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A Practical Approach to Treating Individuals with Parkinson’s disease

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Course Outline
- Lit review of OT tx for PD
- Neuroplasticity
- Motor Learning
- Transfers
- Bed Mobility
- Gait – Turns, FOG
- Balance and Falls

- Exercise Options & Programs
- Addressing Strength and Aerobic needs

2014 Systematic Review of OT Interventions
- Articles from 2003-2011: 55 in this review – 35 RCTs level 1
- 3 categories of intervention:
  1. (1) exercise or physical activity
  2. (2) environmental cues, stimuli, & objects
  3. (3) self-management & cognitive-behavioral strategies
Interventions: exercise or physical activity

To improve performance skills:
- most responsive to task-specific
- direct performance skill training does not generalize as well to more complex occupational performance or QOL
- Exercise improves motor performance, postural stability, & balance
- Limited evidence for postural effecting FOF or fall reduction

Interventions: exercise or physical activity

To improve occupational performance:
- very limited research on the effect or outcomes of self-care or meal-prep training in those with PD
- low-mod evidence that complex & multimodal activity training (such as func. mob & nonspecific ADL training and sports/rec activities - primarily dance) supports short-term improvement in functional movement activities.

Environmental Cues, Stimuli, & Objects to Improve Task and Occupational Performance

Evidence for:
- use of auditory rhythmic stimuli
- providing a safe movement enviro for focusing on the functional task
- cueing paired with cognitive strategies
- cueing on amplitude of movement
- adaptive equipment for safety against falls
Integration of Self-Management and Cognitive–Behavioral Strategies Into Daily Life to Improve Occupational Performance and QOL

- Promoting wellness initiatives & personal control
- Help with modifying lifestyles and improving QOL
- Use a “cognitive–behavioral intervention that involved education, goal setting, performance skill training, practice, and feedback related to incorporating habits into daily life.”

Advances in neuroscience – Animal Model

Studies suggest that exercise may slow, halt, or reverse the progression of PD

- by protecting the remaining “viable” DA neurons
- by restoring compromised signaling pathways
- by increasing reliance on undamaged systems
- by increasing efficiency of available DA
- by creating more DA receptors
- by staying in synapse longer (fewer DA transporters)
- by shutting down noisy/interfering circuits in BG
- by increasing neurotrophic factor (“feed” the cells & help with neurotransmitter transmission)
- doesn’t increase the amount of DA, but increases its release


Animal Model PD Research

1st - Rats given chemically-induced PD

2nd - Cast non-affected limb x 7 days to force use of affected limb

Cast removed…

Results:
- limbs move the same
- ↓ cell degeneration
- ↑ in neurotrophic factor

Neuroplasticity in Humans

- Aerobic exercise leads to an enhanced brain-derived neurotrophic factor (BDNF) response & release
- BDNF is a protein that:
  - maintain the growth, health, and survival of nerve cells
  - promotes the growth and development of new neurons and synapses
  - helps with memory formation, learning and behavior, synaptic plasticity & neuronal connectivity
- This is turn may lead to functional, cognitive, and mood improvements in humans


Neuroplasticity in Humans

- It is the initial phase of neurodegeneration in which the most neurons are rapidly lost.
- This is the time where treatment can have the most impact on preventing further degeneration and symptoms.
- If “exercise plays a powerful enough mitigating/palliative role, it should be performed very early and aggressively, and ideally prophylactic years before the onset of this process.”


Neuroplasticity

1. Use it or Lose it – inactivity is pro-degenerative
2. Use it & Improve it - skilled training facilitates plasticity
3. Specificity – task specific training: train to the deficit
4. Repetition Matters – the key to permanent change in brain and behavior; add novel movements
5. Intensity Matters – push/challenge your patient! more reps, longer duration & frequency, HR, BORG scale

Neuroplasticity

6. **Time Matters** – better earlier, but can occur at any point
7. **Salience Matters** – must be important to the patient
8. **Age Matters**
9. **Transference** – changes in one area can promote concurrent or subsequent changes elsewhere
10. **Interference** – learning compensatory strategies first may lead to plasticity that needs to be overcome

Motor Learning

ML = “a set of processes associated with practice or experience, leading to relatively permanent changes in the capacity of movement”
- Acquisition is preserved
- With cues used during training - retention of skills is shown
- But when re-tested without the help of feedback - retention diminishes
- With context-specificity training - retention of skills is shown
- But when performing under dissimilar conditions from those practiced, there is difficulty in performing the task
- This may be due to the problem with task and focus shifting

Clinical Applications

- Learning rates are slowed in PD – allow for time processing and performance
- Potential for ML is better earlier in the disease – begin ASAP
- PRACTICE, PRACTICE, PRACTICE
- Challenge your patient
- Earlier stages: develop a weaning-off stage from cues so that more sensory learning can occur
- Later stages: use & dependency of cueing strategies may be necessary, consciously think about the movement
- Context-specificity: practice activity in an environment that closely matches the patient’s – then vary task
Clinical Applications

- Variability of practice
  - practicing the same task under same conditions helps to facilitate **Retention**
  - variability of practice helps to facilitate **Generalization (transfer of skills)**
- How do we test this?
  - Objective measurement (5TSTS)
  - Transfer test – can pt. perf this with different chair or therapist?
  - Retention test – assess task after a time lag
  - Skill strength test – perf when fatigued, less motivated, or distracted

Mobility Guidelines

**Teach Thoughtful Movement ASAP**

- Break task into parts
- Finish one part completely before the next (ex. – getting into a chair)
- “Think before you move”
- Move with larger movements

“**PWP are like run-on sentences - we must teach them to put in the commas**"
Transfer Training

- Task-specific training
- Teach sequencing
  - "Don't reach before turning"
  - Practice the most difficult portion 1st
- Use incline wedge for theater seats
- Go from high to low seats (keep measurements)
- DO NOT FORGET to practice:
  - return to sit
  - getting in & out of chair at table/desk
  - Tape on floor where feet should be

Bed Mobility

- Break task into smaller steps/movements
- Awareness- "Thoughtfulness of Movement"
  - Warm-up with rocking
  - Large movement with UEs
  - Turn head in direction to move
  - Tape on floor where feet should be
- Adaptive Equipment
  - Handrails, Risers, Satin sheet in middle of bed, Blanket Support
  - Firm mattress
Gait Training

- In PD THE ABILITY TO MOVE IS NOT LOST: THERE IS AN ACTIVATION PROBLEM (Meg Morris)

- Patient first must understand the motor-sensory disconnect
  - Video analysis helps here

- We can teach patients good quality movement that prevents LOB/Falls through motor learning and conscious movement training

- Cueing– countless studies showing that external cues help improve gait quality (carryover is limited when cue removed)

Cueing Strategies

“Attentional Cues”

- In PD there is ↓ BG input going to the SMA/Primary motor cortex control
- Override this by ↑ use of frontal-cortical control (Premotor cortex) by thinking about the movement

[Diagram of Attentional Cues]

**Attentional Cues**

- Tape lines on floor
- Lasers
- Metronomes
- Imagination (stepping over something)
- Tactile (tapping the frozen foot)
- RAS - Rhythmic Auditory Stimulation
  - using the physiological effects of rhythm/music to facilitate rhythmicity in gait.


- After cue is removed - effects can last up to 8 weeks after training but then fade

Kadivar, Conic, Fedor. _Kinesiology_ 2011 Sep;25(7):626-35.
Mobilaser™

Device can be attached to any walker and projects a straight line to step to, or over to help combat FOG

www.mobilaser.org
Gait Training

- Walking with big movements
  - get that arm swinging & that foot landing on the heel “kick”
- Have patient tell you what they will do first
- Practice weight shifting & stepping
- Practice in open and small areas
- Practice stopping, starting, and turning
  - at an object
  - with a cue

Eval walk 1

Eval walk 2
Gait Training
- Practice in functional settings
  - Elevators, revolving door, etc.
  - Crowds
- Dual taking
  - Motor & Cognitive
    Carrying objects
    Head turns to read letters on wall
  - are they safe to do this?
  - may need to avoid dual tasks
- Force a freeze & have patient correct
- Reduce the # of steps in a certain distance

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Gait Training...size matters, keep movements big to all stages

**Early Stage:**
- Address amplitude and symmetry
- Add in dual tasking with cognitive & motor loads
- Vary the environment and exercise
- Push them hard!

**Mid Stage:**
- May now be dealing with motor fluctuations
- Need strategies for “on” and “off” times
- Begin addressing festination and retropulsion, LOB

**Mid-Late Stage:**
- FOG
- Increasing Falls
- Increased “off” times
- More need for cues and care partner assistance

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FOG Strategies
**Understand/identify triggers**
- Weight displacement on feet
- Stress/Anxiety/Fear
- Anticipatory FOG
- Turn technique/Turn to sit
- Cognition/Attention/Distraction
- Crowds
- Environment
  - Small spaces
  - Sudden changes in flooring type or pattern
  - Doorways
  - Thresholds
  - Approaching people, furniture, objects
FOG Strategies

*Never fight the freeze!!!*

- Stop, breathe, start again (use an attentional cue)
- 4 S’s
  1. Stop
  2. Stand tall
  3. Shift weight
  4. Step big

*The key is to unweight 1 foot & make the next step a big step*

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FOG Strategies

- **Areas in home** (Doorways, around furniture)
  - *Tx: Destination Estimation*
  - may not work for those with trouble multi-tasking
  - *Tx: Look through door to wall ahead*
  - *Tx: Stop and step over threshold*

- **Crowds – elevator, escalator, church, concerts, trains/buses**
  - *Tx: Allow others to go first, move to the side*

- **Turns**
  - *New Techniques*

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**Turning**

*Keep COG over BOS/Never pivot*

- Keep body and feet moving in same direction, especially with
  - Use of walker
  - Return to sit
  - From static pose to turn & reach
- *U-turn – open space*
- *RR/LL turn – smaller space*
- *Marching turn – smaller space & to get out of a freeze*
- *Sideways Arc – to avoid back steps*

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*Continued*
To turn RIGHT, shift weight on LEFT and move RIGHT foot first.
Walkers & Canes & Poles

- Avoid Aluminum Straight-Wheeled Walkers! – pt. must lift to turn
- Avoid QC’s – multi-tasking and tripping on legs
- 4 wheeled RW with brakes & seat tend to work best
- Trekking poles work well with YOPD - bilateral support, facilitates UE reciprocal motion, trunk rotation, & symmetry
- Laser Cane ustep.com

Balance & Falls

*Begin before there is a balance problem - “Pre-habilitation”*
- Balance exercises with ADLs
- Add cognitive challenge as pt. improves, with YOPD begin immediately

*Once falls begin:*
- Continue balance exercises
- Determine cause – treat cause
  - Freezing, Festination, Turns, ↓ Safety Recall, Multi-tasking
- Fall Diary
- Education for pt. and care partner
- Protective gear (knee pads)
- ADs
- Some pts will continue to fall no matter what and truly need constant supervision/VCs
Balance & Falls

Prevention
- COG over BOS at all times (especially with reaching)
  - Closets, refrigerator, oven, picking up objects from table
- Environmental modifications at home & office
- Energy conservation
  - Sit to dress, dry off, prepare meals
  - Avoid multi-tasking (in late-mid & later stages)

The lit. shows ex & movt trng to be effective tools in improving balance - but does not show which are best at which stage of the disease.

Retropulsion

Retropulsion: backward balance loss with reduced step size and increased cadence; underscaled stepping response

Triggers:
- Reaching up
- Opening doors (cabinet, stove, etc.)
- Stepping back to get out of the way of something or someone (sudden movement)
- Backing in to a chair

Prevention:
- Stand sideways to open doors
- Sideways arc
- Power stance

Retropulsion

Prevention:
- Stand to side of oven, dishwasher, fridge & doors to open
- Teach “Power Stance” and performing activities within LOS
- Steady self with one hand
- Walk sideways
Festination

**Festination**: gait with increased step cadence; “runaway train”

**Triggers**:
- Reaching too far forward
- Increasingly flexed posture
- Being told to “hurry up”
- Reaching for the chair before turning to sit
- Not focusing on quality of steps
- Letting the rollator control them, rather than controlling the rollator (being in a freeze and moving the rollator rather than the feet)

**Festination Prevention**:
- No reaching before turning
- Training in big steps and focus on HS
- Visual cues on rollator
- Reverse-braking system rollator

In more severe cases:
- Towel rolls under arms
- Velcro-release strap attached to rollator around patient’s waist or hips
Thoughts on Falls

“Falls are a blunt endpoint. Instability episodes or near-falls may be a better measure.”
Lee Dibble, PhD, Univ. of Utah

Almost Falling occurs more frequently than actual falls.

Considering that most studies compare an active intervention group to an inactive control group - “results imply that the type of activity may not be important, but rather that the performance of some sort of physical activity or exercise as opposed to being sedentary is critical.”
Lee Dibble, PhD

Micrographia & Tremor Tx

- Practice does not make perfect
- Pt. must THINK about making each letter big
- Lines help, but not when removed
- Try easier flow type pens to limit the dual task of holding and pressing
- Print is better than cursive/script

“…no support for the clinical recommendation of using weighted utensils or weighted wrist cuffs to alleviate postural hand tremor in PD.”
Cognition


Fatigue Management


Exercise – What is Considered “Best-practice”???

- Exercise type
- Time of implementation
- Frequency
- Duration
- Intensity
- Practicality
- Cost-effectiveness
- Environment
- Adherence
PWR! (Parkinson Wellness Recovery)

Novel clinical framework created by Becky Farley, PT, PhD, that teaches & guides clinicians how to:

- implement evidence-based principles of learning and neurolasticity into everyday practice that can be implemented across disease severity
- provide early intervention and continuous access to research-based exercise approaches that target the unique physical, emotional, and cognitive challenges for individuals living with PD
- target bradykinesia/hypokinesia through the performance of whole body large amplitude movements
LSVT® BIG

- Based on principles of LSVT®LOUD (Lee Silverman Voice Tx - “Think Loud”)
- Evidence-based protocol of 1 hour sessions, 4x/week for 4 weeks
- Focus on retraining the motor-sensory disconnect
  - Perform large amplitude exercises with intensity I repetition
  - Perform large amplitude functional movements & gait
  - Work toward goals that incorporate big, quality movements into ADLs and functional tasks
- Must be certified to provide this treatment
- www.LSVTglobal.com

Tx Session Overview

Maximal Daily Exercises
1. Floor to Ceiling
2. Side to Side
3. Forward step
4. Side step
5. Backward step
6. Forward Rock and Reach
7. Sideways Rock and Reach

Functional Component Tasks
5 EVERYDAY TASKS
- Sit-to-Stand
- Pulling keys out of pocket

Walking BIG
Distance/time may vary

Hierarchy Tasks
Patient identified tasks:
1. Getting out of bed
2. Playing golf
3. In and out of a car

Build complexity across 4 weeks of treatment towards long-term goal
**BIG Research**

**The Berlin BIG Study**

- 60 randomized subjects (2 drop outs)
  - 20 BIG
  - 19 Nordic walking
  - 19 Home program

*All performed 4x/week for 4 weeks, except for walking – this was 2x/week for 8 weeks (b/c that is the norm for this)*

- UPDRS improved for BIG, worsened in others
- BIG was superior to others in TUG & 10 Meter walk


**BIG vs. short protocol (5x/week for 2 weeks)**

- 42 subjects
- Motor performance the same but BIG was more effective to obtain patient-perceived benefit.


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**Research-Based Options**

1. **Tai Chi**
   - balance, strength, & gait – up to 3 months later

2. **Boxing**
   - balance, gait, ADLs, & QOL – up to 36 months later
   - Rock Steady Boxing, Indianapolis, IN
   - Now offering a Training Camp in the “Rock Steady Method”

   www.rocksteady.org


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**Fight like a girl**
Research-Based Options

3. Dancing
   Argentinian Tango, Intense Tango
   • balance & gait – up to 1 month later
   • Partnered
   • Non-partnered
   • Contact Improvisation

Dance for PD®
   • collaboration between the Mark Morris Dance Group and the Brooklyn Parkinson Group
   • dance classes in more than 75 other communities around the world
   • provides teacher training www.danceforparkinsons.org

4. Nordic Walking
   • postural stability, stride length, gait pattern & variability
   • 10meter walk, 6MWT, TUG & PDQ-39
   “American Nordic Walking System”
   www.skiwalking.com
   • Provide instructor certification

5. Nintendo Wii™
   • balance, mobility, function, QOL, ADL, Mood….

Other Exercise Options

The John Argue Method
   • “...The overall strategy for coping with...symptoms...is to develop an artful way of moving and speaking.
   • An artful action is one that is graceful, mindful, and complete.
   • Participants practice ways to bring these qualities to everyday tasks such as walking, turning, sitting down, standing up, and reaching.”
   www.johnargue.com
Music Therapy
2012 meta-analysis of 6 RCTs of music therapy and PD:
- significant improvement in walking velocity
- significant effect sizes seen in Berg, TUG, & stride length
- Active music therapy - 13 weekly group session, 2 hrs.
- Listening, singing, rhythmic moving, facial expression, playing instruments, voice ex, breathing, free body expression, conversation, relaxation
- Signif improvement in bradykinesia (UPDRS)
- Improvements in QOL, ADL abilities and happiness

Strength
- Studies show improvements in strength, muscle size, gait speed, stride length, 6 MWT, balance, QOL, & UPDRS
- 2008 review outlines 5 studies that provide quantitative exercise prescriptions for resistance training ex
  - Eccentric PRE (generate high levels of force with minimal oxygen consumption) Dibble, L et al. Mov Disord. 2006;21(9):1444-52.
  - Target the extensors, core, posture
  - High intensity eccentric resistance training
  - Theraband, theraball, weights, body resistance
  - Limit ex for chest, biceps (unless weak)
  - Avoid crunches, squeeze balls/thera-putty

Aerobic
- Lit. shows improvements are possible in:
  - improved walking economy
  - aerobic capacity
  - 6 minute walk times
  - BORG (perceived exertion)
  - Walk (inside, outside, TM), pool, recum. bike, elliptical, dancing, chair aerobics… get creative & get that HR up!
  - Find something the patient enjoys

Remember – pts. will self select a lower intensity of exercise. Increased the intensity of their programs.
Tandem Biking
In 2003 Jay Alberts PhD of the Cleveland Clinic was raising money for PD research by tandem biking 400 miles across Iowa with an individual with PD. After one full day of biking the individual’s symptoms were all reduced – and her tremor had diminished enough that she was able to write clearly.

Forced-exercise: Tandem Biking Studies
- Individuals’ voluntary efforts are supplemented through:
  - Increased pedaling rate (80-90 rpms)
  - Less focus on resistance, more focus on rate
  - Consistent pedaling rate
  - Consistent pedaling pattern
  - Increased aerobic work
  - 65-80% target HR
  - 3x/week x 8 weeks
  - 1 hour sessions (10 min w/u, 40 min ride, 10 min cool-down)

Outcomes
- FE group
  - pedaled 30% faster
  - VO₂ max improved
  - UPDRS motor section scores improved - 41% in rigidity, 38% in tremor, and 28% in bradykinesia (even 4 weeks post intervention)
  - Improved dexterity, hand movement speed, interlimb coordination, and increased rate of grip force production
  - Anecdotal reports from subjects on using less anti-PD meds
  - Suggesting reduction in anosmia
  - Improved handwriting
**Conclusion** – FE results in global improvements in motor function for those with PD by possibly triggering the release of neurotrophic factors and possibly dopamine.

“It is not about the bike, it is about the pedaling”


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**Aerobic Equipment**

- Stationary bike
- Stationary rowing
- Treadmill
- MotoMed
- The Body:
  - Dancing
  - Gardening
  - Swimming
  - Chair aerobics
  - Pole walking

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**Advocate for Occupational Therapy**

- PTs training MDs
- Encourage referrals to therapy immediately after dx
- Develop readily available early intervention programs
- Need opportunities for continuous access to fitness
- Facilitate programs that are neuroplasticity-principled
- Develop groups that encourage social interaction, physical and cognitive exercise, and support
Stage Guidelines

In all stages, keep the focus on large quality movements & thoughtfulness of movement

YOPD: high level balance, aerobic, agility and plyometrics; increase the challenge with dual cog & motor loads; keep posture & extensors strong

Early Stages (I&II): Prehabilitation – start before there is a deficit/problem; incorporate functional moves into ex; drive reciprocal arm swing and movements; highlight need to focus on quality of movements not just when ex, but also while “living your life.”

*YOPD and H&Y I/II often similar in tx approaches

Stage Guidelines

Mid-Stage (III/IV): function, function, function; training to keep amplitude of movement large t/o all ADLs & gait; motivate to keep exercise at priority; training care-partners proper ways to cue and assist; fall prevention

“EXERCISE = MEDICINE”

Late-Stage (IV/V): training care-partners proper ways to cue and assist; fall prevention; maximizing safe mobility; increased focus on external cues and compensatory strategies; expect greater bradykinesia, delayed processing and answering, “off” times and FOG episodes

Take Home Message

• Start exercise as soon as possible!
  • Prehabilitation
  • Educate on the sensory – motor disconnect
  • Increase the intensity
  • Incorporate functional tasks
  • Work toward dual tasking
  • Focus on large amplitude movements
  • Make it important to the patient
  • Work the extensors
  • Weight shifting and directional changes
  • Look for (or create) programs for continued exercise options once therapy ends
One Last Thought…
Adults “Work Out” - Children “Play”

How do children stay fit?

Constant Movement
- Running
- Jumping
- Skipping
- Dancing
- Singing
- Laughing
- Imagination

Create ways to make exercise enjoyable, functional, and long-lasting.

Resources
- LSVT BIG
  www.lsvtglobal.com
- Parkinson Wellness Recovery - Exercise for Brain Change
  www.nfnw.org
- Institute for Music & Neurologic Function
  musictherapy.imnf.org
- Rock Steady Boxing
  www.rocksteadyboxing.org
- Dance for PD
  www.danceforparkinsons.org
- Davis Phinney Foundation
- Michael J. Fox Foundation
- Email me at: Heather.Cianci@uphs.upenn.edu