

ACL Injury Prevention

Why it should be on every coach's "to do" list

By Lynn Pantuosco Hensch, Ph.D.

What do professional soccer player Brandi Chastain, basketball player Rebecca Lobo and beach volleyball player Liz Masakayan have in common? If you answered "an ACL injury," you were correct. In addition to these high profile names, most soccer coaches can reel off the names of a number of their own players who have injured an anterior cruciate ligament (ACL). While it is the injuries of professional athletes that we hear most about in the media, the overall numbers are staggering.

Did you know that one in 10 female college athletes will injure their ACL this year? Or that one in 100 female high school athletes will injure an ACL? These ratios result in 2,200 female college athletes with ACL injuries and thousands more at the high school level. The NCAA ACL injury rates are highest for women in basketball and soccer. Although females are four to six times more likely to injure an ACL than males, the number of male injuries also continues to increase.

As coaches, there is no doubt that we already have too much to do in too little time. Yet in light of increasing ACL injury rates, I challenge coaches to add one more important task to their "to do" list: ACL injury prevention.

WHAT IS AN ACL INJURY?

The ACL is one of four ligaments within the knee. The ACL crosses from underneath the femur (thigh bone) to the top of the tibia (shin bone). It serves as the primary restraint to forward motion of the tibia and contributes to the overall stability of the knee. Unfortunately, ACL injuries have become all too common in soccer, especially for women.

An ACL injury occurs from contact or non-contact. Most injuries (more than 75 percent) are non-contact. When asked about the professional athletes previously mentioned, you really aced the quiz if you knew that all three women experienced non-contact ACL injuries. The non-contact injuries are typically a result of inappropriate cutting, jumping/landing, pivoting or even just running (acceleration/deceleration) that causes excessive rotational force to the knee.

Common symptoms of an ACL tear include sudden giving way of the knee, hearing a "pop" at the time of injury, sudden swelling of the knee and pain in the knee when walking (Cluett, 2005). While recognizing the symptoms of ACL injuries is useful, the more valuable skill is preventing these injuries from happening in the first place. Before establishing a prevention program, it is necessary to understand why ACL injuries occur and why females are at a greater risk.

Researchers have established a number of risk factors that set females apart from males in terms of ACL injuries. The risk factors

are body types, hormonal differences, body positioning and muscle imbalances (Ahmad, et al, 2006; Hayward, 2001; Hewett et al, 2006; Moeller, et al, 1997). Each risk factor will be described in brief:

- **Body types** Women generally have a smaller intercondylar notch in the knee (place where ACL passes through the joint). Therefore, because of smaller, narrower knees, less stress is needed to tear ligaments in a female knee compared to that of a larger male knee. In general, females have wider hips than men and tend to rotate them more, which places females at greater risk for injuries.

- **Hormonal differences** Hormonal changes during the menstrual cycle lead to muscle tissue becoming more elastic than at other times for women. Studies have shown that estrogen levels may affect ligament laxity for some women.

- **Upright body position** Females tend to bend their knees less during typical soccer and athletic movements compared with males. Females are more apt to land flat-footed and with straight legs compared with males, who are more likely to have soft landings. Overall, women play soccer and other sports with a more erect posture than males, which increases the risk for injury.

- **Muscle imbalances** Males and females have stronger quadriceps than hamstrings. But with females the muscle imbalance tends to be greater (quadriceps and hamstring strength). Female athletes have been shown to utilize hamstring muscles less than male athletes, resulting in improper movements and greater occurrence of injuries.



A study involving North Carolina's men's and women's soccer teams showed that gender-related ACL risk differences exist, even among players of high skill level.

RESEARCH ON GENDER DIFFERENCES

A wide variety of research has been conducted to explore the gender differences that put females at greater risk for knee injuries than males. Interestingly, a study done with the University of North Carolina's men's and women's soccer teams resulted in similar gender differences. The female soccer players flexed and recruited the muscles around the knee differently than the males. According to researcher Michael DiStefano, "the females had more erect posture, rotated their hips more and had more quadriceps flexion than the males when performing the maneuvers" (DiStefano, 2004). The conclusion was that these ACL-related gender differences were not influenced by the skill level of the soccer players. If the talented Carolina women are at risk, so are other female soccer players.

FACTORS ATHLETES CAN CONTROL

Athletes cannot control genetics and anatomical structure (body type, hormones, etc.), but other risk factors may be altered. Both muscle imbalances and upright body position can be changed through proper training. Newer research suggests that preventive training can

significantly reduce the number of non-contact ACL injuries (Myer, et al, 2004; 2006; Wilkerson, et al, 2004).

ACL INJURY PREVENTION PROGRAMS

Available research supports ACL injury prevention programs, but the exact protocols still are up for debate. While experts suggest a variety of exercise prescriptions, there are some common themes and guidelines that tend to hold true across various protocols. Experts agree that learning proper techniques and patterns to avoid unnecessary stress on knees is paramount to any successful injury prevention program. Other important concepts include learning to jump, land, pivot and run properly. Several primary components should be the basis for an injury prevention program, including core strength, leg strength and balance.

- **Core strength.** Develop a strong trunk of the body to improve stability. Various exercises using physio balls, Pilates or abdominal exercises can build core strength. The stronger the core, the better the all-around support of the body will be, especially in competitive soccer.
- **Leg strength.** Create balance in quadriceps/hamstring strength. In order to build leg strength and create muscular balance, exercises which involve the hamstrings are key. Jumping programs such as plyometrics (explosive jumping movements) involving boxes, hoops and agility ladders can be helpful. Resistance bands also are a practical, inexpensive tool to incorporate. For those with access to more sophisticated equipment, weight training that focuses on hamstring strength and safe lateral movements can be very valuable. Exercises such as lunges (which can be done without equipment) can be worked into any soccer program. Lunges with both legs in forward,

backward, side and diagonal directions are an inclusive set of exercises to add to any practice.

- **Balance.** Training for balance, agility and coordination will increase dynamic balance. Exercises that require shifting balance, direction and speed are helpful. These types of movements can be done with and without a soccer ball. Simple equipment such as hoops, ladders and boxes can be utilized.

ACL EXERCISE GUIDELINES

Well-rounded programs should include muscular strength, balance and dynamic sport-related movements. Injury prevention programs should promote motor control and body awareness with players. Exercises such as plyometrics are valuable, but should be used with caution. An effective program implements a variety of exercises, including ones that:

- Promote a "ready position" with bent knees and light feet
- Require one leg at a time
- Require changing direction
- Require acceleration and deceleration
- Involve shifting balance
- Encourage soft landings

OUTLOOK ON ACL INJURY PREVENTION

The bottom line with ACL injury prevention is that something can be done to reduce the alarming injury rates. Researchers suggest that injury prevention programs and exercises are advantageous. Current research is in progress that should specify which types of programs, protocols and exercise prescriptions are most effective for injury prevention.

For example, U.S. Soccer team physician Dr. Bert Mandelbaum leads the group that created the Prevent Injury/Enhance Performance (PEP) program for knee injury prevention in southern California. The PEP program requires a 15-minute routine consisting of a warm-up, stretching, strengthening, plyometrics and sport-specific agilities that is performed two to three times per week.

A comparative study showed a dramatic reduction in injury rates for female soccer players who utilized the PEP training during 2000 (88 percent) and 2001 (74 percent) (www.aafa.org/3ce/acl_firmst.htm). Longitudinal outcomes will be helpful for future program design. Other studies suggest significant changes may occur in as little as six to eight weeks of training, which is reassuring for the busy soccer coach (Hewett, 2000). In essence, learning proper movement techniques is vital. And like any other soccer technique taught, players will need plenty of repetition before mastery. Coaches can fight the odds of ACL injury by being proactive in terms of education and prevention.

WHAT WE'RE DOING AT WESTERN UNITED

With the Massachusetts Premier club I work with, we are trying to be proactive on a smaller scale. We are organizing an ACL Injury Prevention Night, where parents, coaches, and players can learn about the information presented in this article. The program is free and open to all of our club members. We have a local professor of sports medicine from Westfield State College and surgical physician's assistant on hand to participate in the program. My role in the program will be to share programming ideas and demonstrate sample exercises. All of the professionals involved are volunteering their time. There are similar professionals in most communities who will welcome the opportunity to get involved.

In our club, we have also started our own strength and conditioning program which focuses on performance enhancement as well as injury prevention. The notion of joining a strength and conditioning

BOW & LEVER
Innovative portable sport equipment

Full Size
8x24

Flexgoal...The amazing training goal!

14 lbs of innovation!
Concave rebound
Easy set up
Portable
Affordable

Used by coaches and players around the world because.....

"you gotta have goals"

WWW.FLEXGOAL.COM

program has a more positive connotation than simply preventing the negative from happening (injuries). Our program focuses on providing strength and conditioning experience and education to players in a developmentally appropriate way. An overview of a club-based strength and conditioning program will be provided in a future article. The strength and conditioning program began without a budget or equipment and now successfully serves a number of our soccer players. ⚽

References

Ahmad, C., Clark, A., Hellmann, N., Schoeb, J., Gardner, T. & Levine, W. (2006). Effect of gender and maturity on quadriceps-to-hamstring strength ratio and anterior cruciate ligament laxity. *The American Journal of Sports Medicine*, 34(3), 370-375.

Cluett, J. (2005). ACL Injury. *Orthopedics*, <http://orthopedics.about.com/cs/aclrepair/a/acl.htm>

DiStefano, M. (2004). Comparison of trunk, hip and knee kinematics during a side-step cutting maneuver between male and female Division I collegiate soccer players. *Kinesiology Publications*.

Hayward, R. (2001). ACL injuries: Why more prevalent in women? *Journal of the American Academy of Physicians Assistants*, 14, 38-40, 43-45.

Hewett, T. (2000). Neuromuscular and hormonal factors associated with knee injuries in female athletes: Strategies for intervention. *Sports Medicine*, 29, 313-327.

Hewett, T., Myer, G. & Ford, K. (2006). Anterior cruciate ligament injuries in female athletes: Part 1, mechanisms and risk factors.

American Journal of Sports Medicine, 34(2), 299-311.

Hewett, T., Stroupe, A., & Noyes, F. (1996). Plyometric training in female athlete: Decreased impact forces and increased hamstring torques, *American Journal of Sports Medicine*, 24, 765-773.

Moeller, J. & Lamb, M. (1997). ACL Injuries in female athletes: Why are women more susceptible? *The Physician and Sports Medicine*, 25(4), <http://www.physsportsmed.com/issues/1997/04apr/moeller.htm>

Myer, G., Ford, K. & Brent, Jensen, L. (2006). The effects of plyometric vs. dynamic stabilization and balance training on power, balance, and landing forces in female athletes. *The Journal of Strength and Conditioning Research*, 20(2), 345-353.

Myer, G., Ford, K. & Hewett, T. (2004). Rationale and clinical techniques for anterior cruciate ligament injury prevention among female athletes. *Journal of Athletic Training*, 39(4), 352-364.

Sullivan, D. (2001). On mended knee: In the past decade 1.4 million female athletes have suffered ACL injuries – twice as many in the previous 10 years. Are you next? Not if we can help it. *Sports Illustrated for Women*, 3(1), 62-67.

Wakeham, T. (2004). Knee injuries: The major problem of female athletes and how to prevent them. *Coach and Athletic Director*, 73(7), 64-68.

Wilkerson, G., Colston, M., Short, N., Neal, K., Hoewischer, P. & Pixley, J. (2004). Neuromuscular changes in female collegiate athletes resulting from a plyometric jump-training program. *Journal of Athletic Training*, 39(1), 17-23.

COLLEGE COACHES: NOMINATE YOUR 2006-07 TEAM FOR THE TEAM ACADEMIC AWARD. DOWNLOAD THE FORM FROM THE AWARDS SECTION OF NSCAA.COM.

Upcoming Non-Residential Courses

Look for one in your area!

List current as of June 10 - for the most current schedule of offerings, visit NSCAA.com.

July

- 6-8 Congreso Latino Americano de Futbol, Cupertino, Calif. Contact: Marco Santillan, 408-559-1503
- 6-8 Advanced Regional Diploma, Plymouth, Mass. Contact: Jon Palmstrom, 781-771-6225
- 7 State Goalkeeping Diploma, Erie, Pa. Contact: Jamie Smith, 814-866-5425
- 7 Regional Diploma, Billings, Mont. Contact: Dan McNally, 406-671-1280
- 7 State Diploma, Center Moriches, N.Y. Contact: Simon Nee, 201-583-7044
- 8 Regional Goalkeeping Diploma, Erie, Pa. Contact: Jamie Smith, 814-866-5425
- 13-15 National Youth Diploma, Danville, Calif. Contact: Fred Wilson, 925-759-6267
- 13-14 Regional Diploma, Jacksonville, Fla. Contact: Thomas Waarum, 904-854-6555, ext. 209
- 14-15 National Goalkeeping Diploma, Churchville, Md. Contact: Jay Golomb, 410-356-0112
- 20-22 Advanced Regional Diploma, Fort Myers, Fla. Contact: Andy Clarke, 404-421-3504
- 20-22 Advanced Regional Diploma, Danville, Calif. Contact: Fred Wilson, 925-759-6267
- 21 Special Topics Course, Frankfort, Ky. Contact: Sherrill Smith, 502-803-0316
- 21 State Diploma, Oley, Pa. Contact: Steve Wilman, 610-747-0838, ext. 203

- 22 Special Topics Course, Foxboro, Mass. Contact: Giovanni Pacini, 617-243-2118
- 27-29 Director of Coaching Diploma, Amesbury, Mass. Contact: NSCAA Office, 800-458-0678
- 29 Regional Goalkeeping Diploma, Reno, Nev. Contact: Graeme Abel, 775-682-6933
- 29 Parent Coach Diploma, Fort Myers, Fla. Contact: Andy Clarke, 404-421-3504
- 29 Regional Goalkeeping Diploma, El Paso, Texas. Contact: Mikel Arnuti, 915-740-3732

August

- 3-5 Advanced Regional Diploma, Littleton, Colo. Contact: Theresa Echtermeyer, 303-797-0055
- 4-5 Regional Diploma, Scranton, Pa. Contact: Aaron Palczewski, 570-347-0797
- 5 State Goalkeeping Diploma, Hanover, Pa. Contact: John Dunnock, 717-965-5004
- 10-12 National Goalkeeping Diploma, Newton, Mass. Contact: Giovanni Pacini, 617-243-2118
- 10-11 Regional Diploma, New Market, Md. Contact: Paul Riley, 301-763-9172
- 10-12 Advanced Regional Diploma, Ormond Beach, Fla. Contact: Paul Beaudoin, 386-677-0612
- 10-12 National Youth Diploma, Scranton, Pa. Contact: 570-350-7407
- 11 Regional Diploma, Bangor, Pa. Contact: Pam Beers, 570-350-7407
- 11 Special Topics Course, Westfield, Mass. Contact:

- Aaron Palczewski, 570-347-0797
- 17-19 Advanced Regional Diploma, Charlotte, N.C. Contact: Adam Denton, 704-578-2310
- 17-18 Regional Diploma, Center Moriches, N.Y. Contact: Simon Nee, 201-583-7044
- 18 State Diploma, Danville, Calif. Contact: Fred Wilson, 925-6267
- 18 State Diploma, Yardley, Pa. Contact: Dave McGovern, 215-206-7038
- 18-19 Regional Diploma, Yardley, Pa. Contact: Dave McGovern, 215-206-7038
- 19 State Diploma, Danville, Calif. Contact: Fred Wilson, 925-6267
- 25 Special Topics Course, Davenport, Fla. Contact: Scott Smith, 863-557-5163
- 25 State Goalkeeping Diploma, Cedar Rapids, Iowa. Contact: Adam Smith, 319-389-5791
- 26 Special Topics Course, Ormond Beach, Fla. Contact: Paul Beaudoin, 386-677-0612

September

- 9 State Diploma, Austin, Texas. Contact: Jonathan E. Ellis, 512-454-5334
- 22 Special Topics Course, Wilmington, N.C. Contact: Chris Neal, 910-962-7033
- 28-30 Advanced Regional Diploma, Holiday, Fla. Contact: Ryan Davis, 727-992-1087

Copyright of Soccer Journal is the property of National Soccer Coaches Association of America and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.