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Evaluating Transcranial Magnetic Stimulation as a Biomarker for Mild Traumatic Brain Injury: An mTBI-Predict Consortium Study

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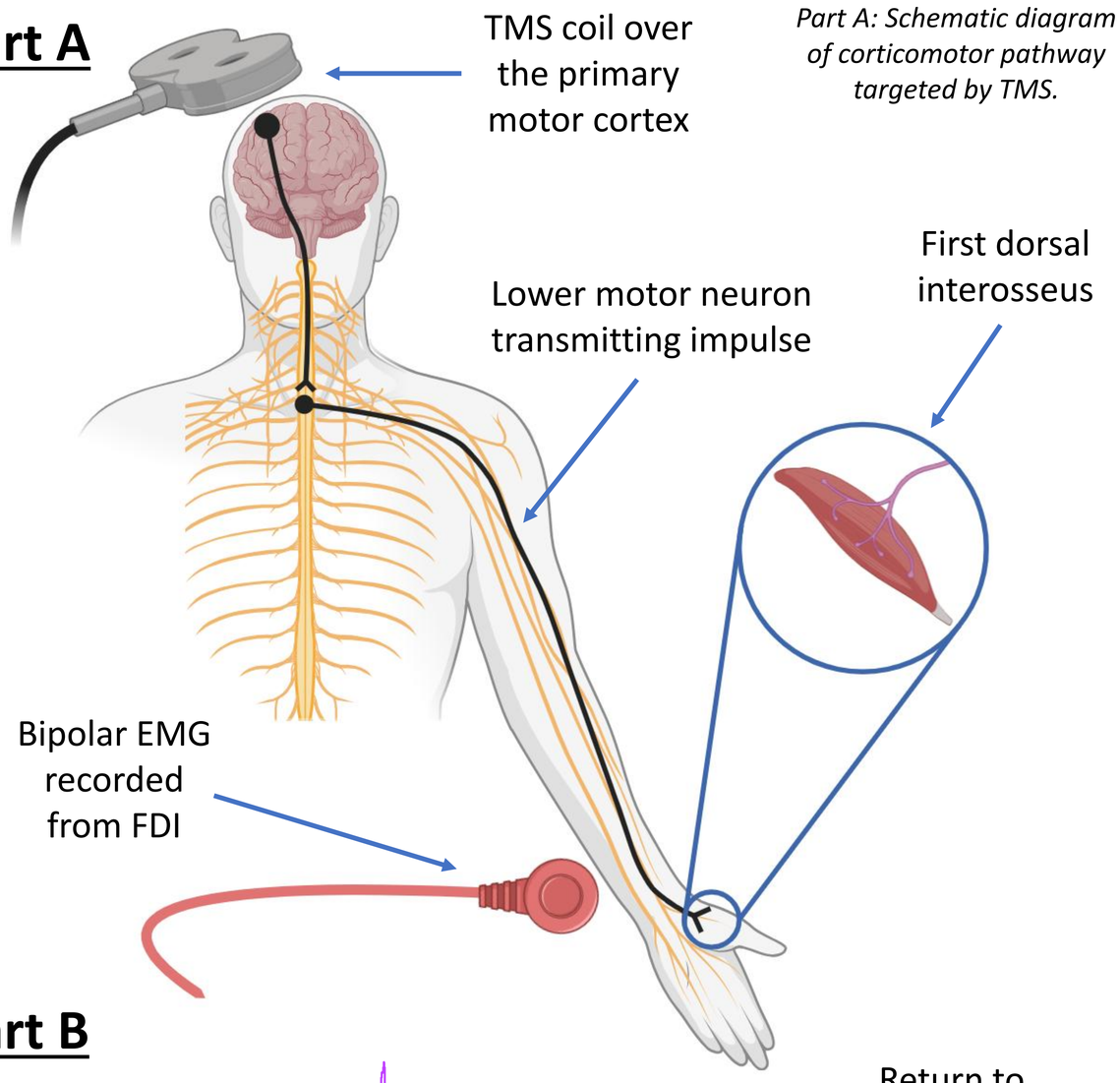
Background

- Mild traumatic brain injury (mTBI) is estimated to cost $17 billion USD annually in the USA, with over 2 million cases each year.
- Within the UK, 1.2 million cases are seen annually, with a third of patients unable to work within a year of their injury.
- New biomarkers are emerging in an attempt to assess recovery following mTBI.
- The cortical silent period (CSP) has been suggested as one such biomarker.
- CSP is a temporary suppression of voluntary muscle activity seen in the electromyography (EMG) of a contracted muscle following a single pulse of transcranial magnetic stimulation (TMS).

Study aim: To assess the variability and utility of the cortical silent period as a characterising biomarker for mild traumatic brain injury.

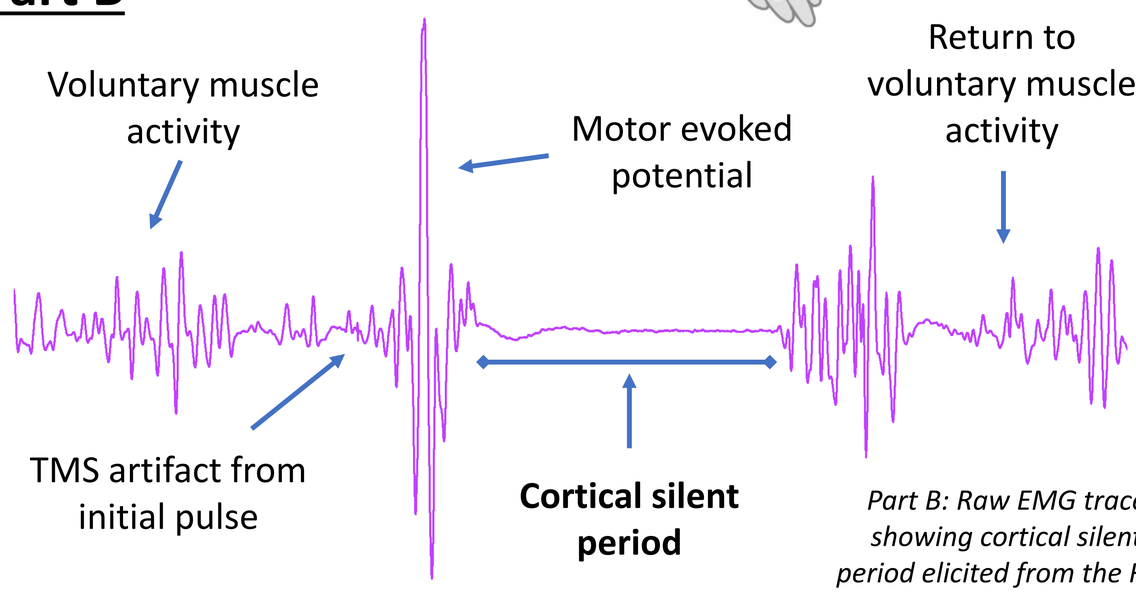
Methods (1)

Part A



Part A: Schematic diagram of corticomotor pathway targeted by TMS.

Part B



Part B: Raw EMG trace showing cortical silent period elicited from the FDI.

Methods (2)

- 11 mTBI patients and 13 healthy control volunteers were recruited.
- Each participant completed four visits across 12 days.
- Single-pulse TMS was delivered to the motor cortex.
- Bipolar EMG was recorded from the first dorsal interosseus (FDI).
- During a handgrip squeeze at 30% maximal voluntary contraction, CSP was elicited from the FDI.
- Two trained operators manually extracted CSP duration.
- Within-subject and between-subject variability was assessed to determine biomarker suitability.

Results

Table 1. Participant characteristics	**mTBI Patients (n = 11)**	**Healthy control volunteers (n = 13)**
Age (years)	31 ± 11	34 ± 13
Sex (n, %), Male	6 (55)	8 (62)
Body mass index (kg/m²)	27.87 ± 4.99	27.01 ± 5.57
Time since injury (days)	29 ± 4	N/A
Total visits analysed (n)	42	49

Table 2. CSP variability	**mTBI Patients (n = 11)**	**Healthy control volunteers (n = 13)**
Mean duration (ms)	138.9 ± 34.4	133.3 ± 32.9
Within-subject variability (CV_I, %)	**16.04**	**17.62**
Between-subject variability (CV_G, %)	**18.86**	**17.26**

- Demographic characteristics were similar across mTBI and healthy groups.
- Primary outcome variables of within-subject and between-subject variability did not show differences.
- Variability was also similar between and within participants.

Discussion

- Due to similar variability between mTBI and healthy individuals, CSP alone may not be a strong biomarker for characterising mTBI.
- CSP duration was slightly higher in mTBI, but further work is needed to investigate significance.
- Ongoing work will assess the usefulness of CSP as a prognostic biomarker for mTBI alongside other potential biomarkers such as vestibular, sleep, and biofluid derived variables.

Funding and conflicts

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