

ANDREW L. MERRITT, MD — PROLIANCE ORTHOPEDIC ASSOCIATES

YOUR PCL SPRAIN RECOVERY — A GUIDE TO PHYSICAL THERAPY

THE ROLE OF PHYSICAL THERAPY IN YOUR RECOVERY

The posterior cruciate ligament (PCL) is the strongest ligament in the knee and heals better than the ACL because it has a better blood supply. The majority of PCL injuries — even complete tears — respond very well to non-operative treatment with a structured rehab program. Your quads are the dynamic equivalent of the PCL: a strong quad group compensates for PCL insufficiency with every step. Quad rehabilitation is the cornerstone of this recovery.

Important: When lying down, always support the shin bone forward (pillow under the calf, not under the thigh). Gravity pulls the shin backward in unsupported supine — this is the same force that stresses a healing PCL.

YOUR RECOVERY TIMELINE

PHASE	TIMEFRAME	PT VISITS	WHAT YOU'RE WORKING ON
1	Weeks 1–4	2–3× per week	• Weight-bearing with PCL functional brace — worn during all walking • Shin bone always supported forward when lying or resting • Aggressive quad activation — quad sets every waking hour • No isolated hamstring exercises — hamstring pulls shin backward
2	Weeks 4–8	2× per week	• Progressive quad and hip strengthening — step-ups, leg press, bike • Gait training and brace weaning as quad strength returns • Careful hamstring introduction in closed-chain exercises only • Single-leg balance and proprioceptive training
3	Weeks 8–16	1× per week + home program	• Return to jogging and sport-specific activity • Hamstring strengthening now permitted in progressive doses • Limb symmetry testing before return to cutting and pivoting sport • Surgical consultation if pain or instability persists after completing this program

Questions about your PT progress? Call our office or bring them to your next appointment. We are always glad to coordinate with your therapist.

PCL SPRAIN — NON-OPERATIVE PHYSICAL THERAPY PROTOCOL

Patient Name: _____ **Surgeon:** Andrew L. Merritt, MD
Date of Surgery: _____ **PT Start Date:** _____

Overview & General Principles

The posterior cruciate ligament (PCL) is the strongest ligament in the knee and is well-vascularized, giving it substantially better intrinsic healing capacity than the ACL. The vast majority of isolated PCL injuries — including complete Grade III tears — respond well to non-operative management when treated with a structured, criterion-based rehabilitation program. This protocol is designed for isolated PCL injuries (Grades I–III) without associated ligament instability, bone injury requiring fixation, or failed conservative management. Grade I and II injuries typically complete this program in 6–10 weeks. Grade III injuries may require 10–16 weeks before return to high-demand activity. Surgical reconstruction is considered when pain or functional instability persists after completing a full non-operative program.

- **GRAVITY IS THE ENEMY — POSITION MATTERS:** In the supine position with the knee unsupported, gravity causes the tibia to sag posteriorly, stressing the injured PCL. The tibia must always be supported anteriorly (pillow under the proximal tibia, not under the distal femur). This applies during rest, sleep, and all supine exercises.
- **QUADRICEPS ARE THE PRIMARY STABILIZER:** The quadriceps muscle group is the dynamic equivalent of the PCL — quadriceps contraction anteriorly translates the tibia, reducing posterior sag and compensating for PCL insufficiency. Aggressive quad rehabilitation is the cornerstone of this protocol.
- **AVOID ISOLATED HAMSTRING CONTRACTION × 8–12 WEEKS:** Hamstring contraction is the primary driver of posterior tibial translation. Active isolated hamstring exercises (leg curls, supine knee flexion against resistance) are prohibited in the early phases. Closed-chain co-contraction exercises are introduced gradually.
- **PRONE POSITION PREFERRED FOR EARLY ROM:** Prone knee flexion does not rely on gravity to produce tibial sag and is the safest position for early range-of-motion work. Supine ROM exercises with the tibia unsupported should be avoided until Phase 2.
- **PCL FUNCTIONAL BRACE:** A brace applies an anterior-directed force to the proximal tibia, mechanically reducing posterior sag. This brace should be worn during all weight-bearing activity for the first 8–12 weeks, depending on grade and symptom response.
- **GRADE-DEPENDENT TIMELINE:** This protocol is made for more significant tears. If lower grade, progressed quickly through as long as you meet the progression milestones. Grade I (mild sprain): Return to activity in 2–4 weeks. Grade II (moderate partial tear): Return to activity in 6–10 weeks. Grade III (complete tear): Return to full sport in 12–16 weeks. All phase timelines represent minimums — progression is criterion-based, not purely time-driven.

PHASE 1 — Acute Protection (Weeks 0–4)

INFORMATION FOR THE PATIENT — What to Expect This Phase

In this phase, the goal is to control swelling, protect the healing PCL from posterior tibial stress, and get your quadriceps working again. You will be allowed to walk immediately — the PCL heals better with gentle, controlled loading than with complete rest. Your brace applies a forward force on your shin to prevent backward sag, and you should wear it any time you are on your feet.

Goals:

- Control effusion and pain
- Restore full passive knee extension equal to contralateral side
- Restore patellar mobility — prevent infrapatellar contracture
- Establish quadriceps activation — quad set with VMO contraction, SLR without extension lag
- Normalize weight-bearing gait with brace
- Initiate prone knee flexion ROM — target 90° by end of Phase 1

Weight-Bearing Status:

Grade I–II: Full weight bearing as tolerated (WBAT) with PCL functional brace from Day 1. Crutches for comfort only if pain limits normal gait. Grade III: Partial weight bearing (PWB) with bilateral crutches × 2 weeks, then progress to WBAT as effusion resolves and quad activation is established.

Range of Motion:

Prone knee flexion: unrestricted — encourage range as tolerated. Supine ROM: avoid unsupported supine knee flexion (tibial sag risk). If supine ROM is performed, therapist must support the proximal tibia anteriorly throughout. Target: 0–90° by end of Week 2 for Grade I–II; 0–75° by end of Week 2 for Grade III. Full passive extension must be maintained from Day 1 — any extension loss is treated as an emergency.

Bracing:

PCL functional brace (dynamic anterior tibial support, e.g., DonJoy Armor PCL, Bledsoe PCL) worn full-time during all weight-bearing activity. Brace is NOT locked in extension. Brace may be removed for sleeping and showering; when sleeping, position a pillow under the proximal tibia (NOT under the distal femur) to prevent posterior tibial sag.

Exercises:

- Cryotherapy and elevation — 20 minutes, 4–6x/day for first week
- Ankle pumps — 3 × 20 reps
- Quadriceps sets — 3 × 15 reps, hold 5 seconds each; emphasize VMO contraction
- Straight leg raise (SLR) — 3 × 15 reps; no advancement until SLR without extension lag
- Hip abduction and adduction — sidelying, 3 × 15 reps
- Patellar mobilizations — superior/inferior and medial/lateral, 2–3 minutes daily
- Prone knee flexion — active-assisted, 3 × 10 reps; encourage full range as tolerated
- Standing terminal knee extension (TKE) with band — 3 × 15 reps
- Seated calf raises — 3 × 20 reps
- Short-arc quads (0°–45°) — 3 × 15 reps
- Mini squats (0°–45°) — 3 × 15 reps with bilateral support
- Partial weight-bearing gait training with brace — normalize heel-toe pattern

Progression Milestones:

- Effusion ≤ trace at rest
- Full passive extension equal to contralateral side
- SLR without extension lag
- Prone knee flexion ≥ 90°
- Normal gait pattern with brace

PRECAUTIONS — Phase 1

- **POSITION TIBIA ANTERIORLY AT ALL TIMES:** Place a pillow or towel roll under the proximal tibia (not under the distal femur) when lying supine or sleeping. Tibial sag under gravity stresses the healing PCL and can prevent proper ligament healing.
- **NO ISOLATED HAMSTRING CONTRACTION:** Avoid all resisted hamstring exercises (leg curls, supine resisted knee flexion). Hamstring contraction is the primary mechanism of posterior tibial translation — the exact force that stresses the PCL.
- **NO UNSUPPORTED SUPINE KNEE FLEXION:** Do not perform ROM exercises with the tibia hanging free in supine — gravity will produce posterior tibial sag. All prone ROM is unrestricted; supine ROM requires therapist support under the proximal tibia.
- **NO HYPEREXTENSION:** Avoid any forced extension past 0°. Hyperextension stresses the posterior capsule and can cause additional injury.
- **WEAR BRACE FOR ALL WB ACTIVITY:** The brace applies anterior tibial force and must be worn during all weight-bearing activity in this phase.

Rationale: The PCL heals through a biologic process that requires controlled mechanical environment. Posterior tibial translation — whether from gravity, hamstring contraction, or unsupported supine positioning — disrupts the healing tissue and can prevent ligamentous consolidation. The quadriceps are the dynamic substitute for PCL function; their activation must be prioritized early and maintained throughout rehab.

PHASE 2 — Progressive Loading & Strengthening (Weeks 4-8)

INFORMATION FOR THE PATIENT — What to Expect This Phase

Now that swelling is controlled and your quad is working, the focus shifts to building strength and restoring full range of motion. You will progress from bilateral exercises to single-leg work and begin using a stationary bike. The brace is unlocked but still worn for any higher-demand activities. Hamstring isolation is still restricted — exercises that use both legs together (like leg press and squats) are fine because the quadriceps dominate the movement.

Goals:

- Full weight bearing without assistive device
- Full ROM in all planes — target full flexion equal to contralateral side by Week 6
- Quad strength $\geq$ 70% limb symmetry index (LSI) vs. contralateral
- Single-limb squat without valgus collapse or trunk deviation
- Normalize stair mechanics — step-over-step
- Stationary bike without pain or effusion

Weight-Bearing Status:

Full weight bearing without crutches. Brace worn during all high-demand activity and exercise. Crutches discontinued once normal gait pattern is established and there is no antalgic gait.

Range of Motion:

Full ROM is the target for Phase 2. Progressive prone and supine ROM exercises. By Week 6, patient should have flexion equal to contralateral side. Stationary bike initiated once 115° of flexion is achieved and full revolution is possible. Continue daily prone knee flexion exercises throughout phase.

Bracing:

PCL brace: Unlocked — worn during all exercise sessions. May be removed for low-demand ADLs (sitting, driving, sleeping) beginning Week 4. Grade I–II: Begin brace weaning by end of Phase 2 (Week 6–8). Grade III: Continue full-time brace with activity through Week 10.

Exercises:

- Stationary bike — begin when 115° of flexion achieved; low resistance, 20–30 min
- Mini squats progressing to full squat depth (0°–90°) — 3 × 15 reps bilateral
- Leg press (bilateral) — 0°–90° arc, 3 × 15 reps; quad-focused loading
- Step-ups — anterior and lateral, 4-inch → 6-inch → 8-inch step, 3 × 15 reps
- Step-downs — eccentric quad focus, 3 × 15 reps
- Standing hip strengthening — abduction, extension with band (terminal range only) 3 × 15
- Wall slides 0°–60° — 3 × 15 reps with isometric hold
- Single-leg balance — flat surface → foam → perturbation training, 3 × 30–60 sec
- Calf raises bilateral → single-limb — 3 × 20 reps
- Prone knee flexion stretching — full available range
- Continue patellar mobilization as needed
- Pool walking / aquatic therapy — if available, excellent low-load strengthening option
- Seated hamstring stretch (passive) — gentle, without resisted contraction

Progression Milestones:

- Full WB without assistive device, normal gait pattern
- Full knee flexion equal to contralateral side
- No effusion with ADLs and exercise
- Single-limb squat to 60° without compensatory movement
- Stationary bike without pain — 20+ minutes
- Quad LSI ≥ 70% by handheld dynamometer or isokinetic testing

PRECAUTIONS — Phase 2

- NO ISOLATED HAMSTRING EXERCISES through Week 8–10: Leg curls, Nordic curls, supine resisted knee flexion, and prone resisted knee flexion remain prohibited. Closed-chain co-contraction (leg press, squats) is permitted because the quadriceps dominate the loading pattern.
- NO LEG PRESS PAST 90°: Deep flexion on the leg press places peak posteriorly-directed tibial force. Limit leg press to 0°–90° arc throughout Phase 2.
- MONITOR EFFUSION: Any exercise that reproduces effusion should be reduced in intensity. Recurrent effusion = arthrogenous muscle inhibition and delayed recovery.
- AVOID RAPID DECELERATION AND PIVOTING: Sports-specific cutting, pivoting, and deceleration place high posterior shear forces on the tibia. These activities are not permitted until Phase 3.

Rationale: Biomechanical studies have demonstrated that PCL stress is greatest at knee flexion angles greater than 90° and during isolated hamstring contraction. The quadriceps act as the primary dynamic stabilizer in the PCL-deficient knee — closed-chain exercises that engage the quads are safe and therapeutic, while isolated hamstring loading remains contraindicated through 8–10 weeks.

PHASE 3 — Advanced Strengthening & Return to Activity (Weeks 8-16+)**INFORMATION FOR THE PATIENT — What to Expect This Phase**

This phase reintroduces hamstring exercises gradually, advances to single-leg strength work, and introduces jogging and agility training. Return to sport is determined by strength testing and how your knee responds to progressive loading — not by the calendar alone. The brace may be fully discontinued at this stage for Grade I–II. Grade III injuries may benefit from continued brace use during sport through 16 weeks.

Goals:

- Quad LSI $\geq$ 85% vs. contralateral side
- Hamstring LSI $\geq$ 80% vs. contralateral side
- Single-leg squat, single-leg press, and lunge without pain or compensatory movement
- Return to running — pain-free, no effusion
- Sport-specific agility and neuromuscular control
- Return to full activity — criteria-based

Weight-Bearing Status:

Full weight bearing without restriction. Brace may be discontinued per Grade: Grade I–II by Week 8–10; Grade III may continue PCL functional brace with sport through Week 16. Brace weaning based on symptom response and strength recovery.

Range of Motion:

Full, symmetrical ROM is expected at entry to Phase 3. Continue flexibility work for quadriceps, hamstrings, hip flexors, and calf. Any ROM deficits persisting into Phase 3 require manual therapy and dedicated stretching before progressing to higher-demand activities.

Bracing:

Grade I–II: Discontinue PCL brace. Athletic activity brace optional per patient preference. Grade III: Continue PCL functional brace during sport through Week 16, then wean.

Exercises:

- Romanian deadlift (RDL) — light load, emphasize hip hinge pattern; safe early hamstring loading, 3 × 12
- Hamstring curls — introduce seated or standing (not prone) at Week 10–12; low load, 3 × 15
- Nordic hamstring eccentric curls — defer until Week 12+ and only after isolated hamstring strength $\geq$ 70% LSI
- Single-leg leg press — 0°–90°, 3 × 15 reps
- Bulgarian split squat — 3 × 12 reps
- Single-leg squat — progressing depth to 70°–80°, 3 × 12 reps
- Lateral lunges and cross-over step-downs — 3 × 12 reps
- Bilateral plyometrics — squat jumps, box jumps, 2 × 10 reps
- Single-leg plyometrics — single-leg hop, forward hop, lateral hop, 3 × 8 per leg
- Running progression — straight-line jogging → running → acceleration (when quad LSI $\geq$ 85%)
- Lateral shuffle, carioca, 45° and 90° cutting — when running is pain-free
- Sport-specific agility — per sport demands
- Core strengthening — plank progressions, rotational work, hip-knee coordination drills

Progression Milestones:

- Quad LSI $\geq$ 85% (isokinetic or single-leg press testing)
- Hamstring LSI $\geq$ 80%
- No effusion or pain with running
- Single-leg hop LSI $\geq$ 90% — triple hop, timed 6-meter hop
- Pass Y-Balance test within 4 cm side-to-side difference
- Physician clearance for return to sport

PRECAUTIONS — Phase 3

- **DO NOT RUSH HAMSTRING REINTRODUCTION:** Introduce hamstrings in closed-chain (RDL, seated curl) before isolated prone/Nordic. Hamstrings must be reloaded progressively — abrupt return to full hamstring training after weeks of restriction risks muscle strain.
- **DO NOT RETURN TO SPORT BASED ON TIME ALONE:** Quadriceps strength LSI $\geq 85\%$ is a minimum hard threshold for running and sport return. Patients who feel well but have not achieved strength criteria have elevated re-injury and arthrosis risk.
- **MONITOR FOR ARTICULAR COMPARTMENT LOADING SYMPTOMS:** Medial compartment and patellofemoral pain are common long-term sequelae of chronic PCL laxity. If compartment symptoms emerge during this phase, modify loading and inform Dr. Merritt.
- **GRADE III INJURIES MAY REQUIRE SURGICAL DISCUSSION:** If the patient completes Phase 3 with persistent functional instability or fails to achieve strength criteria, refer back to Dr. Merritt for surgical consultation — PCL reconstruction outcomes are better than continued functional instability.

Rationale: PCL laxity does not always correlate with functional limitation — many patients return to high-level sport with objective laxity. However, long-term follow-up studies demonstrate a significantly elevated rate of medial compartment and patellofemoral arthrosis in chronically PCL-deficient knees. Strength recovery and neuromuscular control are the modifiable risk factors that most strongly predict good long-term outcomes.

Return to Activity Criteria

Criteria for Return:

- Quadriceps LSI $\geq 85\%$ on isokinetic testing or single-leg press
- Hamstring LSI $\geq 80\%$ on isokinetic testing
- Single-leg hop test battery LSI $\geq 90\%$ (single hop, triple hop, timed 6-meter hop)
- Y-Balance test: anterior reach asymmetry ≤ 4 cm side-to-side
- Full ROM equal to contralateral side
- No effusion at rest or with functional activity
- Pain-free running and direction changes
- Grade I–II: minimum 6–8 weeks from injury
- Grade III: minimum 12–16 weeks from injury with physician clearance

Surgeon Notes / Special Instructions: