Exercise and Physical Therapy for Parkinson’s disease

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• How many of you have seen a Physical Therapist (PT) for your Parkinson’s?
• How many of you are currently exercising?
• What are you doing?
  • Stretching?
  • Strengthening?
  • Walking/cardio?
  • Balance program?
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 address balance deficits?**

**Known losses associated with PD**
- Range of motion (neck and torso)
- Strength
- Cardiovascular condition

- **People with PD fall more often than controls (5X age-matched!)**
  - Recent meta-analysis: 46% fell during 3 month period and 21% of non-fallers fell.
  - Women with PD have 7.3% lower bone mineral density and 2.6X higher incidence for hip fracture.

- **MEDICATIONS (AND DBS) DON’T ALWAYS IMPROVE BALANCE!**

- Rehabilitation has been shown to improve balance/decrease falls

Studies of effects of exercise are on the rise

One theory: neuroprotection of nigro-striatal Dopamine system

- Long presymptomatic period where exercise may reduce risk, delay symptoms or slow progression (?)
How does exercise help Parkinson’s Disease?

**PREVENTION**

**COMPENSATION**

**NEUROPROTECTION**

- Avoid falls and fractures
  - Medications and DBS don’t help balance
- Avoid cardiovascular disease
  - Heart attacks and stroke
- Avoid depression
- Avoid back pain
- Avoid loneliness
COMPENSATION

Learn New Strategies/useful tricks
- External Cues
- Turning
- break down task
- Start walking

Use alternative parts of the brain

King et al., movement disorders, 2013
Compensation: Visual cues to help mobility...down the road

Strategies for movement

23 seconds to roll over in bed  9 seconds to roll over in bed
What’s the best exercise? Not all exercise is the same

- 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)-
  - walking while talking test
**Dual Tasking**

**More difficult with Parkinson’s Disease**
- Need more attention to walk and balance
- Reduced working memory
- Difficult to switch between tasks
- May not prioritize balance

Owen et al., 1997; Lewis et al 2005

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**Balance and walking require more attention in PD**

![Gait Velocity Graph]

- Controls
- PD
- Patient
- Control
- Patient-Cog
- Control-Cog

Month 0, Month 3, Month 6, Month 9, Month 12
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; Yogeve et al. 2012

Engaging Cognitive Circuits

Skilled Exercise on Complex Wheel  Aerobic Exercise on Simple Wheel
Evidence that “complex” activities improves symptoms of PD

Dance/Tai Chi for PD - improves balance

- Dance targets specific PD-related motor deficits:
  - Flexed Posture
  - Rigidity
  - Bradykinesia
  - Postural instability
  - Shuffling gait
  - Cognitive impairment
    - Inhibition
    - Attention
  - Depression

- Music and partner may serve as cues to facilitate

- Social, engaging, caregiver fun, adaptable

Gearhart, Hackney et al, 2009, 2014
Tai Chi and PD

- Tai chi more beneficial at improving postural control vs resistance training/stretching
- Helpful for non-motor symptoms
- Group may be more beneficial than Individual

Yang JH et al; Parkinsons Dis 2017
Li F et al; N Engl J Med 2012

Multidimensional Balance Training outdoors Hong Kong

Dynamic Balance while Walking
Sensory Integration
Strength
Limits of Stability
Preparatory Posture Prior to Stepping
Soft/uneven ground/obstacles


Courtesy of M. Mak
Balance Test improves in short and long term after 8 weeks balance training

Improvements with Multi-dimensional Balance training:
- Fewer injurious falls
- Use arms for balance
- Better dual-task time

Why think about Turning?

✓ How many times do we turn each day?
✓ Every task takes 2-3 turns per 10 steps (1000/day).
✓ Falls during turning causes fractures.
✓ Turning is complicated.
✓ Turning results in freezing.
Our experience: Origins of Agility Boot Camp program

- Designed around impairments
- Expert panel to design best approach to exercise for PD
- Theoretical framework rather than single exercise

Agility; what is it?

- Balance
- Coordination
- Speed
- Reflexes; balance reactions
- Cognition/dual task
- Endurance
- Strength
Examples of Agility Exercises

Our Experience: Agility Boot Camp
Agility Boot Camp with cognitive focus
Practice shifting attention

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
Obstacle Course with Dual Task

Week One (DT Not Possible)

Week Six (With Dual Task)

Before and after 4 weeks Agility Boot Camp
Many people are asking what type of exercise but we also need to know how best to administer

- **Home Exercise Program**: Standard of care
- **Individual PT**: Limited coverage
- **Group Exercise**: Not covered by insurance
Its difficult to improve alone. Individual physical therapy and/or a group class is better

- **Individual** groups improved the most on functional outcomes
  - Balance
  - ADL scores
  - Depression

- **Classes** improved the most on gait outcomes
  - Freezing of gait
  - Dual task
  - Walking metrics

Comorbidities that impacted success were mainly for the home group only:

- Depression
- Mild cognitive impairment
- Medical comorbidities
- # of meds
- Disease severity

King LA et al., JNPT 2015

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**How to exercise safely with PD**

- **Fall risks:**
  - backwards
  - trips
  - low vision
  - dual tasks

- **Light headedness:** quick postural changes

- **Musculoskeletal injuries:** rigidity, immobility

- **Medication effects**

- **Pain and strains**

- Doctors clearance
- See a PT
- Find a trainer or PT with experience in PD
Physical therapy for all stages of PD

• “I’m having problems getting...”
  • Out of my car
  • Out of bed
  • Off a low chair or a soft, squishy couch
  • Off the floor
• Not doing same level of activity as before, fear of falling
• Provides a formal assessment:
  • Balance
  • Walking
  • Strength
  • Functional mobility
• Check in over time: reassessments 1-2 times/year for problem solving

PT and PD: What can I expect?

• Discussion:
  • What are your problems?
  • What are YOUR goals?
  • Care partners are encouraged to attend
• Assessment:
  • Balance
  • Walking
  • Strength
  • Functional mobility
• Plan
• Check in over time
Different focus of exercise as PD progresses

<table>
<thead>
<tr>
<th>Early</th>
<th>Later</th>
<th>All stages</th>
</tr>
</thead>
</table>
| •Sports/Agility  
•Aerobic  
•Strength  
•Mental/dual task | •Walking/Transitions  
•Tricks  
•Fall prevention | •Flexibility  
•Postural alignment  
•Large movements  
•Deep breathing kinesthesia |

Seeing specialized PTs improve outcomes

<table>
<thead>
<tr>
<th></th>
<th>Specialized PT (n=2129)</th>
<th>Usual PT (n=2252)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parkinson’s related complications (hospital admissions for fractures, orthopedic injuries, pneumonia)</td>
<td>368 (17%)</td>
<td>480 (21%)</td>
</tr>
<tr>
<td>Patients receiving care by the same PT during the entire study period</td>
<td>1204 (57%)</td>
<td>736 (33%)</td>
</tr>
<tr>
<td>Patients with Parkinson’s disease per therapist</td>
<td>3.89 (3.91)</td>
<td>1.48 (1.24)</td>
</tr>
<tr>
<td>PT sessions per patient per year</td>
<td>33.72 (26.70)</td>
<td>47.97 (32.11)</td>
</tr>
<tr>
<td>Medical expenses (PT and hospital costs, in €)</td>
<td>2056 (3272)</td>
<td>2586 (3756)</td>
</tr>
<tr>
<td>Mortality</td>
<td>134 (6%)</td>
<td>205 (9%)</td>
</tr>
</tbody>
</table>

Ypinga JH et al; Lancet Neurology 2018
### Vital categories to include:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardio:</strong></td>
<td>• 30-60 min</td>
<td>• 5 times/week</td>
</tr>
<tr>
<td></td>
<td>• Moderate intensity exercise</td>
<td></td>
</tr>
<tr>
<td><strong>Strength:</strong></td>
<td>• 2-3 times/week</td>
<td>• 10-15 reps per set</td>
</tr>
<tr>
<td></td>
<td>• 2-3 sets</td>
<td></td>
</tr>
<tr>
<td><strong>Flexibility:</strong></td>
<td>• 10 min daily at the end of exercise</td>
<td>• 10-30 sec per stretch</td>
</tr>
<tr>
<td><strong>Balance:</strong></td>
<td>• 20-30 min</td>
<td>• 3 times/week</td>
</tr>
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</table>

### Type of exercise Description Details

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<tbody>
<tr>
<td>Walking</td>
<td>Walking can be on a treadmill or overground. Benefit has been show for use of trekking poles overground.</td>
<td></td>
</tr>
<tr>
<td>Cycling</td>
<td>Cycling can be done on stationary or road bike. The benefits of cycling occur with a fast spin rate: &gt; 85 RPM</td>
<td></td>
</tr>
<tr>
<td>Weight lifting</td>
<td>Strengthening should be done 2-3 times/week; 10-15 reps/sec with 2-3 sets. Focus on the extensor (straightening) muscles</td>
<td></td>
</tr>
<tr>
<td>Yoga</td>
<td>Yoga can be done standing or seated. If yoga includes standing poses, it can address balance deficits or be considered strengthening.</td>
<td></td>
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<tr>
<td>Tai Chi</td>
<td>Tai Chi or Qi Gong can be beneficial and is offered in standing and seated forms</td>
<td></td>
</tr>
<tr>
<td>Dance</td>
<td>Numerous types of dance have been found beneficial including waltz and tango. Depending on the intensity of the dancing, this could also be considered cardio.</td>
<td></td>
</tr>
<tr>
<td>Boxing</td>
<td>Non-Contact boxing can be done in both sitting or standing. This can include upper body and lower body coordination and agility exercises. Depending on the intensity of boxing, this could also be considered cardio.</td>
<td></td>
</tr>
<tr>
<td>Agility</td>
<td>Agility exercises consists of a mix multi-directional movement, coordination exercises and incorporates doing 2 things at once. Examples: ladder drills, lunges, hurdles, jumping.</td>
<td></td>
</tr>
<tr>
<td>Ball Sports</td>
<td>Ball sports includes basketball, tennis, ping pong and pickleball. Depending on the intensity, this could also be considered cardio.</td>
<td></td>
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</tbody>
</table>
Exercise take home message

• Intense!
  • How hard are you working? Goal 5-6/10
  • Heart Rate: (220-age) x 65-80%
    • 70 yo: 220-70=150 Heart Rate range: 98-120
• Challenging: makes you think
• Is something that you will do?
• Mix it up!
• Goal: 5 times/week for at least 30 min
• See an experienced physical therapist for guidance along the way

The OHSU Balance Lab group- Portland Oregon

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