Rhythmic auditory stimulation (RAS) for major spinal cord injury: A case study

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Background

- *Rhythmic auditory stimulation (RAS)* is a well documented form of music therapy for individuals living with motor impairments (*for review see Thaut, 2010*), involving synchronization of motor movement to a rhythmic auditory cue.

- Here, a **spinal cord injury** is defined as partial or complete severance of spinal cord tract (*Creasey et al., 1997*)

- Previous research suggests that the involvement of the motor cortex in rhythm perception (*Grahn & Brett, 2007*) bolsters the efficacy of RAS in motor rehabilitation

- It is also suggested that increased power in neural activity in the **delta** band (0.5 - 3.5 Hz) and decreased power in the **beta** band (13-30 Hz) is correlated with efficacy of RAS. (*Thaut, 2011; Gourab & Schmit, 2010*)

- **However,** little to no research has examined the use of RAS in a population with major spinal cord injuries, despite the established relationship between RAS and improvements for other motor impairments (*Thaut et al., 1996; Whitall et al., 2000*)

Aims

1. Determine if RAS is a viable and effective means of motor rehabilitation for our case study

2. Examine the underlying neural activity during RAS at the delta and beta bandwidth

Methods

Participants
- *n* = 10
  - J.D.
  - Healthy matched control

Equipment
- Starstim 20 EEG system (*Neuroelectrics, 2018*)
- Oculus Quest 2 (*Facebook Technologies, LLC, 2020*)
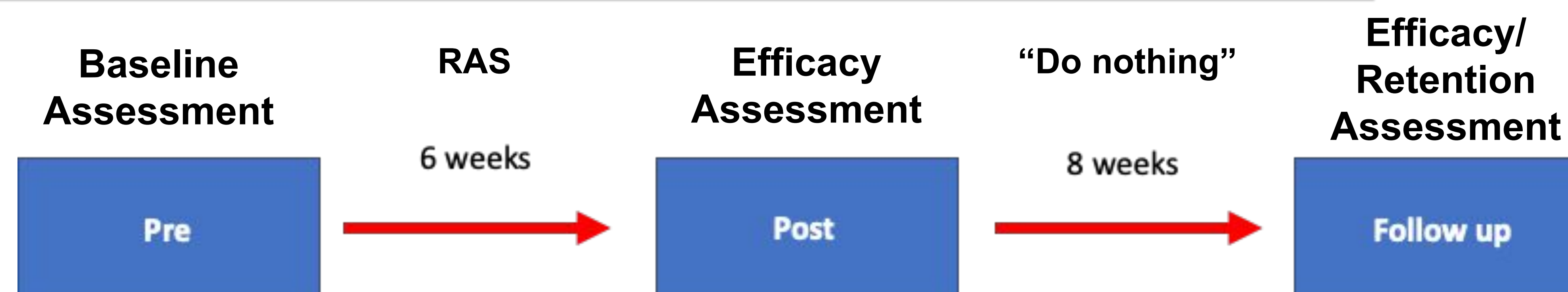- Beat Saber (*Beat Games, 2019*)

Neural measures
- Beta band desynchronization
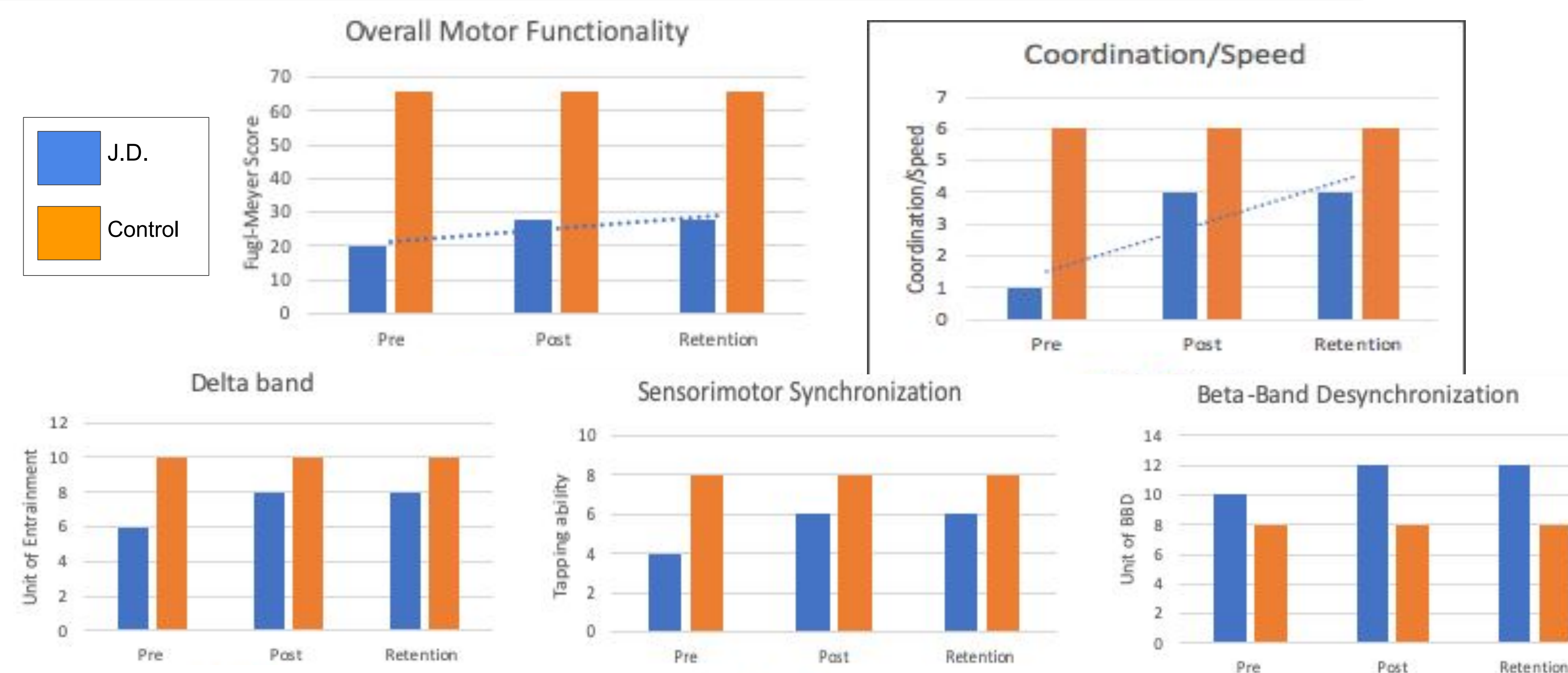- Delta band synchronization

Behavioural measures
- Assess motor function with Fugl-Meyer assessment (*Whitall et al., 2000*)
- Assess sensorimotor synchronization with tapping ability

Longitudinal Design

Baseline Assessment	**RAS**	**Efficacy Assessment**	**"Do nothing"**	**Efficacy/ Retention Assessment**
Pre	6 weeks →	Post	8 weeks →	Follow up

Proposed Results

Implications

1. Initiates the literature on whether RAS can be implemented as a means of motor rehabilitation for those with major spinal cord injuries
2. Furthers our understanding of the neural mechanisms underlying RAS

Future Directions

1. Scale to a larger samle
2. Eventually conduct an RCT (randomized control trial).
3. Examine RAS for different degrees of spinal cord injuries ranging in:
   - Severity
   - Location of severance

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