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# Efficacy of an ankle orthosis with a subtalar locking system in restricting ankle kinetics and kinematics in lateral cutting

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## Introduction

The ankle joint is the most injured joint during sports participation [1]. Ankle orthoses have been shown to be effective in reducing ankle inversion injuries and are often prescribed for rehabilitation and prevention of lateral ankle sprains. Efficacy of ankle orthoses is often assessed by comparing reduction of passive inversion ROM as well as ankle kinematics between braced and unbraced movements [2,3]. However, joint kinetic responses in lateral cutting were rarely examined. Therefore, the objective of this study was to examine the effectiveness of a new semi-rigid ankle orthosis with a subtalar joint locking mechanism in restricting ankle kinetics and kinematics during a lateral cutting movement.

## Methods

Ten female and ten male subjects performed five lateral cutting trials in each of four conditions wearing no brace (NB), a semi-rigid Element ankle brace with a calcaneal and subtalar locking system (AB1, DeRoyal), a semi-rigid Functional ankle brace with a hinge joint (AB2, DeRoyal), and a soft ASO lace-up ankle brace (AB3, Medical Specialties). A seven-camera motion analysis system (240 Hz, Vicon Motion Analysis Inc.) and a force platform (2400 Hz, AMTI) were used to obtain the three-dimensional kinematics and ground reaction force data respectively. A one-way repeated measures ANOVA was used to evaluate differences among the brace conditions on selected variables ($p < 0.05$) with post hoc comparisons conducted to detect specific differences among the braces using a Bonforroni adjustment (SPSS, Inc.).

## Results

For the angular velocity, the peak contact inversion velocity (On_Y) was significantly reduced for AB1 compared to the control group (Table 1). No significant differences were seen in the peak lateral impact GRF (Min_X) among the brace conditions. However, the peak vertical GRF

**Table 1: Selected kinematic and kinetic variables: Mean ± STD.**

| Cond | On_Y (deg/s) | Min_X (BW) | Max_Z (BW) | Min_Y (Nm/kg) |
|---|---|---|---|---|
| NB | 322.3 ± 103.7[1] | -1.05 ± 0.24 | 1.71 ± 0.29[1] | -0.58 ± 0.19 |
| AB1 | 263.6 ± 113.6 | -0.98 ± 0.21 | 1.58 ± 0.20[3] | -0.60 ± 0.16 |
| AB2 | 257.5 ± 128.6 | -1.02 ± 0.27 | 1.67 ± 0.28 | -0.62 ± 0.19 |
| AB3 | 295.7 ± 129.9 | -1.04 ± 0.23 | 1.68 ± 0.24 | -0.60 ± 0.18 |

[1] significantly different from AB1, [3]significantly different from AB3.

(Max_Z) for AB1 was significantly smaller than no brace and AB3. In addition, the peak ankle eversion joint moment (Min_Y) did not show significant differences among the brace conditions (Table 1).

## Conclusion

The ankles did not reduce peak horizontal GRF data which is consistent with the findings of Cordova and his colleagues [2] in a shuffle movement. However, the peak vertical GRF was reduced with the Element brace compared to the ASO and control condition. Furthermore, the results showed that the Element ankle brace provides restriction of ankle inversion at early contact and pushoff. These results suggest that the Element brace is more effective in the lateral cutting. In addition, the tested orthoses also accommodate movement requirements that are commonly desired of an effective ankle orthosis.

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