

ACL INJURY: BEFORE SURGERY (PREHAB)

Presurgical Physical Therapy Protocol

PATIENT

PHYSICIAN

Andrew L. Merritt, MD

DATE OF REFERRAL

PT START DATE

For the patient

Physical therapy **before** ACL surgery makes a real difference. People who get the knee fully straight, wake up the quad muscle, and control the swelling before surgery do better, both 2 years and 10 years later. The goals come in order: **a fully straight knee first**, then a working quad, then strength. This usually takes **4 to 8 weeks** after your injury. **Surgery is not scheduled until your knee is ready.** Do not rush this phase. Until your surgery, **no pivoting, cutting, twisting, or sports.**

PROTOCOL AT A GLANCE

DIAGNOSIS · GOAL	Torn ACL, surgery planned. Straight knee, working quad, no swelling, then strength
ACTIVITY	Full weight as tolerated; crutches only if needed. Hinged brace only if the knee gives way
PHYSICAL THERAPY	2× a week , then as needed for the pre-op check
KEY PRECAUTIONS	No pivoting, cutting, twisting, or sports until after surgery. Stretch gently; never force the knee. If it swells after exercise, back off
PROGRESSION	Next phase when all its goals are met, not by the calendar. Full straightening comes first
SURGERY	When the knee straightens fully , swelling is minimal , and the quad works (no lag), usually 4 to 8 weeks after injury. Strength ≥80% is a goal, not a requirement

Recovery Timeline

Phase	When	PT visits	Focus
1	Weeks 0–2	2× a week	Control swelling; get the knee fully straight; wake up the quad (NMES at PT if needed)
2	Weeks 2–6	2× a week	Quad and hamstring strength; stationary bike; single-leg balance
3	Weeks 4–8	As needed	Pre-op check: straight knee, minimal swelling, quad working (no lag); cleared by Dr. Merritt

Questions about your pre-surgery program? Call our office or bring them to your next visit. We coordinate directly with your therapist to make sure you are ready.

For the Therapist

Check the surgeon notes first. They override anything else in this protocol. Questions or setbacks: call (425) 656-5060.

Surgeon notes and special instructions

General principles

- **Scope.** Rehabilitation of the ACL-deficient knee from injury until surgery. Structured prehabilitation before ACL reconstruction gives significantly better 2-year and 10-year outcomes than going directly to surgery (Delaware-Oslo ACL Cohort, Grindem et al.: 2-year KOOS superiority across all subscales, maintained at 10 years).
- **Priorities in order:** full extension, quad activation, effusion control, then strength. Surgery should not be scheduled until the minimum readiness criteria are met: full extension, minimal effusion, and good quad control (no extension lag). Quad and hamstring strength $\geq 80\%$ LSI is a goal, not a requirement for surgery. PT and Dr. Merritt communicate directly about the readiness timeline.
- **Extension first.** Full passive and active extension, matching the other side, is the single most important presurgical goal. Patients entering surgery with a flexion contracture are at significantly higher risk of post-operative stiffness and a second surgery.
- **Control effusion.** Effusion causes arthrogenic muscle inhibition (AMI): the quad cannot be fully activated when the knee is swollen, so effusion must be controlled before meaningful strength gains are possible.
- **Activation before strengthening.** The quad must fire voluntarily before it can be loaded. Do not advance to loaded exercises until a solid quad set is achievable.
- **Swelling and pain rules.** Do not force flexion if it increases effusion. If swelling returns with loading, reduce intensity and return to Phase 1 effusion management before continuing.
- **Protect the ACL-deficient knee.** It is at risk of further injury (meniscus tear, cartilage damage). No pivoting, cutting, twisting, or contact sports until after surgery.
- **Blood flow restriction (BFR)** is approved and valuable when pain or effusion limits heavier loading in Phase 1 and early Phase 2.
- **NMES** is provided at PT visits when volitional quad activation is poor. No home unit is needed.
- **Cold compression.** A compression cryotherapy unit used aggressively for effusion: 20 min on, 20 min off, several times a day, especially after exercise.
- **Psychological readiness matters.** Patients who complete prehab arrive at surgery with better body awareness, less fear, and familiarity with their post-op exercises, and this transfers directly to recovery.

PHASE

1

Acute Management

Weeks 0–2 after injury

For the patient: what to expect

Your most important job right now is getting your knee fully straight. A knee that won't straighten going into surgery is the leading cause of stiffness after surgery, and stiffness after ACL surgery can need a second procedure and gives a worse result. Ice and compress your knee often to control swelling: **20 minutes on, 20 minutes off.** Swelling stops your quad from firing normally, so the faster you control it, the sooner you can start building strength. **No pivoting, cutting, or sports until after your surgery.**

WEIGHT BEARING	As tolerated. Crutches if needed for pain or instability. Advance to full weight without a device as pain and swelling allow. The ACL-deficient knee is stable enough for walking, so keep crutch use to a minimum once comfortable
MOTION	Extension is the top priority: full passive extension equal to the other knee by the end of week 1. Heel props over a rolled towel, prone hangs 10–15 min 2–3× a day, gravity-assisted extension. Flexion by heel slides and active-assisted motion toward 90° without forcing. Patellar mobilization in all 4 directions from day 1 to prevent early adhesions
BRACE	Hinged ACL brace or knee immobilizer for walking only if giving-way episodes occur. It is for safety and comfort, not required if quad control is adequate and gait is stable. Off for exercise and motion work

Goals

- Full passive knee extension, equal to the other side
- Effusion reduced to trace or absent
- Volitional quad activation: quad set with a visible VMO contraction
- Straight-leg raise without an extension lag
- Flexion: work toward 90° or more without forcing
- Normal gait: walk without a limp before advancing

Move on when

- ☐ Full passive extension (0°), equal to the other knee
- ☐ Effusion trace or absent
- ☐ Quad set with a visible or palpable VMO contraction
- ☐ Straight-leg raise without an extension lag
- ☐ Walking without a significant limp

Exercises

Exercise	How
Quad sets	Isometric, against a rolled towel, every waking hour. The most important exercise of Phase 1
Straight-leg raise	Begin once a quad set is achievable. 3 × 15, without an extension lag
Heel props · prone hangs	Passive extension, 10–15 min sessions, 2–3× a day
Patellar mobilization	Superior, inferior, medial, and lateral; 2 min each direction, 2× a day
Heel slides	Supine, active-assisted flexion; stop at pain or resistance. 3 × 15
Hip strengthening	Straight-leg raise in 4 planes, clamshells, side-lying abduction, to maintain limb strength
Ankle pumps	20 reps every hour, to reduce swelling in the lower leg
BFR	Quad sets and straight-leg raise with the BFR cuff; valuable if significant quad inhibition prevents meaningful voluntary activation

NMES	At PT visits, if volitional quad activation is poor
Cold compression	20 min on, 20 min off, after all exercise and 2–3× a day at rest; elevate above heart level when possible

Precautions

- No pivoting, cutting, twisting, or lateral sports movements. The ACL-deficient knee lacks the primary restraint against anterior tibial translation and rotational load; a secondary injury (meniscus tear, cartilage damage) complicates surgery and recovery
- Do not force extension with aggressive stretching. Gentle, sustained, gravity-assisted extension is more effective and safer than forced mobilization
- Do not progress to strengthening until effusion is controlled. Swelling inhibits quad firing (AMI); loading a swollen knee produces poor strength gains and worsens the effusion
- No contact sports or return to competition before surgery

PHASE

2

Strengthening and Neuromuscular Training

Weeks 2–6, or until the readiness criteria are met

For the patient: what to expect

Your swelling is under control and your quad is firing. **Now it's time to build strength.** People who build quad and hamstring strength before ACL surgery recover faster and return to sport more often than those who go straight to surgery. You're not just waiting for surgery; you're making it work better. If your knee swells after exercise, back off and ice. Keep avoiding any movement that could re-injure the knee: **one more injury before surgery can add months to your recovery.**

WEIGHT BEARING	Full. Progress to single-leg activities when strength and control allow
MOTION	Full, symmetric motion is the target, equal to the other knee in extension and flexion. Stationary bike for motion and conditioning. If any extension deficit persists, continue prone hangs and heel props daily until it is fully resolved
BRACE	Functional ACL brace optional for higher-demand activities. Not needed during PT exercises

Goals

- Goal: quad strength $\geq 80\%$ LSI ($\geq 90\%$ if the timeline allows)
- Goal: hamstring strength $\geq 80\%$ LSI
- Full, pain-free motion equal to the other knee
- Single-leg balance and neuromuscular control restored
- Normal gait and functional movement patterns
- Psychological readiness for surgery and post-operative rehab

Move on when

- ☐ Required: full extension, minimal effusion, and no extension lag maintained under loading
- ☐ Goal: quad and hamstring strength $\geq 80\%$ LSI (testing recommended at weeks 4–5)
- ☐ Goal: full motion, equal to the other knee
- ☐ Goal: single-leg stance 60 sec without a significant balance deficit
- ☐ Goal: walking and stairs without pain or compensation
- ☐ Goal: patient understands what to expect from the post-operative protocol

Exercises

Exercise	How
Stationary bike	15–20 min, progressive resistance, for motion and conditioning
Leg press	Both legs, progressing to single-leg. 3 × 10–15
Mini squats (0–60°) · step-ups	Step-ups on a 4–6-inch step. Both legs, progressing to single-leg
Hamstring curls	Seated or prone, progressive resistance. 3 × 15
Romanian deadlifts	Eccentric hamstring loading. 3 × 10
Nordic hamstring curls	If tolerated; eccentric emphasis. Strongest evidence for hamstring strength
BFR	Leg press, squats, and hamstring curls with the BFR cuff when pain or apprehension limits heavy loading; a meaningful strength stimulus at low resistance
Single-leg balance	30–60 sec; progress to eyes closed and perturbation
Balance board · BOSU	Double-leg, then single-leg; proprioceptive retraining

Lateral band walks · hip strengthening	Glute and hip abductor emphasis
Calf raises	Both legs, progressing to single-leg. 3 × 20
Gait and movement quality	Correct any persistent limp, Trendelenburg, or compensatory pattern

Precautions

- No pivoting, cutting, or lateral agility sports. The ACL is still absent; a secondary meniscus or cartilage injury before surgery significantly worsens surgical complexity and the post-operative timeline
- No contact sports or return to team practice before surgery
- No plyometrics unless surgery is being delayed beyond 8–10 weeks and the strength criteria are met; plyometric loading of an ACL-deficient knee carries secondary injury risk. Discuss with Dr. Merritt if applicable
- Monitor effusion. If swelling returns with loading, reduce intensity and return to Phase 1 effusion management before continuing

Why: The Delaware-Oslo ACL Cohort shows superior 2-year KOOS outcomes across all subscales after structured prehabilitation, maintained at 10 years. Quad strength symmetry at the time of surgery independently predicts post-operative strength recovery and return-to-sport rate: every percentage point of quad LSI gained before surgery means a faster and more complete recovery after it.

PHASE

3

Surgery Readiness

Weeks 4–8, when the criteria are met

For the patient: what to expect

This is your **pre-op check**. Your therapist confirms that your knee straightens fully, like your other knee, that swelling is minimal, and that your quad works (no lag). Strength of 80% of the other leg is a goal, not a must. Dr. Merritt reviews the results before surgery is scheduled. Keep up your Phase 2 program and avoid pivoting and sports until surgery. **The stronger and straighter your knee is going in, the easier your recovery will be.**

PHYSICAL THERAPY	As needed for the readiness check. Continue the Phase 2 program until surgery
ACTIVITY	Full weight bearing. Phase 2 precautions continue until surgery
AFTER SURGERY	The ACL Reconstruction PT protocol starts 5–7 days after surgery, 2× a week

Surgery readiness criteria

Measure	Status	Target
Knee extension	Required	Full passive and active extension, equal to the other side
Effusion	Required	Minimal: trace to absent; no significant joint swelling at rest
Quad control	Required	Good quad control; straight-leg raise with no extension lag
Quad strength	Goal	≥80% LSI (≥90% if the timeline allows)
Hamstring strength	Goal	≥80% LSI
Knee flexion	Goal	Within 10° of the other knee (typically 125° or more)
Weight bearing · gait	Goal	Full, without a device; gait normalized
Single-leg stance	Goal	30 sec or more without significant instability
Psychological readiness	Goal	Understands the post-op protocol; realistic expectations
Clearance	Required	Dr. Merritt reviews the criteria before surgery is scheduled

Functional testing

- Motion: passive and active extension compared side to side; flexion measured on both sides
- Effusion: clinical exam (ballottement, stroke test); trace or absent required
- Quad strength: handheld dynamometry or functional assessment; straight-leg raise quality
- Single-leg stance: timed, eyes open, then eyes closed
- Gait: observe for a limp, Trendelenburg, or an antalgic pattern

Clinical note

Surgery should not be scheduled until full extension, minimal effusion, and quad control without a lag are met; strength ≥80% LSI is a goal, not a gate. Patients who go into surgery with a flexion contracture, even a mild one (5°), have substantially higher rates of stiffness needing manipulation under anesthesia or revision surgery. If a patient cannot meet the extension criteria within 4–6 weeks of injury, contact Dr. Merritt to discuss barriers and adjust the timeline. There is no evidence that delaying surgery by 2–4 weeks to reach prehab goals worsens outcomes; the evidence consistently shows the opposite.