



Neuroplasticity in Parkinson's Level 1

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Module 1

What is PD Warrior

The Four Pillars



NEURO-ACTIVE EXERCISE PROGRAM



EDUCATION TO EMPOWER



BEHAVIOUR CHANGE PROGRAM



COMMUNITY

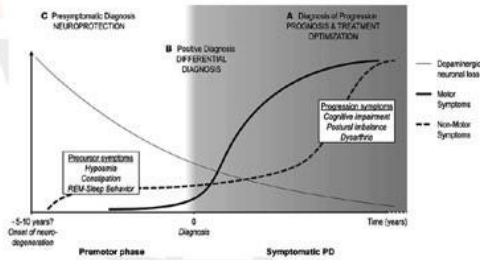


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© Steph Abegg, 2012

Dopamine deficiency

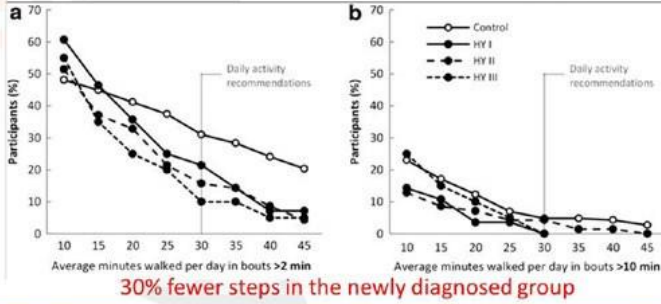


Lebouvier et al 2010

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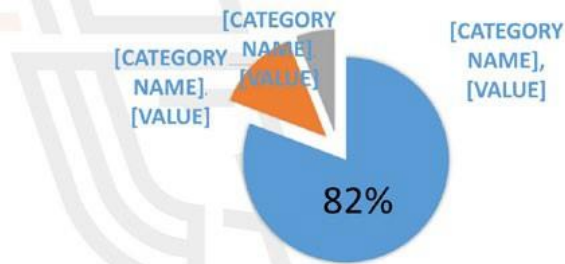
Early Intervention



Lord et al 2013, van Nimwegen 2011

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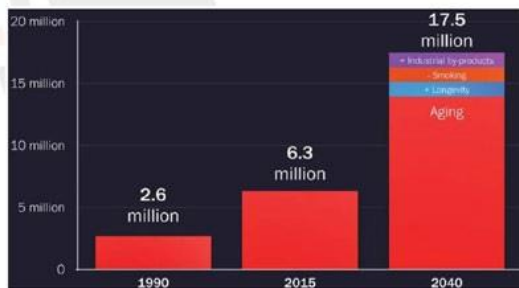
Early Intervention



Deloitte Access Economics 2015

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Global Projected Burden



Brundin, Langston and Bloom 2018

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Therapy Revolution



- 1950s • Visual cues
- 1960s • Levodopa introduced
- 1970s • Drugs improved. Exercise not helpful
- 1980s • Exercise adjunctive
- 1990s • Deep brain stimulation
- 2000s • Exercise complimentary with meds
- 2010+ • Neuroplasticity & Neuroprotection

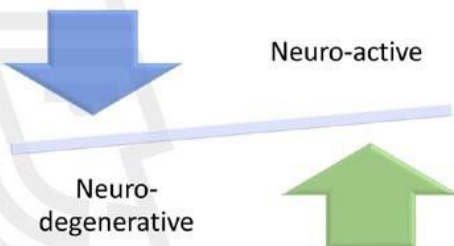
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Neuroplasticity



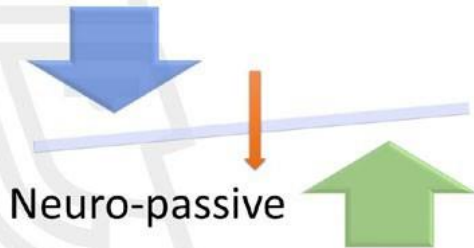
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Neuroplasticity



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Neuroplasticity

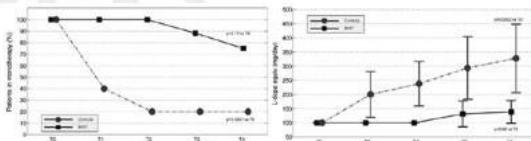


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Neuroprotection



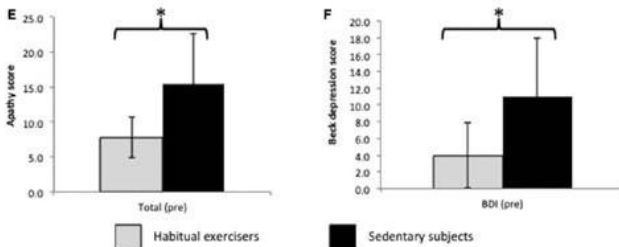
- Increased time on monotherapy (75% v 20%)
- L-dopa significantly in control only (p=.0015)
- Improved UPDRS & Motor scores at T4 v T0



Frazzitta et al, 2015

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Non-Motor symptoms



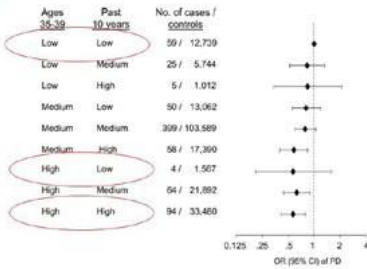
Sacheli et al 2018

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Long-term patterns



Figure 1. Changes of physical activities in relation to risk of Parkinson disease (PD)



Xu et al 2010

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Role of Medication



- Medication does not slow Parkinson's down
- Deep Brain Stimulation does not slow Parkinson's down
- Exercise shows the only promise for slowing Parkinson's down currently



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Who Is It For?



- Early to moderate stage idiopathic PD
- People who are reasonably active and fit already
- Motivated individuals



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Who is it for?



stage	Hoehn & Yahr Scale	Modified Hoehn & Yahr Scale
1	Unilateral involvement only usually with minimal or no functional disability	Unilateral involvement only
1.5	-	Unilateral and axial involvement
2	Bilateral or midline involvement without impairment of balance	Bilateral involvement without impairment of balance
2.5	-	Mild bilateral disease with recovery on pull test
3	Bilateral disease; mild to moderate disability with impaired postural reflexes; physically independent	Mild to moderate bilateral disease; some postural instability; physically independent
4	Severely disabling disease; still able to walk or stand unassisted	Severe disability; still able to walk or stand unassisted
5	Confinement to bed or wheelchair unless aided	Wheelchair bound or bedridden unless aided

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Who is it for?



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Type of Parkinson's



Bradykinesia	Tremor Dominance	Agility Impaired
<ul style="list-style-type: none"> Amplitude Scale Symmetry 	<ul style="list-style-type: none"> Forced Use High Effort Motor Output 	<ul style="list-style-type: none"> Weight shift Fall prevention Agility

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Benefits For Your Patients



Become your patient's biggest asset

- Help them build confidence
- Fight impairments head on
- Slow deterioration and falls
- Keep them coming back for more!



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Our Mantra Is To...



**BE > TRAIN > LIVE
BRAVE!**

Taking People from Zero to 365 Days A Year

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Satisfaction Levels



Popielkiewicz et al., 2015

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Brave Blog Patient Stories



10 Week Challenge



- Weekly Education Webinars
- Daily Exercise program
- Community and Comradery
- Long Term Behaviour Change
- Life Changing!



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Tribe 365



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Vision

To change the lives of those living with Parkinson's one rep at a time. You're next...

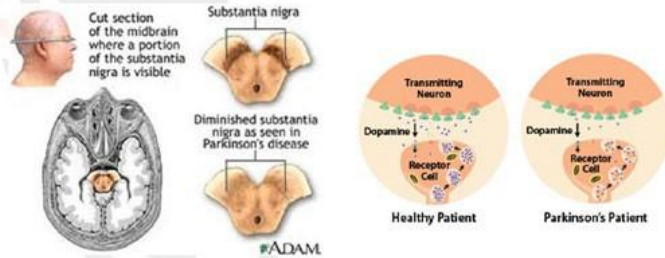
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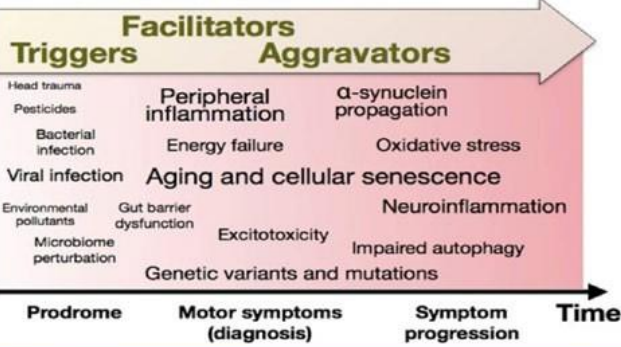
Module 2

Pathophysiology of Parkinson's

What is Parkinson's disease?



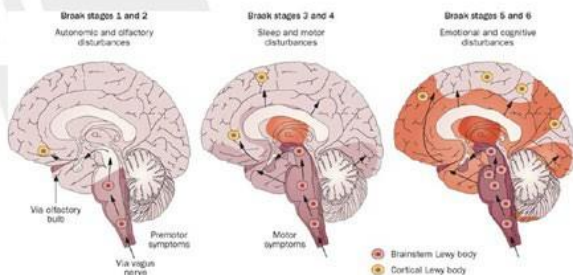
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Stecher 2019

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Braak stages



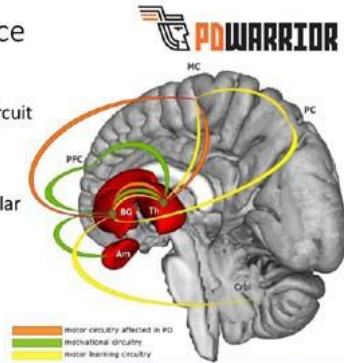
Braak and Del Tredici 2008.

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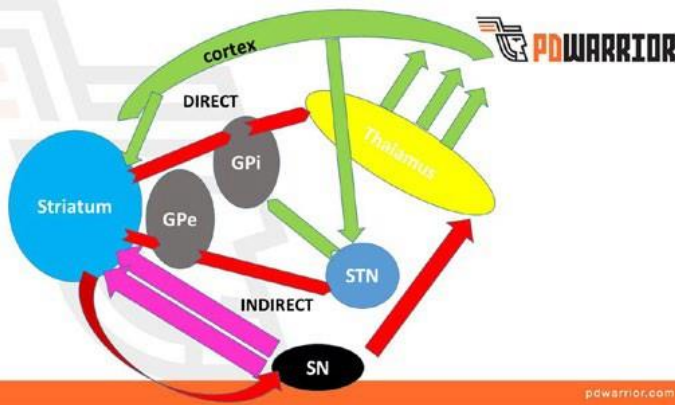
Brain Circuit Interference

- Cortico-striato-thalamo-cortical circuit
- Cerebello-thalamo-cortical circuit
- Meso-cortico-limbic circuit
- Cortico-striato and cortico-cerebellar



Zemankova et al 2016

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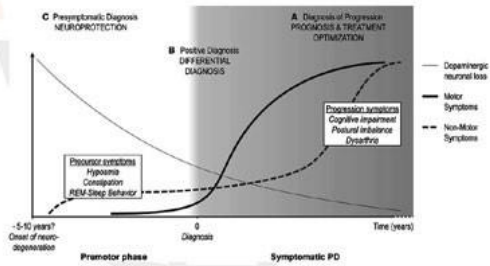
Clinical diagnosis of IPD

- Differential diagnosis!
- Tremor
- Bradykinesia
- Rigidity
- Exclusion of other neurological conditions
- Response to medication
- Non-motor symptoms



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Dopamine deficiency



Lebouvier et al 2010

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Primary Motor Impairments



- Hypokinesia
- Bradykinesia
- Tremor
- Rigidity
- Weakness
- Dyskinesia & Dystonia
- Akinesia
 - Difficulty initiating movement
 - Freezing



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Bradykinesia



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Rigidity



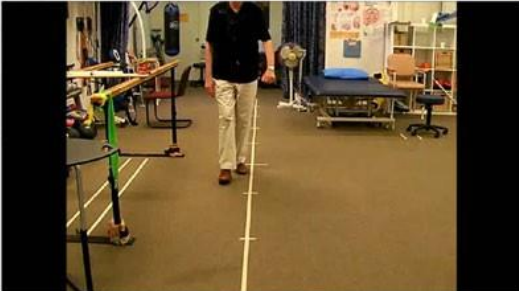
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Tremor



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Freezing of Gait



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Apraxia



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Dyskinesia



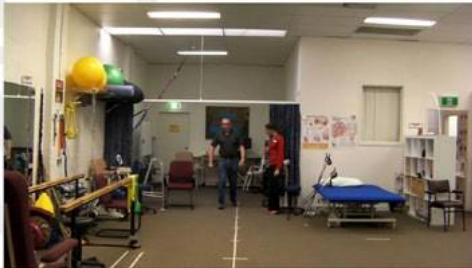
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Post DBS



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Dystonia



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Postural Instability



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Type of Parkinson's



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<ul style="list-style-type: none">• Amplitude• Scale• Symmetry	<ul style="list-style-type: none">• Forced Use• High Effort• Motor Output	<ul style="list-style-type: none">• Weight shift• Fall prevention• Agility

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Non Motor Impairments



- Depression
- Apathy
- Anxiety
- Cognitive impairment
- Ans dysfunction
- Insomnia
- Constipation



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Secondary Impairments



- Depression & Mood change
- Fatigue & Anxiety
- Weakness & loss of flexibility
- Falls and near misses
- Reduced cardiorespiratory fitness
 - Self care limitations
 - Mobility limitations
 - Hx of falls
 - Duration of disease



Decreased QOL

Soh et al 2013

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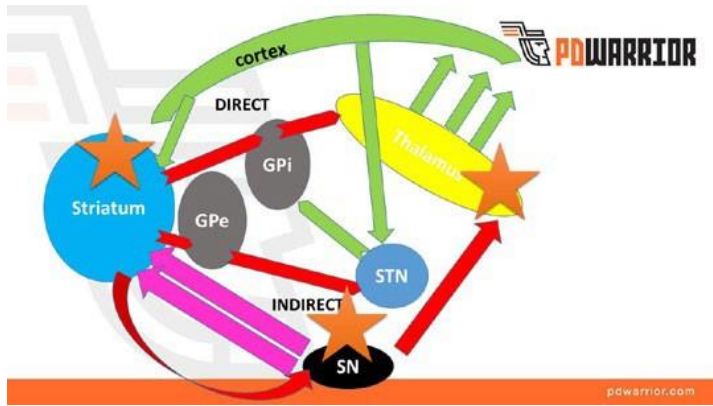
Precription Medication



- MAO-B Inhibitors- AZILECT
- Dopamine Agonists- SIFROL & APOMORPHINE
- Carbidopa/Levodopa therapy- SINEMET
- Anticholinergics- ARTANE
- COMT Inhibitors - ENTACAPONE
- Others- AMANTADINE



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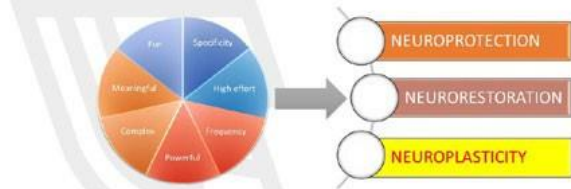
Module 3

7 CORE PRINCIPLES

PD Warrior Core Principles



New research suggests that exercise may slow, halt or reverse the progression of PD



Ahlskog 2011, Frazzitta 2015, Petzinger et al 2010

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Seven Core Principles



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Specific To Impairment



- Use it or lose it (defer the expected deficits)
- Use it and improve it (defeat the existing deficits)
- Different exercise approach for different impairments. No one size fits all.
 - Tremor Dominant
 - Post DBS
 - Bradykinesia
 - Anxious & MCI



Carcos et al 2013, Rochester et al 2010

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Type of Parkinson's



Bradykinesia	Tremor Dominance	Agility Impaired
<ul style="list-style-type: none"> • Amplitude • Scale • Symmetry 	<ul style="list-style-type: none"> • Forced Use • High Effort • Motor Output 	<ul style="list-style-type: none"> • Weight shift • Fall prevention • Agility

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Activity Limitations

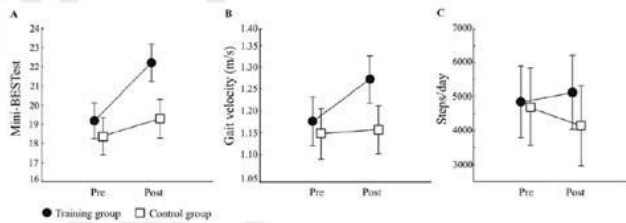


- Handwriting or typing
- Getting out of low chair or car seat
- Walking – different environments and contexts
- Rolling in bed
- Dressing & Grooming
- Eating & Meal prep
- Doing the laundry
- Unpacking the dishwasher
- Playing with or looking after grandkids



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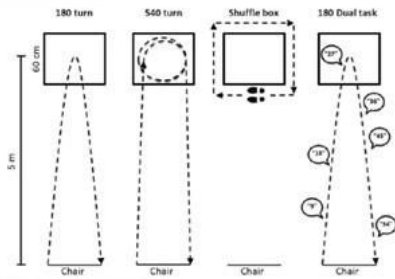
Specificity



Conraddson et al 2015

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Cognition and FOG



Walton et al 2018

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Non-motor Improvements



- Depression
 - Beck Depression Inventory II $p < 0.05$
- Fatigue
 - PD Fatigue Scale -17% ($p < 0.005$)
- PDQ-39
 - Emotional well-being (-11)
 - Bodily discomfort (-7.14)
- PDQ-8 $p < 0.05$

Morberg et al 2014; Kelly et al 2014; Cugusi et al 2014

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2. High Effort



- Metabolically prepares neural substrates to learn- **neuroplasticity**
- Drives BDNF and GDNF -**neuroprotection**
- Alters cortical hyperexcitability - **neurorestoration**

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Role of BDNF

- Brain-derived neurotrophic factor and glial derived neurotrophic factor
- Striatal upregulation of BDNF & GDNF
- Endogenous increase of BDNF & GDNF in SNPC and Striatum
- BDNF is a key component in neurogenesis, synaptogenesis and cell survival.

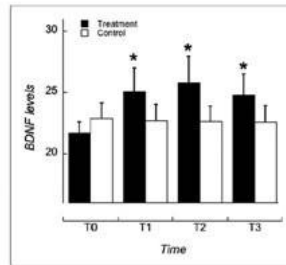
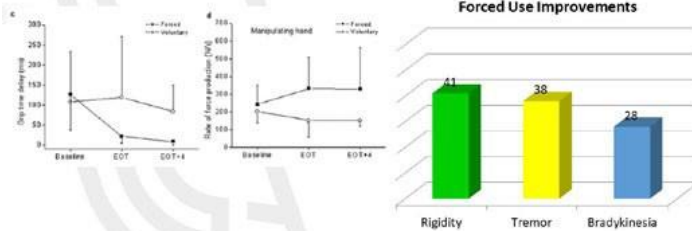


Figure 2. Time course of brain-derived neurotrophic factor (BDNF) serum levels. Time course of BDNF serum levels in the group of patients who underwent intensive rehabilitation treatment (black) and in the control group (white) at time T0 (admission/visit), T1 (10 days after), T2 (20 days after), and T3 (discharge, 28 days after). * $P < .017$.

Frazzitta et al, 2014

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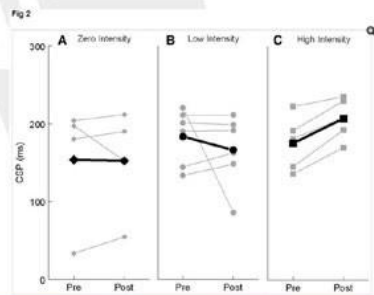
Forced Use



Ridgel et al 2009

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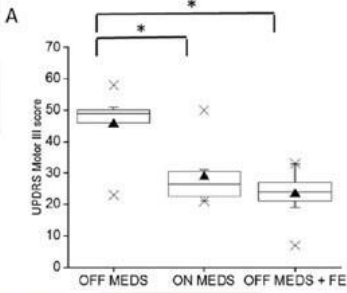
High Effort



Fisher et al, 2008, 2013, Petzinger et al 2010, 2013

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Neurorestoration



Alberts et al 2015

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PD Warrior RPE Scale

"I am powerful and feisty!"

PD WARRIOR RPE SCALE	
10%	I'm not even pretending to do this exercise
20%	I'm doing the exercise with insignificant effort
30%	I'm going through the motions and feel less than impressive
40%	I could do this exercise all day
50%	I could do this exercise at least fifty times and not break a sweat
60%	I am starting to generate power and force in my movements
70%	I am starting to feel athletic and definitely breaking a sweat
80%	I am powerful and feisty. I am moving like a PD Warrior!
90%	I am at risk of levitating. I am moving so vigorously
100%	I am going to hurt myself, someone else, or the furniture.

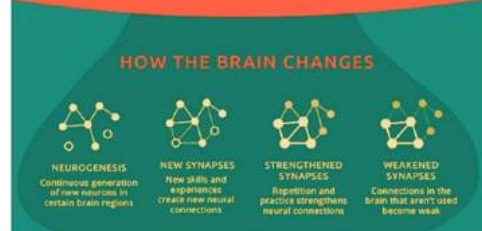
3. Frequency



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NEUROPLASTICITY

The Ability of the Brain to Reorganize Itself,
Both in Structure and How it Functions



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Skill Acquisition



- Neuroplasticity = re-organisation of the neuronal pathways in response to stimulation.
- Best methods to drive skill acquisition through practice
 - Variability & random practice
 - Problem solving with reward
 - Challenging & effortful
 - Rate of skill acquisition & performance plateau
- Stages of skill acquisition:
 - Cognitive *what to do*
 - Associative *how to do it*
 - Autonomous *automaticity*

Carr & Shepard 1987, Olivier et al 2019

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Motor Learning



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4. Power



- Amplitude
- Speed
- Accuracy



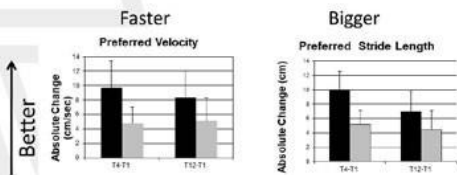
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Coaching Power



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Amplitude Training



Improvements occurred in both groups and lasted 3 months.
ES 2X larger for BIG

Farley and Koshland 2009, McDonnell et al 2018

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5. Complexity



- Role of automaticity
- Dual tasking interference
- Skill acquisition & automaticity
- Generalisability, Adaptation & Retention



Penko et al 2018, Strouwen et al 2015, 2019

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Lever



- Temporal
- Spatial
- Increase accuracy
- Hierarchy of DT interference

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Hierarchy of Dual Tasking

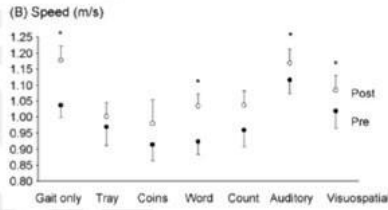


Fig. 1. Step length (A) and gait speed (B) across the single task (gait only) and six dual task conditions, pre- (filled circle) and post- (open circle) training. *Significant difference between pre and post. Error bars denote standard error of the mean.

Brauer 2009, Wild et al 2013

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6. Meaningful



- Goal driven and salient
- Functional for everyday activities
- Rewarding and motivating
- 'I am doing PD Warrior because....'



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Goal Setting

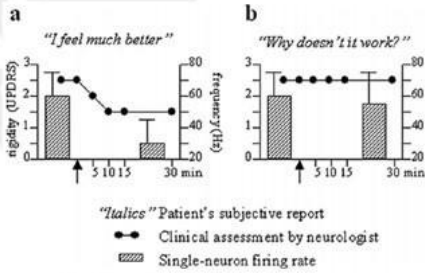


- Link main problems
- Define short and long term goals
- Smart verse Dumb goals
- Define obstacles to achieving goals

SMART V DUMB

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Self-efficacy & Placebo



Benedetti et al 2004

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Barriers To Exercise



Barriers:

- Low outcome expectation
- Lack of time
- Fear of falling

Facilitator:

- High self-efficacy
- Quick wins



Ellis et al 2013, 2015

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7. Fun!



Natbony et al 2013, Yin et al 2008

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Benefits of Group Based Training

- High energy level
- Cost effective
- Social & Fun
- Motivating
- Challenging
- Social Modelling
- Accountability



COMMUNITY!

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Module 4

EFFECTIVE COACHING



PEOPLE DON'T DIE OF PARKINSON'S DISEASE

THEY LIVE WITH IT.....

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Why Is it Important?

- Your client is likely thinking:
 - Progressive condition that they can do little about
 - Too mild for you to help them
- No-one has told them that they can improve. You might be the first.
- Their journey is going to be hard work and we want them to live their best life

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Purpose of Motivation?



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Failure To Complete Set Goals



1. Forget to take action or have second thoughts at the critical moment
2. Denial or Lack of insight
3. Cognitive Impairment
5. Negative self-state, such as a bad mood or feeling distressed
6. Expectations of a negative effect
7. Failure to embed into long-term behaviour patterns
8. Failure to set clear and effective goals
9. Lack of support

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Motivational Concepts



Intrinsic	Extrinsic
Driven by interest or enjoyment of the task itself	Performance based activity to attain an outcome
Self motivated to improve	Incentive based to improve
Eg: mastery	Eg: competition, money and threats of punishment

NB: Extrinsic motivation can become internalised by the individual if the task fits with their values and interest. Can drive self-motivation if empowered.

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Where Do You Sit?



TRADITIONAL MODEL

- Patients should change
- Want to change
- Health is a major priority

COACHING MODEL

- Facilitate autonomy
- Identify barriers
- Drive self-efficacy

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Where Does Your Patient Sit?



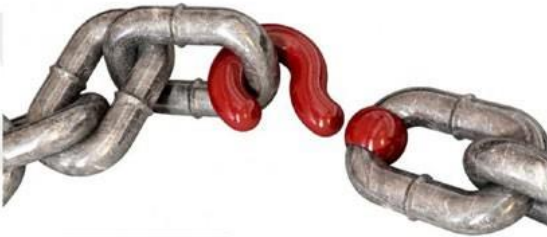
1. Pre-contemplation
2. Contemplation
3. Preparation
4. Action
5. Maintenance



Prochaska et al., 1992

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Techniques



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1. Engagement



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Equipment



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Music

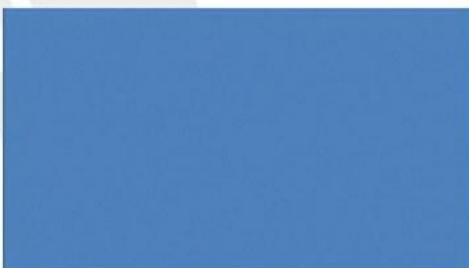
- Beat and volume roughly 60bpm
 - 110bpm Survivor
 - 120bpm Black Betty
 - 130bpm Black Eyed Peas
 - 140bpm Coldplay
 - 150bpm Twisted Sister
- Creating an atmosphere
- The right playlists



<http://log.in/popular-workout-songs>

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Develop A Tradition



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Fun



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**NO
CHALLENGE
NO
CHANGE.**

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Buy In



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Are You Your Client's Biggest Asset?



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2. Drive Self-efficacy



Ellis and Merl 2013, Ellis et al 2013

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Educate



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Empower



• "How important is exercise for you?".....
0 1 2 3 4 5 6 7 8 9 10

• "How confident are you that you can exercise regularly if you decide to do so?".....
0 1 2 3 4 5 6 7 8 9 10

*What would have to happen to change your 3 to a 7?
What is stopping you from rating higher?*

Rollnick et al, 1999. Budden & Sagarin 2007

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Implementation Intentions



• If situation Y is encountered, then I will do Z

IF			THEN	
What	When	Where	How	Who

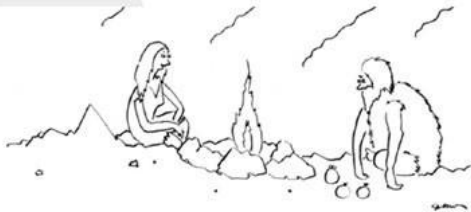
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Reward



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Saliency



"Enough with the low-hanging fruit. How about some slow-moving meat?"

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Communication



- Simple commands and single cues
- Reduce processing time with YES or NO response
- Give appropriate feedback- don't over exaggerate
- Prompt constant Self-reflection & RPE
- Objective and non-judgemental

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Feedback



- Learning through feedback
 - Visual, manual, proprioceptive
 - Error based and problem solving
 - Implicit verse explicit learning
 - Autonomous verse directed
 - Social context

play = learning



Petzinger et al 2013, Flanagan et al 2003

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3. Behaviour Change



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Evaluating Adherence



- Regular assessment of patient adherence by itself can lead to increased patient adherence
 - Do you ever forget to do your exercises?
 - Are you complacent at times about doing your exercises?
 - When you feel better, do you sometimes stop doing your exercises?
 - Sometimes, when you feel worse, do you stop doing your exercise?

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Simplify Program Characteristics



- Home program
 - Fewer exercises - 3-4 exercises
 - Once a day
 - Complex stages introduced sequentially
- Goals
 - Linked to deeper meaning and reasons for change

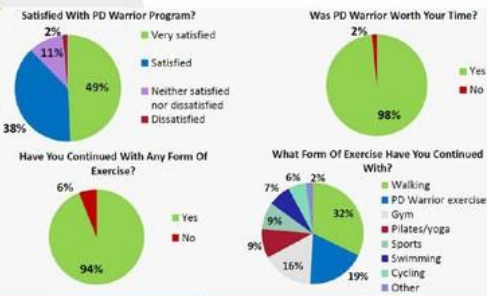
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Sustainable



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Satisfaction Survey



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Team Bonding



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Create A Community

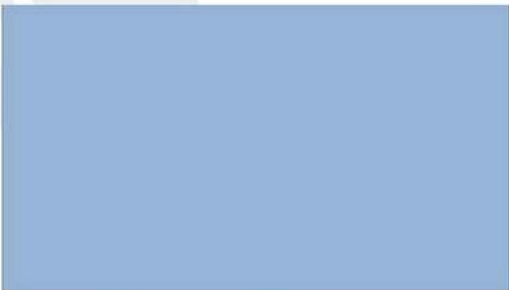


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PD Warrior in Action!



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Module 5

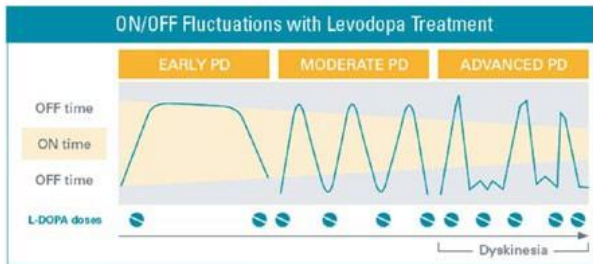
ASSESSMENT

Therapy Model



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ON or OFF?

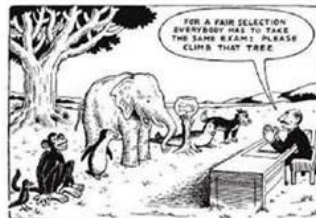


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Assessment



- Type of Parkinson's
- Primary/secondary impairments
- Functional problems
- Brave goals
- Limiting PHx
- Level of cognitive impairment
- Readiness & motivation
- Dual task capacity
- Current exercise behaviours
- Medications
- Logistics/barriers to completing program
- Support network
- Expectations of therapy



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Subjective



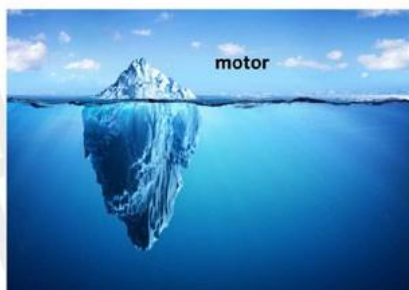
- Current medical history
 - date of diagnosis, specialist involvement
 - main presenting symptoms (m & nm)
- Past medical history
- Social history
- Medications and advance therapies (any ON/OFFs)
- Expectations of therapy
- Brave Goals

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Non-motor symptoms



- Fatigue
- Constipation
- Urinary Urgency
- Cognitive Impairment
- Anxiety & Depression
- REM Sleep disorder
- Hallucinations
- Restless leg syndrome



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Objective



Functional Tasks!

- Walking. Quality, endurance, confidence?
- Pick biggest problem tasks from SPDDS and subjective Ax
- 'let me see you do that'
- E.g. Rolling/STS/buttons/dressing/opening doors
- Dual tasking, Balance, quality, very early stage education

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Impairments



- Rigidity
- Bradykinesia
- Tremor
- Postural Instability
- Freezing
- Non-motor

Look and feel!

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Outcome Measures



- 10mwt
- 6mwt
- miniBEST
- PDQ-39
- PD-PRO
- IPEQ
- SPPDS
- PSFS
- HiMAT
- 10 Bean Test
- Challenge Task
- Video footage and analysis

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Show me how you do that



- Specific and functional
- Meaningful to client
- From their list of biggest problems!
- Timed
- Re test during session and between sessions
- Begin to apply new way of moving in everyday life...your client sees success...REWARD!
- PSFS

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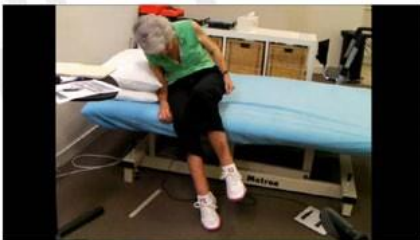
Light Bulb Moment

- Complex task
- Dual task activity



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Challenge Task



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Goal Setting

- Specific
- Measurable
- Achievable
- Relevant
- Timely



- Daring, dream driven
- Uplifting
- Magnificent
- Brave

SMART V DUMB

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Tips to help identify meaning



- What do you most enjoy doing?
- What makes you happy?
- What qualities, skills or talents do you have?
- List your best wow moments and accomplishments from doing PD Warrior so far
- Articulate 'I am doing PD Warrior because...'

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Precautions & Contraindications



- Falls & near misses
- Freezing
- Atypical presentation
- Unstable cardiac or respiratory system
- Concurrent conditions
- Cognitive impairment
- Apathy, anxiety & depression

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Treatment planning



- Falls & near misses
- Freezing
- Atypical presentation
- Unstable cardiac or respiratory system
- Concurrent conditions
- Cognitive impairment
- Apathy, anxiety & depression

TREATMENT PLAN

NAME: _____
ADDRESS: _____
PHONE: _____

GOALS	START DATE	STATUS

ADDITIONAL SERVICES

Home Instruction Personal Trainer Support Registered for SHRED

EMERGENCY NUMBER (if not 911): _____
EMERGENCY SERVICE PROVIDER: _____
DATE: _____

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Gait values



METRES	SECS	M/S	STEPS	STRIDE CM
10	35	0.29	35	57.14
10	30	0.33	30	66.67
10	25	0.40	25	80.00
10	20	0.50	20	100.00
10	18	0.56	18	111.11
10	16	0.63	16	125.00
10	14	0.71	14	142.86
10	12	0.83	12	166.67
10	10	1.00	10	200.00
10	9	1.11	9	222.22
10	8	1.25	8	250.00
10	7	1.43	7	285.71
10	6	1.67	6	333.33
10	5	2.00	5	400.00
10	4	2.50	4	500.00

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6 minute walk test



Age	Gender (N)	Mean	SD	Normal Range (2SD)
60-69	Male (15)	572m (1,877 ft.)	92 m	388-756 m
	Female (22)	538 m (1,765 ft.)	92 m	354-722 m
70-79	Male (14)	527 m (1,729 ft.)	85 m	357-697 m
	Female (22)	471 m (1,545 ft.)	75 m	321-621 m
80-89	Male (8)	417 m (1,368 ft.)	73 m	271-563 m
	Female (15)	392 m (1,286 ft.)	85 m	222-562 m

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6. Due to having Parkinson's, how often during the last month have you...

	Never	Occasionally	Sometimes	Often	Always or cannot do at all
Had difficulty getting relaxed in public?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Had difficulty dressing yourself?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt depressed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Had problems with your drive (planned, electronic)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Had problems with your concentration eg when reading, watching TV?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt unable to communicate with people properly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Had painful muscle cramps or spasms?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt embarrassed in public due to having Parkinson's disease?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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