

OPENING-WEDGE HIGH TIBIAL OSTEOTOMY

Physical Therapy Protocol

PATIENT

SURGEON

Andrew L. Merritt, MD

DATE OF SURGERY

PT START DATE

For the patient

Your shin bone (tibia) was realigned with an opening-wedge osteotomy. A precise cut at the top of the tibia is held open by a bone graft or implant and secured with a plate. There is no bone-to-bone contact yet, so the correction must be protected while it heals. **For 6 weeks, your foot only touches the floor for balance, and your crutches carry your weight.** After your 6-week X-ray shows early healing, you add weight step by step. **This is the most important rule of your recovery.** Your other early job is getting your quad muscle working and keeping your knee fully straight.

PROTOCOL AT A GLANCE

WEIGHT BEARING	Toe-touch only (about 10 to 15 pounds, for balance) until the 6-week X-ray. Then 25% at week 6, 50% at week 8, 75% at weeks 9–10, and full weight at weeks 10–12. Most people are off crutches by 10 to 12 weeks
BRACE	Hinged and unlocked from day 1 , for walking and sleep. Hinge 0–90° in week 1, 0–105° in week 2, then fully open. Stops after you are off crutches , around 10 to 12 weeks
MOTION GOALS	Full straightening (0°) at all times. Bending 90° by week 1, 105° by week 2, 115° by week 3, 125° by week 4
PHYSICAL THERAPY	Starts 5 to 7 days after surgery, 2 times a week at first
KEY PRECAUTIONS	No pillow under the knee. No hamstring curls for 6 weeks. No anti-inflammatory medicines for 6 weeks. No nicotine for 3 months
RUNNING · SPORT	Running at 6 months if the X-ray shows solid healing. Cutting and pivoting sports no sooner than 9 months , after testing

Recovery Timeline

Phase	When	PT visits	Focus
1	Weeks 0–6	2× a week	Toe-touch only, quad activation, full straightening, staged bending to 125°
2	Weeks 6–12	2× a week	After the X-ray: add weight step by step, wean crutches, early strength
3	Weeks 12–20	1–2× a week	Full weight, strength and balance, low-impact activity
4	Months 5–12+	As needed	Running from month 6, cutting sports from month 9

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

- **Toe-touch is non-negotiable for 6 weeks.** The opening wedge relies on bone graft or allograft to hold the correction. Full loading before bridging callus forms risks graft collapse, loss of correction, and hardware failure. This is the most critical rule of this protocol.
- **Criterion-based progression.** Weight bearing advances only after X-ray confirmation of early callus at week 6. Progression is milestone-driven, not calendar-driven.
- **Quad activation from day 1.** Arthrogenic muscle inhibition (AMI) is significant after proximal tibia surgery. Quad sets begin immediately. **NMES is provided at each PT visit, starting at the first visit;** no home unit. BFR is approved and encouraged for quad re-education in all phases.
- **Extension first.** Full active extension is the priority. Never allow a flexion contracture. Avoid sustained knee flexion positioning; no pillow under the knee.
- **Staged flexion.** 90° by week 1, 105° by week 2, 115° by week 3, 125° by week 4. The brace hinge is set 0–90° in week 1 and 0–105° in week 2, then fully open.
- **Brace.** Hinged and unlocked from day 1, worn for walking and sleep. When weight bearing starts at week 6, it stays unlocked if the SLR has no lag; otherwise lock it for walking until it does. It stops after the patient is off crutches.
- **Control effusion.** Effusion control is a prerequisite for quad activation and pain control. Ice or cold compression 20 min on, 20 min off, throughout Phase 1.
- **No anti-inflammatory medicines (NSAIDs) for 6 weeks, including topical gels such as Voltaren.** They can slow bone healing; Dr. Merritt decides at the 6-week visit. The 81 mg aspirin is part of the plan and continues.
- **No smoking or nicotine** for at least 3 months after surgery. Smoking significantly delays bone healing (27+ additional days to union, per meta-analysis). Reinforce cessation counseling.
- **Lateral hinge fracture awareness.** If a lateral hinge fracture is seen on post-operative imaging, contact Dr. Merritt before advancing weight bearing. Rehab progression depends on the fracture type.

PHASE

1

Bone Healing Protection

Weeks 0–6

For the patient: what to expect

For 6 weeks, your foot only touches the floor for balance, about 10 to 15 pounds. Your crutches carry your weight. The bone graft cannot take weight until it starts to heal. Squeeze your quad every hour, ice 20 minutes on and 20 minutes off, and keep your leg up and straight, with no pillow under the knee. Bend a little more each week. No anti-inflammatory medicines for 6 weeks.

WEIGHT BEARING	Toe-touch: foot on the floor for balance only, about 10–15 lb. Two crutches at all times when walking. No progression before the week 6 X-ray
BRACE	Hinged, unlocked for walking and sleep. Hinge 0–90° in week 1, 0–105° in week 2, then fully open. Off only for showering, PT exercises, and protected rest
MOTION	Full extension (0°) at all times. Flexion 90° by week 1, 105° by week 2, 115° by week 3, 125° by week 4

Goals

- Protect the osteotomy with toe-touch during graft incorporation
- Active quad contraction (quad sets, NMES)
- Full extension; flexion to 125° by week 4

Move on when

- ☐ Toe-touch kept, with safe crutch walking
- ☐ SLR without a significant lag
- ☐ Extension 0°; flexion at the week's goal
- ☐ Week 6 X-ray: early bridging callus (required)

Exercises

Exercise	How
Quad sets · ankle pumps	Quad sets, knee flat: 3 × 15 every 1–2 hours while awake. Ankle pumps: 3 × 20 every hour (DVT prevention)
NMES	Quadriceps, at each PT visit from the first visit; essential for AMI
Heel slides	Supine, gravity-assisted, within the week's flexion goal: 3 × 10
SLR · hip isometrics	SLR supine, abduction, adduction once a quad contraction is present: 3 × 10. Hip abductor, adductor, extensor isometrics: 3 × 10
Patellar mobilization	Superior-inferior and medial-lateral, once the incision is stable: 3 × 60 sec
Crutch gait training	2-point or 3-point toe-touch pattern, level surfaces and stairs
BFR	Quad sets and SLR (low load, high reps) once tolerated

Precautions

- Strict toe-touch until the week 6 X-ray: no standing weight shifts or standing loading exercises
- No pillow under the knee; a flexion contracture that develops now is very hard to correct
- Cold therapy (20 min on, 20 min off) is required: effusion inhibits the quad through the AMI reflex
- Lateral hinge fracture (Takeuchi type II or III): call Dr. Merritt before any exercise
- No isolated hamstring curls: hamstring contraction creates posterior tibial shear at the osteotomy

Why: With no bone-to-bone contact, the plate and graft carry the load until bridging callus forms (about week 6 for wedges ≤9 mm, later for larger ones). Premature loading risks subsidence and correction loss.

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2

Progressive Weight Bearing

Weeks 6–12

For the patient: what to expect

Once your 6-week X-ray shows early healing, you add weight step by step: about a quarter of your weight at week 6, half at week 8, three-quarters at weeks 9 to 10, and full weight at weeks 10 to 12. Keep icing after PT. Most people are off crutches by week 10 to 12, and the brace stops after that.

WEIGHT BEARING	Only after the X-ray confirms early callus: 25% at week 6 → 50% at week 8 → 75% at weeks 9–10 → full at weeks 10–12. Wean 2 crutches → 1 → none as quad control and gait allow
BRACE	For walking until off crutches. Unlocked if the SLR has no lag; otherwise locked for walking until it does. Stops after crutches, around weeks 10–12
MOTION	Progress to full: 0° extension, flexion ≥125°

Goals

- Step-by-step weight bearing after the X-ray
- Off crutches by weeks 10–12
- Full motion; normal gait; start stairs
- Quad strength with BFR and closed-chain work

Move on when

- ☐ Week 6 X-ray: bridging callus (required gate)
- ☐ 0° extension, flexion ≥125°
- ☐ Normal gait without a device; 6-inch step with control
- ☐ No quad lag; quad MMT ≥4/5; minimal swelling

Exercises

Exercise	How
Quad sets · SLR · BFR	Continue quad sets and NMES (at PT visits). SLR all planes with cuff weight. BFR mini squats and step-ups once weight bearing is ≥50%
Bike · patellar mobilization	Bike: short crank if flexion <90°, full crank once >110°, 15–20 min. Patellar glides: continue, add inferior glide
Mini squats · step-ups	Mini squats 0–45° with both arms supported; step-up and step-down on a 2–4-inch step
Gait training	Heel strike and full extension at loading response
Stretching · hip	Prone hang or seated heel prop daily; standing quad and supine hamstring stretch; standing hip abduction, extension, flexion with resistance

Precautions

- No weight progression before week 6 X-ray confirmation. Cold therapy after every PT session through week 8
- No isolated open-chain hamstring resistance (leg curls) until week 6; then progress gradually, closed-chain first
- Do not rush crutch weaning: compensatory gait stresses the osteotomy
- Watch for patella infera (best prevented by early, sustained motion and patellar work)

Why: Until cortical union the plate carries most of the load, so weight is added gradually and gated by X-ray.

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3

Strength and Function

Weeks 12–20

For the patient: what to expect

The bone is healing solidly. Now the work is getting your strength back. The quad on the surgery side takes a long time to recover, so consistency matters. Leg press, squats, step-ups, and balance work are the focus. Cycling, swimming, and the elliptical are cleared. Keep up your BFR exercises. No running yet.

WEIGHT BEARING

Full, no device, no restrictions. No brace

CONDITIONING

Bike (full crank), elliptical, and pool walking cleared at week 12

Goals

- Symmetric quad, hamstring, and hip strength
- Advanced closed-chain strength and function
- Balance and neuromuscular control
- Low-impact recreation (cycling, swimming, elliptical)

Move on when

- ☐ Strength $\geq 4+/5$; quad LSI approaching 80%
- ☐ Single-leg squat, 5 reps with good control
- ☐ Single-leg stance ≥ 45 sec, firm surface
- ☐ 30-min walk without more swelling or pain

Exercises

Exercise	How
Leg press	Both legs → single leg → eccentric emphasis
Step-up · step-down	Advance to a 6–8-inch step
Squats · lunges	Functional squats 0–90° (wall, ball, body weight). Lunges forward, reverse, lateral from weeks 14–16
Single-leg mini squat	0–45°, once quad strength is $\geq 4/5$
Hamstring · glutes	Prone curls, Nordic preparation, standing band curls; single-leg bridges, monster walks, lateral band walks
Balance	Single-leg stance: flat → foam → perturbation
Walking program	Retro then forward treadmill; start by week 12
BFR · core	Single-leg leg press and step-downs with BFR; dead bugs, bird dogs, side planks

Precautions

- No running until 6 months: impact before full cortical union risks hardware stress fracture and correction loss
- No pivoting, cutting, or jumping until Phase 4
- Quad LSI deficits $>20\%$ are common; build a strength base before high loads
- More swelling or pain after activity: reduce load; recheck X-rays if it persists

Why: Complete cortical union takes 16–24 weeks for larger opening wedges. Quad strength is about 80% at 6 months and may not be symmetric until 12 months. BFR builds similar hypertrophy to high-load training with much less joint stress.

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4

Return to Activity and Sport

Months 5–12+

For the patient: what to expect

This is the long game. Most people return to recreational sport at 6 to 9 months and higher-demand sports at 9 to 12 months. Running starts at 6 months with a walk-jog program, once the X-ray shows solid healing. Cutting and pivoting sports need full bone healing and passing strength and hop tests. The stronger your quad and hip, the better your result.

BRACE	None. Functional brace for sport at Dr. Merritt's discretion
RUNNING	Walk-jog program from month 6 if X-ray union is confirmed
CUTTING	Agility drills months 7–9; cutting and pivoting sport no sooner than 9 months

Goals

- Quad and hamstring strength $\geq 90\%$ LSI
- Return to running (minimum 6 months, surgeon clearance)
- Cutting and pivoting sport (minimum 9 months, surgeon clearance)
- Long-term strength maintenance

Move on when

- ☐ Quad and hamstring strength $\geq 90\%$ LSI; single-leg hop $\geq 90\%$ LSI
- ☐ Y-balance composite within normal limits
- ☐ Complete union on X-ray (surgeon-confirmed)
- ☐ Walk-jog 20 min without pain or swelling
- ☐ Sport drills at game speed without pain or instability

Exercises

Exercise	How
Strength	Advanced leg press, squats, lunges; single-leg deadlifts, Bulgarian split squats
Deceleration	Lateral bounds and controlled hops from months 5–6
Walk-jog program	From month 6 if X-ray union is confirmed
Agility · sport	Lateral shuffles, figure-8, cone drills at months 7–9; sport-specific training at month 9+
Plyometrics	Box steps → controlled hops → bounding, with surgeon clearance
Balance	Agility ladder, BOSU, perturbation
BFR	Maintenance 2× a week

Precautions

- Running before 6 months needs explicit surgeon approval and X-ray confirmation of solid union
- Pivoting or contact sport before 9 months requires X-ray clearance and $\geq 90\%$ LSI on hop and strength tests
- Quad deficits persisting beyond 9 months despite consistent rehab: reassessment by Dr. Merritt

Why: Return to sport after HTO is dual-gated: the bone must heal and the patient must show strength and hop symmetry. Most patients return to some sport after HTO, but fewer return to their pre-operative level. Returning before both gates are met is the main modifiable risk for failure and revision.

Return to Activity and Sport

Both gates, bone healing and function, must be met before clearance.

Measure	Target
Running	At least 6 months, with X-ray confirmation of solid union and surgeon clearance
Cutting · pivoting sport	At least 9 months, with X-ray clearance and functional testing
Quad and hamstring strength	≥90% LSI
Single-leg hop for distance	≥90% LSI
Y-balance composite	Within normal limits
Bone healing	Complete union on X-ray, confirmed by Dr. Merritt
Symptoms	No pain, swelling, or instability with sport drills at game speed
Clearance	Formal clearance from Dr. Merritt

Functional testing

- Strength: isokinetic or manual testing
- Single-leg hop for distance
- Y-balance test

Weight-bearing advancement and return-to-activity milestones require X-ray confirmation at weeks 6 and 12, and again before running clearance. If imaging does not confirm adequate healing at week 6, keep toe-touch and recheck at week 8. Do not advance weight bearing on the calendar alone.