

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

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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:** cognitive processes such as working memory, planning and execution, task flexibility

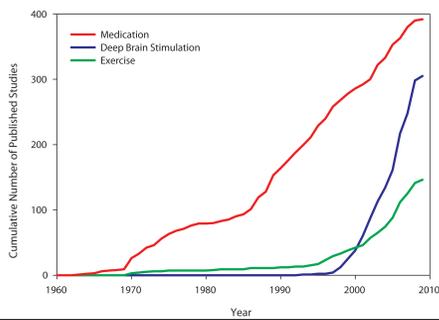
Why is it especially important for people with PD to exercise?

- **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)

Other reasons to 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



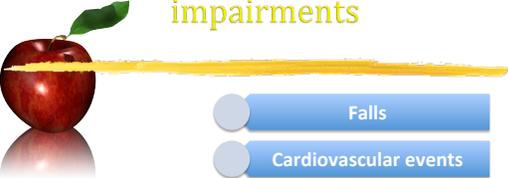
How does exercise help Parkinson's Disease?

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 relations,
- 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)



External cues

Neuroprotection

- Animal models suggest exercise may be neuroprotective (Zigmond, exp neurol 2003 (review); Fisher B 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 greater structural adaptation
- Early exercise (use it or lose it)

Review on enhancing neuroplasticity in PD: Petzinger GM et al., 2010 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	EcG	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 <i>mvts</i> , 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



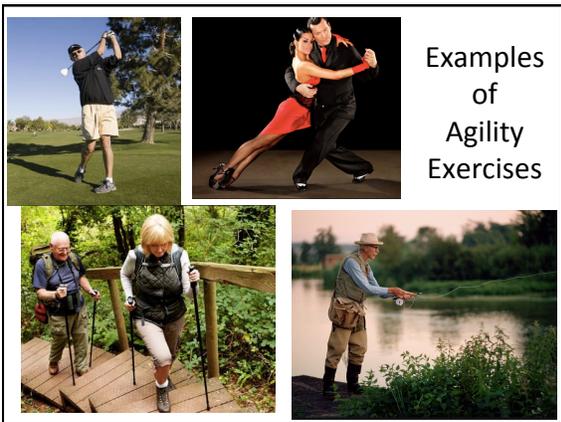
Gatts SK and Woollacott, 2006 and 2007

Before and after 4 weeks Agility Boot Camp



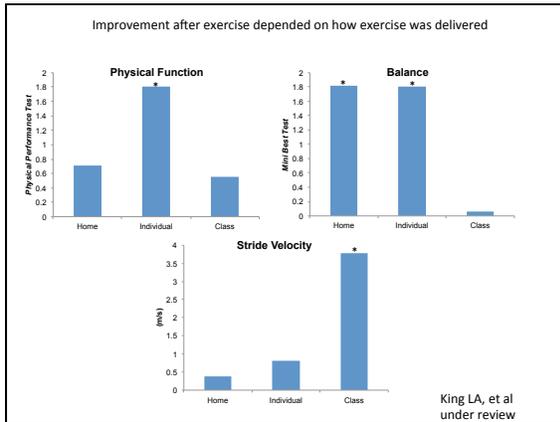


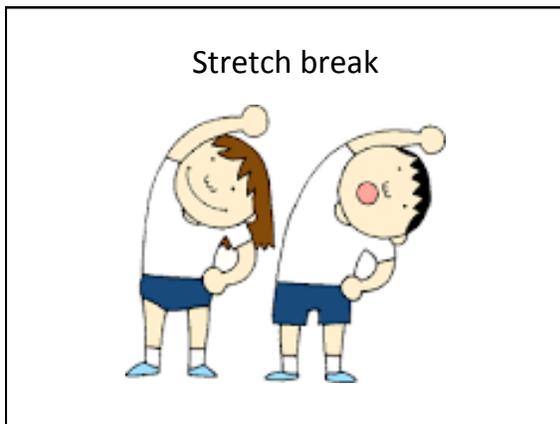




Purpose: To investigate the most beneficial mode of exercise intervention for patients with chronic neurologic disease.

-  Home Exercise Program
-  Individual PT
-  Group Exercise

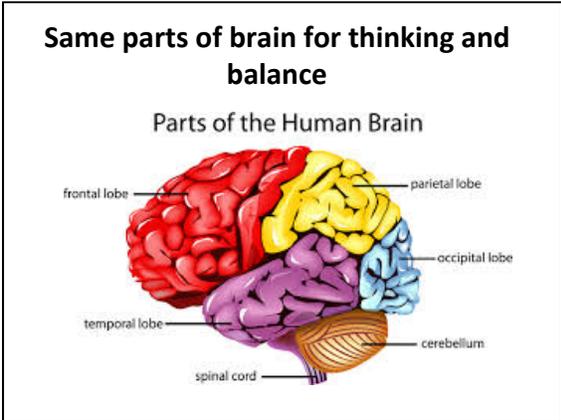


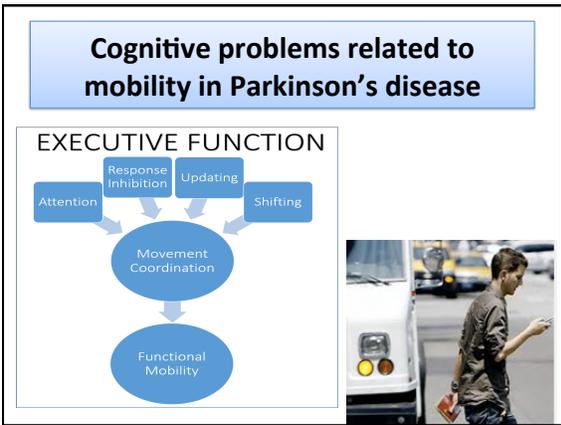




Cognition and Balance

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





Dual Tasking

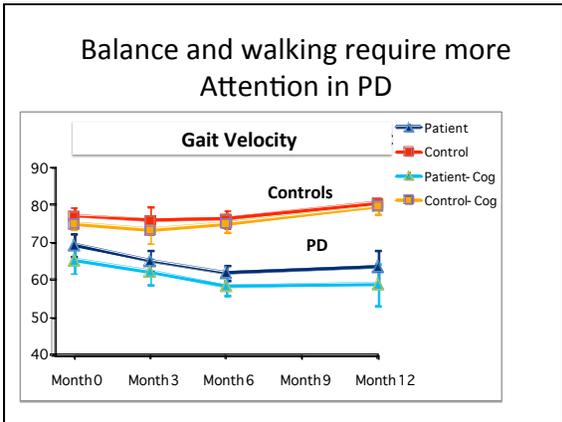
"Dual-Task Interference"
Walking slows when talk
Thinking slows when walk

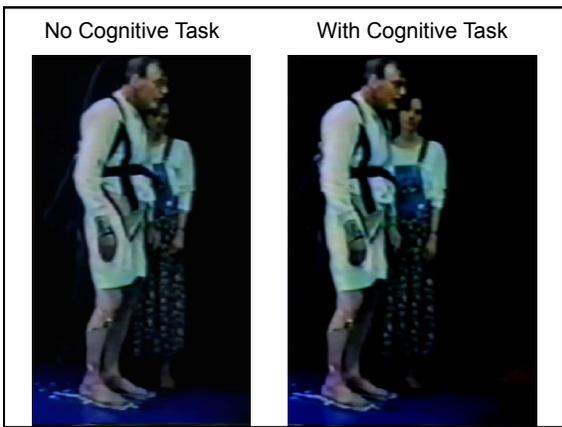
More difficult with Parkinson's Disease:

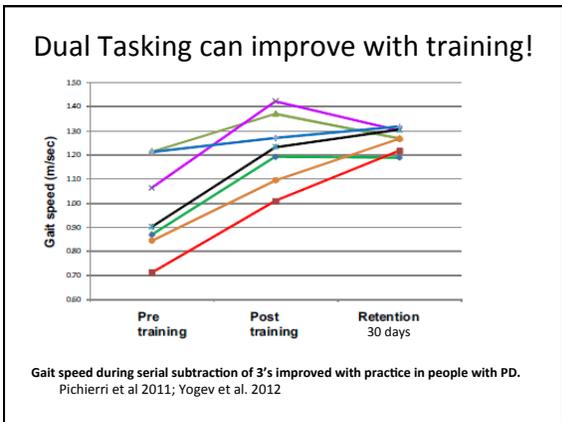
- Need more attention to walk and balance
- Reduced working memory
- Difficult to switch between tasks
- Make not prioritize balance

Owen et al., 1997; Lewis et al 2005

A photograph of a person riding a bicycle on a city street, illustrating the concept of dual tasking.







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

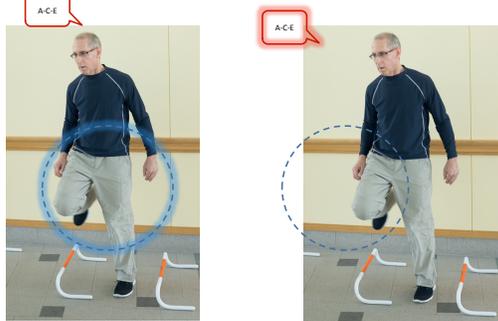


- Balance/Gait
- Executive Function
- Brain Functional Connectivity

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

THE BRAIN BENEFITS OF EXERCISE

INCREASES PRODUCTION OF NEUROCHEMICALS THAT PROMOTE BRAIN CELL REPAIR

IMPROVES MEMORY

LENGTHENS ATTENTION SPAN

BOOSTS DECISION-MAKING SKILLS

PROMPTS GROWTH OF NEW NERVE CELLS AND BLOOD VESSELS

IMPROVES MULTI-TASKING AND PLANNING

Men's Health



EE for PD

Exercise and Education for Parkinson's Disease IRB # 8879

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

	<p>What is EE for PD?</p> <p>12 weeks of exercise & education classes specific to PD</p> <ul style="list-style-type: none"> -Safe for all types of Parkinsonism -Led by trained professionals -Provided at no cost -Appropriate for first time to advanced exercisers -Evaluated through testing of cognition, balance, gait and MRI brain imaging -This is a research study and not a treatment program 	<p>WHAT TYPE OF EXERCISE?</p> <ul style="list-style-type: none"> •Agility training, quick thinking, balance exercises and walking in small groups. •90 minutes, 3 days a week for 6 weeks 	<p>WHAT TYPE OF EDUCATION?</p> <ul style="list-style-type: none"> •Self-management program to teach skills to help you take charge of your PD. •90 minutes, 1 day a week for 6 weeks
<p>Friendly and Fun!</p> <p style="font-size: x-small;">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).</p>			
<p>Who can join?</p> <p style="font-size: x-small;">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!</p>			

TO LEARN MORE CONTACT:
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Approved December 5, 2014 Study ID: 8879 PI: Fay Horak PhD, PT | 3710 SW US Veterans Hospital Rd. Portland, OR 97239
