KINEMATIC DIFFERENCES BETWEEN DROP JUMP, CUTTING, AND REBOUND LANDINGS

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INTRODUCTION

It is well established that non-contact ACL injuries are one of the most common injuries among female basketball players [1]. Predominantly, the risk of non-contact ACL injuries are far greater in sports where athletes perform pivoting and jumping maneuvers [2]–[3].

A common method to estimate the potential an athlete has to obtaining a non-contact ACL injury is through analysis of lower body kinematics during the vertical drop jump (DJ). The DJ has been shown to highlight potential knee valgus on the initial contact, as well as on the second contact that prelude to greater risk of injury [2],[5]. Yet little research has been done comparing lower body kinematics of the DJ to common basketball movements.

The purpose of this study is to determine whether DJ kinematics compare to the basketball movements rebound and cut maneuver. This method will investigate the potential differences of the knee and hip angles between the DJ landings (DJ-1 DJ-2), rebound, and cut maneuver to investigate the potential of alternative methods in predicting ACL injury across athletes.

METHODS

A total of 7 division 1a female basketball players (mean age = 19.9 years), (mean height 178.3 cm), (mean weight 67.8 kg), participated in this study. All participants were healthy and had no prior record of ACL injuries.

Each Athlete performed 3 trials of drop jump, 4 reactive cutting maneuvers, and 3 rebounds. During the cutting maneuver motion, the player reacted to the movements of another participant to simulate a one-on-one scenario. Both rebound and cutting maneuver were intended to be as close to a game scenario as possible.

Kinematics were recorded using a 12-camera motion capture system (Qualisys) sampling at 200 Hz. Marker trajectories were exported to V3D (C-Motion, Inc.) where joint angles for the hip and knee were calculated.

Knee and hip angles from initial foot contact to max knee flexion were compared through DJ-1, DJ-2, rebound, and the cut maneuver. Differences in joint angles were determined using multiple 1-way ANOVAs with repeated measures. A bonferroni post-hoc was used to find differences between dependent measures.

RESULTS AND DISCUSSION

Results indicated a significant difference of ROM in each movement, for hip external/internal rotation, knee varus/valgus, flexion/extension, and internal/external rotation. Contact angles for hip internal/external rotation, knee varus/valgus, and flexion/extension were also significantly different among movements. Peak angles for hip internal/external rotation, knee internal/external rotation, and knee flexion again showed significant differences between the different movements. Mean angles and standard deviations are indicated in the Table 1.
CONCLUSIONS

The results indicate that when compared to rebound and cutting maneuvers, the drop jump accurately represents knee varus/valgus and hip ab/adduction values of an individual. However, it was found that hip internal rotation was greater during a rebound and cutting maneuver. The larger ROM of hip internal rotation during these movements could lead greater chance ACL injury if knee valgus and hip abduction are occurring simultaneously. Therefore, it could be beneficial to test athletes not just on a drop jump but rather a combination of game like dynamic movements to better evaluate and assess an individual’s risk to a non-contact ACL injury.

REFERENCES


Table 1: Mean and standard deviation of knee valgus/varus and hip abduction/adduction for each movement

<table>
<thead>
<tr>
<th>Joint</th>
<th>Variable</th>
<th>DJ-1</th>
<th>DJ-2</th>
<th>Rebound</th>
<th>Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee</td>
<td>Valgus</td>
<td>-11.58*</td>
<td>-13.54*</td>
<td>-12.77*</td>
<td>-16.29*</td>
</tr>
<tr>
<td></td>
<td>Abduction</td>
<td>+2.7</td>
<td>+4.6</td>
<td>+3.5</td>
<td>+2.8</td>
</tr>
</tbody>
</table>

*p significance in Post Hoc test. *p < .05