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TASK-ORIENTED APPROACH IN MANAGING BALANCE AND POSTURAL CONTROL IN THE ELDERLY

Salvador Bondoc, OTD, OTR/L, BCPR, CHT, F AOOTA

Objectives

At the end of this presentation, participants should be able to:

1. State principles of intervention to address balance and postural control in the elderly
2. Identify specific strategies to address/manage issues pertaining to balance and postural control in the elderly

Schedule/Outline

• 1:30 – 1:40
  Review of issues on Balance and Postural control affecting the elderly

• 1:40 – 2:15
  Management strategies on balance/postural control

• 2:15 – 2:30
  Wrap up
  Question-and-Answer
ISSUES RELATED TO BALANCE AND POSTURAL CONTROL IN THE ELDERLY

Postural Control Systems

Sensory Interactions
Cognitive System

Sensory and Motor Integration

Neuromotor Responses

Affective and Motivational System

Musculo-Skeletal

Musculoskeletal Issues

3. Trunk and Hip Control
   • Weak core stabilization
   • Muscle tightness
   • Limited trunk mobility

4. Ankle Control
   • Limited mobility and weakness

1. Postural Alignment
   • Asymmetrical stance
   • Atypical or dysfunctional spinal curvature

2. Upper Body and Extremity Control
Neuromotor Issues

1. Anticipatory Control
   • Delayed initiation, motor planning
   • Freezing-like behaviors

2. Reactive Control
   • Slow reflexive response
   • Exaggerated startle response

3. Ongoing Task Performance
   • Decreased dynamic adaptation of postural control according to task and environmental demands

Sensory System Issues

1. Decreased Somatosensory
   • May manifest as mild ataxia
   • Increased visual dependence
   • Compensate with UE

2. Decreased Visual Acuity
   • Loss of depth perception

3. Vestibular Hypofunctioning
   • Stiffening of the upper body
   • "Stop and Go" pattern
   • Fear of anxiety with movement transitions

   GAZE STABILIZATION
   • Saccades
   • Pursuits
   • Vestibulo-ocular reflex
   • Optokinetic reflex

Other Key Issues:

• Cognitive:
  • Decreased attention/dual-task performance
  • Decreased problem solving

• Psychosocial:
  • Fear of falling
  • Kinesiophobia
  • Motivation

• Cardiovascular

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POSTURAL CONTROL AND BALANCE
TRAINING IN OLDER ADULTS
A task oriented approach

Task Oriented Approach
• Based on systems model and motor learning theories
  • Systems Model
    • Balance and postural control is complex with multiple variables that
      interact with task and environmental demands
  • Motor Learning
    • Acquisition and modification of learned movement depends on
      • Practice (duration, intensity, context)
      • Feedback (intrinsic and extrinsic)
      • Functional capacity (body structures and functions)

Considerations
Intervention Plans should incorporate
these training components

Component-based Training
• Focus on directly remediating the impairment
• Easy to deliver
• Patient performs “drills” – can be automated
• Leads to non-distributed learning
  • training effect is limited to a given context

Task-based Training
• Focus on skills training and carryover in real-world tasks
• Requires creativity
• Patient performs a task (discrete or continuous)
• May lead to distributed learning
  • with “interference,” may result in skills transfer
Intervention goals

1. Resolve, reduce, or prevent impairments in systems that are important to balance

2. Develop effective task-specific sensory, motor, and cognitive strategies

3. Retrain in performance of functional tasks with varying postural control demands under changing environmental contexts

Intervention Strategies

1. Multi-Dimensional Impairment Training
   - Strengthening
   - Range of Motion
   - Endurance

2. Task-Oriented Training
   - NeuroMotor Aspects
   - Sensory-Integrative Aspects
   - Cognitive Aspects

3. Skills Transfer

Impairment-Focused Training

Talk Test!

<table>
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<tr>
<th>Rate of Perceived Exertion (RPE)</th>
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<th>2</th>
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<th>7</th>
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</table>

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### Strength Training Guidelines

<table>
<thead>
<tr>
<th>Exercise Variable</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| Intensity         | Beginner (moderate: 5-6/10 RPE)  
                      Advanced (hard: 7-8/10 RPE) |
| Quality           | Technically correct movement  
                      Maximal range of motion |
| Quantity          | 10-15 reps with moderate resistance (beginner)  
                      6-12 reps hard resistance until muscle fatigues (advanced)  
                      2 – 3 sets of concentric contraction  
                      2 – 3 sets of eccentric contraction |
| Rest              | 2 minutes between sets |

---

### Sample Go4Life Exercise 1

**WHAT YOU NEED**
- Resistance band and stool, armless chair

**Go to your progress, use a heavier strength band.**

- Sit on a sturdy stool chair with your feet flat on the floor, shoulder-width apart.
- Place the center of the resistance band under your foot. Hold each end of the band with palms facing inward. Keep elbows at your sides. Breathe in slowly.
- Keep arms straight and slowly breathe out as you bend your elbows and bring your arms toward your shoulders.
- Hold the position for 1 second.
- Breathe in as you slowly lower your arms.
- Repeat 10-15 times.
- Rest, then repeat 10-15 more times.

---

### Sample Go4Life Exercise 2

**TARGETED MUSCLES**
- Buttocks and lower back

**WHAT YOU NEED**
- Sturdy chair

- Stand behind a sturdy chair, holding onto for balance. Breathe in slowly.
- Breathe out and slowly lift one leg straight back without bending your knee or pivoting your torso. Try to lean forward. The leg you are standing on should be slightly bent.
- Hold position for 1 second.
- Breathe in as you slowly lower your leg.
- Repeat 10-15 times.
- Repeat 10-15 times with other leg.
- Repeat 10-15 more times with each leg.

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Trunk Control Training

- Lateral Flexion - Recovery
- Hip-Hiking - Scooting

Task Oriented Training

- **Motor Aspects**
  - Steadying (Stance) Dynamic Balance Training
  - Reactive Balance Training
  - Anticipatory/Proactive Balance Training

- **Sensory Aspects**
  - Training to increase vestibular response
  - Incorporate multi-sensory cues

- **Cognitive training**:
  - single to dual task condition

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**Relationships Between Trunk Muscle Strength, Spinal Mobility and Balance Performance in Older Adults.**


**Abstract**

This study investigated associations between variables of trunk muscle strength (TMS), spinal mobility, and balance in seniors. Thirty-four seniors (18 female, 16 male, age: 70±4 years, activity level: <2.22 kcal/d) were tested for maximal isometric strength (MIFS) of the trunk extensor muscles.

Lateral flexor, rotator, spinal mobility, and steady-state, reactive, and proactive balance. Significant correlations were detected between all measures of TMS and static steady-state balance (r=0.43±0.20).

No significant correlations were found between all variables of TMS and reactive/proactive balance and between all variables of spinal mobility and balance.

Regression analysis revealed that TMS is related to measures of steady-state balance which may imply that TMS-promoting exercises should be integrated in strength training for seniors.

PMID: 26152579 (Published as supplied by publisher)
Sensory and Cognitive Strategies

<table>
<thead>
<tr>
<th>SENSORY</th>
<th>COGNITIVE</th>
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<tbody>
<tr>
<td>• Visual retraining or visual compensation</td>
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</tr>
<tr>
<td>- Saccades and Pursuits</td>
<td></td>
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<tr>
<td>- Depth perception</td>
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<tr>
<td>• Vestibular training</td>
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<tr>
<td>- Head turns</td>
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<tr>
<td>- Visual fixation on object</td>
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<tr>
<td>• Dual-task vs. single-task balance tasks</td>
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<tr>
<td>• Anticipatory problem solving</td>
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</table>

Cognitive Training

Effects of Single-Task Versus Dual-Task Training on Balance Performance in Older Adults: A Double Blind, Randomized Controlled Trial

Guidelines for Steadying Balance

<table>
<thead>
<tr>
<th>Exercise Variables</th>
<th>Recommended Progression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base of Support</td>
<td>Normal shoulder width → Narrow → Tandem/Semi-Tandem → 1-leg partial stance</td>
</tr>
<tr>
<td></td>
<td>Within BoS (static) → Within LoS (dynamic)</td>
</tr>
<tr>
<td>Surface</td>
<td>Hard (wood floor) → Soft (carpet)</td>
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<tr>
<td></td>
<td>Stable (concrete) → Unstable (sand)</td>
</tr>
<tr>
<td>Direction</td>
<td>Forward &lt; &gt; Backward</td>
</tr>
<tr>
<td></td>
<td>Left &lt; &gt; Right</td>
</tr>
<tr>
<td></td>
<td>Diagonal and Rotational</td>
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</tbody>
</table>
Progressive Shift in Center of Mass in Steady-State Stance

Preparation for Progressive Stance

Progressive Stance
### Guidelines for Reactive and Proactive Balance Training

<table>
<thead>
<tr>
<th>Reactive Balance</th>
<th>Proactive Balance</th>
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<tbody>
<tr>
<td>• Semi-predictable perturbation</td>
<td></td>
</tr>
<tr>
<td>• Patient aware of need to take step or potential for perturbation</td>
<td></td>
</tr>
<tr>
<td>• Controlled perturbation by therapist</td>
<td></td>
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<tr>
<td>• Push or Pull</td>
<td></td>
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<tr>
<td>• Varying speeds</td>
<td></td>
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<tr>
<td>• Activities that require transitions in place</td>
<td></td>
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<tr>
<td>• High-lo surfaces</td>
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<tr>
<td>• Sit-to-stand activities</td>
<td></td>
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<tr>
<td>• Activities that require change in direction and speed during mobility</td>
<td></td>
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<tr>
<td>• Turning corners while carrying an object</td>
<td></td>
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<tr>
<td>• Stepping over or avoiding obstacles</td>
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</tbody>
</table>

### Proactive/Anticipatory Balance: STS

#### Force-Control Strategy

#### Momentum Strategy

### Incorporating Vision-Related Strategies and Manual Dual Task during STS
Proactive Balance Transitions

Reactive Balance

*One intervention strategy that is currently underutilized and that has far-reaching potential is to promote an older adult’s own neuromuscular protective mechanisms appropriate for reducing the incidence of falls (Pai & Bhatt, 2007)

- Semi-predictable:
  - Push-pull activity
  - Perturbation training
  - Ball-related activity
- Therapist-controlled perturbation
Perturbation Training

Perturbation – Step Training

Therapist Controlled
Repeated-Slip Training

Revised: November 20th, 2013. (1)1 1/75:1.00; doi: 10.25250/20950.

Repeated-Slip Training: An Emerging Paradigm for Prevention of Slip-Related Falls Among Older Adults

T. P. Ph. D. (PhD); H. M. Ph. D. (PhD); H. A. Ph. D. (PhD); H. B. Ph. D. (PhD)
Department of Physical Therapy, University of Illinois at Chicago

Summary

• Issues surrounding balance and postural control in the elderly are complex

• Interventions should be comprehensive and must consider a systems-based model to address various aspects of balance and postural control
  • Integrates impairment-focused with task-focused intervention
  • Incorporates motor learning principles of practice and feedback
Questions?

• Thank you!

Select References


