# Peak Knee Flexion During Gait Associates With Quadriceps Strength and Self-Reported Knee Function 6 months After Anterior Cruciate Ligament Reconstruction

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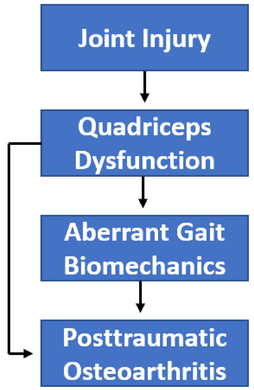
## Background

•Persistent quadriceps weakness is common in patients after anterior cruciate ligament (ACL) injury and ACL reconstruction (ACLR). Patients with quadriceps weakness report the following:

•More disability

•Altered cartilage composition

•Greater tibiofemoral joint space narrowing




These limitations are linked to the early development of post-traumatic knee osteoarthritis (PTOA).

Patients who fail to meet quadriceps strength cutoffs (3.0 Nm/kg) display aberrant gait biomechanics compared to those exceeding the cutoff.

However, it is unclear if improving quadriceps strength during the first 6 months of rehabilitation following ACLR mitigates aberrant gait biomechanics associated with PTOA development.

## Purpose

- To identify associations between peak knee flexion changes from 1 to 6 months, quadriceps strength, and self-reported knee function.

## Subjects & Study Design

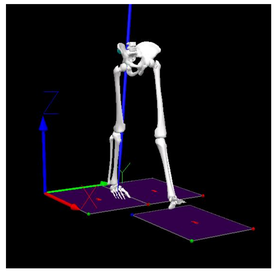
- This data comes from a randomized controlled trial evaluating the effects of vibration on outcomes linked to PTOA development
- Gait biomechanics and self-reported knee function were assessed in two sessions 1 month and 6 months after ACLR. The strength assessment was only completed during the 6-month session.
  - Subjects were 11 individuals with unilateral ACLR (45% male, 21.6 years old, 23.07 BMI)
  - 18% were classified as strong (> 3.0 N*m*kg^-1) at 6 months post-ACLR

## Methods

**Gait Biomechanics Assessment**

Subjects walked barefoot at their preferred speed

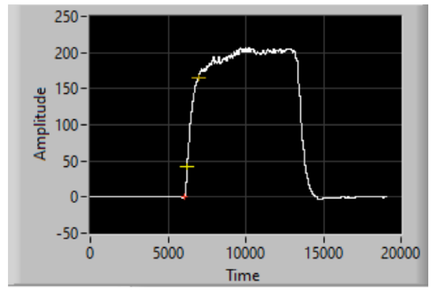
- Outcomes were calculated during the 1st 50% of the stance phase (midstance)
  - Peak vertical ground reaction force (vGRF)
  - Peak internal knee extension moment (KEM)
  - Peak knee flexion angle (KFA)
  - Gait speed



**Isometric Strength Assessment**

During their 6-month session, subjects underwent a strength assessment using a HUMAC Norm dynamometer to measure maximum voluntary isometric contraction (MVIC).

- Patients were given warm up trials before performing three maximal trials. The maximal trials were averaged and used in the final data analysis.
- The peak torque was normalized to body mass (Nm/kg)




Subjects kicked as hard as they could (left), as the HUMAC dynamometer measured their torque (right)

**International Knee Documentation Committee (IKDC)**

Subjects completed a subjective scale that provides information regarding overall knee function. The questionnaire focuses on three categories: symptoms, sports activity and knee function.

**Statistical Analysis**

Pearson product-moment correlations (r) were used to determine the strength of association between the following variables:

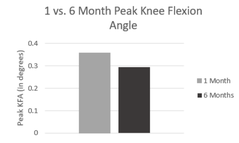
Peak torque, IKDC score, change in peak KFA, change in peak KEM, change in peak vGRF, and limb symmetry of each outcome

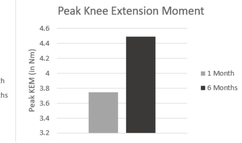
## Results

None of the associations yielded significant results (P > 0.05)

Correlation Matrix

| | | Injured Norm. MVIC | Change in Peak KFA | IKDC |
|---|---|---|---|---|
| Injured Norm. MVIC | Pearson's r | — | | |
| | df | — | | |
| | p-value | — | | |
| Change in Peak KFA | Pearson's r | 0.461 | — | |
| | df | 9 | — | |
| | p-value | 0.153 | — | |
| IKDC | Pearson's r | 0.408 | -0.176 | — |
| | df | 9 | 9 | — |
| | p-value | 0.212 | 0.604 | — |





## Discussion

**Conclusions**

Although this study failed to yield significant results, this is a question worth further researching. Obtaining a larger sample size (N > 10) and examining progress at further stages (9 and 12 months) could provide more insight into providing proper rehab to prevent the development of PTOA.

These findings suggest that other factors beyond quadriceps strength (e.g. pain relief, reduced joint swelling and inflammation, etc.) likely influence changes in gait biomechanics over the first 6 months post-ACLR

**Limitations**

- Small sample size (N=10)
- High variance in subject performance at 1 and 6 months after ACLR

This research was supported by the United States Department of Defense award number W81XWH-15-1-0287.

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