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WHAT IS THE ACL?
WHY ARE GIRLS AT RISK?
HOW TO PREVENT INJURY?



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ACL INJURY PREVENTION GUIDE

For Female Athletes

BY **KEN BERGER**

MAX VELOCITY FITNESS + PERFORMANCE

The Ultimate Guide to Girl Power

STRONG
STRONG
STRONG

DOMINANT
DOMINANT
DOMINANT

One of the first things I remember about Teri DellaVecchia is that she was always lifting weights with a knee brace. Not a knee sleeve or a wrap, mind you ... a full-on knee brace.

The kind of contraption that 300-pound offensive linemen wear in the NFL.

As it turned out, that piece of equipment had a story to tell. And unfortunately, it was the story of the modern-day female athlete.

Teri, one of the original trainers at Max Velocity Fitness + Performance, started participating in organized sports a bit later than her brothers and boys of a similar age. She was active in swimming and cheerleading in elementary and middle school, but didn't play competitive soccer until she was in high school. When she got to the College of Mount Saint Vincent and made the women's soccer team, she decided to try her hand at lacrosse, too.



Playing a sport for the first time as a collegian? That's unusual. But unfortunately for Teri, another aspect of her athletic journey was far more typical: She tore her anterior cruciate ligament (ACL) when she was 18 years old.

"I can't really pinpoint when it happened," she said. "All I know is, one day I had a doctor tell me I had torn my ACL and would probably never play competitive sports again. Those are words that a young athlete never wants to hear."

For teenage girls playing competitive sports, torn ACLs have become an epidemic. Little did Teri know that she and her college roommate -- who also tore her ACL when she was 17 and hobbled around campus on crutches with Teri for an entire semester -- were especially vulnerable to this devastating injury.

Girls between 15-19 years old make up the largest population of ACL tear victims, according to the Lurie Children's Institute for Sports

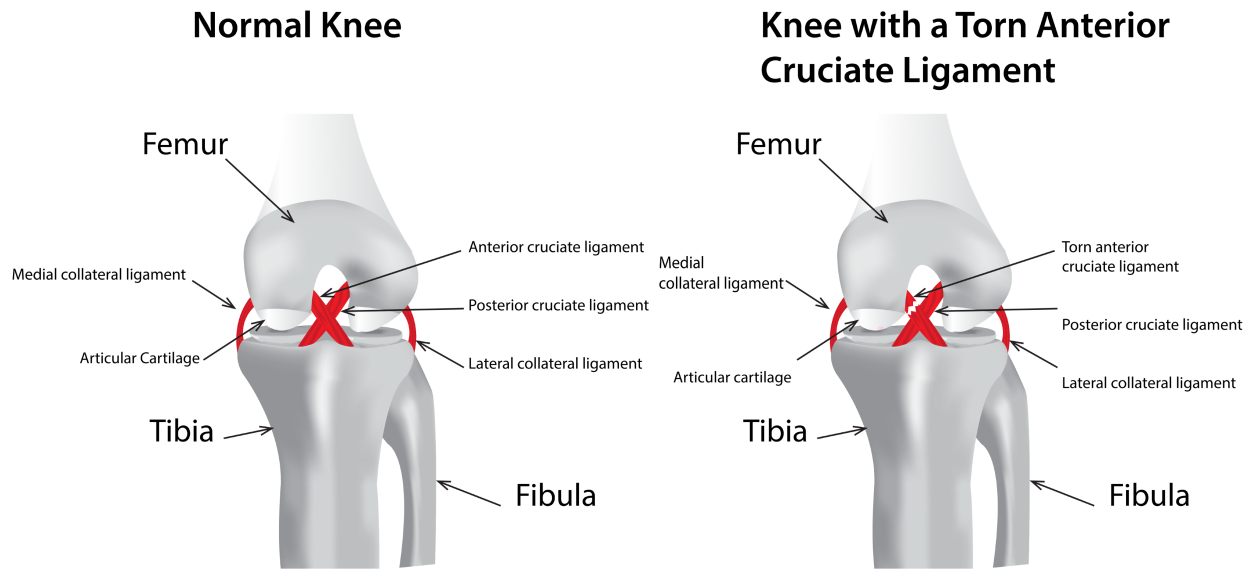


Medicine in Chicago. Additionally, compared to boys playing similar sports, girls have a 4-6 times higher risk of tearing their ACLs. They're more likely to require surgery, and they're less likely than boys to return to sports after the injury.

In this guide, we're going to explore:

- **Function:** What the ACL is and what it does.
- **Risk Factors:** Why female athletes are more prone to ACL tears.
- **Prevention:** Exercises and training techniques that have been proven to reduce ACL injuries by up to 82 percent.

Torn Anterior Cruciate Ligament



What Is The ACL And What Does It Do?

The ACL is one of four major ligaments connecting the knee joint, which forms a hinge between the femur (upper leg) and tibia (lower leg). It runs diagonally through the middle of the knee, providing rotational stability to the joint, according to the American Academy of Orthopedic Surgeons (AAOS).

It is also one of the most commonly injured ligaments in the knee. Incidence of ACL injuries is currently estimated at 200,000 annually, with about half those injuries resulting in reconstructive surgery.

Risk Factors

It is estimated that at least 70 percent of ACL injuries are of the non-contact variety. Such injuries often are associated with “deceleration coupled with cutting, pivoting or sidestepping maneuvers, awkward landings or ‘out of control play,’” [according to AAOS](#).

Why are girls at a higher risk for ACL injuries? Let’s explore the research.

The sports with the highest incidence of ACL injuries for girls are soccer and basketball, according to the Knee Injury Prevention Program (KIPP) at Lurie Children's Institute. This is due in part to the popularity of these sports for girls; 25 percent of adolescent girls play competitive basketball, while 17 percent play soccer, according to a study

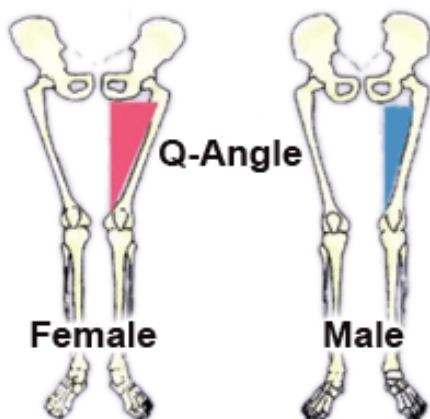


performed for the United States Tennis Association. It's also the nature of the sports, which involve repetitive episodes of deceleration, cutting, changing direction, jumping and landing.

The most common fault noted in ACL injuries is known as "dynamic knee valgus," a mechanism by which the hip is internally rotated and adducted, the tibia is externally rotated and the ankle is pronated (or collapsed).

Several theories have emerged as to why girls experience a higher rate of ACL injuries. Let's explore them:

1. Hormones: Researchers have explored whether higher estrogen levels and hormonal fluctuations due to the menstrual cycle are responsible for girls' increased risk for ACL injuries. The data have demonstrated no relationship between the two, according to KIPP.



2. Anatomy: Girls have a wider pelvis and quadriceps angle (or "Q-Angle") than boys. But studies have failed to link this anatomical difference with girls' higher risk for ACL injuries.

3. Ligament Laxity: Girls tend to have more laxity in their ligaments,

making them more prone to knee hyperextensions. Studies have demonstrated that this could account for as much as a 2-3 times higher risk for girls suffering ACL injuries, but it does not fully explain the gender gap.

4. Neuromuscular Function: Herein lies the most persuasive evidence explaining girls' higher risk for ACL injuries, according to KIPP. Girls' muscles tend to fire differently than boys' during athletic maneuvers, which could be explained by the burst of testosterone that boys receive during their pubescent growth spurt. This increase in testosterone results in larger, stronger muscles that are able to control the athletes' new height and weight. Girls lack this testosterone boost, which compromises their ability to stabilize their joints while engaged in athletic activities.

Four key areas of neuromuscular differences between boys and girls have been demonstrated:

1. Quadriceps Dominance: Girls tend to have overdeveloped quadriceps (the larger muscles in the front of the thighs that serve as prime movers for athletic movements like running and jumping). This imbalance relative to the muscles of the posterior chain (gluteal and hamstring muscles) is indicated by poor hip and knee flexion, which translates uneven forces to the knee.

2. Uneven Weight Distribution: Females are more likely than boys to have one leg stronger than the other. This bilateral imbalance is a strong risk factor for ACL injuries.

3. Ligament Dominance: When landing, girls' knees tend to collapse inward (valgus collapse) because their bodies rely more on ligaments than muscles to stabilize the knee joint. This is a blueprint for an ACL injury.

4. Poor Core Stability: Girls tend to have relatively weaker core muscles compared to boys of the same age. This results in less coordination between trunk and leg movements, placing the knee at increased risk for the valgus forces that often result in ACL injuries.

Fortunately for today's female athlete, these movement patterns and structural faults can be modified with a well-designed strength, stabili-

ty and corrective exercise program. Now let's explore some of the progressive strength, balance and plyometric (jumping and landing) exercises that have been demonstrated to [reduce ACL injuries by up to 82 percent.](#)

Prevention

According to the American Journal of Sports Medicine, the combination of both in-season and off-season training has been shown to be most effective in preventing ACL injuries. Additionally, the most effective tool is feedback from qualified coach or trainer, who can teach young athletes how to recognize and avoid high-risk knee positions and use safe landing and deceleration techniques.

Let's take a look at the "Core Four Exercise Series" that we use to progressively strengthen core and leg muscles; improve balance and address bilateral strength differences; and enhance proper jumping and landing mechanics to reduce our female athletes' injury risk.

Soft Tissue/Muscle Activation/Core Strengthening

We always begin training sessions with some type of soft-tissue work combined with targeted exercises that activate the stabilizing muscles that support proper hip and knee function.

Foam Rolling: Proper foam-rolling techniques can reduce muscular knots and adhesions, alleviate soreness and improve movement patterns. As a baseline preventive measure, we recommend at least one minute each on the quadriceps and iliotibial (IT) band, as demonstrated in the videos below.

[FOAM ROLL QUAD](#)

[FOAM ROLL IT BAND](#)

Muscle Activation/Core Strengthening: "Monster Walks" develop the necessary strength in the muscles that stabilize the hips and enhance external hip rotation (which, in turn, gives the athlete the ability to avoid the valgus fault that is a key contributor to ACL injuries).

Side Planks are an effective static hold that can be progressed or modified depending on the size, strength and level of the athlete. This movement addresses core strength and the stability of both hips. We

begin our athletes with three levels of this movement, as demonstrated in the videos below.

MONSTER WALKS: 1-2 sets of 5 yards each direction

SIDE PLANKS: 2 sets of :30 work/:15 rest each side

Dynamic Warmup

Once our athletes have performed soft-tissue work and muscle activation techniques, it's time to warm them up and prepare them for training. We use the same warmup in 3-4 week intervals, allowing the athletes to truly master the movements before moving on to more advanced progressions.

We'll take the athletes through a warmup that progresses from compound, active mobility movements to more dynamic movements. Below are examples of the key drills that appear in most of our sessions:

BEAR CRAWL: :30 forward/:15 rest/:30 backwards

FORWARD LUNGES: 20 reps (total/alternating)

REVERSE LUNGES: 20 reps (total/alternating)

SIDE SQUATS: 10 reps (each side)

LATERAL JACKS: 2 sets, 5 yards over and back, :30 rest

CARIOCA: 2 sets, 5 yards over and back, :30 rest

HIGH-KNEE SKIPS: 2 sets, 5 yards over and back, :30 rest

Now that our athletes are properly mobilized and warmed up, let's explore the plyometric (jumping and landing) techniques we use to protect our athletes, teach them safe deceleration mechanics and instill proper posture and mechanics for athletic movement.

Jumping/Landing

Just as an athlete would practice good posture, mechanics and technique on a free-throw attempt or penalty kick, so, too, must they practice the challenging athletic positions that they will encounter on the court or field. Running, stopping, changing direction, jumping and landing are skills that can -- and should -- be practiced.

Below are videos of the jumping and landing drills we introduce our athletes to when they begin training with us. The most important point is for the athlete to land in a stiff, stable “knees-out” position.

FORWARD-BACK JUMPS: 2 sets of :30 work/:30 rest

SIDE-TO-SIDE JUMPS: 2 sets of :30 work/:30 rest

SINGLE-LEG VERTICAL JUMP: 2 sets of :20 work/:15 rest

Lastly, let's explore how we train the posterior chain (glutes/hamstrings) to help counteract the female athlete's tendency for quadriceps dominance.

Posterior Chain

We do some kind of posterior chain activity in every session with our athletes, especially with the girls. Quad dominance has been shown to be a contributing factor to girls' higher risk for ACL injuries, and the simplest way to counteract it is to strengthen and develop the competing muscle groups: the glutes and hamstrings.

Below are training videos demonstrating two of our favorite posterior chain movements: the Banded Good Morning and the Partner Glute-Ham Raise. These exercises directly target the glutes and hamstrings and should be progressed by adding sets, reps and resistance/difficulty over time.

BANDED GOOD MORNING: 2 sets of 10 reps, :30 rest

PARTNER GHR-LEVEL 1: 2 sets of 5 reps, :30 rest

PARTNER GHR-LEVEL 2: 2 sets of 5 reps, :30 rest

ADDITIONAL RESOURCES

====> [PRIVATE YOUTUBE PLAYLIST WITH ALL VIDEOS](#) <====

====> [WORKOUT CARD TO PRINT OR VIEW ON PHONE](#) <====

Girls just wanna have fun ... and stay safe

Participation in organized youth sports has skyrocketed in recent years, with some organizations estimating that as many as 36 million kids are involved in competitive sports at any given time.

The fastest growing population? Girls. Since Title IX legislation aimed at increasing opportunities for girls in sports was passed in 1972, the number of girls competing in high school sports has increased from 295,000 to 3.4 million, according to the National Federation of State High School Associations. Similarly, the number of women competing in collegiate sports has grown from 30,000 to 216,000, according to the NCAA.

Another way to look at it: According to the Women's Sports Foundation, only 18 percent of girls between the ages of 8 and 17 *haven't* joined a sports team. Simply put, a *lot* more girls are playing competitive sports than ever before.

The benefits of sports participation have been well-documented, including the obvious health benefits. Sports participation also has been shown to enhance self-esteem, and studies have consistently linked physical activity with mental acuity.

Of course, with higher participation comes higher injury risk. According to the [National SAFE KIDS Campaign and the American Academy of Pediatrics](#), more than 3.5 million children and teens are injured participating in organized sports each year.

As we have seen, ACL injuries are among the most common -- and they afflict young girls at a much higher rate than boys.

Thankfully, it no longer has to be this way. The best trainers and coaches now have the knowledge and experience to properly train the female athlete with exercises that have been shown to reduce the risk of ACL injuries by up to 82 percent. Given the sobering statistics, we don't view this kind of training as supplemental or optional. It's a requirement and a responsibility.

There are more resources and knowledgeable trainers available to young female athletes than ever before. With techniques like those outlined in this "ACL Injury Prevention Guide for Female Athletes," we look forward to the day when the statistics tell a very different story -- one of success, achievement and safety for all female athletes.

Ken Berger is the owner and founder of [Max Velocity Fitness + Performance](#) in Bayside, N.Y. He is a certified Functional Movement Systems (FMS) trainer, Certified Speed & Agility Coach (CSAC) and Precision Nutrition-certified coach.

Ken is also a professional journalist specializing in NBA coverage. He has worked for the Associated Press, Newsday, CBS Sports, The Athletic and Bleacher Report. His award-winning work has been honored in Best American Sports Writing and with numerous top-10 finishes in the Associated Press Sports Editors writing contest. He can be reached at ken@maxvelocityfitness.com.

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