Student Information Sheet 1

**Anterior Cruciate Ligament (ACL) Injury and Risk Factors**

Anterior cruciate ligaments (ACL) are important in stabilising the knee joint and can be injured when overstretched. This tends to occur in sports where there is a twisting motion such as football, rugby, basketball and alpine skiing and can be a contact or non-contact injury and. Some well-known sportsmen (Paul Gascoigne, Michael Owen, Tiger Woods, [Theo Walcott](file:///C%3A%5CUsers%5Cjro%5CDocuments%5CPersonal%5CPS%5CResearch%20UK%5Clink%20to%20recent%20newspaper%2C%20%20%20http%3A%5Cmetro.co.uk%5C2014%5C01%5C06%5Ctheo-walcott-injury-what-is-cruciate-ligament-damage-4252244%5Carticle)) have suffered this injury. Sometimes the athlete can hear the ligament tear during twisting movement or rapid deceleration. Treatment can include reconstructive surgery and a recovery period of at least six months. Osteoarthritis can occur later in life. There are gender differences in ACL injury frequency in adults – females have a smaller ACL which tears at a lower loading force.

Prevention of this injury may be possible by training in movement technique. Screening tools can be used to identify candidates that might be susceptible to injury. In this research project athletes are videoed jumped and scored according to a number of factors including how they land. Below is are some diagrams showing normal stance (ankles, knees and hips in a straight line parallel to the downward force), varus (knees outwards), valgus (knees inward). A greater torque force occurs on the knee for the varus and valgus examples – see Diagram 2) and there is a risk of injury to the ACL.

Student Information Sheet 2

Diagram 1 Normal stance “Varus” “Valgus”

Diagram 2 Torque force on knee shown for Varus and Valgus

**Biomechanics research method for ACL Injury Risk**

You may be familiar with games software which uses infra-red or accelerometers to detect player movements. In biomechanics research markers are placed at selected positions on an individual and movement videoed. Using weight data or sensors in force plates in the floor, the forces on the body can be calculated to assess injury risk to knees, calves, thighs, cruciate ligament etc. This research also has application in design of artificial joints. Without the need for detailed calculation, it is possible to screen athletes for likelihood of injury by “scoring” their jumping technique. Professor Iain Spears has recently developed a new video system that can be used to screen athletes on the risk of sustaining different injuries, including sustaining an ACL rupture. This system is under evaluation by professional athletes.

It is possible for you to carry out your own research in school either by viewing videos provided by the researcher or by making your own videos of a person jumping and then assessing the movements.

**Comments from the researcher about the experimental method**

It is important to place the camera in such a position that all movement can be recorded. Ideally, two cameras would be used. With two cameras, one can be placed at the side, to see the flexion (bending) in the several joints.

It is important to control the distance jumped (as data will be collected from repeated jumps). This is often half the athlete’s height. Normally the video data would be anonymized (for ethical reasons).

The researcher has recorded videos of several movements, all used in rehabilitation programs to assess the movement technique and strength of patients.

It is important that the whole body is recorded during the movements, because the body works dynamically. When one part of the body moves, all other parts move as well to try and stay balanced.

Student Information Sheet 3

Details of the University of Teesside ACL Injury Scoring System

The score sheet below used by the experienced researchers is quite complicated. For your experiment, it is suggested that you propose a simpler method of reporting results.

Student Information Sheet 4

**Analysis of video clips – evaluation by researcher**

|  |  |
| --- | --- |
| Vertical drop jump |  |
| Video 000 | Good, although more knee flexion would have been better |
| Video 001 | Knee valgus angle |
| Video 002 | External knee rotation |
| Single leg hop |  |
| Video 003  | Error, hopped from one leg onto the other leg |
| Video 004 | Good |
| Video 005  | Error, jump was diagonal instead of straight forward, and knee valgus |
| Video 006 | Good |
| Video 007 | Good |
| Video 008 | Good |
| Squats |  |
| Video 009 | Good |
| Video 010 | Knee external rotation |
| Video 011 | Knee valgus |

**Further video clips filmed from front and side with comments by researcher**

|  |  |
| --- | --- |
| Counter movement jumps | Comment |
| CMJ\_1 front/CMJ\_1 side | Not enough knee flexion |
| CMJ\_2 front/CMJ\_2 side | Knee varus angle |
| CMJ\_3 front/CMJ\_3 side | Not enough knee flexion |
| CMJ\_4 front/CMJ\_4 side | Knee external rotation |
| Single leg hops (SLH) | Question for students: Why where the first three recordings better than the second three?Answer: Was during the second three recordings hard to assess from side view, because we recorded from the wrong side! |
| SLH\_1 front/SLH\_1 side | Unbalanced, foot moved after landing. Not much knee flexion |
| SLH\_2 front/SLH\_2 side | Unbalanced over the whole body.  |
| SLH\_3 front/SLH\_3 side | Good jump |
| SLH\_4 front/SLH\_4 side | Not enough knee flexion |
| SLH\_5 front/SLH\_5 side | Knee external rotation, not enough knee flexion |
| SLH\_6 front/SLH\_6 side | Knee internal rotation and knee valgus |
| Squats:  |  |
| Squat 1 | Good squat |
| Squat 2 | Knee valgus |
| Squat 3 | Knee external rotation |
| Squat 4 | Good squat |
| Squat 5 | Good squat |

Note: To assess better the single leg hops, the distance could be measured.

Note: To assess better the squats, the maximum weight used could be measured