KNEE MEDIAL PATELLOFEMORAL LIGAMENT (MPFL) RECONSTRUCTION POST-OPERATIVE GUIDELINES

The following medial patellofemoral ligament reconstruction (MPFLR) guidelines were developed by HSS Rehabilitation. Progression is based on healing constraints and functional progression specific to the patient. Phases and time frames are designed to give the clinician a general sense of progression. Patients undergoing this procedure typically present differently depending on their history of acute dislocations or chronic instability. Those with a history of chronic instability will have developed quadriceps inhibition, apprehension and compensatory strategies. Timelines for these distinct patient populations will vary greatly so achievement of milestones is recommended for advancement to higher level activities such as running, plyometrics, and sports. In addition, concomitant procedures such as patellofemoral joint replacement (PFJR), osteotomy, cartilage procedure, lateral release, and tibial tubercle transfer/osteotomy (TTT/ TTO) will alter progression through the guideline.

Follow physician modifications as prescribed.
KNEE MEDIAL PATELLOFEMORAL LIGAMENT (MPFL) RECONSTRUCTION
POST-OPERATIVE GUIDELINES

Pre-operative Phase

PRECAUTIONS

- Avoid activities that are known to cause patella dislocation (e.g., twisting over planted leg, quadriceps set, or straight leg raise [SLR] causing dislocation/subluxation)
- Avoid pain with range of motion (ROM) and strengthening exercises
- Modify or minimize activities that increase pain and/or swelling
- Use appropriate assistive device as needed
- Wear brace as prescribed by physician

ASSESSMENT

- Lower Extremity Functional Scale (LEFS)
- International Knee Documentation Committee (IKDC)
- Numeric pain rating scale (NPRS)
- Patellar mobility
- Patellar apprehension
- Swelling (girth and description)
- Quality of quadriceps contraction
- Lower extremity (LE) active range of motion (AROM) and passive range of motion (PROM)
- LE flexibility
- LE strength
- Single limb (SL) stance
- Gait
- Current activity level/demands on LE
TREATMENT RECOMMENDATIONS

- Patient education
  - Post-operative plan of care
  - Edema and effusion control with cold and compression
  - Activity modification
  - Gait training with expected post-operative assistive device
  - Basic home exercise program (HEP)

- Ankle pumps, quadriceps sets, gluteal sets
- Active assisted range of motion (AAROM) knee flexion (KF) and knee extension (KE)
- SLR in multiple planes (if doesn’t risk subluxation or dislocation); consider SLR with slight KF
- LE flexibility exercises e.g., supine calf and hamstring stretches
- Passive KE with towel roll under heel
- Plantarflexion with elastic band or calf raises
- Gait training with appropriate pre-operative assistive device if needed
- Additional recommendations for patients attending multiple sessions pre-operatively
  - Edema and effusion management
  - ROM exercises e.g., KF AAROM, supine KE PROM
  - LE flexibility exercises
  - LE progressive resistive exercises- no open chain KE
  - Balance/ proprioceptive training
  - Stationary bicycle

CRITERIA FOR ADVANCEMENT

- Familiarization with post-operative plan of care
- Knee PROM: full extension to 120° knee flexion
- Minimal to no swelling
- Active quadriceps contraction with superior patella glide – avoid dislocation
- Demonstrates normal gait
- Demonstrate alignment and control in SL stance
- Able to verbalize/demonstrate post-operative plan of care

EMPHASIZE

- Familiarize with post-operative plan of care
- Quadriceps contraction
- Control swelling
- Promote / maximize pain-free knee ROM
KNEE MEDIAL PATELLOFEMORAL LIGAMENT (MPFL) RECONSTRUCTION
POST-OPERATIVE GUIDELINES
Acute Care Phase (Ambulatory Surgery): Day of Surgery

PRECAUTIONS
- Avoid prolonged sitting, standing, and walking
- Avoid ambulation without brace and without crutches
- Avoid pain with walking and exercises
- Avoid painful activities
- Avoid applying heat to knee
- No open chain KE
- Do not put a pillow under the operated knee for elevation – elevate entire leg

ASSESSMENT
- Mental status: alert and oriented x3
- NPRS
- Wound status
- Swelling
- PROM/ AAROM of KF in sitting (0°-90° by 4 weeks)
- Post-anesthesia sensory motor screening
- Functional status including ability to manage brace
- Understanding/ independence in HEP and precautions

TREATMENT RECOMMENDATIONS
- Transfer training
- Gait training: weight bearing as tolerated (WBAT) with assistive device and brace locked in extension on level surfaces and stairs
- Patient education
  - Cold therapy using unit recommended by MD
  - Edema and effusion management: demonstrate proper elevation techniques
  - Activity modification
  - Brace management
  - Initiate and emphasize importance of HEP
- Quadriiceps sets with towel roll under knee, gluteal sets, ankle pumps
- Seated knee AAROM KF (0°-90° degrees by 4 weeks)
- Passive KE with towel roll under heel, as needed
CRITERIA FOR DISCHARGE

- Independent ambulation with appropriate assistive device and brace locked in extension on level surfaces and stairs
- Independent brace management
- Independent with transfers
- Independent with HEP

EMPHASIZE

- Reduce swelling (use cooling machine/cold pack)
- Quadriceps contraction
- Independent transfers
- Gait training with appropriate assistive device
- PROM/ AAROM and KF to 90° by 4 weeks)
- Appropriate balance of activity and rest
KNEE MEDIAL PATELLOFEMORAL LIGAMENT (MPFL) RECONSTRUCTION
POST-OPERATIVE GUIDELINES
Post-Operative Phase 1: Protection Phase (Weeks 0-6)

PRECAUTIONS
- Avoid ambulation without brace locked in 0° KE
- Avoid ambulation without crutches if poor load tolerance evident (increased pain, swelling and quadriceps shut down)
- Avoid lateralization of patella
- Avoid applying heat to knee
- Do not perform AROM open chain KE
- Avoid provocation of quadriceps inhibition, joint effusion, active inflammation
- KF ROM as per MD guidelines
- Be mindful of concomitant procedures: TTO/TTO, articular cartilage procedure, PFJR, osteotomy

ASSESSMENT
- LEFS
- IKDC
- NPRS
- Knee ROM flexion/extension with goal of 90° at 4 weeks
- Motor function
- Swelling (girth and descriptive)
- Thigh girth
- Patella mobility (per MD)
- Apprehension
- Gait and tolerance to weight bearing
  o Ambulation WBAT with brace locked in extension
- Quadriceps activation
- Sensation
- Wound and skin status
- Ambulation with assistive device and brace locked in extension
- Proximal strength (ability to perform SLR flexion, SLR abduction with brace locked in extension)
- Check that patient has cooling unit, neuromuscular electrical stimulation (NMES) home unit
TREATMENT RECOMMENDATIONS

- Patient education: emphasize patient compliance with HEP and weight bearing precautions/progression
  - WBAT with brace locked in extension with appropriate assistive device on level surfaces and stairs
  - Cryotherapy: home cold therapy unit
  - Electrical stimulation (NMES) for quadriceps re-education: quadriceps set with towel roll under knee: 20 minutes, 2-3x/day
  - Continuous passive motion machine (CPM) with concomitant cartilage procedure: 6-8 hours/day
  - Sitting knee ROM exercise: AAROM KF to PROM KE

- Quadriceps set with towel roll under knee
- Hip progressive resisted exercises: pain-free; SLR with brace if lag is present
- Distal strengthening (e.g., plantarflexion with band resistance)
- Flexibility exercises, as needed (e.g., hamstrings, gastrocnemius)
- Consider blood flow restriction (BFR) program with FDA approved device and qualified therapist if patient cleared by MD
- Short crank bicycle if achieved ROM 80°-90° KF
- Patella mobilization as per MD

CRITERIA FOR ADVANCEMENT

- Independent with HEP
- Minimal post-operative pain/swelling
- Fair to good quadriceps contraction
- Good patellar mobility in medial direction
- Knee ROM: 0° KE to ≥ 90° KF
  - Contact surgeon if ROM not trending towards 90° by 4 weeks
- 0/10 pain at rest
- Able to SLR pain-free without quadriceps lag
- Independent ambulation with brace locked in extension and appropriate assistive device on level surfaces and stairs

EMPHASIZE

- Ambulation with brace locked in extension
- Improving quadriceps contraction
- Controlling pain/effusion
- KF ROM > 90°
- Compliance with home instructions: cold therapy unit, CPM, quadriceps re-education with electric stimulation unit
KNEE MEDIAL PATELLOFEMORAL LIGAMENT (MPFL) RECONSTRUCTION
POST-OPERATIVE GUIDELINES
Post-Operative Phase 1: Address Gait (Weeks 7-10)

PRECAUTIONS
• Avoid provocation: pain, inflammation, quadriceps inhibition, joint effusion
• Concomitant procedures: TTT/TTO, articular cartilage procedure, PFJR, osteotomy
• Do not perform AROM open chain KE
• Avoid lateralization of the patella
• Pathological gait pattern (quadriceps avoidance)
• Avoid painful arcs of motion
• Avoid discharge of assistive device too soon
• Avoid pivoting or turning with foot planted

ASSESSMENT
• LEFS
• IKDC
• NPRS
• Quadriceps activation/ motor function
• Swelling (girth and descriptive)
• Sensation
• Wound and skin status
• Thigh girth
• Tolerance to weight bearing
• Patella mobility (per MD)
• Apprehension
• Knee ROM flexion/ extension
• Gait mechanics with appropriate assistive device and brace use
• SL stance: alignment and control
• Proximal strength (ability to SLR flexion, SLR abduction with brace locked in extension)
• Independence with HEP, use of quadriceps stimulation and cold therapy machine
• Current level of activity: monitor step count
TREATMENT RECOMMENDATIONS

- Patient education: activity modification, progression of gait training, cryotherapy
- ROM exercises
  - Sitting PROM KE in a pain-free arc of motion to AAROM KF
  - Progressing from sitting to stair ROM
  - Supine wall AAROM as tolerated (requires ~125° KF in sitting, quadriceps control)
  - If difficulty with progressing ROM, then unlock brace for ambulation with crutches
- Gait training
  - Emphasize heel toe gait pattern with assistive device and brace open to 90° or functional brace
    - Determining factors to unlocking post-operative brace or applying functional brace include:
      - Adequate quadriceps control as demonstrated by SLR without a lag or pain
      - Ability to achieve KE and KF adequate for gait
      - MD preference
    - Determining factors to discharge assistive device:
      - No quadriceps avoidance during loading response
      - Tolerance to weight bearing, swelling, pain
    - Treatment techniques to ensure normal loading response:
      - Low grade elevation treadmill walking or retro-walking to encourage neuromuscular control with KF during loading response, weight shifting, closed chain KE with resistance band behind knee, hydro–treadmill (given adequate wound healing) or anti-gravity treadmill
- Quadriceps strengthening: progress pain-free arc of motion, closed chain only
  - Continue with NMES, biofeedback, quadriceps set, as needed
  - Leg press: monitor arc of motion for pain and compensations (bilateral progressing to single, eccentric)
- Functional training:
  - Squat progression once able to press close to body weight with bilateral leg press: sit to stand with chair/ platform and cushions; pain-free and compensatory-free arc of motion; monitor for hip first strategy and symmetry
  - Leg press for SL static loading with soft knee; contact guard knee to prevent buckling
  - Initiate forward step up (FSU) progression :4”-6” step with adequate strength (without compensation)
  - Consider BFR program with FDA approved device and qualified therapist if patient cleared by MD
• Stationary bicycle
  o Progress from short crank (short crank requires > 80° KF in sitting)
  o Standard crank requires 115° KF in sitting, 80 revolutions per minute (RPM)
• Advance proximal strength and core training: (e.g., side planks, bridge)
• Initiate balance and proprioceptive training: double limb support on progressively challenging surfaces to SL support on level surface only with demonstration of good alignment, stability and neuromuscular control
• Patellar mobilization, MD directed
• Advance HEP as tolerated
• Continue phase I exercises, as appropriate

CRITERIA FOR ADVANCEMENT
• ROM 0° KE → 125° KF, no limits
• Pain and inflammation controlled
• Good quadriceps contraction
• Normal gait pattern
• Good patella mobility
• Postural stability, alignment and neuromuscular control in SL stance
• 0/10 pain with ADLs and therapeutic exercise
• Independent with HEP

EMPHASIZE
• Normalize gait pattern with good neuromuscular control in the stance phase
• Minimizing knee effusion
• Postural stability and lower extremity alignment
• Symptom control with ADLs, therapeutic exercise
KNEE MEDIAL PATELLOFEMORAL LIGAMENT (MPFL) RECONSTRUCTION
POST-OPERATIVE GUIDELINES
Post-Operative Phase 3: Address Impairments (Weeks 11-18+)

PRECAUTIONS

- Avoid provocation of pain, and active inflammation/effusion, quadriceps inhibition
- Do not perform AROM open chain knee extension
- Avoid gait deviations such as quadriceps avoidance
- Avoid “too much, too soon” progression
- Avoid poor movement quality and strategies
- Monitor for secondary complaints resulting from compensations

ASSESSMENT

- LEFS
- IKDC
- NPRS
- Knee ROM flexion/extension: 0° KE - 125° KF
- Swelling (girth and description)
- Thigh girth
- Patella mobility (per MD)
- Apprehension
- Gait pattern and tolerance to weight bearing
- Quadriceps activation/strength
- SL stance: alignment and control
- Proximal strength
- Function:
  - Squat for pain-free, movement strategy, symmetry, depth, alignment;
  - FSU for pain, alignment, compensations
- Performance of HEP
TREATMENT RECOMMENDATIONS

- HEP
- Patient education: activity modification (monitor step count), individualized, and cryotherapy
- Quadriceps strengthening: progress as tolerated, monitor arc of motion, closed chain only
  - Squat progression: chair squats to free squats
  - FSU progression: 6” step progressing to 8” step (dependent on patient height)
  - Eccentric quadriceps strength:
    - Eccentric leg press
    - SL squat to chair with support of opposite foot
    - Forward step down (FSD) progression: begin with 4” step ultimately progressing to 8” step (dependent on patient height)
  - Consider BFR program with FDA approved device and qualified therapist if patient cleared by surgeon
- SL strengthening: SL squat to chair, leg press eccentric, SL bridge, SL Romanian Deadlift (RDL)
- ROM exercises
  - AAROM KE to AAROM KF in sitting to supine wall slides to stair stretch
- Gait training to emphasize heel-toe gait pattern with emphasis on loading response
- Advance proximal strength:
  - Bridging progression
  - Standing clam shell, clock,
  - RDL, windmill, lawn mower
  - Core training (planks, side planks, Sahrmann progression)
- Balance progression with postural alignment and neuromuscular control (static to dynamic, introduce different planes of motion, challenging surfaces)
- Address muscle imbalances – evaluation-based (e.g., gluteal strength, 2 joint hip flexor length, quadriceps length, calf length)
- Address biomechanical factors – evaluation-based (e.g., ankle mobility)
- Cross training: elliptical trainer initiated with good strength/quality during 6” FSU, bicycle (80 RPM), swimming (avoid breaststroke, butterfly)
CRITERIA FOR ADVANCEMENT

- Medical clearance by MD to begin running and plyometrics
- ROM within normal limits
- No pain or swelling
- Demonstrate SL strength and stability
- Ability to demonstrate alignment, control, stability in SL stance during dynamic activities
- Core stability: SL bridge = 30 seconds, Sahrmann ≥ level 3
- Able to ascend 6”/8” step with good control
- Able to descend 6”/8” step with good control and alignment throughout the full arc of motion
- Movement strategy, alignment, symmetry (double leg tasks), control (SL tasks) during selected movement patterns
- 90% limb symmetry index (consider hand-held dynamometry, 1 repetition maximum, or 3 repetition maximum on leg press)
- Quantitative assessments ≥ 90% of contralateral LE
- Note that the uninvolved side may be subpar
- Independent with HEP

EMPHASIZE

- Normal gait
- Identifying and addressing muscle/soft tissue imbalances
- SL strengthening
- Neuromuscular control
- Functional progression
- Quality of movement: symmetry during double limb tasks, hip movement strategy, alignment during selected movement patterns (squat, SL squat to chair)
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POST-OPERATIVE GUIDELINES

Post-Operative Phase 4: Functional Strengthening (Months 5-7)

PRECAUTIONS

• Avoid pain with therapeutic exercise and functional activities
• Do not perform AROM open chain KE
• Ensure adequate strength, functional strength, ROM, flexibility, and fitness when returning to sport
• Avoid activity level > ability

ASSESSMENT

• LEFS
• IKDC
• NPRS
• Knee ROM
• Swelling
• Thigh girth
• Patella mobility
• Apprehension
• Neuromuscular control during SL tasks
• Eccentric quadriceps strength: FSD, SL, squat, symmetry
• SL ability: alignment and control
• Proximal strength
• Function:
  o Squat for pain-free, movement strategy, symmetry, depth, alignment;
  o FSU: pain-free, alignment, control
TREATMENT RECOMMENDATIONS

- Continue to advance LE strengthening (SL strength and eccentric quadriceps), flexibility, dynamic SL stability and agility programs
- Continue to address muscle imbalances - evaluation-based
- Advance core stability
- Cross training
- Initiate plyometric program progressing from double leg to SL and from vertical to horizontal:
  - Progress 1 exercise per week (see Appendix 1)
  - Vertical jumping progression
    - Double leg box jump → jump in place → drop jump
    - SL box jump → jump in place → drop jump
  - Horizontal jumping progression
    - Forward hops (double leg to SL)
    - Side to side hops (double leg to SL)
    - Broad jump (double leg to SL)
    - Side to side jumps
- Initiate running program on non-consecutive days with interval training (see Appendix 2)
  - Utilize antigravity treadmill if available

CRITERIA FOR DISCHARGE OR ADVANCEMENT TO PHASE 5 IF RETURNING TO PLAY

- Medical clearance by MD to initiate return to play progression
- Successful completion of plyometric training
- Maximize strength and flexibility as to meet demands of individual’s sport activity
- Ability to demonstrate hip strategy, symmetry (double leg tasks), control (SL tasks) and alignment during selected movement patterns: squat, FSD, jumping tasks, SL squat
- Cardiovascular fitness to meet demands of sport
- Lack of apprehension with sport specific movements

EMPHASIZE

- Quality of movement
- Functional progression
- SL strength
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POST-OPERATIVE GUIDELINES

Post-Operative Phase 5: Return to Play (Months 7+)

PRECAUTIONS

- Avoid pain with therapeutic exercise and functional activities
- Avoid inadequate strength, functional strength, ROM, flexibility, fitness when returning to sport
- Avoid inadequate rest
- Note the importance of gradual return to participation with load and volume monitoring under guidance of physical therapist, exercise physiologist, physician, certified athletic trainer (ATC) and coach
- Avoid premature or too rapid full return to sport

ASSESSMENT

- LEFS
- IKDC
- Knee ROM
- Swelling
- Thigh girth
- NPRS
- Patella mobility
- Apprehension
- Neuromuscular control during SL tasks
- Eccentric quadriceps strength: FSD, SL, squat, symmetry
- SL ability: alignment and control
- Proximal strength
- Function
  - Squat for pain-free, movement strategy, symmetry, depth, alignment
  - FSU: pain-free, alignment, control
- Independence with HEP
TREATMENT RECOMMENDATIONS

- Gradually increase volume and load to mimic load necessary for return to activity
- Progress movement patterns specific to patient’s desired sport or activity
- Progression of agility, cutting, and deceleration (see Appendix 3)
- Increase cardiovascular load to match that of desired activity
- Collaborate with ATC, performance coach/strength and conditioning coach, skills coach and/or personal trainer to monitor load and volume as return to participation
- Consult with referring MD on timing return to sport including any recommended limitations
- Continue to advance LE strengthening, flexibility, dynamic SL stability, core stability and agility
- Advance plyometric program with MD clearance
  - Horizontal jumping progression: broad jump to hop to opposite to SL hop
  - Progress running program

CRITERIA FOR DISCHARGE

- Medical clearance by MD to initiate return to play progression
- Quantitative assessments 95% of contralateral extremity
- Hop test > 95% limb symmetry with good alignment, strategy and control
- Lack of pain, apprehension with sport specific movements
- Maximize strength and flexibility as to meet demands of individual’s sport activity
- Ability to decelerate with good control, and alignment on SL
- Cardiovascular fitness to meet demands of sport
- Flexibility to meet demands of sport
- Independent with gym program for maintenance and progression of therapeutic exercise program
- Demonstrates quality of movement with required sports-specific activities
- Lack of apprehension with sport specific movements

EMPHASIZE

- Return to participation
- Collaboration with Sports Performance experts
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POST-OPERATIVE GUIDELINES

Appendix 1: Phase 4 – Examples of Plyometrics Progression

Example 1
- Week 1: Onto box
- Week 2: In place and jumping rope
- Week 3: Drop jumps
- Week 4: Broad jumps
- Week 5: Side to side hops
- Week 6: Hop to opposite

Example 2
1. Bilateral plyometrics on leg press
2. Bilateral jumps onto a 6” box
3. Bilateral jumps in a cross pattern, e.g., clockwise (below right) and counterclockwise (below left)
4. Bilateral jumps on/off box 6” / 8” / 12”
5. Unilateral jumps in a cross pattern, e.g., clockwise (below right) and counterclockwise (below left)
6. Unilateral jumps on/off box
Example 1

- Week 1
  - Run: 30 seconds
  - Rest/Walk: 30 seconds
  - Reps: 3
- Week 2
  - Run: 1 minute
  - Rest/Walk: 1 minute
  - Reps: 3
- Week 3
  - Run: 2 minutes
  - Rest/Walk: 1 minute
  - Reps: 2
- Week 4
  - Run: 4 minutes
  - Rest/Walk: 2 minutes
  - Reps: 1
- Week 5
  - Run: 4 minutes
  - Rest/Walk: 2 minutes
  - Reps: 2
- Week 6
  - Run: 8 minutes
  - Rest/Walk: n/a
  - Reps: 1

Example 2

1. Retro running 30” on treadmill or Alter-GTM run 30” 80% WB, progressing to 95% WB
2. Treadmill forward running 30”, advancing to 1’ (note: not jogging, not sprinting, but running)
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POST-OPERATIVE GUIDELINES
Appendix 3: Phase 5 – Agility

- Throughout agility program, monitor for knee valgus, hip strategy, compensatory movement, apprehension and good knee control before advancing to higher level activity.
- Progress drills from non-contested to contested drills; non-contact scrimmage before contact scrimmage then live play.
- Time progression (note: may need to spend more than one week at each phase to ensure quality of movement)
  - Week 1: Forward running, back pedaling, side shuffles, cariocas- 50% effort
  - Week 2: Increase to 75% effort
  - Week 3: 45° cuts, figure eight, circle cone- 50% effort
  - Week 4: Increase to 75% effort
  - Week 5: Four corners, T-drills, 90° cuts, acceleration/deceleration- 50%-75% effort
  - Week 6: Increase to 80% - 100% effort
  - Week 7: Reaction drills- 80%-100% effort
  - Week 8: Sports-specific/dual tasking drills
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POST-OPERATIVE GUIDELINES

References


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