The Physical Root

Medial Patellofemoral Ligament Reconstruction Rehabilitation Protocol

Criteria-based guidance after MPFL reconstruction

Purpose

A clinician-facing framework after uncomplicated primary MPFL reconstruction. Timing is approximate. Progression is based on the operative report, concomitant procedures, graft/fixation considerations, patellar stability, wound status, effusion, ROM, quadriceps control, gait quality, movement strategy, and the operating surgeon's instructions.

Protocol at a glance

Phase	Typical timing	Primary priorities
0. Readiness	Before surgery	Quiet knee, strength baseline, education and equipment
1. Protection / activation	Day 0 to week 2	Protect reconstruction, extension, swelling, quadriceps, safe gait
2. Motion / foundational strength	Weeks 2-6	Progress ROM, normalize gait, CKC and low-load OKC
3. Strength / running readiness	Weeks 6-16	Unilateral capacity, valgus control, gym progression, impact criteria
4. Power / return	Months 4-9+	Plyometrics, cutting, sport exposure and recurrence prevention

Design principles

- The operative report governs care. Isolated MPFL reconstruction differs from MPFL reconstruction combined with tibial tubercle osteotomy, trochleoplasty, cartilage restoration, or other realignment procedures.
- Restore full knee extension early while progressing flexion according to graft, fixation, soft-tissue irritability, and surgeon limits.
- Prioritize quadriceps recovery, gait, patellar stability, hip/trunk capacity, proprioception, and dynamic alignment.
- Open-chain knee extension is one useful component, not the organizing principle of rehabilitation.
- Use objective criteria and the 24-hour joint response rather than time alone.

1. Scope, precautions, and clinical decision rules

Applies to: adults and adolescents after uncomplicated primary MPFL reconstruction. This document does not supersede the operative report, surgeon communication, facility policy, or individualized restrictions.

Adapt or obtain explicit clearance for: tibial tubercle osteotomy (TTO), trochleoplasty, cartilage restoration, osteochondral fixation, lateral retinacular procedures, revision stabilization, multi-ligament surgery, fracture, substantial generalized hypermobility, neurological disease, or other comorbidity affecting protection or exercise safety.

Urgent and emergent escalation

Finding	Recommended action
Chest pain, severe dyspnea, syncope, new confusion, or stroke signs	Activate emergency response / call emergency services.
Concerning calf pain/swelling, warmth, color change, or unexplained shortness of breath	Stop treatment and follow the surgeon/facility pathway for urgent DVT/PE assessment.
Drainage, dehiscence, spreading redness, purulence, fever, chills, or abrupt pain increase	Contact the surgeon promptly; same-day assessment when concerning.
New traumatic patellar shift/dislocation, rapid hemarthrosis, deformity, or acute loss of function	Protect the knee, stop loading, and contact the surgeon promptly.
Loss of distal pulse, new foot drop, progressive sensory loss, or severe unremitting pain	Urgent surgical or emergency evaluation.

Patellar boundaries

Do not perform aggressive medial patellar mobilization after MPFL reconstruction. Avoid lateral patellar stress and activities that reproduce apprehension. Patellar mobility techniques, when indicated, must respect the reconstruction and surgeon guidance.

Key monitoring variables

- Effusion, pain, warmth, incision, patellar apprehension, and 24-hour response.
- Full active/passive extension, flexion trajectory, steri-strip/incision tolerance, and stiffness.
- Quadriceps activation, straight-leg-raise lag, gait, device/brace use, stairs, and balance.
- Foot, ankle, hip, pelvis, and trunk contributions to dynamic knee alignment.
- Fear of reinjury, confidence, and recurrent-instability history.

2. Operative report and procedure-specific considerations

Information to obtain

Operative detail	Why it matters
Isolated MPFL reconstruction	Weight bearing and ROM may progress relatively early when fixation is secure and no additional restrictions apply.
Tibial tubercle osteotomy	Bone healing changes weight bearing, brace use, loaded knee flexion, open-chain load, impact, and return-to-running timelines.
Trochleoplasty	May require slower ROM/loading and surgeon-specific patellofemoral precautions.
Cartilage / osteochondral procedure	Lesion location changes weight bearing, ROM, loaded flexion, impact, and return-to-sport progression.
Graft and fixation	Graft source, patellar/femoral fixation, bone quality, tunnel/anchor concerns, and surgeon-noted tension guide protection.
Other procedures	Meniscal, lateral retinacular, ACL, chondral, or alignment procedures add restrictions.

Required communication

Before advancing weight bearing, loaded knee flexion, open-chain resistance, running, or pivoting, review the operative report and clarify whether the reconstruction was isolated or combined with bony/cartilage realignment.

Common pathway modifiers

Pathway	Typical implication
Isolated MPFLR	Often WBAT with brace/crutches and progressive ROM, but surgeon pathways vary.
MPFLR + TTO	Protected weight bearing and slower loaded progression until radiographic/clinical healing.
MPFLR + cartilage procedure	Procedure- and lesion-specific ROM/weight-bearing/impact restrictions.
Revision / complex instability	More conservative progression and closer surgeon coordination.

Preoperative readiness

- Reduce effusion, restore full extension and useful flexion, and normalize gait as possible.
- Record quadriceps strength, hip/trunk strength, balance, dynamic alignment, patient-reported function, and instability history.
- Teach brace/device use, swelling management, home setup, and realistic return expectations.

3. Phase 1 - protection, extension, and activation

Typical timing: day 0 through week 2. Concomitant procedures may require slower weight-bearing or ROM progression.

Goals

- Protect the reconstruction and incision.
- Achieve full passive extension and progressive active extension.
- Reduce effusion and pain; regain quadriceps activation.
- Establish safe gait and transfers with prescribed brace/device.
- Progress flexion within surgeon-defined limits without forceful stretching.

Interventions

Domain	Examples and dosing guidance
ROM / swelling	Heel prop or prone hang; heel slides; compression/elevation; cryotherapy when appropriate. Avoid aggressive lateral patellar stress.
Quadriceps	Quad sets, NMES, straight-leg raise when lag-free, short-arc knee extension if permitted.
Weight bearing / function	Weight shifts, gait training, elevated sit-to-stand, supported mini-squat within restrictions.
Hip / trunk / ankle	Hip abduction/extension, bridge, calf raise, ankle pumps, trunk control.
Dose	Several brief sessions daily. Use extension, effusion, pain, apprehension, and next-day response to guide dose.

Avoid

- Aggressive medial or lateral patellar mobilization without explicit indication.
- Persistent pillow support directly behind the knee.
- Loaded flexion, weight bearing, or brace weaning beyond surgeon restrictions.
- Exercise that produces patellar apprehension, increasing swelling, loss of extension, or gait deterioration.

Phase 1 progression criteria

Progress when most are present	Hold, regress, or communicate when
Incision stable; full/near-full passive extension; flexion progressing; trace-to-1+ effusion trending down; lag-free SLR; safe gait with prescribed device; no instability episode.	Worsening wound/systemic signs; extension regression; increasing effusion; repeated buckling; calf symptoms; recurrent patellar shift/apprehension; uncontrolled pain.

4. Phase 2 - motion, gait, and foundational strength

Typical timing: weeks 2 to 6. Entry depends on ROM, effusion, gait, quadriceps control, and procedure-specific restrictions.

Goals

- Maintain full extension and progressively restore flexion.
- Normalize gait and transition to the least restrictive brace/device when cleared.
- Develop quadriceps, hip, calf, and trunk capacity without reactive effusion.
- Improve balance, confidence, and control of the femur/pelvis over the foot.

Exercise progression

Category	Examples
Closed chain	Leg press in permitted range, sit-to-stand, box squat, low step-up, supported split squat, calf/soleus raise.
Open chain	Long-arc knee extension with low load in a comfortable range; straight-leg raise progression; hamstring curl when permitted.
Hip / trunk	Bridge, hip hinge, lateral band walk, hip abductor/adductor work, Pallof press, side plank progression.
Proprioception	Single-leg stance, tandem/perturbation work, foam progression, reach tasks when safe.
Valgus / alignment	Band-feedback squat, low lateral step-down, mirror/video feedback, foot tripod and pelvis control.

Open-chain knee extension

Open-chain quadriceps exercise may begin with activation and low-load short-arc or long-arc work when allowed by the surgeon and tolerated by the knee. Begin with a controlled, comfortable arc and progress range and load gradually. After TTO or cartilage procedures, follow the specific loading restrictions. Monitor anterior knee pain, apprehension, effusion, and next-day stiffness.

Progression criteria

- Full extension maintained; flexion progressing toward functional range.
- Trace-to-zero or stable minimal effusion.
- Safe, non-antalgic gait with appropriate brace/device.
- Controlled bilateral squat, sit-to-stand, and low step-up without apprehension.

Clinical priority

Do not let the open-chain question overshadow the major recovery tasks: patellar stability, ROM, quadriceps activation, gait, confidence, whole-chain alignment, and progressive functional loading.

5. Phase 3 - progressive strength and gym return

Typical timing: weeks 6 to 12. Combined bony or cartilage procedures may delay this phase.

Goals

- Build quadriceps and whole-limb strength with objective testing.
- Develop unilateral squat, step, hinge, and lunge control.
- Improve proprioception and dynamic alignment.
- Return to structured lower-extremity gym lifting without recurrent effusion.

Strength menu

Capacity	Exercise examples	Progression signal
Quadriceps	Knee extension machine, leg press, squat, split squat, step-up/down	Stable patellofemoral symptoms and no reactive effusion.
Posterior chain	RDL, bridge/hip thrust, hamstring curl, assisted Nordic when appropriate	Controlled hinge and donor/procedure tolerance.
Hip / trunk	Lateral band walk, hip airplane preparation, side plank, Copenhagen progression, carries	Level pelvis/trunk and improved frontal-plane control.
Calf / ankle	Standing calf raise, seated soleus, foot/ankle control	Full excursion and improved stance/propulsion.
Balance / alignment	Y-Balance pattern, single-leg ball toss, perturbation, lateral step-down	Knee centered over foot with controlled trunk.

Return to lower-extremity gym lifting

Typical window	Recommended activity
0-2 weeks	Home/clinic activation and protected functional exercise only.
2-6 weeks	Bike when ROM permits; light leg press, sit-to-stand, box squat, hip/calf/trunk work within restrictions.
6-12 weeks	Structured gym return: knee extension, leg press, squat pattern, split squat, step-up/down, RDL, hamstring curl, calf/soleus.
12-16+ weeks	Progress heavier bilateral/unilateral lifting and larger ROM when strength, alignment, and joint response permit.
4-6+ months	Heavy strength and power preparation after objective readiness and procedure-specific clearance.

Gym rule

Return to the gym is structured, not unrestricted. Use a written menu, defined ROM and load, no unplanned maximal testing, and a 24-hour response rule. Progress one variable at a time.

6. Phase 4 - running readiness, power, and multidirectional control

Typical timing: weeks 12 to 24. Running commonly begins no earlier than 12 to 16 weeks after isolated uncomplicated MPFLR and later after TTO/cartilage procedures.

Suggested running-entry criteria

- Full ROM and trace-to-zero effusion.
- No patellar apprehension or instability; no pain during daily activity or progressive lifting.
- Quadriceps strength index approximately 80% or greater, interpreted with absolute strength and procedure type.
- Controlled repeated single-leg squat/step-down and low-level bilateral impact preparation.
- Surgeon restrictions and bony/cartilage healing requirements satisfied.

Progressive activities

Domain	Examples
Impact preparation	Pogos, jump rope, snap-down, squat jump and stick, low box jump.
Running skill	March, A-skip, wall drill, walk-jog intervals, progressive level-surface running.
Power	Countermovement jump, broad jump, lateral bound and stick, single-leg hop and stick.
Deceleration	Forward deceleration, lateral shuffle to stick, planned stopping drills.
Dynamic valgus correction	Lateral step-down, single-leg RDL, hip airplane, landing feedback, external targets, trunk/foot strategy.

Progression criteria

- No reactive effusion, apprehension, or instability after running/impact.
- Quadriceps and hip strength continue to improve toward 90% symmetry.
- Controlled bilateral and unilateral landing mechanics.
- Tolerates progressive running volume before speed or cutting.

Alignment principle

Dynamic valgus correction is not a single hip exercise. Modify trunk position, pelvis control, foot placement, ankle strategy, task speed, stopping distance, visual targets, and fatigue exposure.

7. Phase 5 - agility, return to sport, and documentation

Typical timing: months 6 to 9 and beyond. Return to unrestricted pivoting sport is commonly delayed until at least 6 to 9 months and requires objective clearance.

Return-to-sport framework

Domain	Minimum considerations
Time / healing	Procedure-specific biological healing complete; TTO/cartilage pathways may be longer.
Strength	Quadriceps strength symmetry at least 90%, acceptable absolute strength, and adequate hip/calf capacity.
Performance	Hop battery at least 90% with quality landing/cutting and restored sport conditioning.
Symptoms / stability	Full ROM, trace-to-zero effusion, no pain, apprehension, instability, or reactive swelling.
Patient report	Appropriate function and psychological readiness, with confidence during sport-specific tasks.
Exposure	Noncontact practice, controlled contact, full practice, restricted competition, then unrestricted competition.

Clinician documentation checklist

- Isolated versus combined procedure; graft/fixation; TTO, trochleoplasty, cartilage, or other restrictions.
- ROM, effusion, pain, patellar apprehension/stability, gait, strength, balance, and patient-reported function.
- Exact exercise range, load, sets, repetitions, tempo, RPE/RIR, and 24-hour response.
- Criteria and rationale for brace/device change, gym progression, running, plyometrics, cutting, practice, and competition.
- Any surgeon communication and resulting plan.

Communication triggers

Trigger	Examples
Immediate / emergency	Cardiopulmonary emergency, loss of distal perfusion, severe neurological change.
Same day	Concerning DVT/PE signs, significant wound issue, systemic infection, acute traumatic loss of function.
Prompt non-emergent	Extension regression, persistent 2+ effusion, recurrent apprehension/instability, new locking, sudden strength loss, failure to progress.
Routine	Clarify TTO/cartilage restrictions, brace, ROM, open-chain load, gym, running, work, or sport progression.

Quality marker

A high-quality MPFL protocol restores confidence and durable patellar stability while rebuilding quadriceps strength, gait, proprioception, whole-chain control, and sport-specific capacity.

8. Evidence and protocol synthesis

This document is an original clinical synthesis. It reflects recurring elements in major academic patellofemoral stabilization pathways and contemporary MPFL rehabilitation literature, including early protection, progressive ROM, quadriceps recovery, movement retraining, objective strength testing, staged running and return-to-sport criteria, and procedure-specific modification.

Primary protocol models consulted

Source family	Contributions reflected
University of Delaware / Delaware Physical Therapy Clinic patellofemoral and criterion-based rehabilitation principles	Objective progression, quadriceps recovery, movement quality, functional testing, and whole-chain rehabilitation.
Massachusetts General Hospital MPFL reconstruction protocol	Phase structure, early precautions, ROM, strengthening, running and return-to-sport considerations.
The Ohio State University Wexner Medical Center MPFL reconstruction clinical practice guidance	Clinical decision rules, red flags, progressive loading, testing, and return criteria.
Hospital for Special Surgery and other major academic MPFL pathways	Procedure-specific protection, brace/weight-bearing progression, strength, agility, and sport exposure.
Contemporary peer-reviewed MPFL rehabilitation and patellar-instability literature	Recognition of protocol variability, objective criteria, psychological readiness, dynamic alignment, and recurrence prevention.

Important interpretation note

Institutional protocols differ in brace use, weight bearing, ROM targets, patellar mobility, open-chain loading, running, and return-to-sport timing. The largest differences occur when MPFL reconstruction is combined with TTO, trochleoplasty, cartilage restoration, osteochondral work, or other stabilization procedures. The operative report and direct surgeon instructions take precedence.

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