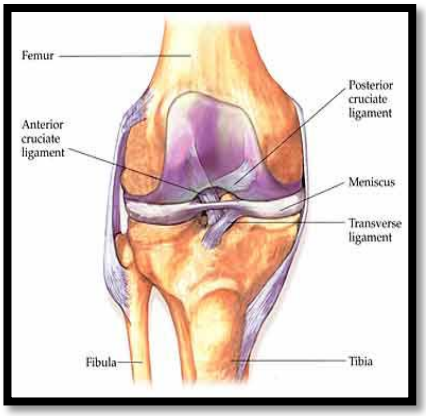
South Shore Hospital

Orthopedic, Spine and Sports Therapy

ACL Non-Operative Protocol

Anatomy and Biomechanics



The knee is a hinge joint connecting the femur and tibia bones. It is held together by several important ligaments. The most important ligament 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 and rotating on the femur. For this reason, the ACL is most susceptible to injury when twisting or rotational forces are placed on the knee. Although this can happen with contact, approximately 70% of ACL tears occur during non-contact events when athletes are cutting, decelerating or 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 a personalized course of treatment. People participating in sports or work related activities that require a lot of pivoting, cutting, or jumping may decide to have surgery. Depending on your lifestyle, however; conservative treatment may be the best option. In the case of an isolated ACL tear with no other ligamentous or cartilage involvement, the associated pain and dysfunction can be successfully treated with physical therapy.

The initial course of treatment in physical therapy includes rest, anti-inflammatory measures and activity modification. After the swelling resolves and normal range of motion and strength is achieved, a decision between you and your physician can be made to determine further treatment options. If a non-surgical approach is chosen, it is imperative to maintain the strength, balance, and range of motion you gained in physical therapy to avoid further injury. At this juncture, many people elect to use a sports brace and limit their participation in activities that require a lot of pivoting, cutting or jumping. If conservative measures are unsuccessful and recurrent buckling persists, you and your physician may elect to have the ACL reconstructed.

Recovery/Time off Work

Recovering from a torn ACL is not an easy process. It can be a long and difficult recovery that requires a tremendous commitment to rehabilitation. You must be an active participant during this process, performing daily exercises to ensure the return of your range of motion and strength. Recovery for a non-operative ACL tear is variable and largely dependent on your goals. People with desk jobs may take up to one week off from work due to pain. Manual laborers can be out of work for up to 6-8 weeks. Athletes will not be able to return to their sport immediately and will have to avoid cutting, pivoting, and jumping. Some people can cope with their injury and return to sports but typically require at least 8-10 weeks of physical therapy. Ultimately, return to sport and work is dependent on how you progress in therapy and whether you continue to have episodes of knee buckling. **Recovery is different for every individual**. Your personal time table for return to activities and work will be addressed by your physician and physical therapist throughout your course of treatment.

At Home

Immediately after the injury, resting and icing your knee can help control swelling and reduce some of your pain. Ice should be applied 3-5 times a day for 10-20 minutes at a time. Always maintain one layer between the ice and your skin. A pillow case or paper towel serves as a good barrier to protect your skin.

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

As a result of the injury, your knee is unstable and your thigh muscles can become extremely weak. It may be difficult to support the weight of your body when walking for the first few days. Crutches and/or a brace may be provided by your doctor to protect the knee from continued episodes of giving way and allow your knee to recover. Once the strength in your leg begins to return and you can demonstrate normal walking mechanics, your physical therapist will instruct you to wean away from the crutches. This typically takes less than 1-2 weeks.

Surgery

Sometimes, conservative treatment is unsuccessful and recurrent buckling persists. In this case, you and your physician may decide to have the ACL reconstructed. 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 graft options used for the ACL graft 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, having an ACL reconstruction requires a significant commitment to physical therapy. Recovery is variable and rehabilitation can take anywhere from 6 months to a year.

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 (Acute Phase)

Goals

Control pain and swelling
Restore pain free ROM
Improve flexibility
Normalize gait mechanics
Establish good quadriceps activation

Precautions

WBAT with crutches until demonstrates normal gait mechanics
Alert physician if patient reports episodes of knee buckling

Recommended Exercises

Range of Motion

- Patella mobilization (Medial/Lateral, Superior/Inferior) 2 Sets of 20 Repetitions
- Belt stretch (calf/hamstring) Hold 30 Seconds 3-5 Repetitions
- Heel slides 2 Sets of 20 Repetitions
- Prone quad stretch Hold 30 Seconds 3-5 Repetitions
- Cycle (minimal resistance) 10-15 Minutes Daily

Strength

- Quad sets 2-3 Sets of 20 Repetitions
- Add sets 2-3 Sets of 20 Repetitions
- SLR *(no Lag)* 2-3 Sets of 10-20 Repetitions
- Hip Abd/Add/Ext/ER (against gravity) 2-3 Sets of 10-20 Repetitions
- Body weight squats (partial range) 2-3 Sets of 10-20 Repetitions
- Standing TKE with Theraband/cable column 2-3 Sets of 10-20
- Standing or prone hamstring curls 2-3 Sets of 10-20 Repetitions
- Heel raises 2-3 Sets of 10-20 Repetitions

Guidelines

Swelling and ROM deficits must be resolved before progressing to next phase. Use exercise bike daily if possible for 10-15 minutes. Perform ROM exercises 3-5 times a day. Perform strengthening exercises 1 time a day.

Phase 2 (Sub-Acute/Strengthening Phase)

Goals

Avoid patella femoral pain
Maintain ROM and flexibility
Restore muscle strength
Improve neuromuscular control

Precautions

D/C crutches if have not already
Alert physician if patient reports episodes of knee buckling

Recommended Exercises

Range of Motion

- Continue ROM and initiate LE flexibility exercises
- Cycle/elliptical 10-15 Minutes

Strengthening

- Continue Open Chain hip and knee strength from phase 1 progress with ankle weights
- Hamstring strengthening (progress from standing curl, leg curl machine, to curl on pball, single leg dead lift) 2-3 Sets of 15-20 Repetitions
- Leg press (progress from double-limb to single limb) 2-3 Sets of 15-20 Repetitions
- Step-up progressions (forward and lateral) 2-3 Sets of 15-20 Repetitions
- Squat progression (limit to 90 degrees) 2-3 Sets of 15-20 Repetitions
- Plank, side plank, single-limb bridge 2 Sets of 30 seconds each (15 seconds each leg with bridge)

Proprioception

- Static Single-limb balance 3 Sets of 30-60 seconds (progress eyes open to eyes closed, foam, BOSU, *sport specific if applicable)

Guidelines

Perform all ROM and flexibility exercises once a day. If possible, cycle daily. Perform strengthening exercises 3-5 times a week (frequency and volume programmed by PT).

Phase 3 (Limited Return to Activity Phase)

Goals

Avoid patella femoral pain
Maintain ROM and flexibility
Progress with single leg strengthening to maximize strength
Progress dynamic proprioception exercises to maximize neuromuscular control
Initiate plyometrics and light jogging
Gradually begin return to sport activities pending physician's clearance

Precautions

Must avoid patella femoral stress
Caution pivoting and lateral movements
Alert physician if patient reports episodes of knee buckling

Recommended Exercises

Range of Motion and Flexibility

Continue ROM and flexibility exercises as needed

Cardio

Cycle/elliptical/treadmill with progressive resistance

Strengthening

Continue progressing Phase 2 strengthening exercises
Step-up progressions (increase height of step) 2-3 Sets of 15-20 Repetitions
Single-limb dead lift 2-3 Sets of 15-20 Repetitions
Static lunge progressions (forward/backward/lateral) 2 Sets of 50 feet

Proprioception

Single-limb balance with perturbations 3 Sets of 30-60 seconds (progress eyes open to eyes closed, foam, BOSU, *sport specific if applicable)

Plyometrcs *emphasize eccentric control, avoiding increased trunk flexion, dynamic genu valgum, and femoral internal rotation, must have appropriate strength to progress to plyometric program* (see page 7 for more detailed progression)

Simple double-limb jumps
Complex double-limb jumps

Guidelines

Perform stretching program daily. Cardio exercise is recommended 3-5 times a week for 20-30 minutes. Perform strengthening/proprioception exercises 3 times a week. Perform plyometric/jumping exercises 2 times a week. Monitor increased swelling with plyometrics. Decrease intensity if swelling persists. Strict attention must be paid to form and to minimize patella femoral pain with exercises.

Phase 4 (Return to Activity/Sport Phase)

Goals

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

Precautions

Limited and controlled lateral movements
Gradual return to sport pending physician's clearance
Work with physician and 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 3 (increase load and decrease repetition)

Progress from static to dynamic lunges

Proprioception

Continue advanced proprioceptive training (increase difficulty of drills)

Plyometrics *emphasize eccentric control, avoiding increased trunk flexion, dynamic genu valgum and femoral internal rotation *(see page 7 for more detailed progression)

Single-limb jumps

Combination double-limb jumps

Combination single-limb jumps

Sport Specific Drills

Initiate sports specific drills

Begin speed/agility program (see page 8)

Guidelines

Perform stretching program daily. Cardio program is recommended 3-5 times a week for 20-40 minutes Perform strengthening/proprioception exercises 3 times a week. Perform plyometric/jumping/agility exercises 2 times a week. Perform return to sport activities as directed by physician and physical therapist. Alert physician if patient reports episodes of knee buckling.

Jumping/Plyometric Progression

Phase 3 *Limit 60-90 foot contacts per workout

Simple Double-limb

Wall jumps
Double-limb hops (anterior/posterior and medial/lateral over line)
Box jump (6-8 inches max)

Complex Double-limb

Double-limb jump (for distance)
Double-limb jump (for height)
Double-limb jump (with 90^{o} or 180^{o} turn)
Double-limb 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 sagittal planes. Stress a soft landing with good eccentric control.

Phase 4 *Limit 90-120 foot contacts per workout

Single Limb

Heiden/speed skater hop
Single-limb hop (distance, height, lateral, 90^{o}/180^{o} turn)
Single-limb bounding
Single-limb box jumps (6-8 inches max)
Single-limb depth jumps (6-8 inches max)

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

Combination Jumps (Double-limb)

Repetitive double-limb jumps (distance, height, lateral, turns)
Jump for distance into jump for height
Depth jump to jump for distance/height
Depth jump to jump with 90^{o} turn

Combination Jumps (Single-limb)

Repetitive single-limb jumps (distance, height, lateral, 90^{o}/180^{o} turn)
Jump for distance into jump for height
Depth jump to jump for distance/height
Depth jump to jump with 90^{o} turn

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

Speed/Agility Progression

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

End of Phase 3/Phase 4

Forward/Backward Sprinting

Workout 1: Sprint 50-100 yards at ½ speed 10 reps.
Workout 2: Sprint 50-100 yards at ½ speed 5 reps. Sprint 50-100 yards at ¾ speed 10 reps
Workout 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.
Workout 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.

Phase 4

Basic Change of Direction

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

Workout 5: T drill 3 reps at ½ speed, forward/backpedal shuttle 5/10/20 yard 3 reps at ½ speed
Workout 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
Workout 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
Workout 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

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

Work with physical therapist 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 Acute Phase	*WBAT with crutches and progress to FWB and d/c crutches when patient can demonstrate normal gait mechanics	*Control pain and swelling *Restore pain free ROM *Restore normal gait mechanics *Establish good quadriceps activation	*Emphasize knee extension equal to contralateral limb *Goal is to achieve full flexion	**ROM** Patella mobilization, calf/hamstring stretches, heel slides, prone quad stretching, bicycle **Strengthening** Quad/Add sets, SLR (no lag), hip Abd/Add/Ext/ER, partial range squats, standing TKE, standing or prone hamstring curl, heel raises	*Minimize joint effusion and edema *Alert physician if patient reports episodes of knee buckling
Phase 2 Sub-Acute Phase	*FWB	*Maintain ROM and flexibility *Progress strengthening *Improve neuromuscular control	*Maintain full ROM and optimize LE flexibility	**ROM** Continue Phase 1 exercises and initiate LE flexibility exercises, bicycle/elliptical with increased resistance **Strengthening** Continue Phase 1 strengthening, leg press, leg curl machine, step-ups, squats, plank series, single-limb balance **Proprioception** Single-limb balance exercises	*Minimize joint effusion and edema *Alert physician if patient reports episodes of knee buckling *Avoid patella femoral joint stress
Phase 3 Limited Return to Activity/Sport	*Straight ahead jogging per physician approval	*Maintain ROM and flexibility *Maximize strength, initiate single leg exercises *Maximize neuromuscular control *Initiate plyometrics and light jogging *Initiate return to sport/work activities with physician approval	*Maintain full ROM and optimize LE flexibility	**ROM/Stretching** Continue ROM and flexibility exercises as needed **Cardio** Bicycle/elliptical/treadmill with progressive resistance **Strengthening** Progress Phase 2 strengthening, step-up progressions, single-limb dead lifts, static lunges **Proprioception** Single-limb balance with perturbations **Plyometrics** Double-limb simple and complex plyometrics	*Alert physician if patient reports episodes of knee buckling *Avoid patella femoral joint stress especially with plyometrics *Monitor increased knee effusion with plyometrics *Caution pivoting or lateral movements *Not cleared to return sports

Phase 4 Return to Activity/Sport	*Sport specific program per physician clearance	* Maintain ROM, flexibility, and strength *Continue dynamic strengthening and proprioceptive exercises *Continue plyometrics and initiate agility training *Progress sport specific drills	*Continue daily LE stretching	**ROM/Stretching** Continue daily stretching **Cardio** Bicycle/elliptical/treadmill with progressive resistance **Strengthening** Progress Phase 3 strengthening, increase load and decrease repetitions **Proprioception** Progress Phase 3 proprioceptive training increasing difficulty of drills **Plyometrics** Begin single-limb plyometrics, advance double-limb and single-limb combination jumps **Sport Specific Drills** Begin speed and agility program	*Alert physician if patient reports episodes of knee buckling *Avoid patella femoral joint stress especially with plyometrics *Monitor increased knee effusion with plyometrics *Caution pivoting or lateral movements *Cleared for return to sport per physician

***Reviewed by Michael Geary, MD**