INTRODUCTION

Ankle injuries, especially lateral sprains, are the most frequently sustained injury in sports and may account for as many as one-third of all sports injuries [1]. Because ankle sprains are recurrent in over 40% of cases, many athletes use ankle taping or bracing to try and prevent either initial ankle sprains or recurring ankle sprains [2, 3].

The effect of ankle immobilization on knee joint biomechanics is important because of the severity of knee injuries, specifically anterior cruciate ligament (ACL) injuries. ACL injuries negatively affect athletes in a number of ways, not the least of which is financially. While there is a large body of research on ankle immobilization (e.g. taping, bracing), there is considerably less regarding the effects of ankle immobilization on the motion of other lower extremity joints, especially the knee.

Landing studies that have investigated ankle immobilization have reported that vertical ground reaction forces tend to be consistent between braced and unbraced conditions, especially at initial contact (IC); however, it is difficult to associate landing tasks with cutting tasks, because landing from a vertical jump or drop does not require as much medial-lateral force as cutting does [4, 5].

The purpose of this study was to determine the effects of ankle immobilization on knee kinematics during an unanticipated 45° cutting maneuver.

METHODS

Four recreationally active, college-aged females (21.8±1.7 y, 1.7±0.0 m, 64.8±4.7kg) served as subjects in this pilot study to investigate the effects of brace use (ASO Ankle Stabilizers, Medical Specialties, Inc., Charlotte, NC) on knee joint kinematics during side-step cutting.

Participants were required to be between the ages of 18 to 25, recreationally active (i.e., exercise and participate in sport 3-5 days per week), have been former varsity high school basketball or soccer athletes, and currently free of any lower extremity injury at the time of testing. Potential subjects were turned away if they had ever suffered a lower extremity or back injury which required surgery. Participants wore their own “tight-fitting” clothes and athletic shoes. Upon arrival to the lab, subjects performed multiple trials of 45° cuts to the left and right. Motion analysis (300Hz, VICON-Nexus, Denver, CO) and force plate (1500Hz, AMTI, Advanced Mechanical Technology, Inc., Watertown, MA) data were utilized to obtain measures of peak vertical ground reaction force (VGRF) normalized to kg body mass, knee flexion at initial contact (FlexIC), peak knee flexion during contact (PKFlex), knee abduction angle at initial contact (AbdIC) and peak knee abduction angle during contact (PKAbd). Sixteen retro-reflective markers were attached to the subject, and the Nexus “plug in gait” served as the kinematic model for analysis. Statistical comparisons were made between braced and non-braced conditions via paired t-tests, with a significance level set at 0.05.

Subjects were instructed to sprint as fast as possible toward a lab assistant, who was acting as a “defender.” When the subject was approximately 2m away, the defender moved slightly to the right or left, forcing the subject to react and cut away (in the opposite direction) from the defender. Subjects had no prior knowledge of cut direction.

Brace condition (braced or non-braced) and cut direction (left or right) were determined using a random number generator. A successful cut trial resulted when the entire foot contacted the force plate. Trials continued until at least 14 successful trials (seven to the right and seven to the left) were
RESULTS AND DISCUSSION

Knee abduction angle at IC was significantly lower in the braced condition compared with the non-braced condition. No other statistically significant differences were observed. Summary results are presented in Table 1.

Table 1: Mean (SD) comparisons between braced and non-braced conditions. Positive abduction values denote knee adduction. * denotes statistically significant differences (P<0.05).

<table>
<thead>
<tr>
<th>Condition</th>
<th>VGRF (N/kg)</th>
<th>FlexIC (deg)</th>
<th>PKFlex (deg)</th>
<th>AbdIC (deg)</th>
<th>PKAbd (deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braced</td>
<td>26.8 (7.8)</td>
<td>21.5 (4.7)</td>
<td>47.5 (2.6)</td>
<td>-1.3 (6.1)*</td>
<td>-14.1 (10.8)</td>
</tr>
<tr>
<td>Non-braced</td>
<td>28.1 (8.6)</td>
<td>21.6 (5.2)</td>
<td>47.1 (5.7)</td>
<td>-7.8 (3.6)*</td>
<td>-19.1 (7.2)</td>
</tr>
</tbody>
</table>

CONCLUSIONS

Excessive knee abduction (i.e., valgus) at IC during landing has been reported to be potentially harmful to the ACL [6]. Our preliminary results suggest that the use of prophylactic ankle braces may actually reduce knee abduction during a cutting maneuver. Aside from the limited subject number, a possible explanation for these results may relate to the subject’s experience with prophylactic brace use. Our subjects were healthy and uninjured, and generally did not have prolonged experience with brace use during their athletic careers. There have been some reports that athletes who utilize ankle braces or taping extensively during sports participation, either for prophylactic or joint instability reasons, may demonstrate altered joint mechanics during similar trials. In other words, perhaps our limited subjects altered their cutting strategy simply because they were wearing unaccustomed ankle braces. Further analysis is needed to determine the nature of this relation, and whether an accommodation period is warranted.

The use of the ankle braces had a lesser effect on stabilizing knee abduction (~3.5° reduction) in subjects demonstrating IC abduction compared with the IC adducted subjects (~8° reduction). These results suggest that the use of ankle braces, while possibly having a stabilizing effect on knee abduction, may have a relatively lesser protective effect in subjects who demonstrate excessive knee valgus and are more prone to ACL injury. The clinical relevance of this 3° to 8° reduction in abduction remains to be determined.

REFERENCES


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