Differences In Core Stability Between Collegiate Football Players With And Without Shoulder Pain
Courtney Butowicz, MSEd, CSCS; Marisa Pontillo, PT, DPT, SCS; Clare E. Milner, PhD, FACSM
David Ebaugh, PT, PhD; Sheri P. Silfies, PT, PhD
Drexel University, Rehabilitation Science Research Lab, Philadelphia, PA

BACKGROUND
- Evidence suggests poor core stability is a risk factor for extremity injury in athletes [1-3].
- Core stability can be defined as the ability to control the motion, position, and stiffness of the trunk and pelvis relative to the extremities to allow for optimal generation, transfer, and dissipation of forces between segments.
- Optimal core stability is dependent upon both muscle capacity (strength and endurance) and neuromuscular control [4].
- Diminished core stability may alter force generation and dissipation in the extremities during tasks that require force transfer through the core, such as blocking in football [3].

PURPOSE
- Determine if differences in core stability existed between collegiate football players with and without current non-traumatic shoulder pain.

SUBJECTS
- 20 collegiate football players (10 with shoulder pain; no pain/pain - mean height (cm): 181 ± 5/182 ± 5; mean weight (kg): 97 ± 17/99 ± 17; BMI matched)

METHODS
- Subjects completed clinical and lab-based measures of core stability (neuromuscular control and muscle capacity).
- Isolated core neuromuscular control was assessed in the laboratory using an unstable chair placed on a force plate (Figure 1A). Forces were converted to center of pressure (COP) data.
- Static control was assessed by center of pressure (COP) movement during seated balance using 95% confidence ellipse area (CEA; mm²) and mean velocity (MVEL; mm/s).
- Dynamic control was assessed during a speed and accuracy target acquisition task (targets displayed on a monitor).
- Directional control [COP path to target (DC; mm)] and precision control [movement around target prior to acquisition (PC; CEA)] were used to quantify dynamic neuromuscular control (Figure 1C). Variables averaged across 3 trials.
- Trunk muscle capacity was assessed clinically by trunk flexor (FLEX, s), extensor endurance (EXT, s), and double-leg lowering (DLL, degree) tests (one trial each).

DATA REDUCTION AND ANALYSIS
- MANOVA (effect size Eta) and t-tests (effect size Cohen’s d) were used to assess group differences (p < .05).
- SPSS 22 was used to calculate descriptive statistics, MANOVA and t-tests.

RESULTS

<table>
<thead>
<tr>
<th>Test/Variables</th>
<th>Mean ± Stdev</th>
<th>P-value</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static Core Control</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEA (mm²)</td>
<td>183 ± 129/131 ± 85</td>
<td>p = 0.38</td>
<td>Eta = .33</td>
</tr>
<tr>
<td>MVEL (mm/s)</td>
<td>5.7 ± 3.0/6.4 ± 2.6</td>
<td>p = 0.49</td>
<td>d = .39</td>
</tr>
<tr>
<td><strong>Dynamic Core Control</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC (mm)</td>
<td>49 ± 9/46 ± 6</td>
<td>p = 0.49</td>
<td>d = .39</td>
</tr>
<tr>
<td>PC (CEA mm²)</td>
<td>143 ± 72/93 ± 25</td>
<td>p = 0.051</td>
<td>d = .93</td>
</tr>
<tr>
<td><strong>Muscle Capacity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLEX (s)</td>
<td>77 ± 38/99 ± 32</td>
<td>p = 0.22</td>
<td>Eta = .40</td>
</tr>
<tr>
<td>EXT (s)</td>
<td>74 ± 22/69 ± 28</td>
<td>p = 0.92</td>
<td>d = .05</td>
</tr>
<tr>
<td>DLL (°)</td>
<td>14 ± 10/15 ± 11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION AND RELEVANCE
- Our data do not provide clear evidence of diminished core stability in collegiate football players with a non-traumatic shoulder injury.
- While our group differences suggest a medium to large effect size, group performance was not statistically different on these variables. This suggests the study is potentially underpowered.
- There is a trend toward group differences in precision control; however this difference did not exceed our MDC (73 mm²). In this case, even if statistical significance was achieved with additional subjects, we would not interpret group differences as meaningful given they do not exceed our protocol measurement error.
- In light of our study findings, training and rehabilitation interventions should consider risk factors for shoulder injury other than core stability.

REFERENCES