Cutting Technique of ACLR Football Players on the Field: Matched Control Study

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Summary

The present study aims at inspecting potential differences in cut manoeuvre technique between ACLR young football players and matched healthy controls, through an on-field kinematic assessment by means of wearable inertial sensors. 62 (21 ACLR, 40 healthy controls) performed planned and unplanned football-specific changes of direction in a football pitch. Kinematics was collected through 8 wearable inertial sensors (MTw Awinda, Movella). Several differences emerged between ACLR players and healthy controls: ACLR players demonstrated a stiffer kinematic strategy, with reduced ROM in the sagittal plane at the hip, knee and ankle ($p<0.001$, d=1.03-1.73), compensated through a greater trunk flexion ($p=0.002$, d=0.65). Additionally, ACLR showed lower ROM in pelvis and trunk rotation ($p<0.001$, d=0.89-0.90) than controls. Differences between healthy and ACLR players persisted after RTS clearance. On-field analysis of football-specific movement technique has the huge potential to underline residual deficits and improve the RTS continuum through quantitative data-driven approaches.

Introduction

The restoration of cutting movement technique is essential for safe return to sport (RTS) following anterior cruciate ligament injuries and reconstruction (ACLR) in football (soccer). In young patients, understanding movement biomechanics is even more critical due to their increased likelihood of sustaining a second ACL injury [1]. Despite extensive knowledge derived from laboratory studies, there is lack of data from sport-specific ecological environments, that could help identifying real residual compensations and poor movement patterns [2,3]. The present study aims at inspecting potential differences in cut manoeuvre technique between ACL-reconstructed (ACLR) young football players and matched healthy controls, through an on-field kinematic assessment by means of wearable inertial sensors.

Methods

61 young football players, 21 ACLR (16.8 ± 1.6 years, 15 males) and 40 healthy (15.9 ± 2.3 years, 24 males) were enrolled. Data collection was held in a regular football pitch during training sessions. Each player performed two tasks (Figure 1): planned 90° changes of direction within the Agility T-test, and unplanned football-specific changes of direction simulating a defensive deceiving action (FS deceiving action). Lower limbs and trunk kinematics were measured through 8 wearable inertial sensors (100Hz, MTw Awinda, Movella). Joint kinematics of the ankle, knee, hip, pelvis, and trunk in the three anatomical planes were extracted for each trial. Peak, range of motion (ROM), angle at initial contact (IC) and peak knee flexion (pKF) were extracted and SPM was adopted to assess differences in waveforms between the injured limb of ACLR players and matched healthy controls (two-tailed Student's t-test with Cohen's d, $p<0.05$).

Results and Discussion

In the Agility T-test, healthy and ACLR players differed in pelvic drop during the entire cut phase ($p<0.001$, d=0.95-1.01). ACLR players showed larger pelvic drop than the control group at IC and pKF. In the FS deceiving action (Table 1), several differences emerged: ACLR players demonstrated a stiffer strategy, with reduced ROM in the sagittal plane at the hip, knee and ankle ($p<0.001$, d=1.03-1.73). Such a reduction was compensated through a greater trunk flexion ($p=0.002$, d=0.65). ACLR players also showed lower ROM in pelvis and trunk rotation ($p<0.001$, d=0.89-0.90). Hip flexion was greater in ACLR players at both IC and pKF ($p<0.001$, d=1.15-1.43). Pelvis-trunk tilt was greater in controls than ACLR players (IC $p<0.001$, d=0.81-1.02, pKF, $p<0.005$, d=0.59-0.75).

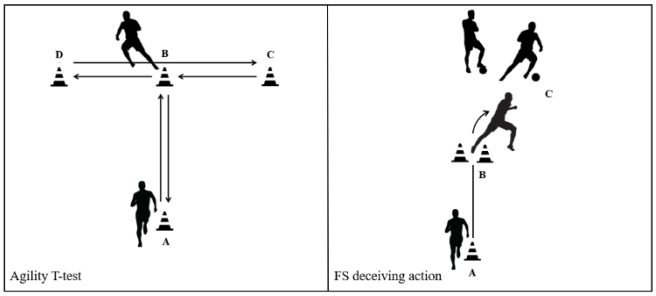

Figure 1: Planned and unplanned football-specific cut maneuvers.

Conclusions

Biomechanical differences between healthy and ACLR players persisted after RTS clearance during football-specific on field testing. Despite minimal differences at the knee joint, ACLR players exhibited a stiffer kinematic strategy than healthy players and compensatory movements to decrease knee loading through hip, pelvis and trunk control. On-field analysis of football-specific movement technique has the huge potential to underline residual deficits and improve the RTS continuum through quantitative data-driven approaches.

References

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