

# Pediatric Rehabilitation Protocol for Medial Patellofemoral Ligament (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 procedures 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, excessive drainage from incision, severe heat and/or redness along incision, uncontrolled pain, or any other symptoms that concern you please call your doctor.

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

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>Protect surgical site</li> <li>Reduce swelling, minimize pain</li> <li>Restore full extension and gradually improve flexion, limited to 30 deg by week 1 and limited to 60 deg by week 2</li> <li>Minimize arthrogenic muscle inhibition, re-establish quad control, regain full active extension</li> <li>Patient education <ul style="list-style-type: none"> <li>Keep your knee straight and elevated when sitting or laying down. Do not rest with a towel placed under the knee.</li> </ul> </li> </ul>
<b>Weight Bearing</b>	<i>Walking</i> <ul style="list-style-type: none"> <li>Brace locked in full extension, PWB 25% WB with crutches (per MD recommendation)</li> <li>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</li> </ul>
<b>Interventions</b>	<i>Swelling Management</i> <ul style="list-style-type: none"> <li>Ice, compression, elevation (check with MD re: cold therapy)</li> <li>Retrograde massage</li> <li><a href="#">Ankle pumps</a></li> </ul> <i>Range of motion/Mobility</i> <ul style="list-style-type: none"> <li>PROM</li> <li><a href="#">Heel slides with towel</a></li> <li>Low intensity, long duration extension stretches: <a href="#">prone hang</a>, <a href="#">heel prop</a></li> <li><a href="#">Seated hamstring</a>, <a href="#">calf stretch</a></li> </ul> <i>Strengthening</i> <ul style="list-style-type: none"> <li><a href="#">Quad sets</a></li> </ul>

	<ul style="list-style-type: none"> <li>○ 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</li> <li>● <a href="#">Straight leg raise</a> - <b>**Do not perform straight leg raise if you have a knee extension lag</b></li> <li>● <a href="#">Hip abduction</a></li> <li>● <a href="#">Standing hamstring curl</a></li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>● Knee extension ROM 0 deg</li> <li>● Knee flexion ROM 60 deg</li> <li>● Quad contraction with superior patella glide and full active extension</li> <li>● Able to perform straight leg raise without lag</li> </ul>

### PHASE II: INTERMEDIATE POST-OP (3-6 WEEKS AFTER SURGERY)

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>● Continue to protect surgical site</li> <li>● Maintain full extension, restore full flexion (contralateral side)</li> <li>● Normalize gait</li> <li>● Patient education</li> </ul>
<b>Weight Bearing</b>	<p><i>Walking</i></p> <ul style="list-style-type: none"> <li>● <b>WBAT: May unlock brace when able to perform straight leg raise without lag</b></li> <li>● For ROM exercises, allow 90 deg flexion by week 4, and 110 deg by week 6</li> <li>● Discontinue use of brace after 6 wks (or per surgeon) and when gait is normalized</li> </ul>
<b>Additional Interventions</b> <i>*Continue with Phase I interventions</i>	<p><i>Range of motion/Mobility</i></p> <ul style="list-style-type: none"> <li>● <a href="#">Stationary bicycle</a></li> <li>● Gentle patellar mobilizations: superior/inferior and medial/lateral - <b>*Not necessary unless stiffness present</b></li> </ul> <p><i>Strengthening</i></p> <ul style="list-style-type: none"> <li>● <a href="#">Calf raises</a></li> <li>● Adductor strengthening: <a href="#">hook lying ball squeezes</a>, <a href="#">SLR adduction</a>, <a href="#">bridging with ball squeeze</a></li> <li>● <a href="#">Ball squats</a>, <a href="#">wall slides</a>, <a href="#">mini squats</a> (from 0-60 degrees flexion)</li> </ul> <p><i>Balance/proprioception</i></p> <ul style="list-style-type: none"> <li>● Initiate single leg balance activities on stable surface and progress to unstable surfaces and more dynamic balance activities as able</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>● No swelling (Modified Stroke Test)</li> <li>● Flexion ROM &gt; 90 deg</li> <li>● Extension ROM equal to contralateral side</li> </ul>

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

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>● Continue to protect surgical site</li> <li>● Maintain full ROM</li> <li>● Safely progress strengthening</li> <li>● Promote proper movement patterns</li> <li>● Avoid post exercise pain/swelling</li> <li>● Avoid activities that produce pain at repair site</li> </ul>
<b>Weight Bearing</b>	<ul style="list-style-type: none"> <li>● FWB without assistive device</li> </ul>
<b>Additional Interventions</b> <i>*Continue with Phase I-II interventions</i>	<p><i>Range of motion/Mobility</i></p> <ul style="list-style-type: none"> <li>● Gentle stretching all muscle groups: <a href="#">prone quad stretch</a>, <a href="#">standing quad stretch</a>, <a href="#">standing hip flexor stretch</a></li> </ul> <p><i>Cardio</i></p> <ul style="list-style-type: none"> <li>● ~8 weeks: Elliptical, stair climber, flutter kick swimming, pool jogging</li> </ul> <p><i>Strengthening</i></p>

	<ul style="list-style-type: none"> <li>Gym equipment: <a href="#">leg press machine</a>, <a href="#">leg extension machine</a>, <a href="#">seated hamstring curl machine</a> and <a href="#">hamstring curl machine</a>, <a href="#">hip abductor and adductor machine</a>, <a href="#">hip extension machine</a>, <a href="#">roman chair</a>, <a href="#">seated calf machine</a></li> </ul> <p>**The following exercises to focus on proper control with emphasis on good proximal stability</p> <ul style="list-style-type: none"> <li>Proximal Strengthening: <a href="#">Double leg bridge</a>, <a href="#">bridge with feet on physio ball</a>, <a href="#">single leg bridge</a>, <a href="#">lateral band walk</a>, <a href="#">standing clamshell/fire hydrant</a>, <a href="#">hamstring walkout</a>, <a href="#">TA brace with UE and LE progression</a></li> <li><a href="#">Squat to chair</a></li> <li><a href="#">Lateral lunges</a></li> <li><a href="#">Romanian deadlift (single and double leg)</a></li> <li>Single leg progression: <a href="#">single leg press</a>, <a href="#">slide board lunges: retro</a> and <a href="#">lateral</a>, <a href="#">split squats</a>, <a href="#">step ups</a> and <a href="#">step ups with march</a>, <a href="#">lateral step-ups</a>, <a href="#">step downs</a>, <a href="#">single leg squats</a>, <a href="#">single leg wall slides</a>, <a href="#">single leg wall sits</a></li> <li><a href="#">Lateral band walks</a></li> </ul> <p><i>Balance/proprioception</i></p> <ul style="list-style-type: none"> <li>Progress single limb balance including perturbation training</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>No effusion/swelling/pain after exercise</li> <li>Normal gait</li> <li>ROM equal to contralateral side</li> <li>Quad/HS/glut index <math>\geq 70\%</math>; HHD mean or isokinetic testing @ 60d/s</li> </ul>

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

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>Maintain full ROM</li> <li>Safely progress strengthening</li> <li>Promote proper movement patterns</li> <li>Avoid post exercise pain/swelling</li> <li>Avoid activities that produce pain</li> </ul>
<b>Additional Interventions</b> <i>*Continue with Phase II-III interventions</i>	<p><i>Strengthening</i></p> <ul style="list-style-type: none"> <li>Progress intensity (weight) and volume (repetitions) of exercises</li> </ul> <p><i>Plyometric activities</i></p> <ul style="list-style-type: none"> <li>Bilateral plyometrics</li> </ul> <p><i>Balance/proprioception</i></p> <ul style="list-style-type: none"> <li>Progress single limb balance including perturbation training</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>Clearance from MD and ALL milestone criteria below have been met</li> <li><b>Functional Assessment</b> <ul style="list-style-type: none"> <li>Quad/HS/glut index <math>\geq 80\%</math>; HHD mean or isokinetic testing @ 60d/s</li> <li>Hamstring/Quad ratio <math>\geq 66\%</math></li> <li>Hop Testing <math>\geq 80\%</math> compared to contra lateral side, demonstrating good landing mechanics</li> </ul> </li> </ul>

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

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>Safely progress strengthening</li> <li>Safely initiate sport specific training program</li> <li>Promote proper movement patterns</li> <li>Avoid post exercise pain/swelling</li> <li>Avoid activities that produce pain at graft donor site</li> </ul>
<b>Additional Interventions</b>	<p><i>Strengthening</i></p> <ul style="list-style-type: none"> <li>Progress intensity (weight) and volume (repetitions) of exercises</li> </ul> <p><i>Interval running program</i></p>

*Continue with Phase II-IV interventions	<ul style="list-style-type: none"> <li>○ <u>Return to Running Program</u></li> </ul> <p>Progress to plyometric and agility program (with functional brace if prescribed)</p> <ul style="list-style-type: none"> <li>○ <u>Agility and Plyometric Program</u></li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>• Clearance from MD and ALL milestone criteria below have been met</li> <li>• Completion jog/run program without pain/effusion / swelling</li> <li>• <u>Functional Assessment</u> <ul style="list-style-type: none"> <li>○ Quad/HS/glut index <math>\geq 95\%</math>; HHD mean or isokinetic testing @ 60d/s</li> <li>○ Hamstring/Quad ratio <math>\geq 66\%</math></li> <li>○ Hop Testing <math>\geq 95\%</math> compared to contra lateral side, demonstrating good landing mechanics</li> </ul> </li> <li>• <u>Possible Self-report Measures:</u> <ul style="list-style-type: none"> <li>○ Lysholm <math>&gt;90\%</math></li> <li>○ KOOS-sports questionnaire <math>&gt;90\%</math></li> <li>○ International Knee Committee Subjective Knee Evaluation <math>&gt;93</math></li> <li>○ Psych Readiness to Return to Sport (PRRS)</li> <li>○ Kujala <math>&gt; 90</math></li> </ul> </li> </ul>

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

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Continue strengthening and proprioceptive exercises</li> <li>• Symmetrical performance with sport specific drills</li> <li>• Safely progress to full sport</li> </ul>
<b>Additional Interventions</b> *Continue with Phase II-V interventions	<ul style="list-style-type: none"> <li>• Multi-plane sport specific plyometrics program</li> <li>• Multi-plane sport specific agility program</li> <li>• Include hard cutting and pivoting depending on the individuals' goals</li> <li>• Non-contact practice → Full practice → Full play (~6-7 months post-op)</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>• Last stage, no additional criteria</li> </ul>

Revised 3/2024

<b>Contact</b>	Please email <a href="mailto:MGHSportsPhysicalTherapy@partners.org">MGHSportsPhysicalTherapy@partners.org</a> with questions specific to this protocol
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References:

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2. Manske RC, Prohaska D. Rehabilitation following medial patellofemoral ligament reconstruction for patellar instability. *Int J Sports Phys Ther* 2017;12:494-511.
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6. Ahmad CS, Lightsey HM, Popkin CA, et al. Rehabilitation variability following medial patellofemoral ligament reconstruction. *Phys Sportsmed* 2018;46:441-448
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8. Matuszewski Ł, Tramś M, Ciszewski A, Wilczyński M, Tramś E, Jakubowski P, Matuszewska A, John K. Medial patellofemoral ligament reconstruction in children: A comparative randomized short-term study of fascia lata allograft and gracilis tendon autograft reconstruction. *Medicine (Baltimore)*. 2018;97(50):e13605

## 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	7
Week 1	W5/J1x5		W5/J1x5		W4/J2x5		W4/J2x5
Week 2		W3/J3x5		W3/J3x5		W2/J4x5	
Week 3	W2/J4x5		W1/J5x5		W1/J5x5		<b>Return to Run</b>

Key: W=walk, J=jog

*\*\*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*

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	20 min		20 min		20 min		25 min
2		25 min		25 min		30 min	
3	30 min		30 min		35 min		35 min
4		35 min		40 min		40 min	
5	40 min		45 min		45 min		45 min
6		50 min		50 min		50 min	
7	55 min		55 min		55 min		60 min
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

## 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

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Safely recondition the knee</li> <li>• Provide a logical sequence of progressive drills for pre-sports conditioning</li> </ul>
<b>Agility</b>	<ul style="list-style-type: none"> <li>• Forward run</li> <li>• Backward run</li> <li>• Forward lean in to a run</li> <li>• Forward run with 3-step deceleration</li> <li>• Figure 8 run</li> <li>• Circle run</li> <li>• Ladder</li> </ul>
<b>Plyometrics</b>	<ul style="list-style-type: none"> <li>• Shuttle press: Double leg→alternating leg→single leg jumps</li> <li>• Double leg:             <ul style="list-style-type: none"> <li>○ Jumps on to a box→ jump off of a box→ jumps on/off box</li> <li>○ Forward jumps, forward jump to broad jump</li> <li>○ Tuck jumps</li> <li>○ Backward/forward hops over line/cone</li> </ul> </li> <li>• Single leg (these exercises are challenging and should be considered for more advanced athletes):             <ul style="list-style-type: none"> <li>○ Progressive single leg jump tasks</li> <li>○ Bounding run</li> <li>○ Scissor jumps</li> <li>○ Backward/forward hops over line/cone</li> </ul> </li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>• No increase in pain or swelling</li> <li>• Pain-free during loading activities</li> <li>• Demonstrates proper movement patterns</li> </ul>

### PHASE II: LATERAL PROGRESSION

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Safely recondition the knee</li> <li>• Provide a logical sequence of progressive drills for the Level 1 sport athlete</li> </ul>
<b>Agility</b> <i>*Continue with Phase I interventions</i>	<ul style="list-style-type: none"> <li>• Side shuffle</li> <li>• Carioca</li> <li>• Crossover steps</li> <li>• Shuttle run</li> <li>• Zig-zag run</li> <li>• Ladder</li> </ul>
<b>Plyometrics</b> <i>*Continue with Phase I interventions</i>	<ul style="list-style-type: none"> <li>• Double leg:             <ul style="list-style-type: none"> <li>○ Lateral jumps over line/cone</li> <li>○ Lateral tuck jumps over cone</li> </ul> </li> <li>• Single leg (these exercises are challenging and should be considered for more advanced athletes):             <ul style="list-style-type: none"> <li>○ Lateral jumps over line/cone</li> <li>○ Lateral jumps with sport cord</li> </ul> </li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>• No increase in pain or swelling</li> <li>• Pain-free during loading activities</li> <li>• Demonstrates proper movement patterns</li> </ul>

### **PHASE III: MULTI-PLANAR PROGRESSION**

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"><li>• Challenge the Level 1 sport athlete in preparation for final clearance for return to sport</li></ul>
<b>Agility</b> <i>*Continue with Phase I-II interventions</i>	<ul style="list-style-type: none"><li>• Box drill</li><li>• Star drill</li><li>• Side shuffle with hurdles</li></ul>
<b>Plyometrics</b> <i>*Continue with Phase I-II interventions</i>	<ul style="list-style-type: none"><li>• Box jumps with quick change of direction</li><li>• 90 and 180 degree jumps</li></ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"><li>• Clearance from MD</li><li>• <u>Functional Assessment</u><ul style="list-style-type: none"><li>○ Quad/HS/glut index <math>\geq 90\%</math> contra lateral side (isokinetic testing if available)</li><li>○ Hamstring/Quad ratio <math>\geq 70\%</math></li><li>○ Hop Testing <math>\geq 90\%</math> contralateral side</li></ul></li><li>• Patient Outcome Measures:<ul style="list-style-type: none"><li>○ KOOS-sports questionnaire <math>&gt;90\%</math></li><li>○ International Knee Committee Subjective Knee Evaluation <math>&gt;93</math></li><li>○ ACL-RSI</li></ul></li></ul>