Assessment and Training of Dynamic Stabilization of the Lumbopelvic-Hip Complex
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BACKGROUND AND PURPOSE

- Antagonist imbalances in strength and flexibility alter joint alignment and can increase susceptibility to injury.
- Neuromuscular control (NMC) of the lumbopelvic-hip complex (LPHC) has been linked to injury risk.
- Current assessment methods for postural alignment focus on muscular factors and ignore the neural component.
- Improved NMC of the LPHC can be expected to improve dynamic stability of the lower extremity joints.
- Isometric contractions have been shown to alter muscle activation patterns without concomitant strength training.
- Adaptations within the central nervous system appear to modulate reflexive antagonist activation levels.
- The purposes of this study were to evaluate the effectiveness of the ROTEX™ device for identification of suboptimal antagonist balance and its potential value for improvement of LPHC function.

RESULTS

- Mean ± standard deviation for pre- and post-intervention measurements presented in Table 1.
- AROM IR, PROM IR, and PROM ER increased significantly after the intervention (Figures 4 & 5).
- Change in AROM IR from pre-to-post-intervention: +2.17°; p<.001; ES=.373.
- No significant change in AROM ER from pre-to-post-intervention: p=.986.
- Change in PROM IR from pre-to-post-intervention: +1.68°; p=.028; ES=.324.
- Change in PROM ER from pre-to-post-intervention: +1.19°; p=.028; ES=.324.
- Average pelvic displacement decreased in sagittal plane (AP) during walk after intervention (Figure 6).
- Change in AP displacement from pre-to-post-intervention: -1.44°; p=.009; ES=.373.
- No significant change in RL displacement from pre-to-post-intervention: p=.986.

CLINICAL RELEVANCE

- Bilateral isometric contractions of the hip internal rotators with posterior pelvic tilt appear to have beneficial effects.
- Our results support the existence of an association between hip ROM and dynamic pelvic stability.
- An optimal range of hip IR and ER may reduce the magnitude of AP pelvic displacements during gait.
- A plausible explanation for our findings is alteration of relative activation levels of antagonist hip muscle groups.
- Decreased muscle tension resistance may explain the post-intervention increase in hip motion.
- Alternatively, the hip motion increase may have been due to improved flexibility of static restraints.
- More research is needed to clarify neuromechanical aspects of optimal LPHC function.
- The possible effect of isometric contractions on muscle activation levels.
- Interdependencies among displacements of the lumbar spine, pelvis, and hip joints.
- The possible influence of suboptimal LPHC function on core and lower extremity injury risk.

PARTICIPANTS AND PROCEDURES

- 37 NCAA Division I athletes: 19.6 ±1.2 years; volleyball, women’s soccer, wrestling, men’s golf, women’s golf
- 22 male, 73.46 ±12.20 kg, 173.64 ±8.82 cm and 15 female, 63.70 ±6.65 kg, 172.38 ±7.43 cm
- Measurements acquired before and after an exercise intervention designed to enhance dynamic pelvic stability
- Hip internal rotation (IR) and external rotation (ER) measured
- Passive and active range of motion; Baseline digital inclinometer (DUO Global, Vista, CA)
- Pelvic displacements measured by Level Belt Pro application (Perfect Practice Inc., Columbus, OH)
- Pod positioned at level of PSIS to record Anterior Posterior (AP) and Right/Left (RL) pelvic tilt
- Intervention protocol involved serial hip IR isometric contractions with pelvis maintained in posterior tilt
- ROTEX™ device (ROTEXMotion, Opelousas, LA) protocol involved progressive increases in hip IR
  • Back and shoulders against wall with feet positioned at center of rotating discs (Figures 1-3)
  • Posterior pelvic tilt in -5°10’ knee flexion and maximum hip IR during 10-s isometric contraction
  • Posterior pelvic tilt maintained with further increase of active hip IR for 10-s; repeated twice
  • Total of 3 isometric contractions for 30-s duration of intervention
  • Repeated measures ANOVA, n=9; (n=5 to 5.10 interpreted as borderline statistical significance)
  • No Bonferroni correction for multiple comparisons (exploratory analysis)
  • Hip ROM (IR and ER); passive and active (average of 3 measurements)
  • Mean pelvic position during 10-m walk; sagittal plane AP and frontal plane RL

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>AROM IR</td>
<td>29.48 ±5.82</td>
<td>31.65 ±4.80</td>
<td>20.23</td>
<td>&lt;.001</td>
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<td>AROM ER</td>
<td>38.70 ±7.81</td>
<td>38.75 ±7.71</td>
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<td>PROM IR</td>
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<td>41.05 ±5.77</td>
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<td>PROM ER</td>
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<td>Mean AP Walk</td>
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<td>-3.78 ±4.35</td>
<td>3.86</td>
<td>.059</td>
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<td>Mean RL Walk</td>
<td>-8.30 ±1.53</td>
<td>-7.90 ±1.58</td>
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