

OSTEOCHONDRAL ALLOGRAFT WITH HIGH TIBIAL OSTEOTOMY

Physical Therapy Protocol

PATIENT

SURGEON

Andrew L. Merritt, MD

DATE OF SURGERY

PT START DATE

For the patient

You had two procedures at once: a donor plug of cartilage and bone on your thigh bone (OCA), and a high tibial osteotomy (HTO), a bone cut in your shin bone that realigns the leg and takes load off the repair. **Both need toe-touch only for 6 weeks.** After the 6-week X-ray shows the bone is healing, weight is added step by step. Running waits until about month 6, and sport until at least month 9. You move to each phase when your knee meets the goals.

PROTOCOL AT A GLANCE

WEIGHT BEARING	Toe-touch only until the 6-week X-ray (about 10 to 15 pounds). Then 25%, 50%, 75%, full by 10 to 12 weeks
BRACE	Hinged, unlocked from day 1, day and night. Worn until you are off crutches, about 10 to 12 weeks
MOTION GOALS	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 anti-inflammatory medicines for 6 weeks. No hamstring curls for 6 weeks
RUNNING · SPORT	Running around month 6 , once the bone has healed. Cutting sports no sooner than 9 months

Recovery Timeline

Phase	When	PT visits	Focus
1	Weeks 0–6	2× a week	Toe-touch, quad activation, staged bending
2	Weeks 6–12	2× a week	Graded weight after the X-ray, off crutches
3	Weeks 13–20	1–2× a week + home program	Strength, step-downs, balance
4	Months 5–12	As needed	Running from month 6, plyometrics, sport at 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

- **Dual healing.** OCA osseous integration at the graft-host interface and callus across the osteotomy proceed together. The osteotomy drives the return-to-sport timeline; the OCA needs no extra delay.
- **Toe-touch × 6 weeks** (about 10–15 lb, for balance). Toe-touch for 6 weeks protects the cartilage, whichever way the bone was cut.
- **6-week X-ray gate.** Weight is added only after the X-ray shows early bridging callus. Then 25% at week 6, 50% at week 8, 75% at weeks 9–10, full at weeks 10–12. No callus: stay toe-touch and recheck at week 8.
- **Brace:** hinged, unlocked from day 1, day and night. Hinge 0–90° in week 1, 0–105° in week 2, then fully open. When weight starts, it stays unlocked if the SLR has no lag; otherwise lock it for walking until it does. Stop after off crutches (weeks 10–12).
- **Bending, no CPM.** Active and active-assisted ROM: 90° week 1, 105° week 2, 115° week 3, 125° week 4.
- **No standing weight shifts during toe-touch.** Weight shifts and bilateral stance start after the 6-week X-ray.
- **No NSAIDs for 6 weeks, including topical** (e.g., diclofenac gel). They can slow bone and cartilage healing.
- **NMES is essential** (quad inhibition after proximal tibia surgery is significant): at PT visits from the first visit; no home unit. **Ice:** 20 min on, 20 min off.
- **BFR** is approved throughout rehabilitation.

Procedures done at the same time

Meniscal repair

- The meniscal repair's weight-bearing limits apply if more conservative; follow the surgeon's milestones.

PHASE

1

Protection

Weeks 0–6

For the patient: what to expect

Toe-touch only (about 10 to 15 pounds, for balance). Your brace stays unlocked, day and night. Bend a little more each week: 90° by week 1 up to 125° by week 4. No standing exercises and no hamstring curls yet.

WEIGHT BEARING	Toe-touch (about 10–15 lb, for balance) until the 6-week X-ray
BRACE	Hinged, unlocked, day and night. Hinge 0–90° week 1, 0–105° week 2, then fully open
MOTION	90° week 1, 105° week 2, 115° week 3, 125° week 4; no CPM

Goals

- Toe-touch × 6 weeks
- Bending on the staged schedule
- SLR without extensor lag by weeks 2–3
- Swelling controlled; early callus at week 6

Move on when

- ☐ Toe-touch maintained × 6 weeks
- ☐ Bending on schedule (125° by week 4)
- ☐ SLR without extensor lag
- ☐ Early callus on the 6-week X-ray

Exercises

Exercise	How
NMES	Quadriceps, 20–30 min at PT visits from the first visit
Quad sets · ankle pumps	Quad sets 3 × 15 every waking hour (VMO priority); ankle pumps hourly
SLR · heel slides	SLR hip flexion, then 4 planes, 3 × 10. Heel slides 3 × 15 to the week's goal
Hip · calf · BFR	Hip abductors, adductors, gastrocnemius 3 × 15. BFR quad sets and SLR when tolerated
Recumbent bike	Once flexion ≥100°; low resistance, 10–15 min
Pool deep-water walking	Weeks 4–5, incisions healed, surgeon approval; forward, backward, sideways
Conditioning · ice	Other-leg cardio and upper body. Ice and elevate after each session

Precautions

- No standing weight shifts, squats, lunges, or resisted open-chain extension
- No isolated hamstring curls (posterior tibial shear at the osteotomy). No pillow under the knee
- Lateral hinge fracture on imaging: contact Dr. Merritt before starting or advancing exercise

Why: No compressive stability until callus forms; early loading risks subsidence and loss of correction.

PHASE

2

Return to Loading

Weeks 6–12

For the patient: what to expect

Once the 6-week X-ray shows the bone is healing **and** your quad can control your leg, weight is added in steps: about a quarter of your weight at 6 weeks, half at 8 weeks, three-quarters at 9 to 10 weeks, and full weight by 10 to 12 weeks. Keep the brace until you are off crutches. Ice after every session.

WEIGHT BEARING	After the X-ray and with quad control: 25% week 6, 50% week 8, 75% weeks 9–10, full weeks 10–12. No callus: stay toe-touch, recheck at week 8
BRACE	Unlocked if the SLR has no lag; otherwise locked for walking until it does. Stop once off crutches (weeks 10–12)
MOTION	Full, unrestricted

Goals

- Graded weight bearing; off crutches by weeks 10–12
- Normal gait on level ground and stairs
- Quad strength 50–60% of the other leg
- Resisted open-chain extension; cycling and closed-chain work without pain

Move on when

- ☐ Off crutches, near-normal gait
- ☐ Squat 0–90° × 15 without pain
- ☐ 20 min bike without reactive swelling
- ☐ Quad strength ≥55% of the other leg

Exercises

Exercise	How
Weight shifts	Bilateral stance, no resistance, after the X-ray
Open-chain extension	5 lb at week 7, +2–3 lb a week as tolerated; 3 × 15
Bike · elliptical	Bike to 20–30 min, more resistance. Elliptical once off crutches
Mini squats	0–60°, 3 × 15; 0–90° by week 12, watching for effusion
Leg press	Both legs, 0–90°, 3 × 12; add resistance; single leg by week 12
Step-ups · stairs	4–6-inch, 3 × 10. Stairs, reciprocal pattern, weeks 10–12
Calf raises · hip	Calf raises both legs → single, 3 × 15. Hip, 4 directions, 3 × 12
Hamstring curls	Resisted from week 8; closed-chain emphasis first
Balance · BFR	Single leg, firm 3 × 30 sec, then foam. BFR mini squats and step-ups once weight ≥50%
Aquatherapy	Shallow-water walking, heel raises, gentle squats

Precautions

- No weight progression before the X-ray shows callus; not on the calendar alone
- Do not rush off crutches with poor quad control; it stresses the osteotomy
- Watch for patella infera: keep up patellar mobilization and ROM
- No running, jumping, or impact. Check effusion and ice after every session

PHASE

3

Return to Function

Weeks 13–20

For the patient: what to expect

The bone is healing solidly. This phase rebuilds strength with leg press, squats, step work, and balance. Cycling, swimming, and the elliptical continue. **No running or jumping yet:** they wait until the X-ray shows the bone has fully healed, around month 6. Keep up your BFR exercises.

WEIGHT BEARING	Full, no assistive device
MOTION	Full, unrestricted
IMPACT	No running or plyometrics until month 6 and X-ray union

Goals

- Quad strength $\geq 80\%$ of the other leg
- 8-inch step-down, symmetric and pain-free
- Strength, flexibility, endurance, neuromuscular control
- Low-impact activity: cycling, swimming, elliptical

Move on when

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

Exercises

Exercise	How
Phase 2 program	Continue with progressive resistance and duration
Leg press	Both legs $\rightarrow$ single leg $\rightarrow$ eccentric
Squats	Functional squats 0–90°; progressive depth and load
Step-ups · step-downs	Step-ups to a 6–8-inch step. Step-down program 4 $\rightarrow$ 6 $\rightarrow$ 8-inch; eccentric quad control
Lunges	Forward, reverse, lateral from weeks 14–16
Single-leg mini squat	0–45°, once quad strength $\geq 4/5$
Hamstrings · glutes	Prone curls, Nordic prep, band curls. Single-leg bridges, monster and band walks
Balance · core	Single-leg stance: flat, foam, perturbation. Dead bugs, bird dogs, side planks
Conditioning · BFR	Bike, elliptical, pool with progressive resistance. BFR single-leg press and step-down

Precautions

- No running or plyometrics before month 6: X-ray union must be confirmed before impact
- No pivoting, cutting, or jumping sports until Phase 4 and surgeon clearance
- Quad deficits $>20\%$ are common now; build the base before high-intensity work
- Swelling or pain after activity, or PF pain with squats or leg press: reduce load; recheck X-rays if it persists

PHASE

4

Return to Impact Activities

Months 5–12

For the patient: what to expect

Running starts around month 6 with a walk-jog program, once the X-ray shows solid bone healing. Jumping drills follow running. Cutting and pivoting sports need full bone healing and passing strength and hop tests, **not before 9 months**. The stronger your quad and hip, the better your result.

RUNNING	Walk-jog from month 6 with X-ray union and surgeon clearance
PLYOMETRICS	After running is established (month 6+), with surgeon clearance
CUTTING · PIVOTING	Drills from month 7; sport not before month 9, with union and testing

Goals

- Isokinetic quad $\geq 90\%$ and hamstring $\geq 100\%$ of the other leg
- Single-leg hop $\geq 90\%$ LSI
- Running from month 6 (union + clearance)
- Cutting and pivoting sport from month 9

Move on when

- ☐ Quad and hamstring $\geq 90\%$ LSI; 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; drills at game speed
- ☐ Knee scores done (IKDC, KOOS, Lysholm, Tegner)
- ☐ Surgeon clearance for sport after month 9

Exercises

Exercise	How
Strength	Leg press, squats, lunges, single-leg deadlifts, Bulgarian split squats
Walk-jog program	From month 6 if union is confirmed; build to continuous running
Plyometrics	After running starts: box steps → controlled hops → bounding; lateral bounds and deceleration
Cutting · agility	Cutting, agility drills, lateral shuffles from month 7
Sport-specific	Month 9+, with surgeon clearance
Hop testing	Single, triple, crossover, timed 6-meter
Maintenance	Agility ladder, BOSU, perturbation; BFR 2× a week

Precautions

- Running before month 6 needs explicit surgeon approval and X-ray union
- No pivoting or contact sport before month 9, and then only with union and $\geq 90\%$ LSI
- Quad deficits beyond month 9 despite rehab: reassessment by Dr. Merritt
- Knee pain or effusion with running needs imaging before progressing

Return to Activity

All criteria must be met, and Dr. Merritt must clear the patient, before cutting, jumping, or pivoting sports.

Measure	Target
Isokinetic quadriceps	≥90% LSI
Isokinetic hamstrings	≥100% LSI
Single-leg hop testing	≥90% LSI (single, triple, crossover, timed)
ROM · effusion	Full, pain-free, equal to the other knee; no effusion after activity
Functional knee scores	IKDC, KOOS, Lysholm, Tegner completed
Bone union	Cortical union on X-ray, confirmed by Dr. Merritt before running
Hardware	Removal discussed per surgeon at the appropriate interval
Earliest running	Month 6 (union + 8-inch step-down)
Earliest cutting · pivoting	Month 9 (union + ≥90% LSI on strength and hop testing)

Clinical Timeline Summary

TOE-TOUCH	Weeks 0–6; X-ray at week 6 is the gate
WEIGHT STEPS	25% week 6, 50% week 8, 75% weeks 9–10, full weeks 10–12
BRACE · CRUTCHES	Unlocked from day 1; off crutches and brace at weeks 10–12
NO NSAIDS	Weeks 0–6, including topical
OPEN-CHAIN	Quad from week 7 (5 lb, +2–3 lb a week); hamstring from week 8
CARDIO	Bike once flexion ≥100°; elliptical once off crutches
UNION · RUNNING	Union usually months 4–6; running month 6; plyometrics after running
CUTTING · SPORT	Drills from month 7; sport month 9+, criteria-based

Progression is dual-gated: bone union on X-ray and functional readiness (strength, hop symmetry, surgeon clearance).