



ACL injuries in female athletes

The ACL injuries are a frequent problem in many sports which require sudden changes in the movement direction—planting and cutting. Such sports are soccer, football, basketball and ice hockey. Another factor common to these sports is a contact or collision with the opponent.

Female sports participation is at the all-time high. In the year 2000, there were more than 2.5 million girls competing in high school sports and another 145.000 in college sports in the U.S. alone. Additionally, the women's participation in professional sports is emerging in many countries in basketball, soccer and ice hockey, to name a few sports.

"Women soccer players had a four-and-a half-times-higher risk of anterior cruciate ligament injuries than their male counterparts."

Data from NCAA Injury Summary

As the female participation is increased, there are more and more female athletes being sidelined due to the knee injuries, especially the ACL injuries. It is estimated that 30.000 female athletes suffer from the ACL injury annually!

Several studies and injury surveillance data sug-

gest that ACL injury patterns are different in men and women who participate in same sports.

For example, the NCAA injury data shows that the ACL injuries are more frequent in female athletes than in their male counterparts.

The NCAA injury summary 1986—2002 shows that the ACL injury rates in games in female soc-

"Women basketball players had a five-times-higher risk of anterior cruciate ligament injuries than their male counterparts. "

The NCAA News -- May 26, 2003

cer players increased from 0,5/1000 athlete exposures in games to 1.6/1000 athlete exposures and in practice from 0.03/1000 athlete exposures to 0.2/1000 athlete exposures. Sowing an increase of 220% and 567%, respectively! In male soccer player the game injury rate was down by 37% and practice injury rate had doubled.

In NCAA all school report 2002-2003 for women's soccer shows an ACL injury rate of 0.15/1000 athlete exposures in practice and 0.84/1000 athlete exposures in games. In women's basketball the ACL injury rates were 0.15 and 0.16, respectively.

Table Knee injuries in female athletes participating in NCAA sports (Source: NCAA Injury Surveillance Reports, 2003)

Sport	Practice injury count		Practice exposure count	Injury rate/Practice		Game injury count		Game exposure count	Injury rate/Game	
	Knee total	ACL		Knee total	ACL	Knee total	ACL		Knee total	ACL
Soccer	117	25	162 931	0,72	0,19	162	44	52 109	3,11	0,84
Basketball	115	19	130 862	0,88	0,15	97	22	33 764	2,87	0,65
Lacrosse	39	9	94 586	0,41	0,10	43	15	19 138	2,25	0,78
Volleyball	74	4	115 825	0,44	0,03	53	10	43 131	1,12	0,21
Gymnastics	29	9	22 317	1,30	0,40	14	3	2 297	6,09	1,31
Softball	45	13	91 977	0,49	0,14	37	5	55 679	0,66	0,09
Average	70	13	103 083	0,71	0,17	68	17	34 353	2,68	0,65

Why are women more susceptible to ACL injuries than men?

Researchers have suggested several factors that contribute to the fact that women have greater predisposition for ACL injuries: anatomical structure, muscular imbalances, hormonal factors and movement patterns.

Anatomical structure

When comparing the differences between men's and women's anatomy, there are obvious differences. Female have wider pelvis, greater Q-angle, greater hip varus, knee valgus and foot pronation than males do. All these contribute to the problem by putting female knees into a very disadvantageous position during planting, cutting and landing situations.

Muscular imbalances

When considering the knee stability, the muscular recruitment of the hamstrings and quadriceps plays a crucial role. Especially, the hamstrings have been found to contribute significantly to the knee stability.

It appears that women tend to favor the quadriceps muscles in attempt to

stabilize the knee during landing, whereas men utilize the hamstring muscles. Also, there appears to be differences in the recruitment patterns especially in fatigued conditions: there appears to be significant strength losses in female hamstrings at the near end extension.

Furthermore, female athletes have decreased stiffness and decreased potential for dynamic stabilization of the knee joint. Proprioception deficits involving the knee and side-to-side strength and coordination imbalances are more often observed in female athletes.

The female athletes involved in high-risk sports exhibit less muscular protection of the knee ligaments during external loading of the knee than did size and sport-matched male athletes.

Hormonal factors

Several studies have investigated the hormonal factors related to the women's ACL injuries. It appears that the female athletes are more vulnerable to the ACL and other

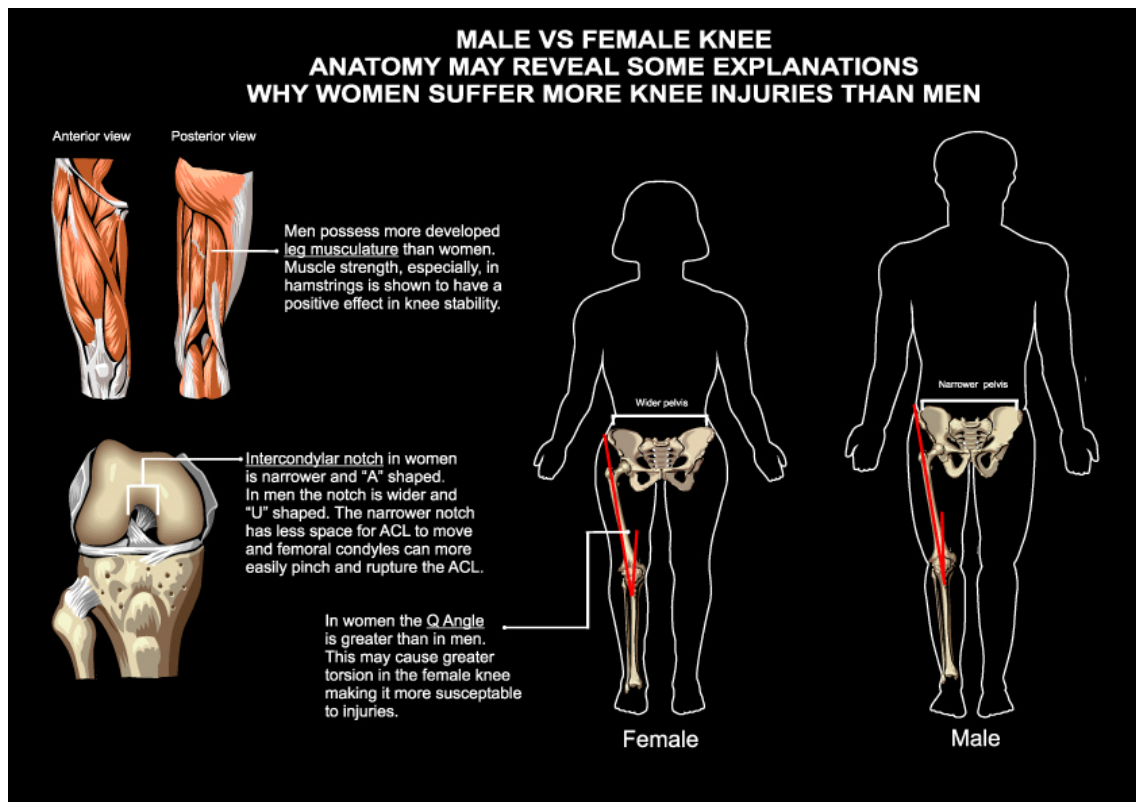
knee injuries at certain phases of the menstrual cycle.

The increased level of estrogen and relaxin appear to be related to the increased risk of ACL injuries. The risk seems to be increased during the ovulatory phase of menstrual cycle.

Movement patterns

In the western societies, there is tremendous variation in the exposure and acquisition of skills of physical activities in young boys and girls. Today, children are more and more often playing inside, using computers and watching television. They are missing out on the possibility to learn safe movement patterns.

Traditionally, the girls have had less physical activity compared to boys and, thus, have not had a chance to learn the movement patterns needed in landing, cutting, pivoting and changing the direction. This lack of normal physical activity leads into decreased movement patterns and skill also needed in these high risk sports.



Are women's ACL injuries preventable?

Even though the epidemic of female ACL injuries is serious, there are some good news as well! Several studies have shown that there are ways to help female athletes to reduce the risk of suffering the ACL injuries.

As we discussed in previously, female athletes tend to have less developed movement patterns and neuromuscular coordination to their male counterparts. This is one of the keys to ACL injury prevention: female athletes must improve their neuromuscular coordination, agility and muscular balance.

There are excellent programs available, which concentrate exactly on this such as Sportsmetrics™ and Santa Monica Injury Prevention Pro-

ject. Also, strength and conditioning specialist Vern Gambetta's LEPP™ clinics and seminars have concentrated on these issues for years.

The common denominators in these ACL prevention programs are:

- Improving functional, dynamic balance, especially on a single leg.
- Focusing on avoiding the vulnerable, knock-kneed position when landing, stopping and cutting—improving the ability absorb the impact during the landing or cutting.
- Strengthening of the core muscles around the pelvis, including the hamstring or back of the thigh.
- Improvement of overall athleticism and athletic ability.

Research has shown that proper

training in these prevention programs have helped the female athletes to reduce the risk factors significantly: athletes participating in well planned and managed prevention program the decreased injury risk may lower by three to four fold!

"...A greater factor, and one that we can control, is how we train girls and women to play sports. Not all ACL injuries are preventable—let's not get that mistaken notion—but many of them are. Contact ACL injuries are tough to prevent; the majority of non-contact ACL injuries, on the other hand, should be preventable."

Vern Gambetta (2000)

How the Newest Powertimer can be used in the ACL prevention programs?

In ACL injury prevention programs the main focus is in improving the basic athletic abilities in (female) athletes. These include leg strength and (vertical) jumping ability, landing skills, ability to change movement direction and cutting ability.

One of the main problems in these type of exercise is to assess the progress in athletes. How can the trainer or the coach make sure that the program actually works? The only way to assess the starting level and progress is to measure the athletes performance in these movement patterns.

Like in any training program, the ACL programs requires a starting level assessment on the skills and performance ability in selected movement patterns and tests. Then, the trainer can use the same tests during the program to assess the improvement of the athletic ability in these given tests.

What tests should be used? The tests used should be ones that are easy to teach and monitor—just like the drills used in the program. Furthermore,

these tests should mimic the movement patterns the athlete faces in his/her sport. Also, the tests should be selective and able to differentiate the skill/performance level of the athletes.

Some of the tests used in these types of prevention and rehab programs have been vertical jump tests, drop jumps, various agility tests and hopping tests.

The Newest Powertimer testing system is a unique system allowing the trainer, therapist or the coach to assess the athletes' performance ability or skills in these types of tests. The Powertimer offers pre-programmed test protocols for static jump (SJ), counter movement jump (CMJ) and drop jump (DJ). Additionally, the system includes agility tests such as 5-0-5-test, Illinois Agility Run Test, Ajax Shuttle and T-Test. It even has a take-off reaction time test for testing movement reaction and subsequent acceleration ability!

In many of these tests there is a built-in comparison to the protocols, allowing the trainer or the coach to

compare the differences in performance between left and right leg (injured/non-injured).

With the Powertimer Analyzer database, which is supplied with the Powertimer system, the trainer, therapist or the coach can monitor the changes in performance ability through out the prevention program and even compare the different athletes and groups participating in the program. This makes the Powertimer system as very powerful tool that may play an essential part in ACL prevention programs!



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The Newtest Powertimer offers 20 athletic performance tests covering the most crucial areas of athletic performance.

When considering the ACL injury prevention programs, The Newtest Powertimer can offer well-defined tests for assessing vertical jumping ability, quickness and agility and cutting ability. Some of these tests include:

- *static jump (SJ),*
- *counter movement jump (CMJ),*
- *drop jump (DJ),*
- *5-0-5 –test,*
- *Illinois Agility Run,*
- *Ajax Shuttle,*
- *T-test,*
- *Take-off reaction time test*

The test results from these tests can be saved into a Powertimer Analyzer database for further analysis and comparison. The database feedback reports motivate and educate the athletes, trainers and coaches and make sure that the ACL injury prevention program stays on track! Contact your nearest distributor for your Powertimer system!



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