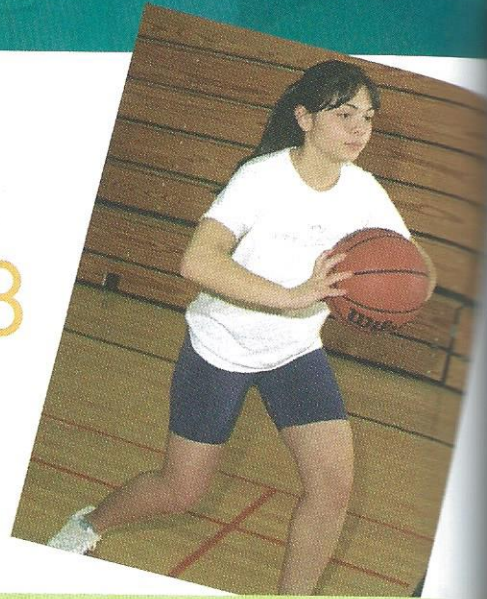


CHAPTER 18

The Knee



KEY TERMS

anterior cruciate ligament (ACL)
articular cartilage
condyle
crepitus
effusion
epiphyseal plates
lateral collateral ligament (LCL)
lateral meniscus
medial collateral ligament (MCL)
medial meniscus
patella
patellar tendon
patellofemoral joint
pes anserine
posterior cruciate ligament (PCL)
quadriceps
retropatellar surface
sesamoid
synovial fluid
synovial membrane
tibial plateau
tibiofemoral joint
valgus
varus

OBJECTIVES

Upon completion of this chapter, the reader should be able to:

- Describe the functions of the knee
- Describe the ligament structure of the knee
- Explain the function of the patellofemoral joint
- List and define various sports-related injuries of the knee

THE K

The knee joints and ligaments and menisci. Because the knee is subject to a great deal of overuse and trauma, it is one of the most commonly injured joints in the body.

The knee joint is a synovial joint. On top of the femur is the patella, the end of the femur. The femur has two prominences called condyles. The condyles are the ends of the femur that articulate with the tibia.

On the tibia, the femur fits into a socket. The femur to form the knee joint. The knee joint is a weight-bearing joint. It is subject to several important stresses. The stresses are limited by the ligaments and menisci on the tibia.

Under stress, the knee joint can be injured. The most common injuries of the knee are ligament tears and meniscus tears. These injuries can be managed with physical therapy and surgery.

Lateral collateral ligament

Lateral collateral ligament

Lateral collateral ligament

Lateral collateral ligament

Tibia

Fibula

Figure 18-1

THE KNEE

The knee joint is one of the most complex joints in the body. Most movements and activities depend on the knee for support and mobility. Because the knee supports the majority of the body weight, it is at risk of overuse and traumatic injuries in both contact and noncontact sports.

The knee is composed of three major bones and muscle groups. On top of the knee is the longest bone in the body, called the femur. The end of the femur flares at its distal end into a pair of rounded prominences called **condyles**. One is medial, the other lateral. The shape of the condyles allows the femur to roll and spin on the flattened top portion of the tibia, called the **tibial plateau**.

On the bottom of the knee is the tibia, which meets with the femur to form the **tibiofemoral joint**. The tibiofemoral joint is a weight-bearing, hinged joint held together with a joint capsule and several important ligaments (Figure 18-1). The motions at this joint are limited to flexion, extension, and a few degrees of rotation of the tibia on the femur.

Understanding the anatomy of the knee joint and common mechanisms of injury will enable the certified athletic trainer to assess and manage these injuries appropriately.

condyle The rounded prominence found at the point of articulation with another bone.

tibial plateau The top, flat portion of the tibia.

tibiofemoral joint The point where the tibia meets with the femur.

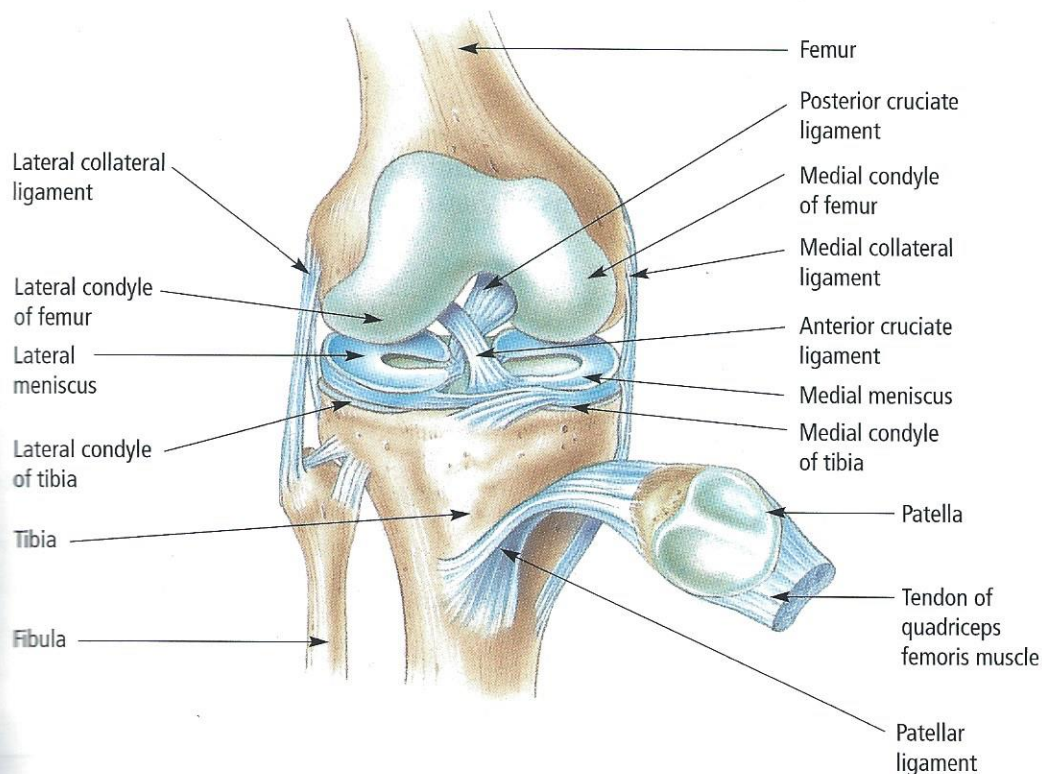


Figure 18-1 Major structures of the knee

KEY CONCEPT

Most movements and activities depend on the knee joint for support and mobility. The movement of this joint allows for flexion, extension, and a few degrees of lateral movement.

articular cartilage The thin layer of connective tissue over the ends of long bones.

medial meniscus Cartilage in the knee between the femoral condyle and the medial tibial plateau.

lateral meniscus Cartilage in the knee between the lateral femoral condyle and the lateral tibial plateau.

Cartilage

Two types of cartilage are found within the knee joint. The ends of both the tibia and femur are coated with a protective layer of smooth **articular cartilage**. This articular cartilage provides a smooth surface for gliding of the joint. Interspersed between the tibia and femur are two crescent-shaped wedges of cartilage called *menisci* (Figure 18-2). The **medial meniscus** lies between the medial femoral condyle and the medial tibial plateau. The **lateral meniscus** lies between the lateral femoral condyle and the lateral tibial plateau.

The menisci play several very important roles in the health and function of the tibiofemoral joint.

They aid in shock absorption, distribute forces, and improve stability of the femur as it rides on the tibia. The menisci are bathed by the synovial fluid of the knee. The **synovial membrane** coats the inner surface of the fibrous joint capsule, but is only about four cells deep. It has many blood vessels, lymph vessels, and nerves. **Synovial fluid**, which is produced by the synovial membrane, lubricates the articulating surfaces of the joint and supplies nutrients to the articular cartilage. The synovial fluid is composed of nutrients needed by the joint structure.

Ligaments of the Knee

Four major ligaments connect the tibia and femur. They control and guide the movement of the tibia and femur in relation to each other.

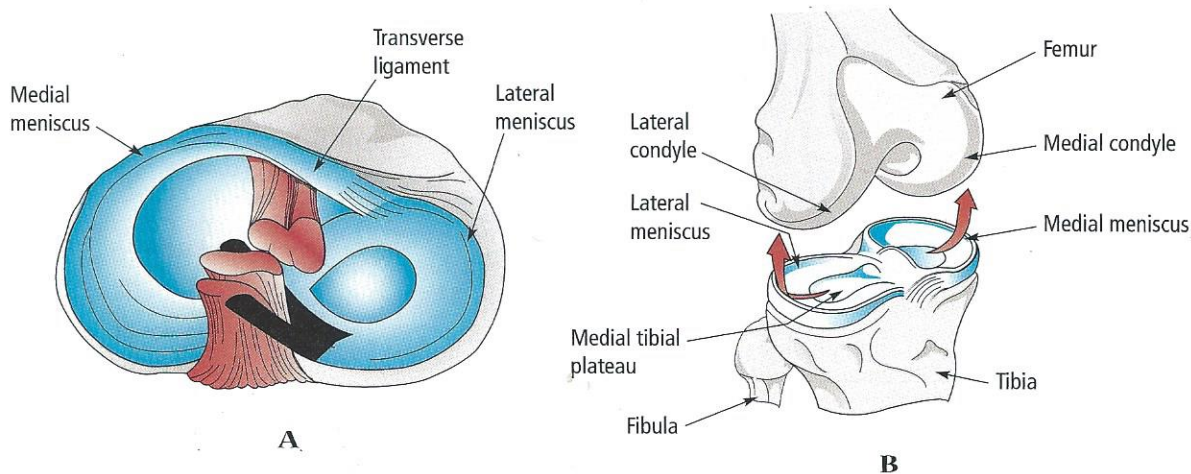


Figure 18-2 (A) The medial and lateral menisci of the knee (B) The menisci help make a more concave surface for the condyles to glide on, thereby making the knee joint more stable.

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The four ligaments all work together as a team, each assisting the others in their functions. Two of the ligaments are on the outside of the joint capsule. These run roughly parallel to each other on the sides of the joint, going vertically (see Figure 18-1). These ligaments are called the *medial* and *lateral collateral ligaments*.

The **medial collateral ligament (MCL)** attaches to the femur above and the tibia below. The **lateral collateral ligament (LCL)** also attaches to the femur, but, unlike the MCL, it attaches to the head of the fibula instead of the tibia. These two ligaments provide medial and lateral stability of the knee joint.

Within the knee joint are two additional ligaments: the **anterior cruciate ligament (ACL)** and the **posterior cruciate ligament (PCL)**. The term *cruciate* is derived from a Latin word meaning “cross.” It is used to describe these two ligaments because they cross each other as they lie in the joint cavity (see Figure 18-1). The ACL attaches to the anterior aspect of the tibial plateau, whereas the PCL attaches to the posterior tibial plateau. It is easy to remember the direction these ligaments run, from their tibial attachments toward their femoral attachments, by remembering the following acronyms:

Anterior cruciate ligament:

APEX = Anterior-to-**P**osterior-**E**xternally

Posterior cruciate ligament:

PAIN = Posterior-to-**A**nterior-**I**nternally

The cruciate ligaments each have a primary function. The ACL restricts anterior translation (movement) of the tibia on the femur; the PCL resists posterior translation of the tibia on the femur. Both of the cruciates have secondary functions of controlling rotation, medial stability, and lateral stability of the joint.

synovial membrane

A layer of tissue that lines joint cavities and produces synovial fluid.

synovial fluid *A lubricating substance, produced by the synovial membrane, found in joints.*

medial collateral ligament (MCL) *A flat longitudinal band found on the medial side of the knee joint.*

lateral collateral ligament (LCL) *A ligament that attaches to the femur and the fibula; maintains stability of the lateral aspect of the knee joint.*

anterior cruciate ligament (ACL) *A ligament in the knee that attaches to the anterior aspect of the tibial plateau, restricting anterior movement of the tibia on the femur.*

posterior cruciate ligament (PCL) *A ligament in the knee that attaches to the posterior aspect of the tibial plateau, restricting posterior movement of the tibia on the femur.*

KEY CONCEPT

There are four ligaments in the knee. These connect the tibia to the femur and control glide movement of the two bones as a unit. The medial and lateral collateral ligaments run roughly parallel to one another on each side of the knee joint. The anterior cruciate and posterior cruciate ligaments cross one another in the joint cavity. These ligaments restrict anterior and posterior movement of the tibia on the femur. They also aid in controlling rotation and providing joint stability.

patella The kneecap.

patellofemoral joint The point where the kneecap and femur are connected in the trochlear groove.

sesamoid A small bone formed in a tendon where it passes over a joint.

retropatellar surface The back side of the patella that is covered with a thick layer of articular cartilage.

DID YOU KNOW . . .

The largest sesamoid bone in the body is the patella.

quadricep A large group of four muscles in the front of the thigh.

KEY CONCEPT

The primary role of the patellofemoral joint is to allow flexion and extension of the knee with a lesser amount of force from the quadriceps. The patella increases quadriceps force by 33 to 50%.

The Patellofemoral Joint

The **patella**, or kneecap, rides in the trochlear groove on the distal end of the femur. This is called the **patellofemoral joint**. The patella is a **sesamoid**, or plate-shaped, bone that is enveloped within the quadriceps tendon on the front of the knee, and is part of the extensor mechanism. The quadriceps muscles, quadriceps tendon, patella, and patellar tendon constitute the structures of the extensor mechanism, which operate to actively straighten, or extend, the knee (Figure 18-3).

The primary role of the patella is to give greater mechanical advantage in extension of the knee. Simply put, the presence of the patella allows knee flexion and extension to occur with a lesser amount of quadriceps force. It is estimated that the patella increases quadriceps force by 33% to 50%. The back side of the patella, which articulates with the femur, is called the **retropatellar surface** and is covered with a thick layer of articular cartilage.

Muscles

The muscles that move the lower extremity are the strongest in the body. The large group of four muscles in the front of the thigh are collectively called the **quadricep** muscles. These muscles are the vastus medialis, vastus intermedius, vastus lateralis, and the rectus femoris. They join together in

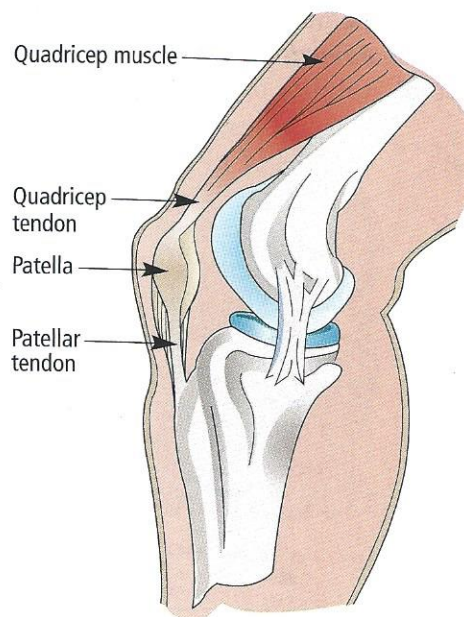


Figure 18-3 Lateral view of the knee, showing the patellofemoral joint

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Biceps femo

Figure 18-

the distal anterior thigh and attach to the patella through the quadriceps tendon (Figure 18-4). The tendon then encompasses the patella and extends distally across the front of the knee as the **patellar tendon**. The patellar tendon inserts onto the tibial tubercle on the proximal tibia. The quadriceps are very powerful extensors of the knee.

Two additional, long, strap-like muscles in the thigh are the *sartorius* and the *gracilis*. These muscles attach to the anteriomedial tibia near the attachment of the semitendinosus. The area of these three attachments in close approximation is called the **pes anserine**. They assist with flexion of the knee.

The hamstrings on the posterior thigh are divided into two groups. The medial hamstrings include the semitendinosus and semimembranosus, and the biceps femoris constitutes the lateral hamstrings (Figure 18-5). The hamstring muscles attach to the pelvis and femur proximally and insert onto the posterior tibia. Because they cross the hip joint, they are also extensors of the hip.

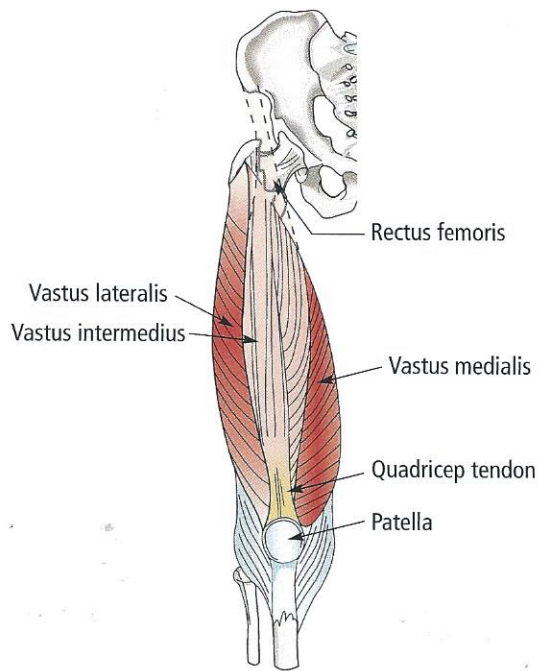


Figure 18-4 Front view of the quadriceps muscles

patellar tendon The tendon that encompasses the patella and extends distally across the front of the knee.

pes anserine The area where the sartorius, gracilis, and semitendinosus muscles attach to the anteriomedial tibia.

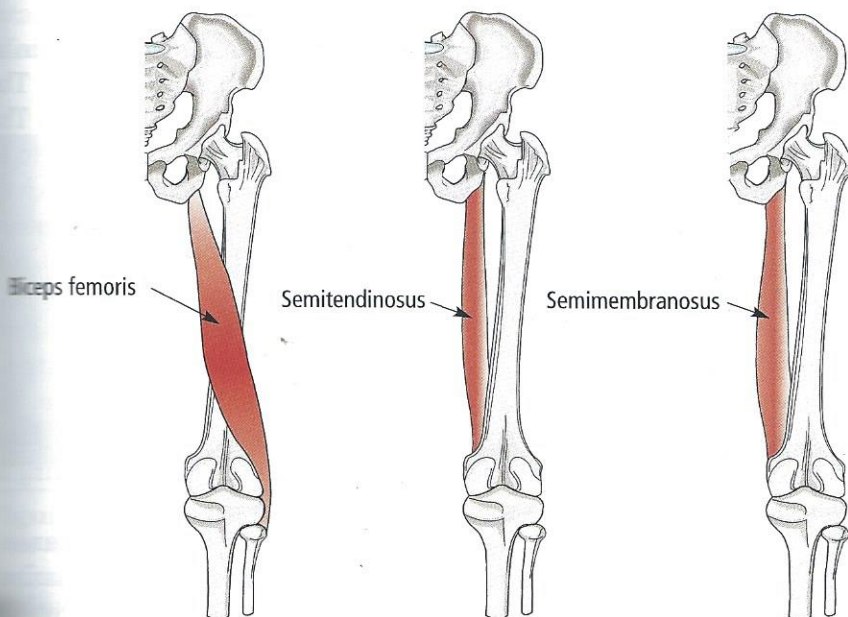


Figure 18-5 Hamstring muscles