

- If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.
- This handout is for reference only. Non-essential images have been removed for your convenience. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date.

No part of the materials available through the continued.com site may be copied, photocopied, reproduced, translated or reduced to any electronic medium or machine-readable form, in whole or in part, without prior written consent of continued.com, LLC. Any other reproduction in any form without such written permission is prohibited. All materials contained on this site are protected by United States copyright law and may not be reproduced, distributed, transmitted, displayed, published or broadcast without the prior written permission of continued.com, LLC. Users must not access or use for any commercial purposes any part of the site or any services or materials available through the site.

## Technical issues with the Recording?

- Clear browser cache using [these instructions](#)
- Switch to another browser
- Use a hardwired Internet connection
- Restart your computer/device

## Still having issues?

- Call 866-782-6258 (M-F, 8 AM-8 PM ET)
- Email [customerservice@PhysicalTherapy.com](mailto:customerservice@PhysicalTherapy.com)

# Individualizing Balance Programs Across the Degenerative Diseases

---

## 1. Neuroplasticity is viable for functional recovery in:

- A. Parkinson's disease
  - B. Cerebellar degeneration
  - C. Multiple sclerosis
  - D. All of the above
- 

## 2. Strength training in the degenerative diseases should be:

- A. Only 1-2x/week
  - B. Using no more than 5# overhead
  - C. Prescribed using perceived exertion scales
  - D. Done on consecutive days to extinguish DOMS
- 

## 3. Muscular endurance training in degenerative diseases:

- A. Should be daily for all cases except ALS
  - B. Should be 15-20 repetitions per set
  - C. Should be performed early in the morning whenever possible
  - D. Should be performed at a weight no greater than 3# overhead
- 

## 4. Cardiovascular endurance training in degenerative diseases should be:

- A. Performed using the Karvonin equation with a target HR of 70-90%
  - B. Performed in a cumulative 10 minutes/setting manner for most
  - C. Performed using perceived exertion
  - D. B and C are correct
-

---

**5. Balance training in the degenerative diseases should be:**

- A. Performed 3-5 days per week at most
- B. Causing a person to need help to prevent a fall 50% of the time
- C. Including standing in feet-together, nudge position, and eyes closed for all
- D. Involve dynamic balance as tolerated

---

**6. According specifically to the OPTIMAL theory of motor learning:**

- A. Persons with degenerative diseases cannot be expected to improve and retain (motor learning). They can only demonstrate motor performance
- B. Balance rehabilitation might be best carried out in a functional task specific setting
- C. Balance rehabilitation includes repetition, blocked practice, and a functional context
- D. Is assigned when the instructor or therapist sees aphasia

---

**7. High intensity exercise in PD**

- A. May stimulate brain derived neurotrophic factor release
- B. May cause the brain to regenerate the substantia nigra
- C. May cause the body to release carbidopa
- D. May stimulate dopamine reabsorption into the cerebellum

---

**8. Dual task training in PD**

- A. Is necessary to force patients to regain automaticity/automatic motor skill
- B. Is contraindicated
- C. May help some patients deal with festinating gait
- D. A and C are correct

---

**9. Perceived exertion is used as a measure of intensity in MS, because:**

- A. Possible autonomic nervous system involvement
- B. Patient response to exercise can be tracked more easily from session-session using a perceived exertion scale
- C. Exacerbation of MS is a frequent occurrence in therapy
- D. A and B are correct

---

**10. Frail patient management includes:**

- A. Functional testing such as timed standing, bed mobility, or w/c propulsion
- B. Body weight support in endurance training as available
- C. Appropriate nutrition and hydration
- D. All of the above

continued

## Individualizing Balance Programs Across the Degenerative Diseases



Mike Studer, PT, MHS, NCS, CEEAA, CWT, CSST

continued

## Learning Outcomes

After this course, the participant will be able to:

- Accurately list at least three key factors to best individualize a balance prescription for individuals with degenerative diseases
- Correctly describe least two evidence-based reasons for modified interventions as related to dementia and impaired attention as uniquely seen in AD, MS, and other degenerative diseases, to include dual-tasking and procedural learning
- List at least three principles of the ICF motivational and psychological characteristics in the management of patients with degenerative diseases
- Identify at least two future technological advances applicable to this area of rehabilitation presented within this course

continued

continued

- <https://youtu.be/ldUzr7FWIbU>  
Cognitive Four Square Step Test
- <https://www.youtube.com/watch?v=6yQtE8HyN3Q>  
Pathway deviation
- <https://youtu.be/ogxPau2tjuM>  
or Dual task card sort
- <https://youtu.be/aNBF-qBsL7U>  
Resisted PD ROGUE
- <https://youtu.be/5lkUcE9Dnm0>  
Freezing of Gait

continued

- <https://youtu.be/YvH8xnoXiEQ>  
Training adaptability
- [https://youtu.be/vffmcTE\\_Rvk](https://youtu.be/vffmcTE_Rvk)  
Mild Cognitive Impairment: Hayling
- <https://youtu.be/S6Er5RN8Z10>  
Mild Cognitive Impairment: Trails B
- <https://youtu.be/wLX26O6vPOQ>  
UWT – Hydrojumps
- <https://youtu.be/Ay24Fan-Gt8>  
Neuropathy SSRW

continued

## Timeline for our presentation...

- Resources and impairments in each of the respective degenerative diseases.
- Using objective measures to maximize patient participation
- Applications in gait, balance and ADL rehabilitation for EACH of the DDs
- Questions and more video applications

## Statistics: The power of numbers in falls...

- Every 20 min in the USA, an older adult (age 65+) dies as a direct result of a fall
- Every 14 seconds in the USA, an older adult falls (4+/- minute)
- 1/5 older adults (about 1/minute) who survive a fall sustain:
- Hip fracture, traumatic brain injury (TBI), and other related injuries exceed \$34 billion in Medicare alone, 2016

continued

## Physiology AND Pathophysiology of Normal Aging

- BALANCE-SPECIFIC NORMAL AGE-RELATED CHANGES
- Reduced conduction velocity
- Reduced reaction speed and attention networks
- Reduced Type I and Type II mm fibers/strength
- Reduced visual acuity
- Presbycusis

continued

## Fall risk INCREASES because of...

- Parkinson's Disease:
- 60 % report one fall/year
- 39 % report recurrent falls

continued



continued

## Fall risk INCREASES because of...

- Multiple Sclerosis:
  - More than 50 % annually
  - More than 35% fall multiple times per month
  - Shumway-Cook et al. and Matsuda, et al: < 50 % of people with MS received information about fall prevention from their primary care provider (PCP)

continued

## Fall risk INCREASES because of...

- Alzheimer's Disease:
  - Every 67 seconds, someone in the USA develops Alzheimer's disease
  - Persons with cognitive impairment and ADRD are >2x as likely to fall as their cognitively intact counterparts

continued

## Individualizing DD programs

- Resources and impairments in the respective degenerative diseases.
- Diseases are not all the same
- Underlying pathologies are not all the same
- Interventions SHOULD NOT be the same

## Degenerative Diseases (DD): Abbreviations

- MS = Multiple Sclerosis
- PD = Parkinson's Disease
- AD = Alzheimer's Disease
- MD = Muscular Dystrophy
- CMT = Neuropathy of Charcot-Marie Tooth type
- ALS = Amyotrophic Lateral Sclerosis
- SCA = Spino Cerebellar Ataxia
- FTD = Fronto-Temporal Dementia
- MSA = Multiple Systems Atrophy (3 subtypes)

continued

## The brain CAN change for the positive in DDs...neuroplasticity

- Tasks must promote: protect, compete, improve...
- Applies to MS, PD, SCAs, CMT, and early ALS\*
- If there is no challenge
- If there is no chance
- If there is no expectation
- If there is no success
- Even with peripheral loss, there can be central changes

continued

## Degenerative Disease POTENTIAL\*

- Muscular strength
- Muscular power
- Muscular endurance
- Cardiovascular endurance
- Somatosensory neuroplasticity
- Motor control neuroplasticity
- Psychological
- Cognitive
- \*Opportunities vary from disease to disease...

continued

continued

## Lessons in DDs

- Control all variables that you can...
- Consistent and lifelong exercise, activity
- No patient has too much strength
- No patient has...too much endurance
- Balance exercises are a daily routine
- Common benefits of psychology
- Common benefits of neurochemistry

continued

## Point by point... how we intervene

- Muscular strength AND (separate) Power
- Muscular endurance
- Cardiovascular endurance
- Somatosensory neuroplasticity
- Motor control neuroplasticity
- Psychological
- Cognitive

continued

continued

## Point by point... how we intervene

- STRENGTH: ESSENTIAL in SCA, PD, MS, MSA, CMT
- Function and falls: AD, FTD
- Resistance tolerated 8-12 reps (at 80% 1RM)
- 2-3 sets
- 3-4 days/week
- Expect soreness
- Perceived exertion drives intensity

continued

## Point by point... how we intervene

- POWER: SCA, PD, MS, MSA, CMT, AD, FTD
- Resistance tolerated 5-8 reps (at 70% 1RM)\*
- 2-3 sets
- 2-3 days/week
- Expect soreness\*\*
- Perceived exertion drives intensity\*\*\*
- \*'s Qualifiers of cognition, functional dosage

continued

continued

## Point by point... how we intervene

- Muscular endurance: PD, MS, SCA, AD, MD, MSA
- Resistance 15-20 repetitions
- Multiple sets
- 3-4 days/week
- DD: the art of cumulative effects (MS, MD)
- Consecutive order for sets?
- Perceived exertion drives intensity

continued

## Balance WITH muscular endurance



Sit to stand  
compliant

Endure on  
unstable  
surface



photo by Lance Cpl. Levi Schultz



Eyes closed  
weightlifting

Yoga and Tai  
Chi



U.S. Air Force photo  
by Rebecca Amber

continued

continued

## Point by point... how we intervene

- Cardiovascular endurance: ALL except ALS\*
- Sustained activity, whole body as able
- 30 minutes
- 10 minutes, 3 +/-day acceptable (cumulative)
- 4-7 days/week
- Recall, in DD: the art of cumulative effects
- Perceived exertion drives intensity

continued

## Point by point... how we intervene

- Sensory neuroplasticity: MS, SCA, CMT, MSAs
- Remove/Alter sensory strengths
- Vision
- Somatosensation
- Daily +

continued

continued

## Point by point... how we intervene

- Motor control neuroplasticity: PD, MS, SCA,MSAs
- “Demand and supply”
- Task specific
- Repetition-based
- MUST be challenged...and see progress

continued

## Point by point... how we intervene

- Psychological – all DDs
- Understand that the brain can change
- Understand that I can improve with a DD
- SEE that I have improved – USE measurements
- Know that challenge = opportunity to improve
- Knowing, “I will do no harm with this activity”

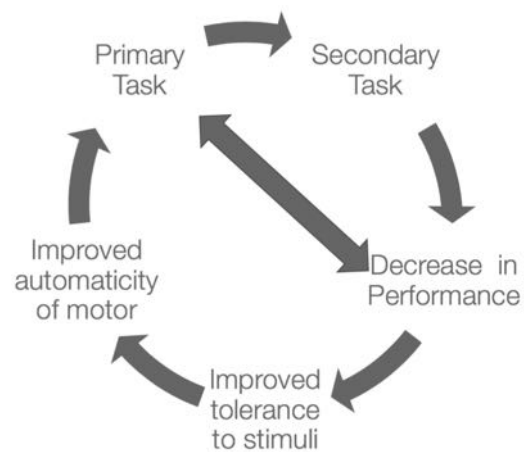
continued



## Point by point... how we intervene

- Cognition – Dementias, MSAs, some PD, MS
- Awareness
- Energy conservation
- Safety training
- Prehabilitation in executive function
- Dual task training\*

## Attentional and Procedural networks



## Attentional and Procedural networks

- <https://youtu.be/ogxPau2tjuM>
- Dual task card sort

## Point by point... how we intervene

- Common benefits of neurochemistry – ??
- Dopamine
- Serotonin
- Oxytocin
- BDNF/GDNF and IGF – neurotrophic and growth

## Disease-specifics

- Parkinson's: High intensity, power focus
- Multiple Sclerosis: Sensory and endurance
- Spino-cerebellar ataxia: Strength, endurance
- Alzheimer's: Procedural training, conditioning
- Neuropathy: Sensory, joint protection, strength

## Common balance-related impairments in PD and some MSA

- Musculoskeletal impairments
  - Posture
  - Muscle flexibility
  - Muscle performance (strength, power, endurance)
  - Tone (hypo- or hypertonicity)
- Movement disorder (brady + dyskinesia, freezing)
- Poor sensory integration
- Difficulty switching tasks in movement sequences
- Impaired cognitive processing and dual-tasking

King LA, Horak FB . Phys Ther. 2009; 89 (4):384-393.

## Movement Disorders

- <https://youtu.be/5IkUcE9Dnm0>

Freezing of Gait

- [https://youtu.be/j\\_QMEISLZpE](https://youtu.be/j_QMEISLZpE)

Dyskinesia

## Disease-specifics: MSAs

- Multiple Systems Atrophy: A, P, C subtypes
- Autonomic: Fitness, awareness, balance
- Parkinsonian: Strength, power, motor control
- Cerebellar: Strength, endurance

## Disease-specifics

- ALS: subtypes, strength, flexibility, function\*
- CMT: Primary motor and distal impairment
- Huntington's: stability, cognitive, strength

## Parkinson's Disease – Common outcome measures

- Four square step test
- 2/6 min walk test
- Modified Dynamic Gait Index
- Timed Up & Go
- Gait velocity
- Sit to stands
- Activity-specific Balance Confidence Scale (ABC scale)

## Video – 4SST

- <https://youtu.be/IdUzr7FWIbU>
- Cognitive Four Square Step Test

## Body-weight supported treadmill training

- Evidence-Based Practice
- Intense gait training in HIIT-delivery model
- Intense balance challenges: speed, movement, surface and dual-task considerations - the “BIG” movement
- Role of VOLUME regulation in all aspects of function
- Make them comfortable with the world BEHIND them
- Provide PROTECTED practice in changing directions
- Postural changes and improving muscular balance
- Compensatory efforts with visual, verbal rehearsal cues

continued

High intensity dynamic balance, gait



continued

High intensity dynamic balance, gait



continued

continued

## High intensity dynamic balance, gait



continued

## Balance and coordination

- <https://www.youtube.com/watch?v=6yQtE8HyN3Q>

Pathway deviation

continued



## Multi-directional gait training

- <https://youtu.be/YvH8xnoXiEQ>

Training multidirectional adaptability

## Strengthening for better balance: Resistance in dynamic function



Photo:  
NIA/NIH



continued

## Strengthening for better balance: Resistance in dynamic function

- <https://youtu.be/ogxPau2tjuM> or  
Dual task card sort
- <https://youtu.be/aNBF-qBsL7U>  
Resisted PD ROGUE

continued

## Arm and leg: Power options



continued

## Upper Extremity: Power options



## The anteropulsive patients...

- <https://youtu.be/y422F8zSsy4>  
Balance PD anteropulsion
- <https://youtu.be/UDZPDEgcQ6c>  
Balance PD anteropulsion - resisted

## Retropulsive patients...

- <https://youtu.be/v1Af-95zG0c>  
Balance PD retropulsion

## Neurophysiology of PD

The critical structures in Parkinson's Disease:

- 1) Substantia Nigra
- 2) The Basal Ganglia

...and  
The DLPFC

continued

## Potential for Neuroprotective benefits in PD

- Brain derived neural protective factors (BDNF)
- Glial derived neural protective factors (GDNF)
- Insulin-like Growth Factor
- Effects of Dopamine release with high intensity ex.

continued

## Multiple Sclerosis

- Reversing deconditioning, sensory reweighting
- “Patients with MS frequently decrease physical activity due to the fear from worsening the symptoms and this can result in reconditioning.
- Physicians now believe that regular exercise training is a potential solution for limiting the reconditioning process and achieving an optimal level of patient activities, functions and many physical and mental symptoms without any concern about triggering the onset or exacerbation of disease symptoms or relapse.”
- BMC Neurol 2017

continued

continued

## Multiple Sclerosis – Common outcome measures

- 2 and 6 min walk test\* (consider order)
- Berg Balance Scale
- Four Square Step test
- Sit to stands
- Gait velocity
- ABC scale
- DGI
- TUG

continued

## Find the potential in your patients!

- Therapy for too much strength?
- Function declines when you are fatigued
- Neuroplasticity is viable in MS
- Understand the pain and overuse cycle
- How much is too much for a person with MS?

continued

## Rehabilitation in Multiple Sclerosis

- Intensity is warranted to reverse the effects of deconditioning and inactivity:
- Muscular strength
- Muscular endurance
- Balance reactions
- Range of motion/flexibility – leading to increased spasticity
- Fear

## Evidence Based Rehabilitation in Multiple Sclerosis

- Somatosensory reorganization and balance training  
AKA “Sensory reweighting”
- Strengthening and monitoring intensity
- Cardiopulmonary/endurance training considerations

## Balance and gait

- High intensity balance challenges
- Eyes closed
- Visual aberration
- Multidirectional
- Forced accuracy
- Intensity does not mean exacerbation of MS!!

## Balance and gait

- <https://youtu.be/ypkA1JXY678>  
Balance Coordination Accuracy/Agility



## VisuaLIES

- Reducing visual dependence across the DDs
- Neuropathy
- Multiple Sclerosis
- <https://youtu.be/0qpfKNpY8WU>
- Balance: Somatosensory Reweighting

## Multiple System Atrophy (MSA)

- MSA-A (autonomic)
- MSA-P (Parkinsonian)
- MSA-C (Cerebellar)

continued

## Balance & gait: MSAs

- [https://youtu.be/lrsrsz-6\\_F4](https://youtu.be/lrsrsz-6_F4)

Balance training in MSAs

continued

## Spino-cerebellar ataxia

- Strength
- Endurance
- Energy conservation and safety
- Tradeoff for activity and safety

continued

## Spino-cerebellar ataxia – Common outcome measures

- Berg Balance Scale
- 2 min walk test
- Dynamic Gait Index
- Sit to stand tests
- Tandem walk test

## Spino-cerebellar ataxia – Interventions

- Prehabilitation of the balance capacities in early diagnosis
- Peripheral “resource” development:
  - Strength (including core)
  - Endurance
  - Address any ROM and pain comorbidities

## Spino-cerebellar ataxia – Interventions

- Somatosensory and rehabilitation therein
- Joint protection in the face of degeneration
- Exploration of prehabilitation of the balance capacities

## Degenerative Neuropathies: CMT

- PRIMARY:
  - Reduced reaction speed
  - Sensation
  - Strength
- SECONDARY:
  - Endurance
  - Fear-related inactivity and extended deconditioning
  - Fear-induced energy expenditures
  - Reduced automaticity, cognitive reserve

continued<sup>®</sup>

## Protective Strengthening

- <https://youtu.be/wLX26O6vPOQ>  
UWT - Hydrojumps

continued<sup>®</sup>

## Neuropathy, balance retraining?



continued<sup>®</sup>

continued<sup>®</sup>

## Neuropathy, balance retraining!!

- <https://youtu.be/Ay24Fan-Gt8>
- Neuropathy SSRW

continued<sup>®</sup>

## Neuropathy - balance retraining!



U.S Air Force photo/Staff Sgt. Shad Eidson

= Amputee balance retraining?!?

continued<sup>®</sup>

continued

## AD + FTD (fronto temporal dementia)

- Impaired declarative (facts) and episodic (events) memories
- NO impact on procedural memories\*
  - (automatic, overlearned tasks)

continued

## Procedural Memories LIVE...

- It is your job to find them and best utilize them!!!
- Or...you can decide that it is easier just to try to
  - create new memories for motor tasks after a brain
  - injury

continued

## AD + FTD: Balance Training

- <https://youtu.be/5kJHRUSDZUU>
- Functional Balance Training - shoes
- [https://youtu.be/hHYmIX8\\_qgk](https://youtu.be/hHYmIX8_qgk)
- Functional Balance Training - water

## Declarative + Procedural together

- Learning style - baseline and imposed
- Declarative subsidizing procedural
- Which comes first?



## Procedural learning in the clinic

- Transfers
- W/C setup
- Bed mobility
- Dressing
- Walking
- Use of an assistive device
- Negotiating stairs

## Dementia – Functional outcome measures

- Berg Balance Scale
- 2 min walk test
- Sit to stands
- Minimal Chair Height Stand Test (MCHST)

## AD + FTD – Early Intervention

- [https://youtu.be/vffmcTE\\_Rvk](https://youtu.be/vffmcTE_Rvk)  
Mild Cognitive Impairment: Hayling
- <https://youtu.be/S6Er5RN8Z10>  
Mild Cognitive Impairment: Trails B

## General Systems Applications

- No one is too strong
- Fatigue contributes to many falls
- Frailty due to cardiopulmonary complications\*
- Treat in function > outside of function
- Personalize exercise modes, education, intervention

continued

## Strengthening for better balance: Resisted or weighted gait



continued

## Strengthening for better balance: Resistance in dynamic function



Photo: NIA/NIH

continued

continued

## RESOURCE: Functional strength



continued

## An overlooked resource for all: cardiopulmonary



continued

continued

## Treating the PERSON

- Treating to the body structure or underlying impairment
- Treating toward the activity loss
- Treating the participation

continued

### VISION

EYES CLOSED  
HEAD NODDING  
HEAD ROTATION (SIDE-SIDE)  
OBSTRUCTION/DISTRACTION

### BASE

ONE LEG  
TANDEM  
FEET STAGGERED  
FEET TOGETHER

ARMS LENGTH REACH  
SIT TO STAND  
REACH BEYOND ARM'S LENGTH  
STOOPING/FLOOR RETRIEVAL

FIRM  
CUSHIONED  
UNEVEN  
SLICK

### MOTION

### SURFACE

continued

## Frail DD patients: MEASUREMENT

- Objective recordings that can be reproduced to prove real changes within a patient's case
- Bed mobility
- 5x sit to stand
- Unassisted sit to stand height
- 10' w/c propulsion
- Standing endurance
- MCHST
- TUG

## Frail patient considerations

- Psychology of rehabilitation
- Nutritional considerations
- Evidence and recommendations: ACSM
- Provide body weight support to allow for endurance improvements
- Build RESOURCES, then function
- Neurochemistry is available to all

continued<sup>®</sup>

Mike Studer, PT, MHS, NCS,  
CEEAA, CWT

- (503) 371-0779
- [mike@northwestrehab.com](mailto:mike@northwestrehab.com)
- [www.mikestuder.com](http://www.mikestuder.com)
- Salem, OR



continued<sup>®</sup>