Dynamic Chiropractic

Anterior Cruciate Ligament Deficiency in Women

Since the passage of the Title IX Educational Assistance Act of 1972 (requiring institutions receiving federal funds to provide equal access to men and women in both curricular and extra-curricular activities), the numbers of female participants has exponentially increased.[1] Some of the advantages of this increase are:

- the "legitimizing" of female athletes (taking female athletes seriously);
- the reminder that most sport's research had been focused on male athletes, and the need for female-specific research; and
- the need to evaluate any valid differences between male and female athletes physiologically to determine gender-specific strategies for sport-specific training.

A disadvantage of this dramatic increase in female participation in sport is the lack of preparedness by coaches and trainers for what training requirements would be needed to prevent injury and to properly prepare someone for sport-specific participation. As a result, many females are often allowed to "learn as they go" without specific instruction in focusing on specific strength deficiencies and proprioceptive demands.

A pattern has surfaced over the last decade of an increased incidence of anterior cruciate injuries in female athletes. One stark example was in the 1988 Olympic basketball tryouts, where both male and female injury rates were documented.[2] Eighty-one per cent of the ACL injuries were sustained by the female athletes! These injury rates were similar to those found with other sports, such as volleyball, rugby, and soccer.[1,3] These and other studies have struggled to determine why females are more prone to injury than males given the same sport activity. A fine review was published by Traina and Bromberg detailing some of the current thinking in this area.[4] The following is a synopsis of their work.

The theories regarding a female predisposition to ACL injury generally fall into two general categories: (1) extrinsic factors, and (2) intrinsic factors. The extrinsic factors focus on conditioning and training. Some questions are:

- Is there a relationship between lower levels of conditioning and injury rates, and are women generally entering sports activities at a lower level of conditioning?
- Is there a relationship between how women are coached in jumping, landing, and decelerating/cutting and ACL injury rates?
- Are there inherent strength differences and reaction-time differences between men and women?

A study conducted by the U.S. Naval Academy illustrated the generally lower level of conditioning seen in females as compared with males.[5] This same study indicated that females responded more dramatically to training then their male counterparts. Several studies indicate that at the high-school level, many girls enter at a "novice" level, having never before participated seriously in

sports.[6] Statistically, it appears that this trend is changing with an enormous increase in girls at younger ages participating in traditionally male-dominated sports, such as soccer, basketball, softball, and hockey.

It is clear that the vast majority (78% in one study) of ACL injuries are noncontact, often occurring when landing from a jump.[7] This is even more true in sports such as basketball and volleyball. One study divided these noncontact injuries into three types and documented the percentage of incidence.[8] Together they account for most ACL injuries in the study, and individually are essentially equal in occurrence (26%-29%):

1. planting and cutting;
2. straight leg landing; and
3. one-step landing with the knee hyperextended.

ACL injury rates were reduced among a group of women by almost 90 percent by simply modifying the plant-and-cut maneuver to a three-step stop, with an emphasis on avoiding knee extension.[8]

It is clear that women have less hamstring and quadriceps strength when compared to males; however, this holds true even when body weight is factored in.[9] This is a clear signal that a focus on general knee strength training should be part of all women's pre-event training schedule. It appears that another factor is the recruitment of muscles. In one study, females were more inclined to use quadriceps contraction when an anterior tibial force was applied, as compared to males, who used hamstring contraction.[9] It is clear that the hamstring contraction is the more protective response and suggests a possible gender or lack-of-training effect that must be corrected prior to event performance.

The time to torque production for hamstring contraction differs between male and female athletes. It appears that males have a quicker response time when compared to females.[9] There may be a training effect at play, yet what should be incorporated into women's training programs is proprioceptive training with the goal of decreasing response time to imposed demands. One study indicated that this could be accomplished through a progressive stability challenge program using balance and rocker boards.[10] Training begins first with the patient seated while the trainer attempts to move the unbalanced platform out from under the patient's foot. This progresses to more challenging positioning with less support available.

Intrinsic factors that may predispose females to ACL injury include instability at the knee, a wide pelvis (affecting limb alignment), and size of the intercondylar notch. It has long been noted that women appear to have "looser" joints than males. Does this static laxity play a part, or is the determining factor more the combination of capsular/ligament laxity and muscle strength?

There has been an assumption that hormonal influences allow for more flexibility and therefore laxity of female's ligaments. Yet, two studies using an objective measurement of ACL laxity with the KT-1000 did not demonstrate a gender specific laxity of the ACL.[11,12] Disagreement regarding the role of ACL laxity as a cause of ACL injury still exists. Although joint laxity may predispose an athlete to injury, it appears that other factors are important, such as muscle strength and reaction time (discussed above).

Although the female predisposition for patellar tracking problems seems to be related to a wider pelvis, femoral anteversion, and increased genu valgum as compared to men, these factors have

not been shown to influence predisposition to ACL injury.[13]

An interesting finding has been an apparent relationship between the intercondylar notch size and ACL injury. It appears that many athletes with ACL injury have a smaller notch size, and women in general have smaller notch sizes.[14] Radiographically, this is measured with the notch width index (ratio of intercondylar notch width to distal femur width) measured at the level of the popliteal groove on a tunnel view.[14] This smaller notch (stenotic notch) may indicate a smaller ACL or an increased tendency for impingement and stress to the ACL.

Even if the factors of notch width, pelvis width, and inherent joint laxity are factors, they generally can't be modified. The focus, therefore, should remain on proper training to ensure proper hamstring and quadriceps strength, decrease in reaction time, and proper recruitment sequence of muscle firing.

References

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OCTOBER 1997