

# Sports Medicine & Movement Laboratory

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## The Effect of Stride Foot Contact Orientation on Overhand Shot Kinematics, Kinetics, and Performance Outcomes in Male Lacrosse Players

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### ABSTRACT

**Background:** Lacrosse is one of the fastest growing team sports in the United States. According to the US Lacrosse Organization, national participation in lacrosse increased from 253,931 players in 2001 to 826,033 players in 2016. Currently, there are no data regarding the kinematics and kinetics of the overhand lacrosse shot as they relate to desired performance outcomes, such as shot velocity and accuracy.

**Purpose:** The purpose of this study was to examine the effect of stride foot orientation on the angular kinematics of the pelvis, trunk, and bilateral upper extremities, joint moment kinetics of the ankle and knee, maximal ball velocity, and accuracy performance in male lacrosse players during overhand shooting.

**Study Design:** Prospective cohort study.

**Methods:** Sixteen male lacrosse players ( $17.19 \pm 5.84$  yrs.,  $169.45 \pm 15.73$  cm,  $63.46 \pm 18.29$  kg,  $6.81 \pm 3.33$  yrs. experience) participated. Participants wore their own, full protective equipment, and performed 9 trials of the overhand shot on an unobstructed goal (Maverik Lacrosse, New York City, NY) from 5 meters for maximal velocity under three stride foot contact orientations: closed, in-line, and open determined via tape markers. Next, a target sheet (Under Armour Goal Blocker Lacrosse Goal Shooting Target, Under Armour, Baltimore, MD) was affixed to the goal, and participants performed 36 trials of the overhand shot being randomly assigned the foot orientation and target at which they shot. Repeated measures ANOVA tests with an alpha level set *a priori* at  $p \leq 0.05$  were used to determine differences in angular kinematics, joint moment kinetics, and shot velocity and accuracy.

**Results:** There was a significant interaction between foot orientation and angular kinematics of the pelvis, trunk, and upper extremities ( $F_{1,14} = 3.108$ ,  $p < 0.001$ ,  $\eta^2 = 0.172$ ) and post-hoc simple effects tests were conducted. There was a significant main effect of foot orientation for ball velocity ( $F_{1,15} = 12.20$ ,  $p < 0.001$ ,  $\eta^2 = 0.448$ ) and post-hoc simple effects tests were conducted. Lastly, there was a significant main effect of shot type for ball velocity ( $F_{1,15} = 31.33$ ,  $p < 0.001$ ,  $\eta^2 = 0.676$ ) and a post-hoc dependent samples t-test was conducted.

**Conclusion:** Examining the biomechanics of lacrosse shooting is vital for the development of proper training programs. Findings from this study suggest that utilizing a closed foot orientation when shooting maximizes angular kinematics of the body, as well as ball velocity. Findings also suggest that accuracy and velocity are inversely related, that is, accuracy is maximized when shooting velocity is decreased.

***This abstract is a brief overview of a manuscript submitted for publication. The full manuscript will be sent to you once it is accepted for publication.***

The Sports Medicine & Movement Laboratory will seek to continue this line of research regarding shooting mechanics in male lacrosse players.

Further information can be found at [www.sportsmedicineandmovement.com](http://www.sportsmedicineandmovement.com) as well as <https://scholar.google.com/citations?user=ae6HxHgAAAAJ&hl=en>. Specific inquires can be send to [goliver@auburn.edu](mailto:goliver@auburn.edu). Thank you again for your participation in our research and we look forward to your further participation. Thank you!