Exercise Is a Prescription, Not a Suggestion

Protecting Gait and Balance in Parkinson's Disease

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Featuring a live demonstration by:

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LMOCO LAB

"Exercise needs to move from a recommendation to a prescription for people with Parkinson's."

— Dr. Jay Alberts, Cleveland Clinic

By the End of This Talk You Will Know:

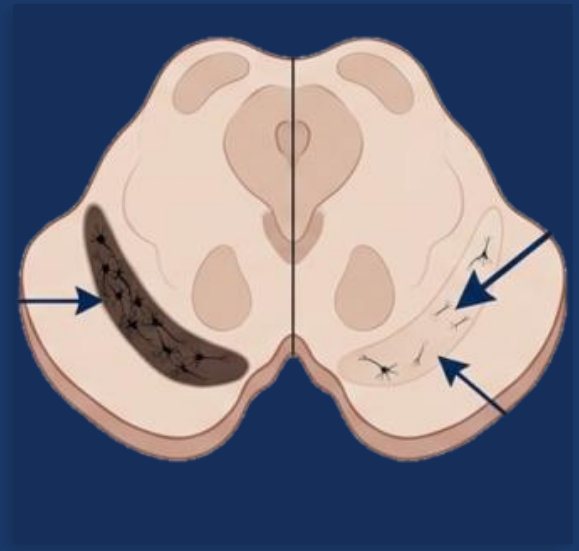
1. Why gait and balance problems resist the treatments you're already on
2. What exercise does to the brain that medication cannot
3. Which exercise targets which deficit — one size does not fit all
4. How objective measurement turns exercise into a precision prescription
5. Where this science is happening in your community right now

Section 1: Understanding Parkinson's Disease

What PD actually does — and why it matters for what comes next

A Progressive Disease — But Not a Simple One

- Loss of dopamine-producing neurons in the substantia nigra
- Symptoms are highly individual — no two people present the same way
- Both motor AND non-motor symptoms — it is not just a movement disorder
- No disease-modifying treatment yet available — management, no cure



Dorsey et al., 2018 | Kalia & Lang, 2015 | Tolosa et al., 2021

When Dopamine Declines, Everything Is Affected

MOTOR SYMPTOMS

- Tremor at rest
- Slowness of movement (bradykinesia)
- Rigidity / stiffness
- Balance problems
- Walking difficulties
- Freezing of gait
- Fatigue

NON-MOTOR SYMPTOMS

- Cognitive changes
- Mood disorders
- Sleep problems
- Loss of smell
- Anxiety
- Depression

Gait and balance impairments are among the earliest functional concerns — and most connected to falls, loss of independence, and quality of life.

Exercise Is Not Just Fitness — It Is Neuroscience

- Promotes neurogenesis — new neural connections
- Improves blood flow to the brain
- Increases synaptic efficiency
- Trains the brain to use remaining dopamine more effectively
- Reduces neuroinflammation and oxidative stress at the cellular level
- May slow disease progression — not just manage symptoms

"Unlike medication, which replaces dopamine externally, exercise trains the brain to work better with its own resources."

Exercise → Brain → Benefits

Petzinger et al., Lancet Neurology, 2013 | Burtscher et al., Ageing Research Reviews, 2024

Section 2: The Treatment Gap

What medication does well — and where it reaches its limits

Medication Works — For Some Symptoms, In Some Conditions

Symptom	Response to Levodopa / DBS
Resting tremor	✅ Strong
Slowness (bradykinesia)	✅ Strong
Rigidity / stiffness	✅ Good
Fine motor / writing	✅ Moderate
Straight-line gait performance*	Some benefit

** Gait benefits measured primarily in controlled, straight-line laboratory conditions — may not reflect real-world performance.*

Levodopa is one of the most effective drugs in neurology — for what it was designed to treat.

The Symptoms That Matter Most Respond Least

Symptom	Lab Setting	Real World
Straight-line gait speed	⚠ Some levodopa benefit	⚠ Less consistent
Turning & obstacles	⚠ Poorly responsive	❌ Often unaffected
Postural instability	⚠ Minimal response	❌ Progresses despite treatment
Freezing of gait	⚠ Often persists on medication	❌ Triggered by real-world contexts
Fall risk	⚠ Not well addressed	❌ Continues to increase
Dual-task walking	Rarely tested	❌ Major daily life challenge

"Gait and balance abnormalities are among the motor symptoms most disabling and most refractory to dopaminergic or other treatments." — Bohnen et al., Movement Disorders, 2022

Dopamine Isn't the Whole Story

MEDICATION REACHES THIS:

Substantia Nigra → Striatum

- ✅ Tremor
- ✅ Slowness
- ✅ Rigidity

MEDICATION REACHES THIS POORLY:

Brainstem + Cerebellum
+ Frontal Cortex + Spinal Cord
+ Cholinergic System

- ❌ Walking
- ❌ Turning
- ❌ Balance
- ❌ Freezing of gait

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Exercise reaches those other circuits — that is the mechanism and why exercise is NOT redundant with medication.

Section 3: Exercise as the Prescription

Which exercise, why it works, and what the dose looks like

Exercise Works Where Medication Struggles Most

MOTOR — GAIT & BALANCE

- ⬆️ Balance
- ⬆️ Walking speed
- ⬆️ Stride length
- ⬆️ Freezing of gait (partial)
- ⬇️ Fall risk
- ⬆️ Coordination & flexibility

NON-MOTOR

- ⬆️ Working memory
- ⬆️ Attention & concentration
- ⬆️ Sleep quality
- ⬇️ Depression & anxiety

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"Gait efficiency, gait velocity, balance and risk of falls are among the features most robustly improved by exercise in PD." — Lauzé et al., 2016

A Prescription Has a Dose

Rx

OPTION A — MODERATE

- 150 minutes per week
- ≈ 20 minutes daily
- 30 minutes, 5 days/week

OPTION B — VIGOROUS

- 75 minutes per week
- ≈ 10 minutes daily
- 15 minutes, 5 days/week

‘Forced’ Exercise Produces Stronger Brain Benefits

FORCED EXERCISE = moving faster or harder than you would naturally choose

Cycling

Higher cadence — tandem or stationary

Music

Rhythm drives pace and movement quality

Dance

Tango, ballroom, line dancing

Boxing

Rock Steady Boxing

Walking

Treadmill at slightly faster than comfortable pace

Nordic Walking

Poles + faster pace = whole-body movement

Alberts et al. — Pedaling for Parkinson's | Schenkman et al., JAMA Neurology, 2018 | Hackney & Earhart — tango in PD

The Best Exercise Is the One You Actually Do

Social

Class, group, care partner

Enjoyment

Dance, biking, geocaching

Competition

Step challenges, group goals

Task Completion

Structured programs, tracking

Learning

Try something new

5 NON-NEGOTIABLES:

1. Do something every day
2. Small steps add up to big steps
3. Not every day feels perfect — show up anyway
4. Build movement into your normal day
5. Any exercise beats no exercise — but don't settle

Section 4: Precision Exercise prescription — Gait Analysis

You cannot target what you have not measured

You Cannot Target What You Have Not Measured

THE PROBLEM

- The human eye misses subtle but critical deficits
- Step variability that predicts a fall — invisible to observation
- Turning hesitation, the earliest sign of freezing — missed on a straight-line walk

THE OPPORTUNITY

- Wearable sensor technology now makes objective gait and balance assessment possible
- In the lab, in the clinic, and in the community
- Generates a precision map of which deficits are present, how severe, and how they respond to intervention

Del Din et al., Annals of Neurology, 2019 | Mirelman et al., Lancet Neurology, 2019

Gait Analysis Finds the Deficit

- 🎯 Which specific deficits are present and how severe
- 🔄 Turning quality — the most common freezing trigger
- 👣 Step symmetry and variability — strong fall predictors
- ⚖️ Balance and stability during standing and walking
- 📈 How all of these respond to an exercise intervention over time

"We generate the precision map that makes individualized exercise prescription possible."

LIVE DEMONSTRATION

Objective Gait & Balance Measurement

with Silvia Campos-Vargas, MS | PhD Student, Team LocoMoCo

Sensors placed — data captured 128 times per second.

An objective fingerprint of how this person moves.

Now instead of 'your gait looks shuffled' — we have numbers.

Step length, symmetry, turn time, arm swing. PT knows exactly what to target.

Gait speed, step length, cadence, symmetry, turn quality +more

10-min assessment

Every Metric Tells a Different Story

Measure	What It Captures	Why It Matters
Gait speed	Overall locomotor function	Strongest single predictor of independence
Step length variability	Consistency of gait pattern	Higher variability = higher fall risk
Gait symmetry	Left-right step balance	Asymmetry signals compensation & progression
Turn duration	Freezing risk during turning	Turns = most common FOG trigger
Postural sway	Balance stability	Predicts fall risk

"Gait parameters from wearable devices can predict future PD diagnosis years before clinical identification — and track response to intervention." — Del Din et al., 2019

WE BRING GAIT SCIENCE INTO YOUR COMMUNITY

Auburn University Locomotor & Movement Control Laboratory

- Community health fairs across rural Alabama and beyond
- Research participation opportunities for people with Parkinson's disease
- Free gait & balance assessments
- Partnering with clinics, support groups, and community organizations

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Team Locomotor and Movement Control Laboratory
Auburn University
School of Kinesiology

"Exercise is the prescription. Gait analysis finds the target. We track whether it's working."

WHAT YOU KNOW NOW THAT YOU DIDN'T BEFORE

1. Gait and balance are the PD symptoms most resistant to medication and surgery — by design, not by accident
2. Exercise reaches the brain circuits that dopamine cannot
3. The prescription exists: dose, frequency, mechanism, evidence
4. Different deficits need different exercise — one size does not fit all
5. Objective gait measurement makes precision exercise possible outside the clinic
6. This science is happening in your community

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