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PHYSICAL THERAPY PROTOCOL

Meniscus Repair — Stable Tear Patterns

Vertical Longitudinal · Bucket-Handle · Ramp Lesion

FOR THE PHYSICAL THERAPIST

Overview and Goals

This protocol governs rehabilitation following arthroscopic repair of stable meniscus tear patterns — vertical longitudinal tears, bucket-handle tears, and ramp lesions. These tear patterns share a common biomechanical characteristic: they preserve meniscal hoop stress, meaning the meniscus continues to function biomechanically after repair, unlike root and radial tears which functionally behave as meniscectomies until healed.[1,2]

A NOTE ON TEAR PATTERN TERMINOLOGY

The descriptors used in operative reports — longitudinal, vertical, peripheral — are often listed together but describe the same tear from three angles rather than three different categories:

- **Longitudinal** describes orientation: running along the long axis of the meniscus, parallel to the circumferential collagen fibers (vs. radial, which cuts across them).
- **Vertical** describes the plane through meniscal thickness: top-to-bottom from femoral to tibial surface (vs. horizontal, which splits the meniscus into superior and inferior leaflets).
- **Peripheral** describes location: at or near the meniscocapsular junction in the vascular outer (“red-red”) zone (vs. central or inner, in the avascular white-white zone).

A typical repairable tear is all three at once: vertical longitudinal peripheral. The protocol covers three actual tear patterns: vertical longitudinal tears, bucket-handle tears (a displaced longitudinal tear, larger but same biology), and ramp lesions (posteromedial peripheral longitudinal tears at the meniscocapsular junction).

Bucket-handle tears, despite preserving hoop stress, are larger, often more displaced, and have higher baseline failure rates than simple longitudinal repairs.[5,6] The framework below suits both simple stable tears and bucket-handle repairs, with bucket-handle-specific modifications described in a dedicated section.

Two principles guide rehabilitation. First, protect the repair in the early weeks through controlled weight-bearing, ROM limits, and avoidance of deep loaded flexion. Although stable tear patterns preserve hoop stress, biomechanical and clinical data suggest early loading still influences healing — a recent randomized trial found a 28% failure rate even with permissive rehab,[4] indicating that protocol choice matters at the margin even for stable repairs. Second, progress through criterion-based milestones rather than time alone. Patients who do not meet criteria should remain in the current phase regardless of elapsed time.

THIS PROTOCOL DOES NOT COVER COMPLEX TEAR PATTERNS

Patients with horizontal cleavage tears, radial tears, or root tears should not use this protocol. Those patterns disrupt circumferential fiber continuity or hoop stress and require the more conservative **Meniscus Repair — Unstable Tear Patterns** protocol.

CONCOMITANT ACL RECONSTRUCTION — READ FIRST

If meniscus repair was performed alongside ACL reconstruction, **do not use this protocol**. Refer to the ACL Reconstruction Rehabilitation Protocol, which incorporates meniscus repair modification callouts. Contact Dr. Roth’s office if uncertain about concomitant procedures.

Rehabilitation Phases

PHASE	WEIGHT BEARING	BRACE	ROM GOALS	EXERCISES	CRITERIA TO ADVANCE
PHASE 1 Weeks 0–2 *Protection & early motion*	• 50% partial weight bearing (PWB) with crutches. • Crutches required throughout Phase 1. A protected early phase optimizes healing biology; immediate unrestricted loading is avoided.[1,2,4,5]	• Hinged knee brace set to 0–90° during ambulation. • Permits motion within the 0–90° arc and prevents loaded flexion beyond 90°. • Remove for prescribed PT and home exercises.[1,2]	**Goals by end of Phase 1:** • Full passive extension (0°) • Flexion to 90° (passive beyond 90° acceptable; no loaded flexion past 90°) • Symmetrical extension to contralateral side	**Swelling / pain control:** • Cryotherapy, elevation, NMES to quadriceps **ROM (loaded within 0–90°):** • Heel slides, wall slides, prone hangs, towel-roll passive extension, patellar mobilization, tibiofemoral mobs into extension[1,2] • Passive flexion beyond 90° acceptable; avoid loaded flexion past 90° • No deep squatting in any plane **Strengthening:** • Quad sets with knee support • SLR (all 4 planes) • Hamstring sets (gentle, no resisted flexion early) • Hip abduction, adduction, extension • Ankle pumps, plantarflexion / dorsiflexion • OKC knee extension 90°–40° only (terminal arc quads, no resistance) • No closed-chain weight-bearing exercises during Phase 1 **Aerobic:** • Upper body ergometer only. No stationary bike during Phase 1.	• Full passive knee extension (0°) • Flexion to 90° • Effusion ≤ 1+ • SLR without extension lag • Tolerates 50% PWB without compensation • Minimum 2 weeks elapsed
PHASE 2 Weeks 2–6 *Weight-bearing progression & ROM advancement*	• Progress to weight bearing as tolerated (WBAT) at the start of Phase 2 (week 2), advancing to full as gait quality and quad control allow.[1,2] • Wean from crutches as patient demonstrates symmetrical, painless gait.	• Wean and discontinue the brace over Phase 2 as quadriceps control returns.	• Progress to full, symmetrical , pain-free flexion. • Continue to avoid loaded deep flexion (squat past 90°) through week 6.[2,8]	**Closed-chain progression (loaded flexion ≤ 90°):** • Mini-squats to 60° (week 4 onward) • Leg press, limited range (~0–60°), low resistance • Step-ups (low step) → progressive height • Heel raises, weight shifting **Open-chain:** • Continue terminal arc quads (90°–40°). Add light-resistance hamstring curls when comfortable. **Aerobic:** • Stationary bike once flexion ≥ 110° and pain-free. Pool walking once incision healed. **Neuromuscular re-education:** • Double-leg balance progressions, weight-shift drills. **BFR:** • May begin as an optional adjunct (see BFR section below).	• Full symmetrical, pain-free ROM • Quad LSI ≥ 70% • No effusion • Full weight bearing with normal gait • Tolerates closed-chain loading without pain or effusion • Minimum 6 weeks before loaded deep flexion
PHASE 3 Weeks 6–16 *Strengthening & plyometric prep*	• Full weight bearing.	• None.	Full, pain-free ROM. • Loaded deep flexion permitted in this phase (after week 6) as tolerated.[2,8]	**Progressive resistance training:** • Single-leg press, single-leg squat progression • Step-downs (lateral and forward) • Lunges with progressive depth • Eccentric hamstring loading (Nordic curls late phase) • Hip strengthening: glute bridges, clamshells, side-lying abduction,	• Quad LSI ≥ 80% • Hamstring LSI ≥ 80% • No pain or effusion with progressive loading • Single-leg balance ≥ 30 sec

PHASE	WEIGHT BEARING	BRACE	ROM GOALS	EXERCISES	CRITERIA TO ADVANCE
				monster walks **Neuromuscular training:** • Single-leg balance, perturbation, foam surface, dynamic balance progressions **Aerobic conditioning:** • Bike (progressive resistance), elliptical, swimming, pool running **Plyometric prep:** • Late Phase 3 — double-leg jumps in place at low intensity, bilateral squat-to-jump **Core:** • Core and trunk stabilization	• Symmetrical step-down mechanics
PHASE 4 Months 4–6+ *Running, plyometrics & return to sport*	• Full weight bearing.	• None.	• Full, pain-free ROM.	**Running initiation (Quad LSI ≥ 80%, no effusion):** • Treadmill walk/run intervals → continuous running[8,10] • Track straights → curves → full track **Plyometrics progression:** • Double-leg jumps in place → broad jumps • Box jumps, lateral bounds • Single-leg hops in multiple planes (late phase) **Agility:** • Ladder drills, carioca, sport-cord lateral drills, deceleration training **Sport:** • Sport-specific drills (non-contact → contact) • Continue progressive resistance training — close strength asymmetry • Home maintenance strength program established	*See Return-to-Sport Criteria section below.* • ~ 4–5 months for non-impact activity (running, swimming, cycling).[8,12] • ~ 6 months for cutting, pivoting, and contact sports.

Procedure-Specific Considerations

Why Conservative Loading Even for Stable Tears

Stable longitudinal tears preserve hoop stress, and a randomized trial (Lind 2013, n=60) found no significant difference in failure rates between “free” and restricted rehabilitation (28% vs 36%, p=0.53)[4] — though both arms had high absolute failure rates. A larger retrospective series (Favreau 2023, n=367) found immediate full weight-bearing was associated with significantly higher failure rates for tears involving circumferential fibers (OR 3.6).[5] This protocol applies a moderately conservative early phase — 50% PWB for 2 weeks and a loaded-flexion cap (0–90°) through 6 weeks — to protect healing biology while still allowing earlier full weight-bearing than is required for root, radial, or horizontal cleavage repairs. Immediate *unrestricted* full weight-bearing — the pattern associated with higher failure for circumferential-fiber tears — is avoided.

Bucket-Handle Tear Modification

Bucket-handle tears, while still preserving hoop stress, are larger, often more displaced, and have higher baseline failure rates than simple longitudinal tears.[6,7] For bucket-handle repairs, the following modifications apply in addition to the standard protocol:

- 50% PWB extended to 4 weeks (vs. 2 weeks standard), based on intraoperative repair-quality assessment

- Loaded 0–90° flexion cap extended to 8 weeks (vs. 6 weeks standard) before progressing toward loaded deep flexion
- Slower Phase 2 progression — closed-chain exercises introduced cautiously; loaded deep flexion deferred through end of Phase 3
- RTS pushed to the longer end of the typical window — 5–6 months non-impact, 6–7 months cutting/pivoting

Patients with chronic, locked, or revised bucket-handle tears warrant case-by-case discussion with Dr. Roth's office before initiating rehabilitation.

Bracing — What It Is & Isn't For

Current evidence does not support post-operative bracing as an independent driver of better outcomes after meniscus repair, and one large retrospective series found bracing paradoxically associated with higher failure rates (likely selection bias — more complex tears were braced).[5] In this protocol, the brace serves a specific mechanical purpose: enforcing the 0–90° loaded-flexion limit during ambulation through the protected period. Compliance with the ROM and weight-bearing restrictions — not the brace itself — is what protects the repair.

When Formal PT Adds the Most Value

Most published meniscus repair protocols use 12–16 weeks of supervised PT, with criterion-based discharge thereafter. The first 8 weeks are particularly valuable for protecting ROM advancement, gait restoration, and avoiding common pitfalls (premature deep flexion, premature loading, quad lag). Athletes targeting return to cutting or pivoting sports benefit from supervised plyometric and agility progression in Phase 4. Patients without complications often transition to a structured home program by month 4–5 with periodic check-ins.

Blood Flow Restriction (BFR) Training — Optional Adjunct

BFR training may be considered as an optional adjunct beginning in Phase 2, particularly for patients with persistent quadriceps weakness or atrophy after the protected weight-bearing phase. Standard parameters (60–80% AOP, 20–30% 1RM, 4 sets of 30-15-15-15) are reasonable defaults — see Dr. Roth's ACL Reconstruction Rehabilitation Protocol for full BFR parameters and contraindications. Because closed-chain loading is restricted in early Phase 2, BFR exercise selection should favor open-chain terminal arc quads and SLR-based loading early, advancing as Phase 2 closed-chain work is introduced.

Return-to-Sport Criteria

Return to activity should be both time-based and criterion-based, consistent with the 2024 ESSKA-AOSSM-AASPT consensus.[1,2] Mean time to return to sport after meniscus repair is approximately 5.8 months across published cohorts (Bensa 2026 meta-analysis, n=846), with a pooled return-to-any-sport rate of 96.9% and return to preinjury level of 81.3%.[12] Mean return to running is approximately 13 weeks.[10] All criteria below should be met before sport-specific clearance.

Domain	Criterion
Range of motion	Full, symmetrical, pain-free flexion and extension[1,2]
Joint signs	No effusion. No joint-line tenderness — persistent tenderness or effusion may indicate delayed or failed healing and warrants surgeon evaluation.[2]
Quadriceps strength	LSI ≥ 85% on isokinetic or handheld dynamometer testing[2,8]
Hamstring strength	LSI ≥ 85%[2,8]

Domain	Criterion
Hop test battery	LSI ≥ 85% on the four-test battery: single hop, triple hop, crossover hop, side hop[9]
Single-leg squat	Controlled, pain-free, symmetrical depth comparable to contralateral side[8]
Time — non-impact	~ 4–5 months for running, swimming, cycling, low-load fitness[2,12]
Time — cutting / pivoting / contact	~ 6 months for cutting, pivoting, deceleration, or contact. Bucket-handle repairs may extend to 6–7 months.[2,6,12]

WHY TIME AND CRITERIA BOTH MATTER

Stable meniscus repairs continue to function biomechanically during healing because hoop stress is preserved, but tissue-to-tissue integration of the repair construct still requires time. A patient who hits ≥ 85% LSI at 3 months is loading a repair that is biologically incomplete. Conversely, a patient at 6 months with persistent strength deficits is biologically ready but functionally not — and should not return until criteria are met.

References

1. Pujol N, Giordano AO, Wong SE, et al. The Formal EU-US Meniscus Rehabilitation 2024 Consensus: An ESSKA-AOSSM-AASPT Initiative. Part I — Rehabilitation Management After Meniscus Surgery. Knee Surg Sports Traumatol Arthrosc. 2025.
2. Monson JK, Tollefson LV, LaPrade CM, LaPrade RF. Current Rehabilitation Principles Following Meniscus Repairs. Curr Rev Musculoskelet Med. 2025;18(9):331–343.
3. O'Donnell K, Freedman KB, Tjoumakaris FP. Rehabilitation Protocols After Isolated Meniscal Repair: A Systematic Review. Am J Sports Med. 2017;45(7):1687–1697.
4. Lind M, Nielsen T, Faunø P, Lund B, Christiansen SE. Free Rehabilitation Is Safe After Isolated Meniscus Repair: A Prospective Randomized Trial Comparing Free With Restricted Rehabilitation Regimens. Am J Sports Med. 2013;41(12):2753–2758.
5. Favreau H, Maroteau G, Praz C, et al. Rehabilitation Protocol After Suturing the Medial Meniscus of a Stable Knee: A Retrospective Series of the Francophone Arthroscopy Society. Orthop Traumatol Surg Res. 2023;109(8S):103651.
6. Ross P, Livingston M, Saraf SM, Miller JR, Mulcahey MK. Bucket-Handle Meniscus Tears: Epidemiology, Diagnosis, Management, and Outcomes. JBJS Reviews. 2025;13(12).
7. Stokes DJ, Frank RM. Editorial Commentary: Meniscus Repair Technique Must Be Determined on a Tear-by-Tear Basis. Arthroscopy. 2024;40(9):2491–2493.
8. Schwach M, Dergham R, Klasan A, et al. Return-to-Sport Criteria After Isolated Meniscus Suture: Scoping Review of the Literature. Orthop Traumatol Surg Res. 2023;109(6):103604.
9. Noyes FR, Heckmann TP, Barber-Westin SD. Meniscus Repair and Transplantation: A Comprehensive Update. J Orthop Sports Phys Ther. 2012;42(3):274–290.
10. Trofa DP, Parisien RL, Noticewala MS, et al. Quality and Variability of Online Physical Therapy Protocols for Isolated Meniscal Repairs. J Knee Surg. 2019;32(6):544–549.
11. Albishi W, Al Yami I, Alyami A, Aldosari OA, AlJasser S. Rehabilitation Strategies Following Isolated Meniscal Repair: A Systematic Review of Protocols and Outcomes. J Clin Med. 2026;15(4):1616.
12. Bensa A, Piano A, Fumagalli GA, et al. Return to Sport After Meniscectomy, Meniscal Repair, and Meniscal Allograft Transplantation for Meniscal Lesions in Athletes: A Systematic Review and Meta-Analysis. Knee Surg Sports Traumatol Arthrosc. 2026.

Glossary

1RM — One-repetition maximum; the heaviest weight a person can lift once with proper form.
ACLR — Anterior cruciate ligament reconstruction.

AOP — Arterial occlusion pressure; the cuff pressure required to fully occlude arterial flow in a limb, used to set BFR cuff pressure individually.

BFR — Blood flow restriction training; low-load resistance training performed with a partially occlusive cuff to drive strength gains at lighter weights.

LSI — Limb Symmetry Index; the operative limb's strength or performance as a percentage of the contralateral limb (operative ÷ contralateral × 100). LSI ≥ 85% means the operative side reaches 85% of the uninvolved side.

NMES — Neuromuscular electrical stimulation; surface electrical stimulation used to augment voluntary muscle contraction.

NWB — Non–weight-bearing; no load placed through the operative limb.

PWB — Partial weight-bearing; a defined portion of body weight (here 50%) loaded through the operative limb, typically with crutch support.

ROM — Range of motion.

SLR — Straight leg raise.

WBAT — Weight-bearing as tolerated; the patient loads the operative limb to comfort, weaning assistive devices as gait normalizes.

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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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