



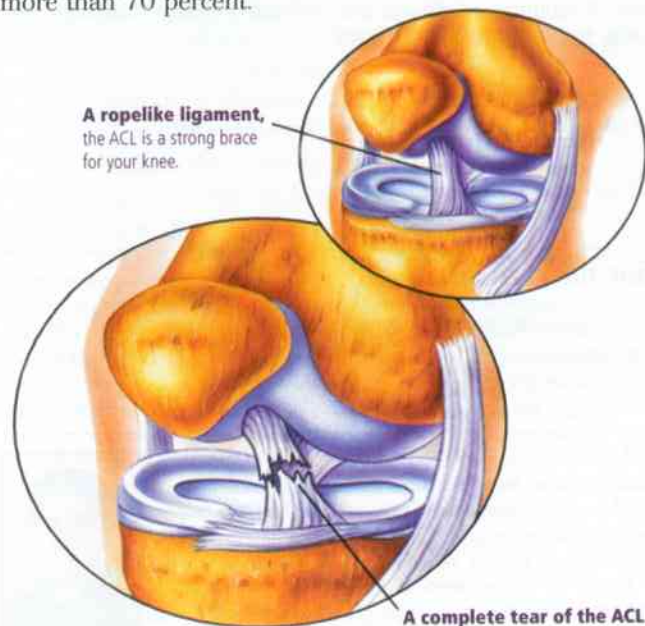
ACL Injuries in the Female Athlete

By David Gallegos, ATC

The Numbers

Since the 1972 Title IX educational amendment, there has been a 10-fold increase in girls participation in high school athletics. A direct result of increased participation has been an increase in knee injury rate. It is estimated that 100,000 Anterior Cruciate Ligament (ACL) injuries occur each year with more than half coming from sports. Women account for two-thirds of these injuries. Approximately 30,000 high school female athletes will sustain an ACL injury each year. Research has indicated that basketball and soccer produce injury rates two to eight times greater for women than men.

With an average cost of \$17,000 and lost participation times of four to nine months. The immediate impact is obvious. Long-term complications such as a 10-fold increase in arthritis risk regardless of surgical intervention highlight the importance of injury prevention. Anterior cruciate ligament injury prevention programs have proven to reduce this risk by more than 70 percent.



Anatomy

The Anterior Cruciate Ligament (ACL) is one of two ligaments crossing inside the knee. It connects the femur to the tibia. Its functions are to support the knee during rotational stress and to prevent the tibia from sliding forward on the femur. As a result, the ACL is critical in jumping, planting and cutting maneuvers.

Assisting the ACL are the thigh muscles with the hamstrings playing a dominant role.

Anterior Cruciate Ligament Injuries

The three letters – “A”, “C” and “L” – are the most feared letters in women’s athletics. An injury to the ACL is usually accompanied by an audible “pop” and a feeling of the knee shifting or giving out. The majority of ACL injuries sustained by women are termed non-contact. Non-contact ACL injuries are simply defined as a tear to the ACL without outside trauma. Research has shown of the non-contact ACL injuries, 29 percent are directly related to landing and planting with the knees in an inward position. An additional 28 percent are due to landing in an unaccommodating upright position. Finally, 29 percent are due to landing with the knee straight. These percentages can be greatly reduced through participation in an ACL injury prevention program.

Anatomical Risk Factors

Many anatomical reasons have been postulated to explain the increased ACL risk for women. Knee angle, limited anatomical space and lax ligaments are some of the current theories.

While pre-puberty risk is equal among boys and girls, puberty produces a change in hip and knee angle. This change places an increased inward force on the knee. As the inward force increases, the ACL strain and injury rates increase.

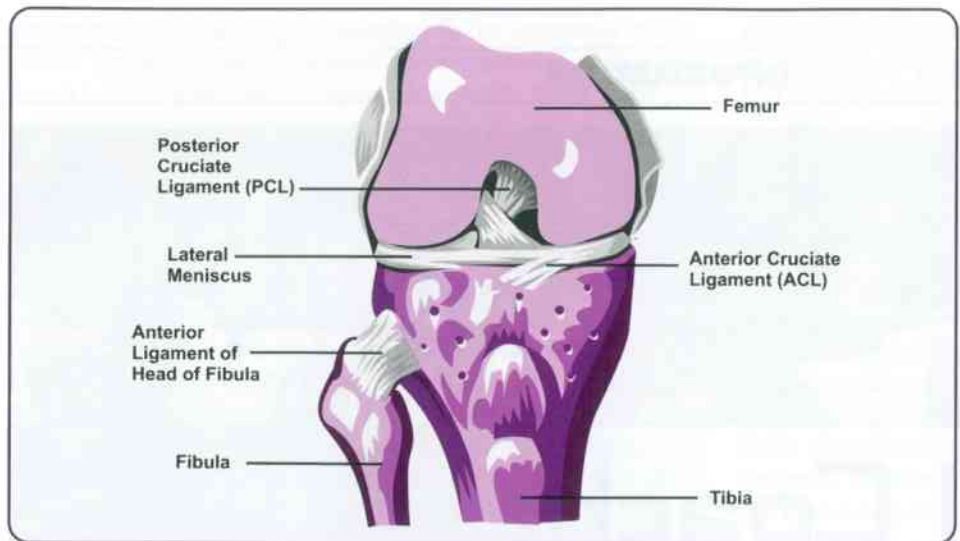
It is also hypothesized that the internal space provided to the ACL and nearby PCL is not sufficient enough causing unnecessary friction and an increase risk of ligament failure.

Finally, current theory suggests women have an increase in ligament flexibility that could cause an increase in injury rate.

Anatomical risk factors are currently under debate and more importantly do not support a viable prevention strategy.

Hormonal Risk Factors

Recent research indicates normal female monthly cycles produce hormonal changes that affect the flexibility of ligaments and muscles. Injury patterns are currently being studied to clarify this relationship.



Neuromuscular Risk Factors: Imbalances

Multiple muscle imbalances have been identified as causes of ACL injuries.

The quadriceps-to-hamstring strength ratios should be approximately 66-70 percent. Findings indicate most male athletes fall in this category while female athletes tend to exhibit a much lower ratio. On average, women's hamstrings are 40-45 percent as strong as the quadriceps. This is important because the hamstrings have a supportive relationship with the ACL while the quadriceps produce harmful stresses. Proper strength ratios are therefore vital.

Research has also indicated the activation rate for the hamstrings during landing and cutting is six-tenths of a second slower than men. Although this seems insignificant, that split second is contributing to the higher injury rate. Leg dominance is the final imbalance factor that has proven to be a key player in injury rates. The weaker, non-dominant leg is showing poorer technique, endurance and balance, which is directly related to injury risk.

Muscle imbalances are easily identified and a part of an ACL prevention program. Strength training, plyometrics and jump training are targeted to address these imbalances.

Anatomical Risk Factors: Proprioception

Spatial awareness and coordination (proprioception) during jumping and landing has proven to be a major component of ACL injury prevention.

The athletic position, defined as weight on the balls of the feet, knees flexed and above the balls of the feet, hips flexed and shoulders over the knees represents the safe position during jumping and landing. Women have consistently performed poorer in maintaining an athletic position during sports activity. Landing in a more upright position with knees falling inward and weight on the heels has produced significant risk for ACL injury.

Failing to maintain this athletic position during changes in direction has also contributed to increased injury rates.

Utilizing this ready position reduces injury risk as well as increasing athletic performance. **CQ**

Additional References for More Information

New Mexico State University Sports Medicine Camps. Contact: Jeb Davis: Camp Director. 505-646-5038.

Santa Monica ACL Prevention Project. <http://aclprevent.com>.

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