Meeting the Challenges of Parkinson’s Disease (Part 2 of 3)

Resources collated for the WACHS South West Clinical Update Day
May 2013
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All information current at May 2013. No responsibility accepted for currency of information accessed after this date
Resource description

These resources were collated by the WA Health Training Centre in Subacute Care (TRACS WA) for the PD Clinical Update day initiated by Bunbury Hospital Subacute Services held in May 2013. This document is a collation of the presentations delivered.

All information was current at the time of the event.

TRACS WA provided funds from the Subacute Learning Fund to support the day and worked with the South West Subacute service to develop the content.

The input of WA Health staff in the development of these resources is acknowledged within the body of the work.

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Presentation Titles (all parts)

1. Overview of the Day
   Stephanie Daniels, Regional Sub Acute Care Coordinator WA Country Health Service - South West

2. Parkinson’s Disease Overview
   Dr Ramesh Parthasarathy, Geriatrician Bunbury Hospital

3. Medical management: pharmacological therapies in PD and side-effects
   Dr Ramesh Parthasarathy, Geriatrician Bunbury Hospital

4. Medication management and nursing implications
   Marieta Simmons - NCWA Neurological Nurse

5. Consequences of PD and Rehabilitation Strategies (The Kingston Principles)
   Tanya Larsen (OPH Senior Physiotherapist)

6. Managing mobility and activities of daily living: Practical assessment and treatment strategies
   Tanya Larsen (OPH Senior Physiotherapist) and Emily Cheetham (OT, OPH)

7. Falls, Exercise and the Evidence
   Tanya Larsen (OPH Senior Physiotherapist)

8. Non-motor symptoms and management implications: Autonomic symptoms; Sleep; Mood; Cognitive decline/ dementia
   Jo Chadwick (PDAWA Nurse Specialist) and Emily Cheetham (OT, OPH)

9. Preventing malnutrition, weight loss and complications associated with aspiration
   Denise Stapleton and Gillian Penman (Dietitian & Speech Pathologist Fremantle Hospital – Moss St Clinic)

10. Addressing patient and carer support – case management and future care planning
    Beng Lin Tan (Social Work Fremantle Hospital – Moss St Clinic)
Consequences of PD and Rehabilitation Strategies

Tanya Larsen – Senior Physiotherapist
Osborne Park Hospital
Parkinson’s Disease Clinic
Cardinal Characteristics of PD

- Bradykinesia
- Resting tremor
- Rigidity
- Postural instability
Consequences of PD

Anxiety and Depression

- Bradyphrenia (slowed thought processes)
- Problems with Memory and concentration
- Stood posture
- Akinesia (absence or poverty of movement)
- Loss of postural reflexes
- Shuffling and festinating gait
- Fine motor problems
- Micrographia
- Dressing difficulties
- Pain
- Dystonia
- Mask-like facial expression
- Drooling
- Swallowing difficulties
- Hypophonia (Low vocal volume)
- Eating Difficulties
- Weight loss
- Constipation

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The Basal Ganglia

- The basal ganglia requires dopamine to plan & control well learnt automatic movements & complex motor skills

- PWP have basal ganglia dysfunction resulting in impaired initiation, quality and control of automatic movements
  - results in the varied Consequences of PD
Bypassing the Basal Ganglia: Cognitive Movement Strategies

There are several strategies used to overcome these movement difficulties.

- **Movement strategies** are based on the assumption that normal movement can be obtained by teaching the individual to bypass the basal ganglia pathology (instead recruiting the frontal cortical pathways of brain):
  - “Normal movement is possible. Activation is needed”

- Treatment needs to be within the context of functional tasks.

- Therapy most effective at peak dose.
Movement Strategies –
The ‘Kingston Principles’ -

Founded by Kingston Movement Disorders Clinic in Victoria

- These principles underpin facilitation of normal movement patterns in PwP
- Adopted by OPH – forms the basis for majority of our treatment

1. Normal movement is possible . Activation is needed
2. Break down movements/tasks into steps (Example: Rolling)
3. Constant Attention
4. Avoid dual tasking (ie: avoid 2 tasks at one time)
5. Use Cues to initiate and maintain movement

- Requires MASS practice (over & over again)
1. Normal movement is possible - Activation is needed

- The basal ganglia in PwP is not able to provide internal cues to commence and maintain motor planning.
- Normal movement is possible by providing a substitute to the process.
2. Break down movements/tasks into steps

- The individual components are practiced before the entire task is completed as a whole
- Perform each part separately
- Verbally recite sequence
- **Example:** getting out of bed
  - Bend knees
  - Turn head
  - Reach with arm across body and roll onto side
  - Drop legs
  - Push to sit
  - Lean forward and stand up
3. Constant Attention

- By actively focussing on a task, the movements are voluntary, not automatic.
  - The frontal cortical pathways are recruited and the basal ganglia is “bypassed”

- Concentrate on one movement at a time

- Prepare in advance
  - STOP before starting a movement

Collated by TRACS WA
4. Avoid dual tasking (ie: avoid 2 tasks at one time)

- Multitasking involves doing at least 1 task automatically, whilst focussing on another
  - The 2nd task can be motor &/or cognitive

- In PwP the most automatic of the movements are the most affected
  - Eg: walking deteriorates when talking

- In PwP the ability to multi task will deteriorate as the illness progresses
5. Use Cues to initiate and maintain movement

- Cognitive or sensory cues can be implemented to trigger PwP to use conscious attention to overcome a performance issue
- Personal preference should be considered
  - *PwP respond differently to different cues*
- When introducing cues select a small number to trial, demonstrate, & ensure the PwP uses conscious attention
  - Provide feedback and encourage practice
- Over time, a cue loses its novelty and becomes ‘automatic’ and less effective
  - When this occurs small changes or new cues may be required to prevent the cue becoming “part of the scenery”
- If cue doesn’t work, try a different one
5. Use Cues (cont...)

**Internal** (*requires sufficient cognition and motivation)*

- **Visualisation**
  - Use imagination to visualise a cue
    - Eg: stepping over a line when frozen in a doorway

- **Mental rehearsal**
  - Imagining the steps required to complete a task prior to commencing it

- **Internal Dialogue**
  - As the task is performed the PwP gives a silent command to themselves
    - Eg: “write big” or “1, 2, 1, 2” or “nose over toes”

- **Proprioceptive**
  - eg: rocking side to side to help initiate movement

**External**

- **Visual**
  - Eg: tape placed on the in a contrasting colour can be used to guide step length and foot position
  - Cue cards
    - single instruction (eg: clock turn or high knees)
    - More detailed instructions (eg: to fasten buttons or get out of bed)

- **Auditory**
  - Concise verbal commands, used by either the PwP or a carer
  - Examples
    - “heels down” when festinating
    - Counting 1, 2, 1, 2 when turning
    - using a metronome or music can be used to provide a rhythm
Rehabilitation challenges / considerations

- Time in medication cycle (on/off periods)
- Fluctuating symptoms
- Anxiety
- Depression
- Apathy
- Fatigue (sleepiness and drowsiness)

- Stress
- Cognitive changes
  - Reduced attention
  - Impulsivity
  - Difficulty planning and problem solving
  - Easily cognitively overwhelmed
  - Decision making difficulty
Managing Difficulties with Mobility and ADL’s

Tanya Larsen – Senior Physiotherapist
Emily Cheetham – Occupational Therapist
Osborne Park Hospital
Parkinson’s Disease Clinic
Common Mobility Problems

- Walking
  - Hypokinesia
  - Akinesia
  - Festination
- Sit to stand
- Bed mobility
- Turning
- Dual Tasking
Common ADL Problems

- Dressing
- Eating
- Toileting
- Handwriting
- Tremor Management
Motor features impact both mobility and ADL performance. Therefore both the Physiotherapists and the Occupational Therapists at OPH Parkinson’s Disease Clinic use the same principles and movement strategies in our interventions.
**Gait - Hypokinesia**

**Features**
- Reduced amplitude of movement
- Characteristics (usually asymmetrical)
  - Arm swing
  - Step length
  - Ground clearance
- Energy inefficient / shuffling gait
- More pronounced at end of dose

**Strategies (to ↑ step length)**
- External CUES
  - Visual cues
    - eg: Step over white lines on floor
  - Auditory cues
    - eg: “big step”, “heel down”, “swing arms”
- Attentional strategies
  - visualisation
  - mental rehearsal

Collated by TRACS WA
Video - Walking without cues
Video – Walking with visual cue
Gait – Akinesia

Features

- Problems with *initiation* and *continuation* of movement

2 types:

- **Start Hesitation**: Problem with movement *initiation*
- **Motor Block/Freezing**: Sudden *cessation* of movement pathway through an action sequence

- Context dependent
  - Examples:
    - doorways
    - Cluttered rooms
    - Confined spaces
    - Moving escalators
    - Crowded shopping centres
    - Complex visual processing situations

- Often unresponsive to levodopa

Strategies

- Relax
- **External CUES**
  - Visual
    - Focus on tape on floor
    - Cue card
  - Auditory
    - Sudden clap
    - Counting, L/R marching

- **Internal cues**
  - **Proprioceptive**
    - Rock from side to side
    - Take a step sideways or backwards
  - **Attentional**
    - Step over an imaginary object
Timed Up and Go (TUG)
Start hesitation and freezing
TUG – using strategies
U step laser walker

How it differs from a standard walker

- **U-Step** surrounds the patient (pts may feel more stable)
- Laser beam between the rear wheels
  - Useful as a visual cue to overcome start hesitation or motor block
- Braking system –
  - Must squeeze one (or both) of the hand levers to move
  - Once you release the hand lever, the walker stops
- Dual tasking
- Cost – approx $1200
Laser stick
Gait - Festination

**Features**
- A gait in which the patient involuntarily moves with short, accelerating steps, often on tiptoe, with the trunk flexed forward
- Can often lead to falls

**Strategy**
1. **STOP**
2. Heels down
3. Stand up straight
4. **Think** about taking a big step
5. Step out and take a long step with heel down first

Collated by TRACS WA
Sit to stand

**Features**

Why is this difficult?
- It’s a sequential movement
- Bradykinesia ♦ Results in difficulty generating momentum
- Failure to move bottom to the edge of the chair
- Rigidity and ↓ in amplitude of movement ♦ causing failure to lean forwards enough
- Akinesia

Other contributing factors
- Fear of falling forwards
- Reduced lower limb muscle strength

**Strategies**

Break movement into parts
- Cue card
  
  **Getting out of a chair**
  1. Hands on chair  
  2. Move bottom forwards  
  3. Feet underneath you  
  4. Lean forwards – ‘nose over toes’
  5. Push to stand up

- Attentional: Mental rehearsal
- CUES
  - Verbal cues (counting; “stand up”)
  - Proprioceptive cues (rocking forwards and back)
- Environment Mods
  - Chair with adequate seat height and arm rests
    - Avoid soft low lounge chairs
  - Chair skis / glides
  - Avoid office/rocker chairs

Collated by TRACS WA
Bed Mobility

**Features**
- Difficulties getting into / out of bed & rolling
- Problems with initiating & then continuing rolling
  - when in bed at night
  - Low medication levels
  - Poor lighting
  - ↓ consciousness
  - Urgent need for toileting
  - Nocturia

**Strategies**
- Slow acting L-dopa medication
- External cues - Verbal / visual
- Mental rehearsal
- Task breakdown (handout)
- **Environment Mods**
  - satin sheets &/or PJ’s
  - Lightweight quilt / bed cradle
  - Bed height not too low
  - Bed rail
  - Mattress firmness
    - Bed board
- **Toilet Strategies at night**
  - Urinal bottle, bedside commode, urodome

Collated by TRACS WA
Bed Mobility

GETTING OUT OF BED – RIGHT SIDE
Think through the steps before starting.

1. Bend knees

2. Turn head to right

3. Reach with left hand to roll onto right side

4. Drop legs

5. Push to sit

6. Lean forward and stand
Turning

**Features**

- Unable to take large steps and change direction at the same time

- As a result – progressive ↓ of step size and ground clearance
  - swivelling on spot
  - falls risk

- Can lead to freezing

**Strategies**

- Walking arc turn
  - Maintain large steps when turning in an arc instead of turning on the spot
  - Turn head in direction of the turn

- Clock turn
  - Turning from a stationary position or in narrow spaces

Collated by TRACS WA
Walking arc turn

for open spaces

When walking *in an open space* and you need to turn a corner or turn around, use an arch turn to ensure you do not lose your balance.
Clock turn strategy

for confined spaces (eg: toilet / kitchen)

CLOCK TURN

CLOCK TURN PRACTICE: PLACE STRIPS ON THE FLOOR AS DRAWN

Stand in the middle of the cross
Imagine the strip of tape in front of you is 12 o’clock,
The strip to the right is 3 o’clock, and
The strip to the left is 9 o’clock

To turn to the right: turn right leg out and take big step to right (towards 3 o’clock position). Left leg to follow

To turn to the left: turn left leg out and take big step to left (towards 9 o’clock position). Right leg to follow

Balance needs to be taken into consideration
Video – Turning
Combining arc turn and Clock turn: Approaching a chair/bed & turning to sit

- Plan your route.
- Imagine a curve directly in front of the chair/bed. *Picture yourself* walking with long steps in a curve as you approach the chair/bed.
- Concentrate only on taking ‘long steps’ and ‘heels down first’ as you are walking.
- Walk as close to the chair/bed as possible before turning to sit down (avoid stepping backwards) keeping feet apart.
- Step around, keeping feet apart, until you feel the chair/bed behind your knees.
- Feel the chair against the back of your legs before you sit down.

You can approach the chair from either side.
**Dual tasking**

**Features**
- Difficulty with sequential movements when performing another task at the same time
- Examples:
  - walking and talking
  - Walking and carrying a cup of tea

**Compensation Strategies**
- Avoid if possible
- Consider alternative methods to carrying objects
  - Place drinks on a tray mobile
  - Use laundry basket to carry washing
  - Place clothing / belongings in a backpack
  - Sit to dress

*Strategy depends on stage of disease*
Dressing

**Features**
- Muscle stiffness
  - Reduced dexterity e.g. difficulty with buttons/zips
  - Difficulty bending down for lower limb dressing
- Impaired balance
- Executive dysfunction
  - Impaired planning, attention & dual tasking
- Bradykinesia

**Strategies**

- To fasten buttons:
  - Sit Down, and say to yourself…
  - ‘Grip Button…’
  - Find Hole…
  - Push Button into Hole…
  - And…Pull’

- General Principles
  - Simplify the task – sit down, appropriate clothing etc
  - Collect all clothing first
  - Reduce distractions

Collated by TRACS WA
Eating and Drinking

**Features**
- Muscle stiffness
  - Reduced dexterity
- Tremor
- Bradykinesia
  - Food becomes cold & unappetising
- Social avoidance
- Hypokinesia

**Strategies**
- Assistive aids/equipment
- Remedial hand therapy
- Posture
- Environmental considerations e.g. distractibility
- Compensation
- Cognitive movement strategies
Handwriting

**Features**
- Executive dysfunction
  - Impaired planning, attention & dual tasking
- Bradykinesia
- Micrographia
- Poor legibility e.g. tremor, impaired dexterity

**Strategies**
- Plan ahead
- Avoid dual tasking and distraction
- Allow sufficient time
- Posture
- Print
- Use lined paper
- Assistive equipment
- Verbal and visual cues e.g. write big

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Tremor Management

**Features**
- May not respond to L dopa
- Resting tremor
  - Ceases on activity
- Action tremor
  - Does not cease in purposeful activity
- Can increase with
  - Fatigue
  - Stress/anxiety/frustration
  - Dual tasking
- Fluctuates
  - “on”/“off” periods

**Strategies**
- Manipulate coins in pocket
- Clasp hands together or lean on thigh
- Place hand under thigh
- Support forearm/wrist with opposite hand during activity e.g. brushing teeth
- Lean elbow on table
- Wrist splint (task specific)
- Avoid dual tasking
- Relaxation techniques
Toileting

**Features**

- Freezing and hypokinesia
  - Toilets are often in confined spaces
- Difficulty with:
  - Transfers
  - Sitting symmetry
  - Managing clothing
  - Managing wiping
- Continence
  - Urinary urgency and rushing
  - Constipation
  - Overnight toileting

**Strategies**

- Arc turn to approach
- Clock turn to sit down
  - Cues
- Over toilet frame/seat raiser
  - Consider effect on constipation
  - Consider effect of symmetry
- Rails/toilet surround
- Cognitive movement strategies
- Easily accessible clothing e.g. buttons/zips vs elastic/velcro
- Flushable wet ones
- Foot stool
- Bedside commode, urinal bottles, urodomes

Collated by TRACS WA
Questions
Falls, Exercise and the Evidence

Tanya Larsen
Senior Physiotherapist
Osborne Park Hospital
Parkinson’s Disease Clinic
Balance / Falls

**Features**

- **Postural instability** – an inability to respond to internal or external perturbations
  - Impaired automatic postural & protective responses
- **Falls in PD**
  - Most falls are “intrinsic” & task related rather than environmental
  - Often unresponsive to L-dopa
  - 60% of PWP have at least 1 fall per year
  - Often multi-factorial
- **Contributors to falls** (other than balance)
  - Hypotension
  - Dyskinesia
  - Gait difficulties
    - Festination
    - Freezing
    - Shuffling (Reduced step height)
  - Rigidity
  - Fear of falling
  - Age related changes independent of the process of PD
Strategies to prevent and manage Falls

**Strategies**

- Plan in advance for potential threat to balance
- **Balance re-training** (includes stepping rxn’s + ankle/hip strategy)
- Balance tips (wide BOS, hold onto supportive surface when doing another task)
- Walking aids
- Environmental modifications (eg: Reduce clutter / visual busyness)
- Education / Prevention
  - Falls diary
  - Training up from floor
  - Hip protectors / knee pads
  - Be aware of postural hypotension
  - Avoid dual tasking
  - Suitable shoes
    - Textured insoles can improve postural stability, particularly during more challenging balance tasks
  - Don’t walk with hands in pockets
  - Modify behaviour
Research on Balance Re-training

Balance and Falls in Parkinson’s Disease: A Meta-analysis of the Effect of Exercise and Motor Training

Natalie E. Allen, PhD, C. Catherine Sherrington, PhD, Serene S. Paul, BAppScPhy(Hons), and Colleen G. Canning, PhD

Movement Disorders, Vol 26, No.9, 2011

Aim: To examine whether exercise and motor training improves balance related activity performance and falls in people with PD

- Also to investigate if the total dose of exercise and the presence of highly challenging balance re-training are associated with the size of effect of intervention on balance.

Conclusions:

- Exercise & motor training can improve performance of balance-related activities in PwP
- Highly challenging balance exercises (HCBE) should be part of rehabilitation programs for people with PD
  - HCBE was defined as involving all of: movement of the centre of mass, narrowing the BOS, and minimising upper limb support
- There was no association b/w the total number of intervention hours & the effect of intervention on performance of balance related activities
  - Trials in the current R/V averaged 18 hours of Rx over 7 weeks (~2.5hrs/week)
- It is unclear whether exercise and motor training can reduce falls in this population
  - Further research is required; Falls are Multi-factorial, not just related to balance
- It is important to develop effective, sustainable programs that people with PD can participate in for the long term
  - Such programs may improve QOL of people with PD, and their families, as well as easing demands on the health care system
Secondary Sequelae and EXERCISE

Features of Secondary Sequelae In PD

Muscle Weakness
Muscle Tightness
Poor Posture
↓ aerobic capacity

Exercise Programs should include the following components:

**Muscle Strengthening**
EG: Using task specific Training eg: sit to Stand

**Muscle Lengthening**
EG: muscle stretches
• lying face down for 10-30 mins/day

**Posture Re-education**
EG:
• using mirrors
• standing with back to wall
• special seating

**Fitness Training**
EG:
* walking (treadmill or outdoors)
* cycling, swimming, golf, dancing

* do exercise programs during “on times” / peak dose of medication
Exercise Options

EDUCATION re exercise options is very important

- Depends on the stage of the disease
  - Stage I & II: Aim for 30 minutes of moderate intensity exercise, most days of the week
    - Recreational activities – eg: dancing, golf, tennis, gardening, cycling, yoga, tai-chi
  - Later stages will require guided programs
  - Options:
    - Individual Physiotherapy (short term) and home exercise program (for specific / personal goals)
      - Bursts of goal directed PT beneficial
    - Exercise Groups (for general goals)
      - Hospital based or community Groups
      - Living Longer Living Stronger (LLLS) – gym based programs

Collated by TRACS WA
Exercise Options (cont...)

- Hydrotherapy (* not swimming)
- Private Physiotherapy
  - DVA, Enhanced Primary Care Program (5 sessions)
- Walking groups
- Gym based exercise program
- Nintendo Wii

ória  long term self management

- Physio needs to gradually shift roles over time from a “doer” & “coach” to a “consultant”
- Patient needs to take on the responsibility for maintaining activity (helps if it is enjoyable!)
Alternative Exercise Options: Tai Chi and Dancing

TAICHI

• This study evaluated three different forms of exercise – resistance training, stretching, and tai chi – & found that tai chi led to the greatest overall improvements in balance and stability for patients with mild to moderate PD (Sample size = 195 patients)

DANCING (Dance for PD®)
• In USA and Europe; coming to Australia
• The Dance for PD® program is A non-profit collaboration between the Mark Morris Dance Group and the Brooklyn Parkinson Group
• It provides teacher training and nurtures relationships among other organizations so that classes are widely available
Length of Physiotherapy Treatment / Exercise

To improve physical capacity (eg: strength or fitness), a treatment of at least 8 weeks is recommended
- If clients can perform a home exercise program, physio review once a week is sufficient to progress the program

To Improve functional ability (eg: transfers) a treatment period of 4 weeks is recommended

References:
KNGF Guidelines for physical therapy in patients with Parkinson’s disease
Plant et al Guidelines for physiotherapy practice in Parkinson’s Disease. Newcastle, UK: University of Northumbria, Institute of Rehabilitation; 2001
Recommendations to Improve Adherence to Exercise


Recommendations:

• Make programs flexible
• Provide strategies to overcome problems with motivation
• Provide feedback about exercises
• Offer a variety of exercises
• Utilise group support
Exercise: Muscle Strengthening

Progressive Resistance Strengthening Principles in PD

GUIDELINES

• All exercises will be steadily progressed, either by ↑ing the number of reps, or the resistance used

• In some cases, the starting position &/or the number of sets may also be used to progress an activity

• The Modified Perceived Exertion Scale (RPE) (Foster et al, 2001) is to be used by patients to determine how hard to work, and by therapists to decide when to progress an activity

• Activities are first performed without resistance until correct form is achieved. RPE at this stage should not exceed 2-3 (easy)
  • Aim for a minimum single set of 8 repetitions for each activity, building to 10
  • Younger, fitter or less disabled subjects may perform 2 or 3 sets at similar RPE
  • Once correct form is achieved, subjects RPE should be between 5-7 (hard to very hard)

• When RPE drops below these values, the activity should be progressed by:
  • *increasing repetitions to a maximum of 15 per set
  • OR increasing sets from 1 to 2 to 3
  • OR increasing resistance by adding 2% of subject’s bodyweight to vest
  • *max values to be determined by therapists based on their clinical judgement

• When an activity is progressed either by ↑ ing the number of sets or adding weights, reduce the number of reps in each set down to 8, then build up again

• Emphasise control of eccentric part of each activity, as well as concentric
# Muscle Strengthening (cont...)

## Modified Perceived Exertion Scale

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<th>Rating</th>
<th>Descriptor</th>
<th>Comment</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>Rest</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Very, very easy</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Easy</td>
<td>While learning correct form</td>
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<tr>
<td>3</td>
<td></td>
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<tr>
<td>4</td>
<td>Moderate</td>
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<td>5</td>
<td>Hard</td>
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<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Very hard</td>
<td>Once correct form mastered</td>
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<tr>
<td>8</td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Very, very hard</td>
<td></td>
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Muscle Strengthening (cont...)  
Examples of core / extensor strength exercises

- Sit to stand
- Trunk extension and rotation
- Lateral pelvic hold
- Step ups
- Heel raises
- Ankle dorsiflexion
- Abdominals
Research on Muscle Strengthening

Few studies were found in the literature that have examined whether patients with PD benefit from muscle strengthening:

Study by Dibble et al. 2006:

- **Subjects:** 20 participants with mild to moderate PD
  - Allocated to experiment group (n=10) or control group (n=9)

- **Intervention:**
  - All participants exercised for 30-40 mins, 3x/week for 12/52
  - Subjects in experiment group substituted LL strength exercises (eg: squats, heel raises) with high force eccentric training using an eccentric ergometer

- **Results** demonstrated a 12 week program of high force eccentric resistance training can produce muscle hypertrophy, increase strength and improve mobility in mild to moderate PD. Similar benefits were not found in the control group.

In the study by Dibble et al, 2006 the control group who received exercise exceeding the intensity recommended by the American Parkinson's Association made minimal gains or worsened slightly over the 12 weeks

- **With a suitable program - Strength gains can be similar to normal healthy adults** (Scandalis et al. 2001)
Time for Lunch?

Need time to refuel – take the next mins!