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ACL Injuries in Women

Each year, more and more women discover the rewards of sports participation. Unfortunately, an increased number of anterior cruciate ligament (ACL) injuries has accompanied the increased participation. ACL injuries in female athletes are an epidemic problem facing women, coaches, and the sports medicine community. The injuries generally occur without contact from another person and most often occur while the athlete is participating in basketball, gymnastics, or soccer.

Female athletes have four to 10 times more ACL injuries than male athletes have. The reasons for the different rates of injury in men and women are not clear, but some theories include differences in anatomy, knee alignment, ligament laxity, muscle strength, and conditioning.

Anatomic differences

In the knee joint, an intercondylar notch (compartment) lies between the two rounded ends of the thigh bone (femoral condyles) (Fig. 1). The ACL moves within this notch, connecting the femur (thigh bone) and tibia (shin bone) and providing stability to the knee. It prevents the tibia from moving too far forward and from rotating too far inward under the femur (see [*Anterior Cruciate Ligament Injuries*](#)).

Women have a narrower notch than men have; therefore, the space for ACL movement is more limited in women than in men. Within this restricted space, the femoral condyles can more easily pinch the ACL as the knee bends and straightens out, especially during twisting and hyperextension movements (Fig. 2). Pinching of the ACL in the joint can lead to its rupture (or tear).

Alignment of the knee

In the knee, the femur meets the tibia at an angle (called the quadriceps, or Q, angle). The width of the pelvis determines the size of the Q angle. Women have a wider pelvis than men have; therefore, the Q angle is greater in women than in men. At this greater angle, forces are concentrated on the ligament each time the knee twists, increasing the risk for an ACL tear (Fig. 3). A twisting injury in a man's knee may only stretch his ACL; however, because of the greater Q angle, the same type of twisting injury in a woman's knee may cause a complete ACL tear.

Ligamentous injury

Female hormones allow for greater flexibility and looseness of muscles, tendons, and ligaments. This looseness helps prevent many injuries because it enables certain joints and muscles to absorb more impact before being damaged. However, this looseness does not necessarily prevent an ACL injury in a woman's knee. If the other ligaments and muscles around the knee are so loose that they cannot absorb the stresses put on them, then even normal loads or forces may be transferred directly to the ACL, making it prone to rupture. In this sense, the ACL not only has to maintain stability about the knee, but it also must make up for instability in a generally loose knee.

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During the menstrual cycle, hormone levels vary and may affect knee stability. Recent studies have shown that, at specific points within the menstrual cycle, the knee becomes looser than normal, and ACL rupture is more common.

Reduced muscle strength

When women and men compete in the same sporting events and at the same levels, they have nearly equal twisting and loading forces placed across their knee joints. However, women have less muscle strength in proportion to bone size than men have. Muscles that help hold the knee in place are stronger in men than in women. Therefore, women rely less on the muscles and more on the ACL to hold the knee in place. Once again, the ACL may have to work overtime, making it more prone to rupture.

Conditioning

Traditionally, male athletes participate in twisting sports (such as basketball, football, and soccer) from a very early age. They develop muscle coordination and reflexes that can protect the knee once they reach the competitive level. These knee reflexes allow strong muscles to control the knee, thereby maintaining stability in it. Some female athletes do not participate in the same sports until a later age. Therefore, their muscle strength and coordination, as well as reflexes, may not be as fully developed when they reach the competitive level. The ACL must provide most of the stability in these knees.

Researchers currently are investigating epidemics of ACL tears in women's sports. Any one or all of the theories presented here may contribute to the increased number of ACL tears in female athletes. As women begin participating in sports at an earlier age and as they continue conditioning and strengthening the muscles around their knees, we hope that the rate of ACL tears in women will diminish.

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