



# ***ACL and Posterior Cruciate Ligament Reconstruction***

## *Rehabilitation Guideline*

This rehabilitation program is designed to return the individual to their activities as quickly and safely as possible. It is designed for rehabilitation following the reconstruction of the anterior and posterior cruciate ligaments (ACL/PCL). Modifications to this guideline may be necessary dependent on physician specific instruction, graft types, concomitant injuries or procedures performed. This evidence-based anterior and posterior cruciate ligament reconstruction is criterion-based; time frames and visits in each phase will vary depending on many factors- including patient demographics, goals, and individual progress. This guideline is designed to progress the individual through rehabilitation to full sport/activity participation. The therapist may modify the program appropriately depending on the individual's goals for activity following ACL/PCL reconstruction.

This guideline is intended to provide the treating clinician a frame of reference for rehabilitation. It is not intended to substitute clinical judgment regarding the patient's post-operative care based on exam/treatment findings, individual progress, and/or the presence of concomitant procedures or post-operative complications. If the clinician should have questions regarding post-operative progression, they should contact the referring physician.

# General Guidelines/Precautions:

- Modified weight bearing for first 2-4 weeks depending on MD preference.
  - Progress to 25-50% WB from 4-6 weeks
  - Progress to 50-100% WB at 6-8 weeks
- Post-op bracing with posterior tibial support first 8 weeks; functional bracing per physician timeline
- PROM from 0-90 degrees for first 4 weeks
  - After 2 weeks, flexion ROM increases 15 degrees per week up until reaching 90 degrees by week 4
  - Performed passively in prone or seated position
  - Full flexion ROM is expected at 5 months (UP TO 125 BY WEEK 10)
- Avoid posterior tibial lag and hyperextension
- No hamstring activity/active knee flexion until week 14
- Precautions to certain exercises and timeframes listed for those:
  - Limited knee flexion 0-30 in CKC strengthening at 8 weeks
  - OKC knee extension limited from 90-30 at 12 weeks
  - OKC knee extension from 90-0 at 18 weeks
  - Low intensity agility and plyometrics initiated at 5 months
  - Straight light jogging at 5 months per return to running criteria
- Additional ligamentous, meniscal, vascular and nerve injuries may result in slower progression through protocol
- Blood Flow Restriction (BFR) training is very beneficial early in the recovery process in this population. Please see BFR guideline for further information.
- Level 1 testing around 5-6 months, Level 2 testing around 9-10 months

# ACL/PCL Rehabilitation Guideline (12-15 months)

PHASE	SUGGESTED INTERVENTIONS	GOALS/MILESTONES FOR PROGRESSION
<p><b>Phase I</b> Patient Education Phase</p>	<p><b>Discuss:</b> Anatomy, existing pathology, post-op rehab schedule, bracing, and expected progressions</p> <p><b>Pre-operative testing:</b> test contralateral isokinetics at 60/180/300o per sec, introduction to blood flow restriction training</p> <p><b>Instruct on Pre-op exercises:</b></p> <ul style="list-style-type: none"> <li>• Quad setting</li> <li>• Straight leg raises</li> <li>• Towel calf stretching</li> <li>• Blood flow restriction (BFR)</li> </ul>	<p><b>Goals of Phase:</b></p> <ol style="list-style-type: none"> <li>1. Regain near normal joint and gait mechanics</li> <li>2. Reduce fear or anxiety prior to surgery.</li> </ol> <p><b>Criteria to Advance to Next Phase:</b></p> <ol style="list-style-type: none"> <li>1. No pain or swelling</li> <li>2. Normal gait and motion</li> <li>3. Excellent quad activation</li> </ol>
<p><b>Phase II</b> Maximum Protection Phase  Weeks 0-6</p>	<p><b>Immediate Post-Operative Instructions:</b></p> <ul style="list-style-type: none"> <li>• Modified weight bearing first 6 weeks</li> <li>• Knee locked in post-operative bracing</li> <li>• No active knee flexion, no biking</li> <li>• No hyperextension</li> </ul> <p><b>Suggested Treatments:</b></p> <p><b>Modalities as indicated</b></p> <ul style="list-style-type: none"> <li>• Edema controlling treatments</li> <li>• NMES for quad activation</li> <li>• BFR with quadriceps and gluteal exercises</li> </ul> <p><b>ROM:</b></p> <ul style="list-style-type: none"> <li>• Passive within protected ROM (0-90°)</li> <li>• Flexion restricted to 45 degrees passively up to 4 weeks; 0-90 by 6 weeks</li> </ul> <p><b>Manual Therapy:</b> Patellar mobilizations, prone knee flexion</p> <p><b>Exercise Examples:</b></p> <ul style="list-style-type: none"> <li>• Quad sets (supine), SLR with NMES as needed, BFR</li> <li>• Passive prone knee flexion, seated knee flexion over the side of table with towel support behind back of knee</li> <li>• Towel calf stretch, static knee extension stretch (prone/supine)</li> <li>• Side-lying hip abduction, clamshell</li> </ul> <p><b>Other Activities:</b></p> <ul style="list-style-type: none"> <li>• Upper body CV training, gait training with crutches, strengthening contralateral leg or proprioceptive exercises</li> </ul>	<p><b>Goals of Phase:</b></p> <ol style="list-style-type: none"> <li>1. Provide environment of proper healing of repair site</li> <li>2. Prevention of post-operative complications</li> <li>3. Improve quad control</li> </ol> <p><b>Criteria to Advance to Next Phase:</b></p> <ol style="list-style-type: none"> <li>1. Control of post-operative pain (0-1/10 with ADL's in brace)</li> <li>2. Resolution of post-operative effusion (trace to 1+)</li> <li>3. Restoration of physiological extension (0°)</li> <li>4. PROM 0-90°</li> <li>5. Independent SLR without brace with no extension lag or posterior sag</li> </ol>

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# ACL/PCL Rehabilitation Guideline (12-15 months)

<p><b>Phase III</b> Protected Motion Phase Weeks 6-12</p>	<p><b>Specific Instructions:</b></p> <ul style="list-style-type: none"> <li>• Continue with previous exercise program</li> <li>• Continue bracing until 8 weeks</li> <li>• Progress weight bearing 25-50% weeks 6-8</li> <li>• Progress weight bearing up to 100% by 8-10 weeks</li> <li>• Strengthening through limited range at 8-10 weeks</li> </ul> <p><b>Suggested Treatments:</b></p> <p><b>Modalities Indicated:</b> Edema controlling treatments</p> <p><b>ROM:</b> Progressive ROM program with progression &gt;90 degrees beginning week 8</p> <p><b>Manual therapy:</b> continue with patellar mobilizations as indicated</p> <p><b>Exercise Examples:</b></p> <ul style="list-style-type: none"> <li>• Weight shifts to prepare for gait</li> <li>• Multi-angle quad isometrics</li> <li>• OKC Knee extensions 60-30 degrees</li> <li>• Step-ups (Forward, lateral)</li> <li>• Mini squats (0-30 degrees)</li> <li>• Standing TKE (band placed on femur)</li> <li>• Standing fire hydrant</li> </ul> <p><b>Other Activities:</b></p> <ul style="list-style-type: none"> <li>• Upper body CV training, strengthening contralateral leg or proprioceptive activities, BFR if available</li> </ul>	<p><b>Goals of Phase:</b></p> <ol style="list-style-type: none"> <li>1. Prevention of complications through gentle protected motion (symmetrical hyper-extension to approximately 90° flexion)</li> <li>2. Reduction of post-operative swelling and inflammation (no to trace effusion)</li> <li>3. Re-education and initiation of quad control with active SLR without extension lag</li> <li>4. Level ground ambulation without compensation by 9 weeks</li> </ol> <p><b>Criteria to Advance to Next Phase:</b></p> <ol style="list-style-type: none"> <li>1. Normalized gait by 12 weeks in unlocked bracing</li> <li>2. Achieve 0-125° of ROM</li> <li>3. Excellent quad control and symmetry with strengthening exercises</li> <li>4. Single-leg balance greater than 15 seconds</li> </ol>
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# ACL/PCL Rehabilitation Guideline (12-15 months)

<p><b>Phase IV</b>  <i>Motion and Muscle Activation Phase</i></p> <p>Weeks 12-18</p>	<p><b>Specific Instructions:</b></p> <ul style="list-style-type: none"> <li>• Continue previous hip and quad strengthening exercises</li> <li>• Initiate hamstring strengthening in high-coactivation exercises; no isolated hamstring strengthening</li> <li>• Initiate CKC strengthening at 0-30, progressing as tolerate to 0-70</li> </ul> <p><b>Suggested Treatments:</b></p> <p><b>Modalities:</b> As needed</p> <p><b>ROM:</b> Progression of ROM program – (Bike for ROM only)</p> <p><b>Exercise Examples:</b></p> <ul style="list-style-type: none"> <li>• Light resisted open chain knee extension (SAQ 90-30°)</li> <li>• Limited depth closed chain quad strengthening (0-70°) avoiding rotation and dynamic valgus stress at knee</li> </ul> <p><u>Which Includes:</u></p> <ul style="list-style-type: none"> <li>- Forward and lateral step ups</li> <li>- Squats → offset → Single-leg</li> <li>- Partial squats</li> <li>- Wall squats</li> <li>- Leg press</li> </ul> <ul style="list-style-type: none"> <li>• Plank progression for core strength and stabilization</li> <li>• DL hip bridge</li> </ul> <p><b>Week 14</b></p> <ul style="list-style-type: none"> <li>• Resisted hamstring strengthening             <ul style="list-style-type: none"> <li>- SL RDLs, weight with prone and/or standing hamstring curls, etc.</li> </ul> </li> </ul> <p><b>Other Activities:</b></p> <ul style="list-style-type: none"> <li>• Aquatic program (if available) - including pool walking, and closed chain strengthening/balance consistent with restrictions above- no running/jumping, swimming allowed, straight knee activity only</li> <li>• Static proprioception training (double to single leg) with perturbation on variable surfaces (rocker board, airex pads, air discs, etc.) &amp; emphasis on proper hip/ knee stability and hip strategy.</li> <li>• Light cardiovascular conditioning program which includes:             <ul style="list-style-type: none"> <li>- Stationary bike</li> <li>- Level ground walking</li> </ul> </li> </ul>	<p><b>Goals of Phase:</b></p> <ol style="list-style-type: none"> <li>1. Progression of ROM program to near full motion</li> <li>2. Improve muscular strength and endurance</li> <li>3. Normalized level ground ambulation</li> <li>4. Normalized single leg static balance with proper proximal control (no valgus and hip medial rotation)</li> </ol> <p><b>Criteria to Advance to Next Phase:</b></p> <ol style="list-style-type: none"> <li>1. Excellent mechanics with closed-chain activity</li> <li>2. Pain at 0-1/10 with ADL's and strength progression</li> </ol>
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# ACL/PCL Rehabilitation Guideline (12-15 months)

<p><b>Phase V</b> Advanced strengthening and eccentric control phase</p> <p>Weeks 18-24+</p>	<p><b>Specific Instructions:</b></p> <ul style="list-style-type: none"> <li>• Continue previous exercises; progress weight for progressive overload</li> <li>• Structure set and rep schemes for strength and hypertrophy</li> </ul> <p><b>Suggested Treatments:</b></p> <p><b>ROM:</b> Progression of closed and open chain quad strengthening (0-90°)</p> <p><b>Exercise Examples:</b></p> <ul style="list-style-type: none"> <li>• Forward and lateral step down</li> <li>• Squat progressions (rocker board, BOSU)</li> <li>• Lateral dips</li> <li>• Forward step downs</li> <li>• Lunge progression (all directions)</li> </ul> <p><b>Week 22</b> To prepare for Level 1 testing:</p> <ul style="list-style-type: none"> <li>• Initiate jumping progression</li> <li>• Initiate functional movement progression</li> </ul> <p><b>Week 25</b> - Level 1 Return-to-play testing (see Knee Return to Sport guideline)</p> <ul style="list-style-type: none"> <li>• Reorganize home program</li> <li>• Continued single leg strengthening as needed</li> <li>• More advanced strength and power lifts             <ul style="list-style-type: none"> <li>- 3-4 sets of 2-8 reps for strength (heavy weight, 2-3 min rest)</li> <li>- 3-4 sets of 8-15 reps for hypertrophy (moderate weight, 45-60 sec rest)</li> <li>- 3-4 sets of 1-5 reps for power (lighter weight, 5-10 min rest)</li> </ul> </li> </ul> <p><b>Exercise examples:</b></p> <ul style="list-style-type: none"> <li>• Continued progression of strength training             <ul style="list-style-type: none"> <li>- Deadlift, RDL, etc.</li> </ul> </li> <li>• Progress into power development (pulling derivatives)             <ul style="list-style-type: none"> <li>- Clean pull, snatch pull, high pull, jump shrug, etc.</li> </ul> </li> </ul> <p><b>Other Activities:</b></p> <ul style="list-style-type: none"> <li>• Aquatic program, resisted bike/elliptical intervals, return to sprinting progression</li> </ul>	<p><b>Goals of Phase:</b></p> <ol style="list-style-type: none"> <li>1. Restoration of full pain-free PROM/AROM (equal to contralateral knee) and full resolution of post-operative effusion</li> <li>2. Normal pain-free ADL's</li> <li>3. Improved quad strength (85% of contralateral limb)</li> <li>4. Normalized gluteal strength</li> </ol> <p><b>Criteria to Advance to Next Phase:</b></p> <ol style="list-style-type: none"> <li>1. Quad and HS deficit &lt; 30% at 60 degrees</li> <li>2. Back squat to 100% body weight with no compensatory movements</li> <li>3. Excellent mechanics with multiplanar movements</li> <li>4. Excellent mechanics with plyometric activity</li> </ol>
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<p><b>Phase VI</b>  <i>Advanced Movement and Impact Phase</i></p> <p>Months 6+</p>	<p><b>Specific Instructions:</b></p> <ul style="list-style-type: none"> <li>• Progression to running program (with appropriate bracing) with training to improve/normalize form and shock absorption (as cleared by physician) <ul style="list-style-type: none"> <li>- see Return to Run guideline</li> </ul> </li> <li>• Progression of open and closed chain strengthening for the entire LE chain with emphasis on single limb strengthening.</li> <li>• Progression to higher level activities and sports specific activities as strength and control dictate (as cleared by physician)</li> </ul> <p><b>Exercise Examples:</b></p> <ul style="list-style-type: none"> <li>• Initiating double limb jump training (around 5 months)</li> <li>• Initiate deceleration and single leg hopping (around 7-8 months)</li> <li>• Initiate cutting activities (around 7-8 months)</li> <li>• Initiate agility and sport specific activities (around 7-8 months)</li> </ul>	<p><b>Suggested Criteria for Discharge:</b></p> <ol style="list-style-type: none"> <li>1. &lt;10% strength deficit in quads and gluteals</li> <li>2. Limb similarity index of 90% or greater on functional tests</li> <li>3. No pain or complaints of instability with functional progression of sport specific skills</li> </ol>
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**\*\*NOTE:** Progression of functional activities should be performed only as pain and proper biomechanics allow. Emphasis should be on proper shock absorption and control of dynamic valgus stress at knee (hip medial rotation with knee valgus) with each task performed. Progression to single limb based tasks (deceleration, hopping, and cutting) should not be performed until double limb activities have been mastered. Activities requiring dynamic control of rotational stress at the knee (cutting, multiple plane lunges/jumps/hops) should not be performed until sagittal and frontal plane control has been mastered. Return to sport may occur at any time during this stage as cleared by physician and as progress and goal achievement occurs.

# Plyometric Progressions

## GUIDELINES

Must be able to perform full, free-weight squat 1.5-2.5 times body weight or squat 60% of body weight five times in five seconds.

Add to sessions 1-2x/week – 3 days between sessions.

Begin with 30-40 foot contacts per session and increase as able.

No more than 80-120 foot contacts per session.

## STEP 1

- Jumping TO box (decreased landing forces)
  - 2 legs to 2 legs
  - 2 legs to 1 leg
  - 1 leg to opposite leg
  - 1 leg to same leg

## STEP 2

- Jumping FROM box
  - Landing on 2

## STEP 3

- Squat jumps
- 1 leg jump → 2 leg land
- 2 leg jump → 1 leg land
- Split squat jumps → scissor jumps
- 1 leg jump → opposite leg land
- 1 leg jump → same leg land

## STEP 4

- Progress to various planes of movement as able.
- Double leg broad jumps, single leg lateral hops, skater lateral jumps, bounding, drop jumps to jumps over hurdles forward or lateral, etc.

# Movement Retraining Progressions

## GUIDELINES

- Single skill blocked practice
- Single skill variable practice
- Combination of multiple skills in blocked practice
- Combination of multiple skills in variable practice
- Combination of multiple skills with reactive cueing
- Use sport specific work:rest ratios
  
- Excellent lateral lunge at multiple speeds → lateral shuffle cone drills
  - Progressing to reactive drills
  
- Excellent forward and reverse lunge at multiple speeds → decelerations
  - 3 step walking deceleration cone drill
  - Jogging deceleration drills, increasing speed as able
  - Reactive deceleration drills
  
- Excellent lateral shuffle and deceleration at multiple speeds → cutting
  - Shallow cuts jogging (45 degrees)
  - Deceleration to lateral shuffle cone drills, increasing speed as able
  - Deceleration to 90 degrees cuts, increasing speed as able
  - Reactive cutting drills
  
- Excellent lateral shuffle, deceleration, cutting, and jumping
  - Reactive, variable, combined drills
    - Utilize strobe glasses, resistance cords, cones, sport specifics, varied surfaces, perturbations

## REFERENCES:

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