Tonic Electromyography in Task-irrelevant Muscles does not differ between Successful and Failed Stopping

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Introduction
Evidence of global suppression of the motor system is observed during action stopping 1-3, potentially mediated by the subthalamic ‘hyper-direct’ pathway.

However, the time course of global motor suppression has not been established.

We examined tonic electromyography (EMG) of the first dorsal interosseous (FDI) in simple and choice stop tasks to address three questions:

1) Can a signature of global motor suppression be identified in tonic EMG of a task-irrelevant muscle?
2) Does background motor excitability differ between successful and failed stop trials?
3) Are tonic EMG patterns similar for responding homologous (FDI) and non-homologous (adductor digiti minimi, ADM) muscles?

Experiment 1
Go Task
- ITI 2.2 s
- Go stimulus
- EMG recorded from both FDI muscles.
- Dynamic EMG of ~10% MVC maintained in non-responding FDI.
- 3 stop signal delay (SSD) staircases adjusted ~50 ms based on performance.
- Go task: 30 trials. Stop task: 108 trials in 4 blocks, 1/3 stop trials
- Feedback on failed stop trials: ‘Try to stop’. Feedback on slow go trials (>2.5 std of GoRT): ‘Speed up’

Stop Task
- ITI 2.2 s
- Go stimulus
- Stop signal
- EMG recorded from both FDI muscles.

Experiment 2
Index
Go Task
- ITI 2.2 s
- Go stimulus
- EMG recorded from both FDI muscles.
- Left FDI maintained tonic ~10% MVC.
- Choice between right index (FDI) or pinky (ADM) responses.
- 3 stop signal delay (SSD) staircases adjusted ~50 ms based on performance.
- Go task: 60 trials in 2 blocks. Stop task: 216 trials in 8 blocks, 1/3 stop trials

Stop Task
- ITI 2.2 s
- Go stimulus
- Stop signal
- EMG recorded from both FDI muscles.
- Feedback on failed stop trials: ‘Try to stop’. Feedback on slow go trials (>2.5 std of GoRT): ‘Speed up’

Behavioral Results

Conclusions
Ongoing motor activity may not be sensitive to widespread motor inhibition during stopping.

- We did not identify a signature of global inhibition of the motor system during successful stopping.
- Tonic EMG did not differ between failed and successful stops.
- These results were replicated in simple and choice versions of the stop signal task.
- Surprisingly, partial EMG onset times on successful stop trials were faster than failed stop EMG onset times in the choice stop task. The opposite pattern was observed in the simple stop task.

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