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PHYSICAL THERAPY PROTOCOL

Patellar Fracture Repair

Open Reduction and Internal Fixation — Tension Band, Screw, Plate, or Combination Constructs

FOR THE PHYSICAL THERAPIST

Overview and Goals

This protocol governs rehabilitation following open reduction and internal fixation (ORIF) of a patellar fracture — tension band wiring, screw fixation, plate fixation, or combination constructs. Because the patella is a bone that must heal and is the fulcrum of the extensor mechanism, the two competing priorities are protecting the fixation and preventing stiffness. To balance these against fracture complexity, the protocol runs on **two tracks** — a **Standard track** for simple patterns (transverse, two-part) with stable fixation, and a **Protected track** for comminuted patterns (AO/OTA C2, C3) or any fixation Dr. Roth considers less stable. Dr. Roth, his PA or his NP designates the track at the time of surgery.

The defining long-term challenge after patellar fracture ORIF is **quadriceps weakness**. Extensor strength deficits of roughly 41% persist at one year, and a mean deficit near 36% remains at five years, with the large majority of patients showing at least 20% asymmetry — deficits that correlate with worse pain and function.[1,2] For that reason this protocol emphasizes aggressive, prolonged quadriceps rehabilitation and criterion-based progression rather than a fixed calendar.

The extensor mechanism must be protected because active and resisted knee extension pull directly across the fracture. The brace is therefore kept locked in full extension for all walking — through week 6 on the Standard track and week 8 on the Protected track — and is then unlocked and weaned over about two weeks. Range of motion is not on a fixed schedule: Dr. Roth sets the initial passive flexion limit at surgery under direct visualization of the repair, and the patient advances it 10° per week by adjusting the brace at home, beginning at the first post-op visit. Quadriceps isometrics and straight-leg raises are encouraged early with the brace locked; active knee extension and resisted open-chain extension are deferred on a track-dependent schedule. This graded approach balances fixation protection against the real risk of arthrofibrosis after periarticular fracture fixation.[3]

Progression is criterion-based and radiographic confirmation of union gates advancement to impact activity and sport. Return to sport is typically 5–8 months, later for comminuted patterns and lower-demand or elderly patients whose goals prioritize activities of daily living.

READ BEFORE STARTING — SCOPE & EXTENSOR-MECHANISM PROTECTION

This protocol applies to patellar fracture ORIF (tension band wiring, screw, plate, or combination constructs).

- Confirm the **track (Standard vs. Protected)** with Dr. Roth — it is designated at surgery based on comminution and fixation stability, and it sets the weight-bearing and ROM progression.
- If a **partial patellectomy or extensor-mechanism repair** was performed, extensor strength and return-to-activity expectations change — confirm with Dr. Roth.

Precautions that apply throughout:

- No resisted open-chain knee extension for the first 6 weeks (Standard) or 8 weeks (Protected).
- Active knee extension is delayed to week 3 (Standard) or weeks 4–6 (Protected) to protect

the repair.

- Standard track: advance passive flexion from Dr. Roth's surgical setting (typically 30–40°), opening the brace 10° per week from the first post-op visit. **Protected track: follow Dr. Roth's individual ROM instruction** — which may be to advance, or to hold the knee locked in extension with no progression through the first 6 weeks.
- Keep the brace locked in full extension for all walking through week 6 (Standard) or week 8 (Protected); then unlock and wean out of the brace over about two weeks.
- No deep squatting, kneeling, or high-impact activity until fracture union is confirmed radiographically.

Rehabilitation Phases

PHASE	WEIGHT BEARING	BRACE	ROM GOALS	EXERCISES	CRITERIA TO ADVANCE
PHASE 1 Weeks 0–2 *Protection & early mobilization*	**Standard track:** • Weight-bearing as tolerated with crutches, brace locked in extension **Protected track:** • Toe-touch weight-bearing with crutches, brace locked in extension	• Hinged brace or knee immobilizer locked in full extension for all ambulation and sleep. • Unlock only for supervised ROM. Flexion stop set to Dr. Roth's surgical start at the first post-op visit, then opened 10°/week at home.	*ROM begins at the first post-op visit (day 5–10).* **Standard:** • Start at the flexion limit Dr. Roth set at surgery (typically 30–40°); advance 10°/week by opening the brace stop at home **Protected:** *Directed individually by Dr. Roth — follow his written instruction.* • May set a starting flexion limit to advance, as on the Standard track, or • For a fragile pattern (e.g., osteopenic comminution), hold locked in extension with no ROM progression through the first 6 weeks to limit displacement risk	**Quadriceps activation:** • Quad sets (isometric) — begin POD 1 • Straight-leg raises with brace locked — begin when tolerated (POD 1–3) • NMES to quadriceps as needed **ROM / mobility:** • Gentle passive extension to maintain full extension • Ankle pumps **Proximal / adjunct:** • Gluteal sets • Cryotherapy and elevation for pain and edema	• Quadriceps activation with SLR (minimal or no extensor lag) • Full passive extension maintained • ROM advancing per Dr. Roth's starting setting • Pain and effusion controlled • Minimum 2 weeks elapsed

PHASE	WEIGHT BEARING	BRACE	ROM GOALS	EXERCISES	CRITERIA TO ADVANCE
			Priority: • Maintain full extension (0°) **Patella:** • Gentle superior and inferior glides		
PHASE 2 Weeks 2–6 *Progressive ROM & weight-bearing advancement*	**Standard:** • Full weight-bearing, off crutches by weeks 3–4 — walking in the brace locked in extension **Protected:** • Toe-touch weight-bearing in the brace locked in extension	• Continue locked in full extension for all ambulation — Standard through week 6, Protected through week 8. • Flexion stop continues to open 10°/week for ROM.	**Standard:** • Continue advancing the flexion stop 10°/week via home brace adjustment **Protected:** • Continue per Dr. Roth's individual instruction — advance as directed, or remain held in extension **Active knee extension begins:** • Standard wk 3; Protected wks 4–6, or per Dr. Roth **Bike:** • Stationary bike when flexion ≥ 110°, elevated seat	**Strengthening:** • Progress SLR all planes (add ankle weights as tolerated) • Heel slides for ROM • Prone / supine passive extension stretch • Mini-squats / wall slides (0–30°) • Standing calf raises (when weight-bearing permits) **Hip / core:** • Side-lying hip abduction, clamshells • Core stabilization **Neuromuscular:** • Balance / proprioception — bilateral stance	• Weight-bearing advanced per track without fracture-site pain • ROM progressing per plan (Standard 10°/week; Protected per Dr. Roth, which may be no progression) • SLR without extensor lag • Gait normalized for weight-bearing status • Minimum 6 weeks elapsed
PHASE 3 Weeks 6–12 *Progressive strengthening — union-gated*	• Standard: full weight-bearing. Protected: advance from toe-touch to full once Dr. Roth clears you at the ~6-week radiographic check.	• Locked-ambulation period ends: Standard week 6, Protected week 8. • Then unlock and wean out of the brace over ~2 weeks, once SLR is without extensor lag — off by ~week 8 (Standard) / ~week 10	• Advance to full ROM once healing confirmed (typically by weeks 10–12). *For a Protected case held in extension, begin ROM now on Dr. Roth's clearance once healing is confirmed.* **Stretching:**	• Milestone: radiographs at 6–8 weeks to confirm fracture healing before impact.[2] **Closed-chain:** • Squats, leg press (0–60°), step-ups (forward and lateral), lunges **Open-chain (limited arc):** • Begin knee extension 90–45° only — Standard wk 6, Protected wk 8 **Neuromuscular / hip:** • Single-leg balance and proprioception • Lateral band walks / monster walks • Hip strengthening all planes, progressive **Conditioning:** • Elliptical, swimming (flutter kick)	• Full, pain-free ROM • No effusion • SLR without extensor lag • Radiographic evidence of fracture healing • Quadriceps MMT ≥ 4/5 • Minimum 12 weeks elapsed

PHASE	WEIGHT BEARING	BRACE	ROM GOALS	EXERCISES	CRITERIA TO ADVANCE
		(Protected).	• Hamstrings, quads, ITB, gastroc/soleus		
PHASE 4 Weeks 12–20 *Advanced strengthening & functional training*	• Full. *Prerequisite: confirmed radiographic union.*	• None.	• Full ROM maintained.	**Strengthening:** • Full-arc open-chain knee extension — progress resistance gradually • Single-leg squats, single-leg press, single-leg deadlifts • Continue hip and core strengthening **Plyometrics:** • Bilateral → unilateral (box jumps, drop jumps, lateral hops) **Agility:** • Ladder and cone drills (linear → lateral → multidirectional) • Sport-specific movement patterns **Conditioning:** • Straight-line jogging (wks 12–16, when quad ≥ 70% of contralateral, no pain/effusion, union confirmed) → interval running	• Quadriceps strength ≥ 80% of contralateral limb • No pain or effusion with advanced activities • Single-leg hop ≥ 80% limb symmetry • Minimum 20 weeks for RTS phase
PHASE 5 Weeks 20–36+ *Return to sport*	• Full.	• None.	• Full ROM.	**Sport-specific progression:** • Sport-specific drills at full speed • Non-contact → contact practice → full competition, over ~4–6 weeks **Maintenance:** • Continue quadriceps and hip strengthening 2–3×/week indefinitely • Monitor for anterior knee pain, hardware irritation, and patellofemoral arthritis	*See Return-to-Activity Criteria section below.* • Return to sport typically ~5–8 months; all criteria below met with confirmed union and physician clearance.[1,2]

Procedure-Specific Considerations

Quadriceps Weakness Is the Defining Long-Term Problem

Persistent quadriceps deficit is the most significant functional consequence of patellar fracture ORIF, and it drives the emphasis of this protocol. At one year, extensor-mechanism deficits of approximately 41% in strength, 47% in power, and 34% in endurance have been documented compared with the uninjured side.[2] At a median of five years, mean extensor strength deficit remained near 36%, with about 85% of patients showing at least 20% asymmetry — and greater deficit correlated with worse pain and function.[1] Even comminuted fractures with excellent reduction and union retained isokinetic torque deficits near 25% at one year.[6] The clinical implication is that quadriceps and hip strengthening should be aggressive and should continue well beyond the point of pain-free walking, ideally 2–3×/week on an ongoing basis.

Protect the Extensor Mechanism

The patella is the fulcrum of the extensor mechanism, so active and resisted knee extension load the fracture directly. Quadriceps isometrics and straight-leg raises are safe and encouraged early because the brace is locked in extension and the load is controlled. Active knee extension is introduced only at week 3 (Standard) or weeks 4–6 (Protected), and resisted open-chain extension is deferred until week 6 (Standard) or week 8 (Protected), then reintroduced in a protected 90–45° arc before progressing to full arc. Closed-chain loading — squats, leg press, step-ups — is the mainstay of quadriceps strengthening in the interim.

Range of Motion Is Individualized at Surgery

Rather than a fixed weekly schedule, Dr. Roth sets range of motion individually. On the **Standard track** he chooses an initial passive flexion limit intraoperatively — flexing the knee under direct visualization of the repair, typically around 30–40° — and the patient advances it 10° per week by opening the brace's flexion stop at home, beginning at the first post-op visit. On the **Protected track**, range of motion is directed case by case: Dr. Roth may prescribe a similar graded advance, or, for a fragile pattern such as an osteopenic comminuted fracture, may elect to hold the knee locked in full extension with no ROM progression through the first six weeks — deliberately accepting some arthrofibrosis risk in exchange for a lower risk of fracture displacement. For a Protected-track patient, always follow Dr. Roth's written ROM instruction rather than a default schedule. The brace stays locked in full extension for all walking — through week 6 (Standard) or week 8 (Protected) — and is then unlocked and weaned over about two weeks. When motion is being advanced, maintaining full passive extension is the single most important safeguard against arthrofibrosis, a recognized complication of periarticular fracture fixation;[3] any loss of previously achieved extension is a red flag warranting prompt re-evaluation by Dr. Roth.

Why Two Tracks

Published rehabilitation after patellar ORIF varies widely, and that variability is driven mainly by fracture complexity and fixation stability. Simple transverse fractures with stable tension-band or screw fixation tolerate early passive motion, active extension by three weeks, and full weight-bearing by six to eight weeks or when radiographic healing is confirmed.[4,5] Comminuted patterns — where plate or fragment-specific constructs are often more reliable than tension-band wiring — require a slower, radiograph-guided progression and carry a greater expected long-term quadriceps deficit.[4,6]

COMMINUTED FRACTURES, PARTIAL PATELLECTOMY & LOWER-DEMAND PATIENTS

Comminuted fractures (AO/OTA C2, C3) follow the Protected track, with range-of-motion and weight-bearing progression guided by Dr. Roth's assessment of fixation stability and serial radiographs; expect a longer time to full range of motion and potentially greater long-term quadriceps deficit. In the most fragile patterns — an osteopenic comminuted fracture, for example — Dr. Roth may deliberately hold the knee locked in extension with no ROM progression through the first six weeks, accepting some stiffness to protect against displacement; follow his written instruction rather than advancing on a schedule. If a partial patellectomy was performed, anticipate reduced extensor-mechanism strength and adjust return-to-activity expectations accordingly. For elderly or lower-demand patients, prioritize independence in transfers, stair negotiation, and ambulation over sport-specific goals, and make fall-prevention and balance training central.

RED FLAGS — CONTACT DR. ROTH

- Sudden increase in effusion or hemarthrosis.
- Loss of active knee extension, or an extensor lag that worsens (concern for extensor-mechanism failure or loss of fixation).
- Palpable hardware migration or prominence.
- Loss of previously achieved range of motion, especially loss of extension.
- Mechanical symptoms — locking or catching.
- Signs of wound infection.
- Inability to perform a straight-leg raise by week 4 (Standard) or week 6 (Protected).
- Pain at the fracture site with weight-bearing (concern for loss of fixation or nonunion).

Return-to-Activity Criteria

Progression is criterion-based and gated on radiographic union. The tiers below are guides; individual patients advance faster or slower depending on track, fixation, and recovery of quadriceps strength.

Activity Tier	Criteria & Timing
Activities of daily living (ADLs)	Full pain-free ROM, quadriceps control without extensor lag, gait normalized off crutches and brace. Timing depends on track and confirmed healing; typically weeks 8–12 (Standard) and later for Protected.
Stationary bike / swimming / elliptical	Flexion ≥ 110° for the bike (typically around weeks 7–9 on the 10°/week schedule), no effusion, elevated seat; elliptical and flutter-kick swimming in Phase 3.
Jogging / running	Confirmed union, quadriceps strength ≥ 70% of contralateral limb, no pain or effusion. Straight-line jogging typically weeks 12–16, progressing to interval running.
Agility, plyometrics, sport-specific drills	Confirmed union, quadriceps strength ≥ 80% of contralateral limb, single-leg hop ≥ 80% limb symmetry, no pain/effusion with advanced activity. Typically Phase 4 (weeks 12–20).
Full return to sport (incl. cutting, pivoting, contact)	Quadriceps strength index ≥ 90% LSI; hop battery ≥ 90% LSI (single, triple, crossover, timed); no pain, effusion, or apprehension; sport-specific drills complete; confirmed radiographic union; physician clearance. Typically ~5–8 months.

REALISTIC EXPECTATIONS & COMPLICATIONS

Patients should be counseled that patellar fracture recovery is a bone-healing timeline: impact and sport are gated on radiographic union rather than on how the knee feels. Two expectations deserve explicit discussion. First, **quadriceps weakness commonly persists beyond a year** — ongoing targeted strengthening is essential, not optional. Second, **anterior knee pain is common**, affecting roughly 80% of patients at one year, and symptomatic hardware is the most frequent complication, particularly after tension-band wiring; hardware removal is eventually performed in about 37–38% of patients.[1,2,7,8] The overall complication rate after patellar ORIF ranges from about 16% to 30%, most of it implant-related.[7,8] Criterion-based progression with radiographic confirmation before advancing is what keeps these risks low. Persistent fracture-site pain with weight-bearing, loss of extension, or failure to reach radiographic union should prompt re-evaluation by Dr. Roth.

References

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Glossary

AAROM — Active-assisted range of motion; the patient initiates motion with assistance from gravity, a strap, or the therapist.

ADL — Activities of daily living.

AO/OTA classification — A standardized fracture classification; C2 and C3 denote complete articular fractures with increasing comminution.

AROM — Active range of motion; the patient moves the joint independently against gravity.

Arthrofibrosis — Excessive intra-articular scar formation causing stiffness and loss of motion.

CKC — Closed kinetic chain; exercises performed with the foot fixed (e.g., squats, leg press).

Extensor lag — Inability to actively achieve the last degrees of knee extension that are available passively.

Extensor mechanism — The quadriceps–patella–patellar tendon unit that straightens the knee; the patella is its fulcrum.

Hemarthrosis — Bleeding into the joint, producing rapid painful swelling.

ITB — Iliotibial band.

LSI — Limb Symmetry Index; the operative limb's value as a percentage of the contralateral limb (operative ÷ contralateral × 100).

MMT — Manual muscle test; a graded (0–5) clinical assessment of muscle strength.

NMES — Neuromuscular electrical stimulation; used to augment quadriceps activation.

OKC — Open kinetic chain; exercises performed with the foot free (e.g., seated knee extension).

ORIF — Open reduction and internal fixation.

Partial patellectomy — Surgical removal of a small, unreconstructable pole fragment with reattachment of the tendon; reduces extensor-mechanism strength.

PROM — Passive range of motion; the therapist or a strap moves the joint while the patient stays relaxed.

ROM — Range of motion.

SLR — Straight-leg raise.

Tension band wiring — A fixation construct that converts distraction forces across the fracture into compression during knee flexion.

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Dr. Roth completed his orthopaedic surgery residency at Harvard Medical School and his sports medicine fellowship at the Kerlan-Jobe Orthopaedic Clinic in Los Angeles. In practice since 2013, he specializes in advanced arthroscopic techniques and sports medicine procedures, and sees patients at Palo Alto Medical Foundation's Palo Alto and Dublin offices. He welcomes calls from physical therapists about his patients or this protocol.

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