



ACL Injuries in Women

Explaining the much larger number of anterior cruciate ligament (ACL) injuries in women has been difficult and has focused mainly on hormonal changes and anatomical factors in the knee joint itself.

More recently, research has focused on neuromuscular factors as the cause of this large difference in women.

Researchers have determined that women have a straighter knee when performing certain maneuvers in running and cutting than men to tend to have more bend or flexion in their knees. Additional factors which place more of a strain on the ACL which are common in women are, a straighter hip and slightly more deviation of the knee joint outward. These two factors are more commonly present in women than in men. Researchers have begun to study these factors with sophisticated recording systems of cameras and instruments to check muscle activity during various exercise maneuvers. One finding has been that women activate their hamstring significantly less than men in some of these maneuvers.

It is possible from these studies that recommendations could be made for changes in the training of women athletes in their strengthening program as well as changes in how certain activities are actually performed.

Another significant difference between men and women in athletic activities is that women tend to flex their knees much less when landing from a jump than men do. This difference could also contribute to higher rates of knee injuries seen in women.

Researchers studying the knees of male and female athletes have determined that there is a significant difference between quadriceps and hamstring strength in male and female athletes; this having been adjusted for body weight.

In addition to the obvious fact that women are not as strong as men, research has shown that women's muscle tissue is more flexible than male muscle tissue. Increased flexibility may be an important cause for women tearing their ACL at a higher rate. It has also been discovered that female muscles stabilizing the knee may take a millisecond longer to respond than their male counterparts. It is suspected that this small difference in the time of contraction to protect the knee could also lead to injury. Hormonal changes in the menstrual cycle may lead to times where the female muscle tissue is more elastic than at other times.

The MRI cross section of the ACL in a man averaged almost 14 millimeters larger than in females at the width of the space through which the ACL travels (which also can contribute to tearing of the ACL) is smaller than in men. The conclusion drawn is that the combination of muscle weakness, smaller ligaments and a smaller space through which the ligament travels can explain the higher incidence in ACL tears in female athletes.

The possibility of hormonal changes in women has intrigued researchers for many years and significant studies have demonstrated that certain serum hormonal levels can increase laxity in the knee joint of women during the menstrual cycle. Some have concluded that such laxity could possibly be a factor in increased risk of ACL tears. Other researchers are not as certain that this is an important factor. Research is continuing in this important area of ACL injuries in women.

We are moving toward the development of prevention programs for female athletes to reduce risk of knee ligament injuries. These programs could help significantly reduce the epidemic number of injuries sustained by female athletes. It has been known that high school and college female athletes are up to six times more susceptible to non-contact ACL injuries than male



athletes.

Most people studying the subject have decided that there is no evidence that knee braces will prevent ACL injuries.

A training program developed at the University of Vermont Medical School designed to prevent ACL injuries in skiers demonstrated a 69% decrease in injuries among ski patrol personnel and instructors who received the training compared with those who did not. Another prevention program developed in Cincinnati demonstrated that a six week program of training could reduce the risks of knee ligament injuries in female athletes. One of the important aspects of the training program is to train these athletes to rely more on hamstring muscles than quadriceps, thereby protecting the knee ligaments. A controlled study of women athletes who did not participate in the training program compared with those who did indicated a five times higher incidence of knee injury than in male athletes. Females who participated in the training had injury levels equal to or only one or two times higher than males.

In addition to the significant pain and suffering experienced by these female athletes, the financial cost is enormous. In one study it was found that 2,200 ACL injuries occurred to female collegiate athletes each year and the cost of reconstructing and rehabilitating these athletes is \$44 million.

From this information I think you can begin to have some appreciation of the magnitude of the problem that orthopaedic surgeons are dealing with.

Addendum



Continued careful observation and research into the problem of anterior cruciate ligament injuries in women are revealing some interesting patterns.

The increased incidence of anterior cruciate ligament injuries in women compared with men participating in athletics is a very complicated subject. Nonetheless, it is beginning to appear that some fundamental differences in the body mechanics of women and men are primarily at fault.

It has been known for some time that in jumping activities women land with their knees much more extended coming down from a jump.

The classic example is a female gymnast jumping down from a mount landing with the knees nearly fully extended. This has been recorded innumerable times on videotape. As a girl lands in this position she stops suddenly with her arms still up in the air over her head and then either collapses to the ground or takes a few steps awkwardly, being able to bear very little weight on the injured knee. There goes another anterior cruciate ligament. The sport could just as easily be basketball or soccer.

Women not only seem to land in a knee extended position, but also pivot in that position when



they land. Both of these things can put much greater strain on the anterior cruciate ligament than landing more in a crouch with the knees and hips both flexed.

No one can do the slightest thing to strengthen his or her anterior cruciate ligament. The athlete can, however, strengthen and condition the muscle groups pertaining to the hip, the knee and the ankle.

It is beyond the scope of this article to teach proper body mechanics and exercises.

A physical therapist or athletic trainer familiar with the anterior cruciate ligament and the muscle groups that compliment it, are very familiar with body mechanics and exercises needed to prevent ACL injuries.

The muscle groups may actually need to be retrained to act correctly to be a force in preventing injury.

We are still amazed that the great majority of women athletes are unaware of these differences and therefore, completely unaware of any techniques that could substantially reduce their possibility of injury.

The American Academy of Orthopaedic Surgeons has attempted in some initial ways to begin to bring this problem to the attention of athletes and their coaches, but I'm afraid we still have a long way to go.

Addendum

Girl's ACL Injuries Result in Arthritis

It is well known that girls who play soccer, basketball and other sports are at high risk for injury to the anterior cruciate ligament (ACL).

A recent study in the respected medical journal *Arthritis and Rheumatism* indicated that half of the girls who had ACL injuries and subsequent surgery to repair the injury ended up with significant arthritis of the knee twelve years later.

At about age 31 a significant percentage of these young women who had sustained ACL injuries now have arthritis in the knee causing pain and difficulty conducting daily activities.

The definition of arthritis in this case is that the articular cartilage covering the ends of the bones in the knee wears out. There is no doubt that the condition will worsen as time goes by.

It has been estimated that a significant number of these women might require a total knee replacement before the age of 50.

Osteoarthritis, of course, typically affects older people, that is, people in their 60's, 70's and 80's.

It is very alarming to have women developing significant arthritis changes in their knees in their early 30's.

Why girls are at higher risk of injuring their anterior cruciate ligament is something that is not entirely known, even though it is the subject of intense research. There are many theories which exist.



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These theories have been previously covered.

Surgery would not seem to be the answer to prevent arthritis from occurring.



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