THE EFFECT OF A LINEAR IN-FLIGHT PERTURBATION ON LANDING BIOMECHANICS

Scott W. Arnett¹, Yang-Chieh Fu², Ryan Thompson³, Petur Sigurdsson², & Kathy J. Simpson²

¹Western Kentucky University, Bowling Green, KY, USA, scott.arnett@wku.edu;
²University of Georgia, Athens, GA, USA;
³University of Tennessee at Chattanooga, Chattanooga, TN, USA
URL: http://www.wku.edu/chhs/cms/index.php/departments/pe-recreation/pe-rec

INTRODUCTION

The exact mechanisms occurring at the time of an ACL injury are still elusive at this time. Although this type of injury is not gender specific, it occurs more prevalently in females (AAOS, 2003), which has led to research on risk factors within the individual. Personal factors, such as anatomical, hormonal, and biomechanical, have been implicated in increasing the risk of incurring an ACL injury during sports participation (Boden et al., 2000; Childs, 2002; Griffin et al., 2000; Markolf et al., 1995). More recently, the focus of ACL injury research has been extended to include the interaction of biomechanical and environmental factors. One such interaction is an in-flight perturbation. Although these events have been implicated in ACL injuries (Hewett et al., 2006; Krosshaug et al., 2007), the effects of these events on drop landing biomechanics are not known at this time. Therefore, the purpose of this study was to determine the effect of a linear in-flight perturbation on landing biomechanics.

METHODS AND PROCEDURES

Thirteen college-aged female soccer and basketball athletes (Table 1) performed double-leg drop landings 0.6 m from the ground with (PERT) and without (CON) in-flight perturbations being applied. Three-dimensional ground reaction forces (1200 Hz) and lower extremity joint kinematics (240 Hz) and kinetics were analyzed for the right limb using paired t-tests (α = 0.05).

RESULTS

Compared to the non-perturbed condition (CON), peak vertical ground reaction force (VGRF) was decreased during the perturbed condition (PERT). No significant differences were demonstrated for peak posterior ground reaction force (GRF) or lower extremity joint kinematics between conditions. Peak hip and knee extensor net muscle moments and peak plantarflexor net muscle moments were significantly greater during the PERT compared to the CON condition (Figure 1).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean ± SD</th>
<th>Range</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
<td>20.3 ± 1.9</td>
<td>18-24</td>
</tr>
<tr>
<td>Body Mass (kg)</td>
<td>62.8 ± 8.2</td>
<td>52.5-79.4</td>
</tr>
<tr>
<td>Body Height (cm)</td>
<td>167.9 ± 7.3</td>
<td>159.6-187.7</td>
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<tr>
<td>No. yr participation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soccer</td>
<td>8.2 ± 6.0</td>
<td>&lt;1-18</td>
</tr>
<tr>
<td>Basketball</td>
<td>7.2 ± 3.6</td>
<td>4-12</td>
</tr>
</tbody>
</table>

Table 1. Participant characteristics.
Figure 1. Peak joint moments during the CON and PERT conditions. Data are means with SD error bars. * denotes statistical significance (p<0.01)

DISCUSSION

The significant differences found between conditions for peak vertical ground reaction force and moments are insightful and at the same time raise questions. The difference in peak VGRF could be interpreted as anticipation by the performer leading to an altered landing strategy. During the PERT compared to the CON condition, increased force could be placed on the ACL due to the shear force created by the peak knee extensor moment (DeMorat et al., 2004; Simpson & Kanter, 1997). Inter-individual variation occurring at the knee joint between conditions supports that individuals utilized different strategies when landing and this variation could possibly be linked to increased risk for an ACL injury.

SUMMARY

While the in-flight perturbation used in this study was light in magnitude, it remains that an in-flight perturbation does influence landing biomechanics.

REFERENCES


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