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Effect of the PEP Program on Biomechanical Risk Factors in Male Collegiate Lacrosse Athletes

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Abstract

Landing and cutting maneuvers are common mechanisms for noncontact anterior cruciate ligament (ACL) injury. Men's lacrosse is a high risk sport for ACL injury. The Prevent Injury Enhance Performance (PEP) program has been shown to decrease injury rates in women's soccer but has not been studied in men's lacrosse. **PURPOSE:** Determine if collegiate men's lacrosse athletes land and cut in ways that put them at risk of ACL tear and to determine the effect of the PEP program on these mechanics. **METHODS:** Twenty-two male collegiate lacrosse athletes participated in this study. Kinetics and kinematics were measured during a single leg drop-landing and a cutting maneuver before and after the spring 2015 season. Half of the participants performed the the PEP program, half of the participants performed a typical lacrosse warm up. **RESULTS:** No group by time difference was observed in any variable in either task. Both groups demonstrated increased knee flexion angles at initial contact while cutting with the dominant limb. **CONCLUSION:** Neither group displayed mechanics that may increase risk of ACL tear. The PEP program did not alter landing and cutting mechanics more than a typical lacrosse warm up.

Background

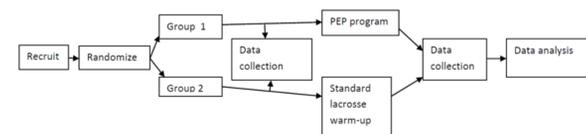
- Noncontact ACL injuries are common in field and court sports.
- Although the rate of ACL tear is approximately 3 times higher for females in most sports, the rate of ACL tear for males and females in lacrosse is nearly identical.³
- Landing from a jump and performing a cutting maneuver are common mechanisms of ACL injury.
- During these maneuvers certain biomechanics place increased strain on the ACL.
 - Increased knee valgus (angle and moment)
 - Decreased knee flexion
 - Decreased hip flexion (upright posture)

Aims

- Aim 1:** Determine what biomechanical risk factors collegiate men's lacrosse athletes demonstrate (if any) during 2 common athletic maneuvers; a single leg landing, and a 60 degree cut.
- Aim 2:** Determine if an established ACL injury prevention program is effective in reducing any risk factors found.
- Hypothesis:** Collegiate men's lacrosse athletes will display risky biomechanics and the PEP program will improve those biomechanics.

Methods

Design: Randomized controlled trial



Participants: 22 Division III collegiate men's lacrosse athletes age 19.9 ± 1.19 years.

Data collection: Each participant performed 5 trials of a single leg landing (Figure 1) and a cutting maneuver (Figure 2) bilaterally.

Variables of interest:

- Peak frontal and sagittal plane knee moments
- Initial contact and peak frontal and sagittal plane knee angles
- Peak vertical ground reaction force (zGRF)
- Peak sagittal plane hip angle

Intervention: The PEP program, as described by the Santa Monica Sports Medicine Foundation. A typical lacrosse warm up created by the team served as the control. Each program was performed 5x a week for 12 weeks.

Statistical analysis: A MANOVA was used to determine significance for each variable of interest. Significance was set to $p \leq 0.05$.

Figure 1

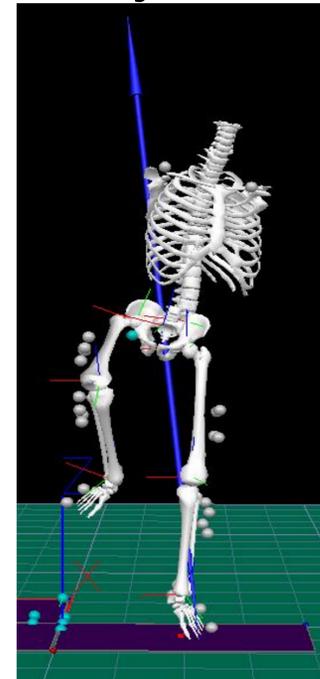
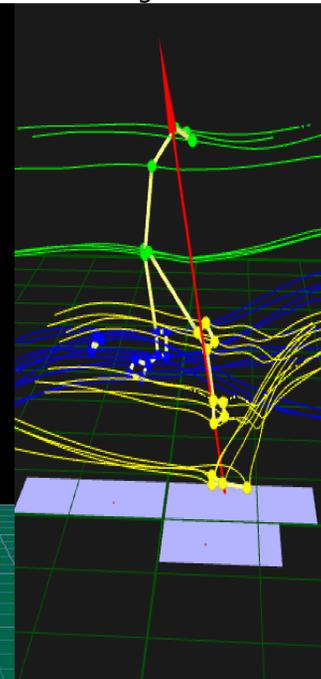


Figure 2



Results

- No participants in either group demonstrated biomechanics consistent with increased risk of ACL tears.
- Knee flexion angle at initial contact increased significantly ($p=0.020$) in both groups during cutting tasks using the dominant limb over the course of the season (Table 1).
- There were no group- by-time interactions in any variable.

Table 1:
Knee flexion angle at initial contact during dominant cutting maneuver in degrees, Mean (SD)

	PEP (n=11)	Control (n=11)
Pre	-19.4 (4.5)	-19.8 (5.5)
Post	-25.0 (8.4)*	-21.4 (5.4)*

*Significantly greater than Pre

Discussion

- ACL injury prevention programs have mixed results on kinetics and kinematics.¹
- The PEP program did not influence kinetics and kinematics any more than a typical lacrosse warm up.
- Collegiate men's lacrosse athletes did not display kinetics and kinematics that put female soccer athletes at risk of ACL tear.²
- The tasks measured may not be the tasks that put male lacrosse athletes at risk of ACL tear.

Limitations

- Small sample size
- Researchers and subjects were unable to be blinded to group allocation

Future Research

- Determine what movements make men's lacrosse a high risk sport
- Investigate the efficacy of other injury prevention programs

Acknowledgments

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Citations

- 1) Pappas, E et al. *Br J Sports Med*, 2014
- 2) Hewett, T et al. *Am J Sports Med*, 2005
- 3) Prodromos, C.C et al. *Arthroscopy*, 2007