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## ACL Injury and the Female Soccer Player

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The anterior cruciate ligament (ACL) has received a lot of press over the past several years, especially in how it relates to the female athlete. Much of the attention has focused on the seemingly higher injury rates in female athletes as compared to males. Numerous research studies that have been conducted over the past 10 years indicate that females are indeed more susceptible to ACL injuries; most studies report that females are 4-8 times more likely to tear this ligament. The heavily pursued goal that many in the medical community have tried to answer is determining the specific reasons why females suffer from this injury more than males.

The ACL is located deep in the middle of the knee, and along with several other ligaments, connects the femur (thighbone) to the tibia (shinbone). Its major purpose is to prevent the tibia from moving too far forward in relation to the femur, and to control the amount the tibia rotates. The ACL is typically injured when a player makes a cut, lands from a jump, or is hit by an opposing player (causing the knee to bend and rotate excessively). When this ligament is torn, the chief complaint is usually a "buckling" or "giving way" sensation in the knee. The reason for this is the ACL's major role in providing stability to the knee; when it is damaged, instability will result.



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Over the years, there has been much debate as to why females are more susceptible to ACL injury. Some of the commonly reported causes are: structural differences in the knee; size of the ligament; alignment of the lower extremity; skill / conditioning deficits; strength deficits; and hormonal influences. While some of these factors can and probably do play a role, recent studies indicate that running and jumping technique might be the major influence in these injuries.

Recently performed studies in 1999 showed that when females landed from a jump, several things occurred that differed from males:

1. Females had a tendency to land on straighter knees, which places more stress on the ligaments and the knee in general.
2. Female knees "buckled" inwards more than males; this directly stresses the ACL.
3. Females muscle activity tended to be the opposite of males. The hamstring muscles (back of the leg) are very important in helping the ACL prevent the tibia from moving too far forward. Male athletes activated the hamstrings sooner and more often than female athletes; this predisposes the females to ACL injury.
4. Females exhibited a muscular imbalance between the hamstrings and quadriceps (front of the thigh). The hamstrings were significantly weaker than the quadriceps, relatively speaking. Once again, this can make the female athlete more prone to injury.

The question now is: how can the female soccer player help prevent an injury to the ACL?

Unfortunately, the answer is not simply strengthening the legs, as many have been lead to believe. Although strong quadricep and hamstring muscles may play a role in injury prevention, those programs alone will not be sufficient. When it comes to the ACL, it is more important to: learn the correct technique for cutting and jump landing; train the proprioceptive system to improve balance; improve functional strength of the lower extremities; and improve the quality and speed of footwork.

#### **\* Jump landing**

As stated previously, females have a tendency to land on stiffer, straighter knees that "buckle" inwards. The result is a landing that is very noisy (feet slapping on the ground), or one in which the knees assume a "knock-kneed" position. It is extremely important to re-train how the female lands from a jump, and this can be accomplished using the following pointers:

1. Make the landing as soft as possible; do not let the feet make a lot of noise when they contact the ground. The best and most appropriate way to accomplish this is by flexing (bending) the knees on contact. This forces the muscles of the legs to absorb the force of landing, as opposed to the ligaments and bones.
2. As the knees flex during landing, make sure they travel in a path straight forward; do not let them come closer together. The ending position for the knees should be directly over the feet.
3. The chest should remain over the knees; do not bend too far forward at the waist, and do not "sit back on your heels." Remember the saying "chest over the knees over the feet" to remind you of the proper landing position.

### \* **Proprioceptive / balance training**

The sport of soccer is essentially a single leg sport, with most skills being performed while standing on a single leg. The best way to train for this is by performing exercises that require balancing during adverse conditions: standing on unstable surfaces; volleying while balancing on one leg; and performing single leg vertical jumps and landing on one leg. As with the jump training, maintaining good lower extremity alignment and proper technique are essential.

### \* **Functional Strengthening**

In the past, too much emphasis has been placed on strengthening programs that focus on weight machines. The two major problems with these programs are:

1. they do not improve the ability to control the body or momentum generated during movement (as occurs in any athletic activity);
2. youth players simply will not do it secondary to a limited access to a full gym, or due to the monotonous nature of weight machines. There is a direct correlation between the ability to control momentum and jump landing; the inward "buckling" that occurs when landing is due to an inability to control this adverse motion. Strengthening programs that stress weight machines will result in strong legs that still buckle inwards. Exercises that are more functional and more appropriate would be lunges, single leg squats, and step-ups. Emphasis must also be placed on the hip abductor muscles (muscles which raise the leg out to the side). Deficiencies in strength of these muscles will result in an inability to prevent the inward buckling of the knee, and may also lead to general patella (kneecap) pain, which is very prevalent in the female athlete.

### \* **Footwork**

Recent studies have shown that simple agility/footwork training can have a beneficial effect on injuries. The key is to be able to move the feet quickly, softly and with a specific purpose. One of the more popular tools for training this component is the "Agility Ladder" or "ABC Ladder." These ladders can be obtained from any strength and conditioning catalog, with videos demonstrating sample drills also available. It is critical that these drills are not performed with a "high knee" technique, which is often seen. Soccer is not played in this manner; the goal should be to get the feet back down to the ground as quickly as possible in preparation for the next skill that needs to be performed during the match.

The goal of this article has been to provide some insight into the most recent research regarding ACL injury prevention. While the prevention of ACL injuries is a very hot topic, it must be stressed that there is no way to prevent their occurrence 100% of the time. A major contributor to injury is pure chance, and if an opponent collides with the outside of your knee, for instance, the strongest leg in the world would be hard pressed to prevent injury every time. However, by following the program outlined above, the risk of ACL injury can be significantly diminished.

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