Ohana Pacific Rehabilitation Services

Advanced Approaches for Improved Mobility in Parkinson's Disease

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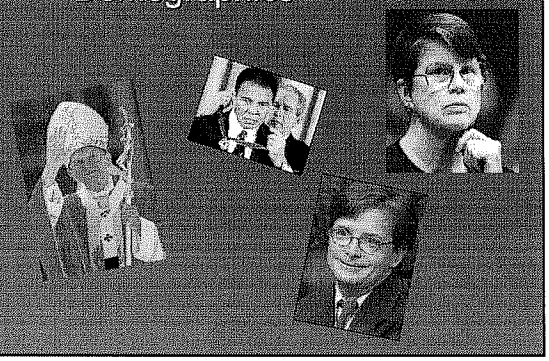
What to expect

- Overview of PD
- Overview of treatments
- Assessment
- Movement strategies
- Other treatment strategies
- Exercise research
- Exercise selection

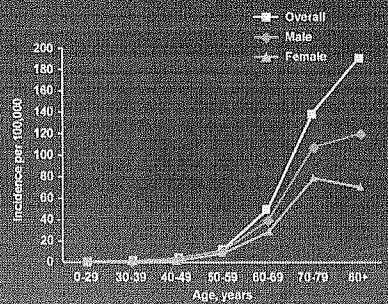
Demographics



Is Parkinson's is not Rare

- Involves 1% of population over age 65
- Increases with age
- By age 70: the disease occurs 120 patients per 100,000 population
- Average age of onset 62 y.o.
- Approximately up to 10% are early onset (Dx before the age of 40.)
- PD rarely seen before age 30.

Annual Incidence Rate of PD by Age and Gender, Kaiser Permanente, 1994-1995



Van Den Eeden SK et al. Am J Epidemiol. 2003;157:1015-1022.

What causes Parkinson's Disease?

Parkinson's Disease

- Majority of Parkinson's Disease is idiopathic. (unknown cause) Primary PD
- Parkinson's Gene. Present in 3-5% of PD. Having gene makes you more susceptible for PD but does not guarantee PD.
- Secondary PD: infection, toxins, head trauma, etc.
- Parkinson Plus syndromes- not responsive to traditional PD drug therapies.

PD Risk Factors

* Exposure to pesticides & herbicides
* MPTP (methl-phenyl tetrahydopyridine) -synthetic narcotic related to heroin
* Chronic use of neurolyptic drugs
* Repetitive head trauma
* Rural Living
* Well Water
* Less risk in Smokers and coffee drinkers

How is diagnosis made?

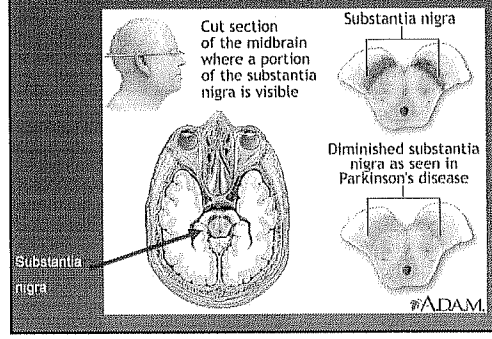
- No specific standard test to diagnose
- Symptomatic & Differential Diagnosis
- Rule out other Parkinson's like symptoms including essential tremors, progressive supranuclear paly, multi-system atrophy, Dementia with Lewy bodies, etc.
- Disease advanced by time of diagnosis

WHAT IS PARKINSON'S DISEASE

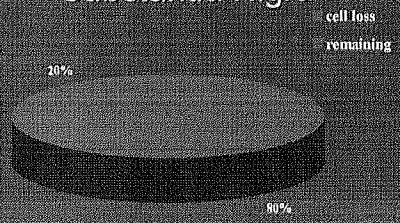
What is Parkinson's Disease

- It is a progressive neurodegenerative disease.
- Characterized by movement disorder due to changes in the midbrain (Substnatia nigra)
- Automatic motor responses impaired.

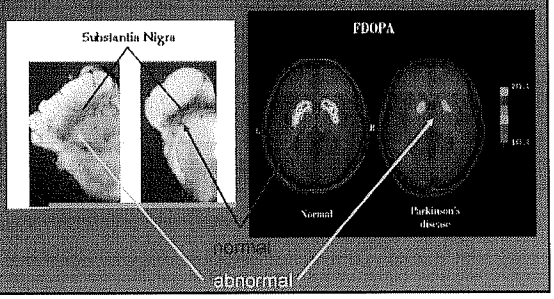
It starts in the substantia nigra



Symptomatic Parkinson's occurs with loss of 80% of Substantia Nigra

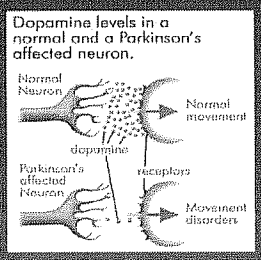


Substantia Nigra damage causes loss of dopamine in brain



Definition: Dopamine

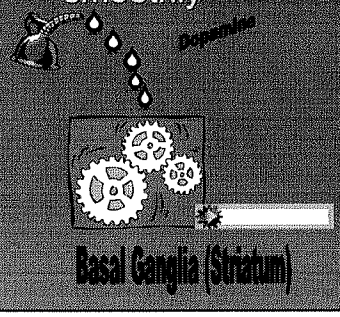
- An important neurotransmitter (messenger) in the brain
- Parkinson's disease is believed to be related to low levels of dopamine in certain parts of the brain.



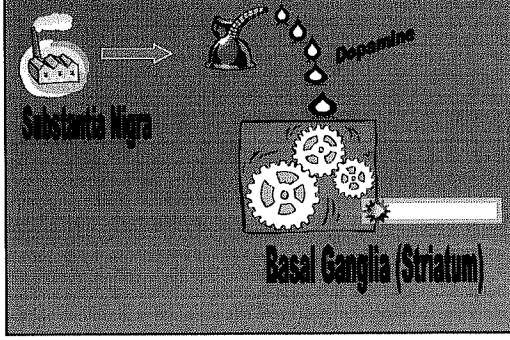
Neuro-transmitters

- Primary symptoms of PD are excessive muscle contraction resulting in rigidity (rigidity vs. spasticity).
- Acetylcholine primarily stimulates muscle contraction.
- Dopamine primarily reduces (dampens) muscle contraction.

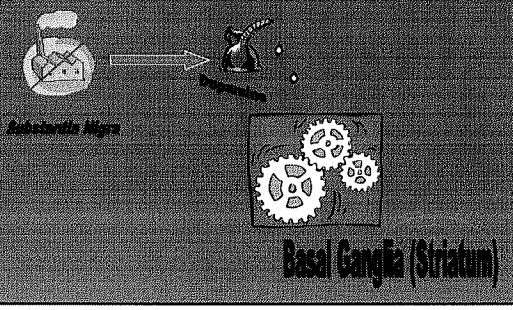
Think of dopamine as a lubricating oil that keeps the machine running smoothly



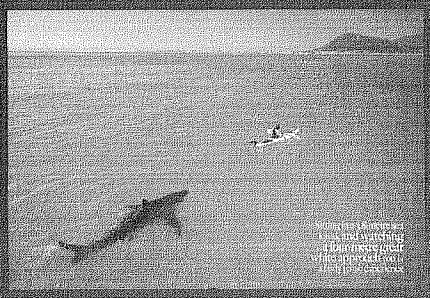
Substantia Nigra is the refinery which makes the oil



Without dopamine to lubricate the machine, it slows down



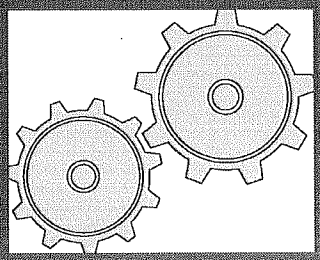
Parkinson's Disease is not for sissies!



Hallmark of Parkinson's Disease

- Cogwheel rigidity
- Bradykinesia/Akinesia
- Abnormality of posture and gait
- Tremor
- Other: Dyskinesia, Falls

Cogwheel rigidity



Cogwheel rigidity

- Rigidity with superimposed tremor
- Ratchet-like feel
- Felt as tightness or stiffness
- Very different properties than seen in spasticity (upper motor neuron syndromes)

Bradykinesia

Bradykinesia

- Several Theories

  1.) Difficulty in maximizing movement speed when motor output is driven by internal control.

  2.) Unable to generate adequate power/force

  (power= work x distance/time)

  3.) Difficulty in changing motor set (motor plans in readiness.)

Gait Abnormality

- Loss of arm swing
- Stiff legged gait
- Leads with head and shoulders
- Festination (difficulty with initiation and termination. Shuffling style gait)

Gait

Postural Instability

- Emerges later on
- Least responsive to dopaminergic drugs
- Not usually improved following DBS
- Loss of protective reactions: cut tree falling

Retropulsion

- Tendency to fall backwards
- Strategies

  * One hand support when reaching overhead

  * Lower cabinets and close bars (closet)

  * Tai Chi stance for improve BOS (saggital plane)

Tremors

- Resting tremors
- 70% of PD cases
- Will start with one body part like toe or finger.
- Pill rolling
- Tremors reduced with purposeful activity.

FREEZING (Akinesia)

- 'Episodic' gait disorders- symptoms are intermittent (e.g., freezing of gait)
  - very incapacitating because individuals cannot easily adjust to the unpredictable gait problem
- Freezing of gait is associated with a high risk of falls and injuries
- Freezing of gait is independently associated with a decreased quality of life

Freezing Environmental Triggers

- Turning
- Confined Spaces
- Doorways/thresholds
- Perceived obstacles
- Floor surface changes
- Elevators
- Escalators

Turning in Parkinson's Disease

- Individuals with PD often have difficulty turning in bed and while standing
- Turning problems may result from trouble in maintaining an interlimb connection and axial (trunk) rigidity.
  - 'En bloc' turning
  - Levodopa does not seem to decrease turning problems

Definition: Dyskinesia

- Difficulty or distortion in performing voluntary movements.
- Dyskinesia can occur as a side effect of certain medications such as L-dopa and the antipsychotics.
- The word dyskinesia (dis-ki-ne´ze-a) is logically derived from two Greek roots: dys-, trouble + kinesis, movement = trouble moving.

Epidemiology of falls in Parkinson's Disease

- It is estimated that up to 70% of Parkinson's Disease patients fall annually
- 13% fall more than once weekly

Fractures in Parkinson's patients

- Individuals with Parkinsonism (from any cause) have a more than two-fold increased risk of sustaining a fall-related fracture

Risk Factors for Falls in Parkinson's Disease

- Dyskinesias and sleep disturbances associated with dopaminergic medications
- Orthostatic hypotension
- Freezing
- Compromised posture and postural stability

Parkinson's Disease

Risk Factors for Falls in Parkinson's Disease

- Impaired ambulation
- Psychological disturbances: depression and post-fall anxiety
- Compromised motor control, agility & planning of lower limbs
- Compromised lower limb strength & muscular endurance

Other Motor Signs & Symptoms

- Micrographia
- Masked Face
- Decreased eye blinking
- Hypophonia

Non-motor Complication

- Autonomic
  - postural hypotension
  - urinary frequency/ incontinence
  - Thermal dysregulation
  - Constipation and other GI problems
  - Sialorrhea
- Pain
- Sleep problem
  - Insomnia
  - REM behavior
  - Excessive sleepiness (side effects of meds)
- Psychiatric
  - Depression
  - Hallucination
  - Dementia (6 x more likely)

Broad Categories

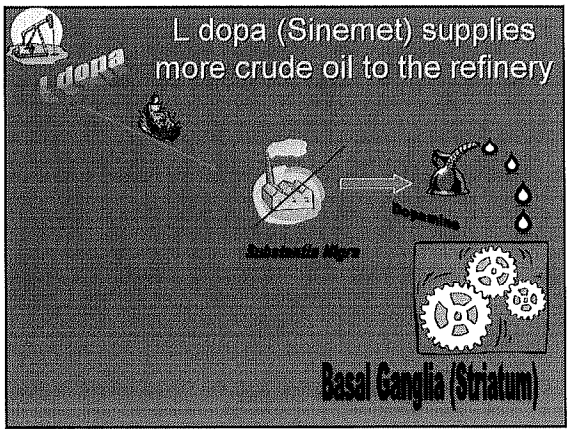
- Tremor predominant (best functional prognosis)
- Bradykinesia/akinesia
- Rigidity/postural instability/Gait difficulty

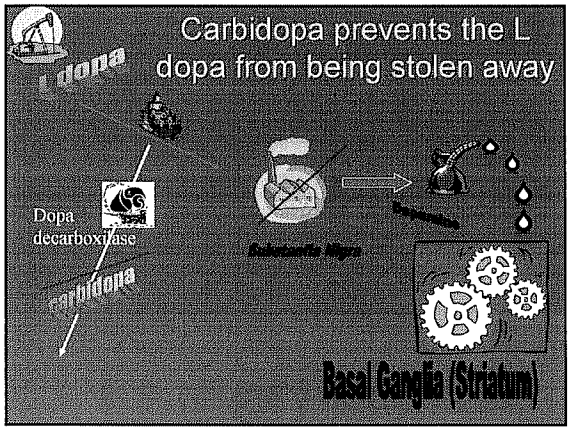
Today's Treatments (symptomatic)

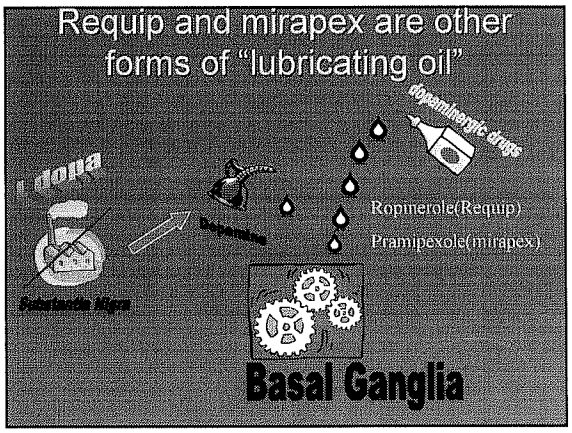
- Medication
- Deep Brain Stimulation vs. Ablative (thalamotomy, pallidotomy)
- Future Therapies: Stem Cell, Gene Therapy, experimental drugs, supplements (creatine)
- Physical Therapy & Exercise

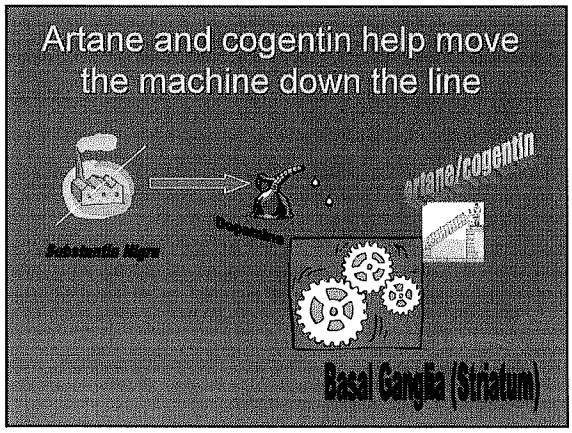
How do medications work in Parkinson's disease?

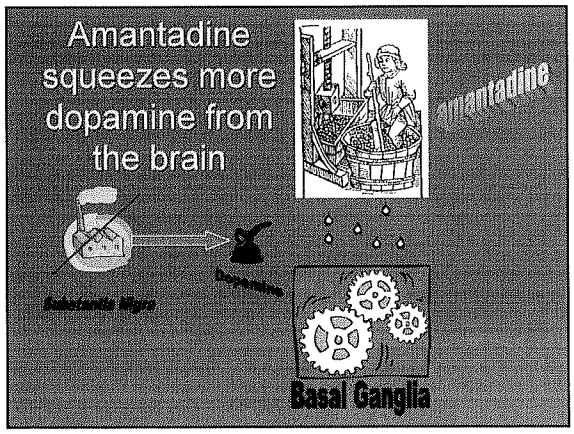
The PD Cocktail











Medication side-effects

- Hallucinations
- Orthostatic hypotension
- Sexual dysfunction
- Sleep Disturbances
- Dyskinesia
- Depression
- Impulse control
  - Hyper sexuality
  - Gambling

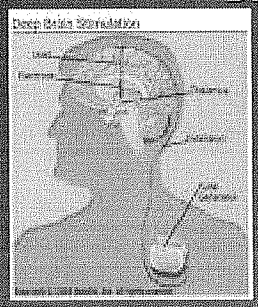
Medication

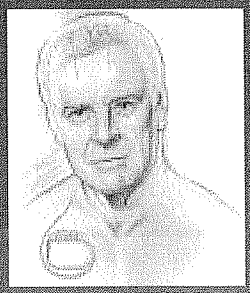
ON & OFF TIME

Surgical Options

- Thalamotomy &Pallidotomy
  - Neuroblatin procedures
  - Permanent- non-reversible
  - Unilateral only
- DBS: Replaced above options
  - reversible
  - can be bilateral
- Other: Gene therapy, stem-cell etc.
  - experimental

DBS



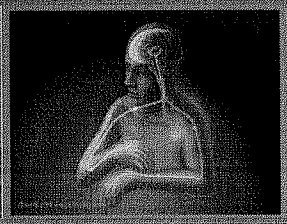


When do we refer patient to DBS surgery?

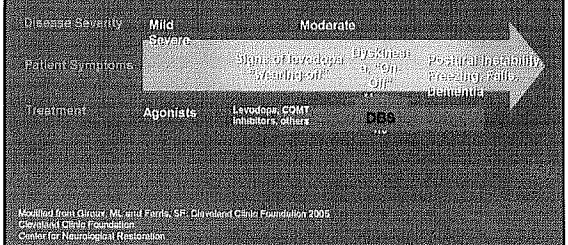
- Motor Fluctuation
- Surgery will help prolong patients "BEST ON STATE" on meds, decrease OFF time
- Cannot usually make ON better
- Can help reduce medication
- Swallow, cognitive, balance does not improve with surgery

Activa DBS Therapy

- Also known as deep brain stimulation, or DBS
- Uses an implanted electrode to deliver high-frequency electrical stimulation to structures involved in the control of movement within either the:
  - Ventral intermediate nucleus of the thalamus (Vim)
  - Subthalamic nucleus (STN)
  - Globus pallidus (GPi)
- This electrical stimulation overrides abnormal neuronal activity within these brain regions to bring motor controlling circuits into a more normal state of function, thereby reducing movement disorder symptoms



Parkinson's Disease Treatment: Continuum of Interventions

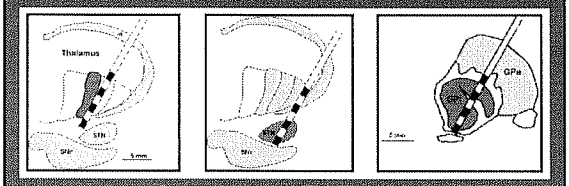


Modified from Ghiuur, VL and Fanta, SR: Cleveland Clinic Foundation 2005
Cleveland Clinic Foundation
Center for Neurological Restoration

Activa DBS Therapy: When Pharmacotherapy isn't Enough

- As Parkinson's disease progresses, medications may fail to provide consistent and adequate symptom control
- Medications used at levels required for symptom control may produce adverse effects
  - Motor complications, such as dyskinesia
  - Cognitive and psychiatric problems
  - Nausea, hypotension, and other systemic effects

Target Sites for Activa DBS Therapy



Vim Thalamus: Essential Tremor | Subthalamic Nucleus: Parkinson's disease and Dystonia | Globus Pallidus: Parkinson's disease and Dystonia

When Should Activa DBS Therapy be Considered?

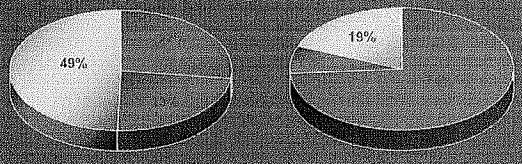
- When, despite optimized pharmacotherapy, your patient experiences troubling motor symptoms, which may include:
  - Wearing off – Off periods that contain troubling bradykinesia, rigidity, tremor, and/or gait difficulty
  - Troubling dyskinesia
  - Motor fluctuations
  - Refractory tremor

Exclusion Criteria for Activa DBS Therapy

- Atypical (non-idiopathic) parkinsonism
- Lack of sustained response to levodopa
- Frank dementia, moderate to severe dementia

Most Activa DBS Implanting Centers will review patient medical history to identify other potential exclusion criteria & verify patient candidacy for Activa DBS Therapy.

"ON" Time Without Dyskinesias Improves from 27% to 74% of a Patient's Waking Day*



*The Core Self-Assessment Package for Parkinson's Disease (CSAP) was used to measure the percentage of the waking day spent in the 'ON' state without dyskinesia, in the 'ON' state with dyskinesia, and in the 'OFF' state. Data on file.

Efficacy: Benefits of Activa DBS Therapy for PD Patient Population

87% of patients demonstrated improved motor scores in the OFF medication state at the 12-month evaluation .*

* Results were for a subset of patients whose data were verified

Motor Symptoms Improvements Maintained After 5 Years

- In a 5-year study, Activa DBS Therapy significantly improved OFF-medication assessments of tremor, rigidity, and akinesia/bradykinesia

	OFF-Medication Motor Score Improvements*			
	6-month	1-year	3 years	5 years
Tremor	79%	75%	83%	75%
Rigidity	58%	73%	74%	71%
Akinesia/bradykinesia	42%	63%	58%	49%

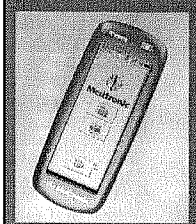
*Results for 87%

Additional Benefits of Activa DBS Therapy

- Bilateral, reversible, and adjustable
- Non-destructive versus ablative procedures
- Can be non-invasively fine-tuned to each patient's individual needs

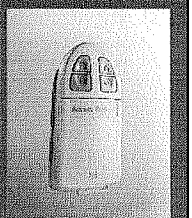
DBS

External Components



8840 N'Vision® Clinician Programmer

Access™ Patient Controller



Access™ Review Patient Controller

Non-pharmacological treatment

- Physical Therapy- Movement Strategies
- Exercise

PHYSICAL THERAPY

- Early Intervention should always be the focus.
- Rationale for therapy
  - Education on Movement Strategies
  - Increase ROM
  - Improve co-ordination of movement
  - Improve/maintain posture and functional abilities.
  - To prevent secondary sequelae
  - TO MINIMIZE FALLS!

PT Evaluation- Subjective

- When diagnosis was made
- Mobility difficulties
- Fall history
- Home/architectural barriers
- Activity level
- Medication list
- Support
- ADLs
- Goals

PT Evaluation- Objective

- Bradykinesia: finger-nose, foot tapping
- Rigidity: Extremities and trunk
- Tremors: severity, location
- Strength: Functional vs. MMT
- ROM/posture: Functional, structural?
- Functional Mobility (Bed mobility, sit-stand)
- Gait
- Balance: somato-sensory, Berg?, ability to recover, challenge for back
- Different tests: Get up and go, sit-stand, functional reach, 6 min walk test.

Treatment Focus

- Movement Strategies
- Posture
- Exercise (Life sentence)

PT Treatment: Movement Strategies

- No more automatic pilot/ Purposeful movement
- Conscious posture/darn that gravity
- Blending/sequential movement
- Freezing/external cues/anti-freezing techniques
- Festination (PD gait)/walking strategies

No more automatic pilot

- Prior to PD you did not have to think to move.
- The automatic pilot does not always work especially during wearing off (off periods) of medications.
- During off periods, you need to turn off the faulty automatic pilot and fly the plane manually!

Purposeful Movement

- Ability to move is not lost
- Basal Ganglia is responsible for automatic motion in learned motor tasks
- Bypass the depleted basal ganglia and use fronto-corticol pathways instead (requires conscious thought)

No more automatic pilot/ Purposeful movement

- ***Visualize***
- ***Plan***
- ***Sequence (one step at a time)***
- ***Complete***

Blending Movements

No More Multi-Tasking

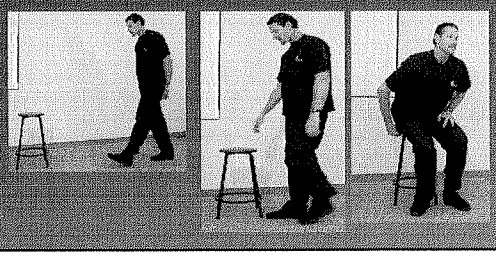
STAY IN THE MOMENT

TURN YOUR PATIENT'S INTO MENTAL

Blending movement

Sequential movement

One step at a time. Complete each step.



Manual flying applied to walking

- Focus on a target down the road.
- Keep stringing targets together to avoid stopping/freezing.

POSTURE

"Your back will tell you that Sister Anne Marie was right."

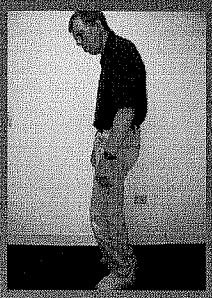
Conscious posture/darn that gravity

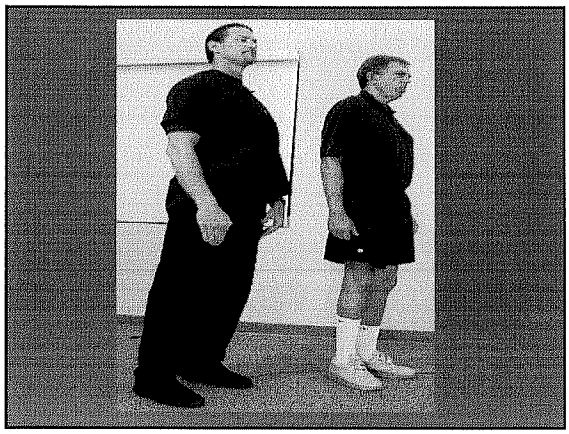
- POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE, POSTURE POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE,POSTURE

Poor Posture=Poor Function

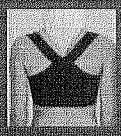
- Sit posture drill (decrease ADLs) (Dressing, etc.)
- Promotes freezing/festination (COG in front of base of support)
- promotes retropulsion (Inclines, reaching overhead)

Typical PD Posture





Posture Braces



Freezing/external cues/anti-freezing techniques

- Initiating Movement (poor man's hula)

External Cues

- Attention- conscious movement
- Auditory- Rhythm
- Visual- Marker/target
- Tactile- Sensory Stimulation

External cues

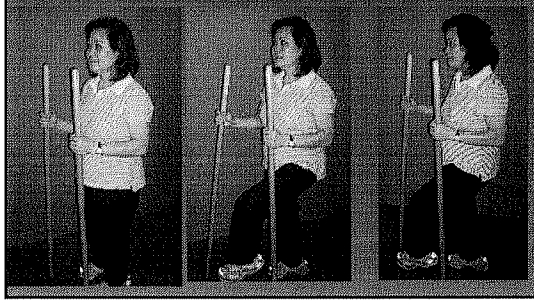
- Visual: Imaginary Line, tape, laser
- Auditory: Talking to self,counting,)
- Focus on a target/destination
- External focus vs. Internal focus (study)

Anti- Freezing Strategies

- Stop when freezing occurs. Do not attempt to move through it as it often leads to loss of balance.
- Restart movement with a purposeful step (*See Poor Man's Hula*).
- Visualize stepping over an imaginary object.
- If doorways and elevators are a problem, try to look past the threshold focusing on where you want to go to versus the threshold itself.
- See what tricks work for you and practice these strategies. Having done this may decrease anxiety lessening the "freezing affect".

Walking Strategies

- Four Point Gait

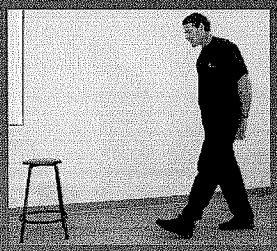


Walking Strategies

- "The British Soldier"

Walking Strategies

- Heel First

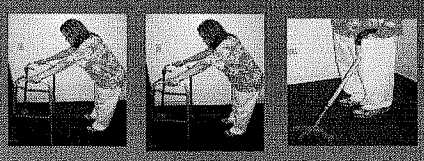


Fall Prevention Strategy

- Arms up

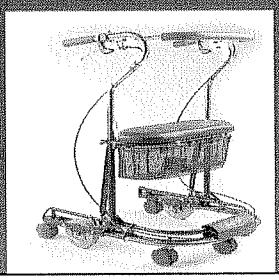
Assistive Devices

- Balance & Posture vs. Off-loading
- Stability vs. Mobility



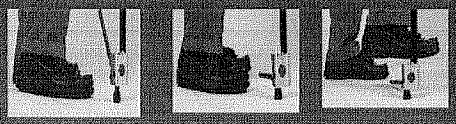
Specialty Devices

- U-Step Walker (Laser)



Specialty Devices

- Next Step Cane



Captain Cheapo

Walking Poles

- Nordic poles or wooden sticks

Functional Mobility

- Bed Mobility
- Coming to standing

Bed Mobility

Supine to sit

Coming to standing

- Sit to stand

Exercise!!!!!!!!!!!!!!!!!!!!!!!!

Exercise and PD

Physical exercise improves quality of life for patients with PD.

Exercise might lower the risk of getting PD or improve function and delay progression

- In rodents after chemical damage to the substantia nigra forced exercise improved dopamine levels and motor function
- Human studies generally indicate that more physical activity is associated with lower PD risk although results have not been definitive

Honolulu Heart Program

- Lower mid-life physical activity measured at least 12 years prior to diagnosis is associated with higher risk of PD among men
- Potential Explanations:
  - Physical activity might protect against PD, or
  - people destined to get PD might not want to do moderate to heavy physical activity many years before diagnosis.

Benefits of Exercise (Zigmond et al)

- Aerobic exercise showed increased blood vessels in the brain. (Causing increased waste removal)
- Balance exercise showed increase synapses.
- Aerobic and (questionably) balance activities showed increase brain cell survival factors

Other Exercise & PD Research

- Univ.Pitt. Zigmond,Michael (Treadmill monkeys)
  - exercise neuro protective
- Wash U-St. Louis (Tango)
  -Compared Tango, Waltz, Tai Chi, no intervention.
  - All exercise groups improved on balance, distance walked & disease severity ratings
  - Only Tango improved on quality of life, and backward walking.

Exercise Goals/Focus

- Strength
- Posture
- Function
- Endurance
- Flexibility
- Other?!*! (Neuro-protective?)

Types of Exercise

- Resistance training such as lifting weights
  - A small number of trials suggest that resistance training is effective for increasing muscle strength, endurance, motor speed, and equilibrium
  - More trials are needed to be definitive
  - Should target postural muscles
  - Focus on speed for power

Types of Exercise

- Aerobic exercise such as walking, swimming
  - More intense aerobic exercise (body supported treadmill) associated with improved motor function, including walking speed, and step length compared to low intensity or no exercise
  - A small study published Jan. 2009 indicates that "forced" exercise may result bigger improvements than self paced exercise (Clevend Clinic- J. Alberts)
    - Tandem bike (480 mi. pedaling for PD)

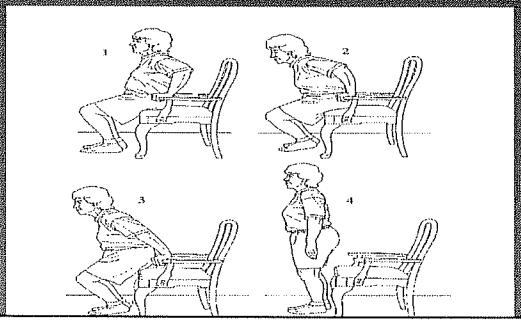
Types of Exercise

- Flexibility training such as stretching, yoga, and tai chi
  - Tai chi has been reported to improve balance and mobility in patients with PD (2008)

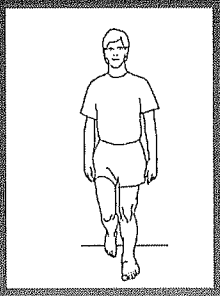
Benefits of Exercise: Unanswered Questions??????????????????

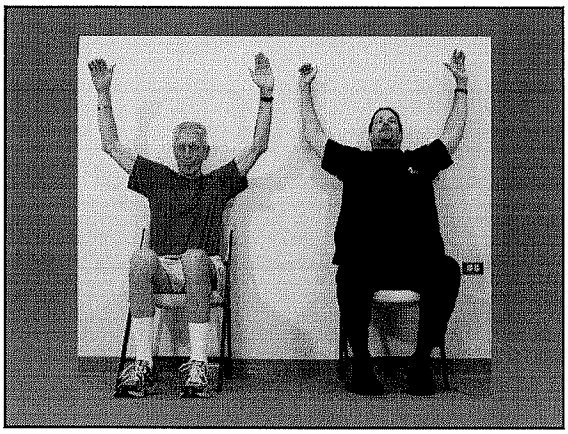
- How much is needed (Ex Volume)?
- What type is most beneficial for staving off symptoms?
- What type is most beneficial for preventive measures?
- What intensity is required for good results?

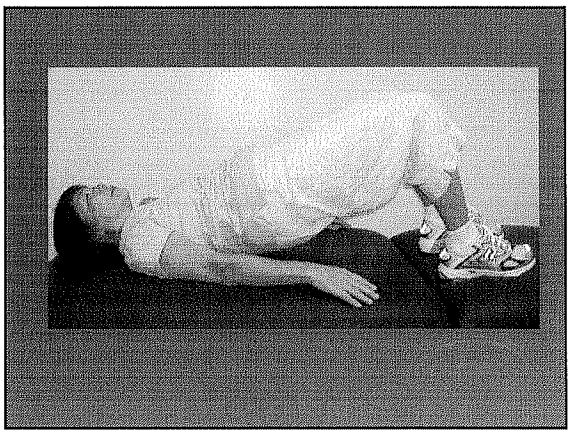
EXERCISES

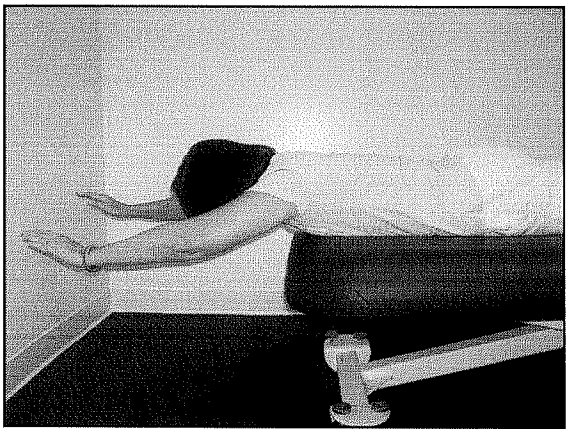


Exercises





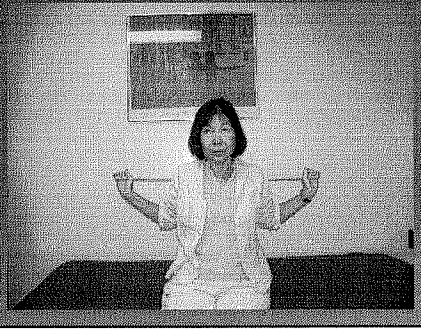




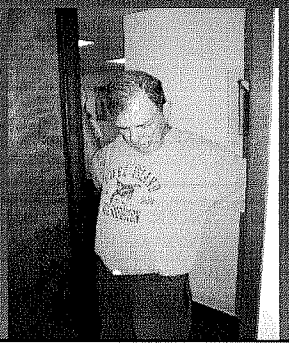
FLEXIBILITY

- Posture, reduce restriction, ADLS
- Static, slow stretches (minimum 20 sec)
- No Bouncing
- Focus on anterior shoulders, chest, hip and knee flexors.

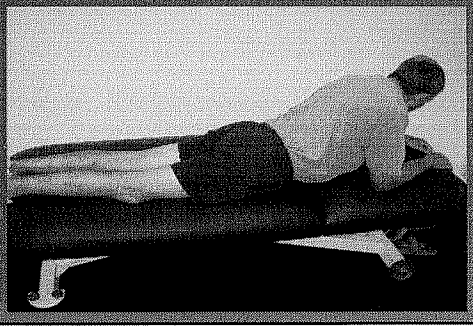
FLEXIBILITY



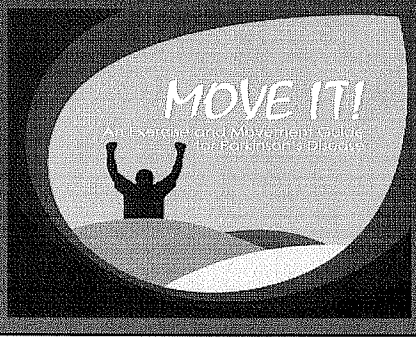
Flexibility



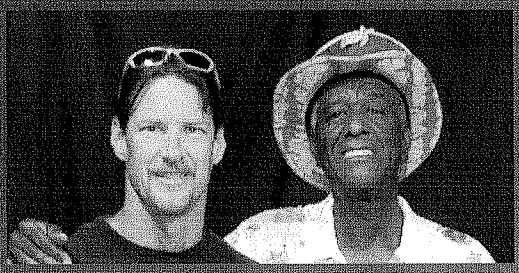
Flexibility



MOVE IT!



Many Mahalos



Mahalos con't

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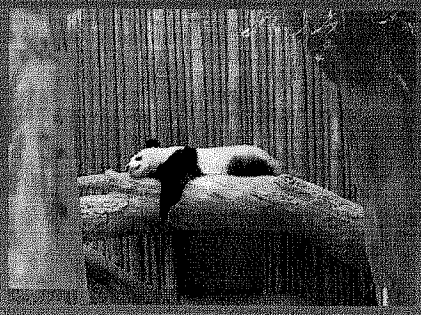
Exercise DVD/Book

- MOVE IT!
- www.parkinsonsmoveit.com or available on Amazon.com

THE END



QUESTIONS

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