



# LEARNING TO BE FORCEFUL: MOTOR ADAPTATION FOR INCREASING PARETIC PROPULSION POST-STROKE



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## Introduction

- Individuals with chronic stroke demonstrate slow gait speed<sup>1</sup>
  - Recovery of walking ability is an important rehab goal<sup>2</sup>
- Slow gait speed has been associated with reduced paretic propulsion.<sup>3</sup>
  - Propulsive force is dependent on both:
    - ankle plantar flexion moment
    - trailing limb angle (TLA).<sup>4</sup>
  - Interventions targeting an increase in the TLA or plantar flexion moment may increase propulsive force.<sup>4</sup>
- Individuals with chronic stroke may have the ability to increase their paretic propulsive limb force and increase their gait speed<sup>5,6,7</sup>
- Individuals with chronic stroke are able to adapt and learn new gait patterns<sup>8,9</sup>
  - If additional force generating capacity is available, we may be able to use motor adaptation to coax additional force from the limb during gait.

## Purpose

To determine if individuals with chronic hemiparesis following a stroke have the capacity to learn to increase paretic limb propulsion during a single-session of treadmill walking.

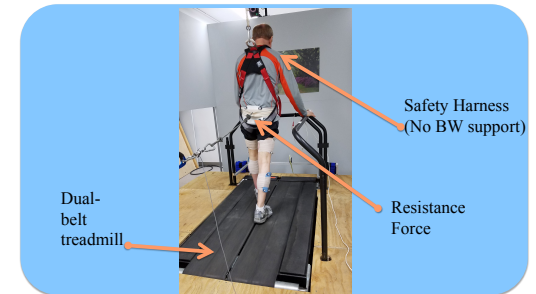
## Methods

Subject Demographics		
	Stroke Group N=6	Control Group N=9
Gender	4 male, 2 female	5 male, 4 female
Age (years)	56 ± 15	29 ± 6.3
Comfortable gait speed (m/s)	0.70 ± 0.20	1.2 ± 0.1
Impaired/tested side	4 R, 2 L	9 R
Time post-stroke (months)	26.4 ± 17.1	-
Fugl-Meyer (lower extremity)	27.5 ± 2.4	-

**Protocol:**

- Instrumentation and Dependent Variables:**
  - Overground comfortable gait speed (Zeno Walkway; ProtoKinetics, Havertown, PA)
  - Lower extremity and pelvic movement data: 8-camera motion capture system (Vicon, Denver, CO)
  - Ground Reaction Force (GRF) measured from dual-belt treadmill (Bertec, Worthington, OH)
  - Posterior resistance force measured from a tension load cell (Transducer Techniques, Temecula, CA)

- Statistical Analysis**
  - Repeated Measures ANCOVA (repeated for time, controlled for gait speed)
  - Bonferroni corrected t-tests



## Discussion

- Individuals post-stroke have the capacity to increase their paretic propulsive limb forces
  - For some, propulsive force appeared to be increased through greater plantarflexion moment (N=2); others used different strategy
  - Reduced paretic propulsive force and plantarflexion moment following stroke, independent of gait speed
  - No signs of aftereffect, suggesting lack of feed-forward mechanism
  - Single subject analysis suggests a differential response: some individuals showed greater response than others

## References

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## Results

