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REHABILITATION PROTOCOL: Nonoperative Management for ACL Injuries

This protocol is intended to guide clinicians through the non-operative course for ACL injuries. This protocol is time based 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 physician’s preference, concomitant injuries, and/or complications. If a clinician requires assistance in the progression of a patient, they should consult with the referring provider.

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.

PHASE I: IMMEDIATE POST-INJURY (0-2 WEEKS)

Rehab Goals	<ul style="list-style-type: none"> ▪ Reduce swelling, minimize pain ▪ Restore full extension, gradually improve flexion ▪ Minimize arthrogenic muscle inhibition, re-establish quad control, regain full active extension ▪ Patient education <ul style="list-style-type: none"> ○ Keep your knee straight and elevated when sitting or lying down. Do not rest with a towel placed under the knee
Weight Bearing	<p>Walking</p> <ul style="list-style-type: none"> ▪ May start walking without crutches as long as there is no increased pain, effusion, and proper gait

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	<ul style="list-style-type: none"> ▪ When climbing stairs, lead with the non-injury side when going up the stairs, and lead with the crutches and surgical side when going down the stairs <p><i>Precautions</i></p> <ul style="list-style-type: none"> ▪ Activities that result in continued locking of the knee ▪ Activities that result in continued episodes of giving way ▪ Continued/worsening of pain and/or edema with progressed physical therapy
Interventions	<p>Swelling Management</p> <ul style="list-style-type: none"> ▪ Ice, compression, elevation (check with MD re: cold therapy) ▪ Retrograde massage ▪ Ankle pumps <p>Range of motion/Mobility</p> <ul style="list-style-type: none"> ▪ Patellar mobilizations: superior/inferior and medial/lateral ▪ Seated assisted knee flexion extension and heel slides with towel ▪ Low intensity, long duration extension stretches: prone hang, heel prop ▪ Standing gastroc stretch and soleus stretch ▪ Supine active hamstring stretch and supine passive hamstring stretch <p>Strengthening</p> <ul style="list-style-type: none"> ▪ 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 <ul style="list-style-type: none"> ○ **Do not perform straight leg raise if you have a knee extension lag ▪ Hip abduction ▪ Multi-angle isometrics 90 and 60 deg knee extension
Criteria to Progress	<ul style="list-style-type: none"> ▪ Full knee ROM ▪ Quad contraction with superior patella glide and full active extension ▪ Able to perform straight leg raise without lag ▪ Able to perform SL balance on affected limb > 30 sec ▪ Edema and pain well managed

PHASE II: INTERMEDIATE (2-6 WEEKS)

Rehab Goals	<ul style="list-style-type: none"> ▪ Maintain ROM and flexibility ▪ Restore muscle strength ▪ Increase proprioception and neuromuscular responses ▪ Restore normal gait with stair climbing ▪ Eliminate instability
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<p>Additional Interventions *Continue with Phase I interventions</p>	<p>Range of motion/Mobility</p> <ul style="list-style-type: none"> ▪ Stationary bicycle ▪ Gentle stretching all muscle groups: prone quad stretch, standing quad stretch, kneeling hip flexor stretch <p>Strengthening</p> <ul style="list-style-type: none"> ▪ Standing hamstring curls ▪ Step ups and step ups with march ▪ Partial squat exercise ▪ Ball squats, wall slides, mini squats from 0-60 deg ▪ Lumbopelvic strengthening: <ul style="list-style-type: none"> ○ bridge & unilateral bridge ○ sidelying hip external rotation clamshell ○ bridges on physioball ○ bridge on physioball with roll-in ○ bridge on physioball alternating ○ hip hike <p>Balance/proprioception</p> <ul style="list-style-type: none"> ▪ Single leg standing balance (knee slightly flexed) static progressed to dynamic and level progressed to unsteady surface ▪ Lateral step-overs ▪ Joint position re-training
<p>Criteria to Progress</p>	<ul style="list-style-type: none"> ▪ Tolerance of Phase II exercises without adverse events or swelling ▪ Sufficient strength to initiate agility activities as indicated by: <ul style="list-style-type: none"> ○ >80% 1RM Leg Press of uninvolved leg*** ▪ Sufficient proprioception to initiate agility activities as indicated by: Y Balance Test Composite Score >= 90% of unaffected side ▪ No signs of active inflammation ▪ No episodes of instability

PHASE III: LATE (6-8 WEEKS)

<p>Rehab Goals</p>	<ul style="list-style-type: none"> ▪ Progressive strengthening ▪ Maintain ROM and flexibility ▪ Restore neuromuscular responses with plyometrics and advanced proprioceptive exercises ▪ Return to running
<p>Additional Interventions *Continue with</p>	<ul style="list-style-type: none"> ▪ Continue to increase intensity of proprioceptive training from Phase II ▪ Exercises to add for progressive agility training: <ul style="list-style-type: none"> ▪ Lateral shuffle (distance changes to inc or dec COD)

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Phase I-II Interventions	<ul style="list-style-type: none"> ▪ Cariocas ▪ Cone drills (figure 8, forward/backward running, T-Test)
Criteria to Progress	<ul style="list-style-type: none"> ▪ Completion jog/run program without pain/effusion / swelling

PHASE IV: UNRESTRICTED RETURN TO SPORT (8-12+ WEEKS AFTER SURGERY)

Rehab Goals	<ul style="list-style-type: none"> ▪ Progressive strengthening ▪ Maintain ROM and flexibility ▪ Safe return to work and/or sport activities (with MD clearance if applicable) ▪ Quadriceps and hamstring strength to >90% of uninvolved leg per isokinetic strength test (if available) ▪ Single leg hop tests >90% of uninvolved leg ▪ Patient education regarding potential limitations and activity modifications ▪ Patient education regarding sports bracing if applicable ▪ Patient education regarding maintaining healthy BMI
Additional Interventions *Continue with Phase II-III interventions	<ul style="list-style-type: none"> ▪ Continue to progress strengthening exercises with increasing resistance assuming proper form and technique ▪ Advance Phase III plyometric training to single leg ▪ Advance agility training to sport-specific movements at competition speed ▪ Progress aerobic and metabolic conditioning appropriate for sport
Criteria to Progress	<ul style="list-style-type: none"> ▪ Clearance from MD and ALL milestone criteria below have been met ▪ Functional Assessment <ul style="list-style-type: none"> o Quad/HS/glut index $\geq 90\%$; HHD mean or isokinetic testing @ 60d/s o Hamstring/Quad ratio $\geq 66\%$ o Hop Testing $\geq 90\%$ 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	<ul style="list-style-type: none"> ▪ Safely recondition the knee ▪ Provide a logical sequence of progressive drills for pre-sports conditioning
Agility	<ul style="list-style-type: none"> ▪ Forward run ▪ Backward run ▪ Forward lean in to a run ▪ Forward run with 3-step deceleration ▪ Figure 8 run ▪ Circle run ▪ Ladder
Plyometrics	<ul style="list-style-type: none"> ▪ Shuttle press: Double leg alternating leg single leg jumps ▪ Double leg: <ul style="list-style-type: none"> ○ 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): <ul style="list-style-type: none"> ○ Progressive single leg jump tasks ○ Bounding run ○ Scissor jumps ○ Backward/forward hops over line/cone
Criteria to Progress	<ul style="list-style-type: none"> ▪ No increase in pain or swelling ▪ Pain-free during loading activities ▪ Demonstrates proper movement patterns

PHASE II: LATERAL PROGRESSION

Rehab Goals	<ul style="list-style-type: none"> ▪ Safely recondition the knee ▪ Provide a logical sequence of progressive drills for the Level 1 sport athlete
Agility	<ul style="list-style-type: none"> ▪ Side shuffle ▪ Carioca ▪ Crossover steps

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*Continue with Phase I interventions	<ul style="list-style-type: none"> ▪ Shuttle run ▪ Zig-zag run ▪ Ladder
Plyometrics *Continue with Phase I interventions	<ul style="list-style-type: none"> ▪ Double leg: <ul style="list-style-type: none"> ○ Lateral jumps over line/cone ○ Lateral tuck jumps over cone ▪ Single leg (these exercises are challenging and should be considered for more advanced athletes): <ul style="list-style-type: none"> ○ Lateral jumps over line/cone ○ Lateral jumps with sport cord
Criteria to Progress	<ul style="list-style-type: none"> ▪ No increase in pain or swelling ▪ Pain-free during loading activities ▪ Demonstrates proper movement patterns

PHASE III: MULTIPLANAR PROGRESSION

Rehab Goals	<ul style="list-style-type: none"> ▪ Challenge the Level 1 sport athlete in preparation for final clearance for return to sport
Agility *Continue with Phase I-II interventions	<ul style="list-style-type: none"> ▪ Box drill ▪ Star drill ▪ Side shuffle with hurdles
Plyometrics *Continue with Phase I-II interventions	<ul style="list-style-type: none"> ▪ Box jumps with quick change of direction ▪ 90 and 180 degree jumps
Criteria to Progress	<ul style="list-style-type: none"> ▪ Clearance from MD ▪ Functional Assessment <ul style="list-style-type: none"> ○ Quad/HS/glut index $\geq 90\%$ contra lateral side (isokinetic testing if available) ○ Hamstring/Quad ratio $\geq 70\%$ ○ Hop Testing $\geq 90\%$ contralateral side ▪ KOOS-sports questionnaire $>90\%$ ▪ International Knee Committee Subjective Knee Evaluation >93 ▪ Psych Readiness to Return to Sport (PRRS)