

ACL Injury Education Program

Woodcreek High School Soccer



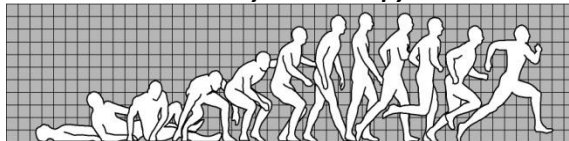
Presented By: Quinn A. McArthur, PT, OCS

Injury Education Coordinator: Placer United Soccer Club

Sports Medicine Director – Woodcreek HS Soccer

Owner/Director: Swanson McArthur Physical Therapy

Swanson McArthur Physical Therapy



Specializing in orthopedic & sports injury rehabilitation

"Restoring function, maximizing performance."

ACL Injury Education For The Competitive Female Athlete

Education designed to address the current epidemic of ACL tears in today's young female athletes.

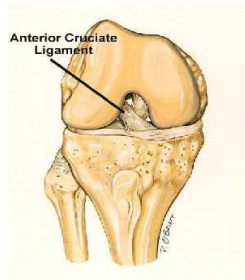
Statistics

Over the past two decades the number of soccer related ACL injuries has risen significantly in girls. Due in large part to Title IX, which gave girls equal opportunity to academic and sports programs, exposure to the recreational activities once dominated by boys changed. As a result, a progressive increase in serious injuries has occurred. When comparing boys with girls in the same sport (soccer) girls have a far greater number of knee injuries and are 3 times more likely to sustain a **non-contact** ACL injury. In fact, 70% of all ACL injuries in girls are non-contact...the ligament tears due to the compromised position the athlete puts it in.

Research directed at this issue is extensive and has helped explain why the disparity between the sexes exists. Anatomical, hormonal, and neuromuscular differences have been studied and the results have been both interesting and helpful.

Functional Anatomy

The **ACL** (anterior cruciate ligament) is a thick fibrous band of tissue deep in the knee joint holding the femur (thigh) to the tibia (leg). Since it is a ligament it receives very little blood flow, and therefore has very poor healing potential if injured. Its function is to prevent the tibia from moving **forward** on the femur. It also resists over-straightening of the knee and twisting.

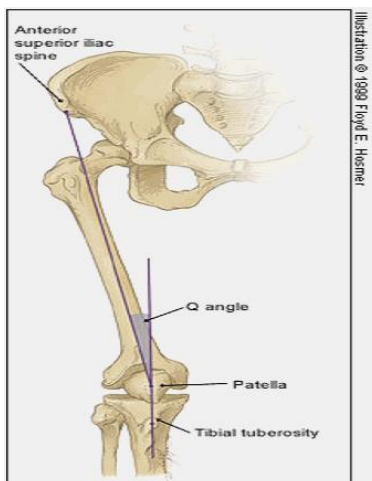


The **intercondylar notch** is the space between the two rounded ends of the femur. In males, the notch is an inverted U-shape, whereas in females, the notch is more of an inverted A-shape. The intercondylar notch is also larger in males than females.

The **quadriceps** and **hamstrings** are groups of muscles covering the front and rear of the thigh which offer support and function to the knee. When the quadriceps contract the tibia is pulled **forward**. As the hamstrings contract, the tibia is pulled **backward**. Therefore, one of the hamstrings' functions is supporting the ACL, and offsetting the forward pull of the quads.



Due to a wider pelvis, girls (adolescent-age) develop a greater **Q-Angle** (quadriceps angle) (see illustration) and a tendency towards a **valgus** or "knock-knees" position.



This angle averages 11 degrees in men and 15 degrees in women. During puberty the angle increases in girls from a value close to that of boys to that stated above, as the pelvis widens. The increase in the Q-angle has been linked to a variety of foot, ankle, and knee injuries.

Studies have shown that girls and boys perform soccer related movements such as cutting and jumping in similar ways prior to musculoskeletal maturation (puberty). Following puberty, girls demonstrate an **inability to control the position of the knee**. As a

result, the knee moves inward excessively and reinforces the tendency toward the knock-knee posture. This position puts the knee at risk for serious injury.

Hormonal factors may exist as well. During ovulation, estrogen levels peak and ligaments are more lax, making ligaments more prone to injury. The research, however, is inconclusive relative to how at risk an athlete is during ovulation to ACL injury.

Soccer-Specific Movement Science

Running, cutting, and jumping are movements vital to the game of soccer. Inherent within these movements is the potential for injury if they are performed incorrectly. Noncontact ACL injuries often occur with knee slightly bent and in a **valgus** position. With highly skilled athletes playing longer seasons at a higher competitive level, the stresses at the knee can be significant. The research indicates that **differences** exist between boys and girls in the way they run, cut, jump, and decelerate. In assessing electrical muscle activity, force plate values, and video analysis, girls have been found to:

- **run** both forward and backward in a more upright position
- **cut**, standing more upright with the outside/planted leg, in valgus (caving in)
- land firmly from a **jump** more flat-footed, with less knee flexion (bend), and less hip flexion (bend)
- over utilize the quads when **squatting** and **running**
- underutilize the hamstrings when **running**, **cutting**, and **decelerating**
- **decelerate** more with dominate quads in a more upright trunk position
- have weaker hamstrings in the non-dominant leg

Putting It Together

If one reviews the **biomechanics** we see that the combination of muscular weakness in the hamstrings and gluteals with the over utilization of the quads puts girls at risk. The hamstrings are unable to counteract the quads forward pull on the tibia. Since the hamstrings and gluteals are weak they don't support a softer landing or a safer cutting motion. As a result the athlete is more upright and in a knock-knee position...further putting her at risk. When these are combined with the **anatomical disadvantages** described previously, as well as the potential hormonal issues, one begins to understand the high incidence of ACL tears in female athletes.

What Can Be Done to Reduce the Risks Inherent in Girls Competitive Soccer?

The research points to 4 potential reasons for ACL failure

- Anatomical
- Hormonal
- Proprioceptive
- Neuromuscular

Since we have no control over anatomical or hormonal factors, our focus must be on re-educating the most important structures in and around the knee. This can be achieved through **neuromuscular** and **proprioceptive** training.

A recent study found specific neuromuscular and proprioceptive training exercises reduced non-contact ACL injuries by 74%. This "prevent injury and enhance performance" program teaches proper running, jumping, and stopping. The 12-week program focuses on injury awareness and avoidance techniques, lower extremity and trunk strength/stability, flexibility, progressive plyometrics, and sports-specific agilities.

Proprioception is our ability to sense where we are in space. We rely on our inner ear for equilibrium, our eyes for visual awareness, and our muscles and joints for limb position and effort. We can, with proper training, use these systems to learn how to properly move, balance, and coordinate actions.

Neuromuscular training is our ability to consciously choose to move in a specific way. We teach our muscles and joints how to perform an activity or movement pattern through biofeedback or instruction. We rely on proprioception (where we are in space) to perform new movements/skills or relearn old, poorly performed movements/skills. Basically, we can train ourselves how to move...properly.

We must teach our soccer players the techniques of how to run, jump, land, and move prior to teaching endless numbers of drills and exercises.

Soccer Training Implications

Since girls possess a tendency to overuse their quads when landing and decelerating, we **must** teach through neuromuscular re-education, how to use alternative and more supportive muscles. In essence, female athletes must learn to move in a way that will reduce the risk of injury. Studies have shown that adding proprioceptive and neuromuscular training exercises to the training regimen can reduce the number of ACL injuries by 2-4 times.

Jumping

The research indicates it is essential that girls land from a jump **softly** on the balls of their feet, then fall to the mid-foot, and then heel. They must bend their knees and maintain a knee position in line with their ankles and second toes. The knees must **never** extend over the foot, **never** hyperextend, and the hips should flex to further absorb shock.

Cutting and Pivoting

These soccer-specific motions must occur with flexed knees, while maintaining knees over the ankles and avoiding a “caving in” of the knees or the tendency toward knock-knee positioning. Flexing the knees properly **teaches** the hamstrings and gluteals to assist the action, counteracting the forward pull of the dominant quads, and reducing ACL stresses.

Running

Girls must run less upright with slightly bent knees, avoid the knock knee position, and stay flat-footed. They should be on their toes when sprinting. Backward running must occur with bent knees while the athlete stays on her **toes** and leans forward (while maintaining a straight back). She will be better balanced and able to change directions safely. Keeping the knees bent and maintaining a lower position will reduce ACL stresses.

Decelerating

The athlete must stay low with the knees over the ankles (not caving in) and the weight off the heels.

Girls can, with the help of a trainer or coach, learn through neuromuscular re-education techniques how to move more effectively, more safely, and more appropriately. This will reinforce proper movements in a game situation, and **reduce** the risk of ACL injury.

Training

Created specifically for Woodcreek High School, Quinn utilizes training principles adapted from the Santa Monica ACL Prevention Project. The program has been established to reduce the risks previously described. It has been designed as a warm-up, should take only 15-20 minutes, and has been proven, in one study, to reduce ACL injuries by 74%. Proper form is always emphasized and corrected if needed.