

EXOSKELETON BOOTS RESULT IN IMPROVED COMFORT AND PERFORMANCE DURING DYNAMIC MOVEMENTS COMPARED TO CONVENTIONAL BOOTS AND BRACING

J Williams^{1,2}, G Moser^{1,2}, F Fallahtafi^{1,2}, C Rasumusen³, K. Eriks⁴, T. Cotton⁴, N. Rokhmanova⁴, M Roser⁴, S Myers^{1,2}

1 Department of Biomechanics, University of Nebraska-Omaha, Omaha, NE USA, 2 Research Service, Omaha Veterans' Affairs Medical Center, Omaha, NE USA, 3 Department of Exercise Science & Pre-Health Professions, Creighton University, 2500 California Plaza, CHSC 470H, Omaha NE 68178, 4 Results Groups. LLC dba Motive Labs, Glastonbury, CT
Email: janiawilliams@unomaha.edu

INTRODUCTION

- Lateral ankle sprains are the most common musculoskeletal overuse injury in soldiers, likely due to training and deployments on uneven terrain.
- A series of bracing levels is the current standard of care, but it is inadequate in rehabilitating soldiers from ankle injury.
- **Research Objective:** To evaluate the impact of FlyBand® ExoBoots™(FB) on ankle joint motion. Three levels of conventional boots and bracing were compared to three similar levels of FB with carbon fiber ankle cartridge inserts.
- **Hypothesis:** We hypothesized that FB would allow more natural movement in the sagittal plane and increase comfort, while providing comparable frontal plane support.

METHODS

- 10 Healthy adults (19-45 yrs) completed six experimental conditions (Figure 1). Participants performed a 55-step stair run and a three-cone shuttle drill, in which completion times were recorded for each task.
- Peak ankle inversion and dorsiflexion angles were calculated from marker trajectories during two-foot landings on a 16° cross-sloping surface from a 24-inch plyo box.
- User comfort was assessed using a Technology Acceptance Model (TAM) visual analog scale, ranging from 'strongly disagree' (0 points) to 'strongly agree' (15 points).
- A 2 x 3 repeated-measures ANOVA ($\alpha = 0.05$) tested the effects of boot type and bracing level on each outcome measure. Least significant difference (LSD) was used for post hoc analysis.

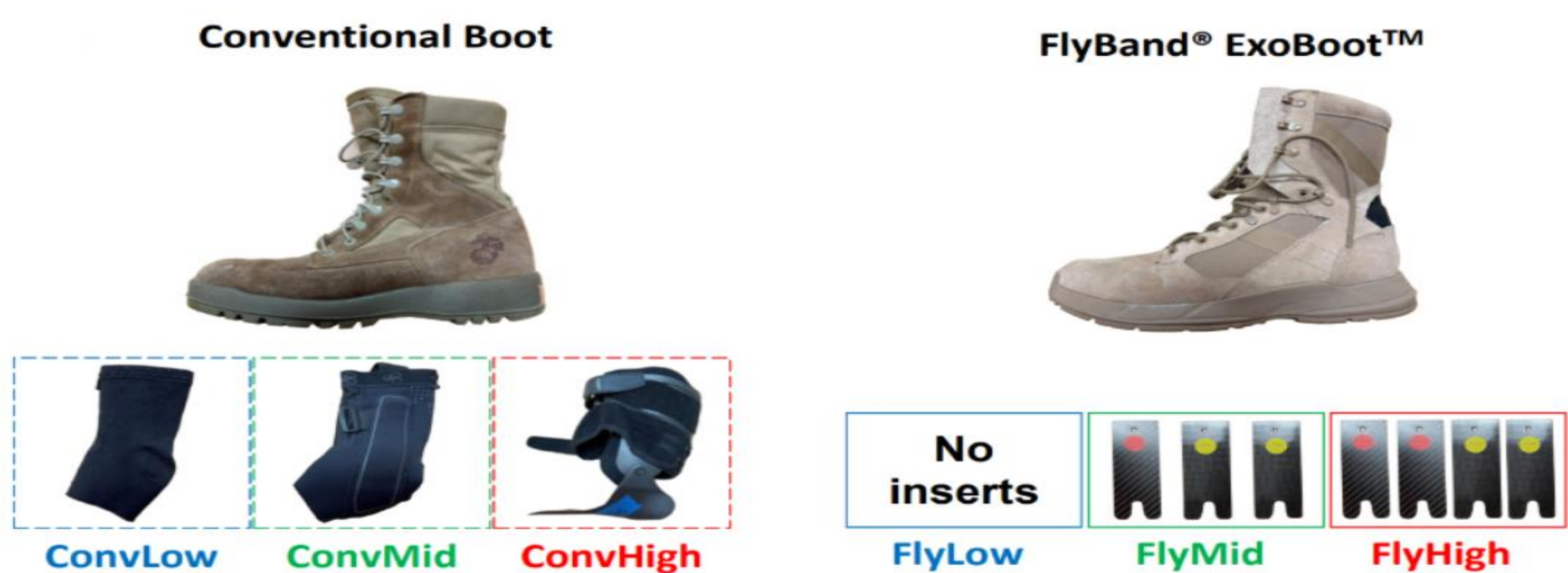


Figure 1. Dynamic assessments were completed in six unique boot and brace combinations.

RESULTS

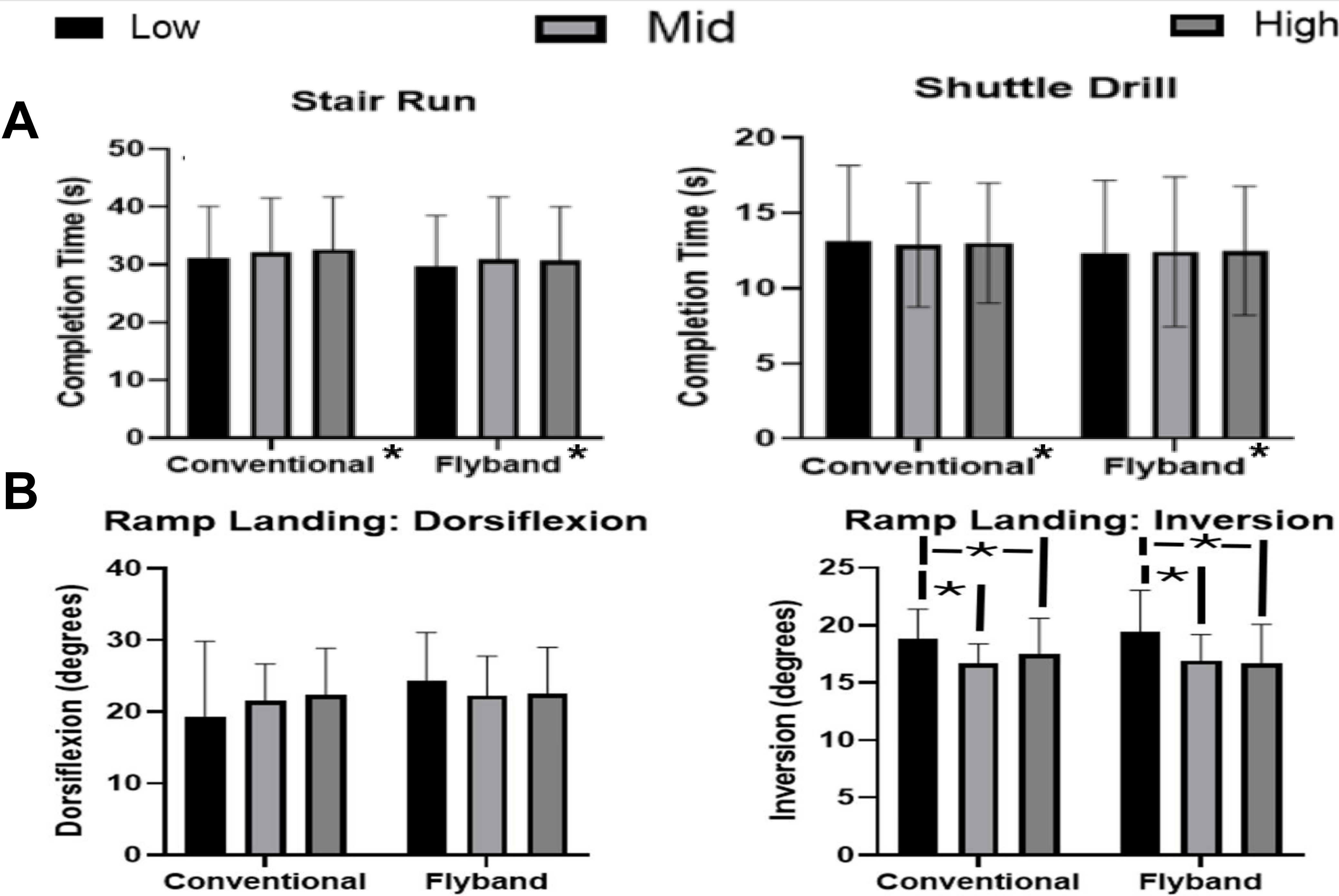


Figure 2: (A) A significant main effect of boot was observed for stair runs and shuttle drill ($p=0.013$). (B) A significant main effect for bracing was observed between low-mid and low-high bracing conditions for peak inversion during ramp landing ($p=0.038$). Not depicted: A significant main effect for comfort rating ($p=0.024$) showed higher comfort rating for FB.

DISCUSSION AND IMPLICATIONS

Boot performance

- FB superior performance and comfort scores during dynamic tasks suggest that the features of this boot, such as the light-weight exoskeleton integration and carbon fiber plate contribute to improved performance and comfort

Bracing performance

- FB bracing is a comparable alternative to conventional bracing in supporting the ankle from low-mid and low-higher bracing levels.

Future Studies

- Future studies will evaluate the effectiveness of boots and bracing on service members with previous ankle sprains

REFERENCES

- [1]Orr, J. D.(2014).Clinics in Sports Medicine, 33(4),675–692.
[2]Dubuc,Y.Z.(2022).Expert Review of Medical Devices, 19(2), 113–122.

ACKNOWLEDGEMENTS

This project was funded by the Department of Defense under Contract No. W81XWH-22-C-0103.

