

*From the U.S. Soccer Communications Center -- May 26, 2009*

## **Prevent Common Injuries in Soccer: Knee Injuries**

The top four time loss injuries in soccer are ligament injuries (to the ankle and knee) and muscle strains (to the hamstrings and groin). The top injury depends on the level of play. In highly intense, competitive soccer, hamstring strains are being reported as the top time loss injury. In lower levels of play, the lateral ankle sprain is the most common time loss injury. But the injury that leads to the most concern, especially amongst middle and high school aged females, their families and coaches, is an injury to the knee, specifically to the anterior cruciate ligament.

While an injury to the ankle is usually isolated to the lateral ankle ligaments, injury to the knee is far more complex and varied. Injuries can happen to the ligaments, tendons, meniscus, or articular cartilage. This all too brief description may stimulate your interest to learn more about any specific injury.

**Ligaments:** There are four primary (and a number of supporting) ligaments. The (medial and lateral) collateral ligaments are located on each side of the knee and prevent the knee from collapsing inward (valgus) or outward (varus). The MCL is injured during the classic 'clip' in American Football. An injured LCL is pretty rare. Injuries to the MCL and LCL rarely require surgery. The other two, the anterior and posterior cruciates, are located within the joint and restrict rotation and anterior and posterior movement of the tibia under the femur. These are usually injured during over rotation of the tibial alignment with the femur.

**Tendon:** The main tendon of the knee connects the quadriceps muscle to the patella and tibia. The most common injury is related to overuse, sometimes called a 'jumper's knee'. There are reports of the tendon tearing, but this is pretty rare and doesn't happen to a normal tendon. The problem is no one knows they have a diseased tendon until it tears.

**Meniscus:** These two crescent moon shaped cups sit on top of the tibia, cushioning the femur. What these discs do is quite complex and injury to a meniscus leads to problems later. Rotation of the femur over the tibia is the usual cause of meniscus injury. If you read of an athlete having arthroscopic surgery and returning to play within a few brief weeks, it's probably safe to assume an injured meniscus was the surgical target.

**Cartilage:** Covering the ends of long bones, including the femur and tibia, is a remarkable tissue that protects the underlying bone during movement. Left undamaged, this tissue can last a lifetime. Knee function is severely limited if the articular cartilage is damaged by injury or arthritis. Surgical repair techniques are still evolving. When you read of an athlete retiring because of some generalized knee issue, you could be safe in guessing that articular cartilage damage is at the root of their inability to continue playing.

In [a previous post](#), the research process for injury prevention was presented. First, establish the incidence of injury. Second, determine how the injury happens. Third, devise a prevention protocol and finally, determine if the post intervention incidence is indeed lower.

While there are a number of potential injuries to the knee, most of the prevention programs are directed at preventing ACL injury. What is interesting is that the interest in the ACL is relatively new; the first paper on ACL surgery was published in 1972 and to date there has been nearly 9000 scientific papers published about the ACL. Googling 'anterior cruciate ligament' today resulted in nearly 1.1 million hits.

Let's follow this injury prevention protocol as it has been applied in a few programs specifically designed to prevent ACL injuries. The main locations for ACL prevention research are the Cincinnati Children's

Hospital Medical Center and at two FIFA Medical Centers of Excellence – Santa Monica Orthopaedic and Sports Medicine and the Oslo Sports Trauma Research Centre.

### **Step 1: Just what is the rate of ACL injury in soccer?**

An ACL rupture is certainly one of the most serious knee injuries in sport, but with surgery and rehabilitation, most athletes return to play within 6-12 months. The actual rate of ACL injury varies according to sex, age, sport and more. More males are injured simply because more males than females play sports. Surgical records of physicians show that ACL injuries in sports are mostly non-existent before puberty. The numbers begin to climb beginning about the age of 14 and peak in high school, and then drop a bit to a plateau during college years before dropping again. Thus, one sees there are essentially three distinct injury rates based on age: 14-18 (middle/high school), college years, post college. Not many studies look at all these age groups and when comparative data are used there comes some error of estimate.

Some of the best sports injury data is contained in the NCAA Injury Surveillance System. For over 15 years, the NCAA catalogued injuries across all sports and divisions and is probably one of the most stable databases on sports injuries in the world. The injury rate for all injuries in male college soccer is 16.4 injuries per 1000 athlete-exposures (1 athlete playing or training for their sport = 1 athlete exposure or A-E). The rate for female players is 5.2. The rate for only ACL injuries is .13 and .31 injuries per 1000 A-E. You can take two things from this basic information. First, ACL injuries are pretty rare. For men, that's less than 1 percent of all injuries, but higher in women at about 6 percent of all injuries. Second, these numbers show the female/male differences in rate showing the often reported statement that female soccer players tear their ACL at a rate of two to three times more often than males. It's a pretty rare injury in professional males and only one occurred at the 2006 FIFA World Cup in Germany.

### **Step 2: How do injuries occur?**

ACL injuries can happen from direct contact to the knee, but most often the injury happens in the absence of any direct impact on the knee. The usual description is a rotation of the femur over a fixed tibia when the knee is near full extension. During play, this could be when a player plants their foot and changes direction. A specific and complex sequence of events has to happen to tear the ACL. Most feel that if the knee is near extension and then collapses inwards, the ACL is placed under considerable strain and can tear. When it does tear, the athlete feels immediate pain and instability of the knee. They may even hear an audible 'pop' when it ruptures.

Why women have more injuries than men is a matter of intense study. Most reports focus on differences in how women land and cut. Men tend to lower their center of gravity when landing or cutting while women do these in a more erect posture. Cutting or landing on an extended knee places the ACL at risk. As you will see, programs include many activities designed to control the knee during these risky actions.

### **Step 3: Devise prevention programs.**

Many prevention programs have been attempted, but the most effective and successful programs combine core strength and neuromuscular control of the knee during landing and cutting. While each program has some variations in technique, they all have commonalities. For simplicity sake, I'll briefly describe the program from the only FIFA Medical Center of Excellence in the US, the Santa Monica Orthopaedic and Sports Medicine. You will need to access the detailed instructions at <http://www.aclprevent.com/PEPExercises.pdf>.

1. Warm-up: Back and forth across the field, jogs, then zigzag run, then jog backwards.
2. Stretch: calf, quads, figure four hamstrings, inner thigh, and hip flexor.
3. Strengthening: walking lunges, Nordic hamstrings (link that word to the hamstring article?), single toe raises.
4. Plyometrics: lateral hops over a cone, forward/backward hops over a cone, single leg hops over a cone, vertical jumps with headers, scissors jumps.
5. Agilities: shuttle run forward and back, diagonal runs, bounding run.

Alternative exercises are offered for variety. These include bridging with alternating hip flexion, abdominal crunches, sitting and double knee to chest, figure four piriformis stretch and seated butterfly stretch.

Once everyone learns the sequence of events, this series of exercises takes about 20 minutes to complete. And these have to be done regularly. None of this 'one and done' or 'two and through' when it comes to injury prevention; these are an everyday part of training that need to be constantly supervised. Other injury prevention programs can be found in the reference list below.

**Step 4: Re-assess injury rate to determine the program's effectiveness.**

Most injury prevention programs lead to overall reductions in injury rates of 30-40 percent. The PEP program described above was conducted over two years in an entire league of young female soccer players in Southern California. About half the teams chose to follow the PEP plan and the remainder carried out their usual warm-up. The study team recorded all injuries over the full 2 years.

After the 2-year intervention program, the teams who followed the PEP program sustained 30% fewer injuries than the other teams. But most importantly, the intervention teams amazingly had 67 percent fewer ACL injuries. When the program was used in college-aged women, there were 70 percent fewer non-contact ACL injuries in the intervention teams. Look at some of the other studies listed in the reference list for other exercises.

What is interesting about prevention programs is that they truly work. Look around at most training sessions and you will probably see well-designed practice plans for skills and tactics, but the weakest part of a training session is likely be the warm-up. So rather than just leave the players to themselves for warm-up, consider a plan that follows some of these programs. You will have a healthier team with fewer injuries better prepared to fulfill your vision of how you want your team to play.

For more information:

At [www.FIFA.com](http://www.FIFA.com), scroll down and click on 'players health'. Click on the picture that links to The 11, then click on Launch The 11. A list of exercises making up the FMARC 11 is displayed on the left. View the videos and download a poster or instruction booklet.

A newer version of The 11 is available and is called The 11+. Download a poster explaining the program at:

<http://www.fifa.com/mm/document/afdeveloping/medical/97/48/07/11+%5fposter2n.pdf>

Access the entire PEP program at: <http://www.aclprevent.com>