

## MEASURING DYNAMIC KNEE MOTION DURING JUMP LANDING

Kosuke Tanaka, Yukio Urabe, Yukari Sugata, Ryota Kurozumi\* and Toru Yamamoto\*

Dept. of Sport Rehabilitation, Graduate School of Health Sciences, Hiroshima University, Hiroshima, Japan

\* Dept. of Technology and Information Education, Graduate School of Education, Hiroshima University, Hiroshima, Japan

**KEY WORDS:** ACL, jump landing, prevention.

**INTRODUCTION:** The majority of anterior cruciate ligament (ACL) injuries in female athletes has been observed in noncontact situations such as jump landing. Theoretically, valgus and external rotation moments imposed to the knee joint will place ACL at high risk for injury (Olsen et al., 2004). Even though, it has been accepted that tibial and femoral rotation affects ACL tension, few studies have demonstrated tibial and femoral rotation angle in the relationship to neutral position. Therefore, the purpose of this study was to measure the tibial and femoral rotation angle during jump landing in female athletes.

**METHOD:** 10 healthy female athletes participated in this study. The subjects were instructed to drop directly down off the box (30cm height) and land with both legs. The tibial and femoral rotation angle and knee flexion angle during landing were measured by using a special device. This device consists of one linear encoder and five rotary encoders for measuring tibial translation relative to femur and tibial and femoral rotation angle. The device was attached to the lateral side of their knee. A landing motion was recorded and analyzed from initial contact to heel contact.

**RESULTS:** At the initial contact, the tibia rotated internally (12.1 degrees), and the femur rotated externally (26.8 degrees). After the initial contact, tibia began to start rotating externally and femur began to rotate to internally. At the heel contact, tibia rotates internally (2.0 degrees) and femur rotated externally (15.7 degrees). Knee flexion angle was 13.6 degrees at the initial contact and 32.5 degrees at the heel contact.

**DISCUSSION:** In this study it was found that tibia rotated externally relative to femur between initial contact and heel contact. Furthermore, all subjects presented less than 30 degrees knee flexion and femoral internal rotation at initial contact. ACL injury would occur at jump landing performed with extended knee joint at less than 30 degrees. We thought that this landing behavior of female athletes may expose them to risk for ACL rupture.

**CONCLUSION:** We developed a new device for measuring knee motion during dynamic knee motion. This study identified the rotation of tibia and femur during jump landing and found that females landed in a harmful position for ACL. It may be a useful information for prevention of ACL injury.

### REFERENCES:

Olsen, O. E., et al. (2004). Injury mechanisms for anterior cruciate ligament injuries in team handball. A systematic video analysis. *American Journal of Sports Medicine*, **32**, 1002-12.