Lower extremity joint contact force symmetry across activities with varied task demands following ACL reconstruction

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Introduction
- ACL rupture is a common sports injury that often involves surgical reconstruction (ACLR) and increases the likelihood of knee and hip osteoarthritis
- Altered knee joint loading following ACLR may expedite premature OA onset and progression
- Compensatory adaptations at the hip and ankle may exist in the presence of altered knee joint loading
- Lower extremity joint kinetic asymmetry during more mechanically demanding tasks than walking has not been reported

Participants and Methods
- 30 (19 female) recreationally active individuals 2-7 years post-unilateral ACLR
- 30 control participants matched on weight, activity level, sex
- Bilateral motion capture
- Joint kinematics
- Hip, knee, and ankle joint contact forces
- Self-selected walking (1.2 m/s) and running (2.7 m/s) pace
- Inverse dynamics
- Validated musculoskeletal model, static optimization
- Limb symmetry index (LSI) calculated for hip, knee, and ankle peak force and force impulse: 
  \[ LSI = \frac{\text{involved/\text{uninvolved}}}{} \times 100 \]
- LSI evaluated between groups across walking and running tasks using separate 2-factor (group x task) ANOVA (α=.05)

Discussion
Greater hip joint contact force asymmetry during running than walking for people following ACLR
- May represent a compensatory proximal redistribution of TFJ loads, when task demands are high
- Greater sagittal plane hip moment during running at 3 years after ACLR compared to healthy control previously reported
- Decreased hip moments in short term after ACLR and among those with knee OA during walking
- Increased hip joint contact force may increase risk of ipsilateral hip pathology

Knee joint contact force asymmetry observed during both tasks
- 2-3% asymmetry did not increase with increasing task demand
- LSI magnitude consistent with previous studies
- ACLR rehabilitation efforts traditionally focused on restoration of knee joint contact force symmetry
- Greater attention to hip asymmetry possibly warranted

Ankle joint contact force asymmetry not observed
- Compensations for altered knee joint loading on average occur proximally rather than distally

References