Movement System Diagnosis in Neurologic Physical Therapy: Where Are We?

Movement System Task Force, Academy of Neurologic Physical Therapy
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Academy of Neurologic Physical Therapy

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Disclosure


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Learning Objectives

1. Discuss the imperative for developing and adopting movement system diagnoses in neurologic physical therapist practice.
2. Describe key attributes of movement system diagnoses for neurologic physical therapist practice.
3. Apply one example of a standardized movement observation system to videotaped patient cases.
4. Discuss the implications for developing and adopting movement system diagnoses on neurologic physical therapist practice, education, and research.
5. Contribute to recommended next steps for the ANPT towards developing and adopting movement system diagnoses.
The Movement System and Neurologic Physical Therapy

Movement System Definition

The anatomic structures and physiologic functions that interact to move the body or its component parts.

Figure developed by the APTA Movement System Task Force.
Used with permission.
An Over 40-year Discussion

- Helen J. Hislop
- Steven J. Rose
- Jules M. Rothstein
- Cynthia A. Coffin-Zadai
- Shirley A. Sahrmann
- Alan M. Jette
- Andrew A. Guccione
- Barbara J. Norton
- Kathy J. Sullivan
- Nancy J. Zimny
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- Edelle Field-Fote
- Ann VanSant
- Diagnosis Dialog Participants
- APTA Task Force I and II
- ANPT Task Force

The Case for Diagnosis

Patient Value = \frac{\text{Health Outcomes}}{\text{Cost}}

Health Outcomes

- Examination includes movement analysis of fundamental tasks
- Diagnosis is identified and labeled
- Intervention is targeted
- More consistency in practice

Cost

- Gains in efficiency
  - Pattern recognition
  - Reduced trial and error
- Care tailored to patient needs rather than blanket reduction in visits or length of stay
ANPT Task Force

• Call for appointments in March 2015
• Convened in June 2015
• Literature review
• Face-to-face meeting in May 2016
• Poster at IV STEP
• Four members attended APTA Movement System Summit in December 2016
• White Paper
• Proposal for Phase II
Is there a Diagnostic Manual for Movement System Problems? What is Available?

Process for Review of Literature

18 journal articles

15 characteristics

Reviewed articles and identified characteristics

Not prepared to offer a single diagnosis approach

4 critical attributes for developing approach

Examples of 4 critical attributes
1. Based on sound, evidence-based theoretical framework(s).
2. Be applied to a wide variety of critical movement tasks that represent the major domains of motor control.
3. Emphasizes movement analysis of key tasks as central to the clinical examination, informs clinical reasoning and decision making, and culminates in a movement system diagnosis.
4. Provide unique and non-ambiguous labels for the diagnostic categories.
Example - Theoretical Framework

2. Be applied to a wide variety of critical movement tasks that represent the major domains of motor control.

   • Requires distillation of the essential diagnostic component, regardless of the task.

Example – Variety of Tasks

3. Include a clinical examination process that will provide a foundation for clinical reasoning/decision making, leading to a movement system diagnosis.

Some standardization of the clinical examination

Performed in a consistent manner

Guides the evaluation process

Hypothesis generation

Results in a label
4. Provide unique and non-ambiguous labels for the diagnostic categories.

- Descriptive
- Not confusing
- New labels are expected
  - Need accompanying descriptions, examination findings, and differential diagnoses
- Will need to be learned
Example – Labels

**Table 1**

<table>
<thead>
<tr>
<th>Original Locomotor Requirements</th>
<th>Modified Locomotor Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name: Initiation</td>
<td>Name: Initiation</td>
</tr>
<tr>
<td>Description: Planned transition from quiet standing to walking</td>
<td>Description: Transition from quiet standing to walking</td>
</tr>
<tr>
<td>Name: Termination</td>
<td>Name Termination</td>
</tr>
<tr>
<td>Description: Planned transition from walking to quiet standing</td>
<td>Description: Termination from walking to quiet standing</td>
</tr>
<tr>
<td>Name: Rhythmic Limb Movement</td>
<td>Name: Coordination of Rhythmic Stepping and Arm Swing</td>
</tr>
<tr>
<td>Description: Manifestation of core locomotor pattern</td>
<td>Description: Reciprocal and symmetrical upper and lower extremity motion during walking</td>
</tr>
</tbody>
</table>


Recommendation

- Exert great efforts towards developing a set of movement system diagnoses that can meet most, if not all, of these attributes.
Implications of a Movement System Diagnosis in Neurologic Physical Therapy Practice, Education, and Research

Movement System Implications

Practice
Clinical Reasoning

Guide to PT Practice:
- History
- Systems Review
- Tests & Measures of
  - Body structure/function
  - Activity
  - Participation

Missing Element:
Movement observation and analysis of tasks
- Why person is experiencing movement problem
- How the movement problem might be labeled
- Standardized approach

Clinical Reasoning - Examination

• Movement Observation of Tasks
  – How should tasks be observed and analyzed?
    ➡️ Focus on critical aspects of movement/task
  – How should tasks be performed?
    ➡️ Systematic manner – protocol and guidelines
  – Which tasks for which patients?
    ➡️ PT selects relevant tasks / Core set of tasks

Clinical Reasoning - Examination

• Core Standardized Tasks:
  – Sitting
  – Standing
  – Sit to stand, Stand to Sit
  – Walking
  – Step Up/Down
  – Reach, Grasp and Manipulation
Case Example – Sit to Stand

Case Example – Rolling
Clinical Reasoning - Examination

Movement Continuum*

INITIAL CONDITIONS ← PREPARATION ← INITIATION ← EXECUTION ← TERMINATION

POSTURE
ABILITY TO INTERACT WITH THE ENVIRONMENT
ENVIRONMENTAL CONTEXT

STIMULUS IDENTIFICATION
RESPONSE SELECTION
RESPONSE PROGRAMMING

TIMING
DIRECTION
SMOOTHNESS

AMPLITUDE
DIRECTION
SMOOTHNESS

TIMING
STABILITY
ACCURACY

OUTCOME
OUTCOME ACHIEVED?

Task: Sit to Stand*

• Initial Conditions:
  – No arm or back support
  – Surface height – level of TT
  – Buttocks at edge, feet on floor/even, hip width apart

• Initiation:
  – Pelvis tilts anteriorly & trunk accelerates forward via hip flexion

• Execution:
  – Buttocks lift off as weight transfers fully onto feet
  – Hips and knees extend simultaneously

• Termination:
  – Erect trunk, full hip & knee extension, minimal postural sway

* Hedman, Rogers & Hanke, 1996

* Bilateral symmetrical task
Case Example Revisited - STS

• Initial Conditions:
  – No arm / back support
  – Surface height higher than TT
  – Buttocks not at edge, feet on floor/L AFO, hip width apart; pelvis posteriorly tilted, trunk flexed

• Initiation:
  – Minimal pelvic or trunk movement, little trunk acceleration or hip flex
  – Reaches R hand to mat, moves out of midline to the R

• Execution:
  – Buttocks lift off as knees extend into mat, weight shared between feet & support from mat
  – Hips and knees extend
  – More weight on R > L

• Termination:
  – Trunk almost erect, full hip & knee extension with support from mat, minimal postural sway
  – Stays shifted to R

Task: Step Up

• Initial Conditions:
  – Standing without support ~6" from a 4-6" step
  – Trunk erect; feet hip width apart

• Initiation:
  – Weight shifts to stance leg

• Execution:
  – HKA flexion of moving leg with placement of foot on step; stance leg in full hip and knee extension

• Termination:
  – Erect trunk, both feet on the ground, minimal postural sway
Case Example – Step Up Task

Clinical Reasoning - Evaluation

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.”*

Diagnostic Label (MSD)
“Pattern recognition” – analyze & match results of the clinical examination to known description of movement system problems.

* www.apta.org, 2016
Identify clearly the movement condition (problem) at which intervention is targeted

Subgroup patients so that evidence-based interventions can be selected for the specific movement problem(s)

Clinical Reasoning - Intervention

Movement System Diagnosis

Movement System Diagnosis 1
- Intervention S
- Intervention H, etc.

Movement System Diagnosis 2
- Intervention L
- Intervention C, etc.
Unwarranted Variability in Practice

“Differences in care that cannot be explained by illness, medical need, or the dictates of evidence-based medicine.”

Wennberg & Gittelsohn, 1973

Unwarranted Variability & MSD

More Consistency in Practice (EBP)
Reimbursement & Coding

Current
Coding is driven by medical diagnosis
Complexity, elements of care are not evident
Data used to assess patient outcomes and reimbursement

Future
Coding sorted by MSD
Complexity and elements of care more clearly reflected in billing codes
Improved data used to assess outcomes and reimbursement

Documentation

• Movement System Diagnosis is best placed within the Assessment (Evaluation/Diagnosis) section of the Initial Examination.
• Examples……
Documentation Example 1*

Pt. is a 46 y/o female who with an acute exacerbation of MS over last 2 weeks. Pt. presents with movement system diagnosis of force production deficit including LE weakness (L > R), impaired balance, fatigue, and limited PROM B hip abd and ankle DF. These problems have led to limitations in performing bed mobility, self-care, and ambulation. Pt. is at increased risk for falls due to postural control impairments and decreased symmetry and rhythmicity of gait. Pt. requires inpatient rehabilitation to address this recent decline in functional abilities and to assist patient in returning to prior functional level – independence in ADLs and community ambulation.

* Modified from Quinn & Gordon, 2016

Documentation Example 2*

Pt. is a 24 y.o. male 6 wk s/p BI with primary diagnosis of motor planning deficit. Pt. is impulsive, confused and easily agitated. He presents with memory deficits, difficulty learning new tasks, L-sided weakness and spasticity, all of which contribute to limitations in safe and independent bed mobility, self-care, transfers, ambulation, and wheelchair mobility. Pt. also presents with impaired anticipatory and reactive balance control, which is the primary factor limiting ambulation.

Before injury, the patient was a FT student, lived with his family, and enjoyed active leisure activities. His residual cognitive and motor limitations have led to safety concerns, lack of independence in functional abilities and significant limitations in social, personal, and occupational life roles. Pt. requires intensive 1:1 6-days/wk BID physical therapy to address the above-stated impairments and activity limitations in light of his cognitive and behavioral deficits.

* Modified from Quinn & Gordon, 2016
Practice Recommendations

• Develop and implement a systematic process for movement observation and analysis of standardized tasks as a critical component of the patient examination.

• Define and validate Movement System Diagnoses (MSDs) with clear descriptions of the key examination findings associated with various movement system problems (pattern recognition).

• Link MSDs, once developed, to evidenced-based interventions though CPG, decision-making algorithms, search terms, etc.

• Integrate MSDs into coding, reimbursement and documentation.

Movement System Implications

Education
Education

Adoption of movement system as core philosophy for PT education - Deusinger, 2016

- Didactic & clinical entry-level
- Post professional training
  - Academic
  - Residencies
  - Fellowships
  - Continuing education

Movement Science

Core philosophy PT education

Education

Movement Science: the basis for concept based entry-level curricula

Figure 5: The Structure of Knowledge

Graham, 2015
CAPTE criteria do not currently reflect human movement system as a fundamental concept

Needed:
Framework for clinical reasoning with human movement system at the center

Duesinger, 2016; Graham, 2015
Education

Examples of movement science as entry-level curricular construct

- Caitlin, 1993
- Hedman, Rogers & Hanke, 1996

Current CAPTE diagnostic criteria: PT will “Determine a diagnosis that guides future patient/client management”

http://mapsdon.com/businessapp
Education

Educate the Educators

- academic and clinical entry level faculty
- residency and fellowship faculty
- all clinicians

Education Recommendations

- Publish descriptions and presentations about human movement system based curricula
- Modify CAPTE criteria to reflect movement science as the core of PT curricula
- Profession wide mentoring for developing entry level curricula and ones that are transitioning their curricula
- Provide continuing education by the Academy of Neurologic Physical Therapy in which participation is both mandatory and offered at no cost
Movement System Implications

Research

• Develop and evaluate effective patient/client classification methods to optimize clinical decision making for physical therapist management of patients/clients.
Research

NCMRR New Research Priorities include:
• To develop objective measures...that may predict rehabilitation treatment response, monitor functional progress, and tailor interventions to the individual abilities, needs, and resources of the person with disabilities.

The process of developing classification systems in neurologic rehabilitation

• Data-driven approach
• Experience-based approach
Data-driven approach

• Utilizes large datasets to categorize patients based on movement-related and other problems
• Depends on standardized approach to assessment

Bland et al. PTJ 2015
Table 2. Clinical Representation of Participants in Each of the 4 Clusters

<table>
<thead>
<tr>
<th>Cluster A</th>
<th>Cluster B</th>
<th>Cluster C</th>
<th>Cluster D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impairment, Sensorimotor</td>
<td>Impairment, Sensorimotor</td>
<td>Impairment, Sensorimotor</td>
<td>Impairment, Sensorimotor</td>
</tr>
<tr>
<td>Motor: full upper and lower extremity movement against gravity with moderate to maximal resistance</td>
<td>Motor: full upper and lower extremity movement against gravity, some able to take moderate resistance</td>
<td>Motor: upper and lower extremity movement but not full range of motion</td>
<td>Motor: limited upper and lower extremity movement</td>
</tr>
<tr>
<td>Sensation: light touch intact</td>
<td>Sensation: light touch intact and impaired</td>
<td>Sensation: light touch intact</td>
<td>Sensation: light touch intact</td>
</tr>
<tr>
<td>Impairment, Cognition</td>
<td>Impairment, Cognition</td>
<td>Impairment, Cognition</td>
<td>Impairment, Cognition</td>
</tr>
<tr>
<td>Dementia: not present</td>
<td>Dementia: minimal impairment</td>
<td>Dementia: moderate impairment</td>
<td>Dementia: major impairment</td>
</tr>
<tr>
<td>Neglect: not present</td>
<td>Neglect: minimal impairment</td>
<td>Neglect: minimal impairment</td>
<td>Neglect: major impairment</td>
</tr>
<tr>
<td>Not present</td>
<td>Minimal impairment</td>
<td>Moderate impairment</td>
<td>Major impairment</td>
</tr>
<tr>
<td>Activity</td>
<td>Activity</td>
<td>Activity</td>
<td>Activity</td>
</tr>
<tr>
<td>Basic ADL: modified independence or supervision</td>
<td>Basic ADL: minimal to moderate assistance</td>
<td>Basic ADL: moderate to maximal assistance</td>
<td>Basic ADL: maximal assistance</td>
</tr>
<tr>
<td>Balance: minimal to moderate impairment</td>
<td>Balance: moderate to maximal impairment</td>
<td>Balance: major impairment</td>
<td>Balance: major impairment</td>
</tr>
<tr>
<td>Walking: ambulates at full community speeds</td>
<td>Walking: unable to ambulate independently</td>
<td>Walking: unable to ambulate independently</td>
<td>Walking: unable to ambulate independently</td>
</tr>
</tbody>
</table>

*Clusters are described in general terms of some of the key impairment and activity limitation deficits. ADL = activities of daily living.

Figure Legend:
Recommendation for future rehabilitation services across all 4 clusters. (A) Summary of discharge recommendation as a percentage of each cluster. (B) Summary of discharge recommendation as a percentage of the whole sample. Discharge recommendations include: home without services, home with services, inpatient rehabilitation facility (IRF), or skilled nursing facility (SNF).
Experience-based approach

- Developed by expert-consensus and/or clinical experience
- Used to guide selection of interventions and develop common terminology for patient groupings

Focus on Diagnosis

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
Example: Classification of movement system problems across medical diagnoses

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.
Example: Classification of gait disorders – across medical diagnoses

**Gait features:**

- Velocity
- Cadences
- Step length
- Asymmetry
- Step width
- Variability
- Arm swing
- Episodic features
- Additional features
Physiotherapy clinical guidelines for Huntington’s disease

Lori Quinn & Monica Busse; on behalf of the European Huntington’s Disease Network Physiotherapy Working Group

Example: Classifications of Movement System problems–disease-specific

Table 1. Classifications for physiotherapy patient management.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Exercise capacity and performance</td>
<td>Absence of motor impairment or specific limitations in functional activities; potential for cognitive and/or behavioural issues</td>
</tr>
<tr>
<td>B. Planning and sequencing of tasks (including bradykinesia)</td>
<td>Presence of apraxia or impaired motor planning; slowness of movement and/or altered force generation capacity resulting in difficulty and slowness in performing functional activities</td>
</tr>
<tr>
<td>C. Mobility, balance and falls risk</td>
<td>Ambulatory for community and/or household distances; impairments in balance, strength or fatigue resulting in mobility limitations and increased falls risk</td>
</tr>
<tr>
<td>D. Secondary adaptive changes and deconditioning</td>
<td>Musculoskeletal and/or respiratory changes resulting in physical deconditioning, and subsequent decreased participation in daily living activities, or social/work environments</td>
</tr>
<tr>
<td>E. Abnormal posturing (seating and bed positioning)</td>
<td>Altered alignment due to adaptive changes, involuntary movement, muscle weakness and incoordination resulting in limitations in functional activities in sitting</td>
</tr>
<tr>
<td>F. Respiratory dysfunction</td>
<td>Impaired respiratory function and capacity; limited endurance; impaired airway clearance resulting in restrictions in functional activities and risk for infection</td>
</tr>
<tr>
<td>G. Palliative care</td>
<td>Active and passive range of motion limitations and poor active movement control resulting in inability to ambulate; dependent for most activities of daily living; difficulty maintaining upright sitting position</td>
</tr>
</tbody>
</table>

Quinn, Busse, et al 2012
Research Recommendations

- Clinicians and researchers should collaborate to refine and further develop classifications.
- Development of classification systems both within and across medical diagnoses should be evaluated and tested for their clinical utility, including their ability to predict outcomes and responsiveness to intervention.
- Classification systems often incorporate both movement-related impairments in combination with activity limitations and we argue that bridging across levels of the ICF model can be helpful to the successful implementation of any approach.
Movement System Diagnosis & Neurologic Physical Therapy

Time for Discussion


