

Progressive Bilateral Alterations in Gait Biomechanics within 2 Years Post – Anterior Cruciate Ligament Reconstruction

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Summary

This longitudinal study examined bilateral gait biomechanics following anterior cruciate ligament reconstruction (ACLR), revealing that the reconstructed limb exhibited progressive normalization of gait mechanics within a 24-month postoperative period, with the notable exception of persistent knee flexion moment deficits. The findings underscore the clinical importance of implementing early-phase therapeutic interventions combined with continuous neuromuscular rehabilitation strategies to optimize functional recovery and mitigate the risk of long-term complications, particularly post-traumatic osteoarthritis development.

Introduction

Bilateral gait biomechanics changed over time early after anterior cruciate ligament reconstruction (ACLR) and may lead to osteoarthritis. However, few studies have investigated the longitudinal changes in bilateral gait biomechanics in the same cohort within 24 months after ACLR. To evaluate the longitudinal changes in bilateral gait biomechanics compared with the healthy control cohort within 24 months after ACLR.

Methods

24 patients who underwent unilateral ACLR surgery for the first time and 24 matched healthy participants were included; three-dimensional gait and ground reaction forces (GRF) information were collected at 3, 6, 12, and 24 months after ACLR. Linear mixed-effects models were used to assess the influence of time and limb in ACLR participants and their interaction effect on each variable of interest. Two-way analysis of variance (ANOVA) was used to compare intergroup and interleg dependent variables.

Results and Discussion

All parameters in the reconstructed side decreased after ACLR compared with the contralateral side and control group and gradually increased over time, except for peak knee flexion angle. The peak knee flexion moment (KFM) in the reconstructed side was lower than the contralateral side and control group 3-6 months after surgery, and in the bilateral side was lower than the control group 12-24 months after surgery. Compared with the contralateral side and control group, peak knee extension angle and moment on the reconstructed side were significantly reduced 3-6 months after surgery, and the differences were clinically insignificant 12-24 months after surgery. The first and the

second peaks of vertical GRF were significantly lower than the control group at 3, 24 months, and 3, 6, 24 months after surgery, respectively.

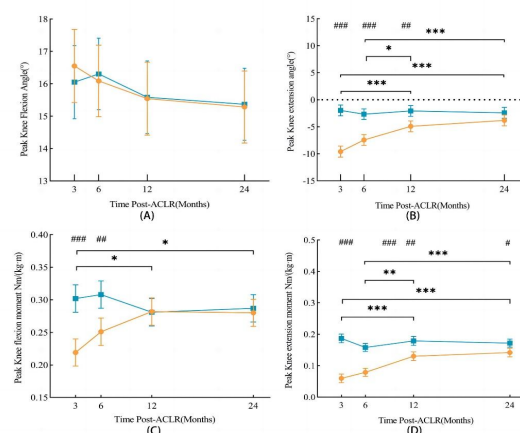


Figure 1: The peak knee flexion angle (A), the peak knee extension angle (B), the external peak knee flexion moment (C); the external peak knee extension moment (D), during stance phase in the level walking at 3, 6, 12 and 24 months after ACLR. *Indicates significant differences between time points in the reconstructed leg of the ACLR group. # Indicates significant differences between the reconstructed leg and the contralateral leg of the ACLR group.

Orange, the reconstructed leg in the ACLR group; blue, the contralateral leg in the ACLR group.

Conclusions

The gait biomechanics of the reconstructed leg gradually approached the level of the contralateral leg and the control group, and sagittal gait biomechanics of the knee were restored to normal within 24 months after surgery, except for the KFM. The KFM of the contralateral side gradually approached the level of reconstructed leg 6-12 months after ACLR. Bilateral gait retraining and neuromuscular control training are recommended as early as possible and should last at least 24 months after surgery.

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References

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