Is motor system excitability during rest the same outside and inside a behavioral task?

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Introduction

- Rest is an ambiguous state that may differ across behavioral contexts.
- TMS investigations of long- and short-term motor learning and plasticity have reported changes in resting corticospinal excitability.1,2,4
- Here, we used TMS to compare resting corticospinal excitability (recruitment curves) between out-of-task and in-task contexts.
- We hypothesized corticospinal excitability would be enhanced at rest during task inter-trial intervals (ITI’s) compared with rest outside of a task context.

Methods

- 26 neurologically healthy adult participants (16F; mean age 21.1 ± 3.1 yo)
- TMS over right primary motor cortex at intensities of 90, 110, 130, 150 & 170% resting motor threshold (random, uniform distribution)
- Motor evoked potentials (MEPs) from left first dorsal interosseous (FDI)
- 3 (condition) x 5 (TMS intensity) Bayesian test for equivalence
- MEP recruitment curve fit with Boltzmann function:

\[ MEP(s) = EMG_{base} + \frac{MEP_{sat}}{1 + e^{-\frac{s50-1}{K}}} \]

\( MEP_{sat} \): plateau value at high stimulation intensities
\( EMG_{base} \): baseline EMG at rest
\( s50 \): stimulation intensity that produces a MEP halfway between \( EMG_{base} \) and \( MEP_{sat} \)
\( K \): change in stimulus intensity from \( s50 \) that relates to a 73% change in \( MEP(s) \)

Results

Bayesian Analysis of MEP Amplitude (mV)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cases</th>
<th>BFM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rest</td>
<td>&lt;0.1</td>
<td></td>
</tr>
<tr>
<td>Intensity</td>
<td>21.898</td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>0.719</td>
<td></td>
</tr>
</tbody>
</table>

Recruitment Curve Mean Maximum Slope (mV/%RMT)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rest</th>
<th>Hand</th>
<th>Finger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (Std.)</td>
<td>0.057 (0.036)</td>
<td>0.062 (0.031)</td>
<td>0.056 (0.037)</td>
</tr>
</tbody>
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Key Points

- Corticospinal excitability during inter-trial intervals of delayed response tasks returns to an out-of-task rest state, contrary to our hypothesis.
- The observed pattern was similar for task-relevant and task-irrelevant muscles within seconds after response execution.
- Clinical populations (Parkinson’s, Essential Tremor) could benefit from TMS investigation of the ability to return to rest with possible relevance for specific motor symptoms.

References & Acknowledgements


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