

The Science and Practice of LSVT BIG[®]: Physical/occupational therapy for Parkinson disease



Erica Vitek, MOT, OTR, BCB-PMD, PRPC

Copyright© of LSVT Global, Inc. 2014

Objectives of Presentation

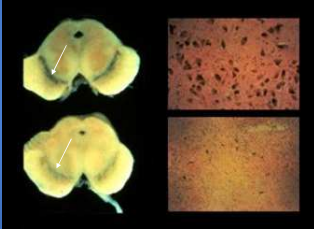
- Briefly review Parkinson disease
- Explain advances in neuroscience and impact on the field of rehabilitation
- Discuss development, data and exercises for the efficacious speech treatment LSVT LOUD
- Describe development, data and exercises of LSVT BIG

What is Parkinson Disease?

- Parkinson disease (PD) is a progressive degenerative disease of the brain in which neurons of the basal ganglia (substantia nigra) degenerate/die causing insufficient formation of the chemical called dopamine. With approximately 50-80% loss of these cells, the person will start noticing symptoms of PD.
 - PD is the second most common neurodegenerative disorder, after Alzheimer's disease.
 - PD belongs to a group of conditions called movement disorders.

Substantia Nigra

Normal Brain



PD Brain

Definitions

- **Dopamine:** Neurotransmitter produced in the substantia nigra; roles and functions of dopamine include mood/behavior, cognition/learning, movement, reward/motivation, and sleep.
- **Idiopathic Parkinson disease (PD):** This is the most commonly referred to diagnosis, meaning of unknown cause. 85% of PD cases are diagnosed as idiopathic.

Who gets Parkinson Disease?

- Approximately 1.5 million people in the United States have been diagnosed with Parkinson disease, and approximately 60,000 new cases are diagnosed each year.
- Accurate numbers are difficult to obtain because early symptoms, which are often subtle or transient, are sometimes mistaken for symptoms of normal aging.

Who gets Parkinson Disease?

- There is increased risk of PD with advancing age.
- Typically develops after age 65, however 15% are individuals under the age of 50.
- PD affects both men and women in equal numbers, however more so in men with young onset diagnosis.
- The majority of PD cases are thought to be caused by a combination of environmental & genetic factors.

How is Parkinson Disease Diagnosed?

- There is no specific test or marker that can definitively diagnose Parkinson disease.
- Diagnosis can be confirmed at time of autopsy.
- In order to diagnose, a neurologist must perform a standardized neurological assessment as well as identify the presence of at least two out of the first three cardinal motor signs and symptoms.
- The cardinal motor symptoms typically begin on one side of the body and progress to the other.
 - To note: prior to the onset of motor symptoms, individuals may realize that in the past months/years they experienced constipation, vivid dreams, depression, and/or a diminished sense of smell.

Cardinal Motor Signs & Symptoms

- Tremor
- Bradykinesia
- Rigidity
- Postural Instability

Non-motor Symptoms

- People with Parkinson disease also suffer from non-motor symptoms which can be as disabling as the cardinal motor symptoms previously described.
 - These symptoms are likely due to the loss of dopaminergic and nondopaminergic innervation in other brain regions.

Motor	Sensory	Cognitive	Autonomic
Bradykinesia	Pain	Mood changes	Thermal regulation
Tremor	Aching	Depression	Sweating
Rigidity	Restlessness	Anxiety	Urinary dysfunction
Postural instability	Paresthesias	Panic attacks	Constipation
Stooped/shuffling gait	Chest discomfort	Paranoia	Seborrhea (drooling)
Decreased arm swing	Anosmia (smell loss)	Dementia	Sialorrhea (flaking scalp)
Lower extremity cramps	Visual perception	Confusion	Sexual dysfunction
Weakness/fatigue	Diplopia	Bradyphrenia	Erectile dysfunction
Hypophonia	Visual hallucinations	Apathy	Orthostatic hypotension
Dysphagia		Inattention	Daytime somnolence
Incoordination/ /dexterity		Obsessive/compulsive	Insomnia
Freezing		Decreased self confidence	
Masked face			
Micrographia			
Decreased eye blinking			

Modified from: "The Clinicians' and Nurses' Guide to Parkinson's Disease (Medscape) "Cardinal symptoms highlighted in yellow"

Standardized Evaluations

1. Unified Parkinson Disease Rating Scale (UPDRS)
2. Hoehn and Yahr Staging
3. Schwab and England Activities of Daily Living

Standardized Evaluations

- Unified Parkinson Disease Rating Scale (UPDRS)
 - Used by a rater to assess the severity of symptoms along the longitudinal course of Parkinson disease
 - 42 items assessing mentation, mood, behavior, ADLs and motor skills
 - Rated on a 0-4 scale (4 being most impaired)
 - The results of each item are then calculated: the greater the number the greater the disability

Standardized Evaluations

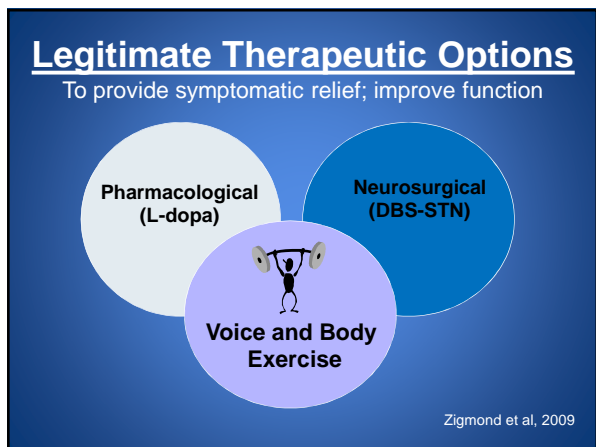
- Hoehn and Yahr Staging

Hoehn and Yahr Staging	
Stage 1	Unilateral involvement
Stage 2	Bilateral involvement
Stage 3	Postural instability
Stage 4	Assist with ADLs, but still ambulating
Stage 5	Bed/wheelchair ridden

Standardized Evaluations

- Schwab and England Activities of Daily Living
 - Scale is used to determine patient's current level of ADL impairment
 - A percentage scale is used and can be rated by the patient or rater

Schwab and England Activities of Daily Living	
100%	Completely independent. Able to do all chores without slowness, difficulty or impairment. Essentially normal. Unaware of any difficulty.
90%	Completely independent. Able to do all chores with some degree of slowness, difficulty or impairment. May take twice as long. Beginning to be aware of difficulty.
80%	Completely independent in most chores. Takes twice as long. Conscious of difficulty and slowing.
70%	Not completely independent. More difficulty with some chores. Three to four times as long on chores for some. May take large part of day for chores.
60%	Some dependency. Can do most chores, but exceedingly slowly and with much effort and errors. Some impossible.
50%	More dependent. Help with half of chores. Difficulty with everything.
40%	Very dependent. Can assist with some chores but few alone.
30%	With effort, now and then does a few chores alone or begins alone. Much help needed.
20%	Nothing alone. Can be a slight help with some chores. Severe invalid.
10%	Totally dependent, helpless. Complete invalid.
0%	Bedridden. Vegetative functions, such as bowel/bladder and swallowing are not functioning.



Medication Management

- The main goal of antiparkinson drug therapy is to replenish, mimic, or enhance the brain's supply of dopamine
- PD symptoms and response to treatment varies widely from one patient to the next (as does the progression of the disease)
- Medication choices and doses must be tailored specifically to each patient

Medication Management

- Diagnosis does not trigger the need for medications
- Avoiding immediate treatment can delay long-term side effects/complications which may interfere with drug therapy years later
- Virtually all the medications have side effects which vary in their pattern and severity
- Timing of the medication administration is key to ensuring the best functional response
- Levodopa (Sinemet® = carbidopa/levodopa) is currently the most effective treatment for motor symptoms
- Non-motor symptoms should be considered as targets for medication treatment as much as the motor symptoms

Levodopa

- Levodopa (L-dopa)
 - Was the first major breakthrough in the treatment of PD
 - Levodopa is converted to dopamine for use by the brain, as dopamine in pure form is unable to cross the blood brain barrier
 - When Levodopa is taken orally, portions of the dose are converted into dopamine by the enzyme DDC (dopadecarboxylase) before it can cross the blood brain barrier
 - Frequent side effects due to peripheral actions of dopamine are:
 - Nausea - Tachycardia
 - Vomiting - Orthostatic hypotension
 - Loss of appetite

Levodopa

- Levodopa
 - Due to the side effects of taking Levodopa alone it is combined with Carbidopa
 - Carbidopa blocks the DDC (dopa decarboxylase) enzyme outside the brain allowing more Levodopa to enter the brain
 - Carbidopa in itself has not been shown to produce side effects
 - Most patients require 75-100 mgs of Carbidopa per day to effectively allow enough Levodopa to enter the brain
 - The representation of the dose appears as Carbidopa (mg)/Levodopa (mg) i.e. Sinemet 25/100 (25 mg Carbidopa/100 mg Levodopa)

Levodopa

- The dosing is highly individualized and varies over time
- As the disease progresses, each dose's action may decrease, which may require more frequent dosing
- Many years of use may cause patients to develop "on" and "off" times
- Many individuals can experience dyskinesias when the medication effect reaches its peak (i.e.) chorea
- Many individuals can experience slowness when the medication effect reaches its trough (i.e.) freezing, bradykinesia/hypokinesia, akinesia

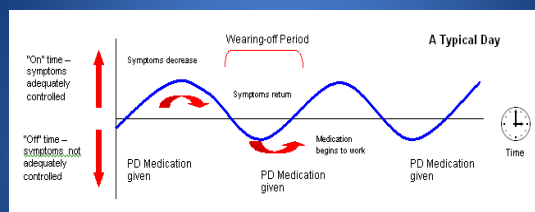
Symptoms that will benefit from L-dopa

Rigidity
Bradykinesia
Tremor
Gait
Hypomimia (flat affect)
Micrographia

Symptoms that do not respond well to L-dopa

Postural instability
Dysarthria
Sexual dysfunction
Excessive sweating
Neurosensory problems
Seborrhea (scaly skin)
Constipation
Depression
Anxiety
Dementia

Wearing-off Phenomenon



- At the peak of the "on" time, patients may experience chorea which can be a sign of "too much" medication
- At the trough of the "off" time, patients may experience freezing and bradykinesia which can be a sign of "underdosing"

It is a “Stunning Time” to be in rehabilitation today

- Basic science evidence for the value of exercise in PD (classically drugs, surgery)
- Identified key principles of exercise that drive activity-dependent neural plasticity
- Demonstrated that exercise can improve brain functioning (neural plasticity) and may slow disease progression
- **Exercise is Medicine!**

Kleim & Jones, 2008; Ludlow et al, 2008

Animal Models of Parkinson Disease

1. Early matters – neuroprotective
Use it or lose it!
2. Intensity matters – neurorestorative
Use it and improve it!
3. Continuous matters – disease modification
Use it or lose it!
4. Inactivity is prodegenerative!

(Tillerson et al, 2001; 2002; 2003)

Animal Models of Parkinson Disease

1. Early matters – neuroprotective
Use it or lose it!




If exercise treatment began EARLY before or during dopamine terminal degeneration, exercise reversed the motor symptoms

Reduction in the loss of dopamine in the striatum

Animal Models of Parkinson Disease

2. Intensity matters – neurorestorative
Use it and improve it!




➔

If LATER, 50% or more loss of the dopamine neurons, exercise reversed the motor symptoms

Caused increased utilization of dopamine

Animal Models of Parkinson Disease

3. Continuous matters – disease modification
Use it or lose it!




➔

Stopping exercise or adding stress CANCELLED the brain and behavioral benefits gained by exercise

Animal Models of Parkinson Disease

4. Inactivity is prodegenerative!



➔

Non-use/inactivity EXAGGERATED the symptoms in animals that had “pre-clinical” or non-symptomatic PD

Clinical Implications from Animal Models

- Rationale for early intervention across disease severity that is INTENSIVE, TASK SPECIFIC, CONTINUOUS exercise that is FUN/ENGAGING!
- Inactivity is pro-degenerative

Video Example:

- 59 year old female
- 2.5 years post-diagnosis
- On-meds pre and post video

Pre/post LSVT LOUD
(Lee Silverman Voice Treatment)
Intensive physical exercise of speech mechanism

Insert Short Shirley Video Here

Patient case: Bernie

- 71 year-old, diagnosed with Parkinson's disease in 1994
- Reason for referral: slowness and difficulty walking, history of falls, freezing
- Optimized on PD medications
- Hoehn & Yahr 3

Insert LSVT Walk BIG video here

Case Study Outcomes:

	<u>PRE</u>	<u>POST</u>
Falls	1-2/month	0/month
Assistive device	Cane	None
Gait Velocity	0.35 m/s	1.17 m/s
% of age matched norm	29.6 %	100%
Endurance	730 ft	1200 ft

- ✓ To improve his walking
- ✓ To go to the movies
- ✓ To play with his grandchildren
- ✓ To go out to dinner with friends and family

Where did we begin...

"If only we can hear and understand her"

Family of Mrs. Lee Silverman 1987



25+ year journey from invention to scale-up Over 8 million dollars in NIH funding

Phase I, II
Phase III
Phase IV, V

- 1987-89: Initial invention; Pilot data (Scottsdale)
- 1989-91: Office of Education OE-NIDRR
- 1991-94: OE-NIDRR
- 1990-95: NIH funded RCT Efficacy
- 1995-00: NIH funded EMG, Kinematics
- 2002-07: NIH funded RCT Spread of effects
- 2007-12: NIH funded RCT, imaging
- 2001-02: Coleman Institute (PDA; LSVTC)
- 2002-04: NIH and M J FOX Foundation PDA (R21)
- 2002-04: Coleman Institute (VT; LSVTVT)
- 2004-06: NIH LSVTVT (R21)
- 2004 : Coleman Institute (LSVT Down Syndrome)
- 2004-07: LSVT –Dissemination
- 2006: Technology-enhanced Clinician Training (SBIR)
- 2010: Technology-enhanced LSVT LOUD delivery (SBIR)

Traditional Therapy Approach

- “Piecemeal approach” targeting multiple impairments unsystematically
- Low to medium intensity
- No treatment of sensory impairments
- Little expectation for lasting improvement
- Compensatory focused

Suggested compensatory strategies for rehab

1. Avoid multitasking during daily activities.
2. Use external cues to initiate and maintain movements during activities.
3. Divide complex movements into a series of simpler components of the overall task, learn to execute sequentially.

van der Marck, Kalfa, Sturkenboom, Nijkrakea, Munneke, Bloem (2009). Multidisciplinary care for patients with Parkinson's disease. Parkinsonism & Related Disorders, 15: S219-23.

Our approach

- Attack underlying mechanism – Early PD
 - Address nigrostriatal deficits
- Also compensatory – Moderate to Late PD
 - Alternative circuits
- Focus on one treatment target: increasing amplitude across motor systems
 - Dual task train
 - Relearn a new internal cue for amplitude scaling
 - Not break systems down, practice with one target
 - Collaborate easily across allied professions

LSVT Programs

Administered in an intensive manner to to **challenge the impaired** system.

Techniques specific to PD-specific deficits!
bradykinesia/hypokinesia
and
kinesthetic awareness
(sensory deficit)

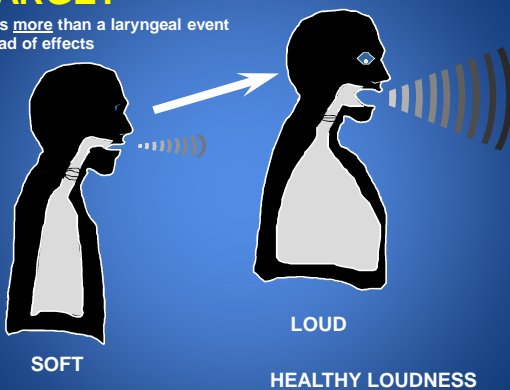
LSVT BIG Paradigm Shifts

(Covey)

- **TARGET:** Amplitude
 - **MODE:** Intensive and High Effort
 - Sensory **CALIBRATION:** Generalization
- Empowering!

TARGET

Loud is more than a laryngeal event
- spread of effects



MODE

What are the LSVT LOUD exercises?

Daily tasks

First half of treatment session

Rescale amplitude of motor output through CORE Loud

- Sustained “ah” (minimum 15 reps)
- High/Low “ah” (minimum 15 reps)
- Functional phrases (minimum 50 reps)

Hierarchical speech tasks

Second half of session

Train amplitude from CORE exercises into in context specific and variable speaking activities

- Week 1 – words, phrases
- Week 2 – sentences
- Week 3 – reading
- Week 4 – conversation

↑ Shorter, simple

↓ Longer, more complex

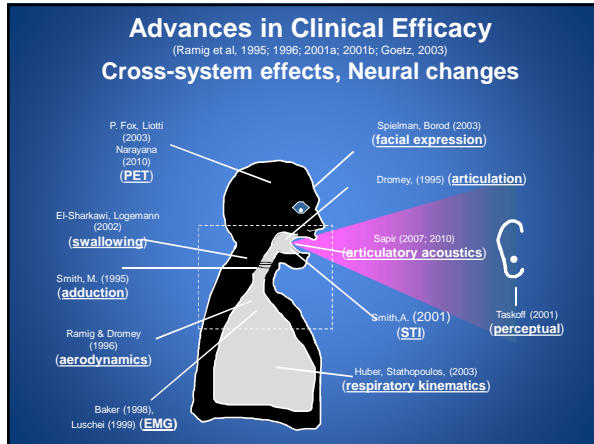
CALIBRATION

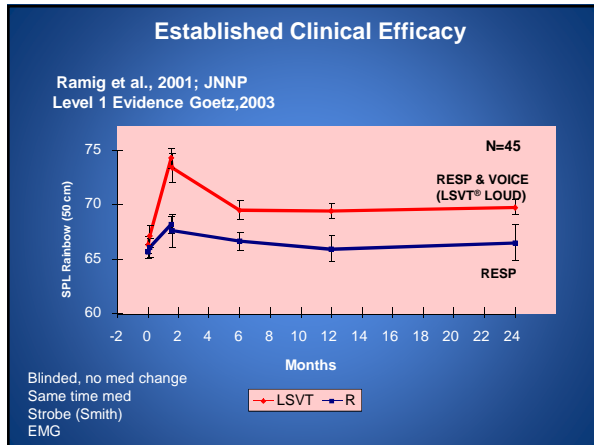
MISMATCH between
self perception of
output and how others
perceive it

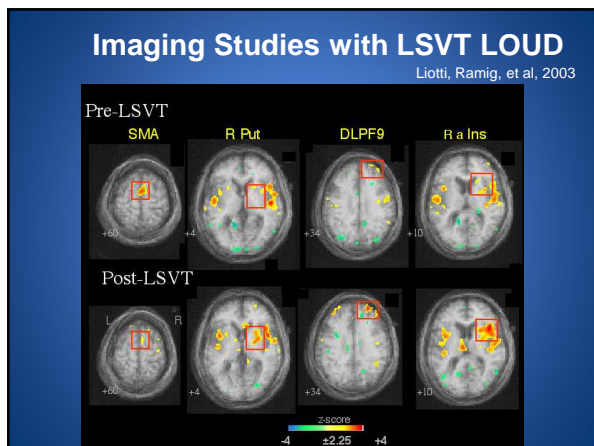
“I’m not too soft”
“I can’t speak like this,
I am shouting!!”

Fox et al, 2002; Sapir et al, 2011

LSVT LOUD: Data







LSVT LOUD® → **LSVT BIG®**



(Ebersbach et al, 2010; Farley & Koshland, 2005; Fox, et al., 2012)

What are the fundamentals of LSVT BIG?

Standardized, research-based, specific protocol

TARGET: Bigness (amplitude)

MODE: Intensive and High Effort

CALIBRATION: Generalization

- Sensory
- Internal cueing
- Neuropsychological changes

TARGET

BIG (Large amplitude whole body movement)

Single Target - Triggers Activation across motor systems



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)

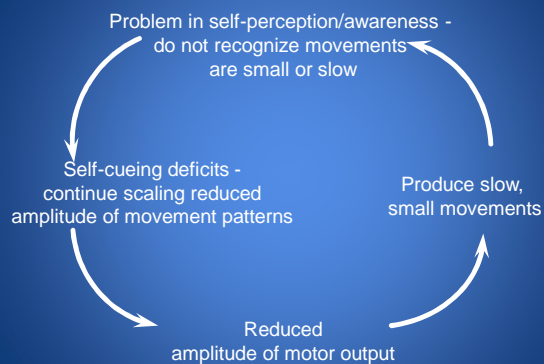
CALIBRATION

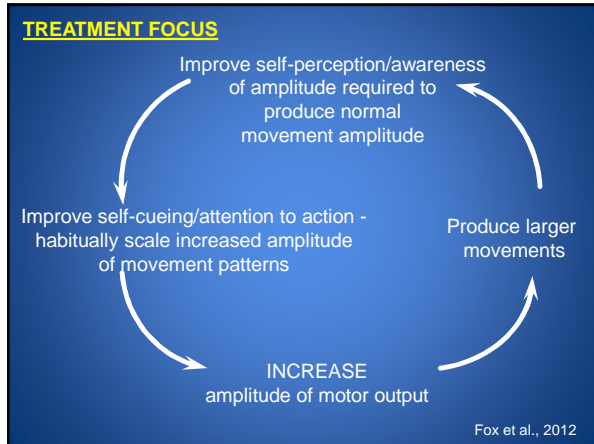
MISMATCH between self perception of output and how others perceive it

"I had no idea how small my world had become"

"I can't move like this, people will think I am crazy!!"

PRE-TREATMENT

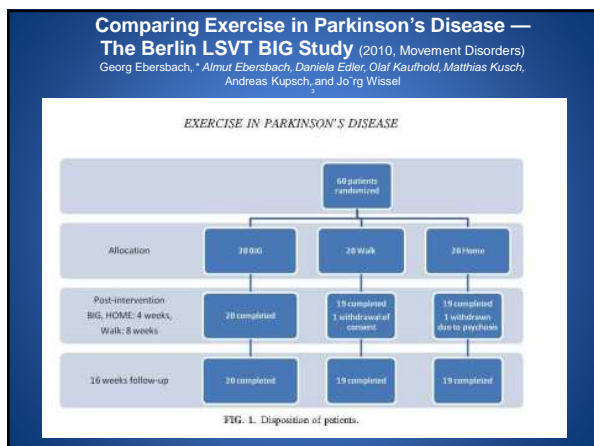


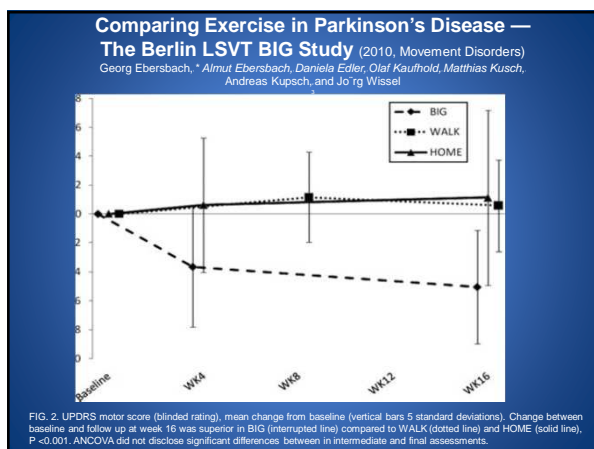


Stimulation vs. Training in Therapy

- Stimulation = pt **performs** a task, inducing a transient behavior in response to an external cue
- Training = pt participates in a systematic & intensive program designed to change a behavior so that the pt will:
 - develop an internal cue to perform the target behavior & will NOT depend on external cues
 - maintain target behavior over a period of time (i.e. months or years)
- Training (and maintaining) requires: **learning**, recall, & ability to internally cue & self-regulation

LSVT BIG: Data





Amplitude-oriented exercise in Parkinson's disease: a randomized study comparing LSVT-BIG and a short training protocol

Georg Ebersbach • Ute Grust • Almut Ebersbach • Brigitte Wegner • Florin Gandor • Andrea A. Ku'hn

May 2014

Comparing 4x/week for 4 weeks to 5x/week for 2 weeks

"In spite of comparable outcome of clinician-rated UPDRS scores and laboratory motor assessments, we recommend to deliver LSVT-BIG according to the standard protocol since shorter training routines are less likely to provide patient-perceived improvement." (carryover to functional life)

LSVT BIG: Treatment Protocol

OVERVIEW – PROTOCOL

- 4 consecutive days a week for 4 weeks
- 16 sessions in 1 month
- 60 minute sessions

LSVT BIG Treatment Session

Maximal Daily Exercises <ol style="list-style-type: none">1. Floor to Ceiling – 8 reps2. Side to Side – 8 each side3. Forward step – 8 each side4. Sideways step – 8 each side5. Backward step – 8 each side6. Forward Rock and Reach – 10 each side (working up to 20)7. Sideways Rock and Reach – 10 each side (working up to 20)	Functional Component Tasks <p>5 EVERYDAY TASKS– 5 reps each</p> <p><u>For example:</u></p> <ul style="list-style-type: none">-Sit-to-Stand-Pulling keys out of pocket-Opening cell phone (flip phone) Hierarchy Tasks <p>Patient identified tasks: Getting out of bed Playing golf In and out of a car</p> <p>Build complexity across 4 weeks of treatment towards long-term goal</p> Walking BIG <p>Distance/time may vary</p>
--	--

Maximum Sustained Movements



Floor to Ceiling



Side to Side

Maximum Sustained Movements



Floor to Ceiling

Video – Floor to Ceiling

Insert HH DVD clip of this exercise

Maximum Sustained Movements



Side to Side

Video – Side to Side

Insert HH DVD clip of this exercise

Multidirectional Repetitive Movements Step and Reach



Forward Step



Sideways Step



Backward Step

Multidirectional Repetitive Movements
Step and Reach



Forward Step

Video – Step Forward

Insert HH DVD clip of this exercise

Multidirectional Repetitive Movements
Step and Reach



Sideways Step

Video Step Sideways

Insert HH DVD clip of this exercise

Multidirectional Repetitive Movements
Step and Reach



Backward Step

Video – Step Backward

Insert HH DVD clip of this exercise

Multidirectional Repetitive Movements
Rock and Reach



Forward/Backward Rock and Reach Sideways Rock and Reach

Multidirectional Repetitive Movements
Rock and Reach



Forward/Backward Rock and Reach

Video Forward Rock and Reach

Insert HH DVD clip of this exercise

Multidirectional Repetitive Movements
Rock and Reach



Sideways Rock and Reach

Video – Sideways Rock and Reach

Insert HH DVD clip of this exercise

Functional Component TASKS

Functional Components – Patient DRIVEN!

- 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

Video - Sit to Stand

Insert HH DVD clip of this exercise

What about Fine Motor Tasks?

- Even small movements are TOO SMALL in people with PD!
 - Examples: writing, buttoning, teeth brushing, stirring

Buttoning BIG Video

Insert buttoning video

1) Walking Duration	1) Walking Duration
2) Balance	2) Balance
3) Fear of falling	3) Fear of Falling
4) Getting out of soft chair	4) Getting Out of Soft Chair
5) Putting pants on	5) Putting Pants On
6) shoes on and off	6) Shoes on and off
7) Standing for long periods	7) Standing For Long Periods
8) standing in shower	8) Standing In Shower
9) handwriting clarity	9) Hand writing Clarity
10) preparing meals on my own	10) Preparing Meals on my Own

Generalized Amplitude: Uncued writing post-treatment and untrained during therapy

Hierarchy Task Examples

“Real-World” BIG Tasks – Patient DRIVEN!

- | | |
|---------------|-------------------------------------|
| In/Out of Car | Getting in/out of bed |
| Walk and Talk | Laundry |
| ADL's | Going out to church/restaurant |
| Writing | Playing with children/grandchildren |
| Tennis | Shopping |
| Chores | Transportation: train/bus/car |
| Golf | Getting the mail |
| Hiking | Cleaning the house |
| Gardening | |

LSVT BIG before and after walking assessments

- Patient 1
 - Before LSVT BIG treatment
 - After LSVT BIG treatment
- Patient 2
 - Before LSVT BIG treatment
 - After LSVT BIG treatment
- Patient 3
 - Before LSVT BIG treatment
 - After LSVT BIG treatment

LSVT BIG TREATMENT GOAL

People with Parkinson disease will use their bigger movements “automatically” in everyday living – and there will be long-term carryover of increased amplitude use!

Summary

- Advances in neuroscience have provided neurobiological and behavioral evidence supporting the positive impact of exercise-based protocols in people with PD
- There is a rapidly growing literature in physical therapy/exercise protocols in humans with PD
- LSVT Programs have been developed and studied over the past 20 years
- LSVT BIG is one type of therapy program that has potential to offer improvements in movement and quality of life for people with PD

LSVT BIG and LSVT LOUD

- Visit www.lsvtglobal.com to find current LSVT LOUD or LSVT BIG Certified Clinicians
- LSVT Global is happy to partner in hosting a course in your area
- DVDs available to introduce the movement exercises used in LSVT BIG and voice exercises used in LSVT LOUD: www.lsvtglobal.com/products or www.amazon.com/shops/LSVTGlobal

QUESTIONS?

Email: info@lsvtglobal.com
Website: www.lsvtglobal.com
