Dynamic Chiropractic

MUSCULOSKELETAL PAIN

Treating Acute ACL Ruptures

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Research into the cause of anterior cruciate ligament (ACL) ruptures has shed some light on this unfortunate and much too common athletic injury. As a result of newly understood concepts, we may now be able to prevent (or at least minimize) many of these injuries. From a sports injury perspective, prevention is the best approach, rather than trying to salvage the knee after the damage has been done. Certain predisposing factors can be identified in athletes, and preventive measures can be recommended.

The Torque Effect

Epidemiology and frequency studies have demonstrated that the vast majority of acute ACL tears occur without any contact or direct trauma to the athlete's knee.[1] This seems contrary to the previous common understanding of this problem, but has now been shown in several different studies. We now know that it is the torque, or twisting forces imposed on the knee joint, that cause some ACLs to rupture. Some athletes have knee joints that seem to be more susceptible to these torque forces, and certain sports activities have been identified as particularly problematic.

Common Causes of Injury

Landing at foot strike with the knee extended or in slight flexion (less than 20 degrees) and internally rotating the tibia in relation to the femur is by far the most commonly described incident which results in tearing of the ACL.[2] A rapid change in direction during running (or a similar twist of the leg during a fall while skiing) can produce just such an episode. This is especially true in sports that use shoe spikes (which fix the lower leg to the ground). Arnold et al. found that 81 percent of athletes with injury to the ACL recalled the moment of injury as having their tibia in internal rotation combined with a sudden change of direction at foot strike.[3]

Markolf et al. used cadaver specimens to measure forces on the ACL with various types of loading. They found that internal rotation of the tibia places a greater force on the ACL than external rotation. The greatest amount of strain occurred when the knee was hyperextended and in internal rotation. Forces were also quite high when the knee was in 10 degrees or less of flexion and internally rotated.[4]

Predisposition Theories

Numerous theories have been investigated concerning factors that could predict which athletes would develop acute ruptures of the ACL. A large discrepancy in the strength ratio between the quadriceps and hamstring muscles is only sometimes present.[5] Another theory which shows some merit is the greater frequency of internal derangement knee injuries in people who are deconditioned and resume strenuous sports activities without proper conditioning.[5]

A study by Beckett et al. retrospectively reviewed a group of athletes with acute, nontraumatic ACL ruptures (arthroscopically-proven) and compared them to a matched control group. These researchers found excessive pronation of the foot and collapse of the arch during weightbearing in the injured subjects, and proposed this finding as the mechanism of injury.

Excessive Pronation and ACL Rupture

Beckett et al. reviewed the biomechanics of the foot and ankle and described how arch collapse and excessive pronation lead to abnormal internal (medial) tibial rotation that "pre-loads" the anterior cruciate ligament. Normally, subtalar joint pronation and internal rotation of the tibia occur only during the initial contact phase of gait. If pronation continues beyond the contact phase, the tibia will remain internally rotated. This abnormal tibial rotation transmits excessive forces upward in the kinetic chain to the knee joint, producing medial knee stresses, force vector changes in the quadriceps muscle, and lateral tracking of the patella.[7]

This theory is supported by Copland's work, which found that passive tibial rotation was statistically greater in hyperpronators than in nonpronators.[8] Beckett et al. conclude that "hyperpronation of the foot and ankle complex may increase the risk of injury to the ACL."[6]

Prevention of ACL Ruptures

The best type of treatment of athletic injuries is prevention. This is particularly true when the injury is one that may lead to permanent joint instability (even with surgical repair) and could end an athlete's career. With our current knowledge of the causes and predisposing factors for ruptures of the anterior cruciate ligament, we can now work to prevent these devastating injuries. All physically active patients and local athletes should be examined and evaluated for the existence of excessive pronation at the foot and ankle. This is true for young athletes and weekend warriors alike.

When you find an athlete with arch collapse and/or hyperpronation, the next step is to communicate and describe the risk factors for ACL rupture, then recommend regular use of custom orthotics during all sports activities. Prescribe a custom orthotic designed specifically for athletes. The critical factors to look for in an orthotic are: shock absorption (without "bottoming out"); support for the arches of the foot; moisture resistance; and little added weight. In addition, the athletic orthotic must have enough flexibility to be comfortable during intense activities, yet have sufficient stability to prevent excessive pronation and tibial rotation.

References

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