

# Female Athlete Program ACL Injuries



Boston Children's Hospital  
Sports Medicine

[bostonchildrens.org/sportsmed](http://bostonchildrens.org/sportsmed)  
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## What is the ACL, and what causes ACL injuries?

The anterior cruciate ligament (ACL) is located inside the knee joint and is a major stabilizer of the knee, particularly for activities where the athlete is changing direction, like pivoting. Many athletic moves can put a lot of stress on the ACL: changing direction quickly, slowing down or stopping, colliding with other players and landing after a jump. Athletes who participate in sports like basketball, soccer, tennis and gymnastics are particularly susceptible to ACL injuries.

Fortunately, overall fitness, targeted exercises and proper athletic technique can reduce the risk of ACL injuries, and most injured athletes can eventually return to their normal activity.

## What makes female athletes more at risk?

Girls are five times more likely than boys to tear an ACL. Though the reasons are still being researched and debated, there are a few common theories:

**Anatomical differences** Because boys typically develop narrower hips than girls, this affects how they land jumps and change directions while running. During movements like jumps and direction changes, female athletes are more prone to higher angular stress on the knees. This kind of stress can result in a higher rate of ACL injury, but fortunately, girls can be taught to use their leg muscles in a way that minimizes this stress, thereby working to prevent an injury.

**Body mechanics** Boys tend to land a jump on their toes, and then bend their knees to cushion the landing, while girls land on their whole foot, and with a straighter knee—resulting in their knee having to absorb greater force. Often, female athletes also have greater strength in their quadriceps muscles (which, when used, place stress on the ACL) than in their hamstring muscles (which, when used, relieve ACL stress). This uneven ratio of strength can lead to greater stress on the ACL, but fortunately, both of these issues can be addressed by strengthening the hamstring muscles, and training to land a jump with a greater bend in the knee.

**Muscular differences** Male athletes tend to have a faster natural reaction time than untrained female athletes. That slower reaction time in females is important during a quick stop or turn, and can result in less stabilization of the knee, and a loss of alignment, which causes more stress on the ACL. With agility and proprioceptive training, female athletes can improve reaction times and help stabilize the knee, reducing risk of ACL injuries.



## The best defense

The current best way to combat ACL injury is neuromuscular training for young athletes. Programs that focus on:

1. jumping and landing mechanics
2. strengthening and stretching key muscle groups
3. improving agility and proprioceptive responses can reduce ACL injuries dramatically and bring girls' risk down to that of boys.

## Global attention

Organizations around the world are focusing on how young athletes can prevent ACL injuries:

### FIFA 11+

This training and warm-up program, proven to cut girls' injuries in half, focuses on running, strength, balance, muscle control and core stability.

[f-marc.com/11plus](http://f-marc.com/11plus)

### OSLO SPORTS TRAUMA

This organization's online materials allow athletes to tailor prevention methods to their specific goals and needs.

[klovaskade.no/en/](http://klovaskade.no/en/)

### THE PREVENT INJURY AND ENHANCE PERFORMANCE (PEP) PROGRAM

This program consists of warm-ups, stretching and strengthening exercises, plyometrics and sport-specific agility exercises.



## ACL reconstruction

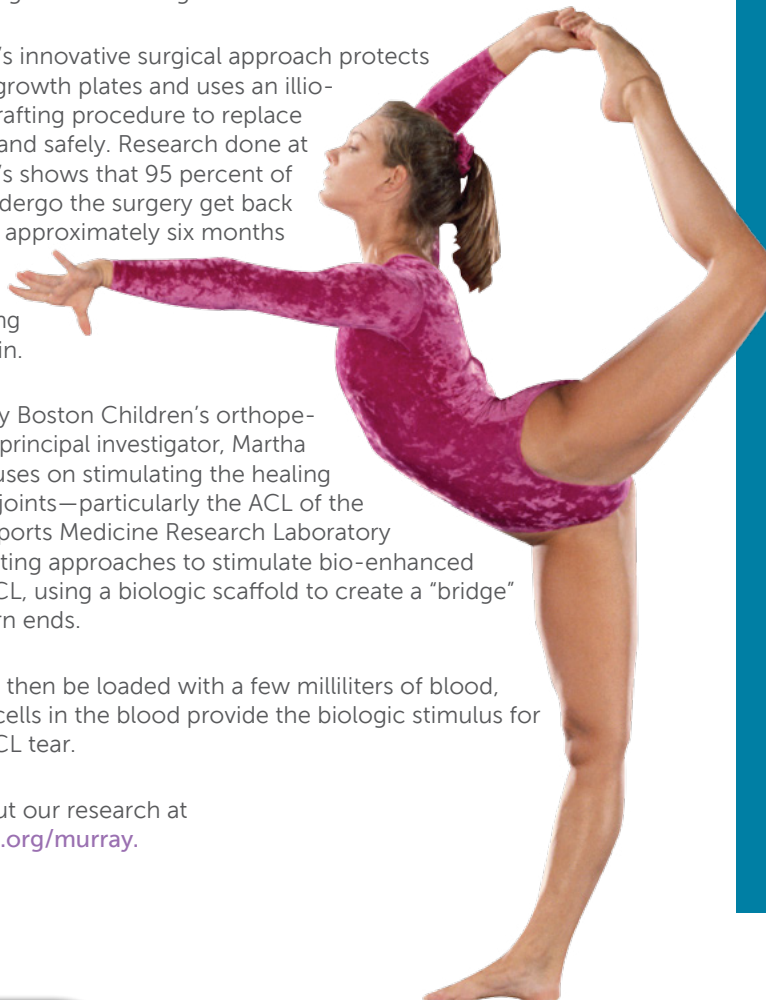
ACL reconstruction is a serious operation, but surgical advancements have made it easier to get back in the game.

Boston Children's innovative surgical approach protects young athletes' growth plates and uses an ilio-tibial (IT) band grafting procedure to replace the ACL quickly and safely. Research done at Boston Children's shows that 95 percent of children who undergo the surgery get back to their sports in approximately six months and have only a three percent chance of needing ACL surgery again.

More research by Boston Children's orthopedic surgeon and principal investigator, Martha Murray, MD, focuses on stimulating the healing of tissues inside joints—particularly the ACL of the knee. Murray's Sports Medicine Research Laboratory team is investigating approaches to stimulate bio-enhanced healing of the ACL, using a biologic scaffold to create a "bridge" between two torn ends.

The "bridge" can then be loaded with a few milliliters of blood, and in turn, the cells in the blood provide the biologic stimulus for healing of the ACL tear.

Learn more about our research at [bostonchildrens.org/murray](http://bostonchildrens.org/murray).



## Reducing the risk of ACL injuries

ACL injuries are not entirely preventable, but female athletes can reduce their risk by:

1. maintaining general health and fitness all year round
2. plyometrics (jump training)
3. agility training that focuses on changes in direction
4. strengthening the hamstrings and legs
5. stretching and flexibility exercises
6. balance and positioning (known as "proprioceptive" training)
7. sport-specific conditioning and practicing the movements, forms and techniques unique to a sport
8. proper nutrition and sleep to help keep athletes strong and alert, which can help prevent injuries
9. cross-training to work muscles that may not be emphasized in your primary sport
10. using proper sport-specific gear



**Boston Children's Hospital**

Until every child is well™

Reviewed by Martha Murray, MD, Boston Children's Hospital

This sheet is part of the Female Athlete Series, which is a suite of educational materials to help female athletes live the healthiest lives possible while competing. For more materials on enhancing athletic performance, call 617-355-3501 or visit [bostonchildrens.org/sportsmed](http://bostonchildrens.org/sportsmed).

