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For Girls, Learning the Right Moves May Prevent A Common Athletic Injury

By Michael Sokolove
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Silver Spring United, a girls' under-16 soccer team, assembled for practice one day last month and started into its regular routine, one that is a little different from that of most teams. Before working on their soccer skills and tactics, the girls spent about 15 minutes practicing how not to suffer a rupture of the anterior cruciate ligament (ACL), the knee injury that is the scourge of women's sports.

The girls jogged around the field for a few minutes to warm up. They stretched their calf, quadriceps, hamstring and hip muscles, making sure to hold each one for 30 seconds. Then they moved on to the most important part of the program: a series of "plyometric" exercises designed to improve their balance and form when decelerating from sprints and landing from jumps.

They made short jumps forward, backward and laterally, each time concentrating on cues they had learned at the beginning of the season: "Keep your toes pointed straight ahead." "Keep your knees over your toes." "Land softly on your toes while bending your knees." They practiced heading the ball, making sure never to come down on just one leg. They balanced on one leg while tossing a soccer ball.

It was all utterly unremarkable to watch. The exercises were not arduous or complicated, which was part of the point: Silver Spring United is enrolled in a study to see whether ACL injury prevention can be broken down to its essentials and brought to community athletic fields.

A regular observer of these exercises is Maj. Anthony Beutler, an Air Force doctor and ACL researcher. This is his study, funded by a small grant from the School of Medicine of the Uniformed Services University in Bethesda, where he is an assistant professor.

"I find it amazing more teams do not do something like this and that more parents don't demand it," Beutler said earlier in the season. "Parents are smart and highly involved in their children's lives." He estimated that among competitive girls' club teams in the Washington area, "one in four do some form of this training, something that could be construed as involving injury and ACL prevention. Half of those (one in eight) do it to some level of competence, meaning they have some professional -- a trainer, physical therapist, someone knowledgeable about exercise science -- who can institute it."

In sports that both sexes play using similar rules -- soccer, basketball, volleyball -- researchers estimate that female athletes rupture their ACLs at rates as high as five to eight times as great as men. The reconstructive surgery after an ACL

rupture is complicated, the rehabilitation painful and long, and those who suffer an injury are at high risk for developing arthritic knees.

While ACL damage can be caused by slamming into another player and buckling the knee, the causes of non-contact ACL injuries are not fully understood, nor are the reasons female athletes are so much more prone to them. Women are, on average, more flexible than men, a performance advantage in many sports but an injury risk when not accompanied by the muscle strength to keep joints in stable positions.

Women's wider hips may also put more stress on the knee, and researchers have looked at hormonal factors as well. But they are most intensely interested in biomechanical factors that can be modified: Women tend to run differently, with a more upright posture than men's.

Beutler compares an ACL rupture to a sudden mechanical malfunction. The body fails to perform a task that it has successfully executed thousands of times, and a surge of energy -- rather than being absorbed in the lower leg and up through the trunk -- sinks into the knee and rips apart a crucial component.

"What we are trying to do with these girls is reprogram their minds to jump and land in such a way that there is some slack in the system," he explained. "We think one of the big things is to avoid rotation of the hips and knees. We want everything in line. Hips over knees. Knees over ankles. Ankles over toes. If you had to tell someone one thing, it would be: Land softly. Use your knee as a hinge."

Beutler is also associated with a National Institutes of Health-funded ACL study that is following students at the three major U.S. military
academies. Led by researchers from the University of North Carolina's School of Public Health, that study is building a database of thousands of subjects and, using sophisticated equipment, compiling the digitized images of their jumping and landing forms. The goal is to identify common risk factors among those who go on to suffer ACL ruptures.

Beutler's project is smaller and much more low-tech. Twenty-five teams playing in Montgomery County (14 of them girls' teams) are enrolled. At the beginning of the season, each player is videotaped as she jumps and lands from a small platform. They are graded by the researchers according to their perceived risk for ACL injury. One whose knees cave inward on impact, for instance, would be judged high-risk. The players are videotaped again at the end of the season to see whether the exercise program has improved their form.

Beutler's exercises fit on a single sheet of paper, and he notes that the videotaping takes place with a camera "that anyone could buy for a couple of hundred bucks." Beutler and his research assistants have begun conducting customized exercise programs for players deemed at high risk.

"This is the wave of the future, where we can bring prevention to this level, out of the laboratory and onto a field," Beutler said. "I think we are getting to the point where we can look in real time and say, with 95 percent certainty, 'You are at low risk. You're at moderate risk. And you're at high risk.' And we can design programs for each of those athletes."

Beutler did not want any recreational-level teams in his trial because they move more slowly and create so little force that they don't stand much chance of hurting themselves. Silver Spring United, a mix of varsity high school players and some junior varsity performers, competes in the classic division of Montgomery County Soccer Inc. "I saw a need [for injury prevention], and I went looking for something," said their coach, Karen Giacopuzzi, who signed up with Beutler after learning that he was seeking teams in the area.

Her players have made ACL prevention part of their routine. The captains led the exercises, with Giacopuzzi standing off to the side. In the season before entering Beutler's program, team members suffered two knee injuries, both of them meniscus tears that required surgery. They have had no significant knee injuries in the 18 months since.

Michelle Morris, 16, caught Beutler's attention because he thought she looked like the best athlete on the field. She moved with a low center of gravity and a springiness, the opposite of the stiff, upright gait that causes alarm. She was among several of the Silver Spring players who said she thought the exercises had improved her form. "I think my balance is way better now," Morris said. "I never learned how to land properly. I fell down a lot, but now, not at all."

The response was significant to Beutler because several studies have identified poor balance as a predictor of ACL

injuries. An athlete who loses balance may twist her body at inopportune times -- for example, with one leg planted and extended out from her body -- while she is stopping or trying to change direction.

This is the third year of Beutler's pilot study, and for the first time, a player on one of the teams under study (a girl) has torn an ACL. He went back and looked at the videotape of her form when she jumped off a platform, and it revealed what he expected: Her knees caved in on landing, and she scored at high risk. The program did not protect her, but it seems to have had a positive effect on others.

It is not a huge group that Beutler has been observing. Nevertheless, the nearly total absence of injuries has encouraged him, considering that it is not uncommon for just one high school or club team of girls to suffer multiple ACL injuries in one season. He has seen one out of a group of about 400.

Studies elsewhere indicate that even relatively low levels of intervention -- swapping out a traditional warm-up for one that includes injury prevention -- may have an impact on lowering ACL injury rates.

The question remains whether coaches will buy in, especially coaches of go-go club teams seeking entries to the most prestigious tournaments and scholarships for their players. They often do not like to do anything they perceive as subtracting from practice time.

Beutler's answer is straightforward: "But you've got to do a warm-up anyway. So why not do this or something like it?"

This article is adapted from "Warrior Girls: Protecting Our Daughters Against the Injury Epidemic in Women's Sports," published this week by Simon and Schuster. Comments:health@washpost.com. Michael Sokolove will be live online at noon today to answer readers' questions at www.washingtonpost.com/health.

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A Tiny Ligament With a Big Job

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Scroll down for further info on the ACL

The anterior cruciate ligament, or ACL, is one of two pieces of tissue that form a cross in the joint under the kneecap. The posterior cruciate ligament, or PCL, which rarely tears, is in the back, and the ACL is in the front of the knee. It stops the tibia from slipping in front of the femur. Considering the big job that the ACL performs, which is to provide rotational stability to the joint, it is tiny: about 30 millimeters long, smaller than a little finger, and less than 10 grams in weight.

Its shape is rectangular, as if you cut a rubber band open and stretched it against a flat surface.

An ACL rupture (also called a tear) happens on the field of play in one of two ways:

· Contact, which is the most frequent cause in football. The injury occurs when, for example, a shoulder pad or a helmet crashes into the knee, buckling it.

· Non-contact, which is the predominant cause in other sports. In these cases, the knee fails as an athlete lands from a jump, after attempting a rebound or a headed ball, for example. A rupture can also happen when a sprinting athlete slows to make a turn.

-- Michael Sokolove