Core Stabilisation Training in Rehabilitation

- What is the core?
- Core stabilisation concepts
- Review functional anatomy
- Postural considerations
- Muscular imbalances
- Assessment of the core
- Core stabilisation training

Weekly tasks:
- Quiz 3 - Chapter 5

What is the Core?

- Efficient core allows for
  1. Maintenance of normal length-tension relationships
  2. Maintenance of normal force couples
  3. Maintenance of optimal arthrokinematics
  4. **Optimal efficiency** in entire kinetic chain during movement
     - **Acceleration, deceleration, dynamic stabilization**
     - **Proximal stability for movement of extremities**

Core musculature and thoracolumbar fascia thought to play critical role in trunk rotation/ load transfer, therefore, **stability of lumbopelvic region**

**Core Stability**


**Anterior OMS, Posterior OMS**

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**CORE Muscle Sling**

Source: Liebenson 2004, *J. Bodywork Mov. Ther.*, 8:43-45
Anterior Oblique Sling

Consists of:
1. 
2. 

Lateral Sling

Consists of:
1. 
2. 
3.
Consists of:
1. Tensor fascia latae
2. Peroneus
3. Biceps femoris
4. Lumbar musculature

Spinal stabilization
Adequate to effectively utilize strength, power, NM control and endurance of the “prime movers”

- Weak core
- ↓ movement efficiency
- ↓ NM control/ body positioning
- ↓ force reduction/ production
**What is Core Stabilisation?**

*Function*
Integrated, multi-dimensional movement

*Functional KC*
address each link of kinetic chain

*Functional strength*
Loading and unloading strategies

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Model of Core Stability

Neuromuscular efficiency

Ability of CNS to allow agonists, antagonists, synerigists, stabilizers and neutralizers to work efficiently / interdependently

• Neuromuscular efficiency
  – Combination of postural alignment and stability strength
    • Optimizes body’s ability to generate and adapt to forces
    • Inefficiency results in body’s inability to respond to postural demands
      – Ability to maintain appropriate forces and dynamic stabilization of the KC

RESULT:

• Rehabilitation generally focuses on isolated uni-planar strength gains in single muscles
  – Functional activities are tri-planar
    ✓ requiring acceleration and stabilization (Turkish Get up)
  – Train 3-D: movements not muscles
  – Balance challenge: dynamic warm-up

• AEPs must be willing to make paradigm shift
  – Train entire kinetic chain on all levels in all planes focusing on functional strength and NM efficiency
  – BAPS: Integrating balance and postural stability exercises

Implementing Balance & Postural Stability: A movement preparation strategy

What we know:
Challenging an athlete’s center of gravity within their base of support may promote a training effect that enhances ability to regain stability in athletic context:
- Heightened sense of lumbar spine position/pelvis orientation during dynamic movements.

Research:
Effect of BAPS exercises on core stability and control.
Influence of a BAPS half-time re-warm strategy on acute performance.

Did you know:
50% of collegiate football players report history of shoulder pain:
- Shoulder injuries comprised approximately 10% of all injuries.
- Football players have ↓ upper extremity sensorimotor control due to repetitive contacts.
- Football players may benefit from ExRx to improve upper extremity sensorimotor control.


3-D Training = Dynamic core stabilization

Dynamic core stabilization is a key component to program:
- Improves postural control
- Ensures appropriate muscular balance and joint arthrokinematics (lumbo-pelvic-hip complex)
- Allows for dynamic functional performance throughout entire KC

- Faries & Greenwood 2007 SCJ 29(2), 10-25 Core training.pdf
- Gamble 2007 SCJ 29(1) Integrated core stabilitypdf.pdf
Review of Functional Anatomy

Please spend time to review Functional Anatomy in your study groups

Key Considerations

- Core maintain postural alignment and dynamic postural equilibrium
- Prevention of muscle imbalances/ synergistic dominance
- Enhance dynamic postural control with strong stable core

Segmental deficit results in predictable dysfunction
Muscular imbalances = deficient NM control
Joint/ligament injury = NM deficits
Photograph (A), illustration (B), and schematic (C) demonstrating the vulnerability of the kinetic chain components in the presence of deficits in trunk neuromuscular control. Greater forces are exerted and larger displacements occur in an attempt to maintain the system’s performance and stability.

- Injury will likely occur at the weakest link, where the joint position is compromised or the forces are close to tissue failure. In this instance, the knee may be the weakest link.


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**Assessment of the Core**

- Overall function of lower extremity kinetic chain
- Muscle imbalances
- Arthrokinematic deficits
- Core function
  - Strength
  - Endurance
  - Neuromuscular control
  - Power

Double leg-lowering test for Core Strength


Raise cuff pressure to 40 mmHg. Patients legs are maintained at full extension, flex the hips to 90°. Instruct patient to perform a drawing-in manoeuvre (pull belly-button to spine) and then flatten back maximally into the table and cuff and then lower the legs toward the table while maintaining their flat back. Test is over when pressure in the cuff decreases. Measure hip angle with a goniometer to determine the angle.

Abdominal Neuromuscular Control Test

Place patient in a supine position with their knees and hips at 90°. Position blood pressure cuff under the lumbar spine (L4-L5) and inflate to 40 mmHg. Instruct patient to perform a drawing-in manoeuvre (pull belly-button to spine) to stabilise the lumbar spine, and then to slowly lower the legs until pressure in cuff decreases. This indicates the ability of the lower abdominal wall to preferentially stabilise the lumbo-pelvis-hip complex. Measure hip angle with a goniometer to determine the angle.
Core Muscular Endurance Tests


Predictive validity of the Sorensen test (n=900)

- Healthy: male 198 s / female 197 s
- CLBP: male 163 s / female 177 s
- Position-holding time <176 s predicted low back pain during the next year in males, whereas >198 s predicted absence of low back pain


Q&A Lecture 1

- Muscle slings

- Anatomy Trains www.anatomytrains.com

- Bunkie' test
Bunkie test: 5 tests to assess functional fascia lines

- Lie on mat in the required position, with feet or one foot on the Bunkie, supporting upper body on elbows
- Lift body up into a neutral position, and takes weight off one foot to test the specific fascia line
- Held for 20–40s
- Novice 20 s; Intermediate 30; Advanced/Endurance athlete 40s,
### 12 Stage Core Assessment (Bird 2008)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Poor (1)</strong></td>
<td>Stage 1: Start in the Plank Exercise Position (elbows on the ground) Hold for 30 seconds</td>
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<td>Stage 2: Lift your right arm off the ground Hold for 15 seconds</td>
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<td>Stage 3: Lift the left arm off the ground Hold for 15 seconds</td>
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<tr>
<td><strong>Below Av (2)</strong></td>
<td>Stage 4: Return your left arm to the ground and lift the right leg off the ground Hold for 15 seconds</td>
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<td><strong>Average (3)</strong></td>
<td>Stage 5: Lift your left leg off the ground Hold for 15 seconds</td>
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<tr>
<td></td>
<td>Stage 6: Lift your left leg and right arm off the ground Hold for 15 seconds</td>
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<tr>
<td></td>
<td>Stage 7: Lift your right leg and left arm off the ground Hold for 15 seconds</td>
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<tr>
<td><strong>Good (4)</strong></td>
<td>Stage 8: Lift your left leg and right arm (star position) Hold for 30 seconds</td>
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<td>Stage 9: Side plank position (left elbow on the ground) Hold for 15 seconds</td>
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<td></td>
<td>Stage 10: Side plank position (right elbows on the ground) Hold for 30 seconds</td>
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<td></td>
<td>Stage 11: Lift your left leg and left arm (star position) Hold for 15 seconds</td>
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<tr>
<td><strong>Excellent (5)</strong></td>
<td>Stage 12: Return to the Plank Exercise Position (elbows on the ground) Hold for 30 seconds</td>
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### Guidelines for Core Stabilization Training?

- **Perform comprehensive evaluation**
  
  Muscle imbalances and arthrokinematic deficits must be corrected prior to initiating aggressive training

- **Program Requirements**
  
  - Systematic – individualised based on functional status
  - Progressive - progression through functional continuum
  - Functional - plane of motion/ body position
  - Muscle contraction spectrum
Specific Guidelines

1. Proprioceptively rich program
   - Stress multiple planes (safe, but challenging)

2. Incorporate multi-sensory environment
   - Derived from fundamental movement skills

3. Activity specific
   - Focus on function

4. Progressive functional continuum

5. Goal of program should be to develop optimal levels of functional strength and stabilization
   - Focus on neural adaptations instead of absolute strength gains
   - Increase proprioceptive demands
   - Quality not quantity - Poor technique and NM control results in poor motor patterns and stabilization
Level I - Stabilisation

What characteristic is targeted?

Level II - Stabilisation & Strength

What characteristic is targeted?
**Level III - Integrated Stabilisation**

What characteristic is targeted?

**Level IV - Power Stabilisation**

What characteristic is targeted?