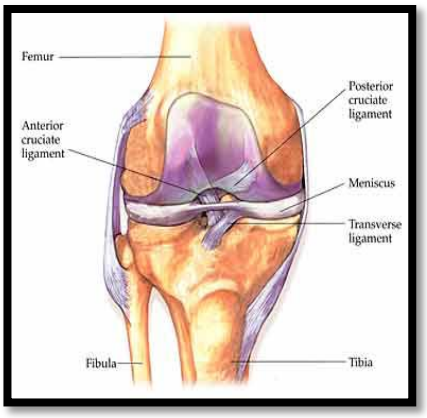
South Shore Hospital

Orthopedic, Spine and Sports Therapy

ACL Reconstruction Protocol

Anatomy and Biomechanics



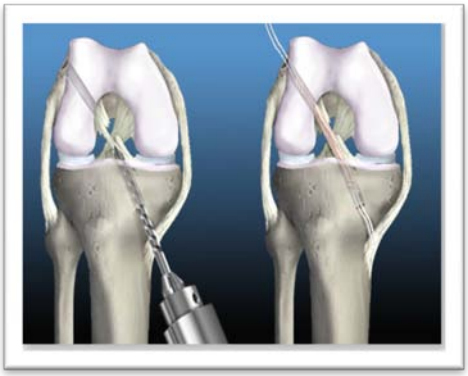
The knee is a simple hinge joint at the connection point between the femur and tibia bones. It is held together by several important ligaments. The most important of these to the knee's stability is the **A**nterior **C**ruciate **L**igament (ACL). The ACL attaches from the front part of the tibia to the back part of the femur. The purpose of this ligament is to keep the tibia from sliding forward on the femur. For this reason, the ACL is most susceptible to injury when rotational or twisting forces are placed on the knee. Although this can happen during a contact injury many ACL tears happen when athletes slow down and pivot or when landing from a jump.

After the ACL is torn the knee is less stable and it becomes difficult to maintain a high level of activity without the knee buckling or giving way. It is particularly difficult to perform the repetitive cutting and pivoting that is required in many sports.

Treatment Options

Regardless of how the ACL is torn your physician will work with you to determine what the best course of treatment will be. In the case of an isolated ACL tear (no other ligaments are involved) the associated pain and dysfunction can be successfully treated with rest, anti-inflammatory measures, activity modification and Physical Therapy. After the swelling resolves and range of motion and strength is returned to the knee a decision can be made as to how to proceed. Many people elect to use a sports brace and restrict their activity rather than undergo surgery to reconstruct the ACL. If a non-surgical approach is taken the patient must understand that it is imperative that he or she maintain good strength in his or her leg and avoid sports or activities that require pivoting or cutting. When conservative measures are unsuccessful in restoring function you and your physician may elect to have the torn ligament reconstructed.

Surgery



ACL reconstruction surgery is not a primary repair procedure. This means that the ligament ends cannot simply be sewn back together. The new ACL must come from another source and grafted into place in the knee. There are a few different options as to what tissue is used for the ACL graft (the three most common are patella tendon, hamstring tendon, and cadaver tendon) and each patient should consult with his or her surgeon to determine the best choice. During the procedure a tunnel is drilled through the tibia and the new ACL graft is passed through it and anchored into place.

Regardless of what type of graft is used ACL reconstruction is typically an outpatient day surgery procedure. This means that it is very rare to have to spend the night in the hospital and all patients will likely be home on the same day as surgery.

Recovery/Time off Work

Recovering from ACL reconstruction surgery is not easy. It is very important that the patient knows the recovery process is difficult and time consuming. He or she must be an active participant during this process, performing daily exercises to ensure there is proper return of range of motion and strength. There is a large amount of variability in the time it takes to fully recover from this procedure. It is usually estimated that it will take at least 6 months for the patient to feel as though he or she has completely returned to a pre-injury level of activity. Some cases may take as long as 9-12 months to make a full recovery. People with desk jobs should plan to take at least 1 week off from work. Manual laborers will likely be out of work for at least 4-6 months. **Recovery is different in each case**. Your individual time table for return to activities and work will be discussed by your surgeon during post operative office visits.

Post Operative Visits

Your first post-op visit to the doctor's office will be approximately 7-10 days after the operation. At this visit your stitches will be removed and you will review the surgery with the surgeon or his/her assistant. At this time you will most likely be cleared to make an appointment to begin Physical Therapy. You should also plan to check in with your surgeon at 6, 12, and 24 weeks after the operation.

At Home

You should replace your post-op dressing 1 day after the operation. The dressing is no longer necessary after two days as long as the incision is dry. Do not remove the strips of tape (steri-strips) that are across your incision. Allow them to fall off on their own or to be removed at your doctor's office visit. You may shower after 2 days, but use a water-tight dressing until your sutures are removed. It is best to use a shower bench if possible to avoid weight bearing on the surgical leg. Bathing without getting the knee wet or sponge baths are another alternative.

Medication

Your surgeon will prescribe pain medicine for you after the operation. Please call the doctor's office if you have any questions regarding medication.

Ice

You must use ice on your knee after the operation for management of pain and swelling. Ice should be applied 3-5 times a day for 10-20 minutes at a time. Always maintain one layer between ice and the skin. Putting a pillow case over your ice pack works well for this.

Crutches

It is very important for you to use crutches after the surgery as instructed by your doctor or physical therapist. Putting too much weight on your knee in the early phases of recovery can create excessive and persistent swelling, poor gait mechanics and may cause undue stress on the healing ACL graft. For Patella tendon grafts you will be allowed to bear as much weight as you can tolerate on your leg while using your crutches right away after surgery. You may start to wean from the use of your crutches at 2 weeks post op. For Hamstring and Allograft ACL's you will be partial weight bearing with crutches for the first 4 weeks. You may progress to weight bearing as tolerated with crutches between weeks 4 and 6 and wean the use of your crutches at 6 weeks post op. In all cases proper gait pattern must be achieved in order to discontinue use of assistive device!

Brace

After surgery your doctor may require you to wear a large hinged knee brace when walking. If your doctor has specific instructions regarding the use of this brace then he or she will go over them with you and your family after the operation, or at your first post operative appointment. Generally it is recommended that you keep the brace locked in extension while walking and when sleeping for the first two weeks after the operation. It is recommended that you unlock the brace when sitting to allow your knee to move and bend. Allowing the brace to be unlocked while walking is generally based on how well you recover muscle tone in your leg. You may need to use this knee brace for as long as four to six weeks after the operation.

CPM

After the surgery your doctor may require you to use a CPM (continuous passive motion) machine. He or she will provide specific instructions regarding the frequency and duration of how long you should use the machine. The CPM is a machine that will bend and straighten your knee for you while you are lying down on your back. The machine is typically prescribed for 1-2 weeks and is to be used for up to 10 hours a day. Your goal should be to achieve a range of motion of 0-100 degrees in the first week and 0-120 in the second week after surgery.

Driving

After ACL reconstruction you will not be allowed to drive as long as you are taking narcotic pain medicine. If you had surgery on your left leg you may drive an automatic transmission car, if your doctor allows you, as soon as you are no longer taking narcotics. If you had surgery on your right leg your doctor will let you know when you are clear to drive. Driving is generally not permitted when your leg is weak enough that you still need to use the post operative brace.

Rehabilitation

****The following is an outlined progression for rehab. Time tables are approximate and advancement from phase to phase as well as specific exercises performed should be based on each individual patient's case and sound clinical judgment by the rehab professional. ****

Phase 1 (0-2 Weeks)

Goals

Control Pain and Swelling
Protect Healing Tissue
Begin to Restore Range of Motion (ROM) Especially Full Extension
Establish Good Quadriceps Activation

Precautions

WBAT with Crutches for Patellar Tendon Graft
PWB with Crutches for Hamstring or Allograft
Bledsoe Brace locked in extension with ambulation and sleeping
Bledsoe Brace unlocked 0-90^{o} when non-weight bearing

Recommended Exercises

Range of Motion

- Heel Slides 2 Sets of 20 Repetitions
- Assisted Knee Flexion/Extension in Sitting 2 Sets of 20 Repetitions
- Heel Prop (passive extension) or Prone Hang 5 Minutes
- Belt Stretch (Calf/Hamstring) Hold 30 Seconds 3-5 Repetitions
- Ankle Pumps without resistance at least 2 Sets of 20 Repetitions
- Cycle (minimal resistance) 10-15 Minutes Daily

Strength

- Quad Sets 2-3 Sets of 20 Repetitions
- SLR *(no Lag)* 2-3 Sets of 10-20 Repetitions
- Hip Abd/Add/Extension (against gravity) 2-3 Sets of 10-20 Repetitions
- Standing or Prone Hamstring Curls (unless Hamstring Graft) 2-3 Sets of 10-20 Repetitions
- T-Band Ankle Pumps 2-3 Sets of 20-25 Repetitions

Guidelines

Use exercise bike daily if possible for 10-15 minutes. Perform Range of Motion exercises 3-5 times a day. Perform Strengthening exercises 1 time a day.

Phase 2 (2-6 Weeks)

Goals

Continued protection of healing tissue
Continue to improve ROM
Normalize gait mechanics
Begin to establish return of lower extremity strength especially quadriceps

Precautions

Wean crutches with Patellar Tendon graft
Hamstring and Allograft PWB for 4 wks post op. Progress to WBAT at 4 wks post op and wean crutches as appropriate.
OK to begin closed chain exercises, but maintain weight bearing restrictions with gait
Bledsoe brace 0-90^{o} with ambulation
Must stress proper gait

Recommended Exercises

Range of Motion

- Continue ROM exercises from Phase 1 until normal ROM is achieved
- Cycle with increased resistance
- *Ensure Proper Patellar Mobility*

Strengthening

- Continue Quad Sets (as needed for VMO activation)
- Continue 4 way SLR program (add ankle weight as needed)
- Hamstring Curls (Patellar Tendon and Allograft Only)
- Standing Terminal Knee Extension
- Mini Squat and/or Wall Slide
- Leg Press
- Heel Raises
- Single Leg Stance
- *Minimize effusion before progressing closed chain exercise*

Guidelines

Perform all ROM and strengthening exercises once a day. Do 2-3 sets of 15-20 repetitions. Cycle daily if possible.

Phase 3 (6-12 Weeks)

Goals

Avoid patellofemoral pain
Continue to maximize return of ROM and flexibility
Establish closed chain strength and proprioception

Precautions

Continue to stress proper gait
Must avoid patella femoral stress
No pivoting or lateral movements
No running

Recommended Exercises

Range of Motion and Flexibility

- Continue ROM exercises from phase 1 if necessary
- Add Lower Extremity stretching (Hamstring, Quadriceps, Calf, Glutes, Adductors, ITB, etc)

Cardio

- Cycle with progressive resistance
- Elliptical at 8 Weeks
- Swimming at 6-8 Weeks

Strengthening

- Continue Progression of 4 way SLR and Hamstring Curls with Ankle Weights
- Gym Equipment (Leg Press, Ham Curl, Multi-Hip)
- Squats to 90^{o}
- Begin Single Leg strengthening
- Step Up Progressions (Forward Step Ups) *Forward Step Downs are not recommended due to increased patella femoral load*
- Static Forward/Backward Lunge

Proprioception

- Single Leg Stance
- Static Balance on Bosu/Wobble Board/Foam/Etc
- Star Drill (single leg stance with reach)

Guidelines

Perform ROM and stretching exercises once a day until normal ROM is achieved. Hold stretches for 30 seconds and perform 2-3 repetitions of each.
Cardio exercise is recommended 3-5 times a week for 20-30 minutes.
Perform strengthening exercises 3-5 times a week. Do 2-3 sets of 15-20 Reps. Strict attention must be paid to form and minimal patella femoral pain with exercises.

Phase 4 (12-16 Weeks)

Goals

Continue to avoid patella femoral pain
Progress with single leg strengthening
Achieve adequate ROM and strength to begin jogging and plyometric training

Precautions

Straight ahead running only
No pivoting or cutting
No sports

Recommended Exercises

ROM and Stretching

Continue daily stretching

Cardio

Continue cycle, elliptical, swimming

Begin return to running progression at 12 weeks post op (outlined by P.T. or Doctor)

Strengthening

Continue SLR Program and Gym Equipment Progression

Continue Step-Up Progressions (lateral step-ups, cross over step-ups) *Forward Step Downs are not recommended due to increased patella femoral load*

Dynamic Lunge

Lateral Lunge

Progressive Single Leg Strengthening (single leg squat, split squat, single leg dead lift)

Proprioception

Dynamic Balance (Bosu/Foam/Etc)

Dynamic Progressions

Begin Plyometric/Jumping Progression (see page 10)

Guidelines

Perform stretching program daily. Hold stretches for 30 seconds and perform 2-3 repetitions of each.
Cardio program is recommended 3-5 times a week for 20-40 minutes
Perform strengthening/proprioception exercises 3 times a week. Do 2-3 sets of 15-20 Reps.
Perform plyometric/jumping exercises 2 times a week

Phase 5 (16-24 Weeks)

Goals

Maintain adequate ROM, flexibility and strength
Continue progressive/dynamic strengthening, proprioceptive, plyometric and agility training
Achieve adequate strength to begin return to sport progressions (pending surgeon's clearance)

Precautions
Limited and controlled lateral movements
Gradual return to sport pending surgeon's clearance (6 months or greater)
Work with surgeon or Physical Therapist to develop specific return to sport progression

Recommended Exercises
Stretching
Continue daily lower extremity stretching
Cardio
Continue cardio program and progress intensity and duration
Strengthening
Continue strengthening program from phase 4 (increase load and decrease volume)
Proprioception
Continue and advance proprioceptive training (increase difficulty of drills)
Dynamic Progressions
Progress plyometric/jumping program
Begin speed/agility program (see page 11)

Guidelines
Perform stretching program daily. Hold stretches for 30 seconds and perform 2-3 repetitions of each.
Cardio program is recommended 3-5 times a week for 20-40 minutes
Perform strengthening/proprioception exercises 3 times a week. Do 2-3 sets of 15-20 Reps.
Perform plyometric/jumping/agility exercises 2 times a week
Perform return to sport activities as directed by P.T. or Doctor

Jumping/Plyometric Progression

Simple Double Limb (12-16 Weeks Post Op) *Limit 60 foot contacts per workout

Double Leg Hops (forward and backward over line)
Box Jump (6-8 inches max)

Focus on sticking each landing with good form in frontal and sagital planes. Stress a soft landing with good eccentric control.

Complex Double Limb (16-20 Weeks Post Op) *Limit 90 foot contacts per workout

Double Leg Jump (for distance)
Double Leg Jump (for height)
Double Leg Jump (with 90^{o} or 180^{o} turn)
Double Leg Lateral Jump/Lateral Box Jump (side to side)
Depth Jump (6-8 inches max)

Focus on sticking each landing with good form in frontal and sagital planes. Stress a soft landing with good eccentric control.

Combination Jumps (begin at 18-20 weeks post op)
- Repetitive Double Leg Jumps (distance, height, lateral, turns)
- Jump for Distance into Jump for Height
- Box Jump to Depth Jump
- Depth Jump to Jump for Distance/Height

String jumps together. Focus on quickly moving from jump to jump.

Single Limb (20-24 Weeks Post Op) *Limit 100-120 foot contacts per workout

Heiden Hop
Bounding
Single Leg Jumps (distance, height, lateral, 90^{o}/180^{o} turn)
Single Leg Box Jumps (6-8 inches max)
Single Leg Depth Jumps (6-8 inches max)

Focus on sticking each landing with good form in frontal and sagital planes. Stress a soft landing with good eccentric control.

Combination Jumps (Single Leg)
- Repetitive Single Leg Jumps (distance, height, lateral, 90^{o}/180^{o} turn)
- Jump for Distance into Jump for Height
- Box Jump to Depth Jump
- Depth Jump to Jump for Distance/Height

String jumps together. Focus on quickly moving from jump to jump.

Speed/Agility Progression

Work with P.T. to establish proper warm-up and cool down before and after each workout agility session.

Forward/Backward Sprinting (16-20 Weeks)

Week 1: Sprint 50-100 yards at ½ speed 10 reps.
Week 2: Sprint 50-100 yards at ½ speed 5 reps. Sprint 50-100 yards at ¾ speed 10 reps
Week 3: Sprint 100 yards at ½ speed 2 reps. Sprint 100 yards at ¾ speed 5 reps. Sprint 50-100 yards at full speed 5 reps. Backpedal 50 yards at ½ speed 5 reps.
Week 4: Sprint 100 yards at ½ speed 1 rep. Sprint 100 yards at ¾ speed 2 reps. Sprint 50 yards at full speed 5 reps and 100 yards at full speed 5 reps. Backpedal 50 yards at ¾ speed 5 reps.

Basic Change of Direction (20-24 Weeks)

*Begin each workout with sprinting and backpedaling 50 yards (2 reps at ½ speed, 5 reps at full speed)

Week 5: T drill 3 reps at ½ speed, forward/backpedal shuttle 5/10/20 yard 3 reps at ½ speed
Week 6: T drill 3 reps full speed, forward/backpedal shuttle 5/10/20 yards 3 reps full speed, box drill with shuffling 3 reps at ½ speed
Week 7: Box drill with shuffling 3 reps at full speed, 10 yard shuttle run (quick direction change) 3 reps at full speed, Z drill 6 reps at ¾ speed
Week 8: Box drill with cuts 3 reps at full speed, 10 yard shuttle run (quick direction change) 3 reps at full speed, Z drill 6 reps at full speed

Advanced Drills (24 Weeks and Beyond)

*Begin each workout with sprinting and backpedaling 50 yards (2 reps at ½ speed, 5 reps at full speed)

Work with P.T. to develop sport specific drills. Perform drills from previous weeks with use of ball, stick, etc. Perform drills seen in typical sports practice with supervision.

Time	Weight Bearing and Gait	Focus	Range of Motion	Recommended Exercises	Precautions
Phase 1 0-2 Weeks	*WBAT (Patella Tendon) *PWB (Hamstring and Allograft) *Bledsoe Brace 0-90^{o} in All Cases	*Wound Healing *Protect ACL Graft *Establish Early ROM Especially Extension *Establish Good Quadriceps Contraction with Quad Set	*Emphasize 0^{o} Extension *Goal to Achieve 120^{o} of Flexion *May Have Specific ROM Instructions if Meniscal Repair	**ROM** Heel Slides, Seated Assisted Knee Flexion, heel prop, prone hang, cycle **Strengthening** Quad Sets, SLR (no lag), Hip Abd/Add/Extension, Standing or Prone Hamstring Curl (unless Hamstring Graft), T-band Ankle Pump	*No Hamstring Strengthening for Hamstring Graft Patients *Minimize Joint Effusion and Edema
Phase 2 2-6 Weeks	*Progress to FWB and d/c Crutches When Gait is Normal (Patella Tendon) *Continue PWB (Hamstring and Allograft) *Continue Bledsoe Brace 0-90^{o}	*Continue to Protect ACL Graft *Progress ROM *Progress Quadriceps Strengthening *Establish Gait Pattern	*Continue Emphasis on 0^{o} of Extension *Goal to Achieve Full Flexion by 6 Weeks *May Have Specific ROM Instructions if Meniscal Repair	**ROM** Continue Phase 1 Exercises until normal ROM is achieved Cycle with increased Resistance **Strengthening** Continue Phase 1 Strengthening Add Standing T-band TKE, Mini Squat, Wall Slides, Leg Press, Calf Raises	*No Hamstring Strengthening for Hamstring Graft Patients *Minimize Joint Effusion and Edema *Must Stress Proper Gait *Avoid Patella Femoral Joint Stress
Phase 3 6-12 Weeks	*Progress to FWB in all Cases * Wean From Brace as Gait Improves	*Normalize Gait Mechanics *Progressive Weight Bearing Strengthening	*Continue to Maintain Full ROM *Begin Lower Extremity Stretching Program	**ROM/Stretching** Cycle, Continue ROM work as needed. Start Lower Extremity Stretching Program all Muscle Groups **Cardio** Cycle with Progressive Resistance Elliptical at 8 Weeks Swimming at 6-8 Weeks **Strengthening** Progress Open Chain SLR/Hip Program with Ankle Weights, Gym Equipment Leg Press/Ham Curl/ Multi-Hip, Squats to 90^{o}, Begin Transition to Single Leg Strengthening, Step Ups, Static Forward/Backward Lunge **Proprioception** Single Leg Stance, Static Balance on Bosu/Wobble Board/Etc, Star Drill Reach	*Hamstring Strengthening Begins at Week 6 for Hamstring Graft Patients *Continue to Stress Proper Gait *Continue to Take Care Not to Overload Patella Femoral Joint

Phase 4 12-16 Weeks	*Straight Ahead Jogging per MD Approval	* Progressive Single Leg Strengthening *Progressive Proprioceptive Training *Begin Jumping Progressions	*Continue Lower Extremity Stretching Daily	**ROM/Stretching** Continue Daily Stretching **Cardio** Cycle, Elliptical, Swimming, Begin Jogging Progression at 12 Weeks **Strengthening** Continue SLR Program and Gym Equipment, Progressive Single Leg Strengthening, Dynamic Lunge, Lateral Lunge **Proprioception** Dynamic Balance with Bosu/Foam/Etc **Dynamic Progressions** Begin Plyometric/Jumping Progression	* Continue to Take Care Not to Overload Patella Femoral Joint *Consult With Physician Regarding Use of Sports Brace *Must Have Full ROM, 70% Return of Strength and No Patella Femoral Pain to Begin Jogging and Plyometric Progressions
Phase 5 16-24 Weeks and Beyond	*Lateral Movement per MD Approval	*Continue Preparation for Return to Sport and Physical Activity *Progressive Strengthening and Jumping *Begin Progressive Agility Drills	* Continue Lower Extremity Stretching Daily	**ROM/Stretching** Continue Daily Stretching **Cardio** Cycle, Elliptical, Swim, Jog **Strengthening** Continue SLR Program if Necessary, Continue Strengthening From Phase 4 With Heavier Loads **Proprioception** Continue Proprioceptive Training From Phase 4 **Dynamic Progressions** Advance Plyometric/Jumping, Begin Lateral Agility Progression Sport Specific Movements	* Must Have Full ROM, 90% Return of Strength and No Patella Femoral Pain to Begin Return to Sport Progressions

***Reviewed by Michael Geary, MD**