Assessing the Relationship between Symptom Severity and Gait Performance in Chronic mTBI Before and After Rehabilitation

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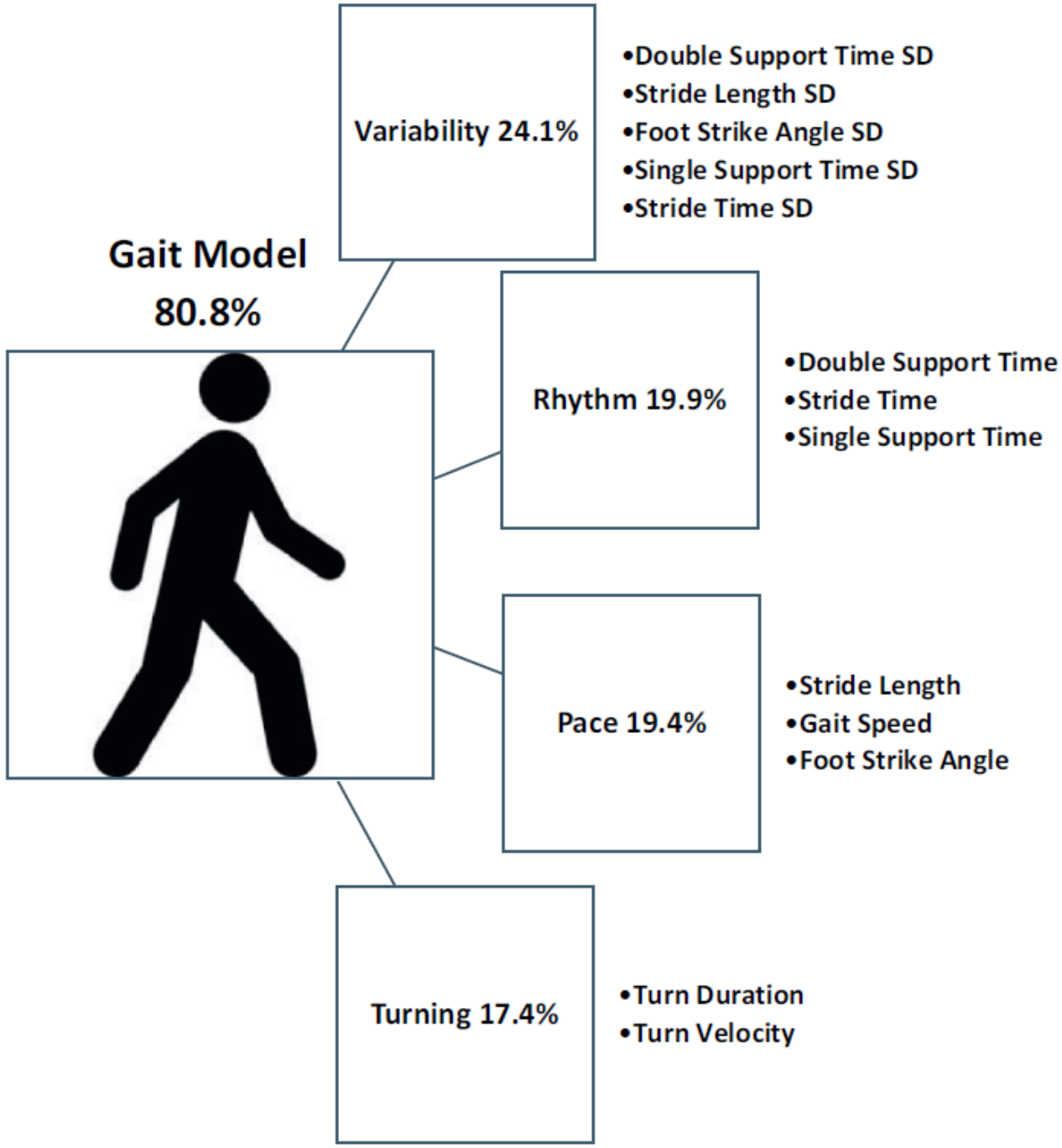
Introduction

- Up to 53% report symptoms >1 year (Nelson et al., 2019; Fino et al., 2016)
- Subtle gait deficits observed up to 1 month post-mTBI
- Reports on gait characteristics in mTBI are variable (Fino et al., 2018)

Gait is more than just Speed



(Stuart et al., 2020)

Why Does Dual-Tasking Matter?

- Simulates “real-world” demands for gait
- Overburden compensatory mechanisms
- Different ways to test dual-task in the lab

Aims

- 1) Determine the differences in gait domains between symptomatic, chronic mTBI and healthy control groups

- 2) Examine the relationship between symptoms and gait domains in the mTBI group

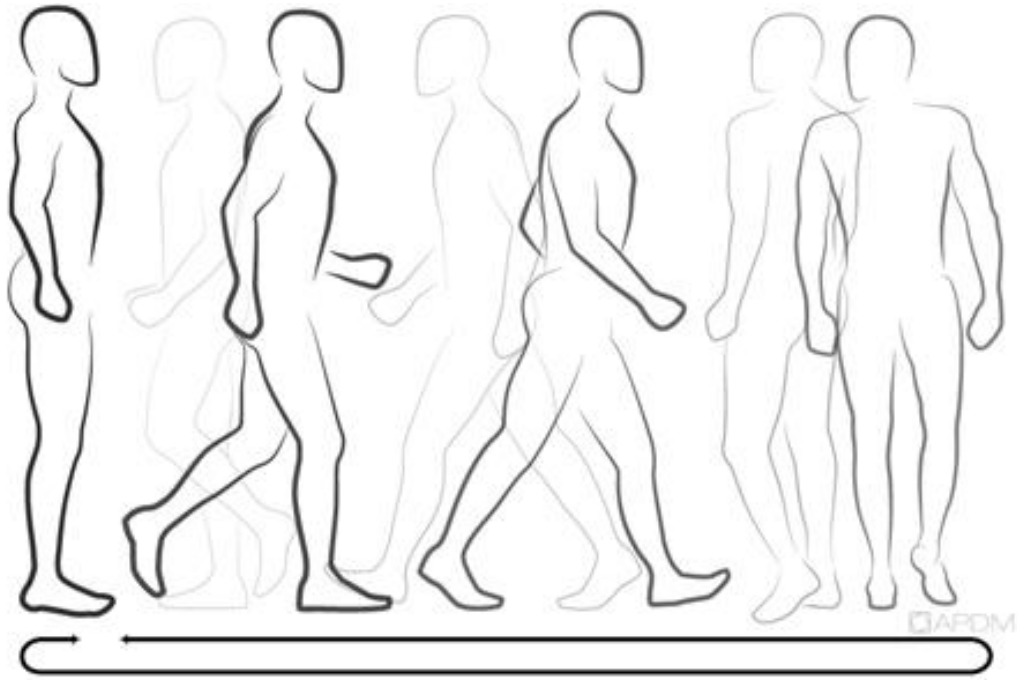
Preliminary Results

- Explore the possible effects of rehabilitation on symptoms and gait domains, and their relationship

Methods – Gait Characterization

- Opal inertial sensors (APDM Inc.)
- Self-selected, “normal” pace
- 13 meter walk, 2 minutes
- Under Single- & Dual-Task conditions

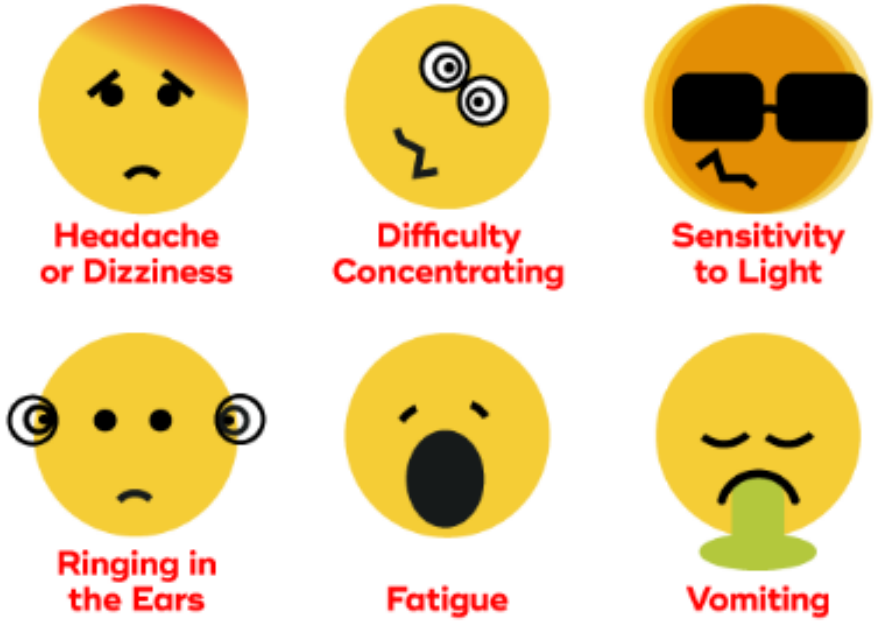
Wearable inertial sensors (IMUs)



Gait	Turning	Transitions
• Cadence • Stride Velocity • Stride length • Arm Swing • Double Support • Ranges of Motion • Asymmetry • 53 parameters	• Duration • Speeds • Number of steps • Step time • 7 parameters	• Duration • Speeds • Accelerations • Ranges of Motion • First step time • 7 parameters

Methods – Symptom Reporting

- The Sport Concussion Assessment Tool (SCAT) 3
  - 22 symptoms
  - Likert scale 0-6 (higher = worse)
  - Self-rated



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Participants

- Inclusion Criteria: self reported balance & complaints of dizziness for >3 months post mTBI
- Exclusion Criteria: a history of injury, surgery or medical condition that would impair cognition or motor ability, beyond a mTBI

	Control	mTBI
n	58	67
Gender (F)	36	45
Age (yrs)	37.3 (12.4)	39.7 (11.6)
Height (cm)	171.2 (9.7)	167.8 (19.7)
Weight (Kg)	75.0 (18.9)	83.6 (30.3)
Time from mTBI (yrs)	NA	1.0 (12.8)
Total Previous mTBIs	NA	1.0 (10.0)
SCAT 3 Total*	**1.8 (3.9)**	**38.4 (23.0)**

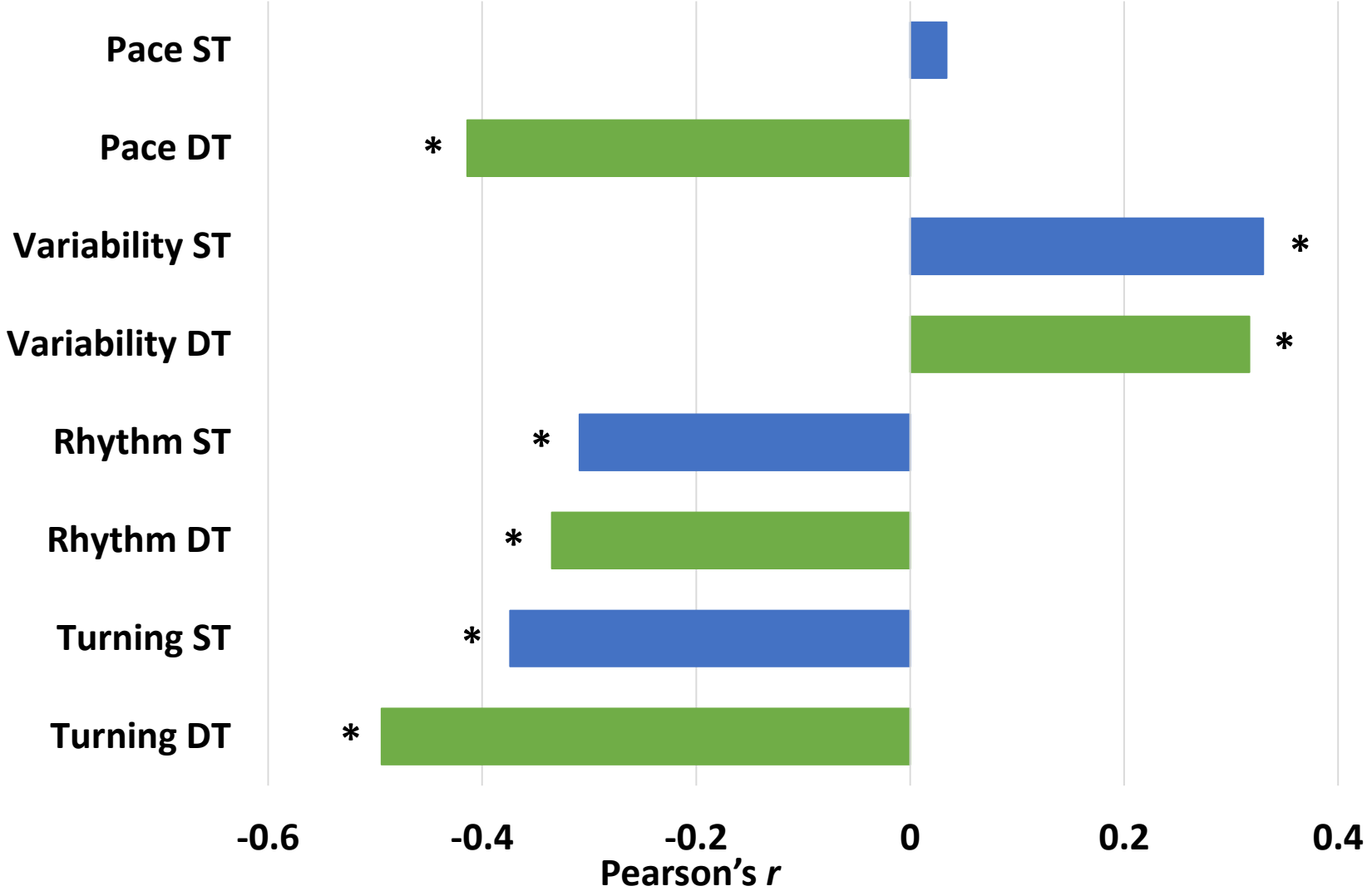
* Indicates $p < 0.05$

mTBI Affects Multiple Domains, Especially DT

ST = Single-Task
DT = Dual-Task

		Control	mTBI	Cohen's *d*
ST	Cognitive Acc (%)	98.8 (4.2)	97.4 (6.3)	0.27
	Pace	0.16 (0.49)	-0.15 (0.94)	0.42
	Variability	-0.11 (0.48)	0.11 (0.56)	0.42
	Rhythm	0.07 (0.14)	-0.08 (1.23)	0.17
	Turning*	**0.37 (0.85)**	**-0.36 (0.88)**	**0.85**
DT	Cognitive Acc (%)	98.5 (1.7)	95.3 (8.1)	0.55
	Pace*	**0.37 (0.80)**	**-0.35 (0.86)**	**0.88**
	Variability	-0.14 (0.71)	0.17 (0.99)	0.36
	Rhythm*	**0.10 (0.27)**	**-0.11 (0.37)**	**0.66**
	Turning*	**0.36 (0.61)**	**-0.34 (1.04)**	**0.45**

SCAT 3 Total Symptoms Are Related To Gait Domains, Particularly with Dual-task Gait



ST = Single-Task

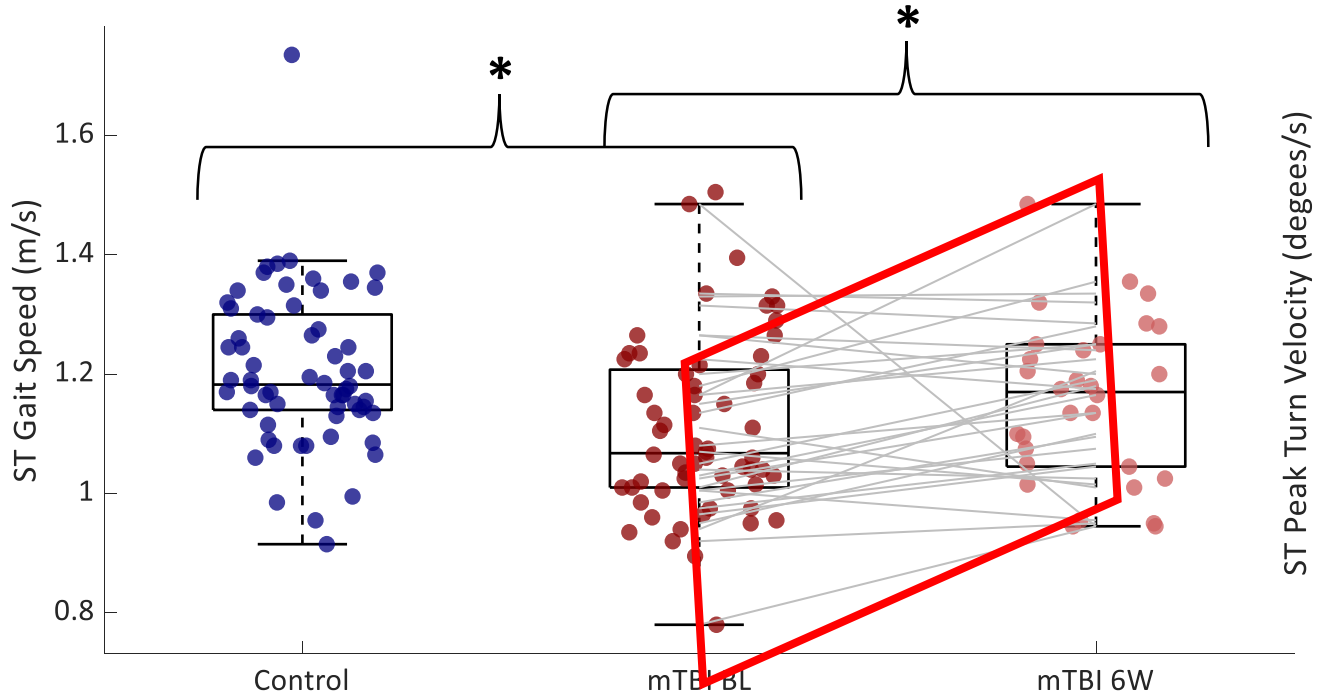
DT = Dual-Task

* p < 0.01

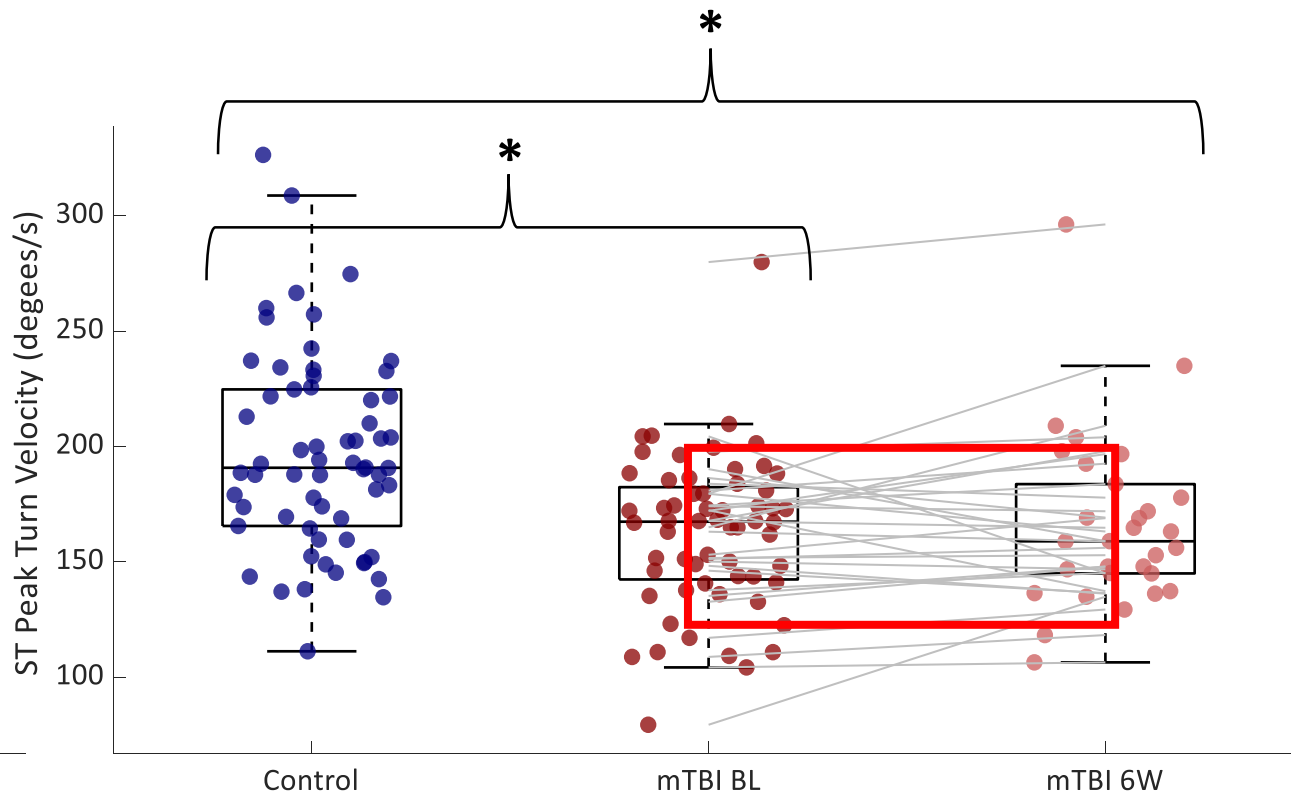
Can Rehabilitation designed to reduce symptoms improve gait performance?

(Fino, et al., 2017)

Rehabilitation May Affect Domains Differently



Gait Speed

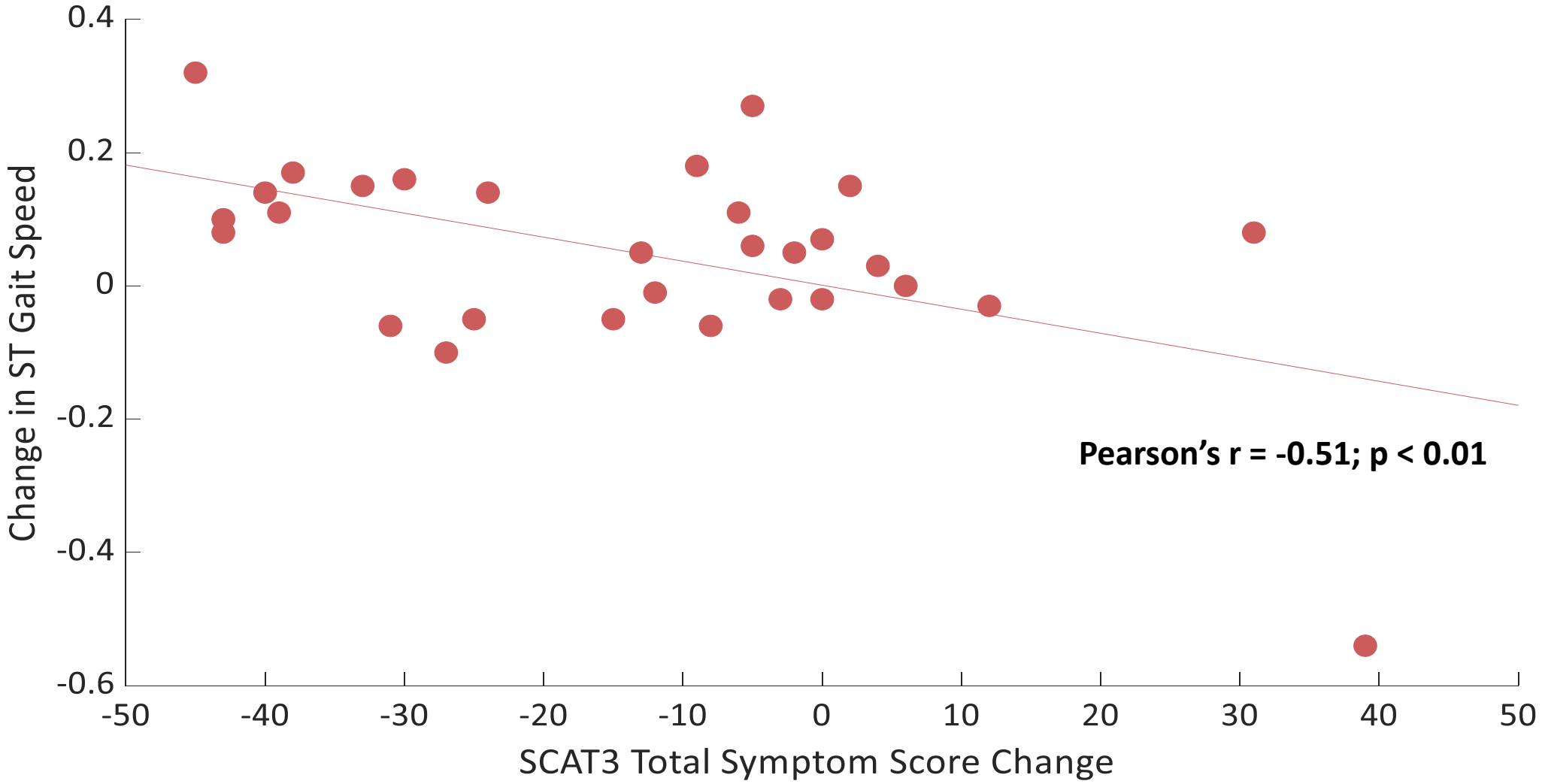


Turn Velocity

Gray lines connect participants across time.

* Indicates $p < 0.05$

Is Change In Gait Speed Related to Change in Symptoms?



Discussion

- Persistent gait deficits exist in chronic mTBI across gait domains, especially under dual-task
- Symptoms related to every gait domain except ST Pace at baseline
- Preliminary results: observed changes in gait and symptoms are related
- A more comprehensive gait assessment may improve rehabilitation outcomes in people with chronic mTBI

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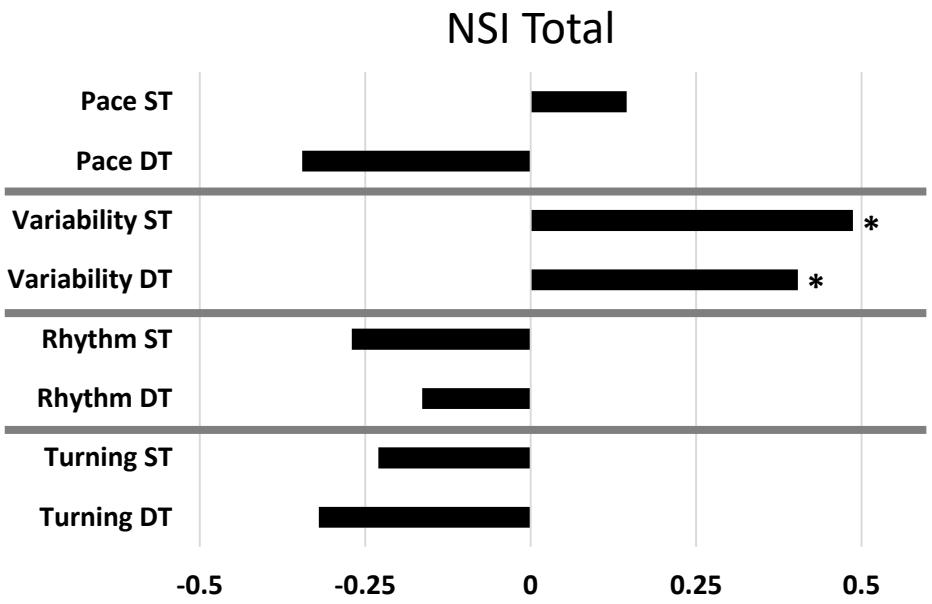

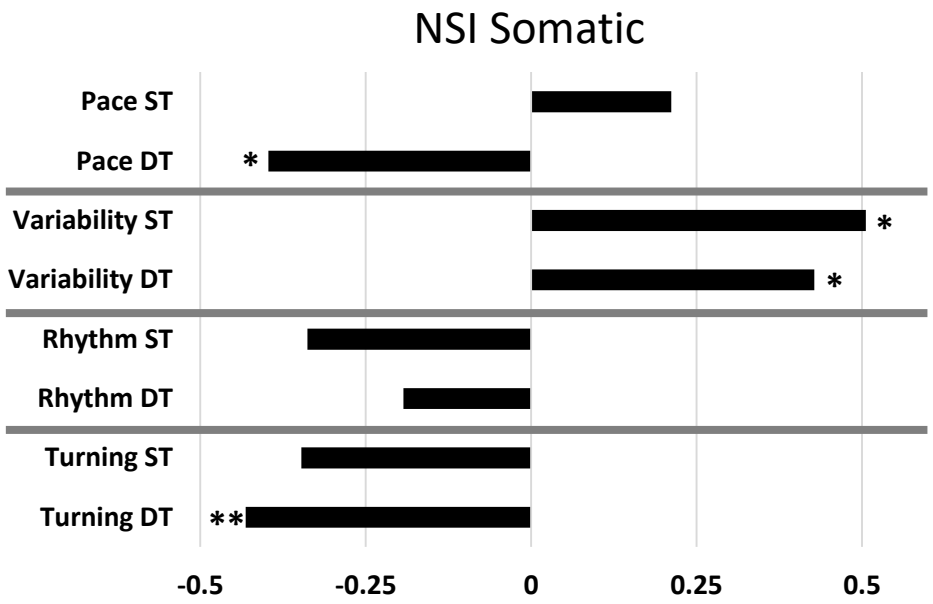

Pearson's Correlations r values for NSI Total score (Left) and NSI Somatic score (Right) with the ST and DT gait domains (within chronic mTBI group only) . * indicates $p < 0.01$; ** indicates $p < 0.003$.