

Sensor-Informed Physiotherapy Following Anterior Cruciate Ligament Reconstruction: A Case Report.

K Nicholas^{1,2,3}, K Button^{1,2,3}, J L Davies^{1,2}, V Sparkes^{1,2}, and M Al-Amri^{1,2}

¹School of Healthcare Sciences, Cardiff University; ²Arthritis Research UK Biomechanics and Bioengineering Centre, Cardiff University; ³Cardiff and Vale University Health Board.

Case: A female twenty-seven years with ongoing knee pain, self-reported stiffness and inability to return to netball and running at 12 months post anterior cruciate ligament reconstruction. Rehabilitation consisted of 30 sessions of individual and group physiotherapy.

Challenge: In the clinical setting it is challenging to evaluate multi-planar joint motion whilst a patient is performing dynamic functional activities. Conventional clinical assessments are usually subjective and involve clinician or patient-rated scales [1]. We have established the reliability and validity of a portable sensor-based motion-capture system (Xsens MVN BIOMECH) in a variety of clinical functional tasks [2], and have custom written a programme in Matlab software (Mathworks) that processes sensor data and generates an immediate, user-friendly clinical movement analysis report in pdf format. Our current aim was to explore how this sensor-based clinical movement analysis report would inform clinical decision making.

Methods: The sensor-based motion-capture system was used to quantify movement kinematics in the clinical setting. Seven sensors were placed on the lower limbs by a musculoskeletal physiotherapist. The patient performed six repetitions of each of the following six tasks; over-ground gait, double-leg squat, single-leg squat, stair ascent, stair descent, and vertical jump. A report providing spatial-temporal data and joint angle waveforms and consistency plots was generated instantly and presented to the treating physiotherapist.

Summary: The report demonstrated predominantly compensatory movements in the frontal plane at the hip and knee of the operated limb in all tasks. Based on this information, the physiotherapist individualised the rehabilitation to target gluteal, quadriceps and hamstring muscle strength and recruitment patterns, alongside specific motor control strategies to address compensations. The report provided the physiotherapist with a deeper understanding of the movement challenges experienced by the patient and informed personalised exercise prescription.

References:

- [1] Whatman et al (2012) *Phys.Ther.Sport*
- [2] Al-Amri et al (2018) *Sensors*