ASSESSING LIMB PROPULSION AND GAIT KINETICS USING RESISTANCE IN EARLY- STAGE PARKINSONS DISEASE

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Introduction

- Individuals with Parkinson disease (PD) often experience gait deviations including freezing of gait, decreased step lengths, and a shuffling step pattern that may lead to falls[1]
- Despite known deficits in spatiotemporal aspects of gait, relatively little is known about the underlying limb and joint kinetics in people with PD

Objectives

- To determine limb and joint kinetics during gait in people with PD
- To examine how deficits (and a potential reserve) in push-off or leg swing might contribute to shortened step lengths for people with PD.
- **Hypothesis**: People with PD will have reduced hip flexor torque (during swing) and reduced ankle plantar flexor torque during push-off compared to unimpaired individuals yet be able to increase step lengths with increased hip flexor and ankle plantar flexor torque.[2]

Discussion

- In early-stage PD, gait kinetics are not as disrupted as originally thought, but reduced hip extension torque might be an early indicator of gait degeneration
  - Contrary to our hypothesis, hip flexion and ankle plantarflexion impulse were not different between groups, nor did those muscle groups increase torque in response to biomechanical challenges
- Participants with PD increased HE torque in response to needed demands
  - Given the baseline deficits in HE torque, this augmentation may provide a possible target for interventions
  - Decreased hip flexion impulse at greater pelvic resistances (>7.5% BW)
    - possibly due to trade-off in torque requirements[3,4]
- Leg swing resistance easily overcome → inadequate resistance force?
  - PD participants: increased leg swing against resistance, suggesting a reserve in leg swing mechanics.[5]

References

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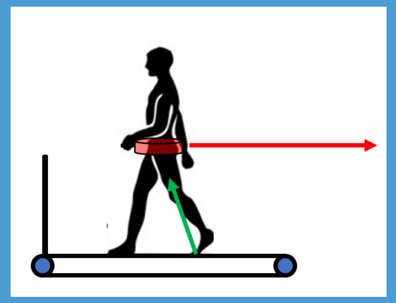
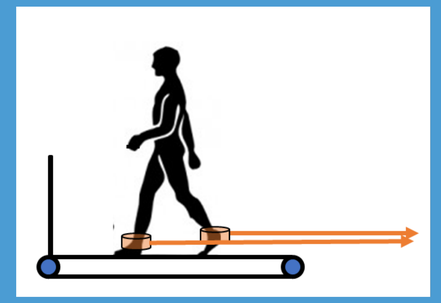
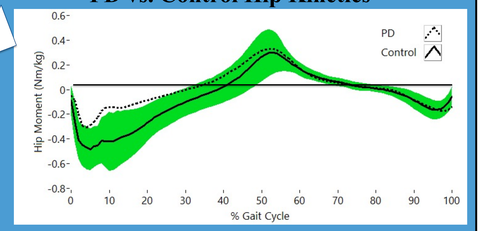
Methods/Results

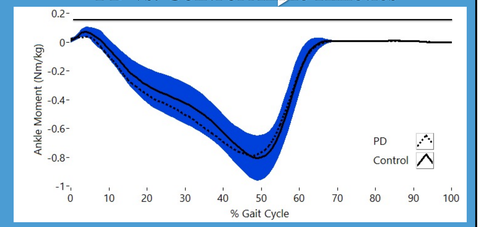
PD and Control Demographic and Baseline Gait Data		
	PD Group N=9	Control Group N=11
Gender	5 male, 4 female	2 male, 9 female
Age (years)	62 ± 15	63 ± 11
Hoehn & Yahr	Stage 1 (n=4), 2 (n=2) and 3 (n=3)	-
Disease Duration (years)	5 ± 3.5	–
Mini BESTest	26 ± 1	–
Comfortable Gait Speed	1.14 ± 0.19	1.20 ± 0.18
Propulsive Impulse	0.028 ± 0.005	0.030 ± 0.005
Step Length (m)	0.55 ± 0.10	0.58 ± 0.07
HE Impulse	-0.05 ± 0.03*	-0.11 ± 0.05*
HF Impulse	0.07 ± 0.04	0.06 ± 0.03
PF Impulse	-0.28 ± 0.05	-0.25 ± 0.07

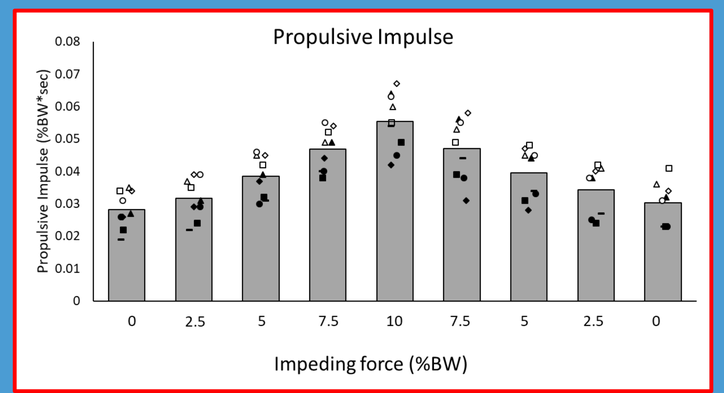
- All participants walked on an instrumented treadmill for 1 min at comfortable speed
- PD Group additionally walked with:
  - Posterior resistance applied to **pelvis** which was increased from 0 to 10% BW in 2.5% increments to challenge propulsion/push-off
  - Posterior resistance applied to both **ankles** at 2.5% BW resistance to challenge swing leg advancement

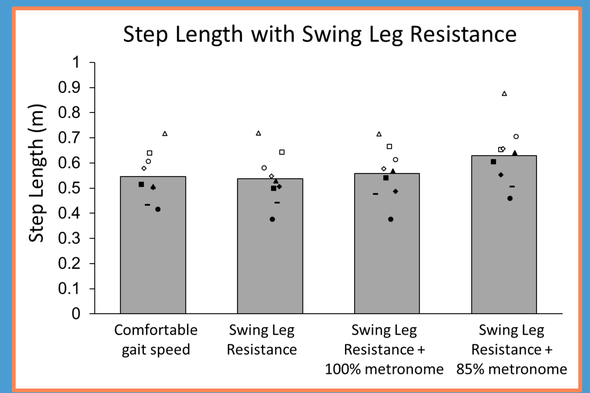












Limb Propulsion Challenge via Pelvic Resistance					
	0% BW	2.5% BW	5% BW	7.5% BW	10% BW
HE Impulse	-0.044±0.027	-0.052±0.028*†	-0.063±0.036*	-0.075±0.035*†	-0.091±0.039*†
HF Impulse	0.080±0.037	0.077±0.037	0.076±0.038	0.070±0.035*†	0.065±0.033*
PF Impulse	-0.272±0.048	-0.269±0.049	-0.275±0.050	-0.281±0.050	-0.294±0.047*

Leg Swing Challenge via Ankle Resistance				
	Baseline	Ankle (no metronome)	Ankle + 100% metronome	Ankle + 85% metronome
Propulsive Impulse	0.028±0.005	0.030±0.005*	0.034±0.005*	0.043±0.009*
HF Impulse	0.075±0.042	0.066±0.031	0.063±0.034	0.060±0.026
PF Impulse	-0.282±0.051	-0.280±0.049	-0.293±0.039	-0.341±0.063*
HE Impulse	-0.045±0.028	-0.067±0.033*	-0.079±0.043*	-0.093±0.044*

*= p>0.05; † = statistically different compared to the preceding condition