

# Pediatric Rehabilitation Protocol for Arthroscopic Meniscal Repair

This protocol is intended to guide clinicians through the post-operative course for meniscal repair. 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 of exercises. Therapeutic interventions should be included and modified based on the progress of the patient and under the discretion of the clinician.

## Considerations for the Post-operative Meniscal Repair

Many different factors influence the post-operative meniscal repair rehabilitation outcomes, including type and location of the meniscal tear and repair. Consider taking a more conservative approach to range of motion, weight bearing, and rehab progression with more complex tears or all-inside meniscal repairs. Additionally, this protocol does not apply to meniscus root repairs or meniscus transplants. It is recommended that clinicians collaborate closely with the referring physician regarding intra-operative findings and satisfaction with the strength of the repair.

## 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.

## Considerations for the Pediatric/Adolescent Patient:

***Children are not small adults! Children have different psychological and physiological needs than adults. These needs should be considered when designing any rehabilitation program. Rehabilitation timeframes may be protracted by these factors and often will require modification/adaptation to the individual patient.***

- **Biological Age:** Rates of growth and development are highly variable, making it important to consider that the patient in front of you may be very different than another patient of the same chronological age. Alterations in center of mass, muscle imbalances, and the relative tightening of the muscle–tendon units due to rapidly growing bones may cause difficulty with coordinated athletic movements or motor learning.
- **Training Age:** The length of time, if at all, a child has followed a structured and supervised resistance training or conditioning program. It is important to consider that some young athletes have never been trained in common functional or joint specific movements found in post operative rehabilitative programs. Extensive motor learning may need to take place prior to multi-joint or compound exercise progression.
- **Development of Strength:**

- Prepubescent children gain strength primarily through neural adaptation, as they lack the necessary hormones for muscle hypertrophy. Once children reach puberty, strength development becomes primarily hormonal which stimulates hypertrophic changes in muscle.
- Myelination of nerve fibers (motor neurons) is absent or incomplete in children, making fast reactions and skilled movements difficult to perform. Thus, high levels of strength and power will not be achieved as in an adult patient.
- **Epiphyseal Plates:** Prepubescent children’s epiphyseal plates have yet to close, so high impact activities such as depth jumps should be progressed with caution. Also, weight bearing, and plyometric activities should be varied to avoid repetitive stress to growth plates.
- **Psychological State:** For many pediatric patients, this may be their first serious injury or surgery. High levels of anxiety both pre and post operatively from patient and parent can affect pain, and thus limit weight bearing/ROM progressions, home exercise performance, and motivation. Different than adults, successful rehab will depend on collaboration with caregivers to assure proper carryover of home exercises. Positive factors found in recovery include being provided with detailed knowledge of the recovery process, developing trusting relationships with providers, having individualized goals, and including sport specific activities as much as possible.
- **Activities of Daily Living:** Pediatric ADL’s differ from that of adults. Often “play” is an integral part of their day, different than an adult patient. Pediatric patients may have gym classes and recess, or active play with friends may be an important part of their preinjury daily activity. Involvement of parents, coaches, and teachers may be necessary to assure that the patient understands activity restrictions in all settings with clear expectations, as children may have difficulty self-regulating their activity level and adhering to precautions.
- **Self-reported Outcome Measures:** It is strongly suggested to use pediatric-specific outcome measures. There is strong evidence supporting the use of pediatric International Knee Documentation Committee (Pedi-IKDC) as it shown to have good properties over the Knee Injury and Osteoarthritis Outcome Score (KOOS).

**PHASE I: IMMEDIATE POST-OP (0-3 WEEKS AFTER SURGERY)**

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>● Protect repair</li> <li>● Reduce swelling, minimize pain</li> <li>● Restore patellar mobility</li> <li>● Restore full extension</li> <li>● <b>Flexion &lt; 90 degrees</b></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 lying down. Do not rest with a towel placed under the knee</li> <li>● Do not actively bend your knee; support your surgical side when performing transfers (i.e. sitting to laying down)</li> <li>● Do not pivot on your surgical side</li> </ul> </li> </ul>
<b>Weight Bearing</b>	<p><i>Walking</i></p> <ul style="list-style-type: none"> <li>● <b>Brace locked, crutches</b></li> <li>● <b>Partial weight bearing</b></li> <li>● When going up the stairs, make sure you are leading with the non-surgical side, when going down the stairs, make sure you are leading with the crutches and surgical side</li> </ul>
<b>Interventions</b>	<p><i>Swelling Management</i></p> <ul style="list-style-type: none"> <li>● Ice, compression, elevation (check with MD re: cold therapy)</li> <li>● Retrograde massage</li> <li>● Ankle pumps</li> </ul> <p><i>Range of motion/Mobility</i></p> <ul style="list-style-type: none"> <li>● <a href="#">Patellar mobilizations</a>: superior/inferior and medial/lateral</li> </ul>

	<ul style="list-style-type: none"> <li>• <a href="#">Seated assisted knee flexion extension, heel slides with towel</a> <ul style="list-style-type: none"> <li>○ ***Avoid active knee flexion to prevent hamstring strain on the posteromedial joint</li> </ul> </li> <li>• Low intensity, long duration extension stretches: <a href="#">prone hang</a>, <a href="#">heel prop</a></li> <li>• <a href="#">Seated hamstring stretch</a></li> </ul> <p><i>Strengthening</i></p> <ul style="list-style-type: none"> <li>• <a href="#">Quad sets</a></li> <li>• NMES high intensity (2500 Hz, 75 bursts) supine knee extended 10 sec/50 sec, 10 contractions, 2x/week during sessions—use of clinical stimulator during session, consider home units distributed immediate post op</li> <li>• <a href="#">Straight leg raise</a> <ul style="list-style-type: none"> <li>○ **Do not perform straight leg raise if you have a knee extension lag</li> </ul> </li> <li>• <a href="#">Hip abduction: side lying or standing</a></li> <li>• Multi-angle isometrics 90 and 60 deg knee extension</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>• Knee extension ROM 0 deg</li> <li>• Knee flexion ROM 90 degrees</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 repair</li> <li>• Reduce pain, minimize swelling</li> <li>• Maintain full extension</li> <li>• <b>Flexion &lt; 90 degrees unless further direction from MD</b></li> </ul>
<b>Weight Bearing</b>	<p><i>Walking</i></p> <ul style="list-style-type: none"> <li>• <b>Brace locked, crutches</b></li> <li>• <b>Continue partial weight bearing unless directed otherwise by MD</b></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>• Gentle range of motion only (see Phase III for conditioning)</li> </ul> <p><i>Cardio</i></p> <ul style="list-style-type: none"> <li>• Upper body ergometer</li> </ul> <p><i>Strengthening</i></p> <ul style="list-style-type: none"> <li>• <a href="#">Calf raises</a></li> <li>• Lumbopelvic strengthening: <a href="#">Sidelying hip external rotation</a>, <a href="#">clamshell in neutral</a>, <a href="#">plank</a>, <a href="#">bridge with feet elevated</a></li> </ul> <p><i>Balance/proprioception</i></p> <ul style="list-style-type: none"> <li>• Double limb standing balance utilizing uneven surface (<a href="#">wobble board</a>)</li> <li>• <a href="#">Joint position re-training</a></li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>• No swelling (Modified Stroke Test)</li> <li>• Flexion ROM 120 degrees</li> <li>• Extension ROM equal to contra lateral side</li> </ul>

### **PHASE III: LATE POST-OP (6-9 WEEKS AFTER SURGERY)**

<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Continue to protect repair</li> <li>• Maintain full extension</li> <li>• Normalize gait</li> <li>• Flexion within 10 degrees of contra lateral side</li> <li>• Safely progress strengthening</li> <li>• Promote proper movement patterns</li> <li>• Avoid post exercise pain/swelling</li> </ul>
<b>Weight Bearing</b>	<ul style="list-style-type: none"> <li>• May discontinue use of brace/crutches after 6 weeks per MD and once adequate quad control is achieved and gait is normalized</li> </ul>

<p><b>Additional Interventions</b> *Continue with Phase I-II Interventions as indicated</p>	<p><i>Range of motion/Mobility</i></p> <ul style="list-style-type: none"> <li>• <a href="#">Supine active hamstring stretch</a></li> <li>• Gentle stretching all muscle groups: <a href="#">prone quad stretch</a>, <a href="#">standing quad stretch</a>, <a href="#">kneeling hip flexor stretch</a>, <a href="#">standing gastroc stretch</a>, <a href="#">soleus stretch</a></li> <li>• Rotational tibial mobilizations if limited ROM</li> </ul> <p><i>Cardio</i></p> <ul style="list-style-type: none"> <li>• Stationary bicycle, flutter kick swimming, pool jogging</li> </ul> <p><i>Strengthening</i></p> <ul style="list-style-type: none"> <li>• <a href="#">Partial squat exercise</a> 0-60 degrees</li> <li>• <a href="#">Ball squats</a>, <a href="#">wall slides</a>, <a href="#">mini squats</a> from 0-60 deg</li> <li>• Hamstring strengthening: <a href="#">prone hamstring curls</a>, <a href="#">standing hamstring curls</a></li> <li>• Lumbopelvic strengthening: <a href="#">bridges on physioball</a>, <a href="#">bridge on physioball with roll-in</a>, <a href="#">bridge on physioball alternating hip hike</a></li> <li>• Gym equipment: <a href="#">leg press machine</a>, standing <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> <li>• Progress intensity (strength) and duration (endurance) of exercises</li> </ul> <p><i>*If resistance machines are to be used, the patient must be sized appropriately to the machine. Adolescent patients may be too small for machines or not be able to independently decide on appropriate weight/progression. In this case, body weight exercises or smaller loads applied in the clinic under close supervision are encouraged. Parents may be included in the process to assure carryover for home program.</i></p> <p><i>Balance/proprioception</i></p> <ul style="list-style-type: none"> <li>• Single limb balance progress to uneven surface including perturbation training</li> </ul>
<p><b>Criteria to Progress</b></p>	<ul style="list-style-type: none"> <li>• No swelling/pain after exercise</li> <li>• Normal gait</li> <li>• ROM equal to contra lateral side</li> <li>• Joint position sense symmetrical (&lt;5 degree margin of error)</li> </ul>

**PHASE IV: TRANSITIONAL (9-12 WEEKS AFTER SURGERY)**

<p><b>Rehabilitation Goals</b></p>	<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> </ul>
<p><b>Additional Interventions</b> *Continue with Phase I-III interventions as indicated</p>	<p><i>Cardio</i></p> <ul style="list-style-type: none"> <li>• Elliptical, stair climber</li> </ul> <p><i>Strengthening</i></p> <ul style="list-style-type: none"> <li>○ <b>**The following exercises to focus on proper control with emphasis on good proximal stability</b></li> <li>• <a href="#">Squat to chair</a></li> <li>• <a href="#">Lateral lunges</a></li> <li>• Single leg progression: <a href="#">partial weight bearing single leg press</a>, <a href="#">slide board lunges</a>: <a href="#">retro and lateral step ups</a>, <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></li> <li>• <a href="#">Knee Exercises</a> for additional exercises and descriptions</li> <li>• Gym equipment: <a href="#">seated hamstring curl machine</a>, <a href="#">hamstring curl machine</a></li> <li>• <a href="#">Romanian deadlift</a></li> </ul>
<p><b>Criteria to Progress</b></p>	<ul style="list-style-type: none"> <li>• No episodes of instability</li> <li>• 10 repetitions single leg squat proper form through at least 60 deg knee flexion</li> <li>• <b>Functional Assessment</b> <ul style="list-style-type: none"> <li>○ Quadriceps index ≥80%; HHD mean preferred (isokinetic testing if available)</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ Hamstring, glut med, glut max index <math>\geq 80\%</math>; HHD mean preferred (isokinetic testing for HS if available)</li> <li>○ Improvement on Pedi International Knee Documentation Committee (Pedi-IKCD) questionnaire</li> </ul>
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### PHASE V: EARLY RETURN TO SPORT (3-5 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> </ul>
<b>Additional Interventions</b> <i>*Continue with Phase II-IV interventions as indicated</i>	<ul style="list-style-type: none"> <li>• Interval running program <ul style="list-style-type: none"> <li>○ <u>Return to Running Program</u></li> </ul> </li> <li>• Progress to plyometric and agility program (with functional brace if prescribed) <ul style="list-style-type: none"> <li>○ <u>Agility and Plyometric Program</u></li> </ul> </li> </ul> <p><i>*Please review special consideration for epiphysial plate in the intro for this protocol</i></p>
<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 of jog/run program without pain/swelling</li> <li>• <u>Functional Assessment</u> <ul style="list-style-type: none"> <li>○ Quad/HS/glut index <math>\geq 90\%</math>; HHD mean preferred (isokinetic testing if available)</li> <li>○ Hamstring/Quad ratio <math>\geq 70\%</math> with isokinetic testing if available)</li> <li>○ Hop Testing <math>\geq 90\%</math> compared to contra lateral side</li> <li>○ Improvement on Pedi International Knee Documentation Committee (Pedi-IKCD) questionnaire</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> <i>*Continue with Phase II-V interventions as indicated</i>	<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</li> </ul>
<b>Criteria to Discharge</b>	<ul style="list-style-type: none"> <li>• Quad/HS/glut index <math>\geq 90\%</math>; HHD mean preferred (isokinetic testing if available)</li> <li>• Hop Testing <math>\geq 90\%</math> compared to contra lateral side</li> </ul>

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<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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## 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>• KOOS-sports questionnaire <math>&gt;90\%</math></li><li>• International Knee Committee Subjective Knee Evaluation <math>&gt;93</math></li><li>• <u>Psych Readiness to Return to Sport (PRRS)</u></li></ul>

