

MECHANISM OF NON-CONTACT ACL INJURIES

SeungPyo Eun MD PhD

Korea Orthopaedic Clinic / Korea Sports Medicine Center, Korea

Anterior cruciate ligament injury is one of the most commonly seen injuries in sports and has a devastating influence on patients' activities levels and quality of life. ACL injuries that occur without physical contact between athletes are referred to as non-contact ACL injuries. As with other sports injuries, understanding injury mechanism is key component of preventing non-contact ACL injuries. However the mechanism for the non-contact ACL injury is still a matter of controversy.

The purpose of this review is to examine studies relating to the mechanisms of non-contact ACL injuries. We hope that this will provide an useful information that can facilitate the investigation of the mechanism of the non-contact ACL injury.

1. Initiating motion and the kinematic position at the moment of ACL injury

For an ACL injury by ground sports, there is a general agreement that the injury occurs during two major initiating motions, cutting and unbalanced landing. During these motions, so called 'valgus collapse' position occurs at the knee joint. This is sudden inward movement of the whole knee joint.

At the moment of injury there has been a controversy in the direction of tibial rotation. But a recent video study shows that the tibia rotates internally in the first 40 msec. Therefore, this suggests that IR of tibia in the valgus knee position is the major contributing factor in ACL injury.

2. Differences between ground sports and skiing

The ground sports such as soccer, basketball, handball etc. and skiing are two major sports activities that cause ACL injury. Even though the mechanism of ACL injuries has not been investigated perfectly yet, what we know so far is that there is a difference between two different sports activities.

In skiing, as stated by the Vermont group, the 'phantom foot mechanism' is recognized as an important mechanism of injury. This is a situation where a skier falls in a sitting position and the inside edge of the ski tail gets caught in the snow, leading to internal rotation of tibia. Because of the nature of skiing equipment, the injury mechanism in skiing has been understood to be different from that of ground sports. However recent video studies repeatedly shows the kinematic positions at the moment of injury in both sports activities closely resemble each other.

The meniscus injuries are frequently combined with ACL injuries. There are differences in the incidence, pattern of combined meniscal injuries between ground sports and skiing. The incidence of combined lateral meniscus injury in skiers was higher than in ground sports. In both group, the tear of the lateral meniscus is more likely to have a tear at the posterior horn, but higher in the skier group. Apparently this comes from the nature of skiing equipments and the environment. Basically skiing produces a bigger torque than ground sports, due to its long leverage and higher speed. And because of the hill slope, going downhill, the center of gravity is located in a more posterior position. On the other hand, the vertical weight bearing force is less, compared to ground sports. These might explain the high ratio of combined LM injury in skiing.

3. The force combination that cause the ACL injury : The theory "Internal rotation injury of the lateral compartment of the knee"

The exact force combination that injures ACL is not fully understood yet. The previous biomechanical studies consistently shows that the anterior shear force at the proximal end of the tibia is a major contributor to ACL loading, while the knee valgus, varus and internal rotation moments may increase ACL loading.