Position-Specific Shooting Kinematics on Peak Ball Speed in Men's Lacrosse

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As the sport of lacrosse grows we need to understand factors that affect performance. We currently understand little about the position-specific biomechanics of lacrosse throwing and shooting, and the factors relating to these biomechanical patterns.

PURPOSE: To determine kinematic factors that are related to maximizing ball speed of the lacrosse shot across different player positions.

METHODS: A 12 camera 3 dimensional motion capture system was used to capture shooting motion. A 28 retro-reflective marker set was used to identify key anatomical landmarks and the crosse (stick). Participants included male high school and collegiate lacrosse players (N=35). Positions analyzed were defense (N=9), midfield (N=11), and attack (N=15). Each participant completed a warm up, followed by motion capture of 12 throws. Throws were performed as quickly and accurately as possible into a standard collegiate goal target. A shot cycle was defined as the point of lead foot contact (FC) to ball release (BR). Dominant and non-dominant overhead throws were used. Matlab software was used to find step length-to-height ratio (SL/H) and trunk lean range of motion (TL-ROM). Ball speed was calculated from the motion capture data. All kinematic factors were calculated relative to the shot cycle.

RESULTS: The average peak ball speed for attackmen, defensemen, and midfielders was 68.9±14.3 mph, 63.6±15.7 mph, and 73.6±8.9 mph respectively. The mean SL/H ratios were higher in the dominant side than the non-dominant side at FC irrespective of position ($p<0.001$). There was a strong correlation between SL/H ratio and ball speed in defensemen at BR ($r=0.836$, $p<0.001$), and low correlations for attackmen (BR $r=0.16$, $p<0.001$;) and midfielders (BR $r=0.22$, $p<0.001$) TL-ROM for attack was 20.6º±10.3º and 15.4º±8.2º for dominant and non-dominant sides, respectively and TL-ROM for defense was 20.6º±14.8º and 18.8º±13.0º for dominant and non-dominant sides, respectively. For midfield, TL-ROM was 16.4±7.4 and 15.2º±8.2º for dominant and non-dominant sides.

CONCLUSION: SL/H ratios were not different by player position type. The TL-ROM in defensemen was more strongly associated to faster ball speed than in attackmen and midfielders. Defenders holding a long lever arm rely more on trunk lean to develop fast ball speeds than midfielders and attackmen who may use other strategies to develop speed including upper body rotation and more wrist motion.