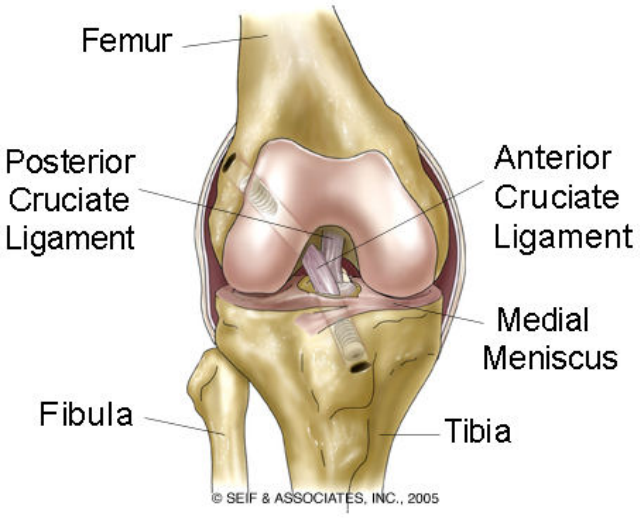
Anterior Cruciate Ligament (ACL) Repair

A ligament is a strong, elastic band of tissue which connects bones together. The anterior cruciate ligament guides the shin bone (*tibia*) through a normal range of movement. When this ligament is torn, the joint loses its stability. Over time and without repair, this will cause more injury to the*:*

- *Articular* (cartilage covering the bone).
- *Meniscal* (cartilage that rests between the femur and the tibia [see picture]).

Because of this, surgical rebuilding of the anterior cruciate ligament (ACL) is often the treatment of choice for people wishing to maintain an active lifestyle.



This is a much more common injury in:

- Young females athletes.
- Basketball and soccer.

CAUSES

An incomplete injury to the cruciate ligaments is sometimes referred to as a "sprain". The ACL is most often stretched or torn (or both) by a sudden twisting or over extending motion. An example is when the feet are planted one way and the knees are turned another.

SYMPTOMS

Injury to a cruciate ligament may not cause pain. Rather, the person may hear and feel a popping sound. The leg may buckle when he or she tries to stand on it. Your caregiver may perform several tests to see if the knee is stable when pressure is applied in different directions. A good examination is necessary. An MRI (Magnetic Resonance Imaging) is very accurate in detecting a complete tear. Arthroscopy (looking inside the knee using a special tool) may be the only sure way of detecting a partial one.

DIAGNOSIS

Your caregiver may use a number of methods to diagnose knee problems.

- **Medical history.** You explain to your caregiver details about any injury, condition, or general health problem that might be causing the pain.
- **Physical examination.** Your caregiver bends, straightens, turns, or stresses on the knee to feel for injury and discover the limits of movement and the location of pain. To assess the knee's function you may be asked to:
  - Stand.
  - Walk.
  - Squat.

Your caregiver may use one or more tests to determine the kind of a knee problem. These include:

- **X-ray** (radiography). An x-ray beam is passed through the knee to produce a two-dimensional picture of the bones.
- **Computerized axial tomography (CAT) scan.** X-rays lasting a fraction of a second are passed through the knee at different angles. These x-rays are then detected by a scanner, and analyzed by a computer. This produces a series of clear cross-sectional images ("slices") of the knee tissues on a computer screen. CAT scan images:
  - Are best at fine bone detail.
  - Show soft tissues such as ligaments or muscles.
  - Can combine individual images to give a three-dimensional view of the knee.
- **Bone scan (radionuclide scanning).** A very small amount of radioactive material is injected into the patient's bloodstream and detected by a scanner. This test detects:

- Blood flow to the bone.
- Cell activity within the bone.

- **Magnetic resonance imaging (MRI).** Energy from a powerful magnet (rather than x-rays) stimulates knee tissue to produce signals. These signals are detected by a scanner and analyzed by a computer. This creates a series of cross-sectional images of a specific part of the knee. An MRI is particularly useful for detecting soft tissue damage or disease. Like a CAT scan, a computer is used to produce three-dimensional views of the knee during MRI.
- **Arthroscopy.** The doctor manipulates a small, lighted optic tube (arthroscope). This tube is inserted into the joint through a small incision in the knee. Images of the inside of the knee joint are projected onto a television screen. While the arthroscope is inside the knee joint it is possible to:
  - Remove loose pieces of bone or cartilage.
  - Repair torn ligaments and menisci.
- **Biopsy.** The caregiver removes tissue to examine under a microscope.

Bones and Cartilage

The knee joint is the junction (coming together) of three bones:

1. The *femur* (thigh bone or upper leg bone).
2. The tibia.
3. The *patella* (knee cap).

The patella is 2 to 3 inches wide and 3 to 4 inches long. It sits over the femur at the front of the knee joint and glides when the leg moves. It protects the knee and enhances the strength of the thigh (quadriceps) muscles.

The ends of the three bones in the knee joint are covered with articular cartilage, a tough, elastic material that helps absorb shock and allows the knee joint to move smoothly. Separating the bones of the knee are pads of connective tissue. One pad is called a meniscus; more than one are called menisci. The menisci are divided into two crescent-shaped discs positioned between the tibia and femur on the outer and inner sides of each knee. The two menisci in each knee act as shock absorbers. These menisci cushion the lower part of the leg from the weight of the rest of the body as well as improving stability.

Muscles

There are two groups of muscles at the knee.

- The quadriceps muscle is made up of four muscles on the front of the thigh that work to straighten the leg from a bent position.
- The hamstring muscles, which bend the leg at the knee, run along the back of the thigh from the hip to just below the knee.

Keeping these muscles strong with exercises such as walking up stairs or riding a stationary bicycle helps support and protect the knee.

Tendons and Ligaments

- The **quadriceps tendon** connects the quadriceps muscle to the patella and provides the power to extend the leg. Four ligaments connect the femur and tibia and give the joint strength and stability:
- The **medial collateral ligament** (MCL) provides stability to the inner (medial) part of the knee.
- The **lateral collateral ligament** (LCL) provides stability to the outer (lateral) part of the knee.
- **The anterior cruciate ligament (ACL)**, in the center of the knee, limits rotation and the forward movement of the tibia.
- The **posterior cruciate ligament** (PCL), also in the center of the knee, limits backward movement of the tibia.
- Other ligaments are part of the knee capsule, which is a protective, fiber-like structure that wraps around the knee joint. Inside the capsule, the joint is lined with a thin, soft tissue called synovium.

TREATMENT

For an incomplete tear, your caregiver may recommend that you begin an exercise program to strengthen

surrounding muscles. Sometimes a brace is used to protect the knee during activity.

For a completely torn ACL in an active athlete and motivated person, your surgeon is likely to recommend surgery. The surgeon may reattach the torn ends of the ligament or reconstruct the torn ligament by using a piece *(graft)* of healthy ligament from the patient (*autograft*) or from a cadaver (*allograft*). Although synthetic ligaments have been developed, the results have not been as good as with human tissue. One of the most important elements in a patient's successful recovery after cruciate ligament surgery is a 4 to 6 month exercise and rehabilitation program. Successful surgery and rehabilitation will usually allow you to return to a normal active lifestyle.

Preventing Knee Problems

You can prevent many knee problems by following these suggestions:

- Before exercising or participating in sports:
  - Warm up by walking or riding a stationary bicycle,
  - Do stretches. Stretching the muscles in the front of the thigh (quadriceps) and back of the thigh (hamstrings) reduces tension on the tendons and relieves pressure on the knee during activity.
- Strengthen the leg muscles by doing specific exercises (for example, by walking up stairs or hills, or by riding a stationary bicycle). A supervised workout with weights is another way to strengthen the leg muscles that support the knee.
- Avoid sudden changes in the intensity of exercise. Increase activity gradually. This is more important as we age.
- Wear shoes that fit properly to help maintain balance and leg alignment when walking or running. Knee problems can be caused by flat feet or *over-pronated feet* (feet that roll inward). It is possible to reduce some of these problems by wearing special shoe inserts *(orthotics)*. Stay at a healthy weight to reduce stress on the knee. Obesity increases the risk of *degenerative* (wearing) conditions such as osteoarthritis of the knee.

Exercise Most Suitable for Someone With Knee Problems

- Range-of-motion exercises help maintain normal joint movement and flexibility. This type of exercise helps maintain or increase flexibility.
- Strengthening exercises help keep or increase muscle strength. Strong muscles help support and limit the stress on joints affected by arthritis.
- Aerobic or endurance exercises improve function of the heart and circulation and help control weight. Weight control can be important to people who have arthritis because extra weight puts pressure on all lower extremity joints.

PROGNOSIS

This procedure is helpful to most patients but outcomes are unpredictable. There may be long-term joint degeneration. The key to success is to return the knee to a working stability. This means the knee is stable during movement. Implantation of a replacement graft does not guarantee success. The mechanical properties (workings) of ACL grafts deteriorate (get worse) after implantation because of biological remodeling (how the body works).

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