Treatment strategies for UE and LE integration in function

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Review of key components to functional movement analysis

• Determine initial biomechanical alignment and base of support

• Understand and assess postural control, including anticipatory postural adjustments required prior to movement
Review of key components to functional movement analysis

• Need to determine ROM requirements in function at every body segment

• Need to determine the Musculoskeletal demands at each segment
  ▫ Isometric
  ▫ Concentric
  ▫ Eccentric

Timing and Sequencing

• What segment initiates movement?
  ▫ What happens 1st

• What segment is stable to allow movement?
  ▫ What segment is stable? What segment is mobile?

• Does the role of the segment change between stable and mobile?
  ▫ As the function progress, does this change?

• Does the BOS change?
  ▫ As the function progress, does this change?
Let’s Watch and Analyze!

- Base of Support?
- Alignment?
- Where is the movement initiated?
- Does the BOS change?
- Do you see trunk movement?
- Do you see LE activity?
- Do you see UE activity?
Linking Movement Analysis to Systems Impairments: Leading you to your treatment strategies

- Musculoskeletal
- Neuromuscular
- Somatosensory
- Visual
- Perceptual
- Vestibular
- Behavioral
- Cognitive
- Respiratory
- Cardiovascular

Musculoskeletal System Impairments?

- Muscle Length
  - Contractures of specific muscles
- Joint Limitations
  - Capsular
  - Ligamentous
  - Connective tissue
- Head and neck?
  - Shortened suboccipitals, levator and scalenes due to forward head?
- Trunk?
  - Shortened Left lateral flexors? Latissimus Dorsi?
- Shoulder Girdle?
  - Shortened Left pectoralis major, subscapularis? Joint capsule?
- UE?
  - Shortened biceps, pronator teres, wrist and finger flexors? Carpal alignment?
- LE?
  - Shortened hip flexors, hamstrings, gastric-soleus?
Neuromuscular System Impairment - Muscle Weakness?

Muscular Weakness Defined

- **INITIATE** muscular contraction
- **INCREASE FORCE**
  - Generate force to meet the demands of the task (strength)
- **SUSTAIN** muscle contraction
  - Maintain for time necessary to complete task (endurance)
- **Type of Contraction**
  - Isometric/Eccentric/Concentric

- **Head and neck?**
  - Deep neck flexors? Left upper trap?
- **Trunk?**
  - Lumbar and thoracic extensors? Abdominals?
- **Shoulder Girdle?**
  - Supraspinatus, Deltoid, Ext Rotators? Scapular depressors? Adductors?

- **UE?**
  - Triceps/biceps, supinator?
  - Wrist and finger extensors?
  - Thumb/Intrinsics?

- **LE?**
  - Hip: Flexors? Extensors?
    - Abductors? IR/ER?
  - Knee: Hamstrings? Quadriceps?
  - Ankle: Tibialis anterior? Peroneals? Gastroc-soleus?
Neuromuscular System Impairments - Spasticity?

• Spasticity
  • “...motor disorder marked by a velocity-dependent increase in muscle tone or tonic stretch reflexes associated with hypertonia.” (Yulia Rivelis; Karen Morice, 2020).
  • Resting tone vs. Fluctuating tone in function

• Coordination
  • Intra-limb coordination
  • Inter-limb coordination
  • Head-trunk coordination

• Do you suspect low or high tone?

• Coordination?

Early Squat Treatment Sequence

• Sit to/from squat
  • Stance
  • Higher Seating Surface
  • B UE support

• In Squat
  • R UE reaching
  • Vary range of squat

Neuro-Developmental Treatment Association
Common Compensatory Strategies Linked to Impairments

<table>
<thead>
<tr>
<th>Compensatory Strategy</th>
<th>Possible Impairments</th>
</tr>
</thead>
</table>
| - Initiate lift off with unaffected UE | - Trunk weakness  
- Hip weakness  
- Quadriceps weakness  
- Plantarflexor weakness  
- Sensorimotor deficit  
- Neglect  
- Visual depth perceptual deficit  
- Learned non-use |

Common Compensatory Strategies Linked to Impairments

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| - Unaffected foot positioned behind affected foot in set-up | - Trunk weakness  
- Hip weakness  
- Quadriceps weakness  
- Plantarflexor weakness  
- Intra-limb incoordination  
- Inter-limb incoordination  
- Sensorimotor deficit  
- Neglect |
Sit to/from Stand in Stride

• Increase demand on Affected LE
• Increase need for forward hip flexion moment to move over a BOS
• Variations
  • Height of Surface
  • UE integration

Gait in Squat

• Inter-limb coordination
• Limiting compensatory strategies for swing phase
• Increased demands on all affected muscle groups

Squat to Lunge

• Increased Isometric Demand on affected limbs
• Inter-limb coordination
Lunge
• Variables

• Change demands with eccentric and concentric contractions
• Increase hip abductor demands with trunk rotation
• Increase UE support w/ ER and scap add

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Squat in Stride during Gait

• Affected LE forward
  • Translation forward over BOS
  • Eccentric quadriceps and plantarflexors

• Unaffected LE forward
  • Smaller BOS on Affected LE
  • Need balance of ankle eversion/inversion
  • Isometric > Eccentric plantarflexor moment on Affected LE

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Treatment Progression at Stairs

- Ability to work on Midstance
  - Variables
  - Direction
  - ROM demands
  - UE support allowed

- Limb loading improves sit to stand and gait

Treatment Progression at Stairs

- Transition to Affected LE leading to ascend steps
  - Prepare in stance
  - Step up with unaffected
  - Assist affected LE to step
  - Descend backward leading with unaffected
Treatment Progression at Stairs

- Unaffected Descending
  - Eccentric Quadriceps and Soleus
  - Similar to Stand to squat or sitting

- Affected Ascending
  - Concentric Hip Extensors, Quadriceps and Plantarflexors
  - Isometric Hip Abductors
  - Similar to Sit to stand

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Treatment to Function!

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Decision Making for Therapeutic Handling

- Upper Trunk Weakness
  - Scapular approximation
  - Integration of Affected UE
- Lower Trunk Weakness
  - Erector Spinae Contact
  - Abdominal Co-activation
  - Base established
- Hip Extensor Weakness
  - Base established
  - Hip extensor cue prior to knee extension

Decision Making for Therapeutic Handling

- Hip Abductor Weakness
  - Ensure Hip/knee/foot Alignment in establishing base
  - More Lateral hip cue
- Quadriceps Weakness
  - Lower abdominal cue prior to concentric moment
  - Quadriceps cue? Vs Tibia cue
- Hamstring Weakness
  - Establish base to close the chain!
  - Work on forward scooting
Decision Making for Therapeutic Handling

• Plantarflexor Weakness
  ▫ Establish and maintain heel approximation

• Learned non-use, neglect OR hemi-inattention
  ▫ Establish midline starting postural alignment
  ▫ Bias base of support to affected LE
  ▫ Establish and maintain heel approximation
  ▫ Integrate affected UE
  ▫ Limit unaffected UE use

Questions?