Biomechanical Asymmetries During Drop Jump Landing and Takeoff in Adolescent Athletes Following Recent Anterior Cruciate Ligament Reconstruction

Ryan Kelln, MD[01], Eva Ciccodicola, DPT[01], Nicole M. Mueske, MS[01], Mia J. Katzel, DPT[01], Curtis D. VandenBerg, MD[01], J. Lee Pace, MD[02], Tishya A. L. Wren, PhD[01]
[01]Children's Hospital Los Angeles, CA, USA, [02]Connecticut Children's Medical Center, CT, USA

BACKGROUND

- Return to pre-injury level of play following ACLR is 43%[1].
- Risk of reinjury (ipsi/contralateral) following ACL reconstruction (ACLR) is high (7-15%)[2].
- Landing during a drop jump is often assessed to help evaluate knee injury risk. However, takeoff mechanics are less often analyzed.
- ***Objective:*** To investigate the occurrence and magnitude of biomechanical asymmetries between limbs and between landing and takeoff phases of a drop vertical jump in adolescent athletes following ACLR.

METHODS

Participants

- 32 athletes
  - Recent ACLR (7.1, SD 1.2 months post-op)
  - Mean Age 15.5 (SD 1.3) years
  - 16 (50%) female

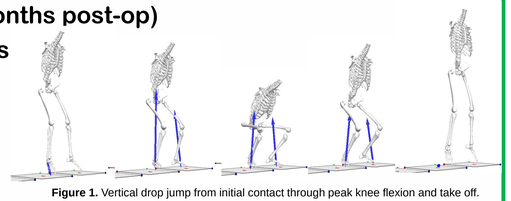


Figure 1. Vertical drop jump from initial contact through peak knee flexion and take off.

Testing

- Vertical drop jump
- 3D lower extremity kinematics and kinetics analyzed during landing (initial contact to sacral marker change of vertical direction) and take off (sacral vCOD to foot off)

Statistical Analyses

- 2-3 trials per side averaged for analysis
- Limb symmetry for frontal and transverse plane variables
  - Surgical minus contralateral limb
- Comparison of biomechanics between landing and takeoff phases
  - Used absolute values for energy absorption and generation

RESULTS

Landing and Takeoff

- Surgical limb
  - Higher ankle inversion (p=0.02; Fig 2)
  - Higher knee adduction angles (p<0.001) and moments (p≤0.09)
  - Higher hip internal rotation (p<0.001)
  - Lower hip adduction moments (p<0.001)
  - Lower ankle energy absorption and generation (p<0.001; Fig 3)
  - Lower knee energy absorption and generation (p<0.001)

Landing ONLY

- Surgical limb
  - Lower hip abduction (p=0.05) (Fig 2)

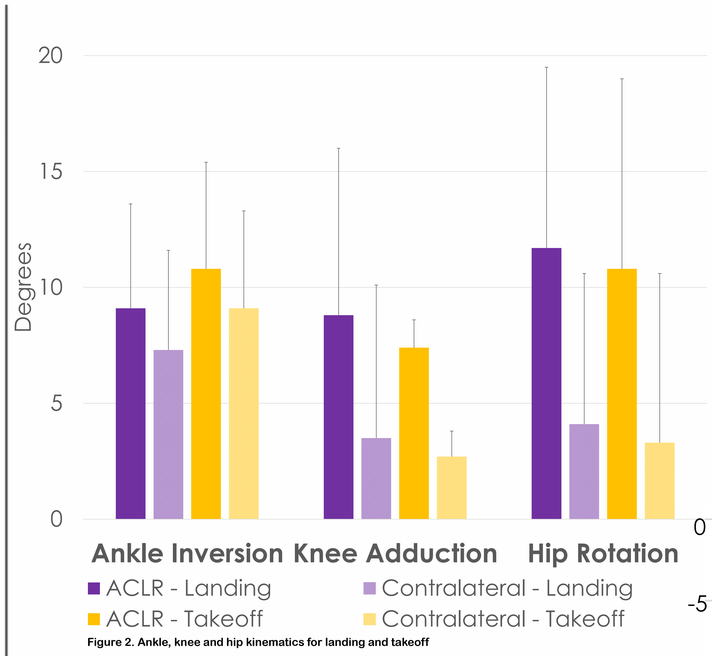
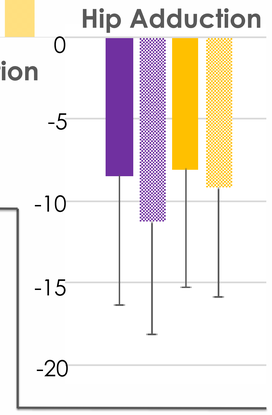


Figure 2. Ankle, knee and hip kinematics for landing and takeoff

Peak Knee Flexion

Peak Jump Height



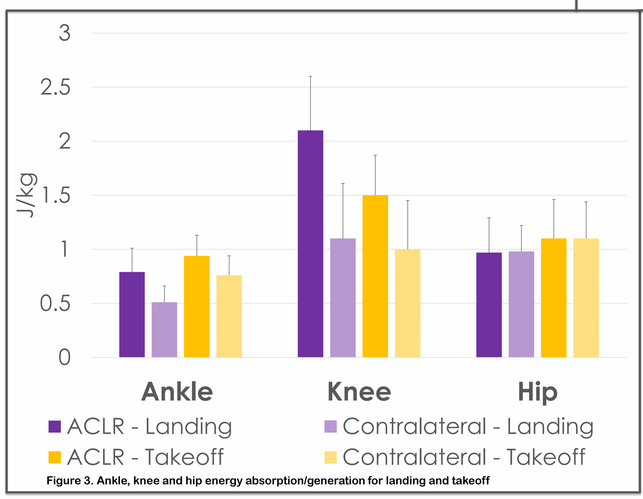


Figure 3. Ankle, knee and hip energy absorption/generation for landing and takeoff

Landing vs. Takeoff

- Asymmetries were greater during landing than takeoff
  - Average hip adduction angle (p=0.02; Fig 2) and moment (p<0.001)
  - Energy absorption/generation at ankle, knee and hip (p≤0.01; Fig 3)
- No differences in kinematic asymmetry between landing and takeoff at the knee or ankle (p≥0.16)

CONCLUSION/SIGNIFICANCE

- ❖ Similar asymmetries present in landing and takeoff.
- ❖ Asymmetries are transferred with some moderation from landing to takeoff.
- ❖ Targeting asymmetries and focusing on both landing and takeoff mechanics during rehabilitation may help to reduce the rate of injuries and maximize performance.

References:[1] McCullough et. al. Return to high school- and college-level… Am J Sports Med. 2012. [2]Wiggins et al. Risk of Secondary Injury… Am J Sports Med. 2016.
Contact Information: CHLA Motion Lab. Ph. # 1 (323) 361-4120 or email Adriana Conrad-Forrest aconradforrest@chla.usc.edu
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