

# OSTEOCHONDRAL ALLOGRAFT WITH DISTAL FEMORAL 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 distal femoral osteotomy (DFO), a bone cut at the end of your thigh 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   | <b>Toe-touch only until the 6-week X-ray</b> (about 10 to 15 pounds). Then 25%, 50%, 75%, full by <b>10 to 12 weeks</b> |
| BRACE            | Hinged, <b>unlocked</b> from day 1, day and night. Worn until you are off crutches, about <b>10 to 12 weeks</b>         |
| MOTION GOALS     | Bending 90° by week 1, 105° by week 2, 115° by week 3, 125° by week 4                                                   |
| PHYSICAL THERAPY | Starts <b>5 to 7 days</b> after surgery, <b>2 times a week</b> at first                                                 |
| KEY PRECAUTIONS  | <b>No anti-inflammatory medicines for 6 weeks.</b> No isolated hamstring exercises for 2 weeks                          |
| RUNNING · SPORT  | Running around <b>month 6</b> , once the bone has healed. Cutting sports <b>no sooner than 9 months</b>                 |

## 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

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### 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 DFO is significant): at PT visits from the first visit; no home unit. **Ice:** 20 min on, 20 min off.
- **Hamstring protection, weeks 0–2.** The distal femoral exposure involves posterior soft tissue near the hamstrings. No isolated hamstring contractions for 2 weeks; quad-hamstring co-contractions from week 2; no high-resistance open-chain curls before week 8.
- **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 yet, and no hamstring exercises for 2 weeks.

|                |                                                                                     |
|----------------|-------------------------------------------------------------------------------------|
| 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; independent on crutches and stairs
- ☐ 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, 3 × 10 (skip abduction SLR if it hurts the back of the thigh). Heel slides 3 × 15 to the week's goal |
| Hip · calf              | Hip flexor and glute isometrics 3 × 10. Hip abductors and gastrocnemius 3 × 15                                        |
| Co-contractions · BFR   | Quad plus hamstring, 5-sec hold × 10, from week 2. BFR quad sets 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 contractions in weeks 0–2 (traction on the healing posterior tissue). No pillow under the knee

*Why: No compressive stability until callus forms. The posterior soft tissue needs 2 weeks of protection before isolated hamstring work.*

## 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.

|                       |                                                                                                                                               |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>WEIGHT BEARING</b> | 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 |
| <b>BRACE</b>          | Unlocked if the SLR has no lag; otherwise locked for walking until it does. Stop once off crutches with good quad control (weeks 10–12)       |
| <b>MOTION</b>         | 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 extension and hamstring work; cycling without pain

**Move on when**

- ☐ Off crutches, near-normal gait
- ☐ Squat 0–90° × 15 without pain
- ☐ 20 min bike without reactive swelling
- ☐ Quad ≥55%; hamstring work without posterior knee pain

**Exercises**

| Exercise                    | How                                                                                   |
|-----------------------------|---------------------------------------------------------------------------------------|
| <b>Weight shifts</b>        | Bilateral stance, no resistance, after the X-ray                                      |
| <b>Open-chain extension</b> | 5 lb at week 7, +2–3 lb a week as tolerated; 3 × 15                                   |
| <b>Bike · elliptical</b>    | Bike to 20–30 min, more resistance. Elliptical once off crutches                      |
| <b>Mini squats</b>          | 0–60°, 3 × 15; 0–90° by week 12, watching for effusion                                |
| <b>Leg press</b>            | Both legs, 0–90°, 3 × 12; add resistance; single leg by week 12                       |
| <b>Step-ups · stairs</b>    | 4–6-inch, 3 × 10. Stairs, reciprocal pattern, weeks 10–12                             |
| <b>Calf raises · hip</b>    | Calf raises both legs → single, 3 × 15. Hip, 4 directions, 3 × 12                     |
| <b>Hamstrings</b>           | Wall slides at week 6; free curls at week 8; no heavy resistance before week 8        |
| <b>Balance · BFR</b>        | Single leg, firm 3 × 30 sec, then foam. BFR mini squats and step-ups once weight ≥50% |
| <b>Aquatherapy</b>          | 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 (torsional stress at the osteotomy). Hamstrings: closed chain first through week 8
- Watch for patella infera (keep up patellar mobilization). No running, jumping, or impact

## 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. Balanced quad and hamstring strength is the focus.

|                |                                                         |
|----------------|---------------------------------------------------------|
| 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 controlled alignment
- ☐ Single-leg stance  $\geq 45$  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                                                                    |
| Hamstrings · glutes   | Prone curls, Nordic prep, single-leg deadlifts. Single-leg bridges, monster and band walks                    |
| Balance · core        | Single-leg stance: flat, foam, perturbation. Dead bugs, planks, Pallof press                                  |
| Conditioning · BFR    | Bike, elliptical, pool with progressive resistance. BFR single-leg press                                      |

**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
- 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.

|                           |                                                                       |
|---------------------------|-----------------------------------------------------------------------|
| <b>RUNNING</b>            | Walk-jog from month 6 with X-ray union and surgeon clearance          |
| <b>PLYOMETRICS</b>        | After running is established (month 6+), with surgeon clearance       |
| <b>CUTTING · PIVOTING</b> | 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                                                                                           |
|--------------------------|-----------------------------------------------------------------------------------------------|
| <b>Strength</b>          | Leg press, squats, lunges, single-leg deadlifts, Bulgarian split squats, eccentric step-downs |
| <b>Walk-jog program</b>  | From month 6 if union is confirmed; build to continuous running                               |
| <b>Plyometrics</b>       | After running starts: controlled hops → bounding, with surgeon clearance                      |
| <b>Cutting · agility</b> | Cutting, agility, and lateral shuffle drills from month 7                                     |
| <b>Sport-specific</b>    | Month 9+, with surgeon clearance                                                              |
| <b>Hop testing</b>       | Single, triple, crossover, timed 6-meter                                                      |
| <b>Maintenance</b>       | 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
- Do not progress running or sport if swelling increases
- 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: wall slides week 6, free curls 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).