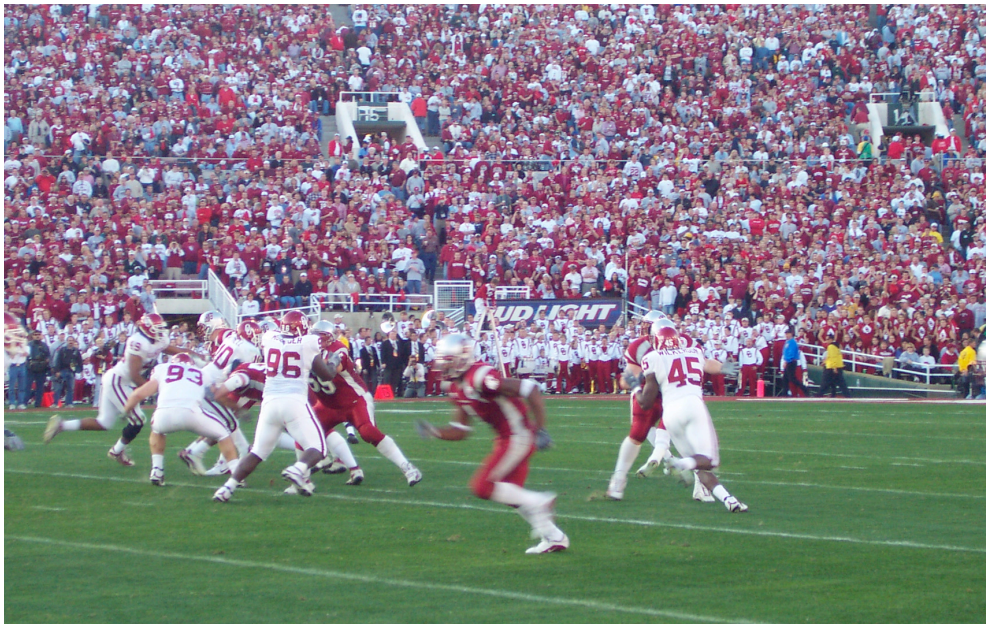
Anterior Cruciate Ligament (ACL) Injuries

Treatment Options & Rehabilitation



Prepared for you by
Edwin M. Tingstad, M. D.

Inland Orthopaedics
& Sports Medicine Clinic
825 SE Bishop Blvd, Ste 120
Pullman, WA 99163
(509) 332-2828

ANTERIOR CRUCIATE LIGAMENT INJURIES

A torn anterior cruciate ligament (ACL) is one of the most common knee ligament injuries. Approximately 1 in 3000 Americans will injure their ACL. Our understanding of the anterior cruciate ligament and its importance to knee stability has increased greatly over the past 15 years. Techniques for diagnosing the injury and performing surgical reconstruction have become more reliable.

Anatomy

The normal anatomy of the human knee is depicted in the figure below. There are four major ligaments that provide knee stability. The anterior cruciate ligament is located inside the knee joint next to the posterior cruciate ligament. The medial collateral ligament (MCL) and lateral collateral ligament (LCL) are on the outside of the knee joint and the posterior cruciate ligament is inside the knee near the back. There are also two meniscal cartilages that act as shock absorbers and provide some stability. The articular cartilage lines the knee joint and allows for smooth, nearly frictionless motion. A torn anterior cruciate ligament is commonly associated with injury to one or more of these structures.

Mechanism of Injury

Injuries to the anterior cruciate ligament occur most often in athletic activities. The injury typically does not require a blow to the knee but instead involves a rapid change in direction or deceleration maneuver. Seventy percent of ACL injuries are not associated with any contact. The individual will often hear or feel a “pop” inside the knee. The injury is usually followed by increasing pain and

swelling, as well as progressive inability to bear weight on the leg, for a short period of time. However, some people will swell very little after an ACL injury.

Initial Management

The initial management of a patient with an anterior cruciate ligament injury is highly individualized, but some general principles exist. Assuming no fractures are present, the patient is often allowed to bear weight on the extremity when pain and swelling and motion allow. Eighty percent of ACL injuries have significant bone bruising that may necessitate minimal weight bearing. You may be advised to wear a brace and/or use crutches depending on the severity of the injury. Application of ice to the knee, usually for 20 minutes 4-5 times per day, may aid in minimizing swelling for the first 3 days after the injury. Therapy will be started to help restore knee motion, maintain muscle strength and reduce swelling. If surgery is to be performed, it will be done after the acute inflammation (swelling) and restriction of motion that accompanies the injury have subsided, which generally takes about 2-3 weeks.

Your physician may choose to obtain an MRI (magnetic resonance imaging) scan of your knee. An MRI scan is not always necessary if the physician's clinical evaluation is evident. This is tailored to each patient.

Definitive Management

Approximately one-third of patients who injury the anterior cruciate ligament will experience relatively few problems and lead a fairly normal lifestyle. Another one-third will have problems with the knee with various athletic activities. These people could live with their knee satisfactorily if they are willing to give up those activities that cause problems. The remaining one-third of patients will have problems with their knee even with simple activities of daily living, such as stepping off a curb or changing directions while walking or jogging.

The decision to undergo reconstructive surgery for a tear of the anterior cruciate ligament is highly individualized. Patients who should consider undergoing anterior cruciate ligament reconstruction are those who plan to continue an active lifestyle, which places demands on the injured knee. Activities that require frequent changes in direction or speed (tennis, skiing, basketball, football, soccer, softball) will generally result in "giving way" episodes in a person with an anterior cruciate ligament deficient knee. These episodes may cause further injury to the menisci and articular cartilage of the knee and are thought to eventually result in degenerative arthritis. Patients who lead a more sedentary lifestyle or those who participate in "straight ahead" sports like jogging, swimming and cycling, may have little, if any, difficulty with their knee. They might prefer to treat their injury

with a rehabilitation program alone. Sometimes, the decision to undertake anterior cruciate ligament reconstructive surgery depends on whether or not a patient is willing to forego activities which can cause episodes of knee instability. We advise patients to strongly consider anterior cruciate ligament reconstructive surgery if they plan to engage in activities that would place the knee at risk for instability episodes. Patients with old ("chronic") injuries to their anterior cruciate ligament should either avoid activities that cause buckling or consider ligament reconstruction. Regardless, of treatment a large percentage of patients with ACL injuries have been shown to have earlier onset of arthritis at 10-15 years after the injury.

Anterior Cruciate Ligament Reconstruction – Options

Reconstruction of the anterior cruciate ligament is a surgical procedure performed in an operating room usually under general or spinal anesthesia. The technique for this surgery is referred to as "arthroscopically assisted ligament reconstruction." That is, an incision is made to obtain the tissue to be used in the reconstruction, but the actual ligament replacement surgery is done with the arthroscope. The ligament reconstruction is performed by removing the remnant of the torn ligament from the knee and then replacing it with biologic tissue. The replacement may come from one of several sources. These include your patellar tendon or hamstring tendons (called "autografts) or tissue from tissue banks (called "allograft"). The decision about which graft source to use should be made by the patient in conjunction with their treating physician.

ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Pre-operative

The initial evaluation and treatment is used to discuss treatment options and outline a rehabilitation plan. Often an MRI is ordered or therapy is arranged to facilitate regaining motion and strength. Regardless of the treatment chosen, this is a critical component of treatment program. If the decision is made to proceed to surgery then the timing of surgery will also be decided upon. Further appointments are arranged around the rehabilitation and surgery dates if chosen.

If surgery is chosen, a separate pre-operative visit is scheduled a few days before surgery. You will be given a paperwork packet containing your insurance information, surgical consent form, and pre-operative orders for the hospital. Take these with you when you go to the hospital for your pre-operative visit.

You will also be given a specific time to arrive at the pre-operative surgery desk at the hospital on the day of surgery. Not uncommonly, however, the operative schedule proceeds either slower or faster than we anticipate. For this reason it is important that we have a means of contacting you on the day of surgery in case there is a last minute change of schedule. We know changes in schedules are frustrating and we will try diligently not to alter yours. **REMEMBER, eat or drink nothing after midnight on the day of surgery**.

The Day of Surgery

When you arrive in the pre-operative holding area, you will be asked to change into a hospital gown and make yourself comfortable on a gurney; (most patients prefer to leave their underwear on during the procedure, and this is fine). You will meet your anesthesiologist in the pre-operative holding area, and options for anesthesia will be discussed. The doctor will come in and initial your knee with a marker, and a compressive stocking will be placed on your other leg. Your knee will be prepared for surgery first by removing the hair from the operative site with hair remover cream, and then by scrubbing it with an antibacterial soap. We ask that you do not shave just before the surgery as it may increase the chance of infection.

From the pre-operative holding area, you will be taken to the operating room. A tourniquet will be placed around your thigh, and it is occasionally inflated for a portion of the surgery. Your leg will be draped in a sterile manner that allows us to work in a completely sterile field.

The surgical time is approximately two hours. If one or both of the menisci (knee cartilage) are torn, the surgery will take slightly longer in order to remove or repair the damaged structures. After the reconstruction is completed, a light dressing, the cold therapy unit, and a brace may be applied.

Local anesthetics will be injected into the knee joint at the end of the operation to reduce post-operative discomfort. Often a nerve block is performed at the end of the surgery. From the operating room you will be transferred to a recovery area for approximately one or two hours. Pain medication as needed is available in the recovery room. Occasionally, nausea may occur from the anesthesia, and medication is available to help control it. The decision of whether to stay in the hospital will be discussed prior to your surgery.

During the first 24-48 hours you should limit your walking as much as possible. The leg should be elevated on 2 or 3 pillows above the level of your heart. The leg does not need to be elevated during sleep. We suggest using the cold therapy unit,

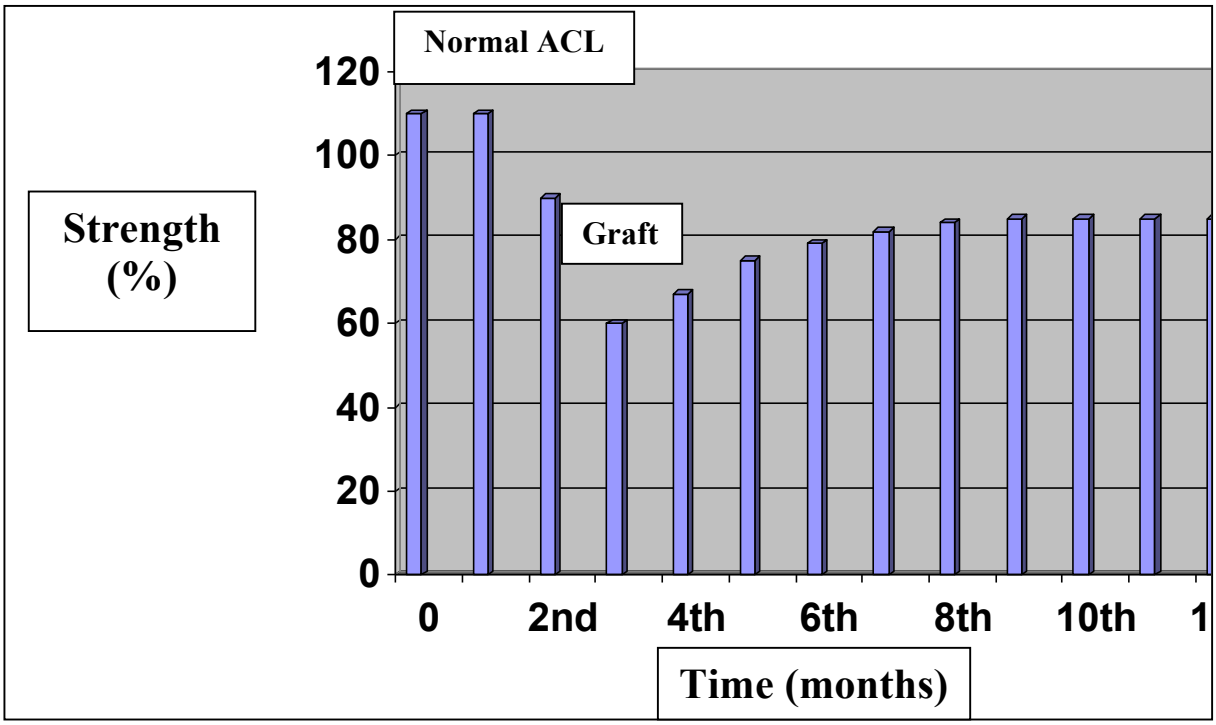
applied over the dressing, for 20 to 30 minutes each hour. Once you are ready for sleep, discontinue cold therapy treatment. Cold therapy treatment is the most effective within the first 48 hours of surgery. If braced, we encourage you to wear the brace at all times except when doing the exercises you were shown by the therapist (which are not necessary the first night). When you do get up, for example, to go to the bathroom, use your crutches. ***Keep your incision and dressing dry***. It is common to experience some bloody drainage from the knee for the first 24-36 hours. If this occurs, simply reinforce the dressing with a sterile gauze if the fluid is bothersome.

Another common occurrence after general anesthesia is a low-grade fever during the first 24-48 hours post-operatively. The fever is usually below 100° and slowly abates. Tylenol works quite well to keep it in check. If your fever is greater than 100º and associated with shaking chills and increasing knee pain, please let us know, as this may be an early indicator of infection. It's also important to cough and take deep breaths regularly during the first 24 hours (we recommend 10 deep breaths per hour during waking hours). Movement of ankle also assists in decreasing swelling and is recommended as much as possible.

REHABILITATION AFTER ACL RECONSTRUCTION

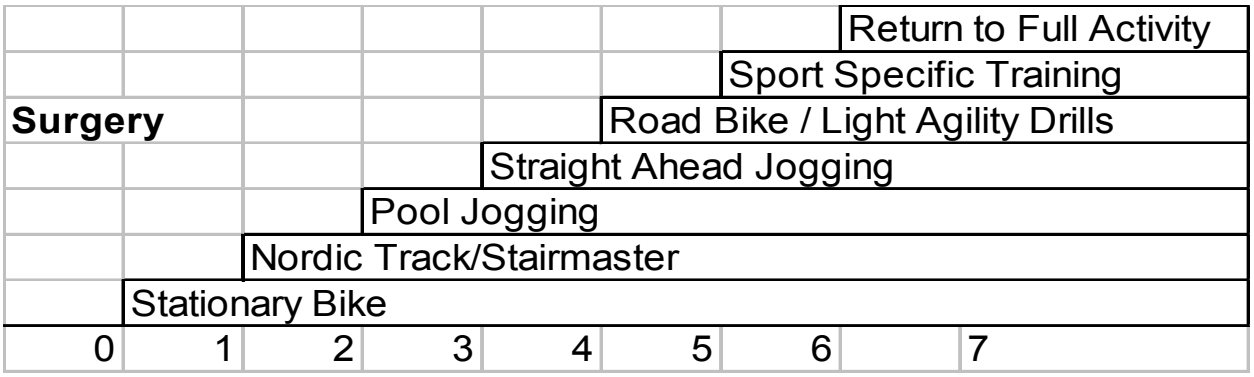
A. General Overview: The 8-12 months following surgery

Your newly reconstructed graft undergoes a biologic transformation from the time of implantation to almost one year post-operatively. Studies indicate that your graft may initially be stronger than a normal ACL but quickly loses its original strength and reaches its lowest point by one month. It then gradually regains strength over the next 6-8 months. The exact numbers are controversial, but the general trend is illustrated below.



Your rehabilitation after surgery is designed to re-establish motion and strength during this remodeling. Initially, activities are permitted which cause the least strain on the reconstructed ligament. Gradually, activities are increased ultimately leading to sport specific training. The priority is to obtain range of motion (ROM) first followed by strengthening. The following time-line summarizes our approach to your rehabilitation and can serve as a quick reference guide. The concept is to permit mild load to promote normal healing and avoid excessive load that might be harmful.

Quick Reference Chart (in Months)



MOON ACL REHABILITATION GUIDELINES

Immediate Post-operative phase (approximate time frame: Surgery – 2 weeks)	
Crutch Use: Weightbearing as tolerated with crutches (beginning the day of surgery) **Discontinue Crutch when you have achieved:** • Normal gait pattern • Ability to safely ascend/descend stairs without noteworthy pain or instability **Knee Immobilizer:** None (Exception: First 24 hours after a femoral nerve block) **Cryotherapy:** Ice bag or cold pack with compression and elevation • First 24 hours or until acute inflammation is controlled; every hour for 15 minutes • After acute inflammation is controlled; 3 times a day for 15 minutes **Scar Massage** • When incision is fully healed	
Goals	• Full knee extension ROM • Good quadriceps control (20 controlled straight leg raises-SLR) • Minimize pain and swelling • Normal gait pattern
Exercises	**ROM** • *Extension:* Low load, long duration (~5 minutes) stretching (e.g. prop pillow under heel and straighten leg out, prone leg hang) • *Flexion:* Heel slides, seated assisted knee flexion, bike: rocking-for-range **Muscle Activation/Strength** • Quadriceps sets • SLR emphasizing no lag • Double-leg quarter squats • Standing theraband resisted terminal knee extension (TKE)

	• Hamstring curls • Side-lying leg raises (Avoid with MCL injury) • Quad/ham co-contraction supine • Prone Hip Extension • Ankle pumps with theraband • Heel raises (calf press)
Cardiopulmonary	• UBE or similar exercise is recommended

CRITERIA FOR PROGRESSION TO PHASE 2

- 20 no lag SLR
- Normal gait
- No use of crutch or immobilizer
- ROM: no greater than 5° active extension lag, 110° active flexion

PHASE 2: Early Rehabilitation Phase (Approximate timeframe: weeks 2 to 6)	
Goals	• Full ROM • Improve muscle strength • Progress neuromuscular retraining
Exercises	**ROM** • Low load, long duration (assisted PRN) • Heel slides • Heel prop/prone hang • Bike (rocking-for-range → riding with low seat height) • Flexibility stretching all major groups **Strengthening** *Quadriceps:* • Quad sets • Mini-squats/wall squats • Step-ups • Knee extension from 90° to 40° • Leg press • Shuttle **Press without jumping action** *Hamstrings:* • Hamstring curls • Resistive SLR with sports cord *Other Musculature:* • Hip adduction/abduction: SLR or with equipment • Standing heel raises: progress from double to single leg support • Seated calf press against resistance • Multi-hip machine in all directions **Neuromuscular training** • Wobble board • Rocker board

	• Single-leg stance • Slide board or fitter
Cardiopulmonary	• Bike • Elliptical trainer • Stairmaster

CRITERIA FOR PROGRESSION TO PHASE 3

- Full ROM
- Minimal effusion/pain
- Functional strength and control in daily activities

PHASE 3: Strengthening & Control Phase (Approximate timeframe: weeks 7 through 12)	
Goals	• Maintain full ROM • Running without pain or swelling • Hopping without pain, swelling or giving-way
Exercises	**Strengthening** • Squats & Wall squats • Leg press • Hamstring curls • Knee extension 90° to 0° • Step-ups/downs • Lunges **Neuromuscular Training** • Wobble board / rocker board / roller board • Pertubation training • Instrumented testing systems • Varied surfaces
Cardiopulmonary	• Straight line running on treadmill or in a protected environment (NO cutting or pivoting) • All other cardiopulmonary equipment (including pool jogging)

CRITERIA FOR PROGRESSION TO PHASE 4

- Running without pain or swelling
- Hopping without pain or swelling (Bilateral and Unilateral)
- Neuromuscular and strength training exercises without difficulty

PHASE 4: Advanced Training Phase (Approximate timeframe: weeks 13 to 16)	
Goals	• Running patterns (Figure-8, pivot drills, etc.) at 75% speed without difficulty • Jumping without difficulty

	• Hop tests at 75% contralateral values
Exercises	**Aggressive Strengthening** • Squats • Lunges • Plyometrics **Agility Drills** • Shuffling • Hopping • Carioca • Vertical jumps • Running patterns at 50 to 75% speed (e.g. Figure-8) • Initial sports specific drill patterns at 50-75% effort **Neuromuscular Training** • Wobble board / rocker board / roller board • Pertubation training • Instrumented testing systems • Varied surfaces
Cardiopulmonary	• Running • Other cardiopulmonary exercises

CRITERIA FOR PROGRESSION TO PHASE 5

- Maximum vertical jump without pain or instability
- 75% of contralateral on hop tests
- Figure-8 run at 75% speed without difficulty

PHASE 5: Return-to-Sport Phase (Approximate timeframe: weeks 17 to 20)	
Goals	• 85% contralateral strength • 85% contralateral on hop tests • Sport specific training without pain, swelling, or difficulty
Exercises	**Aggressive Strengthening** • Squats • Lunges • Plyometrics **Sport-Specific Activities** • Interval training programs • Sprinting • Change of direction • Running patterns in football • Pivot and drive in basketball • Kicking in soccer • Spiking in volleyball • Skill / biomechanical analysis with coaches and sports medicine team

Return to Sport	**RETURN TO SPORT EVALUTION RECOMMENDATIONS** • Hop tests • Isokinetic strength test (60°/second) • Vertical jump • Deceleration shuttle test **RETURN TO SPORT CRITERIA** • Cleared by Dr. Tingstad • No functional complaints • Confidence when running, cutting, jumping at full speed • 85% contralateral values on hop tests

ACL Reconstruction
Most Frequently Asked Questions

1. When can I shower?

You may shower as long as you cover the incision with plastic and keep it dry until your sutures are removed in the office. After this, you may shower without covering the incision. Please wait 2 weeks from the time of surgery before you immerse the knee in water.

2. How many incisions will I have?

The answer to this question depends on what graft is used and what type of fixation. If we use your patellar tendon, you will have a 3" incision on the front of your knee and a small incision above your kneecap. Sometimes we need an additional 1" incision on the outside of your knee. If your menisci need repairing, you will have additional 1-2" incisions corresponding to which meniscus is repaired.

3. How long do I use crutches?

We like you to use crutches for the first week and as long as is necessary for balance. The length of time they are to be used depends on the extent of further surgery.

4. Can I put weight on my leg?

You are permitted to weight bear as tolerated on your leg from the first day after surgery, as long as you have your brace on, and it is locked in extension. We prescribe that you use the brace for one month when weightbearing, and use the crutches as described above.

5. When can I drive? (2-6 weeks)

Driving depends on which leg is operated upon and whether your car has an automatic or manual transmission. If it is your left leg, and you have an automatic, you may drive when you are comfortable. If it is your right leg or a manual transmission, it takes longer, perhaps two-ten weeks depending on the individual. We ask that you practice in a vacant area to be sure you are safe before driving on the main road. Reflexes are slowed for a prolonged period after surgery.

6. Will I always need a brace?

We may have you wear a post-operative brace for usually the first two weeks. Some patients wear a sport brace for the first year if returning to a sport, especially if it is a high risk sport, such as basketball, football or tennis. A few individuals will use the brace longer. However, most are brace-free after they have completed their rehabilitation.

7. Does my brace stay locked or unlocked?

For the first week, your brace remains locked for both ambulation and sleeping. As you begin to ambulate more and need the crutches less, you may unlock the brace for walking and begin transitioning into a more normal gait pattern.