Knee Anterolateral Capsule Reconstruction with Semitendinosus Graft Decreases Anterior Cruciate Ligament Forces

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Introduction

The combination of lateral extraarticular tenodesis (LET) procedures with ACL reconstruction have been described to treat persistent rotatory laxity after ACL injury. Concern exists that LET procedures may over constrain the knee, as observed in biomechanical studies, preventing complete force restoration. LET procedure investigated in this study is an anterolateral complex (ALC) reconstruction.

Objective

Quantify the effects of an anterolateral capsule reconstruction procedure on ACL and ALC forces and knee kinematics

Hypothesis

(1) ALC deficiency would increase in situ force in the ACL
(2) ALC reconstruction would restore in situ forces in the ACL compared to the intact knee

Methods

- 9 fresh-frozen cadaveric knees (mean age 66.4 years) were tested using a 6-degree-of-freedom robotic testing system
- Loading Conditions: 200-N axial compression coupled with (1) 134-N anterior tibial load and (2) 7-Nm internal tibial torque, from 30Ü to 90Ü of knee flexion
- ALC deficiency simulated by removing a 2-cm-wide strip from anterior to the LCL to proximal and lateral to the Gerdyôs tubercle
- ALC reconstruction performed utilizing a 6-mm semitendinosus graft placed according to the anterolateral ligament [8]
- Kinematic data was collected for these knee states:
  1. Intact
  2. ALC deficient (Fig. 1A)
  3. ALC reconstruction (Fig. 1B)
- In situ forces in ALC, LET graft, and ACL determined using the principle of superposition
- ANOVA with post-hoc Bonferroni test

Methods

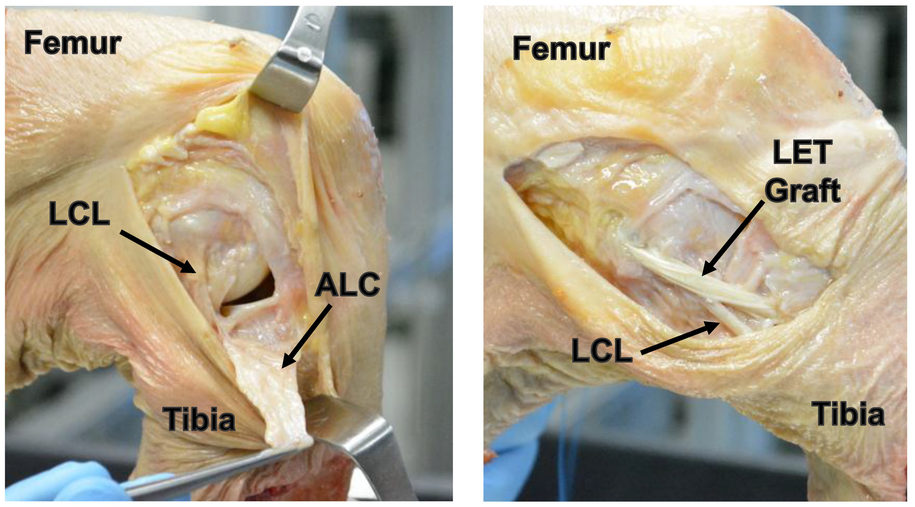
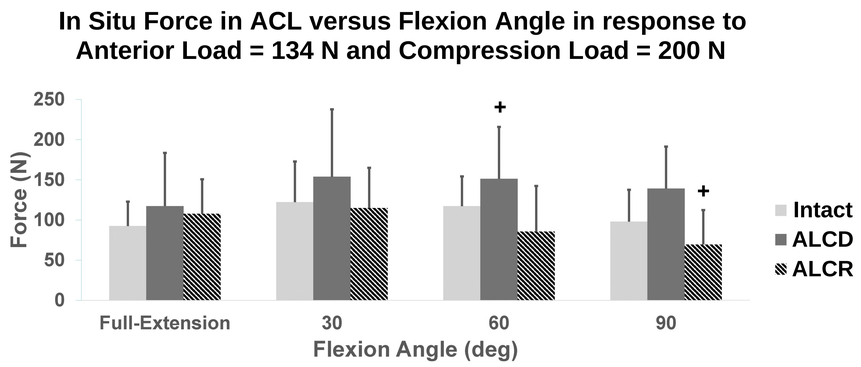


Figure 1: Surgical procedure; (A) A 2-cm-wide strip of ALC is removed to simulate ALC deficiency; (B) Lateral extra-articular tenodesis (LET) is performed utilizing a 6-mm semitendinosus graft.

Results

- In situ force in ACL decreased after ALC reconstruction compared to ALC deficient at 60Üand 90Ü
- In situ force in ALC graft higher than in native ALC at all flexion angles in response to internal torque and axial compression



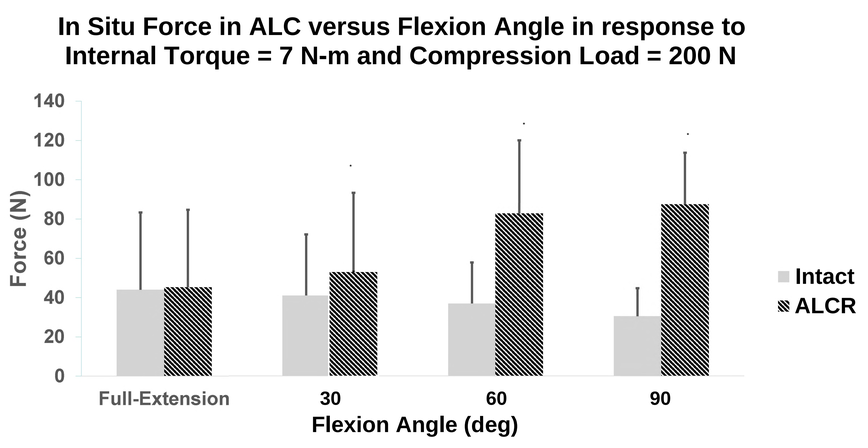


Figure 2: A) A) In situ forces in the ACL at each knee state (Means Ñ SD) B) In situ forces in the native anterolateral capsule and graft (Means Ñ SD)* p <0.05

Discussion

- In situ forces in the LET graft were higher than the native ALC
  - LET graft may provide support for other knee structures from injury
  - LET graft may protect knee structures when ACL deficient
- No decrease in forces in ACL after ALC reconstruction
  - Lack of complete force restoration
  - ALC reconstruction may lead to over constraining
- No Differences in knee kinematics between the intact knee state and after ALC reconstruction

Future Direction

- Compare the effect of other types of LET procedures on in situ forces of the knee structures

Significance

- ALC reconstruction with a semitendinosus graft can reduce in situ forces in the ACL after ALC deficiency making it possibly protective of the ACL. However, this only occurred at limited flexion angles and loading conditions making further investigation necessary.

Acknowledgements

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