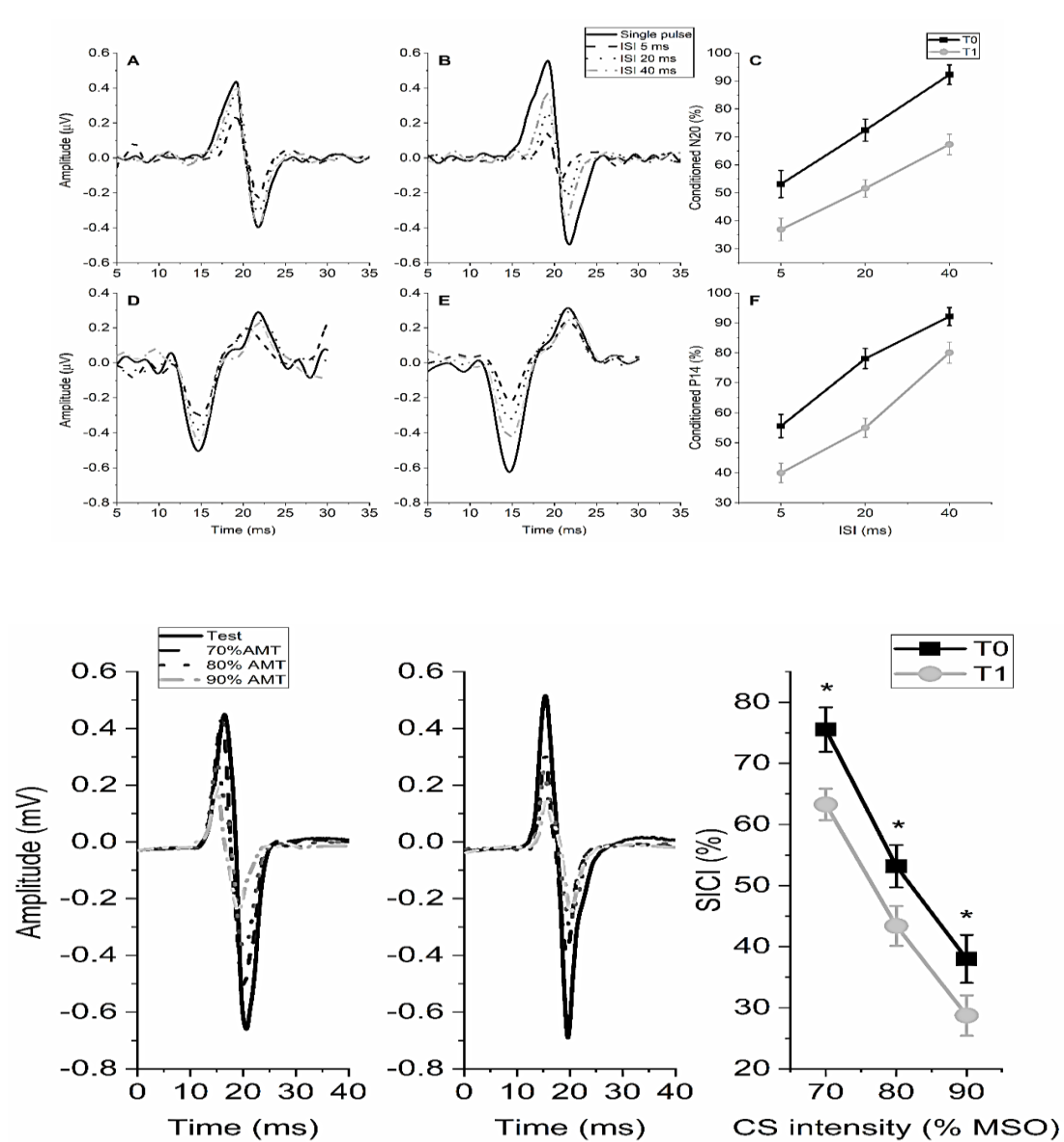


□ Target group  
◆ Control group



- HF-RSS leads to improvement in object recognition and hand motor function (nine-hole pegboard test, repetitive finger tapping) in healthy elderly subjects and stroke patients

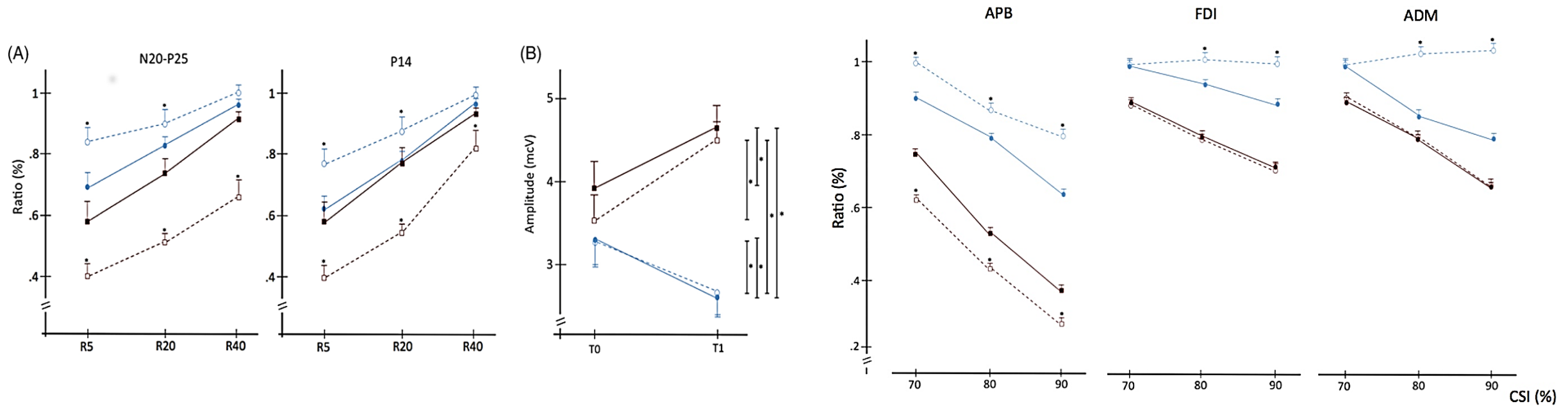
# Background



- HF-RSS leads to enhancement of intracortical inhibitory mechanisms within S1
- This is paralleled by increased inhibition in M1 as tested with short intracortical inhibition (SICI) paradigm

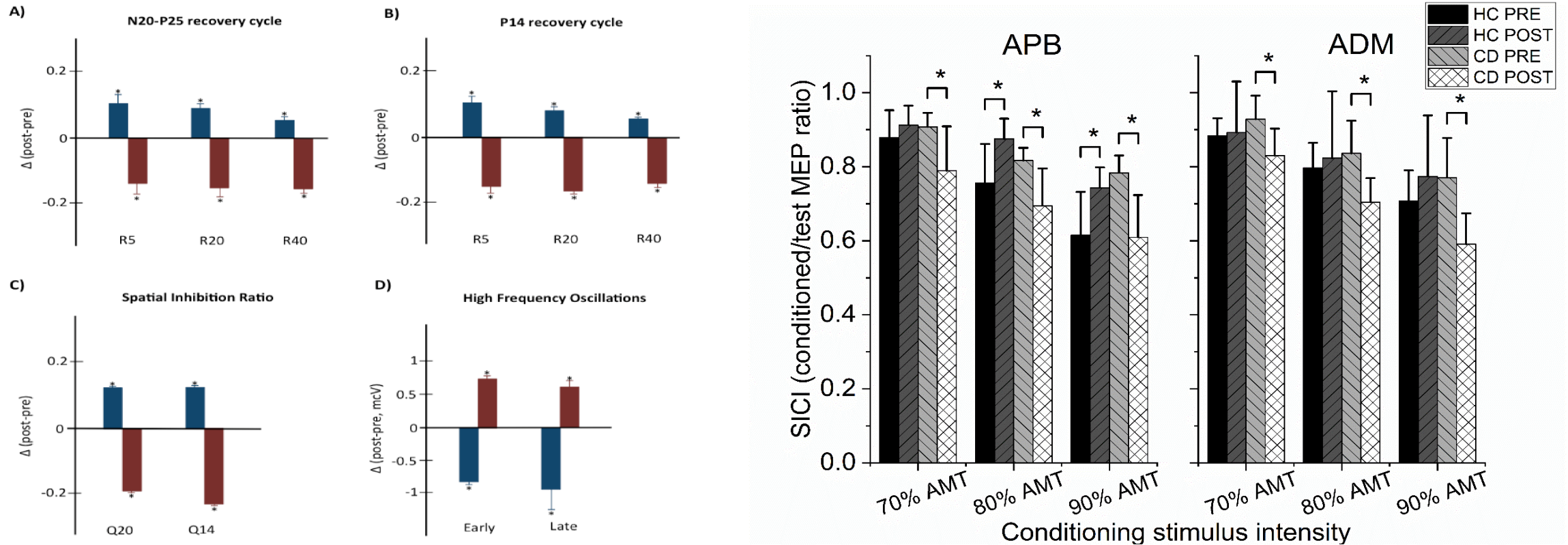


# Background



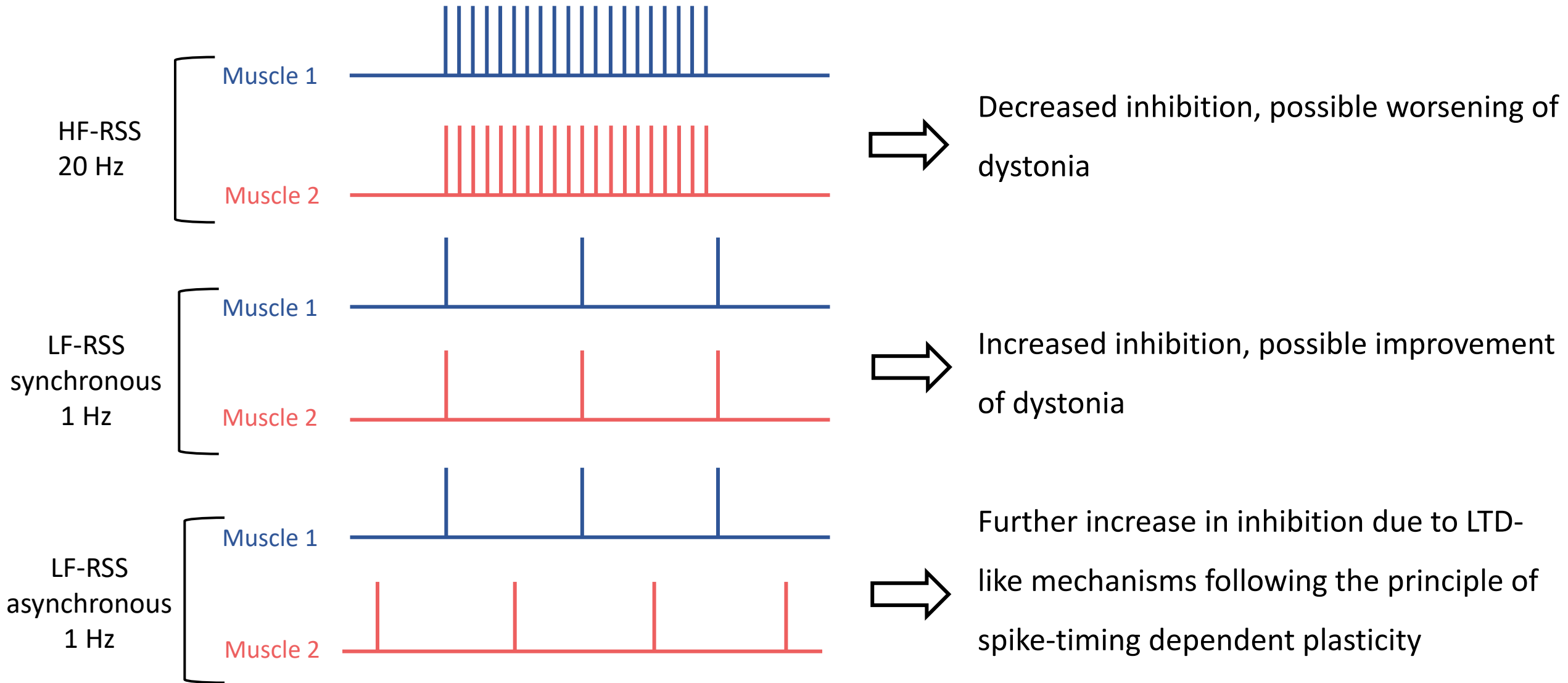
- Paradoxical effect of HF-RSS applied on the finger skin in idiopathic cervical dystonia: decrease in PP-SEP suppression, HFO area and SICl
- Altered homeostatic plasticity in dystonia?
- Would reversal of effects also occur with LF-RSS?

# Background



- LF-RSS applied on the finger skin in idiopathic cervical dystonia increases PP-SEP suppression, HFO area and SICI
- Could LF-RSS be used to ameliorate dystonia?
- So far, RSS applied on a body part **not affected by dystonia**

# Hypothesis



# Project outline

Three groups of 15 patients with focal hand dystonia,  
(HF-RSS, synchronous LF-RSS, asynchronous LF-RSS)

Arm Dystonia Disability Scale (ADDS), Unified Dystonia Rating Scale (UDRS)  
SEP from muscle stimulation (paired-pulse, dual site, HFO)  
Short intracortical inhibition via transcranial magnetic stimulation  
Surface electromyography



45-minute stimulation  
(either HF-RSS, synchronous LF-RSS or  
asynchronous LF-RSS)



SEP from muscle stimulation (paired-pulse, dual site, HFO)  
Short intracortical inhibition via transcranial magnetic  
stimulation  
Surface electromyography