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Bradykinesia and Timed Up and Go Are Improved after Dynamic Cycling in Parkinson's disease

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Background

- Parkinson's disease (PD) affects about 1.5 million Americans
- Motor and non-motor symptoms
- Progressive nature of PD
- PD presents differently in each person
- There is no specific
  - Dosage
  - Intensity
  - Intervention type

Previous Research

- Resistance Exercise combined with balance training improves functional measures
- Variable Speed Treadmill training improves gait and balance but has safety concerns
- Active-Assisted cycling improves bradykinesia and tremors after a 40 minute protocol

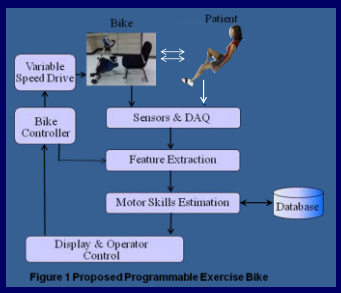
Purpose

- To collect data from the instrumented bicycle and develop a “brain” for a future bike controller.
- Examine the importance of motor speed variability during accelerated cadence.

The SmartBike

- Responds to the individual
- Collects performance data from individuals with PD during two different modes of cycling
- This data will be used to develop a control paradigm for the SmartBike

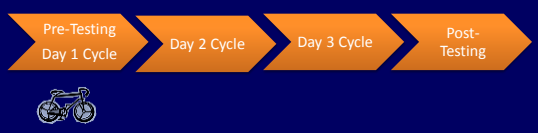
Model



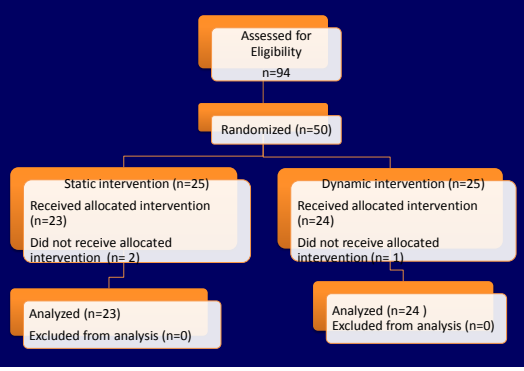
Protocol

Participants were randomized :

1) Dynamic cycling
2) Static inertial load cycling



Recruitment



Demographic Data

Group Statistics			
	Static (n=23)	Dynamic (n=24)	p-value
Ages (years)	67.26± 0.97	67.17 ± 1.66	0.962
Male/Females	16/7	13/11	0.179
HY	1.83 ± 0.14	2.13 ± 0.16	0.151
Height (cm)	67.71 ± 0.74	68.15 ± 0.76	0.681
Weight (lbs)	165.17 ± 6.00	175.08 ± 8.14	0.336
BMI	25.08 ± 0.71	26.64 ± 0.91	0.186
PD duration (months)	77.74 ± 9.73	83.46 ± 11.17	0.702
Levodopa Equivalent Dose	153.32 ± 23.95	178.80 ± 29.43	0.507

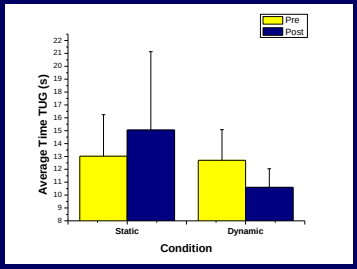
Measures

- Timed Up and Go Test (TUG)
  - Three Trial Average
  - Objective, valid, and reliable in population with Parkinson's disease
  - Improvements in functions (Thompson, 1998)

Measures

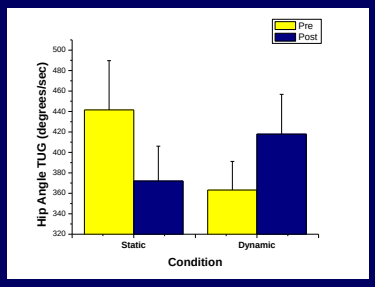
- Functional Analysis of Biomechanics (FAB™)
  - Radio Signal
  - Sensors on torso, thigh, and tibia

Average TUG Times



Average TUG times were compared for the static and dynamic groups at baseline and after three days of cycling. Data shows a 15.6% worsening in the static group and a 16.5% improvement in the dynamic group. (p=0.246)

TUG Hip Angle Velocity



TUG test hip angle velocity was compared for the static and dynamic groups at baseline and after three days of cycling. Data shows a 15.8% worsening in the static group and a 15.0% improvement in the dynamic group. (p= 0.036)

Conclusions

- Dynamic cycling improves speed of movement
- Hip angle velocity, an indirect measure of bradykinesia, improves in individuals who perform dynamic cycling
- High-cadence cycling has shown and continues to show promising results in symptom management

Conclusions

- Large variability in an individual's symptoms and severity of their symptoms suggests that exercise programs should be individualized.
- Greater improvements are observed after dynamic cycling in six minute walk time, an indirect measure of movement speed.

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Questions