Exercise: How it May Help Mobility Problems in Parkinson's Disease

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Constraints Limiting Mobility in PD

- ***Rigidity:*** stiffness, flexed posture
- ***Bradykinesia:*** slow, small movements
- ***Freezing:*** small weight shifts
- ***Poor Sequential Coordination:*** difficulty turning, rolling, quick switching
- ***Sensory Integration:*** sense of body position and movement
- Executive function: cognitve processes such as working memory, planning and execution, task flexibility

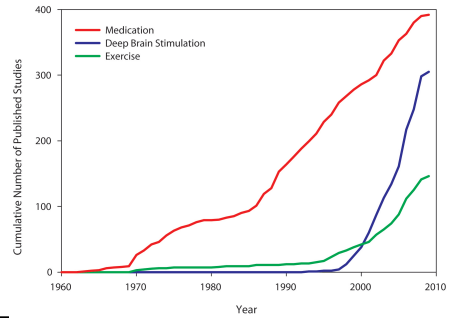
Why is it especially important for people with PD to exercise?

- Avoid falls and fractures (5X age-matched!)
  - -Recent meta-analysis: 46% fell during 3 month period and 21% of non-fallers fell. (Pickering et al., Mov Disord 2007)
  - Women with PD have 7.3 % lower bone mineral density and 2.6 X higher incidence for hip fracture. (Schneider JL et al Osteop Int 2008)
  - Deep Brain Stimulation and DOPA do not improve balance! (St. George, et al J Neurosurgery 2012)

Othe reason t Exercise

- Effects of Immobility
  - Cardiovascular
  - Depression
  - Back pain
- Medications don't help balance and mobility
- Prevent secondary problems
- May slow disease progression?

Studies of effects of exercise in PD on mobility lag behind other interventions



How does exercise help Parkinson's Disease?

PREVENTION

COMPENSATION

NEUROPROTECTION

Prevention of secondary impairments

- Falls
- Cardiovascular events
- Back pain, orthopedic
- Fatigue, inactivity
- Apathy, depression

Cardiovascular Events
2nd -leading Cause of Death

Immobility:

- impairs heart
- impairs strength
- social relation,
- independence

Exercise:

- CV System & Endurance
- Strength & Balance
- Flexibility
- Social Ties
- Attitude

Can we prevent or delay the predictable constraints that occurs with PD?

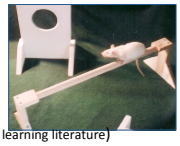
Compensation

- Sensory cues improve motor function (gait (review Rubenstein et al., 2002 Mov Disord)
- Find useful tricks (Meg Morris)
  - external cues vs internal
  - break down task into parts vs automatic whole movement
- Use alternative parts of the brain
  Dorsolateral Prefrontal Cortex instead of Supplementary Motor Cortex (Hanakawa, 1999, Ann Neurol)

Externa cues

Neuroprotection

- Animal models suggest exercise may be neuroprotective (Zigmond, exp neurol 200 (review); Fisher et al, 2004)
  - Neurotrophic factors
  - Cerebral oxygenation
  - DA synthesis



- Neuroplasticity (Greenough papers, motor learning literature)
- Intensive task-oriented activity maximizes synaptic plasticity
- Complex environment and goal-directed activities promote greate structural adaptation
- Early exercise (use it or lose it)

Revie o enhancin neuroplasticity in PD: Petzinger G e al., 201 Mov Disord

Neuroprotection

- Increase brain neurotrophic factors
- Reduce cell death
- Improve cell function
- Increase brain plasticity

- Need to start exercise early to PROTECT neurons and function

Most effective type of exercise for PD is unknown






Different focus of exercise as PD progresses

Early: sports--agility, aerobic, strength, mental

Later: walking--transitions, tricks, fall prevention

All stages: flexibility, postural alignment, large movements, deep breathing, kinesthesia

Stick Fighting
10-28-08

Agility Boot Camp (ABC)

King and Horak
Physical Therapy 2011; 2013

Delaying Mobility Disability in People With Parkinson Disease Using a Sensorimotor Agility Exercise Program

ABC Exercise Station	Posture Constraints						Progressions				Goals of Station
	APA	APR	Sensory	Gait	FoG	Arm Swg	Speed	Strength	Sensory	Cognitive	
Tai Chi	X	X	X	X	X	X		X	X	X	Balance and weight shifting
Kyaking	X	X	X	X	X	X	X	X	X	X	Flexibility of trunk and shoulders
Agility	X	X	X	X	X	X	X	X	X	X	Fast, BIG mvts and coordination
Boxing	X	X	X	X	X	X	X	X	X	X	Quick arms/steps, APAs, strength
Lunges	X	X	X	X	X	X	X	X	X	X	Big balance steps, long strides
Pilates	X		X			X		X			Postural transitions, flexibility

King and Horak
Physical Therapy 2011; 2013

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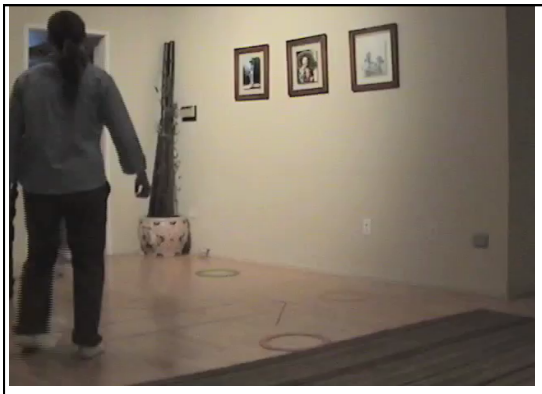
Kayaking progression

Tai Chi to increase limits of stability

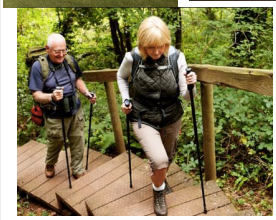
Gatts SK and Woollacott, 2006 and 2007

Before and after 4 weeks Agility Boot Camp



After 6 weeks of Agility Rehab

Examples of Agility Exercises

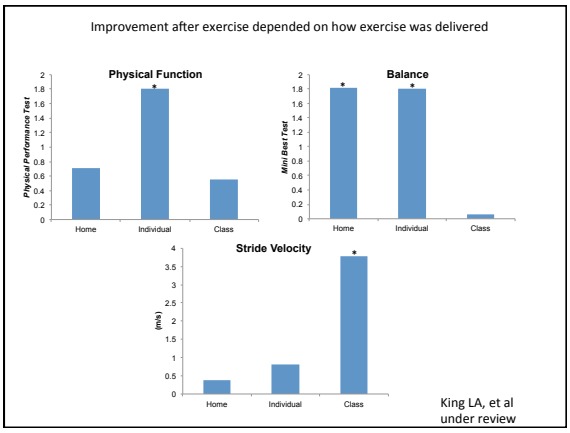


Purpose: To investigate the most beneficial mode of exercise intervention for patients with chronic neurologic disease.

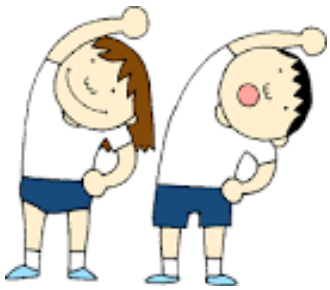
Home Exercise Program

Individual PT

Group Exercise



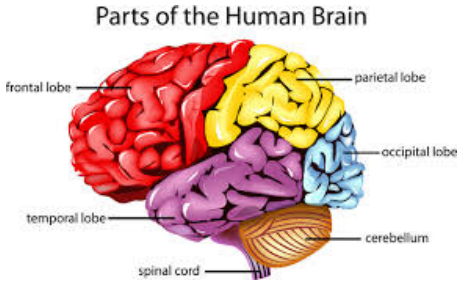
Stretch break



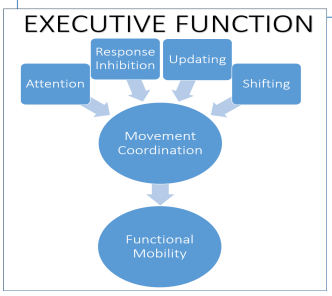
Cognition and Balance

- Cognitively impaired older people fall twice more than cognitively intact
- PD patients with worse cognitive deficits have more falls
  (Segev-Jacubovski et al. 2011)
- Gait and balance are not automatic processes in older people, esp with PD
  (Stuss et al. 2000)

Same parts of brain for thinking and balance



Cognitive problems related to mobility in Parkinson's disease



Dual Tasking

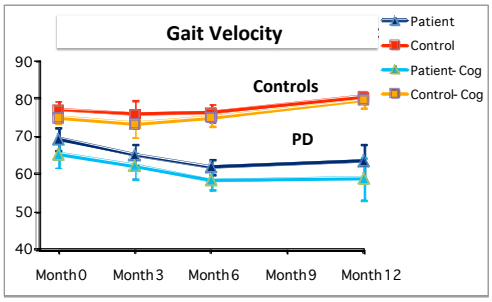
"Dual-Task Interference"
Walking slows when talk
Thinking slows when walk

More difficult with Parkinson's Disease:

- Need more attention to walk and balance
- Reduced working memory
- Difficult to switch between tasks
- Make not prioritize balance

Owen et al., 1997; Lewis et al 2005

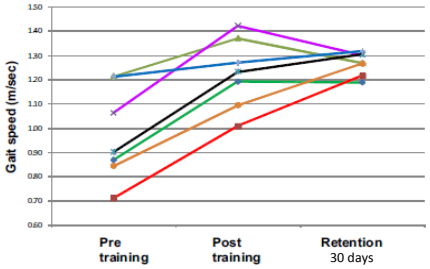
Balance and walking require more Attention in PD



No Cognitive Task

With Cognitive Task

Dual Tasking can improve with training!



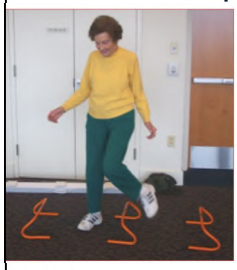
Gait speed during serial subtraction of 3's improved with practice in people with PD.
Pichierri et al 2011; Yogev et al. 2012

Stroop Test- conflict resolution

Look at the chart below and say the COLORS, not the words. Try to say them fast!

YELLOW BLUE ORANGE
BLACK RED GREEN
PURPLE YELLOW RED
ORANGE BLACK GREEN
BLUE RED PURPLE
GREEN ORANGE BLUE

Does intense cognitive-agility exercise for PD improve

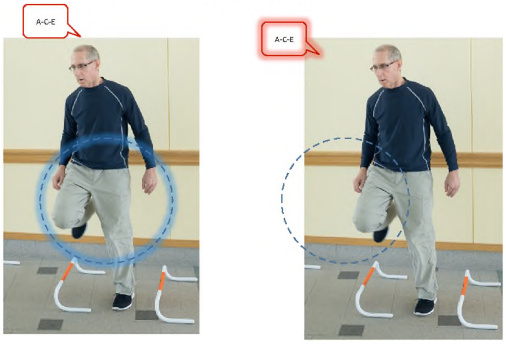


- Balance/Gait
- Executive Function
- Brain Functional Connectivity

Hypothesis:
Make balance and gait more automatic,
(ie; less cortical control of locomotion circuit)
so more attention for cognitive function.

Next step...Agility Boot Camp with cognitive focus

Practice shifting attention

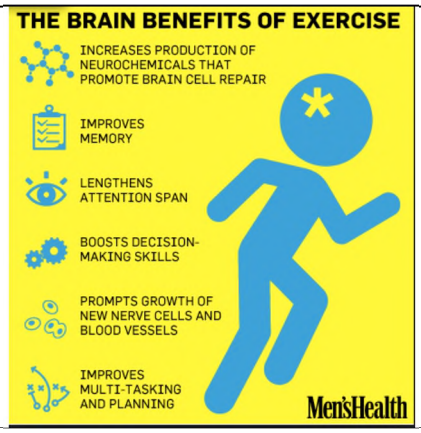


Boxing with Stroop

How to exercise safely

- **Fall risks:**
- **Light headedness:** quick postural changes
- **Musculoskeletal injuries:** rigidity, immobility

- Doctors clearance
- See a PT
- Find a trainer with experience in PD



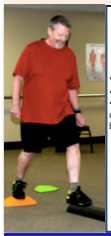
BE SMART - EXERCISE!

EE for PD

Exercise and Education for Parkinson's Disease

IRB # 8979

A research study on the effects of exercise and education for people with Parkinson's Disease



What is EE for PD?

12 weeks of exercise & education classes specific to PD

- Safe for all types of Parkinsonism
- Provided at no cost
- Evaluated through testing of cognition, balance, gait and MRI brain imaging
- Led by trained professionals
- Appropriate for first time to advanced exercisers
- *This is a research study and not a treatment program*

Friendly and Fun!

As reimbursement for your time, you will receive $25 for each test session and $5 for each exercise/education session that you attend (maximum reimbursement of $270).

WHAT TYPE OF **EXERCISE**?
- Agility training, quick thinking, balance exercises and walking in small groups.
- 90 minutes, 3 days a week for 6 weeks

WHAT TYPE OF **EDUCATION**?
- Self-management program to teach skills to help you take charge of your PD.
- 90 minutes, 1 day a week for 6 weeks

Who can join?

People with Parkinson's disease and freezing of gait.

If you do not have freezing of gait, can't commit to the 12-week program or are a healthy control subject, you can still participate!

TO LEARN MORE CONTACT:

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Michael Fleming 503-346-0842

Approved: December 5, 2014
Study ID: 8979

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