Overview and Pathophysiology

- Parkinson's disease (PD) is a chronic, progressive neurodegenerative disease second only to Alzheimer's disease. It is a movement and sensory disorder and neuropsychiatric disorder.
- 70% neuronal death in substantia nigra by the time of diagnosis.
- These neurons produce dopamine, a neurotransmitter that controls movement and coordination.
- Cell death may be due to abnormal build-up of alpha-synuclein proteins into Lewy bodies in neurons (PD=synucleiopathy)
Pathophysiology continued

- 5 major pathways connecting to basal ganglia impacted with PD:
  1) Motor
  2) Oculo-motor
  3) Associative
  4) Limbic
  5) Orbitofrontal

Pathway dysfunction = PD, OCD, ADHD, addiction

Function of Basal Ganglia

- The basal ganglia is imperative for high level integration of somatosensory and visual information.
- PD - impaired kinesthesia/proprioception which lead to over-reliance on vision and bradykinesia
- Impaired kinesthesia can be worsened by L-Dopa
- Study by Horak et al and Wright et al - PWP had difficulty detecting rotation of a surface and passive rotation of trunk
- Basal ganglia: automatic control of balance/gait while switching attention b/t tasks, motor program selection

PD Causes

- Primary PD is idiopathic - cause is largely unknown although there may be genetic and environmental factors contributing to PD. Aging is a risk factor. Smoking and coffee/caffeine decrease risk of PD.
- Genetic Factors: 15-25% of persons with PD have a relative with PD. 4-9% higher risk of PD if a parent/sibling has PD. Several gene mutations (rare) have been discovered.
- Environmental Factors: rural living, well water, pesticides/insecticides/herbicides (including Agent Orange), heavy metal exposure (studies inconclusive)
- In 1970’s a synthetic form of heroin containing a neurotoxin MPTP led to immediate and permanent Parkinsonism - the "Frozen addicts"

Epidemiology/Incidence/Prevalence

- 1 million Americans living with PD
- 60,000 Americans diagnosed yearly
- Grossly 7-10 million people worldwide have PD
- About 5-10% people diagnosed between ages 20-50 (young onset PD) but typically persons are diagnosed in their 60’s.
- Men 1.5X greater incidence of PD than women
- Less prevalent in African/Asian population vs. Caucasians in North America and Europe—disputed by some studies

Movement and Sensory Disorder

** Issues regulating size and speed of movements
  - Too small, too slow
  - Do not recognize
** Impaired motor control
  - Start/Stop
  - Sequence of tasks
** Loss of automatic movements
  - Decreased arm swing, gesturing, blinking, swallowing, righting reactions
SYMPTOMS

Primary Motor Symptoms:
1. Resting Tremor: 70% start with a slight unilateral hand/foot tremor and in some cases tremor of face/jaw. Tremor typically disappears with an action. Tremor can increase with stress/ excitement.
2. Bradykinesia: “slow movement” and hypokinesia “small movement” - i.e. short, shuffling steps, difficulty and increased time requirements with buttoning/ADL’s take much longer.

Primary Motor Symptoms Cont’d:
3. Rigidity: Stiffness of extremities, neck and trunk. Involved muscles do not relax which can lead to limited ROM and discomfort. Rigidity and bradykinesia can cause limited or no arm swing.
4. Postural Instability: PD causes impaired balance reactions, loss of balance and falls typically posteriorly seen when transferring sit to stand. Retropulsion – uncontrolled backwards propulsion i.e. with opening a door/backing up to chair. Forward propulsive gait/festination - small steps with increased speed with center of gravity excessively forward. Freezing also contributes to loss of balance and falls.

SECONDARY MOTOR SYMPTOMS

1. Freezing of Gait (FOG): Patients feel their feet are glued to the floor particularly with initiating gait (start hesitation), turns, approaching a chair, going through doorways/ crossing a threshold/ elevator or in crowded areas. FOG can be transient to lasting minutes/ prolonged time periods of inability to move.
   - https://www.youtube.com/watch?v=3-yrNhVTNE
2. Mask-like Expression: Face appears less expressive/less facial movements

SECONDARY MOTOR SYMPTOMS CONT’D

3. Micrographia: small handwriting that worsens the more one writes due to bradykinesia/hypokinesia.
   - "Drooling and excessive saliva d/t impaired swallowing movements.
4. Unwanted Accelerations: a) festination: uncontrolled acceleration in gait b) tachyphemia - excessively fast speech/stammering

NONMOTOR SYMPTOMS

Neuropsychiatric Symptoms

- **Behavior/Mood Changes**: anxiety, depression, apathy
- **Nonmotor symptoms may appear years before PD diagnosis.**
- **Impulse control disorders/hallucinations and delusions may occur due to excess of dopamine due to medication**
- **Cognitive Deficits**: slowed cognitive processing, impaired working memory, difficulty with abstract thinking and planning, problems inhibiting inappropriate actions, impaired perception and visuospatial deficits
- PD 2-6X greater risk for dementia vs. general population
Nonmotor symptoms: Autonomic Symptoms

- ***orthostatic hypotension/BP dysregulation
- Excessive sweating, oily skin
- Urinary incontinence/frequency, constipation/gastric paresis
- Sexual dysfunction

Nonmotor symptoms continued

- Vision Changes: decreased blink rate, dry eyes, decreased tracking/saccadic movements (fast automatic b/l eye movements in same direction, convergence insufficiency, diplopia, decreased contrast sensitivity (dark sunglasses)
- Sleep problems: REM sleep disorder (act out dreams), daytime drowsiness, insomnia, 15% sleep attacks due to medications /PD fatigue
- Altered sense of smell
- PD Pain: altered central processing ie oral/genital burning, numbness/paresthesias. Young PD: shoulder/foot pain and older PD neck/back pain

NEUROGENIC ORTHOSTATIC HYPOTENSION

Definition of Orthostatic Hypotension: Drop in SBP >=20 mmHg or Drop in DBP >=10 mmHg within 3 mins of standing. Standing 1 minutes typically detects most cases. Symptoms: dizziness/light-headedness, blurred vision, weakness, confusion.

Do supine-sit-stand BP checks. Low BP can also occur due to Levodopa

Treatment: hydration, increase salt intake, TEDS, abdominal binders, change positions slowly. Need to closely monitor BP response to activity; don’t stand for prolonged periods, avoid sitting outside in heat or exercising in the heat; eat small, frequent meals; avoid alcohol which dilates blood vessels leading to low BP, caffeine causes vasoconstriction increasing BP; keep head of bed at 30-40 degrees

Caution as syncopal episodes may occur esp with MSA (Multiple Systems Atrophy). May be worse after eating a meal

Medications to increase BP ie Midodrine (Vasoconstrictor) and/or Fludrocortisone (Florinef) - increase blood volume via increasing sodium retention and the excretion of potassium in urine

VISION CHANGES

Antecollis

- Antecollis- “dropped head”- forward flexion of head and neck =>45 degrees
- Seen in PD and MSA
- 1 study looked at surface EMG showing increased tonus of neck mm but needle EMG was normal
- May be caused by dopamine agonists ie pramipexole
- SX may improve by d/c of dopamine agonist
- Approx. 3.8% prevalence in PD

Pisa Syndrome (PS)

- Pisa Syndrome (Pleurothotonus)- Lateral flexion of trunk (> 10-15 degrees) with backwards rotation noted with sitting/standing. Disappears in supine. If fixed may be scoliosis.
- In study by Cristine Tassorelli 20 pts with idiopathic PD and PS had EMG, Xray and CTScan.
- Consistently sidebending was away from side of sx at onset.
- EMG showed abnormal hyperactivity in paravertebral muscles (T7-10) and obliques on side of deviation.
FOCAL DYSTONIAS

- Great toe extension
- Toe curling
- Inversion
- Knee extension/PF
- Bletherospasms of eye lids—cannot maintain eyelid opening
- May benefit from botox injections

Sinemet

- Carbidopa-Levodopa (Sinemet)-Levodopa treats bradykinesia and rigidity.
- Levodopa is converted to dopamine by an enzyme but is metabolized before getting to brain.
- Carbidopa blocks the metabolism of levodopa in the liver allowing more to get to the brain. This allows for a smaller dose of required levodopa and helps decrease nausea.

Sinemet

- Side Effects: nausea, dry mouth, hypotension/dizziness, and dyskinesia (involuntary movements) with longterm use.
- Longterm use of levodopa can cause hallucinations, psychosis. Over time levodopa becomes less effective.
- Possible interactions may occur with the following: antacids, anti-seizure meds, anti-hypertensives, anti-depressants and high protein food.
- https://youtu.be/CaJymwziF

RYTARY

- Rytary-extended release Sinemet in tablet form with beads that dissolve at different rates prolonging effectiveness.
- For those with mod-advanced PD with motor fluctuations on Sinemet
- Given 3x/day vs Sinemet can be given 4-5 x/day
- Therapeutic dose achieved like immediate release Sinemet (IR) but sustained longer
- Phase 3 clinical trial showed a decrease in “off times” by 1.18 hr and significantly improved QOL (PDQ-39)

DUOPA

- Duopa- Continuous delivery Dopamine pump FDA approved 205 -16 hrs/day, disconnected at night (oral Sinemet taken at bedtime)
- For treatment of advanced PD with motor fluctuations
- Components: PEG J-tube, pump (moves medication from cassette through J-tube) and cassette containing Carbidopa-levodopa in gel form
- Dose needs to be titrated initially
- In a 12 week study Duopa decreased “off” times by 4 hrs/day vs 2 hrs with IR (Immediate release) Sinemet

DOPAMINE AGONISTS

- Examples: Mirapex, Requip (Ropinirole), Parlodel, Neupro transdermal patch (longacting drug)
- Dopamine agonists stimulate areas of the brain affected by dopamine, and are usually given along with Sinemet or as an initial course of care before starting Sinemet. The brain “thinks” it is getting required dopamine.
- Side effects: nausea, dizziness/hypotension, sleepiness, headache, hallucinations, sudden sleep attacks, impulse control disorders (shopping/gambling/hypersexuality/binge eating).
- Apomorphine (Apokyn)-“rescue medication”-fast-acting injectable medication used to enhance movement during “off times”, lasts 30-60 mins. It may induce dyskinesias. Causes severe nausea. Need to take anti-nausea meds.
**MAO-B INHIBITORS**
- **Rasagiline (Azilect) and Selegiline (Carbex)** inhibit monoamine oxidase B (enzyme) which oxidizes dopamine allowing for increased available dopamine.
- **Side Effects**: nausea, dizziness/postural hypotension, confusion, hallucinations, agitation, dry mouth, indigestion, abdominal pain, and dyskinesias. Can’t take with tricyclic antidepressants (Pamelor) or opiates (Demerol, Prozac) and decongestants. Selegiline can cause insomnia – don’t take after 1pm.
- In early PD it may delay need for Sinemet. Can be used in late stages of PD with Sinemet to enhance its effects.

**Anticholinergics**
- Used to treat to treat tremor, and may ease dystonia. Used with Levodopa. Examples include: Cogentin, Benadryl, Artinon, Artane.
- Reduces activity of acetylcholine (neurotransmitter that regulates movement and memory) to balance the decrease in dopamine.
- Not widely used currently. Used with early onset PD for treating tremor. May help reduce dystonia in "off times".
- Side effects: dry mouth, blurred vision, constipation, diarrhea and blood in urine. Tasmar need regular liver function blood tests.

**COMT (Catechol-o-methyl transferase) INHIBITORS**
- **Carbidopa-Levodopa-Entacapone (Stalevo)**: can cause dyskinesias and nausea.
- Entacapone (Comtan) and Tolcapone (Tasmar) do not directly effect PD sx but extend the effects of Levodopa via blocking its breakdown.
- Side effects: abdominal pain, back pain, nausea, constipation, diarrhea and blood in urine. Tasmar- need regular liver function blood tests.

**AMANTADINE (SYMMETREL)**
- Used in early PD to reduce tremor. Can also be used to help dyskinesias later stages of PD.
- Facilitates dopamine release, blocks its re-uptake, and may reduce acetylcholine activity.
- Side effects: dry mouth, constipation, bladder problems, ankle swelling, skin rash/mottled skin.
- Droxidopa-used to treat neurogenic orthostatic hypotension
- Exelon-FDA approved for treating dementia in PD

**Medicinal Marijuana for PD**
- In an observational study by Lotan et al noted decrease tremor, rigidity and bradykinesia and improvement in the UPDRS (United PD Rating Scale) with cannabis consumption
- Another study showed improved QOL and well-being
- Another study showed decreased pain, decrease in sleep disturbances and less dyskinesias
- Consumed via: smoking, vapors, drinks/foods prepared, dried buds, synthetic drugs

**Nutrition**
- Eat balanced diet
- Maintain Bone health-PD – prone to osteoporosis (CA and Vit. D) and high falls risk
- Maintain bowel regularity: constipation is a sx in PD. Eat foods high in fiber, drink plenty of fluid and exercise. May need laxatives.
- PD meds can cause nausea and poor appetite. Can take ginger ale and crackers with meds.
- Dietary protein (meat, fish, poultry, dairy products) can decrease effectiveness of levodopa. Sinemet and amino acids compete for the same receptors. They both need to cross the intestinal wall to access the blood and then cross the blood-brain barrier. Limit meat to size of deck of cards (3 oz) and take Sinemet 30-60 mins. prior to a protein meal. Avoid taking Sinemet with a high-fat meal as fat is digested very slowly.
- Diet may need to be altered based on dysphagia (swallowing study/Speech therapy)
Deep Brain Stimulation (DBS)

- DBS - high frequency (<100 Hz) brain stimulation. DBS is a surgical implant to treat tremor, rigidity, bradykinesia, gait, akinesia, and dyskinesias.
- Can be used to treat essential tremor and dystonia
- Implantable pulse generator (IPG) - lead wire implanted in targeted area in brain with the extension (insulated wire) passed under the skin to the battery-operated pulse generator placed under skin under clavicle unilaterally or bilaterally. Parameters (pulse width, pulse frequency, current amplitude) are adjusted telemetrically.
- Prior to use of DBS ablative stereotaxy was used (1970’s-1980’s) - brain tissue was lesioned ie pallidotomy.

DBS Cont’d.

- DBS blocks the abnormal nerve signals improving movement.
- Improved mvmt allows for smaller dose of meds and can lessen dyskinesias
- DBS does not slow the PD progression and can worsen cognitive sx.
- DBS typically not recommended if signs of dementia are present

DBS cont’d.

- DBS can be removed if causing ill effects
- Risks (low) for brain infection or bleeding with procedure.
- DBS can be programmed/adjusted
  - Thalamic stimulation (VIM-ventral intermediate nucleus) - treats contralateral tremor. Subthalamic nucleus (STN) and globus pallidus (Gpi) DBS treat ‘off’ motor symptoms and dyskinesias. STN DBS > Gpi-DBS with controlling akinesia in off times, greater reduction in PD meds and less stimulation is needed; however, there is risk of psychiatric/behavioral side effects. Drug withdrawal can lead to drive and mood issues.
  - Research: Study of approx. 300 patients looked at subthalamic nucleus (STN) DBS vs. globus pallidus interna DBS. Both had gains in motor control and quality of life (QOL). STN group showed a decrease in visuomotor processing and slight increase in depression.

Diagnosis of Idiopathic PD

- Early motor symptoms (2/3):
  - Bradykinesia, resting tremor, rigidity
  - + response to DA replacement
  - DaTscan
  - Definitive dx: autopsy
  - Rule out secondary parkinsonism, atypical PD
  - Blood test for Nfi (Alaas et al., 2013)
  - Refer to a movement specialist
  - PDF Helpline (800)457-6876

Differential Diagnosis of Parkinsonism

- Idiopathic PD (42%-85%)
  - Secondary Parkinsonism
    - Drug induced
    - Metabolic
    - Toxic
    - Trauma
    - Brain tumors/structural
    - Vascular
    - Post viral
    - Normal pressure hydrocephalus
Differential Diagnosis of Parkinsonism

- Atypical PD
  - Essential tremor (ET)
  - Multiple system atrophy (MSA)
  - Progressive supranuclear palsy (PSP)
  - Diffuse Lewy body dementia (LBD)
  - Corticobasal degeneration (CBD)

- Suspect something else:
  - Rapid progression
  - Symmetrical onset
  - Lack of resting tremor
  - Early postural instability, frequent falls
  - Early autonomic dysfunction
  - Early cognitive changes
  - Widespread dystonia
  - Lack of response to levodopa

Secondary Parkinsonism: Drug Induced

- Exposure to dopamine antagonists
  - Anti-psychotic meds
  - Bilateral onset
  - Main symptom of bradykinesia
  - Younger onset: arm involvement>leg
  - Symptoms improve w/ drug removal
    - Days, week, months

Secondary Parkinsonism

- Toxin exposure
  - Carbon monoxide
  - Manganese
  - Cyanide
  - Methanol
  - Fungicides
  - Mine workers, factory workers

- Post viral
  - Symptoms develop during acute/recovery phase of illness w/ fever
  - Encephalitis
  - West Nile Virus
  - HIV

Secondary Parkinsonism

- Vascular
  - Small lacunar infarcts in bg and corticobasilar pathways
  - Imaging
  - Primarily LE involvement
  - Wide box, shuffling gait
  - Frequent falls
  - Poor response to levodopa

- Normal pressure hydrocephalus
  - Magnetic gait
  - Urinary incontinence or frequency
  - Early cognitive changes
  - Enlarged ventricles on imaging

Essential Tremor

- Tremor is the only feature
- Action or postural tremor
- Familial link
- Higher frequency than PD (6-11 beats/sec)
  - PD 4-7 beats/sec
- Alcohol can dampen tremor
- PD dopaminergic drugs have no effect
Multiple System Atrophy (MSA)
- Autonomic dysfunction (Shy-Drager Syndrome)
- Cerebellar signs (Sporadic Olivopontocerebellar atrophy)
- Parkinsonism/slow rigid movements (Striatonigral degeneration)
- Absence of tremor
- Early gait instability, frequent falls
- Dysphagia and dysarthria
- Poor response to levodopa (used in tx)
- Autonomic dysfunction - meds to raise BP, sleep w/ head elevated, inc salt intake
- PT/OT/Speech

Progressive Supranuclear Palsy (PSP)
- Early gait instability, frequent falls
- Vertical gaze palsy
- Blepharospasm
- Bradykinesia, rigidity
- Tremor is rare—5-10%
- Symmetrical onset
- Dysphagia—present in 80%
- Psudobulbar palsy
- Apathy, dec executive function
- Micrographia from beginning—PD trails off
- Poor response to levodopa
- Hummingbird sign on MRI—at midbrain

PSP: Differential dx from PD
- F: frequent, sudden falls early in dx
- I: Ineffective meds
- G: Gaze palsy
- S: speech and swallowing changes

Diffuse Lewy Body Dementia
- Dementia early in disease: within 1 yr
  - May predate movement issues
  - Parkinson’s disease dementia
  - Cognitive deficits > 1 yr after motor issues
- Psychosis
- Agitation
  - Onset 50 yrs old+
  - Progression over 5-7 yrs average (span 2-20)
  - 20% of those w/ dementia
- Meds: Cholinesterase inhibitors for cognition, levodopa motor symptoms, caution w/ antipsychotics
- PT/OT/Speech/Behavioral health

Staging of PD: Hoehn and Yahr Scale
- Stage 1: Unilateral symptoms
- Stage 2: Bilateral symptoms w/o impaired balance
- Stage 3: Mild/moderate b/l symptoms, some postural instability, can live I
- Stage 4: Severe disability, can walk I
- Stage 5: Wheelchair bound or bedridden
Staging of PD: Modified H&Y Scale
- Stage 0: No signs of disease
- Stage 1: u/l
- **Stage 1.5: u/l + axial involvement**
- Stage 2: b/l, w/o impaired balance
- **Stage 2.5: mild b/l, recovery on pull test**
- Stage 3: mild-mod b/l, some postural instability
- Stage 4: severe disability, 1 walking/standing
- Stage 5: w/c bound or bedridden

Goetz et. al, 2004

Severity of PD: MDS Unified Parkinson’s Disease Rating Scale (UPDRS)
- Comprehensive assessment of PD signs, symptoms, and drug responses
- Monitors progression of symptoms
- Higher scores = greater impact of PD symptoms

- **Part 1: Non-motor ADLs**
- **Part 2: Motor ADLS-Self report**
- **Part 3: Motor Examination**
- **Part 4: Motor Complications**

Refae-Moore, 2016

Classification
- **Mild/Early: H&Y 1-2**
- **Moderate/Middle: H&Y 2.5-4**
- **Severe/Late: H&Y 5**
- Postural-instability and gait disorder predominant (PIGD) subtype
- Tremor predominant subtype
- Mixed
- Young onset PD (age 21-40, 5-10% of cases)

Schenkman et al, 2011

PD Cases
- **1. Case early/mild:** 70 y/o male, H&Y 2, 1 yr since dx
- **2. Case middle/moderate:** 49 y/o female, H&Y 3, 15 yrs since dx
- **3. Case middle/moderate:** 79 y/o male, H&Y 4, 5 yrs since dx
- **4. Case late/severe:** 80 y/o male, H&Y 5, 10 yrs since dx

Examination: History
- Observations begin immediately
- Date of dx and type of Parkinsonism
- Being followed by neurology? A movement specialist?
- Medication hx
  - Medication for PD
  - Dose and timing of meds
  - Any medication side effects (dyskinesia, orthostatic hypotension, on/off periods)
  - Impact on symptoms-positive and negative
- PMH/PSH (DBS)
- Past treatments for PD
  - medical and therapies

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Examination: History

Social Information
- Daily routine
- Home setup
- Caregiver role
- Employment
- Driving
- Equipment at home
- Leisure activities past and present

Activity level and exercise history past and present
- Are there things you stopped doing be of PD symptoms?
- Emotions/coping strategies of pt and caregivers
- Involvement in community groups
- Support groups, church

Motor Symptoms
- First symptoms, side of onset
- Current symptoms
- Biggest movement problem
- Solutions to move better
- Fall history
  - Number of falls in the last yr, last 6 months
  - Circumstances leading to falls, direction
  - Fall related injuries
  - History of near falls
- Freezing
  - Locations, circumstances
- ADLs, handwriting
- Speech and swallowing issues

Screening for Cognitive decline: 84%
- Early changes executive function, immediate memory (Muskinovic et al, 2005)
- Attention, bradyphrenia
- Dementia later stages (Aarsland et al, 2010)

Pain: 80%
- Fatigue (Parkinson's Fatigue Scale): 33-58%
- Depression: approx 50%
- Hallucinations: 50%
- Urinary incontinence: 41%
- Bowel/sexual dysfunction
- Sensory disturbance: 40%
- Postural hypotension: 35%
- Sleep disturbance

Depression Screening
- Higher incidence in PD: decreased dopamine, serotonin, and norepinephrine levels
- Major depressive scales may not capture severity of PD depression
- Dx based on subjective reports of anhedonia and feeling of emptiness
- Valid Screening tools for dPD: Hamilton depression scale, Beck depression inventory, hospital anxiety and depression scale, geriatric depression scale
  - Geriatric depression scale short form
    - 15 questions yes/no format
    - >5 score suggests depression (not PD specific)
    - https://www.healthcare.uiowa.edu/igec/tools/depression/GDS.pdf

Musculoskeletal system
- Posture
  - 1/3 of PWP have deformity of trunk, neck, or limbs (Doherty et al, 2011)
  - Increased thoracolumbar flexion
  - Rounded shoulders
  - Increased limb flexion
  - Describe impairment, take picture
  - Static vs. w/ activity
  - Fixed vs. flexible deformity
  - Response to cueing
  - Various positions

ROM
- Hamstring, gastroc, pec length
- Trunk rotation
- AROM may increase w/ cueing

MMT
- Careful of tone and rigidity
- Make test better
- Decreased strength in trunk flexors, extensors, rotators (Bridgewater et al, 1998)
- Issue scaling amount of force needed
Examination: Body structure and function

- CV/Pulmonary
  - Vitals
  - Orthostatic hypotension
  - Severe postural changes-lung function
  - PNA most common cause of death
- Cognitive
  - Montreal Cognitive Assessment
- Vision

Examination: Neurological

- Tremor (MDS-UPDRS)
- Rigidity (MDS-UPDRS)
- Bradykinesia (MDS-UPDRS)
- Hypokinesia (MDS-UPDRS)
- Freezing (MDS-UPDRS)
- Coordination-RAMS (MDS-UPDRS)
- Postural stability
- DTRs and proprioception of foot/ankle
- Sensation

Examination: Cognitive

- Montreal Cognitive Assessment

Examination: Vision

- Vision

Examination: Orthostatic hypotension

- Severe postural changes

Examination: PNA

- PNA most common cause of death

Examination: Endurance

- Severe postural changes
- Lung function

Examination: Examination: Tremor

- Resting tremor
- Postural tremor
- Tremor frequency 4-7 beats/sec
- Varies w/ activity
- Note tricks to hide tremor
- UPDRS
  - Part II and III

Examination: Examination: Rigidity

- Present in 90-99% of PWP
- Lead pipe rigidity vs. cogwheel rigidity
- Unilateral, bilateral, limbs, trunk
- Flexors > extensors
- Note location, impact on ROM, impact on function, impact on posture, pain
- Impaired postural set
- Enhanced reflexes in agonist and antagonist muscles
- Can't adjust postural set to activity demands
- Pathophysiology debatable (Santens et al, 2003)
- Long loop reflexes vs. reticulospinal tract influence

MDS Unified Parkinson’s Disease Rating Scale (UPDRS)

- 65 questions, scored 0-260 pts
- Part 1: Non-motor experiences of daily living - observation and self report
- Part 2: Motor ADLS-Self report
- Part 3: Motor Examination
- Part 4: Motor Complications
- Items at all levels of ICF
- Higher scores=greater impact of PD symptoms
- PDEDGE highly rec part 1 and 3: body structure and function
- PDEDGE highly rec part 2: activity measure
- Fee to do online training
- Need permission to use, free for personal use in clinic

MDS-UPDRS (Part III)

- Motor exam, 18 questions
  - Speech, facial expression, rigidity, finger tapping noting amplitude and speed, opening and closing the hand, RAMS, toe taps, leg agility, sit to stand, gait, freezing of gait, postural stability, posture, tremor

MDS-UPDRS part 3

MDS-UPDRS part 1

Montreal Cognitive Assessment

PDEDGE

Ebadi et al, 2005
National Parkinson Foundation
Examination: Hypokinesia
- UPDRS-items 3.4, 3.5, 3.6, 3.7
  - Finger tapping, hand movements, pro/sup, toe tap, leg agility
- Task specific observation
  - Describe as % of desired movement
    - Step length
    - Arm swing
    - Reaching distance
    - Note laterality
- Handwriting (micrographia)
  - Sample of writing

Examination: Bradykinesia
- More pronounced w/complex movements
  - Related to decreased amplitude
    - EMG studies show PWP alternating bursts of agonists/antagonists but not large enough to generate rapid force (Hallett, 1980)
  - Effects extensors > flexors
  - Items in UPDRS
  - RAMS-note speed and amplitude
- Time functional mobility tasks and ADLs-compare to norms
  - Gait speed
  - Stair climb
  - TUG
  - 5xsts
  - 9 hole peg test

Examination: Freezing/Akinesia
- 7% in early stages, 60% in advanced stages of PD (Bartels et al, 2003)
- Highly correlated w/falls and avoidance of activity
- UPDRS: item 2.13, 3.11
- FOG Questionnaire
  - Highly rec by PDEDGE-activity measure
  - 0-24 pts (higher=more severe FOG)
  - 6 items rated 0 (not present)-4 (most severe)
  - Rec H&Y II, III, IV
  - Timed up and go through doorway or trigger spot

Examination: Postural Stability
- Slowed or absent righting reflex
- COM moves anterior to BOS
- Narrow base of support
- UPDRS-Part III
- Items on BESTest

Examination: Cognition
- Montreal Cognitive Assessment (MoCA)
  - Highly rec H&Y I, II, III, IV
  - 16 items, various cognitive domains
  - Max score of 30
  - 26 and above=normal
- Mini-Mental Status Exam
- A&O x4, 3 word recall
- Dual tasking
- Command following

Examination: Vision
- Impaired visual perception
  - Postural awareness
  - Environmental awareness-distances/depth
  - Reduced saccades
    - Visual scanning, surface changes, obstacles
  - Balance, mobility, fall risk impact
  - Test saccades, smooth pursuit, eye rom w/ and w/o target, convergence, note blinking frequency
Examination: Speech and Swallowing

- Ask about during hx, listen t/o exam
- Hyponia
- Monotone
- Speed inc or dec
- Often poor self awareness
- Mumbling
- Dysphagia
- Slowing of automatic process
- Poor posture
- Drooling
- Refer to SLP
- LSVT-LOUD
- Encourage loud voice and reassure WNL volume isn’t shouting
- Communicate face to face with your patient

Examination: Activity

- Bed mobility and transfers
- Balance
- Gait
  - Level surfaces
  - Uneven surfaces
  - Through cluttered spaces/doorways
  - Turning tight and wide turns
  - Stairs
  - Dynamic tasks
  - Quiet and busy environments
  - Without cuing and with cuing
- Dual tasking
  - Motor and cognitive
  - Opening a door
- Fine motor performance (buttons, handwriting)
  - Time tasks, handwriting sample, outcome measures
- Specific ADLs
  - Dressing-observe and time
  - Observe for
    - Bradykinesia
    - Hypokinesia
    - Tremor/rigidity impact
    - Freezing
  - Repulsion
  - Festination
  - Time, describe quality, measure size of movement, video

Gait Observation

- Short step length
- Short stride length
- Increased cadence
- Decreased gait speed
- Decreased heel strike
- Decreased or absent arm swing
- Increased trunk forward flexion
- Turns-not moving feet, crossing over, too many steps
- Freezing/akinesia
- Festination
- Retropulsion

Outcome Measures—Activity

- Highly rec by PDEDGE
  - 6 minute walk test (MDC PD 82m)
  - 10MWT
  - Mini BESTest
  - MDS-UPDRS-part 2
  - FGA
  - 5xsts (cutoff PD: >16sec)
  - 9 hole peg test
  - Freezing of gait questionnaire
  - ABC scale (MDC 17%, cutoff PD: <=69% predictive of falls)
  - Timed up and Go cognitive

Gait speed: 10 meter walk test

- SSV
- Fast speed
- Compare to age/sex norms
- Can add motor or cognitive dual task
- PD MDC ssv 0.18 m/s, fast: 0.25 m/s

Mini BESTest

- 14 items
- Max 28 pts (32 R&L)
- Rated 0-2 (worst-best)
- 4/6 sections of original BESTest
  - Anticipatory postural adjustments, reactive postural control, sensory orientation, dynamic gait
- MDC PD: 5.52 pts/17.1%
- MCID balance disorders: 4 pts
- Cut-off PD: <=20/32
  - (21,19,16 pt cut-offs also reported)
- Rec H&Y I, II, III, IV
- Body structure/function and activity domains
Functional Gait Assessment (FGA)
- 0-30 (worst-best)
- 10 items scored 0-3 (severe impairment-normal)
  - Normal gait, gait w/ head turns, gait w/ speed change, gait w/ turn and quick stop, gait backward, gait e/c, gait over obstacle, gait on stairs
- Cut-off fall risk PD: ≤15/30
- Cut-off elderly: ≤20 or 22
- Norm data available
- Rec H&Y: I, II, III, IV

Timed up and Go
- PD cut-off fall risk: >11.5s
- MDC PD: 3.5, 4.85, 11 sec
- TUG (cognitive) dual task
  - Count backwards by 3 starting at a number 20-100 randomly selected
  - Alternate: recite every other letter of alphabet (A,C,E,...)
- TUG (manual) Walking holding cup of water
  - Cut-off: >4.5 sec difference indicates inc fall risk
- Various norms available
  - Can alter cognitive task or manual task based on pt and goals
- TUG through doorway—look at freezing

9 hole peg test
- Timed test for UE function, fine motor
- Do for right and left hand
- MDC=2.6 sec for dominant hand, 1.35 non-dominant hand
- Norms available

Other balance measures
- Berg: 0-56 pts, MDC PD: 5pts, general cut-off inc fall risk: ≤45 pts, mean BBS PD=50
- Functional Reach Test
  - Cut-off: <25.4cm, <31.75cm
- Push and release vs. pull test (Vadakias et al, 2008)
  - Screen for retropulsion and postural instability
  - Push and release test more accurate at identifying those at risk to fall during med ON state
  - Push and release test correlates better w/ self reported falls
  - Push and release in Mini BESTest
  - Push and Release Test Demo

Falling in PD
- PWP are 2x more likely to fall compared to general elderly population
- 60% of PWP have had a fall in the past year
- 2/3 of these fallers fall recurrently
- Risk of hip fx 4x age matched controls
- Flexed posture, delayed postural reactions, extensor weakness, freezing, dual tasking deficit, postural hypotension
- Fall predictors: previous falls, disease severity, disease duration, dementia, loss of arm swing, dyskinesia, festination, fear of falling
- Use fall risk cut-off scores with outcome measures
- Fear of falling: ABC scale and Modified Falls efficacy scale

Outcome Measures-Participation
- PDQ-8 or PDQ-39
- QOL measures
  - Self report
- Parkinson’s Fatigue Scale
  - All ICF domains
  - Self report
  - 16 items
Summary of PDEDGE

Assessment/Prognosis

Legitimate Therapeutic Options

Prognosis

Molecular and Neurophysiologic Response to Exercise: Healthy Brain

Exercise is Neuroprotective: Animal Studies
Exercise is Neuroprotective: The Bottom Line

- Exercise may slow disease progression!!
- Decrease dose of meds
- Delay need for DBS
- Decrease financial burden of disease

Principles of Neuroplasticity

- Intensity matters
- Complexity matters
- Repetition matters
- Salience matters
- Timing matters
- Specificity matters

Exercise in PD: The Earlier the Better

- Farley et al, 2008
  - Evidence for PT tx over placebo or no Rx in PD
  - Cochrane SLR
  - 39 trials, 1827 participants
  - PT sig improved
  - Gait speed, 2MWT, 6MWT, FOG, TUG, functional reach, BBS, and clinician rated UPDRS (Part III)
  - Measured in short term (<3 months)
  - No difference for falls or pt rated QOL
  - No evidence for different tx effects across interventions
  - Studies included have poor quality

Evidence for PT tx over placebo or no Rx in PD

- Tomlinson et al, 2013
  - Effects of Physical Activity in PD: 2016 Systematic Review
  - 106 studies (1981-2015)
  - 868 outcome measures
  - Improved UE/LE strength, endurance, speed
  - Improved metabolic function
  - Improved gait
  - Improved mobility
  - Improved balance
  - Improved posture
  - Improved UPDRS-Part III (motor exam)

What type of PT intervention is best?

- Tomlinson et al, 2014
  - Cochrane SLR
  - 43 trials, 1673 participants
  - Interventions grouped
  - General PT, exercise, treadmill, cueing, dance, martial arts
  - Quantitative meta-analysis could not be performed
  - Unable to determine superior form of tx

Lauze et al, 2016

Kleim and Jones, 2008
What type of PT intervention is best?

- Gait speed
  - Sig> tango vs. waltz/foxtrot (Hackney 2009)
- TUG
  - LSVT BIG over nordic walking or HEP (Ebersbach 2010)
- Forced exercise
  - Tango over waltz/foxtrot or tai chi (Hackney 2009)
- PDQ-39 (QOL)
  - Tango over Waltz/foxtrot and tai chi (Hackney 2009)
- UPDRS-Part III
  - LSVT BIG over nordic walking or HEP (Ebersbach 2010)
  - BWSTM training over conventional gait training (Talakkad 2011)

Tx goals across all disease stages

- Promote I in exercise program (regular, long term)
  - Tune-up sessions
- Optimize I and participation in life roles: home, work, school, leisure
- Optimize I and safety in functional tasks
  - Gait, balance, transfers, ADLs
- Preserve or improve physical capacity-endurance, strength, flexibility
- Aerobic conditioning program: 3x/wk, 30+mins, 4 months
- Strength program: 2-3x/wk, 1-3 sets, 8-12 rep max (mod intensity), 6+wks
- Stretching program: 3x/wk for 6-12 wks
- Lack of long-term studies
- Most studies on mild-moderate PD

Interventions: Mild PD (H&Y 1-2)

- High intensity exercise
- Maintain flexibility, strength, balance, and cardiovascular function-teach HEP
- Task specific practice of relevant mobility, I/ADL, work and leisure skills to maintain or relearn
  - Focus on amplitude, intensity, regular practice
  - Add cognitive challenges, balance challenges, resistance
  - Teach pt to self cue-should be more automatic
  - Exercise for neuro repair and protection
  - Introduce to community based programs
  - Ed to return for a checkup in 6 months
  - LSVT-BIG or PWR!

Interventions: Moderate PD (H&Y 2.5-4)

- More compensatory
- External cueing
- Task specific practice of functional tasks
  - Wider range compared to mild PD
  - Change task or environment to improve participation
  - Encourage activity during on state
  - Begin to reduce dual-tasking
  - Fall prevention and reduction
  - Multi-factorial risk reduction
  - Falls diary
- Falls diary

Interventions: Severe PD (H&Y 5)

- Compensatory
- Train caregivers-cueing
- Break exercises into UE and LE components
- Seated exercises
- Reduce distractions
- No dual tasking
- BIG walking w/ AD and assistance
- Extra weeks of LSVT, modified positions, seated
- Dec # of reps

Task Specific Practice

- Model and cue WNL amplitude
- Make it intense
- Lots of reps
- Complex whole body movements, quick set selection
- Bed mobility
- Transfers
- Ambulation
- Stairs
- ADLs
- Work, sport, hobby specific tasks
- Think of neuroplasticity principles
- Mild/Moderate pts: add balance and cognitive challenges
Gait Training
- Model and cue WNL amplitude
- Step length and arm swing
- Speed follows increased size
- Include turning practice
- U turn large space
- ¼ turns small space, clock turn
- Include dual tasking-motor and cognitive
- Weight shifting
- Forward, laterally, backwards
- Indoors and outdoors
- Curb, ramps, stairs
- Trekking poles (Nordic/pole walking)
- Overground or treadmill or robotic?

Dual Task Training in PD
- Improved gait speed and stride length
- Improved 6MWT
- Improved sensory organization test
- No change in tandem stance time
- Sig improvement on trail making test
- 31% fewer errors on serial subtraction task
- Dose 30 mins-3hrs/wk for 16 wks

Dual Task Training in PD
- Conversation
- Math tasks
- Naming things from categories
- Reciting recipe from memory
- Directions
- Trail making

Be creative, have fun!

Dual Task Training in PD
- Using cell phone
- Getting items from purse
- Transferring objects between pockets
- Walking and carrying objects
- Walking w/ball toss

Freezing
- Don't fight the freeze!
- 5S: Stop, Stand tall, Shake it off, Shift weight, Step big
- Count steps
- Look beyond thresholds/doorways
- Imagine stepping over something
- Visual cues of tape on the floor
- Auditory or tactile cues
- Let others go in front
- Break up tasks into manageable parts
- Freezing w sit to stands
- Identify triggers and recreate in the clinic

Retropulsion
- Power stance
- Stand to side

Assistive Devices
- U-Step II
  - Reverse brakes
  - Wheels pivot for turns
  - Foot lever for curbs
  - Can add metronome and laser
  - Approx $824 ($575 no laser, metronome)
  - Med B partial coverage
Assistive Devices
- Laser Cane
- $199 In-Step mobility
- Rollator
- Add extra weight
- Trekking poles
- Avoid quad cane, standard walker

Treadmill Training
- Can improve gait speed (moderate quality evidence)
- Can improve stride length (low quality evidence)
- Walking distance and cadence didn’t improve
- Variable control groups, variable dose
- Heterogeneous subjects in studies
  - May have better results w younger pts, earlier in disease (H&Y I, II, III)
  - Unsure of the long term benefit >3 months
  - Speed: age norm or faster
  - Increased reps—increased intensity—motor learning
  - No difference between treadmill and robotic gait training
    for gait and disease severity (Da Rocha et al, 2015)

Nordic Walking/Pole Walking
- 1 hr, 2x/wk, 6 wks
- Post training sig improvement:
  - TUG
  - 10MWT
  - 6MWT
  - PDQ-39
- Gains maintained at 5 month followup
- LSVT-BIG vs Nordic walking: In favor of BIG (Tomlinson et al, 2014)

Video: Walking Poles and Turns

Balance Exercise
- Moderate evidence exercise improves postural stability and balance in PD
- Limited evidence exercise decreases falls
- But what type of balance exercise is best???
  - Anticipatory, reactive, sensory orientation, dynamic
  - Standing static vs. dynamic balance
  - Tai Chi
  - Use testing results and fall hx
  - Challenge balance during functional mobility and ADL tasks
  - Appropriate at all stages of disease

Balance Exercise: Protective Stepping
- Protective stepping
  - 2 wks tx, 2x/day, 20 mins, 180-230 pushes/pulls per session
  - Backward and lateral stepping
  - Positive feedback provided
  - Improved speed and size of protective step, maintained 2 months post intervention
  - Sig improvement in cadence and step length

Jobges et al, 2004
Van Dijk et al, 2008
Mehrholz et al, 2015 (Cochrane review)
Fall Prevention

- Balance training, extensor strengthening, improve posture
- Environmental scanning and obstacle negotiation
- Practice falling
- Practice getting up off the floor
- Slow position changes to avoid dizziness with postural hypotension
- Discuss side effects of meds with neurologist
- Time activity with on/off times
- Avoid dehydration
- Manage impulsive behavior
- Supervision – aide
- Chair alarms
- Keep a falls diary

Fall Prevention

- Environmental changes
  - Remove throw rugs
  - Avoid clutter
  - Keep cords against walls
  - Install grab bars
  - Keep areas well lit
  - Install 1-2 handrails on stairs
  - Keep objects on shelves within reach

Evidence for progressive resistance training in PD

- Saltychev et al, 2016 SR
  - 12 RCTs/controlled clinical trials
  - PRE vs no tx vs other tx
  - No sig effect in favor of PRE
  - Gait speed, 6mwt, TUG, max oxygen consumption
- Chung et al, 2016 SR
  - 7 RCTs included, H&Y 1-4
  - PRE vs no tx vs other tx
  - Results in favor of PRE
  - Muscle strength, balance, motor symptoms
  - No effect on gait, balance confidence, or QOL measures

Inconsistency in SR results, varied doses, varied disease stages

Fatigue Management

- Pharmacological Interventions
  - Rasagiline
  - Donepezil?
- Exercise Interventions?
  - Low quality evidence
  - Improve economy of movement
  - Aerobic exercise
  - Ed on activity pacing/energy conservation
  - Napping
  - PT/OT/Speech
- Cognitive-Behavioral therapy?

Which type of cueing is best?

- Cognitive (frontal cortex)
- Visualization
- Mental practice
- Segmentation
- Auditory cueing
  - Metronome
  - Music
- Visual cues (visual cerebellar)
- Sensory/tactile cues (dorsolateral pre-motor region)
- Verbal cues
- fMRI shows PWP greater cortical activity to perform “automatic” tasks compared to persons without PD (Wu et al, 2005)

- 7 studies
  - Visual cues (2), auditory cues (2), verbal cues (1), combined visual-auditory (1), sensory cues (1)
  - Average sessions: 19.1
  - Varied duration: 2-8 wks
  - Intensity not described
- Improved step length, stride length, gait speed, cadence, and UPDRS
- Step length improvements-visual cues
- Speed improvements-visual, auditory, combined visual and auditory, sensory
- Cadence-visual, sensory
- Stride length-sensory
Which type of cueing is best?

- Attentional cues better than auditory (Baker et al, 2007)
  a. Rhythmic auditory cueing w/metronome
  b. Attentional strategy-think big steps
  c. Combination
- Only short term benefits when cueing is removed (Nieuwboer et al, 2008)

LSVT BIG

- LSVT=Lee Silverman Voice Treatment
- LOUD developed in 1987
- Later applied LOUD principles to limb movements for BIG
- https://www.lsvtglobal.com/

What are the fundamentals of LSVT BIG™?

TARGET: Bigness (amplitude)

MODE: Intensive and High Effort

CALIBRATION: Generalization
  - Sensory
  - Internal cueing
  - Neuropsychological changes

Mode:

DELIVERY
- Certified LSVT BIG™ Physical/Occupational Therapist
- 1:1 intervention

TIME OF PRACTICE
- 4 consecutive days per week for 4 weeks
- 16 sessions in one month
- 60 minute sessions
- Daily carryover assignments (30 days/entire month)
- Daily homework (30 days/entire month)

Treatment Session

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

Functional Component Tasks
5 EVERYDAY TASKS- 5 steps each
For Example:
- Sit to Stand
- Pulling keys out of pocket
  - Opening refrigerator door
Walking BIG: distance/time may vary

Hierarchy Tasks
Patient identified tasks:
- Getting out of bed
- Playing golf
- In and out of a car

Build complexity across 4 weeks of treatment towards long term goals

Maximum Sustained Movements

Floor to Ceiling
Side to Side
**Multidirectional Repetitive Movements**

**Step and Reach**

- Forward Step
- Sideways Step
- Backward Step

**Rock and Reach**

- Forward/Backward Rock and Reach
- Sideways Rock and Reach

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**Functional Component TASKS**

**Functional Components**

- Rolling
- Floor to Stand
- Getting in or out of bed
- Sit to stand
- Sit & reach
- Stand & reach
- Walk & reach
- Walk & turn
- Stand & turn

**Sit to stand BIG**

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**Daily Hierarchical Tasks**

**“Real-World” BIG Tasks – Patient DRIVEN!**

- Bed to Bathroom
- In/Out of Car
- Walk and Talk
- Tennis
- Chores
- Golf
- Hiking
- Gardening

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**Treatment Example: Dr. W, H&Y 2**

**Components:**
1. Sit to stand
2. Golf backswing
3. Buttons
4. Handwriting
5. Tennis Serve

**Hierarchy:**
1. Play tennis match-doubles
2. Golf 18 holes

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**Video: Tx, Dr. W**
Video: Tx 2, Dr. W

Treatment Example: Joe, H&Y stage 4

Components:
1. Sit to stands
2. Lift legs in/out car
3. Step in/out shower
4. Stairs
5. Buttons
6. Tie shoelaces

Hierarchy:
1. Getting in and out of the car
2. Showering
   - Step in/out of tub
   - Sit/stand from shower chair
   - Reach for items in shower
   - Dry off with towel

Video: Joe

LSVT BIG™ vs. Traditional Outpatient Physical Therapy
Randomized Comparative Pilot Study
Matched Frequency/Duration
4X/week for 4 weeks; 1-hour individual sessions
N=42
Hoehn & Yahr 1-3
Intention to treat analysis

Walking Improvements

Faster
Bigger

Improvements occurred in both groups and lasted 3 months.
Farley & Koshland, in preparation (Unpublished data)

Trunk Rotation

Only improved for LSVT BIG™
Farley & Koshland, in preparation (Unpublished data)
**Video Example: Pre and Post BIG**

**LSVT-BIG**
- Patient selection
  - Optimized on meds
  - The earlier in dx, the better
  - Can be used for atypical PD pts-less research
  - Stimulability trials
  - May need to do "prehab"-pain, endurance
- Research support best outcomes
- Idiopathic PD
- Bradykinesia/rigidity dominant
  - H & Y 1-3
  - 56-86 y/o
  - Mild dyskinesias
  - Optimal meds

**PWR!**
- Aerobic training + PD specific skill training
- Similar to LSVT BIG but more flexible approach
- Basic 4 PWR! Moves, 5 positions
  - Seated, standing, prone, supine, quadruped
- Combine into dance, yoga, tai chi, etc

**PWR! Moves**
1. PWR! UP
2. PWR! Rock
3. PWR! Twist
4. PWR! Step

**Rationale**
1. Posture
2. Weight Shift/Freezing
3. Trunk Rotation/bed mobility
4. Transitions

**PWR! Seated/Standing**

![Image](https://www.pwr4life.org/moves/approach/)

**PWR! Prone**

![PWR! Up](image1)

![PWR! Rock](image2)

![PWR! Step](image3)

![PWR! Twist](image4)
PWR! Supine

PWR! Quadraped

PSP: Treatment
- **Medical**: levodopa, botox, cognitive enhancers, antianxiety meds, antidepressants, bladder meds
- **PT**:
  - Compensatory-caregiver cueing, visual cues at home, safety is key
  - Take time w/ transfers, avoid dual tasking
  - Environmental scanning
  - Heel wedge to dec posterior lob
  - Add weight or reverse brakes to AD
  - Stair glide or 2nd HR on stairs
  - Balance exercise w/ visual tracking
  - Caregiver education-rec level of supervision

PSP: Treatment
- **Vision**:
  - Eye closing-eye crutch/use hand
  - Gaze palsy-downward head tilt
  - Glare protection-hat or tinted glasses
  - Visual scanning practice-stationary and w/ mobility training
  - Refer to ophthalmologist-diplopia
  - Referral to OT and speech
  - Compensatory ADL strategies

Adaptive Equipment
- Weighted utensils
  - No evidence to improve tremor
- Car transfers
  - Handy bar
  - Car disk
  - Car Ease Slide or plastic bag
- Bed mobility
  - Silk sheet or PJs
  - Bed rail
- Impulsive/Dec safety awareness
- Chair alarm
- Ask OT!

Tune-up sessions
- 3-12 months
- More frequent
  - Atypical PD
  - Cognitive impairment
  - Changes with DBS or medication
- Less frequent
  - Young
  - Motivated
  - Good adherence to HEP/community programs
  - Good support system
- PT is a key player in chronic disease
Adjunctive Forms of Exercise in PD

- PWP: 64% sedentary (Hirsch et al, 2011)
- Issues w/compliance, adherence to long term exercise
- Many barriers
- Need for programs that are:
  - Enjoyable
  - Improve quality of life
  - Include social interaction
  - Promote wellbeing
- Mind-body exercise (dance, tai chi, yoga) (Kwok et al, 2016)
  - Improved motor function (UPDRS III)
  - Improved postural stability (fleg)
  - Improved Timed up and Go
  - Improved 6 min walk test
  - In mild-moderate PD
  - Unsure of long term benefit

Dance

- Improved QOL with Dance for PD program
- BBS, gait speed, 6MWD >MDC w/ Dance for PD program
- Most studies mild-moderate PD
- Dose 2x/wk, 60-90 mins, 6-12 wks
- Most studies on Tango
  - Superior outcomes vs. foxtrot /waltz style (Hackney et al, 2009)
  - Tango vs Dance for PD in favor of Tango to improve motor subscale on UPDRS and TUG (McNeely et al, 2015)
    - Tango considered superior bc of more time in standing
  - Dance better than no intervention to improve gait, balance, disease severity (Da Rocha et al, 2015)
  - Tango improved balance > traditional exercise
  - Music is auditory cue
  - Functional movements-task specific
  - Repetitive

Tai Chi

- Slow and flowing movements
  - 18-100 postures based on style
  - Move COM, stepping, SLS
  - Proposed to improve balance, strength, coordination, cardiovascular health
- 2014 Gao et al study
  - 24 form Yang style
    - 60 mins, 3x/wk, 12 weeks vs. no exercise
  - Improved BBS Tai Chi group
  - No difference UPDRS, TUG
- 21.6% falls Tai Chi group vs. 48.7% control at 6 months

Yoga

- Reduced UPDRS motor scores (Kwok et al, 2016 & Puymbroeck MV, 2016)
  - More than tai chi and dance
  - Improved balance control (Puymbroeck MV, 2016)
  - Mini BESTest
  - Improved Parkinson’s Fatigue Scale, ABC scale, PDQ-8 (Mendoza EU, 2016)
  - Wait list control improved fatigue and pdq-8
  - Pilot studies yoga vs. no intervention

Cycling

- Forced exercise cycling
  - >voluntary cadence, intensive
  - Tandem bike study
    - 24 sessions, 8 wks, 85 RPM, trainer does 75% work
    - 28% improvement bradykinesia
    - 38% improvement tremor

Active Assisted Cycling

- N=10 (mild-moderate PD)
- Motomed
  - 5 min warm-up/cool down 40-50 RPM
  - 30 mins 80-85 RPM, 1 session only
- Results
  - Average 60-70% HR max
  - Average RPE 13.3 somewhat hard
  - UE tremor and bradykinesia post cycling off meds similar to on med state
Boxing
- Evidence based on case series
- Can improve functional mobility, ADL, gait, balance, QOL, endurance, gait velocity
- Intensive aerobic workout
- Agility and balance
- Rock Steady Boxing

Exercise gaming
- Exergaming
  - Improved UPDRS II, standing balance, and cognition
  - Maintained at 60 day follow-up
  - Nintendo Wii or X-box 360
  - May be too confusing for some patients
  - Safety unknown-home use
  - Feasible

Smartphone Feedback
- Real time feedback on gait
- Inertial measurement
- Smartphone application
  - CuPiD-system
  - Gait training w/ device
    - 30 mins, 3x/wk, 6 wks
  - Compared to active control w/ feedback
  - Testing pre/post/4 week follow-up
  - Both groups improved gait speed, dual task gait speed
  - More improvements in balance in CuPiD group (small) and maintained QOL at follow-up

Community-based group exercise
- Combs et al, 2013
  - 24-36 sessions
  - 90 minute sessions
  - 12 week duration
  - Stretching, resistance exercise, aerobic training, balance activity
  - Pre/post testing
    - Improved balance confidence, balance, mobility, and QOL
- States et al, 2011
  - 2x/wk, 1 hour session, 10 weeks (short term)
  - 2x/wk, 1 hour session, 14 months (long term)
  - 73% attendance
  - No injuries reported
  - Improved short term and long term grip and 6 min walk test
  - No change gait speed or Timed up and go

MossRehab Maintenance Programs for PD
- Meets at Tabor Road, Mondays 4-5pm
- Meets at Elkins Park, Tues/Thurs 5-6pm
- Max 10 participants, rolling admissions
- $36/12 sessions
- Supported by a grant from the Parkinson Council
- Multimodal exercise:
  - Large amplitude, dance, cycling, yoga
  - Pre and post testing (8 months apart)
  - Maintained TUG, 5xsts, 10MWT SSV (n small)

Community Resources
- The Parkinson Council (http://theparkinsoncouncil.org/)
- Dance for PD groups
- YMCA in Abington
- The 954 Dance Movement Collective (Philly)
- Dance for PD home DVD
- Let Your Yoga Dance
  - Find local teachers for specialty populations
    - http://www.letyouryogadance.com/
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