

# The Effect of Cognitive Dual-Task Interference on Metabolic Cost of Walking During a Treadmill Walking Intervention in Individuals with Chronic Stroke

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## Introduction

- Recovery of walking ability for individuals with chronic stroke remains an important and common rehab goal.<sup>1</sup>
- Many individuals experience a persistently slow, asymmetric, and energetically inefficient gait that limits the distance they can walk.<sup>2,3</sup>
- Propulsion assistance may:
  - Help the impaired limb accelerate the body's center of mass (COM) forward.
  - Improve energy efficiency, which can become impaired when the legs do not provide symmetric push off.<sup>4</sup>
- Walking interventions may not be as effective if individuals cannot attend to the desired motor task.
  - Walking capability may further be limited by competition between increased attentional and motor demands as a result of the stroke.<sup>5</sup>

## Purpose

To determine the effect on energy cost of adding a cognitive task to a novel gait training intervention that assists with propulsive forces.

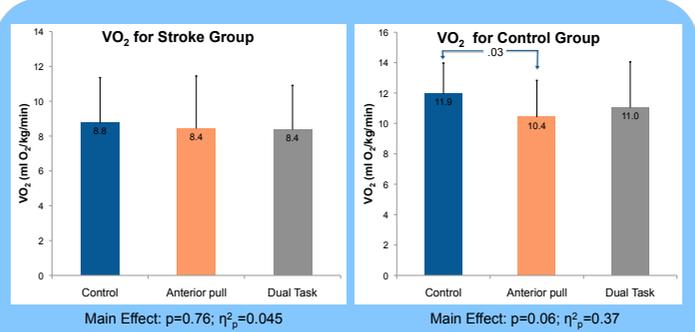
## Methods

Subject Demographics		
	Chronic Stroke (>6 mo) Group n=7	Control Group n=7
Gender	2 male, 5 female	3 male, 4 female
Age (years)	52 ± 13	26 ± 3
Comfortable gait speed (m/s)	0.68 ± 0.26	1.37 ± 0.16
Impaired/tested side	3 R, 4 L	5 R, 2 L
Time post-stroke (months)	115 ± 148	-
Fugl-Meyer (lower extremity)	26.7 ± 3.1	-
MoCA	22.7 ± 7.3	-

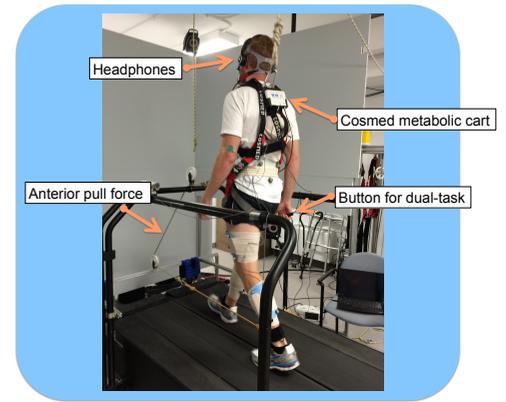
- Protocol:**
- All subjects completed single session of 3 randomly-ordered walking conditions on a dual-belt, instrumented treadmill (Bertec Corp) for up to 5 minutes with at least 5 minutes of rest between conditions:
    - Propulsion assistance
    - Propulsion assistance with concurrent cognitive task (dual-task)
    - Control walking
  - Propulsion assistance was provided by an elastic element which was attached to the subject's waist (COM), looped over the front of the treadmill, and attached at the impaired (or tested) ankle.
    - Target peak pulling force set at 10% body weight.<sup>6</sup>
    - Assisted with forward progression of COM during unilateral propulsion phase of gait for impaired (or tested) limb.
  - Subjects listened to and completed a two-back task (identifying a letter repeated two letters previously) as an initial practice trial and during the dual-task condition, with a button push for input.
  - Subjects wore a non-restricting safety harness that attached overhead. No BWS was provided.

- Data Collection:**
  - Overground CGS (Zeno Walkway; ProtoKinetics, Havertown, PA)
  - Lower extremity and pelvic movement data: 8-camera motion capture system (Vicon, Denver, CO)
  - Gas exchange data recorded on a breath-by-breath basis using portable K4b2 metabolic cart (Cosmed)
  - Average reaction times and accuracy of the two-back task measured using DirectRT software (Empirisoft, New York, NY)
- Statistical Analysis:**
  - Repeated-measures ANOVA: average VO<sub>2</sub> over the final minute for each condition was compared separately for each group between conditions
  - Post-hoc tests: paired t-tests
  - Significance set at  $\alpha = 0.05$

## Results



Accuracy of Two-Back Task			
	Single-task (practice)	Dual-task	P-value
Stroke Group	0.88 ± 0.11	0.85 ± 0.10	0.17
Control Group	0.96 ± 0.03	0.96 ± 0.03	0.80



## Discussion

- In unimpaired controls, propulsion assistance reached near-significance in reducing metabolic cost compared to control walking
- The addition of a cognitive task to a treadmill intervention did not have profound increases in energy expenditure in both groups
  - The effect of the propulsion assistance on metabolic cost was not as strong with a concurrent cognitive task
- Subjects did not sacrifice task accuracy
- This may suggest that distractions may prevent patients from learning the proper movements during the early phases of relearning

## References

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