

OSTEOCHONDRAL ALLOGRAFT OF THE KNEECAP WITH TIBIAL TUBERCLE OSTEOTOMY

Physical Therapy Protocol

PATIENT

SURGEON

Andrew L. Merritt, MD

DATE OF SURGERY

PT START DATE

For the patient

You had two procedures: a donor plug of cartilage and bone on your kneecap or the groove it runs in (OCA), and a tibial tubercle osteotomy (TTO), a bone cut that moves the kneecap's attachment to take load off the graft. **The bone cut sets the weight rules: toe-touch only for 6 weeks.** The graft sets the bending steps and the brace locked straight at night. Running starts at about 14 to 16 weeks; cutting sports at 6 to 9 months. You move to each phase when your knee meets the goals.

PROTOCOL AT A GLANCE

WEIGHT BEARING	Toe-touch only for 6 weeks (about 10 to 15 pounds). Weight added after the 6-week X-ray; off crutches 8 to 10 weeks
BRACE	Locked straight for walking and sleep through week 6. Opened over weeks 7–8; stops after you are off crutches
MOTION GOALS	Bending 45° by day 5, 60° by week 1, 75° by week 3, then up to 90° until the 6-week X-ray
PHYSICAL THERAPY	Starts 5 to 7 days after surgery, 2 times a week at first
KEY PRECAUTIONS	No anti-inflammatory medicines for 6 weeks. Bike after week 3, rocking only within your bending limit
RUNNING · SPORT	Running at 14 to 16 weeks , after a step-down test. Sport at 6 months; 9 months for cutting sports

Recovery Timeline

Phase	When	PT visits	Focus
1	Weeks 0–6	2× a week	Toe-touch, staged bending to 90°, quad and VMO
2	Weeks 7–12	2× a week	Weight after the X-ray, off crutches, then brace
3	Weeks 13–20	1–2× a week + home program	Single-leg strength, jogging, early plyometrics
4	Months 5–12	As needed	Cutting and sport drills, testing, return to sport

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 integration and tubercle callus proceed together; the TTO sets weight bearing and early loading. Bone-to-bone healing fits a 6-month return, like TTO (MACI 12–18 months).
- **Toe-touch × 6 weeks (TTO)**, about 10–15 lb, for balance; replaces the weight-as-tolerated rule of OCA kneecap alone.
- **Bending, no CPM, non-weight-bearing:** 45° day 5, 60° week 1, 75° week 3, then up to 90° until the 6-week X-ray; full by weeks 10–12.
- **Brace:** locked at 0° for walking and sleep through week 6; opened over weeks 7–8; stopped after crutch-free unlocked walking (8–10 weeks).
- **Bike:** from week 3, rocking within the bending limit; full revolutions once the cap lifts after the X-ray.
- **VMO emphasis, no valgus.** VMO is the main dynamic patellar stabilizer; hip abductor and ER work in every phase; cue neutral alignment.
- **No NSAIDs for 6 weeks, including topical.** They can slow bone and cartilage healing.
- **NMES** at PT visits from the first visit (VMO biofeedback as needed); no home unit. **Cold compression:** 20 min on, 20 min off.

Why this differs from TTO alone

TTO alone allows 90° from the start, with the brace off for sleep. Here the graft keeps the staged steps and the brace locked at night, to limit kneecap pressure on it. The bone cut still sets the 90° cap and the bike rules.

Procedures done at the same time

MPFL reconstruction · lateral retinacular lengthening

- No change to this protocol. Gentle medial glides per surgeon; avoid compressing the graft.

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1

Protection

Weeks 0–6

For the patient: what to expect

Toe-touch only (about 10 to 15 pounds, for balance). Brace locked straight for walking and sleep. Bend in steps: 45° by day 5, 60° by week 1, 75° by week 3, then up to 90° until your X-ray. Bike after week 3, rocking only.

WEIGHT BEARING	Toe-touch, 2 crutches (about 10–15 lb, for balance); no more without surgeon direction
BRACE	Locked at 0° for walking and sleep; unlocked only for ROM and hygiene
MOTION	Non-weight-bearing only: 45° day 5, 60° week 1, 75° week 3, then ≤90° to the X-ray

Goals

- Protect the tubercle and graft: toe-touch × 6 weeks
- 20 SLR in a row without lag by weeks 4–6
- VMO activation; bending on the staged steps
- Patellar mobilization; pain and effusion controlled

Move on when

- ☐ Toe-touch maintained × 6 weeks
- ☐ 20 SLR in a row without lag
- ☐ Active ROM 0–90° (supine)
- ☐ VMO palpable; effusion trace; bike rocking pain-free

Exercises

Exercise	How
NMES	20–30 min at PT visits from the first visit; VMO biofeedback as needed
Quad sets · glute sets	Quad sets 3 × 15, 5-sec hold, 3–4× a day from day 1. Glute sets 3 × 15
BFR	Low-load quad sets with the cuff from weeks 1–2; 30-15-15-15
SLR · heel slides	SLR 3 × 15 once a quad set is present. Heel slides 3 × 15 within the limit
Short-arc quads	Towel roll under the knee, 3 × 15, from week 2
Patellar mobilization	Superior, inferior, gentle medial, 1–2 min each, from day 1
Hip · ankle	Supine hip abduction 3 × 15 from week 2; ankle pumps 2 × 20
Stationary bike	After week 3: no resistance, rocking within the bending limit
Pool · conditioning	Deep-water walking weeks 4–5 once healed. Other-leg and upper-body cardio

Precautions

- Toe-touch strictly × 6 weeks; no squats, step-ups, or lunges. Brace locked for walking and sleep
- NMES early for absent activation or lag; lag past week 4: more NMES, notify Dr. Merritt
- Gentle glides, no graft compression; avoid dynamic valgus

Why: The TTO is a screw-fixed controlled fracture; callus forms at weeks 6–12. The locked brace spares the graft and fixation.

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Return to Loading

Weeks 7–12

For the patient: what to expect

After your 6-week X-ray you add weight at your own pace; stop if the bone cut hurts. The brace opens over weeks 7 and 8. **Crutches come off first, then the brace.** Mini squats and step exercises rebuild strength.

WEIGHT BEARING	After the X-ray; patient-guided by osteotomy comfort and quad control
BRACE	Opened weeks 7–8; stop once walking confidently off crutches, unlocked
MOTION	Full by weeks 10–12. Loaded flexion $\leq 60^\circ$ to weeks 10–12; 90° by week 14

Goals

- Toe-touch to full weight, at the patient's pace
- Off crutches, then off the brace
- Full active ROM ($0-120^\circ+$); bike full revolutions
- Closed-chain strength: mini squats, step-ups
- Single-leg balance; quad and VMO toward 70% LSI

Move on when

- ☐ Full weight without crutches; brace off
- ☐ ROM $0-120^\circ$ or equal to the other knee
- ☐ Mini squat to 45° , pain-free, no valgus
- ☐ Step-ups $\times 10$ on 4-inch, no compensation
- ☐ Single-leg stance 20 sec; quad $\geq 55\%$

Exercises

Exercise	How
Open-chain extension	5 lb at week 7, +2–3 lb a week, 3×15 ; limited arc initially, no deep flexion load
Bike · elliptical	Full revolutions, 20–25 min. Elliptical once off crutches
Mini squats · wall sits	$0-45^\circ$, 3×15 , knee over 2nd toe, mirror; $0-60^\circ$ by weeks 10–12. Wall sits $3 \times 20-30$ sec
Step-ups · stairs	4-inch, operative leg leads, 3×10 , 5-sec hold, from weeks 8–9; 4–6-inch by week 12. Stairs off crutches
Sit-to-stand · leg press	Sit-to-stand 3×10 , armrests $\rightarrow$ none. Leg press $0-60^\circ$, 3×12 , no deep flexion
Hip · hamstrings	Hip abd/ER 3×12 ; band walks 3×15 ; clamshells $3 \times 15-20$; curls 3×12
Balance	Single leg, firm $3 \times 20-30$ sec once off crutches; then foam
Patella · BFR · pool	Self patellar mobilization daily. Continue BFR; aquatherapy as tolerated

Precautions

- No valgus collapse in squats or step-ups; step-ups only once mini squats to 45° are pain-free
- Brace comes off after crutches, never before
- No loaded flexion past 60° through weeks 10–12; PF pain: back to isometrics
- No running, jumping, or impact. Check effusion and ice after every session

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Return to Function

Weeks 13–20

For the patient: what to expect

You'll rebuild strength and teach your leg to move well under higher demands: single-leg squats, jogging, and low-level jumping. Running starts when you can step down from an 8-inch step with good control, usually at 14 to 16 weeks. Pain in the front of the knee or at the bone cut is always a reason to slow down.

WEIGHT BEARING

Full; progressive single-leg and impact loading

MOTION

Full. Loaded flexion past 90° now allowed

Goals

- Quad ≥80% of the other leg
- 8-inch step-down: symmetric, pain-free, no valgus
- Walk-jog at weeks 14–16; bilateral plyometrics at weeks 16–17
- No valgus on single-leg squat or step-down

Move on when

- ☐ Single-leg squat to 60° × 10, no valgus
- ☐ Quad LSI 80% (90% before Phase 4 clearance); hop 80%
- ☐ Jogging 20 min, flat, pain-free
- ☐ No osteotomy pain with loading; plyometrics tolerated

Exercises

Exercise	How
Phase 2 program	Continue with progressive resistance and duration
Squats	Goblet squats 0–90°, 3 × 12–15, from weeks 12–13; then to full depth; avoid if PF pain
Step-ups · step-downs	6-inch step-ups 3 × 15 from weeks 12–13; step-downs 6–8-inch 3 × 12–15 from weeks 14–15
Single-leg work	Mini squats 0–30° from weeks 14–15, to 60° by week 18. Bulgarian split squats and 8-inch lateral step-ups from week 16
Posterior chain	Nordic curls 3 × 6–10 from week 16; single-leg bridges 3 × 12 from week 13; Copenhagen adduction 3 × 15
Balance	Band walks, foam and wobble board; therapist perturbation 3 × 30 sec
Leg press	Progress ROM and resistance; avoid if PF pain
Jogging	Weeks 14–16, flat surface, once single-leg squat is pain-free; add distance and pace weekly
Plyometrics	Double-leg jump and stick 3 × 8 from weeks 16–17; lateral bounds 3 × 6 from weeks 17–18

Precautions

- Running not before weeks 14–16 and not before the step-down is met; check running mechanics first
- No single-leg plyometrics until single-leg squat control is good; none if the osteotomy is tender
- Anterior knee pain past 90°: reduce depth; call if it persists. Reactive effusion: reduce intensity. No cutting or pivoting sport before 6 months

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4

Return to Sport

Months 5–12

For the patient: what to expect

This is sport preparation: cutting, reacting, and playing at full speed. You'll need strength and hop tests and Dr. Merritt's sign-off. The minimum is 6 months for moderate sport, and 9 months is recommended for cutting and pivoting sports. If you feel unstable or nervous during drills, stop and tell your therapist.

WEIGHT BEARING	Full, unrestricted
RETURN TO SPORT	Minimum 6 months (moderate sport); 9 months recommended for cutting and pivoting

Goals

- Isokinetic quad and hamstring $\geq 90\%$ of the other leg
- Single-leg hop $\geq 90\%$ LSI
- Cutting, pivoting, and deceleration at full speed
- No pain, instability, or apprehension; clearance from Dr. Merritt

Move on when

- ☐ Quad LSI $\geq 90\%$ at 60°/sec; hops $\geq 90\%$ LSI (incl. 6-meter timed)
- ☐ Y-balance symmetry $\geq 90\%$; confidence $\geq 8/10$
- ☐ Full-speed cutting without instability or apprehension
- ☐ No anterior knee pain or osteotomy tenderness; knee scores done

Exercises

Exercise	How
Single-leg hops	Jump and stick 3 × 5–8; lateral hops 3 × 8, progressive amplitude
Depth jumps · bounds	12-inch box, both legs then single, 3 × 5–6 from week 22; crossover bounds 3 × 8
Speed · cutting	Straight-line sprints; 45° cuts (then reactive); 90° drills: T-drill, 5-10-5
Sport sequence	Accelerate, cut, decelerate, pivot
Maintenance	Single-leg squats 3 × 12, band walks 3 × 20, Nordics 2 × 10; BFR and quad work 3–4× a week in season

Precautions

- Bone remodeling continues through 9–12 months; time alone is not clearance (LSI $< 90\%$ raises re-injury risk)
- Apprehension with cutting disqualifies: back to Phase 3 training. Any subluxation: stop and notify Dr. Merritt
- Anterior knee pain or effusion with sport 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	≥90% 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
Patellar stability	No apprehension, instability, or subluxation with sport
Functional knee scores	IKDC, KOOS, Lysholm, Tegner completed
TTO union · hardware	Union confirmed by Dr. Merritt; no osteotomy tenderness. Hardware per surgeon
Earliest running	14–16 weeks, after the 8-inch step-down is met
Earliest cutting · sport	6 months for moderate sport; 9 months recommended for cutting and pivoting

Clinical Timeline Summary

TOE-TOUCH	Weeks 0–6 (TTO-driven); weight added after the X-ray, patient-guided
BENDING	45° day 5, 60° week 1, 75° week 3, ≤90° to the X-ray; full by weeks 10–12
BRACE · CRUTCHES	Locked through week 6; opened weeks 7–8; off crutches weeks 8–10, then brace off
NO NSAIDS	Weeks 0–6, including topical
BIKE	Rocking from week 3 within the limit; full revolutions after the X-ray
LOADING	Open-chain from week 7 (5 lb, +2–3 lb a week); loaded flexion 90° by week 14
RUNNING · PLYOMETRICS	Running weeks 14–16 after the step-down; plyometrics weeks 16–17
RETURN TO SPORT	Minimum 6 months; 9 months for cutting and pivoting