

Interlimb Asymmetries Post ACL Reconstruction During Sprints

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Background

ACL reconstruction (ACLR) after a complete ACL tear is aimed at restoration of the mechanics of the limb. After reconstruction, neuromuscular mechanics of the lower extremities (LE) may change asymmetrically due to the integrity of the reconstructed ACL or due to alterations in weight bearing during rehabilitation. Since the ACL is comprised of inert tissue, it has lower adaptability under tension. With altered LE mechanics after ACLR, mistranslated force distribution between joints can increase the risk for a secondary tear while running, landing from a jump or cutting. At this time, return to sport protocols for ACLR do not include analysis of walking, jogging or sprinting mechanics when considering whether an athlete is ready to go back to their sport, which may allow an athlete to return before they are ready to do so. 2-Dimensional (2D) motion analysis is an easily accessible means for analyzing LE mechanics in a physical therapy clinic versus 3-Dimensional (3D) motion analysis. The purpose of this study is to use 2D motion analysis to assess limb asymmetries in individuals with ACLR during sprints.

Methods

6 ACLR (4 females, 2 males, age 19-24, 1-5 yrs post-surgery) & 6 BMI-matched controls (MC) participated. Participants ran at a maximum (MAX) self-selected speed/sprint for 30s on a treadmill. 2D data were recorded via Apple iPads and analyzed via Kinovea[®] for max joint angular displacements (AngDisp: max flexion to extension) at the hip, knee and

ankle in the sagittal plane. AngDisp were compared between groups using Kruskal-Wallis H Test. ACLR limbs were compared to dominant limbs (Dom) and healthy ACL limbs (UnI) were compared to non-dominant limbs (NDom). Limb symmetry indices (LSI) were calculated (Involved/Healthy *100) for participants. and compared between ACLR and MC.

Results

No statistically significant differences in AngDisp between the groups were observed ($p=.281, .676, .895$; $\chi^2=2.538, .784, .222$) for the hip, knee and ankle respectively. LSI values ($85 > X > 115\%$) are clinical indicators of asymmetry between limbs¹. LSI values showed clinically significant differences at the ankle in ACLR group (84%) but not in MC (87%). There were no clinically significant differences in LSI at the hip or knee (92-94%).

Conclusions

Persistent LE neuromuscular deficits post ACLR and rehabilitation may continue to predispose athletes to injury up to 2 years post-op². These deficits are usually not visible without use of 3D motion analysis. In the absence of advanced technology, common neuromuscular deficits can be missed. Many clinics do not have access to advanced technology such as 3D motion analysis to assess neuromuscular asymmetries due to the price of the system as well as finding a space for the system. Decisions are thus made based on clinical presentations using common return to sport (RTS) tests and time. However, these tests do not take into account the actual mechanics of the lower extremity.

If deficits are missed, it allows patients to be discharged and RTS too early, potentially leading to secondary tears (re-injury rate after RTS: 23%)³. Although there were minimal asymmetries reported on LSI, detailed 3D analysis might be essential to understand the quality of the running mechanics or any possible neuromechanical deficits to understand the quality of LE neuromuscular mechanics post-rehabilitation for individuals during functional activities like walking, jogging or running to prevent secondary ACL tears upon RTS.

Bibliography

1. Lynch AD, Logerstedt DS, Grindem H, et al. Consensus criteria for defining 'successful outcome' after acl injury reconstruction: a Delaware-oslo acl cohort investigation. *Br J Sports Med.* 2015;49:335-342.
2. Capin JJ, Zarzycki R, Arundale A, et al. Report of the primary outcomes for gait mechanics in men of the acl-sports trial: secondary prevention with and without perturbation training does not restore gait symmetry in men 1 or 2 years after acl reconstruction. *Clin Orthop Relat Res.* 2017;475:2513-2522.
3. Wiggins AJ, Grandhi RK, Schneider DK, et al. Risk of secondary injury in younger athletes after anterior cruciate ligament reconstruction: a systematic review and meta-analysis. *Am J Sports Med.* 2016;44:1861-1876.