

ANDREW L. MERRITT, MD — PROLIANCE ORTHOPEDIC ASSOCIATES

CARTILAGE GRAFT RECOVERY — A GUIDE TO PHYSICAL THERAPY

THE ROLE OF PHYSICAL THERAPY IN YOUR RECOVERY

An osteochondral allograft (OCA) replaced damaged cartilage and bone on your thigh bone with a precisely matched donor plug. OCA heals differently from MACI — it is a bone-to-bone integration, which is structurally stronger and faster. This supports a return-to-sport timeline of approximately six months, compared with 12–18 months for MACI. For the first six weeks, toes barely touch the ground to protect the graft while early bone union forms at the edges of the plug.

Important: Toe-touch weight-bearing for six weeks is required despite the press-fit stability of the plug. Axial load before early bone union risks graft displacement. Do not advance weight-bearing before clearance.

YOUR RECOVERY TIMELINE

PHASE	TIMEFRAME	PT VISITS	WHAT YOU'RE WORKING ON
1	Weeks 1–6	2–3× per week	• Toe-touch only — crutches carry your weight for graft protection • Quad activation with electrical stimulation from Day 1 • Free range of motion when seated or lying down • Avoid arc of motion where defect contacts the tibial surface × 4 weeks
2	Weeks 6–16	2× per week	• Weight-bearing progresses — partial to full over several weeks • Stationary bike and aquatic therapy for controlled conditioning • Progressive strengthening — leg press, step-ups, functional exercises • No impact or deep squatting until Month 4
3	Months 3–5	1–2× per week + home program	• Progressive strengthening and jogging program begins • Limb symmetry testing at Month 3 and Month 5 • No cutting or pivoting until Phase 4 • Running mechanics screen before return to running
4	Months 5–6	As needed	• Sport-specific agility and cutting drills • Final hop and strength testing • Return to sport at approximately 6 months when criteria are met • Clearance by Dr. Merritt before return to contact or pivoting sport

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

OSTEOCHONDRAL ALLOGRAFT — FEMORAL CONDYLE PHYSICAL THERAPY PROTOCOL

Patient Name: _____
Date of Surgery: _____

Surgeon: Andrew L. Merritt, MD
PT Start Date: _____

Overview & General Principles

Osteochondral allograft (OCA) transplantation replaces full-thickness cartilage and subchondral bone on the femoral condyle with a size-matched donor plug. Unlike MACI, OCA healing is osseous — bone-to-bone integration at the press-fit graft-host interface. This provides immediate mechanical stability and supports a faster return-to-sport timeline of approximately 6 months, compared with 12–18 months for MACI. Progressive loading begins at Week 7 once quad control is confirmed. ROM is unrestricted from Day 1.

1. **OSSEOUS INTEGRATION ADVANTAGE:** OCA bone plug integrates with the host condyle through osseous union at the graft-host interface periphery. The press-fit technique provides immediate structural fixation, supporting an earlier weight-bearing progression and faster overall return-to-sport timeline than MACI's cellular scaffold ingrowth.
2. **TTWB × 6 WEEKS:** Toe-touch weight bearing (crutches carry body weight; toe contacts floor for balance only) is maintained × 6 weeks. Despite the press-fit mechanical stability, axial loading before early osseous union risks graft subsidence, micromotion, or delayed union. Begin PT within 3 days post-op.
3. **ARC PROTECTION × 4 WEEKS:** Avoid the arc of motion during which the defect articulates with the tibial plateau for the first 4 weeks. The specific arc depends on defect location — confirm with surgeon. This protects the articular surface of the graft during the most vulnerable integration window.
4. **ROM UNRESTRICTED — NO CPM:** Active and active-assisted ROM exercises are used throughout — no continuous passive motion (CPM). ROM without load is unrestricted from Day 1.

CONCOMITANT PROCEDURE MODIFICATIONS

Concomitant Meniscal Repair

5. When meniscal repair is performed simultaneously, weight-bearing restrictions from the meniscal repair take precedence if more conservative than the OCA protocol. Follow surgeon instructions for WB advancement milestones.

Concomitant ACL Reconstruction

6. If combined with ACL reconstruction, bracing and WB restrictions from the ACL protocol apply during Phase 1. The OCA arc protection restriction and loading precautions remain in effect. Confirm combined protocol timeline with surgeon.

PHASE 1 — PROTECTION (Weeks 0–6)

INFORMATION FOR THE PATIENT — What to Expect This Phase

Your bone and cartilage graft needs six weeks of protected weight bearing. Toe-touch weight bearing means your toe can contact the floor for balance, but your crutches carry all your body weight. Moving your knee freely while sitting or lying down is safe and encouraged from Day 1 — no restrictions on bending.

For the first 4 weeks, avoid the specific bending range where the graft makes contact with the opposite side of the joint — your surgeon will tell you which range to avoid. Quad exercises and electrical stimulation begin immediately to prevent muscle loss.

Goals:

7. Protect graft osseous integration — TTWB $\times$ 6 weeks
8. Avoid articulating arc of defect $\times$ 4 weeks (confirm arc with surgeon)
9. Full active ROM (0–130°+) by Week 4–6
10. Restore quad activation — SLR without extensor lag by Week 2–3
11. Control swelling and pain; aggressive cryotherapy
12. Begin supervised PT within 3 days post-op

Weight-Bearing Status: Toe-touch weight bearing (TTWB) $\times$ 6 weeks. Crutches required for all mobility. Toe contacts floor for balance only — crutches bear body weight. No partial or full weight bearing before Week 7. Deep-water aquatherapy may be permitted at Week 4–5 with surgeon approval — buoyancy provides full joint offloading.

Bracing: Hinged knee brace for comfort during ambulation Weeks 1–3. Unlock for ROM exercises. Wean from brace as weight bearing and quad control progress.

Range of Motion: Unrestricted from Day 1. Active and active-assisted ROM exercises — no CPM. Avoid the arc of articulation of the defect $\times$ 4 weeks (surgeon to specify). Target full active ROM (0–130°+) by Week 4–6. Stationary bike permitted when ROM reaches 100°+ (typically Week 4–6).

Exercises:

13. NMES to quadriceps — 20–30 min, 2 $\times$ daily; begin Day 1–2 post-op
14. Quad sets — 3 $\times$ 15, every waking hour; VMO activation priority
15. Straight-leg raises (hip flexion, then all 4 planes) — 3 $\times$ 10 each
16. Heel slides (active-assisted knee flexion, full ROM) — 3 $\times$ 15
17. Ankle pumps — hourly
18. Hamstring curls — 3 $\times$ 12
19. Hip abductor, adductor, and gastrocnemius strengthening — 3 $\times$ 15
20. Closed-chain exercises without resistance (weight shifts, bilateral stance) — begin Week 2–3
21. Stationary recumbent bike — begin when ROM $\geq$ 100° (typically Week 4–6); low resistance, 10–15 min
22. Pool deep-water walking (when incision healed, Week 4–5): forward, backward, sideways — full joint offloading
23. Well-leg cardiovascular conditioning and upper extremity exercises as tolerated
24. Ice and elevation after each session — 20 minutes; aggressive cryotherapy

Progression Milestones — Must Meet All Before Advancing:

25. TTWB compliance maintained $\times$ 6 weeks
26. Full active ROM (0–130°+) by Week 4–6
27. SLR without extensor lag
28. Pain and swelling diminishing

PHASE 1 PRECAUTIONS — GRAFT PROTECTION

29. TTWB × 6 weeks — no partial or full weight bearing before Week 7
30. Avoid articulating arc of defect × 4 weeks — confirm specific arc with surgeon
31. No squatting, lunging, or loaded knee flexion while weight bearing in Phase 1
32. No resisted OKC knee extension in Phase 1
33. Monitor for reactive effusion — increased swelling warrants load reduction

Rationale: OCA press-fit fixation provides immediate mechanical stability, but axial loading before early osseous union at the graft-host interface periphery risks graft micromotion, subsidence, or delayed union. TTWB for 6 weeks protects the integration interface during the most vulnerable healing window.

PHASE 2 — RETURN TO LOADING (Weeks 7–12)**INFORMATION FOR THE PATIENT — What to Expect This Phase**

Weight bearing begins at Week 7, but only after your quad control is confirmed — your physical therapist will assess this before you start. Over the next 2 weeks you will progress from bilateral crutches to walking without any crutch. Resisted knee straightening exercises begin this phase with light weight, increasing gradually. Cycling and elliptical build your endurance.

Goals:

34. Assure adequate quad control before initiating weight bearing
35. Full WB without crutch by Weeks 8–10
36. Normal gait on level surfaces and stairs
37. Quad strength 50–60% contralateral
38. OKC knee extension with progressive resistance established
39. Stationary cycling and closed-chain strengthening without pain

Weight-Bearing Status: Start PWB at Week 7 — confirm adequate quad control first. Progress over 2 weeks: bilateral crutches → single crutch → no crutch by Weeks 8–10, guided by pain and quad control. Reduce activity for pain or effusion.

Bracing: Brace discontinued at Week 6–7 as weight bearing and quad control improve.

Range of Motion: Full, unrestricted.

Exercises — Weeks 7–10:

40. Active OKC knee extension with progressive resistance — begin 5 lbs Week 7, increase 2–3 lbs/week as tolerated, 3×15 (limited arc as directed by surgeon initially)
41. Ergometry / stationary bike — progress to 20–30 min; increase resistance progressively
42. Mini-squats (0–60°) — 3×15; advance to 90° by Week 12
43. Leg press (bilateral, 0–90°) — 3×12; add resistance progressively
44. Step-ups (4–6 inch) — 3×10
45. Terminal knee extension (TKE) with resistance band — 3×15
46. Standing calf raises (bilateral → single-leg progression) — 3×15

47. Hip abduction/adduction/flexion/extension with progressive resistance — 3×12
48. Hamstring curls with resistance — 3×12
49. Proprioceptive / neuromuscular exercises: single-leg balance on firm surface — 3×30 sec
50. Aquatherapy: shallow-water walking, heel raises, gentle squats
51. Cryotherapy after every exercise session

Exercises — Weeks 10–12 (add to above):

52. Elliptical trainer — low to moderate resistance; introduce when FWB without crutch
53. Mini-squats progress to 0–90° — monitor for reactive effusion
54. Leg press: increase resistance; add single-leg progression by Week 12
55. Single-leg balance: progress to foam or unsteady surface
56. Stair climbing and descent — reciprocal pattern

Progression Milestones — Must Meet All Before Advancing:

57. Full WB without crutch, near-normal gait
58. Squat (0–90°) ×15 without pain
59. 20 min stationary bike without reactive swelling
60. Quad strength ≥55% contralateral

PHASE 2 PRECAUTIONS

61. Confirm adequate quad control before advancing weight bearing — delay WB if quad inhibition persists
62. WB progression guided by pain and effusion — reduce activities if reactive swelling occurs
63. No running, jumping, or impact activities in Phase 2
64. Monitor for joint effusion after each session — cryotherapy required after every session

PHASE 3 — RETURN TO FUNCTION (Weeks 13–16)

INFORMATION FOR THE PATIENT — What to Expect This Phase

This phase adds plyometric drills and begins running preparation. Running starts when you can perform an 8-inch step-down with good mechanics — typically at 14–16 weeks. Squatting and leg press progress in depth and resistance. Balance board exercises and agility preparation begin.

Goals:

- 65. Quad strength $\geq 80\%$ contralateral
- 66. 8-inch step-down with symmetric mechanics and no pain
- 67. Begin plyometric progression (bilateral)
- 68. Initiate running program (walk-jog intervals) at 14–16 weeks
- 69. Enhance strength, flexibility, endurance, and neuromuscular control

Weight-Bearing Status: Full, unrestricted.

Range of Motion: Full, unrestricted.

Exercises:

- 70. Continue all Phase 2 exercises with progressive resistance and duration
- 71. Progressive squatting program — increase depth (full depth when tolerated) and resistance
- 72. Leg press program — progress to single-leg; increase resistance. Avoid if patellofemoral pain — return to isometrics.
- 73. Progressive step-down program: 4 inch $\rightarrow$ 6 inch $\rightarrow$ 8 inch — focus on eccentric quad control and symmetric mechanics
- 74. Balance board squats — bilateral, then single-leg
- 75. Plyometric drills — begin bilateral jump/land, progress to single-leg hops; introduce Week 13–14
- 76. Ergometer, StairMaster, elliptical — progressive resistance and duration
- 77. Walk-jog intervals — initiate when 8" step-down satisfactory (after 14–16 weeks); flat surface, short intervals
- 78. Agility ladder, lateral shuffles, direction change drills — low intensity initially

Progression Milestones — Must Meet All Before Advancing:

- 79. Quad strength $\geq 80\%$ contralateral
- 80. 8-inch step-down with symmetric mechanics — required before running
- 81. Running 10+ minutes continuous without pain or effusion
- 82. Bilateral plyometrics without pain

PHASE 3 PRECAUTIONS

- 83. Running not before 14 weeks AND 8" step-down criteria met — both required
- 84. Cutting, jumping, and pivoting sports not before 22 weeks (Phase 4)
- 85. Patellofemoral pain with squatting or leg press — avoid and return to isometric exercises; do not push through PF pain
- 86. Reactive effusion after loading — reduce intensity and reassess

PHASE 4 — RETURN TO IMPACT ACTIVITIES (Weeks 17–26)

INFORMATION FOR THE PATIENT — What to Expect This Phase

Running progresses toward continuous sport-level running. Cutting, jumping, and general agility drills begin — not before 22 weeks. Return to sport is gradual and MD-directed, typically after 6 months once all criteria are met.

Goals:

87. Isokinetic quad strength $\geq 90\%$ contralateral
88. Isokinetic hamstring strength $\geq 100\%$ contralateral
89. Single-leg hop test $\geq 90\%$ limb symmetry index
90. Full return to sport or recreational activity

Weight-Bearing Status: Full, unrestricted.

Range of Motion: Full, unrestricted.

Exercises:

91. Running program — progressive build from walk-jog intervals to continuous running; increase duration and pace
92. Cutting, jumping, and general agility drills — not before 22 weeks post-operative
93. Sport-specific agility exercises and skill program — progressive functional difficulty
94. Plyometric progression: bilateral jump/land → single-leg hops → reactive drills
95. Hop testing: single-leg hop, triple hop, crossover hop, timed 6-meter hop
96. Continue quad and hip maintenance program 3–4×/week

Progression Milestones — Clearance for Sport:

97. Isokinetic quad strength $\geq 90\%$ contralateral
98. Isokinetic hamstring strength $\geq 100\%$ contralateral
99. Single-leg hop test $\geq 90\%$ limb symmetry index
100. Running 20 minutes continuous without pain or reactive effusion
101. Functional knee scores completed (IKDC, KOOS, Lysholm, Tegner)
102. Surgeon clearance — gradual return to sport after 6 months, MD directed

PHASE 4 PRECAUTIONS

103. Cutting, jumping, and pivoting — not before 22 weeks; criteria-based only
104. Gradual return to full sport after 6 months — MD directed; do not rush based on subjective readiness alone
105. Knee pain or effusion with running warrants imaging evaluation before progression

RETURN TO ACTIVITY CRITERIA

All criteria below must be satisfied AND surgeon clearance obtained before return to cutting, jumping, or pivoting sports.

Return-to-Activity Criterion	Required Threshold
Isokinetic Quadriceps (LSI)	≥90% contralateral limb
Isokinetic Hamstrings (LSI)	≥100% contralateral limb
Single-Leg Hop Testing (LSI)	≥90% contralateral (single, triple, crossover, timed)
Full Pain-Free ROM	Equal to contralateral
No Reactive Effusion	No joint effusion after functional activity
Functional Knee Scores	IKDC, KOOS, Lysholm, Tegner completed
Minimum Time — Running	14–16 weeks (after 8" step-down criteria met)
Minimum Time — Cutting/Jumping	Not before 22 weeks post-operative
Surgeon Clearance	Required; gradual return to sport after 6 months (MD directed)

Clinical Timeline Summary

Toe-touch weight bearing: Weeks 0–6 (crutches carry body weight)

Supervised PT begins: Within 3 days post-op

Weight bearing advances: Week 7 (after quad control confirmed)

Full WB without crutch: Weeks 8–10

Brace discontinued: Weeks 6–7 as quad control improves

Arc protection (articulating arc): Weeks 0–4 (confirm specific arc with surgeon)

OKC resistance begins: Week 7 (5 lbs; +2–3 lbs/week)

Low-impact cardio (cycling, elliptical): Weeks 7–10

Plyometrics: Weeks 13–14

Running (walk-jog): 14–16 weeks — after 8" step-down criteria met

Cutting / jumping / agility drills: Not before 22 weeks

Return to sport: After 6 months — criteria-based, MD directed

Note: OCA osseous integration supports a faster return-to-sport timeline than MACI. Progression is criteria-based — strength, hop testing, and surgeon clearance determine advancement. Reactive effusion after any session is a signal to reduce loading intensity.

Surgeon Notes / Special Instructions: