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**ACL Reconstruction Rehabilitation Protocol**

One of the most common problems following ACL reconstruction is loss of motion, especially loss of extension. Loss of knee extension has been shown to result in a limp, quadriceps muscle weakness, and anterior knee pain. Studies have demonstrated that the timing of ACL surgery has a significant influence on the development of postoperative knee stiffness.

THE HIGHEST INCIDENCE OF KNEE STIFFNESS OCCURS IF ACL SURGERY IS PERFORMED WHEN THE KNEE IS SWOLLEN, PAINFUL, AND HAS A LIMITED RANGE OF MOTION.

The risk of developing a stiff knee after surgery can be significantly reduced if the surgery is delayed until the acute inflammatory phase has passed, the swelling has subsided, a normal or near normal range of motion (especially extension) has been obtained, and a normal gait pattern has been reestablished.

Preoperative Rehabilitation Phase

Prepare for surgery using the information within this section.

Goals:

- \*Control pain and swelling
- \*Restore normal range of motion
- \*Develop muscle strength sufficient for normal gait and ADL
- \*Mentally prepare for surgery

Before proceeding with surgery the acutely injured knee should have with little or no swelling, have a full range of motion, and the patient should have a normal or near normal gait pattern.

More important than a predetermined time before performing surgery is the condition of the knee at the time of surgery. Use the following guidelines to prepare the knee for surgery:

## Immobilize the knee

Following the acute injury you should use a knee immobilizer for as little time as possible (to be determined by your surgeon) and crutches until you regain good muscular control of the leg. Extended use of the knee immobilizer should be limited to avoid quadriceps atrophy (weakness). You are encouraged to bear as much weight on the leg as is comfortable unless otherwise directed by your physician.

## Control Pain and Swelling

Ice packs, Cryocuff or a Gamer Ready along with non steroidal anti-inflammatory medications such as Advil, Aleve (2 tablets twice a day), Naprosyn (Naproxen) or Celebrex are used to help control pain and swelling. The non-steroidal anti-inflammatory medications are continued for 7-10 days following the acute injury.

## Restore normal range of motion

You should attempt to achieve full range of motion as quickly as possible. Quadriceps isometrics exercises, straight leg raises, and range of motion exercises should be started immediately.

### Full extension is obtained by doing the following exercises:

#### 1) Passive knee extension.

- Sit in a chair and place your heel on the edge of a stool or chair.
- Relax the thigh muscles.
- Let the knee sag under its own weight until maximum extension is achieved.

#### 2) Heel Props:

- Place the heel on a rolled towel making sure the heel is propped high enough to lift the thigh off the table.
- Allow the leg to relax into extension.
- Do this 3-4 times a day for 10 - 15 minutes at a time.

#### 3) Prone hang exercise.

- Lie face down on a table with the legs hanging off the edge of the table.
- Allow the legs to sag into full extension.

### Bending (Flexion) is obtained by doing the following exercises:

#### 1) Passive knee bend

- Sit on the edge of a table and let the knee bend under the influence of gravity.

#### 2) Wall slides (figure 3) are used to further increase bending.

- Lie on the back with the involved foot on the wall and allow the foot to slide down the wall by bending the knee. Use other leg to apply pressure downward.

- 3) Heel slides are used to gain final degrees of flexion.
- Pull the heel toward the buttocks, flexing the knee. Hold for 5 seconds.
  - Straighten the leg by sliding the heel downward and hold for 5 seconds.
  - In later stages of rehabilitation, do heel slides by grasping the leg with both hands and pulling the heel toward the buttocks.

### Develop muscle strength

Once 100 degrees of flexion (bending) has been achieved you may begin to work on muscular strength:

- 1) Stationary Bicycle. Use a stationary bicycle two times a day for 10 - 20 minutes to help increase muscular strength, endurance, and maintain range of motion.
- 2) Swimming is also another exercise that can be done during this phase to develop muscle strength and maintain your range of motion.
- 3) Low impact exercise machines such as an elliptical cross-trainer, leg press machine, leg curl machine, and treadmill can also be used.

This should continue until you have achieved a full range of motion and good muscular control of the leg (you should be able to walk without a limp).

### Mentally prepare

- Understand what to realistically expect of the surgery
- Make arrangements with a physical therapist for post-operative rehabilitation
- Make arrangements with your place of employment
- Make arrangements with family and/or friends to help during the post-operative rehabilitation
- Read and understand the rehabilitation phases after surgery

## Understanding Surgery

### Pain control, Knee Immobilizer

A long local anesthetic will be injected around your femoral nerve. This will block the pain nerve fibers and local pain receptors in your knee.

Recent studies have shown that this is a safe and effective way to control pain after knee surgery. In many cases the injection will last 12 or more hours after surgery and significantly reduce the amount of pain medication that you will have to take.

Prior to leaving the operating room a knee immobilizer will be applied to your knee.

- The knee immobilizer is to be worn while walking and sleeping (for the first 5-7

days) otherwise it can be removed for therapy and bathing or when you are sitting at home

· After surgery, your leg will be wrapped in tensor bandage with some gauze underneath. The purpose of the wrap is to control swelling in the leg.

Underneath the tensor bandage is a larger band aid (Aqualcel). This is waterproof and you can shower with this. Leave the Aquacel on your leg for 10 days then you can remove it.

After the anesthesia has worn off, your vital signs are stable and your pain is under control you will be discharged from the hospital.

You will not be allowed to drive a car. Prior to your discharge arrange for transportation.

### **Postoperative Days 1-7**

Follow the guidelines within this section for the first seven days after your surgery.

Outpatient physical therapy should have been arranged to start 48-72 hours after your operation.

**IT IS EXTREMELY IMPORTANT THAT YOU WORK ON EXTENSION IMMEDIATELY.**

Goals:

- \* Control pain and swelling
- \* Care for the knee and dressing
- \* Early range of motion exercises
- \* Achieve and maintain full passive extension
- \* Prevent shutdown of the quadriceps muscles
- \* Gait training

Control Pain and Swelling

- 1) Control Swelling. Following discharge from the hospital you should go home, elevate your leg and keep the knee iced. You may get up to use the bathroom and eat, but otherwise you should rest with your leg elevated. Liberal use of ice (with either ice packs or your Game Ready) during this phase is recommended. It will be more effective once the dressing is changed.

**DO NOT SIT FOR LONG PERIODS OF TIME WITH YOUR FOOT IN A DEPENDENT POSITION, AS THIS WILL CAUSE INCREASED SWELLING IN YOUR KNEE AND LEG.**

WHEN SITTING FOR ANY SIGNIFICANT PERIOD OF TIME, ELEVATE YOUR LEG AND FOOT.

- 2) Control Pain. You will be sent home with a prescription for a strong narcotic medication such as Percocet. You should take this for severe pain, as directed on the prescription bottle label.
- 3) You may also be given an anti-inflammatory such as Naprosyn or Celebrex or Take this as directed for 14 days.
- 4) As your pain and swelling decrease you can start to move around more and spend more time up on your crutches.

### Caring for your knee

If the dressings become extremely bloody or wet you should change them as needed.

Use the following directions for changing the dressing:

The tensor should be removed 48 hours following surgery. You can remove the tensor bandage and throw away the gauze 48 hours after surgery. On our skin will be an Aquacel dressing. It is a moisture-retention dressing, which forms a gel on contact with wound fluid and has antimicrobial properties of ionic silver.

Leave the Aquacel dressing on for around 10 days then you can remove it.

### Weight bearing status

This applies to all ACL reconstruction unless otherwise specified.

You can put all of your weight (weight bearing as tolerated) immediately but use both crutches.

You may shower after you have removed the Tensor bandage. The Aquacel dressing is waterproof. Do not soak the area (avoid a bath or hot tub).

A follow-up visit should be scheduled for 2 weeks following the operation. This will usually be in the fracture clinic at the hospital. The hospital should give you the appointment date and time.

You may remove the knee immobilizer while doing exercises or if you are in a safe, protected environment. However, the knee immobilizer should be worn while sleeping for the first 5-7 days, and while you walk until you regain muscle control of the leg.

### Early Range of Motion and Extension

- 1) Passive extension of the knee by using a rolled towel. Note the towel must be high enough to raise the calf and thigh off the table.

- Remove the knee immobilizer from your knee every 2-3 hours while awake
- Position the heel on a pillow or rolled blanket with the knee unsupported
- Passively let the knee sag into full extension for 10 - 15 minutes. Relax your muscles, and gravity will cause the knee to sag into full extension. This exercise can also be done by sitting in a chair and supporting the heel on the edge of a stool, table or another chair and letting the unsupported knee sag into full extension.

2) Active-assisted extension is performed by using the opposite leg and your quadriceps muscles to straighten the knee from the 90 degree position to 0 degrees. Hyperextension should be avoided during this exercise.

3) Passive flexion (bending) of the knee to 90 degrees.

- Sit on the edge of a bed or table and letting gravity gently bend the knee.
- The opposite leg is used to support and control the amount of bending.
- This exercise should be performed 4 to 6 times a day for 10 minutes.

### Exercising Quadriceps

1) You should start quadriceps isometric contractions with the knee in the fully extended position as soon as possible.

- Do 3 sets of 10 repetitions 3 times a day.
- Each contraction should be held for a count of 6 sec. This exercise helps to prevent shut down of the quadriceps muscle and decreases swelling by squeezing fluid out of the knee joint.

2) Begin straight leg raises (SLR) with the knee immobilizer on 3 sets of 10 repetitions 3 times a day. Start by doing these exercises while lying down.

- This exercise is performed by first performing a quadriceps contraction with the leg in full extension. The quadriceps contraction "locks" the knee and prevents excessive stress from being applied to the healing ACL graft.
- The leg is then kept straight and lifted to about 45-60 degrees and held for a count of six.
- The leg is then slowly lowered back on the bed. Relax the muscles.

REMEMBER TO RELAX THE MUSCLES EACH TIME THE LEG TOUCHES DOWN

This exercise can be performed out of the brace when the leg can be held straight without sagging (quad lag). Once you have gained strength, straight leg exercises can be performed while seated.

### Exercising Hamstrings

1) The hamstring muscles are exercised by pulling your heel back producing a hamstring contraction. This exercise can be performed if your own patellar tendon graft was used to reconstruct the ACL or if an allograft was used.

## **Postoperative Days 8-10**

Use the guidelines within this section for days 8-10 after your surgery

Physical therapy

Maintain full extension

- 1) The steri-strips will peel off over time
- 2) Your sutures will dissolve. There is nothing that needs to be removed. You may apply vitamin E oil to the incisions, as this will improve their appearance.
- 3) The appearance of your incision can be improved further if you keep direct sunlight off of it for one year. When exposed to the sun the incisions can be covered with a bandage or zinc oxide paste.

### **Physical Therapy and Full Extension**

- 1) Continue doing the quadriceps isometrics, SLR, active flexion, and active-assisted extension exercises.

REMEMBER THAT IT IS EXTREMELY IMPORTANT TO CONTINUE TO REMOVE YOUR LEG FROM THE KNEE IMMOBILIZER 4 TO 6 TIMES A DAY FOR 10 – 15 MINUTES AT A TIME TO MAINTAIN FULL EXTENSION.

### **Returning to Work**

- 1) As far as returning to work, if you have a desk type job you can return to work when your pain medication requirements decrease, and you can safely walk with your crutches. Typically this is between 10 - 12 days after surgery.
- 2) Patients who have jobs where light duty is not permitted will be out of work for a minimum of 6 - 12 weeks.

## **Postoperative Week 2**

Use the guidelines in this section during the second week after your surgery

Goals:

- \* Maintain full extension
- \* Achieve 100 - 120 degrees of flexion
- \* Develop enough muscular control to wean off knee immobilizer
- \* Control swelling in the knee

**MAINTAINING FULL EXTENSION AND DEVELOPING MUSCULAR CONTROL ARE IMPORTANT**

Maintain Full Extension

- 1) Continue with full passive extension (straightening), gravity assisted and active flexion, active-assisted extension, quadriceps isometrics, and straight leg raise.
- 2) Work toward 90-100 degrees of flexion (bending)

## Develop Muscular Control

### 1) Start Partial Squats.

- Place feet at shoulder width in a slightly externally rotated position.
- Use a table for stability, and gently lower the buttocks backward and downward.
- Hold for 6 seconds and repeat.
- Do 3 sets of 10 repetitions each day.

### 2) Start Toe Raises.

- Using a table for stabilization, gently raise the heel off the floor and balance on the ball of the feet.
- Hold for 6 seconds and ease slowly back down.
- Do 3 sets of 10 repetitions each day.

3) Start to wean off the knee immobilizer if you have good muscle control of the leg (straight leg raise without the leg sagging – quads lag).

4) Once you have weaned off the immobilizer you should continue to use the crutches until you can put full weight on the leg and walk with a normal heel to toe gait and no limp.

5) You can start using a stationary bike when you can bend your knee at least 100 degrees.

Cycling is an excellent conditioning and building exercise for the quadriceps.

- The seat position is set so when the pedal is at the bottom, the ball of the foot is in contact with the pedal and there is a slight bend at the knee.
- No or low resistance used. Maintain good posture throughout the exercise.
- As your ability to pedal the bike with the operative leg improves you may start to increase the resistance.
- Your objective is to slowly increase the time spent on the bike starting first at 5 minutes and eventually working up to 20 minutes a session.
- The resistance of the bike should be increased such that by the time you complete your workout your muscles should "burn".

THE BIKE IS ONE OF THE SAFEST MACHINES YOU CAN USE TO REHABILITATE YOUR KNEE, AND THERE IS NO LIMITATION ON HOW MUCH YOU USE IT.

## Control Pain and Swelling

- 1) Once you have finished the anti-inflammatory that was given to you, you can take an over-the-counter anti-inflammatory medication, provided you have no history of stomach ulcer. The cheapest and simplest medication to



- take is Advil, Motrin or Aleve.  
2)

When can you drive a car?

**IT IS ILLEGAL TO TAKE PRESCRIPTION PAIN MEDICATIONS AND OPERATE A MOTOR VEHICLE!**

- First, you must not be taking any prescription pain medications.
- Patients who have had surgery on the left knee, and who have an automatic transmission may drive when they can comfortably get the leg in and out of the car.
- During driving the knee immobilizer can be removed.
- Patients who have had surgery on the left knee and have standard transmissions should not drive until they have good muscular control of the leg. This usually takes 2-3 weeks.
- Patients who had surgery on the right knee should not drive until they have good muscular control of the leg. This usually takes 2 - 3 weeks.

**Postoperative Weeks 3-4**

Goals:

- \* Full range of motion
- \* Strength through exercise

- 1) Expected range of motion full extension to 100 - 120 degrees. Add wall slides and hand assisted heel drags to increase your range of motion.
- 2) Continue quadriceps isometrics and straight leg raises
- 3) Continue partial squats and toe raises
- 4) If you belong to a health club or gym you may start to work on the following machines:

- Stationary bike. Set the seat position to regular height to avoid too much bending or straightening of the knee. Increase resistance as tolerated. Try to work up to 15- 20 minutes a day.
- Elliptical cross-trainer 15 - 20 minutes a day.
- Inclined leg-press machine for the quadriceps muscles. 70 - 0 degree range. See
- Seated leg curls machine for the hamstring muscles.
- Upper body exercise machines.
- Swimming: pool walking, flutter kick (from the hip), water bicycle, water jogging. No whip kicks.

**Postoperative Weeks 4-6**

Goals:

- \* 125 degrees of flexion pushing toward full flexion
- \* Continued strength building

- 1) Your expected range of motion should be full extension to 125 degrees. Start to push for full flexion. Walls slides added if your flexion range of motion is less than desired.
- 2) Continue quad sets, straight leg raises, partial squats, toe raises, stationary bike, elliptical machine, leg presses, and leg curls.
- 3) Tilt board or balance board exercises

### **Postoperative Weeks 6-12**

By week 6, your range of motion should be full extension to at least 135 degrees of flexion.

Goals:

- \* 135 degree of flexion
- \* Continued strength
- \* Introduce treadmill

- 1) Continue quad sets, straight leg raises, partial squats, toe raises, stationary bike, elliptical machine, leg presses, and leg curls.
- 2) Continue tilt board and balance board for balance training.
- 3) Continue swimming program.
- 4) Start treadmill (flat only).
- 6) You may begin outdoor bike riding on flat roads.

NO MOUNTAIN BIKING OR HILL CLIMBING.

At the three month mark, a isokinetic test (Biodex/Cybex) will be arranged through the office to assess your muscle strength.

### **Postoperative Weeks 12 – 20**

Goals:

- \* Continued strength
- \* Introduce jogging and light running
- \* Introduce agility drills
- \* Determine need for ACL functional brace

- 1) Continue all of week 6 -12 strengthening exercises.
- 2) Start straight, forward and straight, backward jogging and light running program.
- 3) Start functional running program after jogging program is completed.
- 4) Optional fitting for ACL functional brace.
- 5) Start agility drills, zig-zags and cross over drills.

### **24 Weeks Postoperative (6 months)**

This is the earliest you should plan on returning to full sports.

Goals:

\* Return to sports: To return to sports you should have:

- Quadriceps strength at least 80% of the normal leg
- Hamstring strength at least 80% of the normal leg
- Full motion
- No swelling
- Good stability
- Ability to complete a running program

Another isokinetic test (Biodex/Cybex) may be necessary and arranged through the office to assess your muscle strength.

### Medication Regimen Post Op

1. Percocet. Take 1-2 tablets every 6 hours as needed for pain. Stop using the narcotics as soon as you can. Please fill the prescription immediately after surgery. You may also use regular over the counter Tylenol, 2 tablets every 6 hours as needed after you are off the narcotics.

2. Naprosyn (Naproxen) or Celebrex is an anti-inflammatory and analgesic. It will be prescribe following surgery and should be taken for 2 weeks. If you have a history of ulcers do not take it.

3. Stool softener if recommended due to the constipating effect of the Percocet. This can be purchased over-the-counter.

### Frequently asked Questions for ACL Reconstruction Patients

1. What are the indications to fix my knee?

Degree of instability – both subjective and objective, Complexity of associated injuries- cartilage tear, chondral injuries, and other ligament injuries.

Young age- this is relative.

High anticipated activity level associated with pivoting sports.

2. Why is the ACL reconstructed and not repaired?

When you tear your ACL it is not longer to sew it back together. Although there has been some recent success with primary repair, this is considered experimental at this time the “gold standard” is reconstructive surgery. Therefore, the ACL is reconstructed with a new graft made of alternative tissue.

3. What kind of graft options are there?

There are two types of graft options: autograft (your own tissue) or allograft

(donor tissue). An autograft (your own tissue) is used in most cases. Autograft options include part of your patellar tendon or two hamstring tendons. The choice of which one to use is based on a case by case assessment but both have equal outcomes. Allograft (donor tissue) options are numerous. These include soft tissue grafts (tendons) and composite grafts of bone and tendon (patellar tendon and Achilles tendon). The advantages of using allografts for ACL reconstruction include unaltered patellofemoral tracking, no donor-site morbidity, decreased overall surgical morbidity, decreased operative time, improved cosmesis with smaller surgical incisions, less postoperative pain, easier rehabilitation, and decreased overall cost. Allografts are particularly useful in patients for whom a previous autograft ACL reconstruction has failed or in patients who need a complex multiple ligament reconstruction. A primary disadvantage of allografts is the risk of viral or bacterial disease transmission. This risk is very low and is estimated to be approximately a 1/1.5 million chance of viral disease transmission. The results of use of allografts or autografts for ACL reconstruction are considered comparable. Age is also a consideration in recommending an allograft for your reconstruction.

#### 4. How are the grafts fixed to the bone?

There are numerous fixation techniques. In almost all cases a bio absorbable screw will be placed in the tunnel to tightly fix the graft against the walls of the tunnel. Staples may also be used for fixation. In some cases these may be irritating later and require removal.

#### 5. How long is the surgery?

Depending on the presence of other injuries to the cartilage or ligaments, the surgery takes 1 hour or less

#### 6. Where are the incisions?

There are two small less than 1 cm incisions around the knee for the arthroscopic equipment. There is a small incision to harvest the graft on the front of the knee. These are small and cosmetically acceptable.

#### 7. Risks of anterior cruciate ligament surgery?

All surgery has inherent risks even though these risks are low. The major risks are infection, swelling, wound healing problems, blood clots, stiffness, recurrent instability, arthritis, pain, and painful hardware. The risk of infection is reportedly about 0.8% and when recognized is treated with cleaning out of the joint and antibiotics. Preventative measures are taken such as: cleansing of the skin, careful surgical technique, and preoperative antibiotics.

Swelling is normal after ACL surgery but if there is a lot of swelling that limits motion or causes excess pain then aspiration of the joint may be necessary. This occurs infrequently.

The incisions are quite small and therefore complications are rare. Occasionally blisters occur but these are usually treated with topical or oral antibiotics.

Blood clots are a concern and patients at risk include patients with family history of clotting, a history of a prior clot, patients over 40, obesity, cigarette smoking, women, birth control pills, history of cancer, and immobility. Preventative measures include a careful documentation of any of these factors, early mobilization, and use of medication. For patients without significant risk factors, prophylactic (preventive) medication is not recommended. This will be at the discretion of the surgeon after a discussion with you.

### Motion

Problems are less frequent now that earlier motion is the rule. If your motion does not progress occasionally a repeat arthroscopy or manipulation is needed. This is considered 2-3 months after your initial ACL surgery and is based on your progress with therapy.

An ACL reconstruction is intended to replace your original ACL. However, in some instances, the graft does not heal to the bone or it stretches. This leaves you with recurrent instability. If this happens then a revision surgery may be needed. Fortunately this is infrequent.

Once your knee is injured no matter what you do the joint is at risk for arthritis. This is due to the ACL tear and the associated injuries to the rest of the joint specifically the meniscus (cartilage). Undertaking a reconstruction of your ACL does not assure that the arthritis will not occur.

Keeping your joint strong and being educated about your limitations as a result of your injury helps to retard the development of arthritis.

Pain associated with the knee and the hardware is not uncommon. This is usually due to scarring, arthritis, swelling, and prominent hardware. Hardware can be removed and occasionally a follow-up (tune up) arthroscopy and clean out may be necessary.

The success rate for ACL reconstructions 90% or greater. These risks are few and the benefit is significant in allowing you to return to an active lifestyle of sports.

### 8. When can I drive?

You should not be taking any prescription pain medications as these can affect your ability to drive. If you drive an automatic car and the ACL reconstruction is on your left knee then you can drive when you feel comfortable getting in and out of the car. If the surgery is on your right knee or if you have a standard car despite the surgery being done on your left knee it usually takes about 2-3 weeks before you have adequate quadriceps or thigh muscle control to be able to operate your car safely.

### 9. How long is physical therapy?

The goal of therapy is to control pain and swelling, restore motion, develop strength, restore function, and to prepare you to return to your sport or sports of choice. This can vary from patient to patient but usually takes 2-3 months. Many of the exercises can be performed in a gym and therefore a membership is recommended unless you have gym equipment at home. Physiotherapy should be started the first week after surgery and so it is advisable for you to set up appointments with your local therapist prior to your surgery. The therapy will be directed by your doctor who may also suggest a physiotherapy clinic with expertise in ACL rehabilitation.

If you require a recommendation ask Dr. Zarnett.

### 10. What happens after surgery?

You can remove your tensor bandage 48 hours after surgery. You will be in a knee immobilizer (brace) that extends from your ankle to your thigh. You may remove the knee immobilizer while doing exercises or if you are in a safe, protected environment. However, the knee immobilizer should be worn while sleeping for the first 2 weeks, and while you walk until you regain muscle control of the leg.

Crutches are used for the first 1- 2 weeks for the same reason. Initially the surgery makes your knee feel weak and unstable. This is due to the pain from the surgery and the swelling that ensues. Therefore the crutches are used for support and protection. You are then seen 14 days later for your first post operative follow up. Follow-up visits are made every 4-6 weeks to monitor your progress until you are discharged.

### 11. When can I return to sports and do I need a sports brace?

You are allowed to golf, and do other non-pivoting sports around 6 months following surgery depending on how your knee is progressing and any other associated injuries. Full return to contact sports is allowed at 6-9 months depending on conditioning of your knee. An ACL brace is usually recommended when you return to twisting/pivoting sports for 1 year. The type of brace should be discussed with Dr. Zarnett. Keep in mind that some sports do not allow a brace and they include rugby, competitive martial arts and some soccer leagues. If you are returning to soccer, check with your specific governing body to determine if you are able to wear a brace.