ACL Reconstruction Appears to Restore Patello-femoral Kinematics During Stair Ascent

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Introduction

Background
• ACL reconstruction (ACL-R) is the 6th most common orthopedic procedure in the United States, with more than 100,000 ACL reconstructions performed annually.
• The reported prevalence of patello-femoral (PF) osteoarthritis (OA) in patients following ACL injury and surgical reconstruction ranges from 16% to 36%.
• The etiology of PF OA following ACL injury is unclear.

Hypotheses
• To evaluate the effects of ACL injury and reconstruction on PF kinematics.

Aim
• In order to assess the effects of ACL injury and repair on PF tracking, it is necessary to evaluate PF kinematics during dynamic functional loading.

Subjects
• Six subjects (include 2M, 4F, average age 29±11; range 21-42 years) signed informed consent and agreed to participant in this IRB approved study.
• All ACL-reconstructions were performed anatomically with either patellar tendon (n=3) or four strand hamstring auto graft (n=3). Fixation was achieved with aperture (patellar) or suspensory (hamstring) fixation.

Methods

Data Collection
• Participants were tested prior to and 3 months after surgery.
• CT scans (0.68x0.68x1.25mm) were obtained for each participant’s knee.
• Three stair ascent trials were imaged using biplane radiographs collected at 100 frames/s for one second, two cameras were placed in a dual horizontal oblique configuration with an angle of 55° between them (Figure 1).

Data Processing
• PF kinematics were determined as a function of knee (tibio-femoral) flexion angle and analyzed at 5 degree intervals (Figure 3 and Figure 4).
• The primary kinematic outcome variables were patellar shift and tilt (Figure 5).
• Repeated measures ANOVA was used to identify differences between ACL-injured and contralateral healthy knees prior to and after surgery, and within ACL-R knees pre to post-surgery.

Results

• Surgical repair of the ACL resulted in patello-femoral kinematics that were more similar to the contralateral knee.
• The ANOVA identified significant differences in shift between the injured and contralateral knee prior to surgery (p=.009) (Figure 3).
  • Post hoc testing did not identify significant differences at any particular knee flexion angle all (p >.510).
• Patellar tilt in the repaired knee looks more similar to that of the contralateral knee in comparison to the ACL deficient knee, however no significant main effects or interactions were identified (all p > .153) (Figure 4).

Discussion

• This study was unable to detect any effect of ACL-injury and reconstruction on PF tilt or shift, however, PF kinematics were more similar to the contralateral side after surgery than they were before surgery.
  • This failure to detect statistically significant differences was likely due to the small sample size.
• Ongoing recruitment will allow comparisons between patellar tendon and hamstring graft patients.
• Long-term follow-up will be necessary to determine if these sort-term effects of surgery are maintained or amplified over time.

Significance
• PF kinematics during stair ascent appears to be partially restored 3 months after ACL-R.

References and Acknowledgement


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