WOMEN AND ACL INJURIES:
TAKING THE BAD NEWS WITH THE GOOD

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THE BAD NEWS

The statistics are impressive. Women are two to eight times more likely to sustain an ACL tear in sports that are at the highest risk such as basketball and soccer.1 The incidence of significant knee injury among females is roughly five times higher per player per hour than for males.2 The volume of injury is significant. It is estimated that 350,000 ACL injuries occur annually in the U.S. alone. More of those injured will still be men by virtue of a greater number of male participation in sports. The data suggests that women who choose to participate in sports are taking a greater risk than men. With the help of Title IX in 1972 and the trend of adolescents to participate in a single sport year round, the number of women and the level of competition in many sports continues to rise. There is no sign of a slowdown in female athletic endeavors, nor should there be. The increasing interest and study in the causes of this disparity among men and women is helping lead to discoveries that can benefit both male and female athletes.

Early research was primarily focused on the anatomical and hormonal differences among men and women. Unfortunately, the studies have not led to obvious answers or methods of injury prevention. Although differences exist, ultimately there would be no reasonable course of action available to change one's anatomy or biochemistry for the sake of basketball. For example, there have been studies on the relationship between femoral notch width to ACL injuries with conclusions that smaller notch width (which on average is smaller in women) show a higher incidence of unilateral and bilateral ACL tears.3 There have been studies about the relationship of ACL injuries in women and the menstrual cycle. Wojts et al4 found that women are three times more likely to injure their ACL during ovulation (when levels of estrogen peak) than during other times of their cycle. Others along similar lines include studies showing greater joint and ligament laxity in women. However, none of theses studies could conclusively find a direct relationship to increased ACL tears.

Additional anatomic differences can be more easily observed. On average, women have greater pelvis widths, a larger "Q angle," greater hip varus, hip ante version, knee

valgus and foot pronation. All combined, these biomechanics may put the ligament at a disadvantage even before any jump or landing is ever made. The exact effect that these characteristics have individually or in combination on ACL vulnerability continues to be explored, but may help identify risk factors. Again, other than possible orthotic intervention in some cases, or the unlikely result of "quitting soccer because of my Q angle," little else can reasonably be done to influence these anatomical traits in women.

THE GOOD NEWS

The most encouraging aspect of the bad news about ACL tears is that 70% are noncontact injuries. This can be viewed with optimism because it says there may be something we can do about one aspect of the problem at a neuromuscular level, rather than hope to accomplish an impossible task by trying to control outside forces such as a tackle from another player. Since there has been no solid evidence to support the benefit of prophylactic bracing for knee injuries, neuromuscular training had to be looked at.

In the neuromuscular arena, women appear, yet again, to have a general disadvantage. There have been reports of women having electromechanical delay in muscle recruitment, poor hamstring recruitment patterns, and less functional joint stiffness (the stability of the joint brought about by muscular constraints).5 Others have noted less hamstring and gluteus medius activation in females than males.3 Still others have noted the functional outcome of all these factors seems to be that women tend to use less hip and ankle musculature during sport, therefore, exposing the knee and ACL to greater amounts of uncontrolled movement.

ACL injuries appear to occur most frequently during deceleration activity such as a sudden stop, change in direction, or landing from a jump. Therefore, eccentric strength and proprioception play a critical role. Both are factors that can be influenced substantially through training. The answer is not simply sport specific training, but functional training, which takes into account quality of movement and the inherit efficiency of muscle integration.

MAKING THE BEST OF IT

There has been documented success with a jumping program that takes into account form, flexibility, and plyometric strength. This program is essentially a progressive jump-training program that emphasizes form and technique of jumping and landing. It progressively builds on plyometric training over a six-week period. Noted benefits are increased overall strength of the hamstrings and an increase in vertical jump. Jump training led to a significant decrease in the incidence of ACL injury among women trained in this manner versus untrained women.2 The power building ability of

plyometrics have long been recognized so it is no surprise that a program like this, when implemented carefully, can help athletes with joint protection as well as performance.

Deceleration training, in which the athlete practices landing from a jump, accelerating, changing direction, and then decelerating, has also been proposed. These programs pick up where pure jump training leaves off and put another functional dimension into the obvious strength and power gains made with a pure jumping program. Although the program emphasizes teaching the athlete to use short quick steps to decelerate and to keep her center of gravity over the knee, this may not always be possible to control during the intensity of competition.

Functional training programs blend the benefits of jumping and deceleration training with exercises that help the athlete prepare for stresses placed in multiple planes concurrently, which is most likely when injury takes place. The addition of various proprioceptive challenges combined with strength building fill in the missing piece to ACL prevention training programs. In addition to jump training, it seems necessary for the athlete to practice recovering from a precarious position that may occur during competition. For example in basketball, a player may have the hip, knee, and arm extended, with the trunk and head rotated while reaching back for a bad pass in basketball. In a game situation, this type of complex movement pattern cannot always simply be avoided. The body may be better prepared for this potentially dangerous situation through exercises that are gradually increased in complexity, and in proprioceptive challenge. The goal being to build a neuromuscular system in the athlete that can efficiently deal with the many proprioceptive challenges inherent to sport. The therapist or trainer must drive the training by imposing various demands at the appropriate level to obtain efficient and safe mechanics. The clinician must be able to recognize poor functional form and correct it through "tweaking" the exercise.6 Functional training is "quality of movement" training that requires careful progression and the understanding of biomechanical and neurological principles.

WHAT TO DO WITH THE NEWS

Unfortunately for women, there seems to be a confluence of factors that put them at risk for ACL and other knee injury. It is imperative that coaches, athletes, and parents be educated in the risks, not to discourage participation, but to encourage pre-season programs. Girls should also be encouraged to participate in numerous sports and cross training activities while growing and developing in order to be exposed to various proprioceptive challenges. It seems counterproductive to funnel children into programs that concentrate on one sport year round. Although the child may become quite skilled, poor habits can develop but not be recognized until injury occurs. Cross training works for all athletes.

The physical therapist has a responsibility to evaluate the athlete thoroughly (whether pre or post injury) in order to combine various parts of the above programs to focus on the individual's weaknesses. It appears that eccentric control of the muscles throughout the lower extremity, good quadriceps to hamstring ratios, and good proprioceptive skills are the cornerstones for training women and men to reduce injury risk. The athlete must be aware of the benefits of pre-season and in-season functional training. These programs must become readily available and clearly taught to coaches and trainers. It should be emphasized that more is not necessarily better, but the right training done with quality and variety may be the key.

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