

Recovery Trajectories Differ for Quadriceps Strength After ACL Reconstruction

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Introduction:

Recovery after anterior cruciate ligament reconstruction (ACL) requires restoration of quadriceps strength to support safe return to sport. While strength testing is a standard clinical tool, its longitudinal recovery pattern has not been well described using repeated measures across the early postoperative period. We aimed to model quadriceps recovery trajectories using mixed-effects approaches.

Methods:

We analyzed LEAP participants with repeated quadriceps isometric knee-extension testing at 60° from 4–12 months post-ACL. Ipsilateral, contralateral, and limb symmetry index (LSI-60) values were modeled using mixed-effects spline regressions with random patient intercepts, adjusting for age and sex. A total of 141 patients (234 visits) contributed quadriceps data; the cohort was 49.7% male (70) and 50.3% female (71). Institutional review board approval and informed consent were obtained for all participants.

Results:

Ipsilateral quadriceps strength improved steadily over time, while contralateral values remained stable. This yielded a +14.3-point increase in LSI-60 across 4–12 months ($p=0.007$). Age and sex were not significant predictors of recovery (both $p>0.10$).

Discussion:

Quadriceps strength demonstrated progressive, linear recovery across the first postoperative year. The stable contralateral limb values confirmed that improvements were driven by recovery of the operated limb. Although this analysis was limited to 4–12 months, patients in the LEAP cohort continue to be followed longitudinally, and extended trajectories will be reported in future work.

Significance/Clinical Relevance:

Objective modeling of quadriceps recovery provides clinically relevant benchmarks for rehabilitation. These findings highlight that strength recovery follows a steady trajectory and can serve as a reliable marker for progress during return-to-sport decision-making after ACL.

