The Development and Assessment of Core Strength Clinical Measures: The Reliability and Validity of Medicine Ball Toss Tests

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BACKGROUND
- Core strengthening has become a significant component of conditioning programs developed to optimize athletic performance, reduce risk of injury/reinjury, and facilitate return from injury.
- Despite the wide usage of medicine ball toss tests (MBTs) as a measure of core strength the reliability and validity of these measures have not been clearly established.
- Reliable and valid measures of core strength are necessary to determine the effectiveness of injury prevention, rehabilitation, and performance optimization programs.

SUBJECTS
- Twenty healthy, physically active males (n=10) and females (n=10).
  - No history of chronic pain in the thoracic and/or lumbopelvic region lasting longer than one year.
  - No complaint of pain in the thoracic and/or lumbopelvic region at the time of enrollment.
  - No history of surgery in the thoracic and/or lumbopelvic region.
  - Demographics are presented in TABLE 1.

EXPERIMENTAL DESIGN AND METHODS
- Testing occurred in two sessions separated by a minimum of 24 hours.
  - Session one: isokinetic strength utilizing Biodex Multi-Joint System 3 Pro (Biodex Medical Systems, Inc, Shirley, NY) and MBTs/Session two: MBTs.
  - Concentric-concentric isokinetic strength (n=m) for torso flexion/extension and right/left torso rotation were performed at 60°/second for five repetitions.
  - Subjects performed five MBTs (cm) in the backward (FIGURE 1,2), forward (FIGURE 2, 3), and right/left rotational (FIGURE 4,5) directions.

RESULTS
- Significant ICCs were observed between session one and session two of MBTs (TABLE 2).
- No significant correlations were observed between the MBTs and the corresponding measure of isokinetic strength.
  - Forward: r=-0.047, p=0.845; Backward: r=-0.074, p=0.756; Rotation (Right): r=0.051, p=0.832; Rotation (Left): r=0.180, p=0.447

SUMMARY AND CONCLUSIONS
- The results illustrate that MBTs have excellent intersession test-retest reliability; however, the validity of the MBTs was not established when compared to isokinetic core strength measures at 60°/second.
- The lack of relationship could be due to differences in muscles examined, muscle contraction type, and/or motion performed.
- Future research should include a modification of each of the MBT techniques to allow for maximal effort of the core musculature, as well as finding a field-friendly measure that is valid against isokinetic strength testing while also being reliable.

TABLE 1: Demographics - Mean ± Standard Deviation

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<thead>
<tr>
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<th>Males and Females (n = 20)</th>
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<tr>
<td>Age (yrs)</td>
<td>22.7 ± 7.8</td>
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<tr>
<td>Height (cm)</td>
<td>164.8 ± 25.7</td>
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<tr>
<td>Mass (kg)</td>
<td>71.0 ± 12.3</td>
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TABLE 2: MBTs Intaclass Correlation Coefficients

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<tr>
<th>MBT Type</th>
<th>ICC</th>
<th>95% Confidence Interval</th>
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<tbody>
<tr>
<td>Forward</td>
<td>0.835*</td>
<td>0.600 - 0.934</td>
</tr>
<tr>
<td>Backward</td>
<td>0.835*</td>
<td>0.580 - 0.934</td>
</tr>
<tr>
<td>Rotation (Right)</td>
<td>0.870*</td>
<td>0.690 - 0.949</td>
</tr>
<tr>
<td>Rotation (Left)</td>
<td>0.905*</td>
<td>0.742 - 0.966</td>
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*Significant p < 0.001

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