A New Way to Assess Movement and Posture: Perception-Action Approach

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Objectives

- List, compare and contrast methods of assessment of movement and posture available to pediatric physical therapists.
- Identify the vital components of observational assessment in the Perception-Action Approach.
- Explain the theoretical foundation of each of the assessment components.
- Apply the new method of assessment to specific patient cases.

Methods of Assessment

- Grouped by ICF Component
  - Body Structures and Functions
    - By body system
  - Activity
  - Participation
  - QoL and HRQL
- Relevant personal factors
  - Level of enjoyment, motivation, interest and persistence in activities and participation
  - Personal preferences in activities, play, etc.

Methods of Assessment

- Standardized assessment
  - Developmental tests (body structures and functions)
  - Functional Tests (activity)

Developmental Testing

- Milestone norms vs. variations among infants and children brought up in different cultures around the world (Adolph et al, 2010)
  - Timing of onset
  - Sequence of emergence
  - Prevalence of specific types of posture and movement
Developmental Testing

- Single-point assessment may lead to interpretation errors (Adolph et al, 2008)
  - Fails to account for
    - Intraindividual variability in daily motor performance
    - Variability of behavior within the same day
  - More frequent or serial assessment may be more accurate (Eldred and Darrah, 2010)

Methods of Assessment

- Assessment of Quality of Movement
  - Traditional Assessment
    - Standardized assessment with emphasis on movement components (The AIMS, the TIMP, the TIME)
    - Traditional observation
  - Other Methods
    - Standardized assessment with emphasis on movement variability
    - Nonlinear tools
      - Emphasis on variability and complexity of postural control
      - Used primarily in research
    - Observation
      - Observation of General Movements
      - Perception-Action Approach

Traditional Observation

- Focus
- Goals
- Recommendations for intervention

Child E (Typical Dev., Age 5.5 mos)

Child K (Dx: Bilateral CP, Age 8 Yrs)

Child E (Typical Dev., Age 7 mos)
Child A (Dx: Bilateral Spastic CP, Age 2.5 Yrs)
Methods of Assessment

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Infant Motor Profile (IMP)
(Heineman et al, 2008)

- Evaluates spontaneous and elicited movement
  - In infants of 3 to 18 months of age
  - In older children with moderate to severe motor disorders
- 80 items arranged in 5 subscales:
  - Variability – size of repertoire
  - Variability – ability to select
  - Symmetry
  - Fluency
  - Performance

Infant Motor Profile (IMP)
(Heineman et al, 2008)

- Variability subscales assess
  - The size of the child’s movement repertoire
  - Ability to select the best movement strategy for the task in the process of spontaneous exploration
- Symmetry subscale evaluates
  - Presence or absence of symmetry
    - In posture of the trunk, head, and extremities
    - In extremity movements

Assessment of Quality of Movement: Other Methods

- Nonlinear tools (Harbourne et al, 2009; Stergiou et al, 2006)
  - Variability of movement and postural control exhibited by a healthy person has a complex structure that resembles chaos.
  - Complexity of postural control can be examined by using nonlinear tools
    - Figure: Harbourne & Stergiou, 2009

Nonlinear Tools
(Harbourne et al, 2009)

- Two features of complexity of postural control that can be examined by using nonlinear tools:
  - Regularity
    - Can be assessed using a statistic called Approximate Entropy or ApEn.
  - Dynamic stability
    - Can be assessed using a nonlinear tool called Lyapunov Exponent or LyE.
Nonlinear Tools (Harbourne and Stergiou, 2009)

- Nonlinear tools are currently used primarily for research.
- With the development of technology, these tools may become available in the clinic in the form of an electronic device that will be used to assess variability.

Physical therapists lack training in:
- Understanding variability and complexity
- Using that understanding in clinical practice
- Introduction of this information in PT education and continuing education may help to bridge the gap between research and clinical practice.

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Observation

- Observation of General Movements (GMs) in early infancy (Prechtl, 1999; Einspieler et al, 2004; Hadders-Algra, 2004)
  - Focus
    - Variation, complexity and fluency of GMs
  - Goals
    - Identify typical and atypical quality of GMs
    - Predict developmental outcome and risk for CP
  - Recommendations for intervention

Perception-Action (P-A) Approach

History of P-A Approach

- Tscharner Akademie for Motor Organization (TAMO) Therapy was developed by Ingrid Tscharner, PT, DPT
  - Tscharner 1993, 2002
  - The approach was taught nationally and internationally
  - Evolved into Perception-Action Approach
P-A Approach

- Theoretical Foundation
  - Perception-Action (P-A) Theory
  - Gibson J, 1966; Gibson EJ, 1988
  - Dynamic Systems Theory (DST)
    - Thelen and Smith, 1994; Thelen, 1995; Kelso, 1995
  - Theory of Neuronal Group Selection (TNGS)

Complementary Nature of Three Major Theories of Development (Thelen 1994, 1995)

- Movement is a system that is
  - Interactive and complex rather than hierarchical and reflexive
  - Embedded in the environment
  - Developmental change is the result of a dynamic interaction between perception and action driven by active exploration and selection processes

Observation

- Perception-Action Approach
  - Focus
  - Goals
  - Recommendations for intervention

Harbourne & Rahlin, in press

- Focus of the P-A Approach is on
  - The child's active exploration of forces within the environment
  - The child's ability to perceive the affordances of his or her own body and the environment
  - Variability of movement and posture
  - Adaptability to the task

P-A Approach: Observational Assessment

- Goals (Tscharnuter 2002; Womack 2013; Harbourne & Rahlin, in press):
  - Assess the relationship of the child's body to the support surface and to gravity
  - Examine the exploratory strategies and movement variability exhibited by the child
  - Assess the child's ability to adapt posture and movement to ongoing, "real time" changes
P-A Approach: Observational Assessment

- Assessment Components (Tscharnuter 2002; Womack 2013; Harbourne & Rahlin, in press)
  - Relationship to support surface
  - Relationship to gravity
  - Variability/Complexity
  - Flexibility/Adaptability

Environment as a System of Coordinates

- Environmental invariants (Gibson 1966, Tscharnuter 2002)
  - Gravity
  - Supporting surface

Assessment Components: Relationship to Support Surface and Gravity

Child J (Dx: DD; Age 5 mos)

Variability/Complexity

- Dusing & Harbourne, 2010
  - Variability is..."a catalyst for changing skill over time..."
- Observed
  - Within single movement
  - In strategies used to complete a task within a single attempt
  - In biomechanical characteristics of skills emerging over time

- Fetters, 2010
  - Variability supports spontaneous exploration
  - Exploration leads to the development of new skills through the process of trial and error

Child D (Dx: Bilateral CP, Age 11 Years)

Variability/Complexity

- Dusing & Harbourne, 2010
  - Complexity is "a measure of the structure of variability"
  - Predictable, regular variability lacks complexity
    - Examples of sitting behaviors:
      - Anterior-posterior rocking
      - Making very small postural adjustments
Optimal Level of Movement Variability

- Stergiou et al, 2006:
  - Movement of a healthy person is characterized by optimal variability that has a chaotic (complex) structure.

Variability/Complexity

- Vereijken, 2010: Complexity of motor development is related to
  - Variability of movement trajectories exhibited by the same child performing the same movement several times
  - Variability of movement solutions for the same task exhibited by a child

Limited and Excessive Variability

- Fetters, 2010:
  - Decreased variability limits adaptability and the ability to develop new skills
  - Excessive variability leads to decreased
    - Consistency of motor performance
    - Adaptability to changing demands of the task
    - Carry-over of the task mastered in one environment or context to other situations

Assessment Components: Variability/Complexity
Child K (Dx: Bilateral CP, Age 8 Yrs)

Flexibility/Adaptability

- Adolph 2008
  - Flexibility is the ability to
    - Select an adaptive movement solution to a new problem
    - Adapt movement occurring in real time to “changes in local conditions”
    - Discover new ways to attain desired results.

- Dusing & Harbourne, 2010
  - Adaptability is the ability to modify action or movement strategy as the result of perceiving and processing the information received from the environment or from a previous action.

Integration of Assessment Components
Child G (Dx: Genetic Disorder, 3.5 years)
Patient Case:
Application of P-A Approach Assessment

Patient Case:
Child D (Dx: Dyskinetic CP, Age 10 Yrs)

- Parental concerns:
  - Family was unable to comfortably eat at a restaurant because of their child’s eating behaviors.
  - Need for adaptive seating
  - Unable to eat without spilling or dropping food
  - Unsafe in handling a fork
  - Self-feeding by crushing food with his hands and pushing it into his mouth
  - Limited drinking options
- Parental goal for the child:
  - To gain independence and improve tidiness of the self-feeding process across settings

Intervention Outcomes
Child D (Dx: Dyskinetic CP, Age 10 Yrs)

- Following 11 months of P-A Approach intervention, the child was able to
  - Sit in a regular chair at the family table or in a restaurant
  - Control (B)Ue for self-feeding, with intermittent minimal assistance provided at his elbow
  - Self-feed finger foods appropriately
  - Use the fork safely
  - Acquire two new drinking options
- Family reported being comfortable eating at restaurants as the result of intervention.

References


Observation

- Perception-Action Approach
- Focus
- Goals
- Recommendations for intervention
References


References