The Core: Testing and Training for the hockey player.

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What is the Core?

• **Passive subsystem:**
  - Spinal ligaments.
  - Facet articulations.
  - Limited load=10 kg.

• **Muscular subsystem:**
  - Local group.
  - Global group.
  - Guy wires.
  - No one important muscle.
    - Contribution is dependent upon the magnitude and direction of trunk loading.
    - Cholewicki and Van Vliet: No single muscle group contributed more than 30% to lumbar stability no matter what the task.

• **Neural subsystem:**
  - Continuous monitoring from muscle spindles, Golgi tendon organs and spinal ligaments.
  - Requirements for stability can change instantaneously.
  - Directs tensioning of guy wires.
What is the Core?
Muscular subsystem

• **Local Muscular Stabilizers:**
  • Primary:
    • Transversus abdominis
    • Multifidus.
  • Secondary:
    • Internal oblique.
    • Medial fibers of the External oblique.
    • Quadratus lumborum.
    • Diaphragm.
    • Pelvic floor muscles.
    • Illiocostalis and longissimus (lumbar portions).
What is the Core?

Muscular Subsystem

- **Global Muscular Stabilizers:**

  - Rectus abdominus.
  - Lateral fibers of the external oblique.
  - Psoas major.
  - Erector spinae.
  - Iliocostalis (thoracic portions).

- Some say we should not divide core muscles into local and global stabilizers. They all work together.
How are we put together?

- Mobility stacked upon stability:
  - Mobile GH joint.
  - Stable scapula.
  - Mobile thoracic spine.
  - Stable lumbar spine.
  - Mobile hips.
  - Stable knees.
  - Mobile ankles.

- Extensive MSK evaluation:
  - Look for limits or stressors above and below the spine.
  - What is throwing gas on the fire???
How do we test it?

- Sahrmann:
  - 5 levels of progression.
Testing

- McGill
- Plank testing.

<table>
<thead>
<tr>
<th>Task</th>
<th>Men Mean</th>
<th>Men SD</th>
<th>Women Mean</th>
<th>Women SD</th>
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<th>All SD</th>
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<td>61</td>
<td>185</td>
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<tr>
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<td>134</td>
<td>81</td>
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<tr>
<td>RSB</td>
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<tr>
<td>LSB</td>
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<td>32</td>
<td>86</td>
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<table>
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<tr>
<th>Ratios Normalized to the Extensor Endurance Test</th>
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<tbody>
<tr>
<td>Flexion / Extension Ratio</td>
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<tr>
<td>RSB / LSB ratio</td>
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</tr>
<tr>
<td>LSB / Extension Ratio</td>
</tr>
</tbody>
</table>

Testing:

McGill

  - 16 female soccer players.
  - Tests:
    - Counter movement vertical jump.
    - Shuttle run.
    - 40 yard sprint.
    - 1RM squat and bench press.
    - McGill plank testing.
  - No significant correlations were identified between core strength and strength and power.
  - Core strength does not contribute significantly to strength and power and should not be the focus of any strength and conditioning program with the intent to improve sports performance.
  - Discussion:
    - McGill’s tests specifically look at muscle endurance utilizing slow twitch muscle fibers.
    - The tests involved 1 repetition explosive drills or exercises utilizing fast twitch muscle fibers.
    - Static measurement versus dynamic movement.
    - N is very small.
Testing:

• Gray Cook:
  • **FMS (Healthy)/SFMA (Injured):**
    • 7 tests.
    • 0-3 grading system.
      • 0 = pain with movement pattern.
      • 3 = perfect movement pattern.
    • Mobility and stability issues?

46 NFL football players of a single team.
Score of 14 or less on the FMS was predictive of serious injury during that season.
  • Specificity of 0.91
  • Sensitivity of 0.54
How do we test it?

• Prone instability test:
  • Part of clinical prediction rule for lumbar stabilization:
    • <40 years old.
    • SLR > 91 degrees.
    • Aberrant spine movement pattern.
    • + prone instability test.

• Bridging with knee extension test:
  • Test of proper gluteal activation.
Continuum of Training
-Injury to performance....

• Train 3 planes of motion:
  • Sagittal plane flexion and extension.
  • Frontal plane.
  • Transverse plane.

• Mat-based training.

• Physio ball training.

• Unilateral training.

• Weight bearing training.
  • Base of support.
  • Unilateral drills/exercises.

• Performance.
  • Development of power and explosiveness while maintaining core control.
Core Training and Injury…

• Core endurance is more important in injury prevention and rehab.

• Type 1 muscle fibers which require only low loads to improve performance.

• Performing trunk exercises on a physio ball results in significantly increased activation of the lower abdominal region.
  • But, there are studies showing it does not change activation….

• Unilateral use of upper extremities while on a ball or bench results in even greater activation of core musculature.

• However….
  • When performing exercises on a ball, force production in the upper and lower extremities is significantly reduced.
Common presentation in the hockey player:

• Lower cross syndrome:
  • Huge issue with many hockey players:
    • Tight hip flexor.
    • Weak glutes.
    • Tight low back.
    • Weak abdominal muscles.
    • Remember the paper on the need for hip rotation and rotational sports.....

• Increased thoracic kyphosis (upper cross syndrome):
  • Lack of thoracic extension.
  • Tight pectorals and Lats.
  • May focus stress on lumbar spine.
  • Remember our wall Lat test.....
Core Training and Performance….

- Can we improve performance by training the Core?

**Effect of Core Stability Training on Throwing Velocity in Female Handball Players**

Atle H. Saeterbakken,1 Roland van den Tillaar,1,2 and Stephen Seiler3

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- 24 Elite high school Norwegian handball players.
  - 14 performed sling exercise training.
    - Similar to TRX training.
  - 10 players in control group
  - Both groups performed regular handball training x 6 weeks.

- **Maximum throwing velocity improved by 5% in the SET group.**
Core Training and Performance….

• Can we improve it?

The Relationship between Hip Muscle Strength and Golf Performance
Tsai, Yung-Shen; Sell, Timothy C.; Myers, Joseph B.; McCrory, Jean L. FACSM; Laudner, Kevin G.; Pasquale, Maria R.; Lephart, Scott M. FACSM

• Purpose:
  • Is there any difference in hip strength among golfers with different proficiency levels.
  • What is the relationship between hip strength and golf handicap.
  • What is the relationship between hip strength and self-reported driving distance.

• 82 golfers.
  • 10-19 handicap.
  • 0-9 handicap.
  • Scratch or better.

• Measured isometric hip abduction and adduction in side lying using a hand-held dynamometer.
  • Scratch or better group was found to be significantly stronger in left hip strength as well as all hip movements tested.
Training the Core:

• Educate the Athlete:
  • Understand the task.
  • Feel the proper pattern.
  • Train the proper pattern.
  • Own the proper pattern.

• See it, Feel it, Do it!
Training Progression:
Bibliography

Bibliography


Thank you