Patients Undergoing Anterior Cruciate Ligament Reconstruction Maintain High Risk Biomechanics During Postoperative Drop Vertical Jump Testing

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INTRODUCTION:

Anterior cruciate ligament (ACL) injuries are one of the most common musculoskeletal injuries in active populations. Given that certain biomechanical parameters, such as increased knee valgus and reduced sagittal knee flexion during athletic stress testing, are known predictors of non-contact ACL injury risk, it is important to understand whether such risk remains following ACL reconstruction (ACLR). Limited research exists on whether high-risk biomechanics persist in patients who underwent ACLR and full rehabilitation. Furthermore, how these biomechanics directly compare to healthy controls (both trained and untrained) is not well understood.

The purpose of this study was to compare lower extremity biomechanics during drop vertical jump (DVJ) testing of patients who have completed their rehabilitation following ACLR to trained varsity athletes and untrained controls. It was hypothesized that patients who have completed their rehabilitation protocol after ACLR will remain at higher risk compared to their sex and BMI-matched varsity athlete counterparts, and they will have a similar risk profile to untrained healthy controls.

METHODS:

Seventy-six (76) ALCR patients were recruited for this study. They were sex and BMI matched with a 1:1:1 ratio to healthy varsity athletes and untrained healthy controls, totaling 228 participants. All groups underwent DVJ testing captured using the Microsoft Kinect V2 system. Participants were excluded from the control groups if they sustained any prior knee injuries or recent lower extremity injuries.

RESULTS:

Statistically significant differences were found using the Kruskal-Wallis H test between the three groups for the initial coronal (IC) and peak sagittal (PS) angles during DVJ. A Mann-Whitney U test comparing the metrics of the paired study groups showed significantly higher IC angles in the ACLR compared to the matched varsity group, as well as significantly lower PS angles in the matched varsity group compared to the untrained group. A secondary analysis in the ACLR group revealed significantly higher IC in the ACLR knees compared to their contralateral side.

DISCUSSION AND CONCLUSION:

This study supports that patients undergoing ACLR retain high risk biomechanics with more knee valgus during DVJ postoperatively compared to trained healthy controls, and maintain similar risk in all jump metrics compared to matched untrained controls. ACLR patients demonstrate higher risk biomechanics on the operated side when compared to the contralateral knee. Healthy varsity athletes exert less knee flexion during jump landing compared to untrained healthy controls, potentially prioritizing performance over injury prevention. These findings support the inclusion of targeted neuromuscular and biomechanical training post-ACLR to reduce reinjury risk and bridge the gap between clinical clearance for return to play and true biomechanical recovery.