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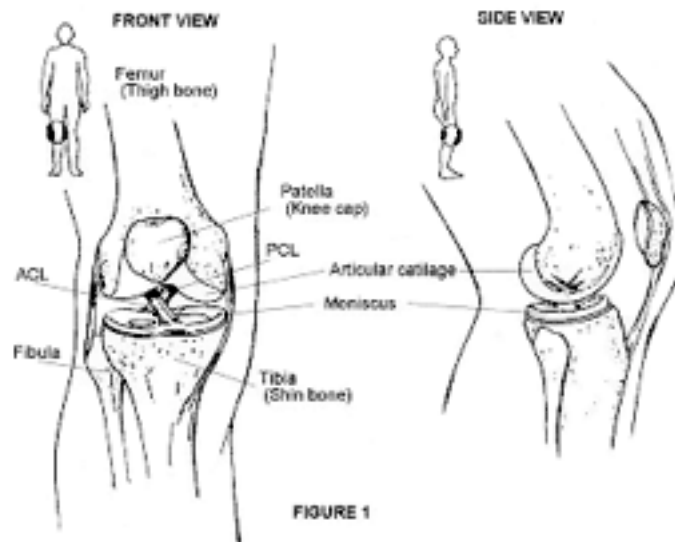
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PATIENT GUIDE TO ACL RECONSTRUCTION

WHAT IS THE ANTERIOR CRUCIATE LIGAMENT?

The knee is a hinge joint held together by four ligaments. A ligament is a soft-tissue structure in the knee that holds the bones together and helps to control joint movement or motion. There is a ligament on each side of the knee (the *collateral* ligaments) and two ligaments deep inside the knee. The two ligaments inside the knee "cross" each other are called the *anterior cruciate ligament* (ACL) and the *posterior cruciate ligament* (PCL). Both ligaments attach on one side to the end of the thigh bone (*femur*) and on the other to the top of the shin bone (*tibia*) [Figure 1].



During activity, the ACL controls how far forward the tibia can "slide" relative to the femur. It essentially acts to prevent too much forward movement. While some degree of motion or sliding is normal and is required for knee function, too much motion may damage other structures in the knee, which can lead to long term problems in some patients.

HOW IS THE ACL INJURED, AND WHAT ARE THE SYMPTOMS?

The ACL can be injured or torn in a number of different ways. The most common mechanism is that of a sudden pivoting or cutting maneuver during sporting activity, which is commonly seen in football, basketball, and soccer. The ligament can also tear due to work injuries or automobile accidents.

At the time of the injury a "pop" or "snap" can sometimes be felt or heard. The amount of pain experienced at the time of the injury is somewhat variable, but can be quite severe. Typically, the person is unable to continue play or activity, and has the impression that a significant injury has occurred. Immediate swelling of the knee develops at the time of injury (within the first several hours), but the extent of swelling can be limited if the knee is immediately iced or splinted.

HOW IS A TEAR OF THE ACL DIAGNOSED?

A tear of the anterior cruciate ligament can be diagnosed by a physician through a history and physical examination. On physical examination, the physician can specifically assess the amount of motion present and determine if the ACL torn or not torn. Additionally, evaluation of other structures within the knee is performed, as ACL tears are often found in association with injury to other structures within the knee such as the cartilage and collateral ligaments.

X-rays are taken to evaluate for the presence of any fractures. In some, but not all, patients a *magnetic resonance imaging* scan (MRI) of the knee may be ordered. The MRI can clarify the question of an ACL tear if the history and examination are inconclusive. The MRI is also useful for evaluating the cartilage in the knee if this information is necessary to make decisions regarding the best treatment for a specific patient.

WHAT ARE THE OPTIONS IF I HAVE AN ACL TEAR?

The treatment options following an ACL tear are individualized for each patient depending on age, activity level, and the presence or absence of injury to other structures within the knee. In general, surgery is recommended for young patients who are active and for those in whom the ACL tear is associated with injury to other structures in the knee. Nonoperative (nonsurgical) treatment is recommended in older more sedentary patients.

The main reason to have surgery is to restore stability to the knee so it no longer gives out or slides too far forward. This is uncomfortable and painful during activity. The other reason (perhaps the most important reason) is to protect the cartilage in the knee from being damaged. It is especially important to protect the meniscus cartilages in the knee.

The meniscal cartilage is a fibrous type of cartilage that sits between the ends of the tibia and femur, and is attached to the lining of the joint. There are two separate meniscal cartilages in the knee, each somewhat C-shaped: one on the inner half of the knee (the *medial meniscus*), and one on the outer half (the *lateral meniscus*) [Figure 1]. The medial and lateral menisci primarily serve as shock-absorbers between the ends of the bones to protect the surface or *articular* cartilage. With recurrent episodes of giving way, the meniscus can be damaged or torn causing it to lose its shock-absorbing capability.

Without a functioning meniscus, the articular cartilage is exposed to increased pressure and "wears" away, leading to arthritis. Additionally, the articular cartilage may be directly injured or damaged with each episode of giving-way.

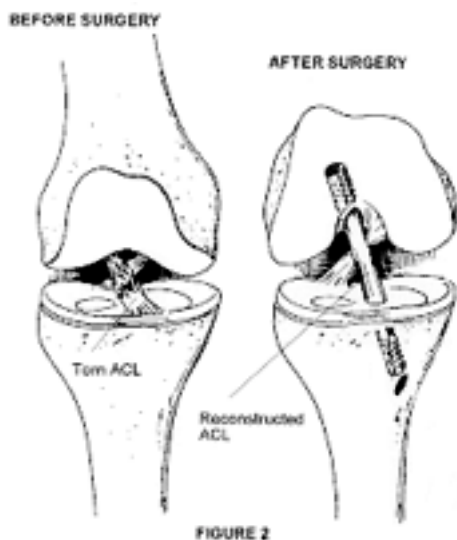
NON-SURGICAL TREATMENT

Nonsurgical treatment consists of physical therapy, activity modification, and use of a brace. The goal of physical therapy is to strengthen the muscles around the knee in order to compensate for the absence of the ACL. Specifically, strengthening the muscles in the back of the thigh (the *hamstrings*) is helpful. Activity modification can be very successful. Sports which do not involve cutting (such as jogging, cycling, or swimming) can often be done without difficulty.

In addition to therapy and activity modification, use of a hinged sports brace (e.g. *DonJoy, CTI, Lennox Hill*) can be attempted. While bracing may be effective in some patients, in others giving-way may continue despite their use.

SURGICAL TREATMENT

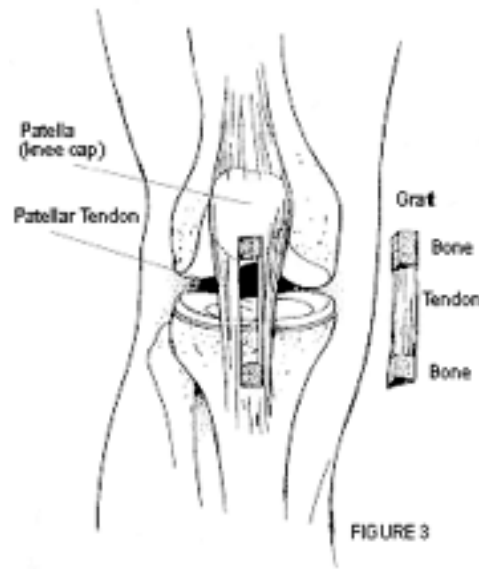
Once the ACL tears, it has usually sustained enough damage that attempts to repair it at surgery are not successful. Consequently, better results are obtained if the ACL is surgically replaced (or reconstructed) with another tendon from around the knee [Figure 2]. There are a number of surgical options for reconstructing the ACL. The type of procedure performed may vary depending on a specific surgeon's preference as well as factors unique to an individual patient.



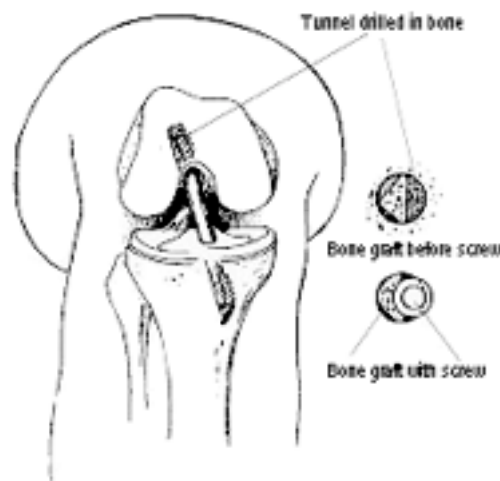
The material used to reconstruct the ligament is called the *graft*. It can either be an *autograft* (from one's own body) or an *allograft* (from another person's body). The two most commonly used autografts are the *patellar tendon* and the *hamstrings tendons*. The patellar tendon graft consists of the central or middle third of the patellar tendon and its attached piece of bone from both the kneecap (*patella*) and tibia [Figure 3]. Thus, it is called a *bone-tendon-bone* graft.

The hamstring graft is usually comprised of the tendons from two of the hamstring muscles on the inside of the thigh, the *gracilis*, and the *semitendinosus*. These tendons are then doubled, or folded in

half, for extra strength. The hamstring muscles themselves are left in place, as are the hamstring muscles and tendons on the outside of the knee, so no overall knee strength is lost.



ACL reconstruction surgery is most commonly performed using *arthroscopic* techniques. Using one or two small incisions on the knee, the graft is taken from the patellar tendon or the hamstring tendons. A tunnel or pathway for the new graft is drilled into both the tibia and femur. The graft is then threaded through the knee joint leaving a piece of bone or extra tendon in each of the tunnels. The majority of the new tendon graft now occupies the position of the original ACL, thus reconstructing the ligament [Figure 2]. The graft is then secured in this position, most commonly by "wedging" a screw between the side of the bone or extra tendon and the tunnel [Figure 4]. Alternatively, the graft can be secured by other techniques including staples, sutures, buttons, cross pins, etc. These screws and/or staples are left in place permanently.



In addition to the ACL reconstruction, other procedures may be done if injury is present to other structures within the knee. A torn meniscus can be either repaired or trimmed (*partial meniscectomy*), and other ligaments can be repaired or reconstructed as well.

The allografts most frequently used today are of the bone-patellar tendon-bone type or from the Achilles tendon at the heel. They come from cadavers that have been screened for infectious diseases (e.g. the hepatitis and HIV viruses). The risk of HIV / AIDS from one of these grafts is not exactly known, but is very small -- generally believed to be 1 out of 500,000. All grafts are carefully screened and tested before they are used in surgery.

HOW LONG DOES REHABILITATION TAKE AFTER SURGERY?

The exact course of therapy may vary somewhat depending on the specific type or reconstruction done, particularly if additional meniscus or ligament surgery is performed. Physical therapy is done in a supervised setting in conjunction with a trained therapist. Early in the course of recovery, visits may be 2 to 3 times per week, but later once every week or two is often sufficient. Home exercises are done on days not scheduled for a formal therapy session.

The rehabilitation following ACL reconstruction includes essentially three phases. The first phase of rehabilitation consists of controlling the pain and swelling in the knee, regaining knee motion, and getting early return of muscle strength. The operated leg is typically placed into a knee immobilizer or hinged brace after surgery.

Initially, weight-bearing is allowed with crutches. Progression to full weight-bearing independent of crutches is permitted as swelling, motion, and muscle strength improve. Most patients are on crutches for one week, although this time frame varies. This phase typically takes 6 to 8 weeks.

The second phase emphasizes continued control of swelling and recovery of full muscle strength. Cycling, treadmill running, and light jogging are started in this phase. In some patients, a sport brace is obtained to replace the postoperative knee brace. This phase typically lasts from 2 to 4 months after surgery.

The final phase consists of graduated return to full activity. Full motion, normal muscle strength, and the absence of swelling are required for successful return to activity. A brace may be recommended early in the return to activity. This phase occurs at 4 to 8 months after surgery, depending on the particular patient and the nature of their activities.

A patient's rehabilitation is monitored closely by both the therapist and surgeon for evidence of potential problems. Most significantly, patients are cautioned not to attempt too premature return to full activity, which may cause the knee to become inflamed, or re-injured. In every patient the graft must both heal into place and be incorporated into the knee: too much stress too soon may increase the risk of graft failure.

WHAT ARE THE POTENTIAL COMPLICATIONS AFTER SURGERY?

The majority of patients experience no complications and return to full activity between 6 and 8 months after surgery. However, the most common complications include pain in the front of the knee and loss of knee motion.

Pain in the front of the knee occurs in 10-20 percent of patients. Fortunately, it can usually be controlled by modification in the physical therapy protocol. Loss of motion occurs in less than 5 percent of patients and is most common seen in patients with limited motion before surgery. While correctable with more aggressive therapy in most patients, it may necessitate re-operation in rare cases. In some individuals, intermittent pain and swelling occur with activity despite a successful ligament reconstruction. This is often related to the amount of meniscal or cartilage injury that was present and identified at the time of surgery.

In the absence of identifiable causes, a small percentage of patients will end up with a persistent detectable increased amount of motion in their knee (a "loose" graft). This may be related to stretching of the graft over time, or due to re-injury.

WILL I BE ABLE TO RETURN TO MY PREVIOUS SPORTING ACTIVITIES?

Approximately 95 percent of patients return to their previous level of activity without restrictions. In the other 5 percent, full return may be limited by a number of causes: pain, swelling, persistent laxity, change in lifestyle related to age, intentional choice, or other unidentifiable causes.