Applying Movement System Diagnoses to Neurodegenerative Diseases

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Disclosures

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• Dr. Fritz has no disclosures

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Course Objectives

At the conclusion of this session, participants will be able to:

- Discuss the concept of movement system diagnosis and its implications for neurologic physical therapy practice.
- Discuss the diagnostic process, and differential diagnosis to appropriately apply movement system diagnoses.
- Describe the key elements of the neurodegenerative diseases movement system diagnostic system.
- Utilize the movement system diagnosis and clinical practice guidelines to develop evidence-based interventions in individuals with neurodegenerative diseases.
Outline

1. Diagnosis and Movement System Diagnosis
2. Application to Neurodegenerative Diseases – development of diagnostic classifications and MSD
3. The Routine Examination
4. Case Studies
5. Q & A
What’s in a diagnosis?
Chorea acanthocytosis

Multiple System Atrophy

Corticobasal degeneration

Parkinson’s disease

Motor neuron disease

Spinal muscular atrophy

Creutzfeldt-Jakob disease

Amyotrophic lateral sclerosis

Alzheimer’s disease

Huntington’s disease

Friedreich’s ataxia

Lewy body

Spinocerebellar ataxia

Multiple sclerosis

Washington University in St. Louis

Wayne State University

Teachers College Columbia University
The Movement System represents the collection of systems (cardiovascular, pulmonary, endocrine, integumentary, nervous, and musculoskeletal) that interact to move the body or its component parts.
What Is Backward Disequilibrium and How Do I Treat it?:
A Complex Patient Case Study

Patricia L. Scheets, PT, DPT, NCS, Shirley A. Sahrmann, PT, PhD, FAPTA,
Barbara J. Norton, PT, PhD, FAPTA, Jennifer S. Stith, PT, PhD, LCSW, and
Beth E. Crowner, PT, DPT, NCS, MPPA

CONTINUUM Review Article

Gait Disorders

Alfonso Fasano, MD, PhD; Bastiaan R. Bloem, MD, PhD

ABSTRACT
Purpose of Review: This article provides insight and reviews useful tools for the clinical assessment, understanding, and management of neurologic gait disorders.
Recent Findings: In recent years, our understanding of the physiology of human walking has steadily increased. The recognition of gait as a complex, “higher-order” form of motor behavior with prominent influence of mental processes has been an important new insight, and the clinical implications of gait disorders are increasingly being recognized. Better classification schemes, the redefinition of established entities (e.g., senile gait), and new insights from research on degenerative disorders primarily affecting gait (e.g., primary progressive freezing of gait) have become available.

Descriptive Data Analysis Examining How Standardized Assessments Are Used to Guide Post–Acute Discharge Recommendations for Rehabilitation Services After Stroke

M.D. Bland, PT, DPT, NCS, MSCI, Program in Physical Therapy, Department of Neurology, and Program in Occupational Therapy, Washington University. Mail- ing address: Program in Physical Therapy, Washington University, 4444 Forest Park, Campus Box 8502, St Louis, MO 63108 (USA). Address all correspondence to Dr Bland at: blandm@wusm.wustl.edu.

Use of Movement System Diagnoses in the Management of Patients With Neuromuscular Conditions: A Multiple-Patient Case Report
Patricia L. Scheets, Shirley A Sahrmann, Barbara J Norton
Developed 8 movement system diagnoses based on medical history, key tests and signs and associated signs.

**EXAMPLE:**

**HYPOKINESIA** The primary movement dysfunction is related to slowness in initiating and executing movement. May be associated with stopping of ongoing movement.

Scheets, Bloom, Crowner, McGee, Norton, Sahrmann, Stith, and Strecker, 2014
APTA Task Force

- Convened in June 2015
- Movement System Summit convened in December 2017
- Confirmed definition of Movement system and criteria for developing diagnoses
- Phase II in process – developing diagnoses and criteria for task analysis

ANPT Task Force

- Convened in June 2015
- White Paper - accepted to JNPT
- Phase II in process – diagnosis and criteria for task analysis
Criteria for developing a Movement System Diagnosis (MSD)

1. Use recognized movement-related terms to describe the condition or syndrome of the movement system. Include, if deemed necessary, the name of the pathology, disease, disorder, anatomical or physiological terms, and stage of recovery associated with the diagnosis.

Criteria adopted by APTA BOD
Criteria for developing a Movement System Diagnosis (MSD)

2. Be as succinct and direct as possible to improve clinical usefulness.

3. Strive for movement system diagnoses that span all populations, health conditions, and the lifespan.

4. Whenever possible, use similar movement-related terms to describe similar movements, regardless of pathology or other characteristics of the patient or client.

Criteria adopted by APTA BOD
What is a diagnosis?

- The term diagnosis refers to both a **process** and the **product of that process**.
- Diagnosis as a **process** is an investigation or analysis of the cause or nature of a condition, situation, or problem.
- Diagnosis as a **product** is a statement or conclusion from such an analysis, typically a recognizable **label** that identifies the nature or the cause of the problem.
Diagnosis

• Diagnostic Process

“...define which elements of the movement system contribute to deficits in capacity or performance, and become the focus of the plan of care.”*

* www.apta.org, 2016

• Diagnostic Label (MSD)

“Pattern recognition” – analyze & match results of the clinical examination to *known description of movement system problems.*

ANPT CSM, 2017
Movement assessment as the link between impairment and activities
Possible benefits of the Movement System Diagnosis

• Reduces unwanted variation in practice between clinicians
• Improve our ability to address patient problems across medical conditions
  – Particularly important in rare diseases
• Improve patient outcomes

Important: We need research to support the validity of diagnoses
Neurodegenerative Diseases

- 5 million Americans suffer from Alzheimer's disease (AD)
- 1 million from Parkinson's disease (PD)
- 400,000 from multiple sclerosis (MS)
- 30,000 from amyotrophic lateral sclerosis (ALS)
- 30,000 from Huntington's disease (HD)
- Over 800 rare neurodegenerative diseases....

- Because neurodegenerative diseases strike primarily in mid- to late-life, the incidence is expected to soar as the population ages.
Framework for Management of NDD

Stage of Condition

Prodromal/ pre-manifest
- Few impairments
- No activity limitations or participation restrictions

Early to Early Middle
- Increasing number and severity of impairments
- Activity limitations
- Participation restrictions developing

Late Middle to Late
- Significant number and severity of impairments
- Increasing number and severity of activity limitations
- Significant participation restrictions

Main problems

Management strategy

Preventative
- Delay the onset of activity limitations

Preventative Restorative
- Maintain activity level and functional abilities

Preventative Restorative Supportive
- Maintain activity level and functional abilities and limit impact of complications

DalBello-Haas 2002
Development of Diagnostic Classifications

• Identification of the primary impairment
• Account for stage of disease
• Determine impairments, activity limitations, and participation restrictions
• Suggested outcome measures and referrals for multidisciplinary care

SPECIAL REPORT

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Development of physiotherapy guidance and treatment-based classifications for people with Huntington’s disease

Lori Quinn & Monica Busse*: On behalf of the members of the European Huntington’s Disease Network Physiotherapy Working Group

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Stages</th>
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<tbody>
<tr>
<td>Exercise Capacity and Performance</td>
<td>Absence of motor impairment; potential for cognitive and/or behavioural issues</td>
<td>Presymptomatic/early</td>
</tr>
<tr>
<td>Planning and sequencing of tasks</td>
<td>Difficulty and slowness in performing functional activities (dressing, bathing, ADLs, sit to stand, etc). Presence of apraxia or impaired motor planning; slowness of movement and/or altered force generation capacity</td>
<td>Early-mid</td>
</tr>
<tr>
<td>Mobility, Balance and Falls Risk</td>
<td>Ambulatory for community and/or household distances; balance, strength or fatigue resulting in falls or high risk for falls</td>
<td>Early-mid</td>
</tr>
<tr>
<td>Secondary adaptive changes and deconditioning</td>
<td>Musculoskeletal and/or respiratory changes resulting in decreased participation in daily activities</td>
<td>Early-mid</td>
</tr>
<tr>
<td>Abnormal posturing (seating and bed positioning)</td>
<td>Inappropriate alignment due to adaptive changes, involuntary movement, inability to facilitate or coordinate movement</td>
<td>Mid-late</td>
</tr>
<tr>
<td>Respiratory dysfunction</td>
<td>Impaired respiratory function and capacity; limited endurance; impaired airway clearance; risk for infection</td>
<td>Mid-late</td>
</tr>
<tr>
<td>Palliative Care</td>
<td>People who are in advanced stages of disease; unable to ambulate; dependent for most ADLs; difficulty maintaining upright sitting position; range of motion and pulmonary issues</td>
<td>Late</td>
</tr>
</tbody>
</table>
A. Exercise Capacity and Performance

**Description:** Absence of motor impairment or specific limitations in functional activities; potential for cognitive and/or behavioural issues

**Stage:** Pre-manifest/early

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### Signs and Symptoms

**Participation:** possible quality of life changes

**Activities:** no problems

**Impairments:**
- Potential for: early gait changes, poor endurance or fitness; mild chorea; cognitive and/or behavioural issues; poor endurance and limited physical activity; lack of motivation and/or apathy; anxiety and/or depression; sleep disturbance which may exacerbate the above impairments

### Aims

Health education and advice including general health promotion strategies, referral for exercise on a prescriptive plan, and agenda setting to optimise exercise performance.

Patient & family education on the importance of early intervention in HD. In animal models of HD, early enrichment of the environment (i.e., exercise) was shown to delay symptom onset and severity. Increased physical activity in HD mice was critical for successful outcomes of disease modifying treatments such as cell transplants, reconnection of grafted tissue and dopamine innervations.

### Treatments

**Baseline testing for fitness level** should be completed prior to exercise prescription. Consider education on fatigue and the timing of intervention/exercises during the day as well as careful instruction on safety during exercise.

**Identify barriers and facilitators** to initiate and maintain an exercise programme. Techniques such as behavioural motivation can be used to help patient identify barriers and facilitators and explore strategies to manage them. Involvement of a caregiver/friend/spouse can make the programme more successful.

**Gym based exercises** can be of benefit to physically-able individuals, as well as people with long term neurologic conditions such as Parkinson’s Disease. Small case reports in HD indicate that if properly supported, people with HD can enjoy the health benefits of physical activity. Interestingly, there is underutilization of PT services in early-stage HD.

Exercise in early stage HD should include:
- Individualized goal setting and home exercise programme prescription for optimization of services in a life-long disease process.
- A focus on task-specific functional activities incorporated into the exercise programme.
- A warm-up and cool-down.
- Careful monitoring of vital signs, dyspnoea, fatigue, pallor, dizziness and specific HD-related signs at rest, during and after exercise

Frequency, intensity, duration and mode are dependent on the baseline fitness level of the individual; however, focus should be on the ACSM goal of exercise for both aerobic and strength training. [19]

**Aerobic exercise:**

*Frequency:* 3 to 5 times a week; *Intensity:* 65% to 85% of the maximal heart rate; 55% to 65% of maximal heart rate for de-conditioned individuals; *Duration:* at least 30 minutes of continuous or intermittent training per day (minimum of 10-minute bouts accumulated throughout the day); *Mode:* any activity that the individual enjoys that uses large muscle groups which can be maintained continuously and is rhythmic and aerobic in nature (e.g. walking, jogging, swimming, and biking).

### Interdisciplinary


### Outcome Measures

**PAR-Q:** The Physical Activity Readiness Questionnaire (PAR-Q) can be utilised as an initial screening method to determine any contraindications to exercise. If any reason to doubt safety in participating in exercise, the physiotherapist should refer persons to their general practitioners (GPs) for a full assessment. **IPAQ:** International Physical Activity Questionnaire: is a useful questionnaire for obtaining information about weekly activity levels at home, work and leisure. It is reliable and valid in 18-65 year old healthy adults as an epidemiological measure. It is not valid as a measure of change or to assess the effects of an intervention.

**Activity Monitor:** if available, a useful measure of physical decline in HD as hypokinesia is related to functional capacity in HD. May also be used to show change in activity over time.
C. Mobility, Balance and Falls

**Risk**

**Description:** Ambulatory for community and/or household distances; balance, strength or fatigue resulting in falls or high risk for falls

### Signs and Symptoms

**Participation:** Fear of falling: unwillingness to participate in home, work, and community activities

**Activities:** Difficulty walking in certain environments or while doing secondary task; turning and changing directions; getting in and out of chairs and beds

**Impairments:** Bradykinesia; Dystonia – affecting trunk (lateral shift; extension), ankles/feet (inversion); chorea*/rigidity; muscle weakness or impaired force production; impaired motor control (i.e., force modulation deficits causing sudden exaggerated movement changes); impaired eccentric motor control; gait impairments (decreased speed; stride length; stride width, increased variability in gait parameters); cognitive and behavioural deficits; deficits in spatial perception; visual disturbances; fatigue.

### Treatments

Impairment focussed exercises: strengthening; general conditioning; endurance; range of motion activity to counteract effects of dystonia; coordination exercises; teach strategies to help people with HD identify when fatigue would increase their risk of falls; Balance training to practice the maintenance of postural control in a variety of tasks and environments; practice of activities that require automatic responses (e.g., throwing ball) to elicit postural responses and train faster movements [progress activities from wide to narrow BOS, static to dynamic activities, low to high COG, increasing degrees of freedom].

Task-specific practice of functional activities such as transfers, reaching high and low, stair climbing, etc. To train balance control during activities of daily living; task specific training to address walking tasks, ideally in specific environments (e.g. outdoor; obstacles and changing speeds/directions); external cueing: lines on floor to promote step initiation, bigger steps, faster speed and symmetry, consider verbal cues (metronome).

Teach strategies as to how to get up from floor if they fall; safety awareness and adaptation of environment (reduce clutter, slippery surfaces, loose rugs, poor lighting, sharp or breakable objects), furniture.

Provision of assistive devices (4 wheeled walker with brakes) when appropriate; family/carer education for guarding and/or assistance during ambulation; wheelchair prescription (long distance mobility). Adaptive devices/equipment: footwear: shoe/orthotic evaluation (shoes with ankle support such as high top tennis shoes or boots; heel wedge and/or lateral wedge for ankle dystonia in inversion/eversion direction; ankle foot orthosis for ankle dystonia in dorsiflexion/plantarflexion direction; custom made shoe inlay for individuals with clawing of toes during walking).

Protective equipment – helmets, elbow/knee pads to be worn by person with HD at risk for falls.

Compensatory strategies (cognitive impairments and inability to dual task); focus attention on maintaining balance before doing a task that challenges their balance; practice two activities at same time under various practice and context conditions in early stages; break down complex tasks into simpler tasks and where necessary attend to one task at a time in middle to late stages.

### Aims

Improve mobility status (increase independence; increase speed; increase distance walked); reduce risk of falls or actual falls; maintain independent mobility including transfers and walking for as long as possible; manage fear of falling which in itself may cause inactivity.

### Interdisciplinary

nursing, OT, neuropsychologist, neurologist, social work

### Outcome Measures

**Participation:** Short Form-36

**Activities:** 10m walk; TUG; 6MWT; ABC Falls Confidence scale; Berg Balance; Tinetti Mobility Test; Dynamic Gait Index; Functional reach test; Assessments of different devices and equipment used during functional activities including the safety during use, alignment, fit, and the patient’s ability to care for the devices or equipment

**Impairments:** gait spatial and temporal measures; falls history; UHDRS motor section
A Classification System to Guide Physical Therapy Management in Huntington Disease: A Case Series

Nora E. Fritz, PT, PhD, DPT, NCS, Monica Busse, PhD, Karen Jones, PT, Hanan Khalil, PhD, Lori Quinn, PT, EdD, and the Members of the Physiotherapy Working Group of the European Huntington’s Disease Network

- 2 individuals with late-stage HD
- Classification: balance, mobility and falls risk
- Primary impairments: balance, increased falls
- 8 weeks of physical therapy
  - Task-specific training – walking, transfers, stairs, etc.
  - Exercise DVD – strengthening, general conditioning
### Neurodegenerative Disease MSD

<table>
<thead>
<tr>
<th>Classifications</th>
<th>Potential Diagnoses</th>
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<tbody>
<tr>
<td>Impaired Exercise capacity and performance</td>
<td>Impaired aerobic capacity, hypoactivity, hypomobility</td>
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<tr>
<td>Motor planning and task sequencing deficit</td>
<td>Apraxia, akinesia, decreased safety/insight into deficits</td>
</tr>
<tr>
<td>Balance impairment with increased fall risk</td>
<td>Hypokinesia, increased gait variability, impaired static and dynamic postural control</td>
</tr>
<tr>
<td>Force production or modulation deficits</td>
<td>Impaired motor control/force production deficit, hyperkinesia, impaired eccentric control</td>
</tr>
<tr>
<td>Secondary musculoskeletal and postural changes</td>
<td>Hypomobility, secondary soft-tissue adaptive changes from poor positioning, poor sitting balance</td>
</tr>
<tr>
<td>Respiratory function limitations</td>
<td>Respiratory dysfunction, ineffective cough, increased risk of aspiration and/or retained secretions, breathlessness on exertion</td>
</tr>
<tr>
<td>End-stage/Palliative Care</td>
<td>Limited volitional control of extremities, limited PROM, risk for contractures, pressure sores</td>
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Motor Planning and Task Sequencing

- Ideomotor Apraxia
- Hypermetria
- Delayed onset of muscle response

Balance impairment with increased fall risk

- Movement pattern coordination deficit
- Akinesia with freezing of gait
- Dyskinesia
Neuromuscular PT diagnosis:

- Force Production Deficit
- Movement Pattern Coordination Deficit
- Fractionated Movement Deficit
- Hypokinesia
- Hypermetria
- Sensory Selection and Weighting
- Sensory Detection Deficit
- Other:
Standardized Evaluation and Assessment Procedure

- Utilize standardized assessment
- Further assess impairments
  - *utilize disease-specific measures (outcomes) as appropriate*
- Determine Movement System Diagnosis
- Determine appropriate intervention plan
### Rehabilitation as Enablement

<table>
<thead>
<tr>
<th>Model of Disablement</th>
<th>Rehabilitation</th>
<th>Expanded Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation restriction</td>
<td>Participation</td>
<td>Involvement in a life situation, which includes the ability to participate in necessary and desired roles (self-care, social, occupational, and/or recreational).</td>
</tr>
<tr>
<td>Activity limitations</td>
<td>Activities (skills)</td>
<td>The execution of a task or action by an individual; ability to achieve a meaningful goal with consistency, flexibility, and efficiency. Goals are meaningful if they are needed to perform personal roles.</td>
</tr>
<tr>
<td>Impairments</td>
<td>Body structures and functions (resources)</td>
<td>Physiologic functions of body systems and anatomic parts of the body. This includes physical and cognitive mechanisms, musculoskeletal linkages, control of basic movement types, and the ability to plan.</td>
</tr>
<tr>
<td>Disease/disorder</td>
<td>Health/recovery</td>
<td>More than merely the absence of disease; rather, an active mechanism that limits future disability; adaptive physiologic mechanisms that support recovery.</td>
</tr>
</tbody>
</table>
THE ROUTINE EXAMINATION
Diagnostic Process

- Chief Complaint
- History
- Physical Examination
- Differential Diagnosis
- Diagnosis
Chief Complaint/Reason for Referral

• Why is the patient there to see you?

• In degenerative disease, complaint frequently (but not limited to):
  – Difficulty Walking
  – Impaired Balance
  – Falls

• Consider spousal input when the patient’s memory is impaired
History

• Vitally important piece of the diagnostic process

• Characterization of movement problem from patient’s perspective

• Helps to shape:
  – Treatment
  – Prognosis
    • Rapid vs. slow progression of movement difficulty

• Imperative to gather information about how movement impairment impacts participation and physical function
Chief Complaint and History

• Imperative for the clinician to listen for key words that describe patient’s movement problem
  - “Slow”
  - “Small” or “short”
  - “Clumsy”, “wobbly”, “uncoordinated”
  - “Legs giving out”
  - “Dizzy”

• These descriptors help to shape your assessment, primarily tests of impairment

• Can help to confirm or refute the movement system diagnosis
Routine Physical Examination

• Imperative that we assess movement the same way every time

• Increases reliability (inter- and intra-rater)

• Reduces variation in practice in an effort to optimize outcomes

• Without routine assessment, there’s a chance you miss a vitally important movement fault

  – Berg Balance Scale vs. Mini-BESTest

Franchignoni et al. J Rehabil Med. 2010
Proposed Routine Examination

- Bed mobility (rolling, supine to/from sit)*
- Quiet sitting (eyes open, eyes closed*)
- Sit-to-stand
- Quiet standing (eyes open, eyes closed*)
- Step-up
- Walking
  - Head turns
  - Stepping over obstacles
  - Forward and backward
- Reach and grasp object (as needed)*
- Wheelchair mobility (as needed)*

- indicates additions to original proposal by Scheets et al. Phys Ther, 2007
- ANPT and APTA Task Forces have developed similar examinations
Routine Examination

• For each assessment item, determine:

  – *Movement strategy*
    • Suggested underlying impairment (e.g., weakness, impaired balance)
    • Important to use detailed description to support diagnosis

  – *Level of assistance needed*
    • Physical assistance, verbal cueing for technique

  – *Skill level – consistency, flexibility, efficiency*
Routine Examination

• For each assessment item, consider:

  – *Patient’s performance in context of disease continuum*

  – *Practice setting*

  – *Meaningful to the patient?*
Critical Tasks

• Complete tasks in a systematic manner (if possible)

• Use necessary amounts of detail to facilitate ruling in or ruling out a particular movement system diagnosis

• Look for common movement abnormalities to persist throughout patient’s performance of critical tasks

  – Example: hypokinesia likely to affect performance of many critical tasks
Critical Impairments

- Motor control
- Muscle tone
- Muscle strength
- Nonequilibrium coordination
- Sensation
- Postural control
- Motion sensitivity
- Mental status
- Joint range of motion

Potential for abnormalities in all of these in patients with DD

Critical Impairments

• Use these tests to further assist in ruling in or ruling out a diagnosis

• Important not to choose only tests that either rule in or rule out
  – Choose both to build a stronger case for your diagnosis

• Understand that not all impairment tests will fit your hypothesis
  – Choose diagnosis based on the preponderance of evidence

• Do not forget about non-motor impairments (e.g., cognitive impairment) that will factor into prognosis
You might be asking yourself…

• Do I have to do all of these examination components?

• Ideally, yes*

• However, if time constraints are present – allow subjective history to guide you

  – *Choose functional tasks that are most meaningful to patient*
Determining the Diagnosis

• Primary Movement System Diagnosis
  – *Based on the cluster of findings from your task and impairment tests*
  – *Describe how your findings led you to rule in your diagnosis and rule out others*

• Patients may have important secondary movement deficits
  – *Treatment focus is primary diagnosis, but could incorporate elements that simultaneously address secondary impairments*

• Diagnosis subject to change over time
  – *Response to treatment (confirms or refutes original diagnosis)*
  – *Progression of disease*
Case Study 1 - John

- 68 year-old male; retired attorney
- Married, lives in ranch home (one step to enter)
- Enjoys being outdoors, walking dog
- Medical Diagnosis: Idiopathic Parkinson disease
  - *Subthalamic Nucleus Deep Brain Stimulation* – 8 years ago
  - *No cognitive impairment (MMSE = 30/30), no other relevant medical or surgical history*
Chief Complaint

• “Trouble with balance”

• “I feel uncoordinated when I walk. My feet tend to cross over one another.”

• “I occasionally trip because I catch my toe.”

• “I really have trouble catching myself if I lose my balance backwards”
History

- 5 falls in the past 6 months; near falls daily
  - Most recent fall occurred when walking toward stairs and tripped – fell forward onto the steps. No injury.
- Uses a walking stick for stability
- Does not currently exercise
- Goal: “To get back to walking outdoors without having to worry about falling”
Case Study - Critical Tasks
Impairment Tests

- Strength: 5/5 bilaterally (UE and LE)

- Sensation: light touch and proprioception intact bilaterally (UE and LE)

- Fractionated movements: no deficits

- Rigidity mild in bilateral UEs, no rigidity in LEs
Differential Diagnosis

• Broad Classification: Balance Impairment with Increased Fall Risk

• Diagnosis: Movement Pattern Coordination Deficit
  – Supported by “ataxic” gait, difficulty with head turns during walking, instability during tandem walking, complaints of tripping while walking, poor sequencing during 4SST

• Other Diagnoses Considered:
  – Hypokinesia – slightly slow walking, slow 4SST

• No deficits in strength, sensation – r/o force production deficit, sensory detection deficit
Pt presents with chief complaint of impaired balance with frequent falls. Examination findings are remarkable for lack of coordination with forward and backward walking. Impairment findings are remarkable for lack of coordination with tandem walking and difficulty maintaining balance when walking with head turns. The pt has slow 4SST performance, which is likely contributed to by slow movement and poor movement sequencing. The primary movement system diagnosis is Movement Pattern Coordination Deficit.

Other diagnoses considered in the differential were hypokinesia and force production deficit. While the slow 4SST would point toward hypokinesia, the lack of significant deficit in gait speed and stride length during forward walking speak against this. The pt does not demonstrate evidence of significant weakness during functional task performance and there is no evidence of significant weakness on MMT. The pt requires targeted coordination training in addition to aerobic conditioning and strength training to improve balance and reduce fall risk in an attempt to reach the pt’s goal of returning to a physically active lifestyle.

The prognosis for treatment is good, but limited by the presence of a progressive neurodegenerative disease (i.e. Parkinson disease) and the lack of a regular exercise regimen.
Case Study 2 – Darren

• 38 year old male
• Premanifest/prodromal Huntington’s Disease

• Goals
  – To delay onset of disease and/or slow progression
  – To develop exercise routine.
Case Study - Critical Impairments

- Reduced exercise capacity
- Core instability
- Risk for:
  - Muscle imbalances (Louis et al. 1999)
  - Lower extremity weakness (Busse et al. 2007)
  - Balance impairments
    - Single limb stance and tandem stance (Quinn et al. 2013; Busse et al. 2014)
    - Dual task (Fritz et al. 2017)
Differential Diagnosis

• Primary Diagnosis: *Impaired exercise capacity and performance*

• Other Diagnoses Considered:
  – *None at present*
FUTURE DIRECTIONS AND SUMMARY
Future Directions

• Research needed to validate diagnoses
  – *Will this better help therapists direct care?*
  – *Will this reduce variability in practice?*
  – *Will this provide better outcomes?*

• Continued development of diagnoses within neurological physical therapy and make links across areas of practice outside neuro.
Summary

• MSDs provide a foundation for providing a consistent framework across neurologic PT practice
• Main Message: It’s ok if you don’t know exactly how to treat this neurodegenerative disease in front of you – you have this framework to figure out where to start.
• We can show similarities in movement diagnoses across different diagnoses (and talk about differences too) BUT the MSD should direct your interventions
Summary

- Management for individuals with NDD must consider the disease spectrum – from prodromal to late stage. But that is not the defining factor for patient management.

- MSD require use in clinical practice and further research to establish their validity.
Acknowledgments

- ANPT Movement System Task Force: 
  - Lois Hedman, Patty Scheets, Kathy Gill-Body, David Brown, Myles Quibien, Nora Riley
  - CSM Presentation: Movement System Diagnosis in Neurologic Physical Therapy: Where Are We? February 2017
- APTA Movement System Task Force, including Barb Norton, Shirley Sahrmann, Sue Whitney and Lisa Saladin
- NIH HD055931 (NICHD; PI: Mueller, Scholar: Duncan)
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• Scheets P. Use of Movement System Diagnoses in the Management of Patients With Neuromuscular Conditions: A Multiple-Patient Case Report. Physical Therapy. 2007. 28