

EFFECT OF FOOTWEAR ON CENTER OF PRESSURE MOVEMENT AND PERFORMANCE IN RIFLE SHOOTING

John Blackwell and David Lee

University of San Francisco, San Francisco, California, USA

KEY WORDS: rifle, cop, footwear, shooting

INTRODUCTION: In the rifle shooting disciplines, the offhand (standing) position is considered one of the most difficult of competitive events because rifle and body movements are harder to control and minimize compared to more stable shooting positions. Shooters attempt to increase stability by relying on a static skeleton that is dependent on the adopted postural position as well as the apparel worn by the shooter. In the offhand position, competitive shooters have pushed the limits of the rules by relying on specialized shooting apparel in order to stabilize and reduce the body's natural tendency to sway and fatigue (Buhlman et al., 2002). One article of clothing that is commonly worn is a specialized shooting boot. The contribution to which the boot makes to postural stability and shooting performance is unclear. The purpose of this study was to objectively measure the effect of footwear on the stability and performance in rifle shooting in the offhand position.

METHODS: A sample of 9 (5M, 4F) skilled rifle shooters from a university rifle shooting team served as subjects. The mean (SD) descriptive data were: age = 18.8(1.1) years, mass = 65.2(6.7) kg, height = 1.7(0.1) m. Subjects participated in a 10-meter, air-rifle task consistent with a competition setting. Subjects shot a half-course (i.e., three sets of two targets), a total of sixty shots. Each set of two targets was performed under one of three conditions: BF = bare feet, AS = athletic shoe, or SB = shooting boot. The order of shoe type was randomized. The stability of a shooting subject has been studied previously using a force platform (Gianikellis, et al., 2001) to analyze the movement of the subject's center of pressure (COP) prior to the shot. Subjects in the current study stood on a 60 cm x 90 cm force platform (AMTI BP600900) that allowed for the whole body to be over the plate while shooting. Data were sampled at 100 Hz and gave an indication of the body's COP movement in the horizontal plane. A microphone next to the rifle detected the shot for data collection purposes. Data were collected for the one second time period prior to the shot.

RESULTS AND DISCUSSION: Initial results indicate that footwear had no effect on stability or performance. Target scores (average per shot) were: BF = 8.7, AS = 8.7, SB = 8.8 and were not significantly different from each other ($p = 0.94$). Additionally, the movement of the COP showed no differences ($p = 0.73$) across footwear conditions. To reduce the natural sway of the shooting position, competitors have come up with various means of reducing or restricting the range of motion at key pivotal points. The shooting shoe is designed to brace the area around the ankles and reduce the range of motion in order to minimize the sway inherent to the position. Although stability has been measured in shooting tasks, the actual efficacy of shooting footwear had yet to be quantified. The results of this study suggest that specialized boots are not critical to stability or shooting performance, at least for the limited conditions of this study. Suggestions for future study will be presented.

REFERENCES:

- Buhlman, G., Reinkemeier, H., Eckhardt, M., & Murray, B. (2002). *Ways of the Rifle*. Verlag MEC: Germany.
- Gianikellis, K., Pantrigo, J., & Vara, A. (2001). Stabilometry applied on the analysis of individual technique in the air-rifle shooting. In Blackwell (Ed.), *Proceedings of Oral Sessions of the XIX International Symposium on Biomechanics in Sports*, San Francisco, 170-173.