Evidence of Age-related Changes in Characteristics of Beta Bursts in the Motor Cortex During Unimanual Movement

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INTRODUCTION

Beta oscillations in the primary motor cortex (M1) emerge as epochs of higher amplitude known as **bursts [**Feingold et al. Proc Natl Acad Sci USA 2015**]**. There is compelling evidence suggesting that temporal dynamics of beta bursts are a strong predictor of motor performance [Simon L. et al. Plos Biology 2019]. In this study, we aim to (1) extract beta burst events over the contralateral M1 to the moving hand, (2) compare the burst rate between younger and older participants and (3) identify the changes in burst occurrence with respect to different target force levels during a unimanual task.

Experiment Protocol

Magnetoencephalography (MEG) recordings were acquired from 12 younger (18 to 30 years) & 12 older (60 to 74 years) healthy individuals at rest and during a unimanual task (**Fig 1) [**Xifra-Porxas A. et al. Neuroimage 2019**]**. For the unimanual task, participants had to track a ramp target ranging from 15% to 30% of their Maximal Voluntary Contraction (MVC).

Fig 1: *Schematic overview of the protocol*

METHODOLOGY

Preprocessing

Cardiac and eye-movement artifacts were removed from the MEG data using signal space projection (SSP) implemented in the Brainstorm software package.

Data analysis

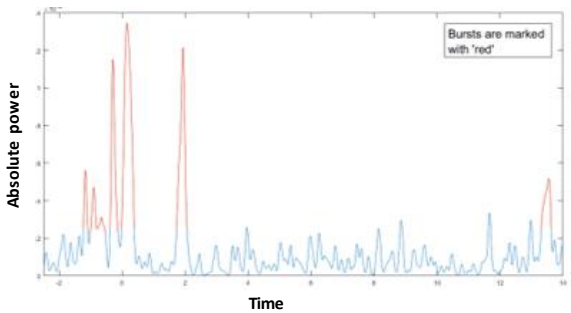

Fig 2: *Detection of beta bursts in a single trial data*

- Beta bursts were extracted over the contralateral M1 during handgrips with the right hand.
- **75th** percentile value of resting state beta power and a minimum burst duration of **100 ms** were used as thresholds (see **Fig** 2).

RESULTS

- Burst rate during pre- and post-movement intervals were significantly higher compared to the movement period for both groups (Fig 3).
- Grand averaged burst rate was higher for older subjects for all intervals. No significant difference in burst rate between groups but more variability was observed in older participants for all intervals.

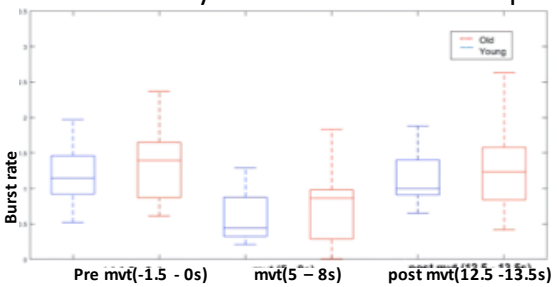

Fig 3: *Burst rate of young & old*

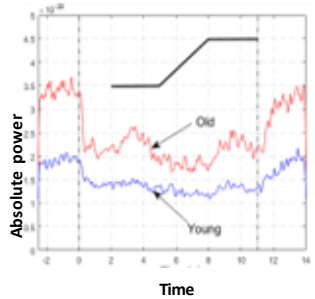

Fig 4: *Absolute beta power in time*

- Higher absolute beta power was observed in older adults during the entire trial (Fig 4). Lower burst rate during dynamic contractions were present compared to sustained ones in both groups.

CONCLUSION

Collectively, our results will provide new insight in the effect of aging on beta bursts during unimanual movements, and this study is the first step towards our long-term goal of developing a closed-loop neurofeedback system using a real-time burst detector to normalize brain oscillatory patterns for stroke patients.