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REHABILITATION PROTOCOL: MPFL Reconstruction

This protocol is intended to guide clinicians through the post-operative course for MPFL reconstruction. This protocol is time based (dependent on tissue healing) as well as criterion based. Specific intervention should be based on the needs of the individual and should consider exam findings and clinical decision making. The timeframes for expected outcomes contained within this guideline may vary based on surgeon's preference, additional procedures performed, and/or complications. If a clinician requires assistance in the progression of a post-operative patient, they should consult with the referring surgeon. The interventions included within this protocol are not intended to be an inclusive list. Therapeutic interventions should be included and modified based on the progress of the patient and under the discretion of the clinician.

Considerations with concomitant procedures:
Many different factors influence the post-operative MPFL reconstruction rehabilitation outcomes, including additional procedure such as tibial tuberosity osteotomy (TTO). It is recommended that clinicians collaborate closely with the referring physician regarding early range of motion, weight bearing status, and use of assistive devices.

Post-operative considerations
If you develop a fever, intense calf pain, excessive drainage from the incision, uncontrolled pain or any other symptoms you have concerns about you should call your doctor.

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PHASE I: IMMEDIATE POST-OP (0-2 WEEKS AFTER SURGERY)

Rehab Goals	▪ Protect surgical site ▪ Reduce swelling, minimize pain ▪ Restore full extension, gradually improve flexion > 90 deg ▪ Minimize arthrogenic muscle inhibition, re-establish quad control, regain full active extension ▪ Patient education ○ Keep your knee straight and elevated when sitting or lying down. Do not rest with a towel placed under the knee
Weight Bearing	Walking ▪ Initially brace locked, PWB (0-1 week) → WBAT with crutches (per MD recommendation) ▪ May start walking without crutches as long as there is no increased pain, effusion, and proper gait ▪ When climbing stairs, make sure you are leading with the non-surgical side when going up the stairs, make sure you are leading with the crutches and surgical side when going down the stairs

Interventions	**Swelling Management**
	▪ Ice, compression, elevation (check with MD re: cold therapy)
	▪ Retrograde massage
	▪ Ankle pumps
	
	Range of motion/Mobility
	▪ PROM
	▪ Heel slides with towel
	▪ Low intensity, long duration extension stretches: prone hang, heel prop
	▪ Seated hamstring/calf stretch
	
	Strengthening
	▪ Calf raises
	▪ Quad sets
	  ○ NMES high intensity (2500 Hz, 75 bursts) supine knee extended 10 sec/50 sec, 10 contractions, 2x/wk during sessions—use of clinical stimulator during session, consider home units distributed immediate post op
	▪ Straight leg raise
	  ○ **Do not perform straight leg raise if you have a knee extension lag
	▪ Hip abduction
	▪ Standing hamstring curl

Criteria to Progress	▪ Knee extension ROM 0 deg ▪ Quad contraction with superior patella glide and full active extension ▪ Able to perform straight leg raise without lag

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PHASE II: INTERMEDIATE POST-OP (2-6 WEEKS AFTER SURGERY)

Rehab Goals	▪ Continue to protect surgical site ▪ Maintain full extension, restore full flexion (contralateral side) ▪ Normalize gait ▪ Patient education
Weight Bearing	Walking ▪ WBAT: May unlock brace when able to perform straight leg raise without lag ▪ Discontinue use of brace after 6 wks (or per surgeon) and when gait is normalized
Additional Interventions *Continue with Phase I interventions	**Range of motion/Mobility** ▪ Stationary bicycle ▪ Gentle patellar mobilizations: superior/inferior and medial/lateral ***Not necessary unless stiffness present** **Strengthening** ▪ Adductor strengthening: hook lying ball squeezes, SLR adduction, bridging with ball squeeze ▪ Ball squats, wall slides, mini squats from 0-60 **Balance/proprioception** ▪ Single leg standing balance (knee slightly flexed) static progressed to dynamic and level progressed to unsteady surface
Criteria to Progress	▪ No swelling (Modified Stroke Test) ▪ Flexion ROM >90 deg ▪ Extension ROM equal to contra lateral side

PHASE III: LATE POST-OP (7-12 WEEKS AFTER SURGERY)

Rehab Goals	▪ Continue to protect surgical site ▪ Maintain full ROM ▪ Safely progress strengthening ▪ Promote proper movement patterns ▪ Avoid post exercise pain/swelling ▪ Avoid activities that produce pain at repair site
Weight Bearing	▪ FWB without assistive device
Additional Interventions *Continue with Phase I-II Interventions	**Range of motion/Mobility** ▪ Gentle stretching all muscle groups: prone quad stretch, standing quad stretch, kneeling hip flexor stretch **Cardio**

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	▪ ~8 weeks: Elliptical, stair climber, flutter kick swimming, pool jogging **Strengthening** ▪ Gym equipment: ○ leg press machine ○ seated hamstring curl machine and hamstring curl machine ○ hip abductor and adductor machine ○ hip extension machine ○ roman chair ○ seated calf machine ▪ Progress intensity (strength) and duration (endurance) of exercises **The following exercises to focus on proper control with emphasis on good proximal stability ▪ Proximal Strengthening: ○ Double leg bridge ○ Bridge with feet on physioball ○ Single leg bridge ○ Lateral band walk ○ Standing clamshell/fire hydrant ○ Hamstring walkout ○ TA brace with UE and LE progression ▪ Squat to chair ▪ Lateral lunges ▪ Romanian deadlift ▪ Single leg progression: ○ partial weight bearing single leg press ○ slide board lunges: retro and lateral ○ step ups and step ups with march ○ lateral step-ups ○ step downs ○ single leg squats ○ single leg wall slides ▪ Lateral band walks **Balance/proprioception** ▪ Progress single limb balance including perturbation training
Criteria to Progress	▪ No effusion/swelling/pain after exercise ▪ Normal gait ▪ ROM equal to contra lateral side ▪ Quad/HS/glut index ≥70%; HHD mean or isokinetic testing @ 60d/s

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PHASE IV: TRANSITIONAL (13-16 WEEKS AFTER SURGERY)

Rehab Goals	▪ Maintain full ROM ▪ Safely progress strengthening ▪ Promote proper movement patterns ▪ Avoid post exercise pain/swelling ▪ Avoid activities that produce pain
Additional Interventions *Continue with Phase II-III interventions	**Strengthening** ▪ Progress intensity (weight) and volume (repetitions) of exercises **Plyometric activities** ▪ Bilateral FWB plyometrics progressed to single leg plyometrics **Balance/proprioception** ▪ Progress single limb balance including perturbation training
Criteria to Progress	▪ Clearance from MD and ALL milestone criteria below have been met ▪ Functional Assessment ○ Quadriceps index >80%; HHD or isokinetic testing 60d/s ○ Hamstrings ≥80%; HHD or isokinetic testing 60 d/s ○ Glut med, glut max index ≥80% HHD

PHASE V: EARLY RETURN TO SPORT (4-5 MONTHS AFTER SURGERY)

Rehab Goals	▪ Safely progress strengthening ▪ Safely initiate sport specific training program ▪ Promote proper movement patterns ▪ Avoid post exercise pain/swelling ▪ Avoid activities that produce pain at graft donor site
Additional Interventions *Continue with Phase II-IV interventions	Strengthening ▪ Progress intensity (weight) and volume (repetitions) of exercises Interval running program ▪ Return to Running Program (See below) Progress to plyometric and agility program (with functional brace if prescribed) ▪ Agility and Plyometric Program (See below)
Criteria to Progress	▪ Clearance from MD and ALL milestone criteria below have been met ▪ Completion jog/run program without pain/effusion / swelling ▪ Functional Assessment ○ Quad/HS/glut index ≥95%; HHD mean or isokinetic testing @ 60d/s ○ Hamstring/Quad ratio ≥66% ○ Hop Testing ≥95% compared to contra lateral side, demonstrating good landing mechanics

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	▪ Lysholm >90% ▪ KOOS-sports questionnaire >90% ▪ International Knee Committee Subjective Knee Evaluation >93 ▪ Psych Readiness to Return to Sport (PRRS) ▪ Kujala > 90

PHASE VI: UNRESTRICTED RETURN TO SPORT (6+ MONTHS AFTER SURGERY)

Rehab Goals	▪ Continue strengthening and proprioceptive exercises ▪ Symmetrical performance with sport specific drills ▪ Safely progress to full sport
Additional Interventions *Continue with Phase II-V interventions	▪ Multi-plane sport specific plyometrics program ▪ Multi-plane sport specific agility program ▪ Include hard cutting and pivoting depending on the individuals' goals ▪ Non-contact practice→ Full practice→ Full play (~6-7 mo)
Criteria to Progress	▪ Functional Assessment ○ Quad/HS/glut index ≥95%; HHD mean or isokinetic testing @ 60d/s ○ Hamstring/Quad ratio ≥66% ○ Hop Testing ≥95% compared to contra lateral side, demonstrating good landing mechanics ▪ KOOS-sports questionnaire >90% ▪ International Knee Committee Subjective Knee Evaluation >93

**Acknowledgement: This rehab protocol was largely adopted from the protocols at MGH Sports Medicine Physical Therapy, which can be found at https://www.massgeneral.org/orthopaedics/sports-medicine/physical-therapy/sports-rehab-protocols*

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Return to Running Program

This program is designed as a guide for clinicians and patients through a progressive return-to-run program. Patients should demonstrate > 80% on the Functional Assessment prior to initiating this program (after a knee ligament or meniscus repair). Specific recommendations should be based on the needs of the individual and should consider clinical decision making. If you have questions, contact the referring physician.

PHASE I: WARM UP WALK 15 MINUTES, COOL DOWN WALK 10 MINUTES Day 1 2 3 4 5 6

Day	1	2	3	4	5	6	7
Week 1	Walk 5 min, Jog 1 min x 5 reps		Walk 5 min, Jog 1 min x 5 reps		Walk 4 min, Jog 2 min x 5 reps		Walk 4 min, Jog 2 min x 5 reps
Week 2		Walk 3 min, Jog 3 min x 5 reps		Walk 3 min, Jog 3 min x 5 reps		Walk 2 min, Jog 4 min x 5 reps	
Week 3	Walk 2 min, Jog 4 min x 5 reps		Walk 1 min, Jog 5 min x 5 reps		Walk 1 min, Jog 5 min x 5 reps		Return to Run

**Only progress if there is no pain or swelling during or after the run

PHASE II: WARM UP WALK 15 MINUTES, COOL DOWN WALK 10 MINUTES

Day	1	2	3	4	5	6	7
Week 1	20 min		20 min		20 min		25 min
Week 2		25 min		25 min		30 min	

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Week 3	30 min		30 min		35 min		35 min
Week 4		35 min		40 min		40 min	
Week 5	40 min		45 min		45 min		45 min
Week 6		50 min		50 min		50 min	
Week 7	55 min		55 min		55 min		60 min
Week 8		60 min		60 min			

Recommendations

- Runs should occur on softer surfaces during Phase I
- Non-impact activity on off days
- Goal is to increase mileage and then increase pace; avoid increasing two variables at once
- 10% rule: no more than 10% increase in mileage per week

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Agility and Plyometric Program

This program is designed as a guide for clinicians and patients through a progressive series of agility and plyometric exercises to promote successful return to sport and reduce injury risk. Patients should demonstrate > 80% on the Functional Assessment prior to initiating this program. Specific intervention should be based on the needs of the individual and should consider clinical decision making. If you have questions, contact the referring physician.

PHASE I: ANTERIOR PROGRESSION

Rehab Goals	▪ Safely recondition the knee ▪ Provide a logical sequence of progressive drills for pre-sports conditioning
Agility	▪ Forward run ▪ Backward run ▪ Forward lean in to a run ▪ Forward run with 3-step deceleration ▪ Figure 8 run ▪ Circle run ▪ Ladder
Plyometrics	▪ Shuttle press: Double leg alternating leg single leg jumps ▪ Double leg: ○ Jumps on to a box jump off of a box jumps on/off box ○ Forward jumps, forward jump to broad jump ○ Tuck jumps ○ Backward/forward hops over line/cone ▪ Single leg (these exercises are challenging and should be considered for more advanced athletes): ○ Progressive single leg jump tasks ○ Bounding run ○ Scissor jumps ○ Backward/forward hops over line/cone
Criteria to Progress	▪ No increase in pain or swelling ▪ Pain-free during loading activities ▪ Demonstrates proper movement patterns

PHASE II: LATERAL PROGRESSION

Rehab Goals	▪ Safely recondition the knee ▪ Provide a logical sequence of progressive drills for the Level 1 sport athlete
Agility *Continue with Phase I interventions	▪ Side shuffle ▪ Carioca ▪ Crossover steps ▪ Shuttle run

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	▪ Zig-zag run ▪ Ladder
Plyometrics *Continue with Phase I interventions	▪ Double leg: o Lateral jumps over line/cone o o Lateral tuck jumps over cone ▪ Single leg (these exercises are challenging and should be considered for more advanced athletes): o Lateral jumps over line/cone o Lateral jumps with sport cord
Criteria to Progress	▪ No increase in pain or swelling ▪ Pain-free during loading activities ▪ Demonstrates proper movement patterns

PHASE III: MULTIPLANAR PROGRESSION

Rehab Goals	▪ Challenge the Level 1 sport athlete in preparation for final clearance for return to sport
Agility *Continue with Phase I-II interventions	▪ Box drill ▪ Star drill ▪ Side shuffle with hurdles
Plyometrics *Continue with Phase I-II interventions	▪ Box jumps with quick change of direction ▪ 90 and 180 degree jumps
Criteria to Progress	▪ Clearance from MD ▪ Functional Assessment o Quad/HS/glut index ≥90% contra lateral side (isokinetic testing if available) o Hamstring/Quad ratio ≥70% o Hop Testing ≥90% contralateral side ▪ KOOS-sports questionnaire >90% ▪ International Knee Committee Subjective Knee Evaluation >93 ▪ Psych Readiness to Return to Sport (PRRS)