CHANGING PARKINSON'S: PHYSIOTHERAPIST-LED EXERCISE AS A PRIMARY TREATMENT

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LEARNING OBJECTIVES:

1. Participants will be able to explain and discuss the current research regarding exercise and physiotherapy treatment as a primary factor in the management of Parkinson’s Disease including the basic neurophysiology of how exercise effects this population.

2. Participants will be able to describe the primary components which should be included in an effective Parkinson’s exercise treatment plan.

3. Participants will leave with at least 3 functional exercises they can use in clinical practice and will have an understanding of how to build upon these using effective and specific principles relevant to this population.
**WHAT IS PARKINSON'S**

**INCIDENCE**
- Over 1,000,000 people with PD in Canada.
- Several new treatments, e.g., deep brain stimulation, are in clinical trials.
- The number of Canadians over 65 living with Parkinson's disease is predicted to almost double by 2051.
- The number of Canadians over 70 living with Parkinson's disease will more than double by 2051.

**CAUSE**
- Genetics
  - A genetic factor is considered to be a significant risk factor.
- Environment
  - Exposure to environmental agents, such as pesticides, is under investigation.
  - Exposure to a virus or other infectious agent is also being studied.
- Inflammation
  - Inflammation may play a role in the development of Parkinson's disease.

**What does Dopamine do?**
- Memory
- Movement
- Sensation
- Emotional control
- Sleep
- Mood

**4 PRIMARY MOTOR SYMPTOMS**
- Tremor
- Rigidity
- Bradykinesia
- Postural instability

**OTHER MOTOR SYMPTOMS**
Cardiovascular
- Postural hypotension
- Falls

**Non Motor Symptoms**
Primary Symptoms (Non-Motor)
- Depression
- Sleep disturbance
- Autonomic dysfunction
- Cognitive symptoms

**FREEZING OF GAIT**
- 1. SLOW
- 2. STAND TALL
- 3. SHIFT WEIGHT
- 4. STEP BIG

Photographs courtesy of Brain Canada.
What is Parkinson’s

- Progressive neurological disorder caused by gradual loss of cells in the Substantia Nigra area of the brain which is responsible for Dopamine production and is the primary source of dopamine for the central nervous system.

"PD is now thought to be a **multisystem** disorder that involves not only the dopaminergic system, but other neurotransmitter systems whose role may become more prominent as the disease progresses" (Eighth et. al, 2013)
INCIDENCE

- Over 100,000 people with PD in Canada
- Second most common neurodegenerative disorder after Alzheimer’s disease
- The number of Canadians over 40, living with Parkinson’s disease, will increase by 65% by 2031
- The number of Canadians over 65, living with Parkinson’s disease, will more than double by 2031

CAUSE

- Unknown
- "Genetics loads the gun, environment pulls the trigger"
- Increased risk - heavy metals, pesticides, male, older age
- Decreased risk - smoking, high uric acid, exercise mid life, anti inflammatory meds, caffeine

- Mapping Connections: An Understanding of Neurological Conditions in Canada.
Dopamine levels in a normal and a Parkinson’s affected neuron.
What does Dopamine do?

- movement
- memory
- pleasurable reward
- behavior and cognition
- attention
- sleep
- mood
- learning
What does it look like: Symptoms

T.R.A.P

- Tremor
- Mask face
- Micrographia/Fine motor
- Bradykinesia
- Freezing/Shuffling
- Postural instability
- Rigidity
- Dyskinesias
4 PRIMARY MOTOR SYMPTOMS

Tremor
Rigidity
Bradykinesia
Decreased Postural Control

OTHER MOTOR SYMPTOMS

Gait Abnormalities
Poor Posture
FOG
Falls

Disc bulges
Back pain
Frozen shoulder
UFT pain
Feeling of generalized weakness
FREEZING OF GAIT

1. STOP
2. STAND TALL
3. SHIFT WEIGHT
4. STEP BIG

Rhythm (Auditory/Visual), Adapt the home, Physical aids, Find the issue and TRAIN IT!
Non Motor Symptoms

Primary Symptoms (Non - Motor)

- Anxiety
- Speech/drooling (Mixed motor/non motor)
- Sleep -REM Disorder – inability to suppress movement – act out dreams, Hit etc..
- Smell
- **Fatigue**
- **Speech**
- **Pain** (40-85%)
- Cognitive issues
- GI issues
- **Autonomic Dysfunction**
- Depression/Apathy
WHAT IS PARKINSON'S

INCIDENCE
- Over 100,000 people with PD in Canada
- More than 10 million people worldwide
- 10% of people over 65 will develop PD
- Disease expected to double every 10 years

CAUSE
- Unknown
- Neurotransmitter levels in the substantia nigra decrease
  dopamine levels in the substantia nigra are reduced
- Motor symptoms are due to a loss of dopamine in specific brain nuclei

Symptoms
- Tremor
- Rigidity
- Bradykinesia
- Freezing of gait

4 PRIMARY MOTOR SYMPTOMS
- Tremor
- Rigidity
- Bradykinesia
- Freezing of gait

OTHER MOTOR SYMPTOMS
- Gait abnormalities
- Slowing of movements
- Stiffness
- Decreased arm swing
- Small steps
- Wide-based gait

FREEZING OF GAIT
- 1 Step
- 2 Steps Tall
- 3 Steps

Non Motor Symptoms
- Primary Symptoms (Non-Motor)
  - Depression
  - Anxiety
  - Sleep disturbances
  - Autonomic symptoms

What does Dopamine do?
- Memory
- Motivational reward
- Behavior and cognition
- Movement
- Sleep
- Mood
- Learning
HOW DO WE TREAT PARKINSON'S

- EXERCISE
- MEDICATION
- OTHER THERAPY
MEDICATION

LEVODOPA
- Increased rates of dopamine-synthesis in the brain
- High efficacy in treating symptoms of PD
- "No drug is a silver bullet" - Fahn, 1997
- Evidence suggests that in regions where levodopa cannot be effectively administered,
- "Ischemia, hyperthermia, or hypoxia, which may result in neuronal death..."

 OTHER THERAPIES
- DBS
- Deep brain stimulation
- Parkinson's Foundation
- Can improve...

RESEARCH IN PROGRESS
- Neuronal stem cell replacement
- Gene therapy
- Stem cell implantation
- Gene therapy in vivo...
LEVDOPA

Use began in the late 1960's and it is still the primary and is to this day still the most effective option for the pharmacological treatment of PD.

"NO DRUGS ARE PROVEN TO SLOW PD PROGRESSION" - Ahlskog, 2011

In order to engage effectively in vigorous exercise medication must be appropriately optimized!

Dopamine Replacement

Levodopa/Carbidopa

- Ons a about 60% of a dose enters the brain-true in other
- Remaining dopamine is subject to autoemission to dopamine in the periphery, which is inactivae, renormalize, and possibly delays.
- In patients with rigidity, medication has been lost.

CONTRA:

- Adverse effects of medication in the periphery
- Possible delayed side effects such as nausea & dyskinesia

Contraindicated in:

- Patients with a low level of physical fitness
- Patients with a history of cardiac disease
- Patients with a history of gastrointestinal disease

"There is no compelling evidence that medication response can be saved for years later... Rather, this approach may translate into lost opportunities."
Dopamine Replacement

Levodopa/Carbidopa

- Only about 10% of a dose crosses the blood–brain barrier
- Remaining levodopa susceptible to conversion to dopamine in the periphery which = nausea, dyskinesias, and joint stiffness.
- Bradykinesia & Rigidity respond best

- Inhibits breakdown of levodopa in periphery
- Prevents/lessens side effects such as nausea & dyskinesia

GOALS =
- Maximize patients’ capabilities to engage in physical activities
- Achieve the best level of physical fitness possible.
- Better outcomes with treatment (exercise and drugs!) early on

“There is no compelling evidence that medication responses can be saved for years later... Rather, this approach may translate into lost opportunities.”
Agonists, MAO-B inhibitors, Anticholinergics

- Pre LDOPA or as adjunct therapy
- Side effects can be very significant (hallucinations, impulse control disorders etc...)
OTHER THERAPIES

- DBS
- PROLOPA PUMP
- FOCUSED ULTRASOUND
- CANNABIS

RESEARCH IN PROGRESS

- Neurotrophic factor replacement
- Stem cell transplantation
- Subcutaneous medication delivery
- Supplements & other aids
Figure 3.1 A care model for pwp

Supraregional Parkinson centre of excellence

Parkinson's disease nurse specialist

Neurosurgeon

Clinical geriatrician

Pharmacist

Home & social care

National or local Parkinson's society

Neurologist & nurse*

Rehabilitation or Elderly care physician

GP

Physiotherapist

Speech therapist

Occupational therapist

Dietician

Sexologist

Social worker

(Neuro) psychologist

 Psychiatrist

*in most situations the care coordinator

http://www.parkinsonnet.info/

Kaus SHJ, Munneke M, Graziano M, et al. European Physiotherapy Guideline for Parkinson's disease. 2014; KNGF/ParkinsonNet, the Netherlands
EXERCISE

People with PD are less active than their age matched peers

Take the regular benefits and amplify them

- Lowered & reduced stress 
- Increased fatigue
- Lowered risk of depression
- Better cardiovascular health
- Improved cognitive functioning
- Improved balance
- Improved depression
- Increased resistance to illness

We know exercise is good but how does it work
People with PD are less active than their age-matched peers.

Take the regular benefits and amplify them:

- Exercise & Physical fitness in seniors =
  - Better cognitive scores
  - Better vascular health
  - Better cardiovascular health
  - Decreased incidence of diabetes mellitus, hypertension, hyperlipidemia, obesity, and osteoporosis, falls and fracture
  - Longer survival
  - Anti-inflammatory effect
  - ...And more!

All this occurs in PD + improved motor and non-motor symptoms & mitigation of disease progression.
Take the regular benefits and amplify them

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We know exercise is good but how does it work

Animal Models

Neuroprotection

Neurrepair

Mechanisms of change

Adaptation

Human Models

Lots of research supporting the positive effects of exercise on both motor and non-motor symptoms of PD.

- Dance
- Yoga
- Tai Chi
- Aerobic Training
- Amplitude Training
- High intensity Training
- BOCET
- Strength Training

Study Highlights

- Increased strength and endurance
- Improved balance
- Reduced falls

The ABC study - home vs. IPT group

- Improved quality of life
- Reduced symptoms
- Increased independence

Boxing Specific Benefits

- Improved balance
- Increased endurance
- Reduced falls

The benefits of exercise in Parkinson's disease.
Animal Models

"Deficits decrease with exercise and were worsened by non use" Alberts, 2011

Neurorepair
- Increase dopamine transporters
- Shut down other noisy circuits in the bg
- Keep dopamine in synapses longer

Mechanisms of change

Neuroprotection
- Protection from neurotoxins
- Reduce inflammation and oxidative stress
- Sparring of dopamine

Adaptation
"Deficits decrease with exercise and were worsened by non use"
Alberts, 2011
Human Models

LOTS OF RESEARCH SUPPORTING THE POSITIVE EFFECTS OF EXERCISE ON BOTH MOTOR AND NON MOTOR SYMPTOMS OF PD

- Dance
- Yoga
- Boxing
- Tai Chi
- Aerobic training
- Amplitude training
- High Intensity Training
- BWSTT
- Strength Training

Aerobic Exercise: Evidence for a Direct Brain Effect to Slow Parkinson Disease Progression
Ahlskog, J. Eric
Mayo Clinic Proceedings, Volume 93, Issue 3, 360 - 372

"...extensive and diverse avenues of scientific investigation converge to argue that aerobic exercise and cardiovascular fitness directly influence cerebral mechanisms mediating PD progression."
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BOXING SPECIFIC
"...immediate and lifelong impact on balance, mobility, and quality of life."
Combs et al., 2011

"the boxing group demonstrated significant improvements in strength and endurance over the course of the study.
Combs et al., 2013

- These changes may be attributed to the unique approach inherent to boxing.

THE ABC STUDY

Treatment: “The program targets the brain by altering biomechanical constraints, kinesthetic awareness, bradykinesia, and coordination due to Parkinson’s disease.”

Set up: 6 stations: Tai chi, Boxing, Yoga, etc. Systematically progressed for 3 levels.

- (1) challenging sensory integration through movement
- (2) restricting availability of external cues
- (3) increasing speed
- (4) increasing resistance
- (5) adding secondary tasks.

FE group demonstrated a 41% improvement in rigidity, 38% improvement in tremor, and a 28% improvement in bradykinesia after the 8-wk intervention.
Forced biking

(Alberts et al.)

Figure 1. Cortical and subcortical activation maps across subjects. Highlighted areas indicate areas in the brain where increased blood flow, or cortical activation is present with hand movement tasks during scanning. The pattern of cortical and subcortical activation was similar while patients were on medication and following FE while off medications.
HOW?

FE = BDNF = Neuronal protection/growth & increased dopamine effectiveness + Increased cognitive ability & Learning = Improvements in rigidity, tremor, bradykinesia, upper extremity function, writing, etc...
Results

FE group demonstrated a 41% improvement in rigidity, 38% improvement in tremor, and a 28% improvement in bradykinesia after the 8-wk intervention.
BOXING SPECIFIC RESEARCH
"...immediate and long-term improvements in balance, mobility, endurance, and quality of life."
*Combs et al., 2011*

"the boxing group demonstrated significant improvements in gait velocity and endurance over time"
*Combs et. al., 2013*

- These changes may have been due to the whole body approach inherent to boxing training
THE ABC STUDY — HOME Vs. PT Vs. GROUP

Treatment: “The program targets basic postural systems in a ‘boot camp’ model to target biomechanical constraints, kinesthesia, limits of stability, anticipatory postural adjustments, bradykinesia, and coordination during gait”

Set up: 6 stations: Tai chi, Boxing, Lunges, Kayaking, Agility course and Pilates. Each activity was systematically progressed for 3 levels by

- (1) challenging sensory integration via alteration of visual and surface conditions,
- (2) restricting availability of external cues
- (3) increasing speed
- (4) increasing resistance
- (5) adding secondary tasks.

Timeline: 3X/week for 4 weeks with 60 minute sessions exercise intervention

Results: HEP showed the least improvement across all measures
Results: HEP showed the least improvement across all measures
TAKE HOME:

EXERCISE HELPS MANAGE MOTOR AND NON MOTOR SYMPTOMS AND KEEPS PEOPLE WITH PARKINSON'S FUNCTIONING BETTER FOR LONGER
EXERCISE PRESCRIPTION
**F.I.T.T**

- **Frequency:** 30-60 mins 5+ days of the week
- **Intensity:** Moderate to Vigorous physical activity
- **Time:** 30-60 mins
- **Type:** Aerobic activity
  - Functional movement training 2-3 days/wk
  - Resistance training 2-3 days/wk
  - Flexibility/Balance training 2 days/wk

**PRINCIPLES**

**OVERLOAD SPECIFICITY**

**USE IT OR LOSE IT (ON STEROIDS)**

**WHAT SHOULD YOUR EXERCISE BASED PD TREATMENT PLAN FOCUS ON?**

- Goal directed high amplitude movement
- Increasing speed of movement
- Reducing rigidity/Increasing movement capacity (e.g. trunk rotation)
- Optimising postural alignment & control for balance & function
- Gait training
- Weight shifting and "anti freeze" techniques
- Patterning & repetition
- Challenging cognition
- Falls Prevention (dual task, reactive control etc.)
- Functional movements (Stepping, Skipping, Rolling)
- EDUCATION
F.I.T.T

FREQUENCY:
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TYPE:
Aerobic activity

+ Functional movement training 2-3 days/wk!
+ Resistance training 2-3 days/wk
+ Flexibility/Balance training 2 days/wk

**THINK ABOUT HOW TO INCORPORATE IT ALL INTO YOUR PROGRAM**
PRINCIPLES

OVERLOAD SPECIFICITY

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WHAT SHOULD YOUR EXERCISE BASED PD TREATMENT PLAN FOCUS ON?

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- EDUCATION
JOIN THE EXERCISE REVOLUTION!
Exercise For Brain Change

People with Parkinson's Fighting for life!
TAKE HOME MESSAGES

1. INTENSIVE, FUNCTIONAL, REGULAR EXERCISE is an integral part of treatment for the PD population both for symptom management and mitigation of disease progression.

2. Intermittent (exercise specific) follow up with a knowledgeable health professional is a MUST.

3. Exercise must be fun and salient in order for clients to take part and stay motivated.

4. CHALLENGE YOUR CLIENTS. Hidden potential is everywhere with Parkinson's.

5. WE ARE THE MOVEMENT EXPERTS. We need to educate ourselves and our clients and KNOW OUR RESOURCES.
NAOMI CASIRO, BSc. (Kin), MPT, Certified PWR! Therapist

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PRACTICAL

- FOG 4S's
- 4 PWR! Moves
- Intervals with purpose