Optimizing Outcomes in Parkinson’s Disease

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Objectives

1. Attendees will be able to define common deficits and functional impairments resulting from Parkinson’s disease that can be addressed within physical therapy and speech therapy.

2. Attendees will learn about current evidence based interventions indicated for individuals with Parkinson’s disease.

3. Attendees will learn how to optimize clinical practice utilizing evidence based interventions for individuals with Parkinson’s disease.
What is Parkinson’s Disease (PD)?

- Progressive disease of the nervous system that affects movement
- Associated with lesions in the **basal ganglia**, predominantly in the **substantia nigra**, and a deficiency of the neurotransmitter **dopamine**
Prevalence Of PD

- Parkinson’s Foundation
  - More than 10 million people worldwide are living with PD
  - Approx. 60,000 Americans are diagnosed with PD each year
  - PD prevalence increases with age
    - Affects 1% of the population above 60 years
  - Men are 1.5 times more likely to have PD than women

Tysnes, 2017
Parkinson’s Foundation Website
PD Causes

- **85-90%** of cases are classified as **sporadic**
- Only about **10-15%** of all cases are genetic forms of the disease

Most experts agree that PD is caused by a **combination** of genetic and environmental factors (chemicals from occupational exposure or rural living, head trauma, etc.)

Tysnes, 2017
Parkinson’s Foundation Website
Hoehn and Yahr Stages

Describes how motor symptoms progress in PD

Rates symptoms on a scale of 1 to 5

<table>
<thead>
<tr>
<th>Stage of Parkinson’s Disease</th>
<th>Early PD</th>
<th>Mid-stage PD</th>
<th>Advanced PD</th>
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<tbody>
<tr>
<td><strong>Severity of Symptoms</strong></td>
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<td>Mild</td>
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<td>Symptoms of PD are mild and only seen on one side of the body (bilateral involvement)</td>
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<td>Symptoms of PD on both sides of the body (bilateral involvement) or at the midline</td>
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**SYMPTOMS**

- Tremor of one hand
- Rigidity
- Clumsy Leg
- One side of the face may be affected, impacting the expression
- Loss of facial expression on both sides
- Decreased blinking
- Speech abnormalities
- Rigidity of the muscles in the trunk
- Balance is compromised
- Inability to make the rapid, automatic and involuntary adjustments
- All other symptoms of PD are present
- Patients may be able to walk and stand unassisted, but they are noticeably incapacitated
- Patient is unable to live an independent life and needs assistance
- May freeze or stumble when walking
- Hallucinations or delusions.
Unified Parkinson’s Disease Rating Scale (UPDRS)

More comprehensive tool

Progression of motor symptoms AND non-motor symptoms

Most commonly used scale within the clinical study of PD

The UPDRS sections:

- **Part I**: evaluation of mentation, behavior, & mood
- **Part II**: self-evaluation of ADLs
  - Speech, swallowing, handwriting, dressing, hygiene, falling, salivating, turning in bed, walking, & cutting food
- **Part III**: clinician-scored motor evaluation
- **Part IV**: complications of therapy
- **Part V**: Hoehn and Yahr staging
- **Part VI**: Schwab and England ADL scale
Motor Symptoms: Physical & Occupational Therapy

- Tremor
- Bradykinesia
- Rigidity
- Postural Instability
- Micrographia

- Shuffling gait
- Freezing
- Dyskinesia
- Festination
- Dystonia
- Masked face (hypomimia)
Motor Symptoms: Speech Therapy

- Hypokinetic Dysarthria (speech impairment)
  - Reduced vocal intensity
  - Breathy voice quality
  - Short rushes of speech
  - Imprecise articulation

- Drooling (Sialorrhea)
AAAHHHHHH!!!!!
Neuroplasticity

“The ability of the brain to encode and learn new behaviors and can be defined as changes in molecular and cellular processes in response to environmental experiences such as exercise.”

Petzinger, 2015.
Onset of symptoms
Diagnosis of PD (pre-disability)
Pharmacological Rx (pre-disability)

No rehabilitation intervention

Traditional Model of Rehabilitation in PD

Onset of overt disability
Acute event (hip fracture, aspiration, etc.)

Referral PT/OT/SLP
Referral PT/OT/SLP

Discrete episodes of care
No follow up

Evidenced Based Model of Rehabilitation in PD

Onset of symptoms
Referral PT/OT/SLP

Referral PT/OT/SLP

Delayed onset of disability

f/u PT/OT/SLP
f/u PT/OT/SLP
f/u PT/OT/SLP
f/u PT/OT/SLP

Center for Neurorehabilitation
Boston University
Neuroplasticity Treatment Considerations

- Specificity
- Repetition
- Age
- Use it or lose it
- Use it and improve it
- Timing
- Complexity
- Intensity
- Transference/Generalization
- Interference
- Saliency
Current Evidence-Based Interventions for Speech/ Voice

Individuals with PD often require speech/voice treatment due to hypokinetic dysarthria, dysphagia treatment due to onset of swallowing impairments, and cognitive-communication therapy due to cognitive decline often associated with PD.

Dysphagia and cognitive deficits in persons with PD are often treated using traditional methods that may not be specific to PD.

For this presentation, the focus of current evidence-based interventions utilized in ST will be on speech and voice due to the high prevalence of hypokinetic dysarthria affecting individuals with PD.
Based Interventions for Speech/ Voice

Intensive treatment programs requiring high-intensity voice and speech exercises with clinician-guided prompting and feedback have been established as effective for improving vocal function (Watts, 2016).

High intensity (large number of repetitions) + clinician-guided exercise → promotes adaptation in muscles and neurological pathways + increased muscular effort → increases motor unit recruitment + increases amplitude of motor activity. (Watts, 2016)

*Increased amplitude of motor activity = increased respiratory effort, louder voice, increased movement of articulators*
Lee Silverman Voice Treatment (LSVT LOUD®)

- Targets vocal effort scaling through increased vocal loudness via intensive, high effort vocalization and speech exercises
- Designed to improve neuromotor abilities and “recalibrate” the patient’s perception of effort during speech production.
- Consists of 4, hour-long sessions per week for 4 weeks (total of 16 sessions).
- Speech exercises follow a hierarchy (words--phrases--sentences--paragraph level and spontaneous speech)
- Home exercise program
- “No junk minutes!” = intensive treatment.
- “Be LOUD”= practice/ repetition using increased amplitude
- Research reflects lasting effects of up to 2 years on average.

(Watts, 2016)
TARGET of LSVT LOUD

Loud is more than a laryngeal event – spread of effects

SOFT

Neural coupling (McClean and Tasko)

LOUD

HEALTHY LOUDNESS

Image from LSVT Global®
Pretreatment

Problem in self-perception/awareness: do not recognize movements are soft, small, or slow

Self-cueing deficits: continue scaling reduced amplitude of speech and movement patterns

Reduced amplitude of motor output

Produce soft voice, small, slow movements
Treatment focus: mode of delivery is intensive, high effort, and salient

- Improve self-perception/awareness of amplitude required to produce normal vocal loudness and movement amplitude
- Improve self-cueing/attention to action: habitually scale increased amplitude of speech and movement patterns
- Produce louder voice, larger movements
- Increase amplitude of motor output

Fox, 2011
SPEAK OUT! ® and LOUD Crowd! ®

- Focus on vocal scaling, targets vocal effort by prompting patients to speak with “intent”
- Speaking with “intent” = purposeful cognitive focus on increasing vocal loudness and intonation variability during speech
- 12 intensive individual therapy sessions over 4 weeks (approximately 45 minute sessions)
- LOUD crowd = continuous therapy component that provides weekly opportunities for program participants to continue practicing their improved voice productions in natural conversation and social settings without a specified ending point.
- Limited outcome data for larger samples -- continued research necessary

(Watts, 2016)
(Levitt, 2014)
Phonation Resistance Training Exercise (PhoRTE)

- Therapy tasks adapted from LSVT, less intensive than LSVT
- Phonatory-Respiratory exercises
- 1x/week
- Authors reported significant improvements in participants’ perceptions of QOL and perceived effort of voice production.
- Long-term effects? Patient can utilize a home-exercise program.

(Zeigler, 2014)
Important Considerations

Prior to initiating an intensive voice therapy program (such as LSVT Loud), it is considered **best-practice** for the individual to obtain an examination (laryngoscopy) by an Ear Nose and Throat doctor (ENT) in order to rule out any structural voice disorders (such as nodules or cysts) for which intensive phonatory exercises can be contraindicated.
Other:

**SpeechVive**

- Uses the Lombard Effect to facilitate increased vocal intensity in individuals with PD.

(Stathalpolous et. al., 2014)
Speech Therapy -- Equipment
The Evidenced Based Approach: Physical Therapy

- Why perform physical activity?
  - Health benefits for individuals of all ages, in healthy & diseased states
  - Protection from a wide range of neurological disorders
    - PD, Alzheimer's disease, cognitive impairment associated with aging

(Petzinger et al. 2015)  
(Conradsson et al. 2015)
The Evidenced Based Approach: Physical Therapy

- **Exercise in Parkinson’s Disease** (Oguh, et al. 2014)
  - Regular exercise (>2.5 hours/week) associated with improved:
    - Quality of life
    - Mobility
    - Physical function
    - Cognition
    - **AND**
    - **Decreased** disease progression
The Evidenced Based Approach: Physical Therapy

Neuroprotection & Neuroplasticity

- Exercise → neuroprotective + neuroplasticity → disease progression
  - Increase in striatal GDNF levels (Cohen et al. 2003)
  - Increases dopamine release in dorsolateral striatum (Akopian et al. 2008)
### Essential Considerations within Physical Therapy

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Effects</th>
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<tr>
<td>Cueing strategies</td>
<td>Improve motor performance (especially gait)</td>
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<tr>
<td>Cognitive movement strategies</td>
<td>Improve everyday motor tasks (walking, standing up, sitting down, dressing, <em>etc</em>), and quality of life</td>
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<tr>
<td>Balance training</td>
<td>Prevent risk of falls, improve postural stability</td>
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<td>Aerobic training</td>
<td>Improve physical capacity</td>
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<tr>
<td>Strength and flexibility</td>
<td>Improve general well-being and quality of life</td>
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</tbody>
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Exercise shown to slow, stop, and reverse disease progression:

Forced movement

High intensity, amplitude based treatment

Cognitive and dual task training
Forced Movement

**Tandem biking** (Ridgel et al. 2009)

- Self selected rate: ~60 rpm; Forced: 80-90 rpm
- 24 session: 3x per week x 8 weeks
- Improved UE coordination via UPDRS:
  - 41% decrease in rigidity
  - 38% decrease in tremor
  - 28% decrease in bradykinesia
- 4 week retention
Forced Movement

**Treadmill training + Virtual Reality** (Mirelman et al. 2011)

- Progressive intensive treadmill training with virtual obstacles
  - Speed, orientation, size, frequency of appearance, and shape of the targets were manipulated
- 3x per week x 6 weeks
- Improved comfortable walking speed & stride length
- Improved dual task speed & stride length
Amplitude Specific Training

- Lee Silverman Voice Treatment (LSVT BIG®)
  - Goal LSVT BIG Program:
    - Teach patients to use bigger movements in routine activities --> sustained training in everyday movements
    - Restore normal movement amplitude by re-calibrating the patient’s perception of movement execution → sensorimotor processing
  - 4 sessions/ week x 4 weeks (16 sessions total)
  - Daily exercises; hierarchy exercises
    - 8-16 reps/ task; 8-9/ 10 intensity
  - Cue = “Think BIG”

Farley et al. (2008)
Fox et al, (2012)
Images from LSVT Global ©
• Farley, et. al, 2005
  ○ Improved gait speed
  ○ Improved balance scores
  ○ Improved stability during dual walking/talking tasks
  ○ 3 month retention

• Ebersbach, et. al, 2010
  ○ Greater improvement in UPDRS, TUG, and timed 10 meter walking in BIG group compared to walking and home groups
  ○ No differences seen within quality of life measures
Amplitude Specific Training

- Parkinson’s Wellness Recovery (PWR!®)
  - Evolution of LSVT BIG® exercise program
  - Targets multiple symptoms, and allows for adaptation for disease severity
  - Perform movements with large amplitude, high effort, and attention to action in multiple postures (floor, all 4’s, sitting, and standing)
  - Targets “4” skills shown by research to interfere with mobility
    - Antigravity extension
    - Weight shifting
    - Axial mobility
    - Transitional movements

http://www.pwr4life.org
Cognitive & Dual Task Training

- Canning, (2008)
  - Cognitive dual task challenges while walking
  - 1x week (30 minute session) x 3 weeks
  - Improved gait speed in single task and dual task conditions
  - 3 week retention
Cognitive and Dual Task Training

- Conradsson, 2015
  - HiBalance program vs. control (usual care)
  - 10 weeks, 3x/week
  - Significant improvements in balance and gait performance
  - No significant between group difference was observed regarding gait performance during dual-tasking
    - Improved performance of the cognitive task while walking
Exercise as a Habit

- Home exercise programs
- Community/group organizations
- Tune ups
Conclusion

- Utilize neuroplasticity training principles within clinical practice
- Targeting increased amplitude, higher intensity training, and recalibration of the sensorimotor system improves generalization and long-term maintenance of treatment effects
- Treatment should include:
  - Early intervention, prevention, remediation
- Exercise doesn’t end in the rehab clinic!


Mirelman, A, "Virtual reality for gait training: can it induce motor learning to enhance complex walking and reduce fall risk in patients with Parkinson's disease?." The Journals of Gerontology Series A: Biological Sciences and Medical Sciences 66.2 (2011): 234.


- Parkinson’s Foundation. Available at: http://www.parkinson.org/Understanding-Parkinsons/Symptoms/Movement-Symptoms.


● Images taken from Google.com