

## **KNEE MULTILIGAMENT RECONSTRUCTION: ANTERIOR CRUCIATE LIGAMENT (ACL), POSTERIOR CRUCIATE LIGAMENT (PCL), AND LATERAL COLLATERAL LIGAMENT (LCL) POST-OPERATIVE GUIDELINES**

The following Multiligament (ACL, PCL, LCL) Reconstruction guidelines were developed by HSS Rehabilitation. Progression is both criteria-based and patient specific. Phases and time frames are designed to give the clinician a general sense of progression. The rehabilitation program following a multiligament procedure emphasizes early, assisted, and controlled motion to prevent knee stiffness and to avoid disuse atrophy of the musculature. The program should aim to maximize flexibility, strength, and pain-free performance of functional activities while protecting the integrity of the surgical repair. This model should not replace clinical judgment.

These types of patients may have additional complications due to high velocity injury. Please be aware of vascular, neurological, and wound healing complications. Communicate with the surgeon regarding any concerns.

Monitor swelling throughout the rehab process. If persistent swelling occurs, monitor load volume and consult with the surgeon.

**FOLLOW SURGEON MODIFICATIONS AS PRESCRIBED.**

## KNEE MULTILIGAMENT RECONSTRUCTION: ACL, PCL, LCL POST-OPERATIVE GUIDELINES

### Post-Operative Phase 1: Weeks 0-6

#### PRECAUTIONS

- Range of motion (ROM)
  - 0-90 degrees, as tolerated
  - Do not force ROM
- Adhere to weight bearing restrictions
  - 20% Toe-touch weight bearing (TTWB) with bilateral axillary crutches
- Brace guidelines
  - Ambulation with brace locked and bilateral axillary crutches
  - Sleep with brace locked in extension for 6 weeks
- Avoid pillow under knee to prevent knee flexion contracture
- Avoid knee flexion active range of motion (AROM)
- Avoid heat application
- Avoid pain with therapeutic exercise and functional activities

#### ASSESSMENT

- Lower Extremity Functional Scale (LEFS)
- Numeric pain rating scale (NPRS)
- Inspection of incision
- Neurovascular assessment
- Edema (girth and description)
- Girth measurements
- Patella mobility
- Lower Extremity (LE) passive range of motion (PROM)
- LE flexibility
- Quality of quadriceps contraction
- Proximal and distal manual muscle testing (MMT)
  - Avoid varus stress
- Gait assessment

## TREATMENT RECOMMENDATIONS

- Patient education
- Soft tissue mobilization, if indicated
  - Quadriceps, hamstring, gastrocnemius/soleus
- Immediate ROM after surgery
  - Do not force ROM
  - Active-assisted ROM (AAROM) knee extension and PROM knee flexion pain-free (e.g., seated knee flexion off table)
- Emphasize full knee extension immediately
  - Calf prop with pillow multiple times per day (avoid hyperextension)
  - LE stretching, including hamstring, gastrocnemius, soleus
    - Modification: avoid hamstring stretching if hamstring autograft is used
- Patella mobilization as indicated (all planes)
- Strengthening
  - Quadriceps re-education with neuromuscular electrical stimulation (NMES)
  - Straight leg raise (SLR) flexion, extension, and adduction; avoid hip abduction open kinetic chain (OKC) and emphasize no extensor lag
    - Brace locked in extension if pain/lag
  - Ankle/hip/core progressive resistive exercises (PRE)
  - Short crank bicycle, once sufficient ROM of 85-90 degrees knee flexion is attained
- Consider Blood Flow Restriction (BFR) program with FDA approved device and qualified therapist with surgeon clearance
- Edema control (cryotherapy)
- Independent with home exercise program (HEP) that addresses primary impairments
- Cardiovascular exercises (e.g., upper body ergometer), as tolerated

## CRITERIA FOR ADVANCEMENT

- Adherence to post-operative restrictions
- Control post-operative pain/edema
- Continued improvement in patella mobility and proximal strength
- Maintain knee ROM 0-90 degrees
- SLR flexion without extensor lag
- Independent with HEP

## EMPHASIZE

- Ambulation with brace locked in extension and 20% TTWB
- Control pain/edema
- Patella mobility
- Knee ROM 0-90 degrees
- Improve quadriceps activation

## KNEE MULTILIGAMENT RECONSTRUCTION: ACL, PCL, LCL POST-OPERATIVE GUIDELINES

### Post-Operative Phase 2: Weeks 7-12

#### PRECAUTIONS

- Progress knee ROM to 0-130 degrees, do not force motion
- Adhere to weight bearing restrictions
  - Progress to partial weight bearing (PWB), then to weight bearing as tolerated (WBAT) while demonstrating proper gait
- Brace guidelines: progress to functional brace, as per surgeon
- Avoid pillow under knee to prevent knee flexion contracture
- Avoid varus stress with supine positioning (avoid hip external rotation)
- Avoid resisted OKC knee flexion PRE
- Activity modification
  - Avoid prolonged standing/walking, pain with functional activity and therapeutic exercise
  - Avoid pivoting or excessive varus force

#### ASSESSMENT

- LEFS
- NPRS
- Inspection of incision
- Edema (girth and description)
- Girth measurement
- Patella mobility
- LE PROM
- LE flexibility
- Quality of quadriceps contraction
- MMT
- Gait assessment

#### TREATMENT RECOMMENDATIONS

- Patient education on continued activity modification and cryotherapy
- Gait training: PWB to WBAT
  - Discontinue crutches when patient demonstrates normal gait pattern
  - Unlock brace when adequate quadriceps control

- Gradual increase of knee ROM to full
  - Week 12: 0-130 degrees
  - Continue exercises from phase 1
  - Step knee flexion stretch
  - Maintain passive knee extension
- Continue patella mobilizations as needed
- Strengthening
  - Continue with NMES as needed for quadriceps activation
  - Quadriceps isometrics at 60 degrees knee flexion
  - Closed kinetic chain (CKC) knee extension: resisted terminal knee extensions
  - Progress multiplanar core/hip strengthening: continue Phase 1 exercises, clamshells, bridges with resistance band, CKC hip strengthening – static to dynamic (e.g., contralateral hip abduction/extension)
  - Leg press: light weight bilateral, 60-0 degrees knee ROM arc
  - Squats: 60-0 degrees knee ROM
  - Forward step up (FSU) 6" → 8"
  - Romanian dead lifts (RDLs)
  - Standing bilateral heel raises
  - Progress to upright stationary bicycle once sufficient ROM of 110-115 degrees knee flexion is obtained
  - Retro-ambulation with focus on quadriceps neuromuscular control
  - Hydrotherapy when incisions are healed – for gait, proximal strengthening, functional movements, balance, and edema control
- Weight shift exercises with upper extremity (UE) support: bilateral leg balance/proprioceptive activities; progress to unilateral/uneven surfaces
- Consider BFR program with FDA approved device and qualified therapist with surgeon clearance

## **CRITERIA FOR ADVANCEMENT**

- Well controlled pain
- Minimal edema
- Normal gait pattern without assistive device
- Knee ROM: 0-130 degrees
- Isometric quadriceps contraction at 60 degrees knee flexion at 70% of contralateral LE
- Proximal MMT > 4/5
- Ascend 8" FSU

## **EMPHASIZE**

- Compliance with brace
- Discontinue crutches only when normal gait demonstrated
- Modify load and activities of daily living (ADL)
- Patella mobility
- Do not force ROM

## KNEE MULTILIGAMENT RECONSTRUCTION: ACL, PCL, LCL POST-OPERATIVE GUIDELINES

### Post-Operative Phase 3: Weeks 13-24

#### PRECAUTIONS

- Monitor symptoms
- Avoid excessive load in ADL
- Avoid pivoting or excessive varus force

#### ASSESSMENT

- LEFS
- NPRS
- Edema (girth and description)
- Patella mobility
- LE AROM and PROM
- LE flexibility
- Isokinetic strength testing (quadriceps/hamstrings) at 6 months
- Gait assessment
- Functional movement assessment, as appropriate
- Knee ligament arthrometer exam at 6 months

#### TREATMENT RECOMMENDATIONS

- Range of motion
  - Gradual increase of ROM to full
    - Continue ROM exercises from Phase 2
  - Continue LE flexibility exercises
    - Prone quadriceps stretch
    - Supine or kneeling hip flexor stretch
  - Initiate foam rolling program
- Continue patella mobilization as needed
- Brace
  - Functional knee brace, per surgeon
  - Discharge brace per surgeon direction
- Soft tissue mobilization as needed

- Strengthening
  - Progress stationary bicycle time
  - Progress to elliptical – when able to perform FSU 8”
  - Leg press bilateral → eccentric → unilateral
  - Retro-ambulation for neuromuscular quadriceps control
  - Underwater treadmill/anti-gravity treadmill training if gait pattern continues to be abnormal
  - Squats: progress squat depth over duration of phase no greater than 90 degrees knee flexion; progress to single leg squat
  - FSU progression
  - Initiate step-down program, emphasize proper movement pattern without deviations
  - RDL: double leg → single leg
  - Hip/core stabilization/kinetic linking progression
- Balance/proprioception progression to include perturbation
- BFR program with FDA approved device and qualified therapist if patient cleared by surgeon
  - Initiate bilateral plyometrics/running program after demonstrating the ability to descend 8” step without pain/deviation

## **CRITERIA FOR ADVANCEMENT**

- Full ROM
- Squat 0-90 degrees symmetrically
- Ability to descend 8” step
- Isokinetic testing – 85% limb symmetry (quadriceps/hamstrings)

## **EMPHASIZE**

- Monitor Edema
- Control volume and load with functional activities
- Emphasis on proper movement strategy/quality of movement

## **KNEE MULTILIGAMENT RECONSTRUCTION: ACL, PCL, LCL POST-OPERATIVE GUIDELINES**

### **Post-Operative Phase 4: Weeks 25+**

#### **PRECAUTIONS**

- Note importance of gradual return to participation with load and volume monitoring under guidance of physical therapist, surgeon, certified athletic trainer, and coach

#### **ASSESSMENT**

- LEFS
- NPRS
- Edema
- Patella mobility
- LE flexibility
- LE strength
- Strength assessment – isokinetic testing, hand-held dynamometry (HHD)
- Balance testing (e.g., Star Excursion Balance Test (SEBT), etc.)
- Functional sport testing (e.g., hop tests)
- HSS Return to Sport Testing (RTS)
- Apprehension with sports specific movement

#### **TREATMENT RECOMMENDATIONS**

- Strengthening
  - Progress load with strengthening therapeutic exercises
  - Biking/elliptical/stair machine/climber
  - Continue with hip/core/kinetic linking progression
  - Advance plyometrics/agility training
    - Double Leg-> Single Leg; Anterior/Posterior -> Medial/Lateral
  - Address deficits found in isokinetic testing, balance testing, functional testing, etc. and retest
  - Initiate sports specific training/deceleration training

#### **CRITERIA FOR ADVANCEMENT**

- Qualitative strength and functional assessment greater than or equal to 90% quadriceps limb symmetry (dynamometry)
- Movement patterns, functional strength, flexibility, motion, endurance, power, deceleration, and accuracy to meet the demands for sport
- Independent with gym strengthening and maintenance program

#### **EMPHASIZE**

- Control volume and load with functional activities
- Emphasis on proper movement strategy/quality of movement



## KNEE MULTILIGAMENT RECONSTRUCTION: ACL, PCL, LCL POST-OPERATIVE GUIDELINES

### References

1. Romeyn RL, Davies GJ, Jennings J. Multiple Ligament Knee Injury Rehabilitation. Sports Physical Therapy Section / APTA Home Study Course, February 2011.
2. Romeyn RL, Jennings J, Davies GJ. Surgical treatment and rehabilitation of combined complex ligament injuries. *N Am J Sports Phys Ther.* 2008;3(4):212-225.
3. Tychanski A, Cavanaugh JT, Ranawat AS. Collateral Ligament and Multiple Ligament Injury. Green A, Hayda R, Hecht AC. *Postoperative Orthopaedic Rehabilitation.* Wolters Kluwer (AAOS), 2017.

Created: 12/2021; Revised 9/2023