HOW DO WE BALANCE & HOW TO MEASURE IT?

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Function of the balance system

Maintains steady posture and allows functional movement.
Systems involved with balance

- Neural and musculoskeletal systems that interact to select and adjust required movements and posture

- Postural and movement responses are organized around the task

- Responses are modified by environmental restraints

Horak F 1989, Shumway-cook A 1990
Neural system

- Cognition / attentional
  - Recognition of potential threats to balance
  - Past experience to help plan best response
  - Adjust and regulate attention

- ‘Automatic’ activity before voluntary movement
  - Basal ganglia interacts with supplementary motor cortex to position COM before voluntary movement
Neural systems active during movement

- Sensory systems – vision, vestibular and somatosensory – input systems
- Central nervous system – integrates, regulates and modifies input and output
- Central and peripheral neural connections to muscular system – output systems
Reactive system

- Back up system
- Ankle strategy
- Step strategy
- Grasp strategy - reaching out for support
  - Centrally programmed
  - Modifiable - not hard wired
How to assess balance systems

- **Mini BESTest**
- **Assesses 4 interacting interdependent systems contributing to balance**
  - Preparation phase pre voluntary movement
  - Sensory orientation
  - Stability in gait – adaptability with various tasks
  - Postural responses
Preparation system

• 3 tasks
  • Sit to stand
  • Rise on toes
  • Stand on one leg
Sensory system

- 2 tasks
  - CTSIB
    - On firm surface, feet together (FT), eyes open (EO)
    - On foam, feet together (FT), eyes closed (EC)
  - Incline 10° toes up feet apart, eyes closed
Stability in gait

- 5 tasks
  - Change in gait speed – fast and slow
  - Change in speed walking with head turns
  - Pivot turns
  - Step over obstacles
  - GUG with dual task
Reactive postural responses

- Forwards
- Back
- To left
- To right
<table>
<thead>
<tr>
<th>Task</th>
<th>Score 2,1,0</th>
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<tbody>
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<td>Sit to stand</td>
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<td>Rise on toes</td>
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<td>Stand on 1 leg</td>
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<td>Firm surface FTEO</td>
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<td>Foam FTEC</td>
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<td>Incline EC</td>
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<td>Change speed 10m</td>
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<td>Change speed head turns</td>
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<td>Pivot turn</td>
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<td>Step over obstacle</td>
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<td>Postural reaction</td>
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