

# ACL Reconstruction Rehabilitation Protocol

Mark Ayzenberg, MD

## NOTES:

These are guidelines for the trained therapist, in part based on the MOON ACL Rehabilitation protocol.

Please AVOID any open chain quadriceps exercises, especially for soft-tissue and allograft reconstructions. If a concern is present as far as quadriceps atrophy, please contact my office to discuss each individual patient if the therapist feels strongly that open chain quadriceps exercises are necessary. These will generally be kept to high flexion angles (90-60 degrees) – no sooner than 4 months post-op and only if approved by Dr. Ayzenberg.

## PHASE I (Week 0-2) - Acute

### *Goals:*

- *Alleviate acute pain and swelling*
- *Increase ROM 0-100° (emphasize 0° extension)*
- *Increase hamstring strength*
- *Good quadriceps control (>20 no lag SLR)*
- *Promote comfortable ambulation WBAT with brace and crutches*
- *Maintain cardiovascular conditioning*

### **Plan (0-2 Weeks):**

- ROM
  - Extension (focus on full extension ASAP)
    - Low load, long duration (~5 minutes) stretching. (eg. Heel prop, prone hang minimizing co-contraction and nociceptor response)
  - Flexion
    - Wall slides, heel slides, seated assisted knee flexion
    - Bike: rocking-for-range. ½ revolution non-resisted bike for knee flexion, progress to full revolution when patient reaches 110°.
  - Patellar mobilization
    - Medial/lateral mobilization initially followed by superior/inferior direction while monitoring reaction to effusion and ROM
  - Hamstring and calf stretching
- Strengthening
  - Quad sets emphasizing vastus lateralis and medialis activation
  - SLR emphasizing no lag
    - E-stim (optional if unable to perform no lag SLR and discontinue when able to perform no lag SLR)
  - Double-leg 1/4 squats

- Standing theraband resisted terminal knee extension (TKE)
- Hamstring sets
- Hamstring curls
- Hamstring and quadriceps co-contraction supine
- Side-lying hip adduction/abduction (avoid adduction moment in this phase with concomitant grade II-III MCL injury)
- Prone hip extension
- 4-Quad (hip flexion, abduction, adduction, extension)
- Ankle pumps with theraband
- Heel raises (calf press)
- Modalities as needed (EMS for muscle re-ed; edema control)

## **PHASE II (Week 2-6) – Early Rehabilitation**

### ***Criteria for progression to phase II:***

- 20 no lag SLR
- ROM: no greater than 5 degree active extension lag, 100 degrees active flexion (Full passive extension)

### ***Goals:***

- Independent ambulation without crutches with normal gait
- Full ROM
- Improve muscle strength
- Progress neuromuscular retraining
- Wean hinged knee brace starting week 4 **IF** demonstrating good quad control

***Crutch D/C Criteria:*** Normal gait pattern, ability to safely ascend/descend stairs without noteworthy pain or instability (reciprocal stair climbing)

### ***Plan:***

- Soft tissue/scar mobilization
- Prone/standing knee flexion
- Proprioceptive training/ balance — BAPS, trampoline
- Weight shifting in standing, 0-30° ROM mini squats
- EMS co-contraction at VMO and hamstrings'
- Theraband ankle exercises - progress to standing as WB dictates
- Begin Stairmaster at 4 weeks
- General conditioning
- Aquatic therapy (when incisions healed) No whip kick

- ROM
  - Continue as in Phase I
  - Flexibility stretching of all major groups
  
- Strengthening
  - Continue Phase I exercises and progress:
  - Quadriceps
    - Mini squats/wall squats
    - Step-ups
    - Leg press
    - Shuttle (press without jumping action)
  - Hamstrings
    - Hamstring Curls
    - Resistive SLR with sport cord
  - Other Musculature
    - Hip adduction/abduction: SLR or with equipment
    - Standing heel raises: progress from double to single leg supports
    - Seated calf press against resistance
    - Multi-hip machine in all direction with proximal pad placement
  
- Neuromuscular Training
  - Wobble board
  - Rocker board
  - Single-leg stance with or without equipment (eg. Instrumented balance system)
  - Slide board
  - Fitter
  
- Cardiopulmonary
  - Bike
  - Elliptical
  - Stairmaster

### **PHASE III – Strengthening and Control (Weeks 7-12)**

#### ***Criteria for progression to phase III:***

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

#### ***Goals:***

- *Maintain full ROM*
- *Running without pain or swelling*
- *Hopping without pain, swelling or giving-way*
- *Control swelling and prevent atrophy*

- *Increase quadriceps and hamstring strength*
- *Increase hip strength*
- *Stimulate collagen healing*
- *Continue general conditioning*

**Plan:**

- Continue phase II exercises
- Continue patellar and joint mobilization and ROM activities
- Continue hamstring and calf stretching
- May use blood flow restriction therapy if appropriate unit available and therapist formally trained.
- Strengthening
  - Continue Phase II exercises and progress:
  - Quadriceps (closed chain only)
    - Half squats
    - Wall squats
    - Leg press
    - Step ups and downs, forward and side
    - Lunges
    - Shuttle
  - Hamstrings
    - Hamstring Curls
    - Isotonic hamstring NK table
    - Sport cord
  - Other Musculature
    - Continue hip strengthening
- Neuromuscular Training
  - Wobble board / Rocker board / Roller board
  - Gentle perturbation training
  - Single-leg stance with or without equipment (eg. Instrumented balance system)
- Cardiopulmonary
  - Gentle straight-line jogging on treadmill or in a protected environment (NO cutting or pivoting)
  - Stairmaster
  - All other cardiopulmonary equipment
- Continue EMS as needed for muscle re-ed and edema
- McConnell taping as necessary
- May begin swimming with modified kick (No “whip kick” or “egg beater kick”)

## **PHASE IV (Weeks 13-16)**

### **Goals:**

- Continue to maintain full ROM
- Continue and progress all goals from Phase III
- IKDC Question # 10 (Global Rating of Function) score of 7 or greater (refer to last page)

### **Plan:**

- Continue phase III exercises and progress as tolerated
- Increase proprioceptive training (sport cord, body blade, plyoballs)
- Continue and increase perturbation training
- Treadmill and straight line running in controlled environment as tolerated
- Light jogging on trampoline
- Continue Stairmaster

## **PHASE V (Week 16-20 +)**

### **Criteria for progression to Phase V:**

- Running without pain or swelling
- Hopping without pain or swelling (bilateral and unilateral)
- Neuromuscular and strength training exercises without difficulty
- IKDC Question # 10 (Global Rating of Function) score of 7 or greater (refer to last page)

### **Goals:**

- Continue all prior goals
- Running patterns (Figure-8, pivot drills, etc) at 50-75% speed max, without difficulty or pain
- Jumping without difficulty
- Hop tests at 75% contralateral values (Cincinnati hop tests):
  - Single-leg hop for distance
  - Triple-hop for distance
  - Crossover hop for distance
  - 6-meter timed hop

### **Plan:**

- Half squats, progress to full squats, lunges (pain-free)
- Progress with closed chain activity
- Plyometrics
- Agility Drills
  - Shuffling
  - Hopping

- Carioca
- Vertical Jumps
- Running patterns at 50-75% speed (e.g. Figure-8)
- Initial Sports-specific drill patterns at 50-75% effort
- Neuromuscular Training
  - Wobble board / Rocker board / Roller board
  - Perturbation training
  - Instrumented testing systems
  - Varied surfaces
- Cardiopulmonary
  - Continue cardiopulmonary conditioning

### **PHASE VI Return-to-Sport Phase (Week 20-36 +)**

#### ***Criteria for progression to Phase VI:***

- *Maximum vertical jump without pain or instability*
- *75% of contralateral on hop tests*
- *Figure-8 run at 75% speed without difficulty*
- *IKDC Question #10 (Global Rating of Knee Function) Score of 8 or greater (reference last page)*

#### ***Initial Goals:***

- *Development of strength, power and endurance*
- *Begin to prepare for return to recreational activity*
- *Begin sport specific training*

#### ***Final Goals:***

- *85% contralateral strength*
- *85% contralateral on hop tests*
- *Sport-specific drills without pain, swelling or difficulty*

#### **Plan:**

- Continue Phase V exercise and conditioning activities
- Aggressive strengthening – squats, lunges, plyometrics
- Running program
- Isokinetic evaluation
- Agility drills
- Sport specific training and drills
  - Interval training programs
  - Running patterns in football
  - Sprinting

- Change of direction
- Pivot and drive in basketball
- Kicking in soccer
- Spiking in volleyball
- Skill / biomechanical analysis with coaches and sports med team

Some additional suggested therapeutic exercises for closer to the end of rehab protocol *if age and sport-appropriate* once patient judged ready and safe by physical therapist:

- Low amplitude low velocity agility drills: forward and backward skipping, side shuffle, skater's quick stepping, carioca, cross overs, backward jog, forward jog
- Closed chain strengthening for quadriceps and glutes - progressing from double leg strengthening to single leg strengthening: lunge progressions and single leg squat progressions
- Single leg balance exercises and progressions, progressing from stationary to deceleration in to holding posture and position
- Initiate low amplitude landing mechanics: med ball squat catches, shallow jump landings, chop and drop stops, etc
- Hip strengthening - especially oriented at neuromuscular control in prevention of hip adduction at landing and stance
- Core strength and stabilization - especially orientated at preventing frontal plane trunk lean during landing and single leg stances
- Unanticipated movement control drills, including cutting and pivoting
- Agility ladder drills
- Stretching for patient specific muscle imbalances

#### **RETURN-TO-SPORT EVALUATION RECOMMENDATIONS:**

- Hop tests (single-leg hop, triple hop, cross-over hop, 6 meter timed-hop)
- Isokinetic strength test (60 degrees/second)
- Vertical jump
- Deceleration shuttle test

#### **RETURN-TO-SPORT CRITERIA:**

- No functional complaints
- Confidence when running, cutting, jumping at full speed
- 85% contralateral values on hop tests
- IKDC Question # 10 (Global Rating of Knee Function) of 9 or greater (see below)

#### **IKDC Question #10:**

How would you rate the function of your knee on a scale of 0 to 10 with 10 being normal, excellent function and 0 being the inability to perform any of your usual daily activities, which may include sports?