Post-Operative ACL Reconstruction Functional Rehabilitation Protocol

Patient Guidelines Following Surgery

The post-op brace is locked in extension initially for the first week with the exception that it may be unlocked for post-op exercises and CPM use. It is unlocked for walking once the patient reaches full knee extension, usually at 1 week post-op.

Brace is discharged when:

- The patient has full knee extension and >90° flexion
- The patient does not have a lag (any knee bending) with Straight Leg Raises
- The patient demonstrates normal pain-free walking
- The patient is at least 6 weeks post-op

Crutches are discharged when:

- The patient has full active and passive knee extension and >100° flexion
- The patient does not have a lag (any knee bending) with Straight Leg Raises
- The patient continues to display full knee extension when walking without the brace
- The patient does not complain of any increased knee pain or present with increased swelling since walking without the brace or crutches
- The patient will initially be weight-bearing as tolerated with 2 crutches for 3-4 weeks; they will then transition to one crutch before walking without the crutches
- Patients that also receive a microfracture or meniscal repair will be NWB for 4 weeks followed by 50% WB for two weeks and then WBAT at 6 weeks

Estimated Return to Sport Milestones (based on graft healing time):

	Jogging	**Low-level Agility**	**Jumping**	**Cutting**	**Return to Sport**
Bone-Patellar Tendon-Bone Autograft	4-5 months	5-6 months	6-7 months	7-8 months	9 months
Hamstring/Quad Tendon Autograft	4-5 months	5-6 months	6-7 months	7-8 months	9 months
Bone-Patellar Tendon-Bone Allograft	5-6 months	6-7 months	7-8 months	8-9 months	10 months
Soft Tissue Allograft	5-6 months	6-7 months	7-8 months	8-9 months	10 months

These times are estimated based on graft healing. They are also dependent upon the patient passing functional testing in physical therapy that assesses strength, neuromuscular control, and balance. The patient should also expect these times to be longer if they also had other surgeries such as meniscal repairs, microfracture/articular cartilage procedures and other ligament damage.

Phase 1: Initial Post-Op Care

Goals for Phase 1 include restoration of ROM and mobility, management of pain and edema, and initiation of strengthening with emphasis on the quadriceps. The post-operative brace may be removed for treatment. Closed kinetic chain (CKC) exercises should be performed in the protected range of 0-45° of flexion and open kinetic chain (OKC) exercises should stay in the protected range of 90-60° of flexion. Exercises should include but are not limited to:

Weeks 1-4:

- 4-way patella mobilizations
- High intensity neuromuscular electrical stimulation
- Biofeedback
- Exercises to regain extension – Hamstring and Gastroc stretches, Prone Hang, Manual overpressure
- Exercises to regain flexion – Heelslides, Posterior tibial mobilizations
- Balance and proprioception exercises
- Gait training – Weight-shifts (side to side and forward/backward), Treadmill walking
- Early Strengthening – Quad Sets, Straight leg raises, Terminal Knee Extension (CKC), Mini-Squats
- Progress strengthening to include – Leg press, Isometric quadriceps setting (at 90° and 60° of knee flexion), Step-Ups, Step-Downs, Bridges, Hamstring curls

The patient should be seen by the physical therapist one time per week. If ROM is severely limited, the patient should be seen 2-3 times per week and the MD should be notified.

Goals at 2 weeks post-op include:
Passive extension equal to the uninvolved side
Active extension to 0° (As measured when doing a Straight Leg Raise)
Active and Passive flexion >100°
Perform a Quad Set that causes superior patella glide
Reduce pain and swelling

Goals at 4 weeks post-op include:
Equal active and passive extension to the uninvolved side
Active and passive flexion within 5° of the uninvolved side
No lag with a Straight Leg Raise
Eliminate swelling
Preparation for full weightbearing and independent gait

Weeks 4-16:
Aggressive range of motion exercises if flexion or extension is still limited
Cardio – Bike, elliptical, fast treadmill walking
Aquatic therapy – 4-way straight leg raises, squats, bicycle kicking, fast walking progressing to a jog

Progress strengthening to include – OKC knee extension (90-60°), Single leg squats, Lunges, Mini-band walking
Perturbation training

The patient should be seen by the physical therapist 2 times per week. Therapy should focus on aggressive strengthening, particularly of the quadriceps.

Goals include:
Normal independent gait pattern
No increase in swelling with exercise
1 repetition-maximum on the Leg Press >70% of the uninvolved

Weeks 16-20:
CKC exercises should be progressed to ~60-75° of knee flexion provided that this does not cause any patellofemoral pain.
OKC exercises should be progressed to full range 90-0° provided that this does not cause any patellofemoral pain.

Goals include:
Pass screening test to begin running

- 30 Step and Holds without loss of balance or excessive motion outside of the sagittal plane
- 10 consecutive Single Leg Squats to 45° of knee flexion without loss of balance or excessive motion outside of the sagittal plane
- ≥ 70% 1-RM on the Leg Press
- No abnormal gait patterns while walking as fast as they can on the treadmill for 15 minutes

Phase 2: Running

Begin jogging on a treadmill when the patient passes the screening exam and is cleared by the physician. Running should begin on a treadmill at slow, comfortable speeds for short durations and distances. The patient may progress in speed, time and distance as long as there is not an onset of new signs/symptoms of inflammation, pain, or increased effusion. When the patient can tolerate 2 miles of treadmill running without new inflammatory signs/symptoms, pain, or effusion, they may begin track and road running. Patients should only run straight ahead (no curves on the track) and avoid hills, inclement weather, and uneven surfaces. Patients should wear their functional knee brace if they were given one.

The patient should be seen by the physical therapist every other week. Aggressive strengthening should continue in preparation to pass the screening test to begin agility drills.

Goals include:
Pass screening test to begin low level agility drills

- 1-Rep Max on the Leg Press ≥ 85%

- 10 consecutive Single Leg Squats to 45° of knee flexion without loss of balance or excessive motion outside of the sagittal plane while holding ≥ 75% extra weight (dumbbells, weight vest, etc.)
- Normal running pattern on the treadmill without complaints of pain

Phase 3: Agility Training

When the patient passes the screening exam and is cleared by the physician, begin agility drills that include lateral shuffling, forward/backward shuttle runs, carioca, and ladder drills.

The patient should be seen one time per week and the physical therapist should focus on elimination compensation patterns, particularly when the patient decelerates. Aggressive strengthening should continue in preparation to pass the screening test to begin jumping.

Goals include:
Pass screening exam to begin jumping

- 10-Rep Max on the Leg Press was ≥ 85%
- 10 consecutive Single Leg Squats to 60° without loss of balance or excessive motion outside of the sagittal plane while holding ≥ 85% extra weight (dumbbells, weight vest, etc.)
- No compensation patterns with deceleration during agility drills performed at 100% effort

Phase 4: Jumping (Two Feet)

When the patient passes the screening exam and is cleared by the physician, begin jumping. Jumping is with 2 feet, both taking off and landing.

Jumps should start with single forward jumps and the physical therapist should watch for genu valgum both when loading into the jump and landing from the jump. When the patient demonstrates consistent equal weightbearing when landing, progress with side to side, rotating, and box jumps. As the patient improves progress from single jumps to consecutive jumping.

The patient should be seen one time per week and the physical therapist should focus on teaching the patient soft, athletic landings. Aggressive strengthening should continue in preparation to pass the screening test to begin hopping and cutting.

Goals include:
Pass screening exam to begin hopping and cutting

- 10-Rep Max on the Leg Press was ≥ 90%
- 10 consecutive Single Leg Squats to 60° without loss of balance or excessive motion outside of the sagittal plane while holding ≥ 90% extra weight (dumbbells, weight vest, etc.)
- No display of genu valgum when loading into or landing from jumps, and equal weight distribution when initiating and landing the jumps

Phase 5: Hopping (Single Leg) and Cutting

When the patient passes the screening exam and is cleared by the physician, they may begin hopping and cutting. Hopping is with 1 foot, both taking off and landing. Hopping should follow the same progression as jumping.

Patients should first practice running in an "S" pattern, then progress to 45° cuts, and then to sharper cuts. Pivoting and cut and spinning should begin when the patient is competent with cutting at sharp angles. Patients should be able to tolerate cutting, pivoting and cut and spinning at full speed before practicing unanticipated cutting. The patient should not progress with high level agility exercises if they demonstrate excessive genu valgum.

Sprinting should begin with transitions from running directly into sprinting short distances. Distance should be progressed to sprinting a 40 yard dash, then a 100 yard dash, and finally sprints to fatigue.

The patient should be seen one time per week and the physical therapist should focus on improving the form and speed of hopping and cutting. Aggressive strengthening should continue in preparation to return to sports participation.

Goals include:
Pass screening exam to take the Return to Sports Test

- Achieves $\geq$ 90% on all strength assessments
- Displays a normal running pattern that does not increase pain
- Has practiced and displays no hesitation or compensation strategies during agility drills (particularly when decelerating) when performed at 100% effort
- Has practiced and displays normal loading (no genu valgum) and soft, athletic landings from all jumps and hops
- Has practiced and displays no hesitation or compensation strategies during cutting drills (particularly when decelerating) when performed at 100% effort

Returning to Sports Participation

The patient should be able to perform all agility, plyometric, and cutting exercises at full speed without compensation patterns or signs/symptoms of inflammation. Exercises should include anticipated and unanticipated cutting and jumping.

The patient should be seen one time per week and all physical therapy should be geared on sport specific training as per the patient's sport and position.

The patient may return to sports participation when they pass the Post-Op ACL Return to Sports test and receive clearance by the physician.

Post-Op ACL Reconstruction Return to Sport Test

1. 10 Single Leg Squats with weight - *Involved/Uninvolved* = ____ / ____ = ____
2. Single broad jump, landing on one foot - *Involved/Uninvolved Distance* = ____ / ____= ____
3. Triple broad jump, landing last jump on one foot –
   Involved/Uninvolved Distance = ____ /____ = ____
4. Single leg triple crossover hop - *Involved/Uninvolved Distance* = ____ / ____ = ____
5. Single leg forward hop - *Involved/Uninvolved Distance* = ____ / ____ = ____
6. Single leg lateral hop - *Involved/Uninvolved Distance* = ____ / ____ = ____
7. Single leg medial hop - *Involved/Uninvolved Distance* = ____ / ____ = ____
8. Single leg medial rotating hop - *Involved/Uninvolved Distance* = ____ / ____ = ____
9. Single leg lateral rotating hop - *Involved/Uninvolved Distance* = ____ / ____ = ____
10. Single leg vertical hop - *Involved/Uninvolved Height* = ____ / ____ = ____
11. Single leg triple hop - *Involved/Uninvolved Distance* = ____ / ____ = ____
12. Timed 6-meter single leg hop - *Involved/Uninvolved Time* = ____ / ____ = ____
13. 10 yard Lower Extremity Functional Test
    - Sprint/back-peddle, Shuffle, Carioca, Sprint
    - Recommended goal for males: 18-22 seconds; females: 20-24 seconds
14. 10 yard Pro-agility Run
    - Both directions
    - Recommended goal for males: 4.5-6.0 seconds; females: 5.2-6.5 seconds

Criteria to Return to Practice:

1. MD clearance
2. Pass Return to Sport Test with ≥90% results for each test.

Criteria to Return to Competition:

1. MD clearance
2. Tolerate full practice sessions with opposition and contact (if applicable) performed at 100% effort without any increased pain, signs and symptoms of inflammation, increased effusion, or episodes of giving way.