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ORTHOPAEDIC SPORTS MEDICINE BOARD REVIEW MANUAL

STATEMENT OF EDITORIAL PURPOSE

The *Hospital Physician Orthopaedic Sports Medicine Board Review Manual* is a peer-reviewed study guide for orthopaedic sports medicine fellows and practicing orthopaedic surgeons. Each quarterly manual reviews a topic essential to the current practice of orthopaedic sports medicine.

NOTE FROM THE PUBLISHER:
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Anterior Cruciate Ligament Injuries

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INTRODUCTION

Anterior cruciate ligament (ACL) tears occur in approximately 1 in 1750 active people.[1,2] More than 70% of ACL injuries in the United States are associated with sports participation, with most occurring in individuals aged 16 to 45 years. Two thirds of ACL injuries in females occur during participation in soccer or basketball. Compared with males, the rate of ACL injury in females is 2.5 times higher during soccer[1,3] and 4.1 times higher during basketball.[4–6]

The ACL can be injured via a contact or noncontact mechanism. Noncontact injuries typically are associated with sudden deceleration or rotation, as commonly occurs during running or cutting maneuvers and jumping/landing activities. ACL tears also can be caused by hyperextension or valgus stress to the knee as a result of a direct blow or noncontact mechanism.

RISK FACTORS FOR ACL INJURY

Sports medicine specialists should focus on injury prevention by encouraging athlete awareness about risk factors for ACL tears.

Hormonal Factors

Despite scientific documentation of estrogen receptor sites in the human ACL, it is controversial whether and how hormones influence ACL structure and composition. It is known that collagen synthesis and fibroblast proliferation decrease significantly with increasing levels of estrogen; conversely, collagen synthesis increases with increasing levels of relaxin.[7–11] The fluctuation of these hormones with the normal menstrual cycle and the direct influence of these fluctuations on the mechanical properties of ligaments remain a mystery.[12] At present, medical manipulation of hormone levels to prevent injury has no scientific evidence of effectiveness. There is also no scientific evidence to support the philosophy of restricting women from sports participation during a specific phase of the menstrual cycle.

Playing Conditions

Shoe-surface interaction contributes significantly to the potential for ACL injuries. Increased friction between the playing surface and athlete's shoe not only improves performance but also increases the risk of injury to knee ligaments. At present, there is no ideal shoe or surface for athletic participation.[13–15]

Prophylactic knee bracing has limited supporting evidence.[16–18] No study has conclusively demonstrated the effectiveness of knee bracing in prevention of noncontact ACL injury. However, the psychological value of a knee brace cannot be measured. Physicians should use caution when prescribing knee braces strictly for the prevention of noncontact ACL injury.

Gender Differences

Significant lower extremity anatomic variations exist between men and women. Neuromuscularly, men have greater absolute lean muscle mass than women. Scientific studies have revealed no gender differences in spinal or skeletal muscle reaction times in the quadriceps, hamstring, or gastrocnemius muscle groups. However, women tend to contract the quadriceps disproportionately in response to anterior translation of the tibia. In addition, men can voluntarily increase their knee stiffness significantly more than women with muscular contraction.[19–27]

Physical training can greatly impact the sophistication of neuromuscular efficiency. Studies have identified a greater electromechanical delay (time between neuroactivation and generation of force) in women athletes versus male athletes.[19–27] With women having less lean muscle mass and a significantly longer electromechanical delay, the relative lack of knee stiffness created by muscle activity will potentially lead to greater injury susceptibility.[20,21,28] With activity, women tend to land in a more upright position than men, with greater trunk, hip, and knee extension. The individual contributions to injury risk that each of these joint positions makes is still not clear. However, several centers have developed muscle training and jump/landing programs to potentially eliminate any influence of these extended joint positions. Recommendations to alter the position of joint extension and to lower the center of gravity when landing from a jump or when making a cutting maneuver are currently being studied.[29,30]