



## Multicenter Orthopaedics Outcomes Network “MOON” ACL Rehabilitation Guidelines

**General Information:** The following ACL rehabilitation guidelines are based on a review of the randomized controlled trials related to ACL rehabilitation. For many aspects of ACL rehabilitation there are either no studies that qualify as “best-evidence” or the number of studies is too few for conclusions to be drawn with confidence. In these circumstances, the recommendations are based upon the guidance of the MOON panel of content experts.

The guidelines have been developed to service the spectrum of ACL injured people (non-athlete ↔ elite athlete). For this reason, **example exercises** are provided instead of a highly structured rehabilitation program. **Attending rehabilitation specialists should tailor the program to each patient’s specific needs.**

The multi-center nature of the MOON group necessitates that the MOON ACL Rehabilitation Program only include treatment methods that can be employed at all sites without purchasing expensive equipment. Consequently, some treatment methods with supporting evidence (e.g., using a high-intensity electric stimulation training program for strength, aquatic therapy) are not included in the program because the expert panel believed that it is unreasonable to expect all sites to carry out such treatments.

Progression from one phase to the next is based on the patient demonstrating readiness by achieving **functional criteria rather than the time elapsed since surgery**. The timeframes identified in parentheses after each Phase are *approximate* times for the average patient, **NOT** guidelines for progression. Some patients will be ready to progress sooner than the timeframe identified, whereas others will take longer.

The *recommended* number of visits to the rehabilitation specialist (including visits merely for evaluation / exercise progression) is **16 to 24** visits with the majority of the visits occurring early (**BIW x 6 weeks**). However, it is recognized that some patient’s health plans are severely restrictive. For this reason, the *minimum* number of post-ACL reconstruction visits to a rehabilitation specialist has been set at **6 visits** for the MOON group patients.

### Phase 0: Pre-operative Recommendations

- Normal gait
- AROM 0 to 120 degrees of flexion
- Strength: 20 SLR with no lag
- Minimal effusion
- Patient education on post-operative exercises and need for compliance
- Educated in ambulation with crutches
- Wound care instructions
- Educated in MOON follow-up expectations



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### PHASE 1: Immediate Post-Op Phase (Approximate timeframe: Surgery to 2 weeks)

#### GOALS

- Full knee extension ROM
- Good quadriceps control ( $\geq 20$  no lag SLR)
- Minimize pain and swelling
- Normal gait pattern

**Crutch Use:** WBAT with crutches (beginning the day of surgery)

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

**Knee Immobilizer:** None (Exception: First 24 hours after a femoral nerve block)

#### Cryotherapy:

- Cold with compression/elevation (e.g. Cryo-cuff, ice with compressive stocking)
- First 24 hours or until acute inflammation is controlled: every hour for 15 minutes
- After acute inflammation is controlled: 3 times a day for 15 minutes
- Crushed ice in the clinic (post-acute stage until D/C)

#### EXERCISE SUGGESTIONS

##### ROM

- Extension: Low load, long duration (~5 minutes) stretching (e.g., heel prop, prone hang minimizing co-contraction and nociceptor response)
- Flexion: Wall slides, heel slides, seated assisted knee flexion, bike: rocking-for-range
- Patellar mobilization (medial/lateral mobilization initially followed by superior/inferior direction while monitoring reaction to effusion and ROM)

##### Muscle Activation/Strength

- Quadriceps sets emphasizing vastus lateralis and vastus medialis activation
- SLR emphasizing no lag

**Electric Stimulation:** *Optional* if unable to perform no lag SLR

**Discontinue** use when able to perform *20 no lag SLR*

- Double-leg quarter squats
- Standing theraband resisted terminal knee extension (TKE)
- Hamstring sets
- Hamstring curls
- Ankle pumps with theraband
- Heel raises (calf press)
- Side-lying hip adduction/abduction (Avoid adduction moment in this phase with concomitant grade II – III MCL injury)
- Quad/ham co-contraction supine
- Prone Hip Extension

**Cardiopulmonary:** UBE or similar exercise is recommended

**Scar Massage:** (when incision is fully healed)

#### CRITERIA FOR PROGRESSION TO PHASE 2

20 no-lag SLR, Normal gait, D/C Crutch/Immobilizer, and AROM 0-5-110 or better



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### PHASE 2: Early Rehabilitation Phase (Approximate timeframe: weeks 2 to 6)

#### GOALS

- Full ROM
- Improve muscle strength
- Progress neuromuscular retraining

#### EXERCISE SUGGESTIONS

##### ROM

- Low load, long duration (assisted prn)
- Heel slides/wall slides
- Heel prop/prone hang (minimize co-contraction / nociceptor response)
- Bike (rocking-for-range → riding with low seat height)
- Flexibility stretching all major groups

##### STRENGTHENING

###### *Quadriceps:*

- Quad sets
- Mini-squats/wall-squats
- Steps-ups
- Knee extension from 90° to 40°
- Leg press
- Shuttle **Press without jumping action**

###### *Hamstrings:*

- Hamstring curls
- Resistive SLR with sports cord

###### *Other Musculature:*

- Hip adduction/abduction: SLR or with equipment
- Standing heel raises: progress from double to single leg support
- Seated calf press against resistance
- **Multi-hip machine in all directions with proximal pad placement**

##### Neuromuscular training

- Wobble board
- Rocker board
- Single-leg stance with or without equipment (e.g. instrumented balance system)
- Slide board

##### Cardiopulmonary

- Bike
- Elliptical trainer
- Stairmaster

#### CRITERIA FOR PROGRESSION TO PHASE 3

- Full ROM , Minimal effusion/pain, Functional strength and control in ADLs
- IKDC Question #10 (Global Rating of Function) score of  $\geq 7$



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### **PHASE 3: Strengthening & Control Phase (Approximate timeframe: weeks 7 to 12)**

#### **GOALS**

- Maintain full ROM
- Running without pain or swelling
- Hopping without pain, swelling or giving-way

#### **EXERCISE SUGGESTIONS**

##### **Strengthening**

- Squats
- Leg press
- Hamstring curl
- Knee extension 90° to 0°
- Step-ups/down
- Lunges
- Shuttle
- Sports cord
- Wall squats

##### **Neuromuscular Training**

- Wobble board / rocker board / roller board
- Perturbation training
- Instrumented testing systems
- Varied surfaces

##### **Cardiopulmonary**

- Straight line running on treadmill or in a protected environment (NO cutting or pivoting)
- All other cardiopulmonary equipment

#### **CRITERIA FOR PROGRESSION TO PHASE 4**

- Running without pain or swelling
- Hopping without pain or swelling (Bilateral and Unilateral)
- Neuromuscular and strength training exercises without difficulty



## **PHASE 4: Advanced Training Phase** (Approximate timeframe: weeks 13 to 16) **GOALS**

- Running patterns (Figure-8, pivot drills, etc.) at 75% speed without difficulty
- 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)

### **EXERCISE SUGGESTIONS**

#### **Aggressive Strengthening**

- Squats
- Lunges
- Plyometrics

#### **Agility Drills**

- Shuffling
- Hopping
- Carioca
- Vertical jumps
- Running patterns at 50 to 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**

- Running
- Other cardiopulmonary exercises

### **CRITERIA FOR PROGRESSION TO PHASE 5**

- 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  $\geq 8$



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### **PHASE 5: Return-to-Sport Phase (Approximate timeframe: weeks 17 to 20)**

#### **GOALS**

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

#### **EXERCISE SUGGESTIONS**

##### **Aggressive Strengthening**

- Squats
- Lunges
- Plyometrics

##### **Sport Specific Activities**

- Interval training programs
- Running patterns in football
- Sprinting
- Change of direction
- Pivot and drive in basketball
- Kicking in soccer
- Hitting in volleyball
- Skill / biomechanical analysis with coaches and sports medicine team

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

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

##### **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  $\geq 9$