Energy Absorption of Lower Extremity Joints During a Drop Vertical Jump Task in Healthy Individuals

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Introduction

Purpose: To describe eccentric loading of the ankle, knee, and hip during a double limb landing task in a healthy cohort—incorporating the total energy absorption at each joint as well as the relative energy absorption contributions between joints—to help determine expected ranges of these variables.

Methods

Participants

52 healthy individuals

20.6 ± 2.7 years old

46 Females

6 Males

1.715 ± 0.092 meters tall

68.6 ± 10.4 kg body mass

Analysis

Separate paired t-tests were calculated for EA and EAC for each joint between the dominant and non-dominant limbs. Statistical significance was set at a priori α = 0.05

Results

Total Energy Absorption (EA)

<table>
<thead>
<tr>
<th>Limb</th>
<th>Ankle (N·m)</th>
<th>Knee (N·m)</th>
<th>Hip (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Dominant</td>
<td>0.034 ± 0.014</td>
<td>0.1 ± 0.024</td>
<td>0.029 ± 0.015</td>
</tr>
<tr>
<td>Dominant</td>
<td>0.029 ± 0.014</td>
<td>0.087 ± 0.025</td>
<td>0.026 ± 0.015</td>
</tr>
</tbody>
</table>

LSI = 96.4 ± 41.5

88.4 ± 17.5

106.5 ± 56.7

*significant difference between limbs (p < 0.05)

Relative Energy Absorption Contribution (EAC)

<table>
<thead>
<tr>
<th>Limb</th>
<th>Ankle</th>
<th>Knee</th>
<th>Hip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Dominant</td>
<td>21.1%</td>
<td>61.4%</td>
<td>17.5%</td>
</tr>
<tr>
<td>Dominant</td>
<td>20.7%</td>
<td>62.7%</td>
<td>18.2%</td>
</tr>
</tbody>
</table>

LSI 100.7 ± 29.0%: 99.9 ± 8.96%. Level: 107.2 ± 36.5%

No significant differences were found between limbs.

Clinical Relevance

Our results aid in determining a range of expected EA and EAC values among healthy individuals during eccentric loading tasks.

- Provided that research has associated greater total EA in the lower extremities with ACL injury risk, it is important to investigate our finding that healthy individuals have greater total EA in the non-dominant limb.
- This finding suggests that the dominant limb in healthy individuals may not be the most valid match to the involved limb in ACLR individuals.
- Our results indicate that we need to consider if the involved limb is the dominant or non-dominant limb when interpreting load magnitude differences between limbs at the ankle and knee during DLL.

Future research should explore how EA and EAC are altered in individuals after ACLR. In turn, this will allow researchers to establish LSI thresholds separately for the dominant and non-dominant limb ACL tears.

References


Questions/Comments

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