Samantha Rhodes[1,2], Chris Bramah[1], Lee Herrington[1], Richard Jones[1]

[1]University of Salford, Manchester, United Kingdom
[2]The Manchester Institute of Health and Performance, Manchester, United Kingdom

Introduction: Biomechanical assessments are often undertaken on surfaces that do not necessarily represent the surface that an athlete trains/plays on. Different surface properties can affect the mechanics of movement and have implications when assessing return to sport readiness or injury risk. An anterior cruciate ligament (ACL) injury is one of the most debilitating knee injuries in sport, leading to pain, instability, time away from sport and an increased risk of future injury. ACL injuries are most common during multi-directional sports such as football, netball, and rugby, and frequently occur as a result of a non-contact mechanism, such as a change of direction (COD). Biomechanical factors, such as an increase in the knee extensor moment (KEM), a reduction in knee flexion and dynamic valgus, have been linked with an increased risk of sustaining an ACL injury during a COD movement. The objective of this study was to determine whether there were any biomechanical differences in a 90-degree cut when performing on a running track surface compared to an artificial grass surface. This may have implications for return to sport testing procedures following ACL reconstruction, particularly the importance of external validity.

Methods: Seventeen participants were included in this study. The study, part of a broader project on the reliability of tasks post-ACL injury, employed a repeated measures design. Participants performed tasks, including a 90-degree cut, on a running track and on artificial sturf. Data collection involved motion capture cameras (29 infra-red cameras, Oqus 700, Qualysis AB, Sweden) and force plates (eight plates, AMTI, USA) embedded in each surface. Participants attended two sessions at the Manchester Institute of Health and Performance, with the first session serving as familiarization for the purpose of this study. Standardized footwear was worn by participants. Retro-reflective markers were placed on the participant to represent the underlying skeleton and were captured using the motion capture cameras. Kinematic and kinetic data were processed using Qualisys Track Manager and Visual 3D. Data was then exported to SPSS (Version 29.0.1.0, IBM corp., USA) and a paired t-test was conducted to determine significant differences.

Results: No significant differences were observed in kinematic variables between surfaces. When looking at the kinetic variables related to the cut, KEM was significantly ($P<0.05$) increased on the track (2.81Nm/kg) compared to the artificial turf (2.57Nm/kg). The posterior braking force was also significantly ($P<0.05$) increased on the track (1.06N/kg) compared to the artificial turf (0.96N/kg). No significant differences were identified in the approach speed to the cut on each surface or the maximum vertical ground reaction force.

Conclusion: Surface type significantly influenced the biomechanics of a 90-degree cut, revealing increased KEM and posterior braking force on the running track compared to artificial grass. This suggests greater demand placed on the knee during COD on track surface, potentially due to greater traction – although this was not measured in this study. These findings underscore the importance of surface-specific assessments in accurately understanding ACL injury risk. Consideration of playing surface nuances is crucial for informed decisions on return-to-sport readiness post-ACL injury.