

Arthroscopic Meniscectomy/Debridement/Chondroplasty Rehab Protocol

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General Principles of ACL Rehabilitation

ACL rehabilitation is a structured, phased process. Rehabilitation is primarily criterion-based, meaning progression through phases depends on the patient demonstrating readiness by achieving specific functional criteria, rather than strictly on time elapsed since surgery. Timeframes provided are approximate for the average patient and are not guidelines for progression.

Pre-operative Recommendations

- Normal gait
- AROM 0 to 120 degrees of flexion
- Strength: 20 SLR with no lag
- Minimal effusion
- Patient education on post-operative exercises and need for compliance
- Educated in ambulation with crutches.
- Wound care instructions

Important Considerations & Red/Yellow Flags

- **Physician Clearance:** Surgeon clearance is a mandatory criterion for return to sport.
- **Red/Yellow Flags:** These are signs/symptoms that require immediate office visit for re-evaluation.
 - Signs of Deep Vein Thrombosis (DVT): Localized tenderness along the deep venous system, diffuse redness of the lower extremity, entire lower extremity swelling, calf swelling >3 cm compared to asymptomatic limb.
 - Lack of full knee extension by 4 weeks (refer to surgeon).
 - Persistent reactive pain or effusion following therapy or Activities of Daily Living (ADLs). This indicates a need to decrease intensity of therapy interventions, continue effusion management, and provide patient education regarding activity modification until reactive symptoms resolve.

Quadriceps Tendon Autograft ACL Rehabilitation Protocol

This protocol is specific to patients with a quadriceps tendon autograft.

I. Protection Phase (Post-ACLR – 4 weeks)

- **Goal:** Restore ROM, minimize effusion and pain.
- **Precautions:**
 - No testing of repaired or reconstructed ligaments (Lachman, Anterior/Posterior Drawer, Varus/Valgus Stress) prior to 12 weeks post-operative.
 - No loaded open kinetic chain knee extension beyond 45 degrees for 8 weeks.
- **Pain and Effusion:** Management includes cryotherapy, compression (e.g., donut, ace wrap), and limited weight-bearing therapeutic exercise as appropriate.
- **ROM:**
 - Strong emphasis on patellar mobilizations (superior/inferior $>$ medial/lateral) to regain full knee ROM.

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- Emphasis on achieving full knee extension immediately after surgery. If full extension is not achieved by 4 weeks, contact the surgeon. Utilize low load, long duration stretching (e.g., bag hangs or prone hangs for 60 minutes total per day, ideally 4x15 minutes).
- ******Flexion:** No forced flexion past 90° for all meniscus repairs. For ACLR and meniscectomy patients, symmetrical flexion can be pursued. ****
- **Therapeutic Exercise Emphasis:** Quadriceps activation without gluteal co-contraction, restore patellar mobility, symmetrical ROM, decrease effusion, and ambulation with appropriate joint loading and without gait deviation.
- **Suggested Interventions:**
 - Extension ROM: Bag hangs or prone hangs.
 - Flexion ROM: Heel slides, wall slides, upright bike.
 - Patellar mobilization: Superior, inferior, medial, lateral.
 - Quad Isometrics; SLR 4-way.
 - TKE: Prone and standing.
 - Prone hamstring curls.
 - Weight shifting, SL balance.
 - Neuromuscular re-education using electrical stimulation (NMES) at 60° knee flexion. NMES pads are placed on the proximal and distal quadriceps. Patient is seated with knee in at least 60° flexion, shank secured. E-stim generates at least 50% of max volitional contraction against fixed resistance or maximal tolerable amperage without pain for 10-20 seconds on/50 seconds off for 15 minutes.
- **Criteria to Discharge Assistive Device:**
 - **ROM:** Full active knee extension equivalent to the healthy, contralateral limb; no pain on passive overpressure.
 - **Strength:** Able to perform strong quad isometric with full tetany and superior patellar glide and able to perform 2x10 supine SLR without quad lag.
 - **Effusion:** $\leq 1+$ is preferred (2+ acceptable if all other criteria are met).
 - **Weight Bearing:** Dependent on if concurrent meniscus repair/cartilage procedure recovery. Generally, patient demonstrates pain-free ambulation without visible gait deviation.

II. Early Loading Phase (4-8 weeks)

- **Goal:** Improve lower extremity loading symmetry, increase strength, and normalize gait mechanics.
- **Precautions:**
 - If full AROM knee extension is not achieved by 4 weeks, contact the surgeon.
 - Open Chain Knee Extension: Initiate unresisted LAQ (long arc quadriceps) at 4 weeks (partial to full range). Initiate multi-angle isometrics (from 90-60°) at 4 weeks. Begin isotonic open chain knee extensions through protected ROM (90-45°) at 6 weeks.
- **Pain and Effusion:** Cryotherapy/compression as needed for reactive effusion. Patellar taping and/or Cho-Pat strap to reduce patellofemoral (PF) symptoms if present.
- **ROM:** Monitor and progress knee ROM, patellar mobility, and LE flexibility. Continue emphasis on end-range ROM and bike for ROM and warm-up.
- **Suggested Interventions and Timelines:**
 - Multi-angle knee isometrics from 90-60°.
 - Initiate open chain knee extension exercises: Unresisted LAQ at 4 weeks, isotonic open chain knee extensions through protected ROM (90-45°) at 6 weeks.

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- Progress weight-bearing quadriceps exercises with emphasis on proper LE mechanics.
- Hamstring curls (prone, machine, or physio ball).
- Progress gluteal and lumbopelvic strength and stability.
- Progress single leg balance.
- Endurance: Low impact activities like treadmill walking, stepper, elliptical (starting at 6 weeks).
- NMES (using parameters from week 1-4).
- **Criteria to Discontinue NMES:** <20% quadriceps deficit on isometric testing. If a Biomedix machine is not available: 10 SLR without quad lag, normal gait, 10 heel taps to 60 degrees with good quality, 10 rep max on Leg Press (LP) with similar effort bilaterally, inability to break quad MMT.

III. Strength and Power Phase (8-12 weeks)

- **Goal:** Increase lower extremity strength and power.
- **Precautions:** Open chain knee extension: resisted open chain knee extension progressing from protected ROM to full ROM.
- **Pain and Effusion:** Cryotherapy/compression as needed for reactive effusion. Patellar taping and/or Cho-Pat strap to reduce PF symptoms if present.
- **ROM:** Monitor and progress knee ROM, patellar mobility, and LE flexibility. Consider higher level warm-ups, including bike sprints or Versaclimber. Continue aggressive techniques to achieve/maintain full knee extension if necessary (e.g., weighted bag hang).
- **Suggested Interventions and Timelines:**
 - Multi-angle knee isometrics from 90-0°.
 - Progress isotonic open chain knee extensions through full range (90-0°).
 - Continue isolated hamstring interventions: RDL (Romanian Deadlift), Nordic hamstring curls.
 - Progress gluteal and lumbopelvic strength and stability.
 - Progress single leg balance.
 - Initiate PWB (partial weight-bearing) plyometrics on shuttle (8-10 weeks).
 - NMES if appropriate (using parameters from week 1-4).
- **Criteria to Initiate Running and Jumping:**
 - **ROM:** Full, pain-free knee ROM, symmetrical with the uninvolved limb.
 - **Strength:** Isokinetic testing 80% or greater for hamstring and quad at 60°/sec and 300°/sec.
 - **Effusion:** $\leq 1+$.
 - **Weight Bearing:** Normalized gait and jogging mechanics.
 - **Neuromuscular Control:** Pain-free hopping in place.

IV. Return to Function Phase (12 weeks-Return to Sport)

- **Precautions to Initiate Hopping:**
 - Full, pain-free ROM.
 - $\leq 1+$ effusion.
 - $\geq 80\%$ isokinetic strength symmetry (hamstrings and quadriceps) OR $\geq 80\%$ limb symmetry on acceptable isokinetic alternative.
- **Precautions to Initiate Jogging (in addition to hopping criteria):**
 - Hop downs with appropriate landing mechanics.

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- Audible rhythmic strike patterns and no gross visual compensation.
- **Pain and Effusion:** Effusion may increase with increased activity; $\leq 1+$ and/or non-reactive effusion is required for progression of plyometrics.
- **ROM:** Full, symmetrical to contralateral limb, and pain-free with overpressure.
- **Therapeutic Exercise:** Focus on performance of quadriceps, hamstrings, and trunk dynamic stability; muscle power generation and absorption via plyometrics; sport- and position-specific activities; begin agility exercises between 50-75% effort (utilize visual feedback); advance plyometrics from bilateral to single leg, altering surfaces, adding ball toss, 3D rotations, etc..
- **Suggested Interventions:**
 - **Therapeutic Exercise/Neuromuscular Re-education:** Squats, leg extension, leg curl, leg press, deadlifts, multi-direction lunges, crunches, rotational trunk exercises on static and dynamic surfaces, monster walks, PWB to FWB jumping, single-leg squats on BOSU with manual perturbation, single-leg BOSU balance, single-leg BOSU Romanian deadlift.
 - **Agility:** Side shuffling, Carioca, Figure 8, Zig-zags, Resisted jogging (Sports Cord) in straight planes, backpedaling.
 - **Plyometrics:** Single-leg hop downs from increasing height (up to 12" box), single-leg hop-holds, double and single-leg hopping onto unstable surface, double and single-leg jump-turns, repeated tuck jumps.
- **Criteria for Return to Sport:**
 - **ROM:** Full, pain-free knee ROM, symmetrical with the uninvolved limb.
 - **Strength:** Isokinetic testing 90% or greater for hamstring and quad at 60°/sec and 300°/sec.
 - **Effusion:** No reactive effusion $\leq 1+$ with sport-specific activity.
 - **Weight Bearing:** Normalized gait and jogging mechanics.
 - **Neuromuscular Control:** Appropriate mechanics and force attenuation strategies with high-level agility, plyometrics, and high impact movements.
 - **Functional Hop Testing:** Limb Symmetry Index (LSI) $\geq 90\%$ for all tests (refer to Appendix E).
 - **Physician Clearance.**

General ACL Rehabilitation Protocol (e.g., for Allografts)

The following guidelines outline the general ACL rehabilitation protocol for patients who undergo reconstruction with allograft tissue.

I. Early Post-Operative Phase (Post-ACLR – 4 weeks) / Immediate Post-operative Phase (Surgery to 2 weeks)

- **Goals:** Restore ROM, minimize effusion and pain. Achieve full knee extension ROM, good quadriceps control (>20 no lag SLR), minimize pain and swelling, and achieve normal gait pattern.
- **Precautions:**
 - No testing of repaired or reconstructed ligaments (Lachman, Anterior/Posterior Drawer, Varus/Valgus Stress) prior to 12 weeks.
 - No loaded open kinetic chain knee extension for 8 weeks.

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- **Crutch Use (MOON):** Weight-bearing as tolerated (WBAT) with crutches starting the day of surgery. Discontinue crutches when normal gait pattern is achieved, and the patient can safely ascend/descend stairs without noteworthy pain or instability.
- **Knee Immobilizer (MOON):** None, except for the first 24 hours after a femoral nerve block.
- **Pain and Effusion:** Manage with cryotherapy and compression (e.g., donut, ace wrap, limited WB therapeutic exercise).
- **ROM:**
 - Emphasis on achieving full knee extension immediately after surgery. Contact surgeon if not achieved by 4 weeks. Use low load, long duration stretching (e.g., heel prop, prone hang).
 - For meniscus repairs, no forced flexion past 90°. For ACLR and meniscectomy, push for symmetrical flexion as appropriate.
 - Flexion ROM: Heel slides, wall slides, upright bike, seated assisted knee flexion, bike rocking-for-range.
 - Patellar mobilization (medial/lateral initially, then superior/inferior).
- **Therapeutic Exercise Emphasis:** Quad activation without gluteal co-contraction, restore patellar mobility, symmetrical ROM, decrease effusion, ambulation with appropriate joint loading and without gait deviation.
- **Suggested Interventions:** Quad Isometrics, SLR 4-way, TKE (prone and standing), LAQ, Weight shifting, SL balance, NMES at 60° knee flexion. NMES parameters are similar to the quadriceps tendon autograft protocol.
- **Criteria to Progress to Middle Phase of Rehab (General Protocol):**
 - **ROM:** ≥ 0 -120 degrees. For MOON, no greater than 5° active extension lag, 110° active flexion.
 - **Strength:** Quadriceps set with normal superior patellar translation, SLR x 10 seconds without extensor lag. For MOON, 20 no lag SLR.
 - **Effusion:** $\leq 2+$ with Modified Stroke Test. Minimal effusion/pain (MOON).
 - **Weight Bearing:** Able to tolerate CKC therex program without increased pain and $\leq 2+$ effusion.
 - **Functional (MOON):** Normal gait, crutch/immobilizer discharge.

II. Middle Phase of Rehabilitation (4-12 weeks) / Early Rehabilitation Phase (weeks 2 to 6) & Strengthening & Control Phase (weeks 7 through 12)

- **Goals:** Increase lower extremity strength and power, improve LE loading symmetry, normalize gait mechanics, progress neuromuscular retraining.
- **Precautions (Open Chain Knee Extension):** Initiate submaximal leg extension 90-45 degrees. Initiate active knee ROM 90-0 degrees (modify if painful). No isolated resisted hamstrings strengthening until 8 weeks.
- **Suggested Interventions:**
 - **ROM:** Continue monitoring and progressing knee ROM, patellar mobility, and LE flexibility. Continue bike for ROM and warm up. Begin more aggressive techniques for full knee extension (e.g., weighted bag hang).
 - **Strengthening:** Multi-angle knee isometrics (60-90° for patients unable to tolerate high-intensity NMES; 90-0° for Strength & Power phase), open chain knee extension exercises

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(unweighted full range LAQ, protected range with isotonic progression), progress WB quadriceps and hamstring exercises (no isolated HS until 8 weeks), progress gluteal and lumbopelvic strength and stability, progress single leg balance.

- Quadriceps: Mini-squats/wall-squats, Steps-ups, Knee extension 90o to 40o/90o to 0o, Leg press, Shuttle Press.
- Hamstrings: Hamstring curls, Resistive SLR with sports cord, RDL, Nordic hamstring curls.
- Other: Hip adduction/abduction, standing heel raises, seated calf press, multi-hip machine.
- **Endurance:** Low impact activities like treadmill walking, stepper, elliptical (starting at 6 weeks).
- **Plyometrics:** Initiate PWB plyometrics on shuttle (8-10 weeks).
- **Neuromuscular Training:** Wobble board, rocker board, single-leg stance with or without equipment, slide board, Fitter, perturbation training, instrumented testing systems, varied surfaces.
- **Cardiopulmonary:** Bike, elliptical trainer, Stairmaster. Straight line running on treadmill or in a protected environment (NO cutting or pivoting).
- **Criteria to Initiate Running and Jumping (Middle Phase):** Same as the Quadriceps Tendon Autograft protocol.
- **Criteria to Progress to Late Phase of Rehab (General Protocol):**
 - **ROM:** Maintain full, pain-free AROM including patellofemoral mobility.
 - **Effusion:** 1+ or less.
 - **Strength:** Isometric or isokinetic quadriceps and hamstrings strength $\geq 80\%$.
 - **Weight Bearing:** Able to tolerate therapeutic exercise program, including jogging progression, without increased pain or $>1+$ effusion.
 - **Neuromuscular Control:** Demonstrates proper lower extremity mechanics with all therapeutic exercises (bilaterally).

III. Late Phase of Rehabilitation (weeks 12-Return to Sport) / Advanced Training Phase (weeks 13 to 16) & Return-to-Sport Phase (weeks 17 to 20)

- **Precautions to Initiate Hopping:** Full, pain-free ROM, $\leq 1+$ effusion, $\geq 80\%$ isometric strength symmetry (hamstrings and quadriceps) OR 20 heel touches on 8 inch step with good mechanics.
- **Precautions to Initiate Jogging (in addition to above criteria):** Hop downs with appropriate landing mechanics, audible rhythmic strike patterns and no gross visual compensation.
- **Pain and Effusion:** Effusion may increase with increased activity; $\leq 1+$ and/or non-reactive effusion for progression of plyometrics.
- **ROM:** Full, symmetrical to contralateral limb, and pain-free with overpressure.
- **Therapeutic Exercise:** Performance of quadriceps, hamstrings, and trunk dynamic stability; muscle power generation and absorption via plyometrics; sport- and position-specific activities; begin agility exercises between 50-75% effort; advance plyometrics.
- **Suggested Interventions:**
 - **Therapeutic Exercise/Neuromuscular Re-education:** Squats, leg extension, leg curl, leg press, deadlifts, multi-direction lunges, crunches, rotational trunk exercises, monster

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walks, PWB to FWB jumping, single-leg squats on BOSU with manual perturbation to trunk or legs, single-leg BOSU balance, single-leg BOSU Romanian deadlift.

- **Agility:** Side shuffling, Carioca, Figure 8, Zig-zags, Resisted jogging (Sports Cord), backpedaling.
- **Plyometrics:** Single-leg hop downs from increasing height (up to 12" box), single-leg hop-holds, double and single-leg hopping onto unstable surface, double and single-leg jump-turns, repeated tuck jumps.
- **Sport Specific Activities (MOON):** Interval training programs, running patterns, sprinting, change of direction, pivot and drive, kicking, spiking, skill/biomechanical analysis.
- **Criteria for Return to Sport:** Same as the Quadriceps Tendon Autograft protocol.
 - **MOON specific criteria:** Maximum vertical jump without pain or instability, 75% of contralateral on hop tests, Figure-8 run at 75% speed without difficulty, 8 for progression to Phase 5. For final return to sport: No functional complaints, Confidence when running, cutting, jumping at full speed, 85% contralateral values on hop tests.

Specifications for Concomitant Meniscus Repair

If a patient has concurrent meniscus repair work performed with their ACL reconstruction, specific precautions and considerations apply across the protocols:

- **Flexion Restrictions:**
 - No forced flexion ROM beyond 90° for 4 weeks.
 - For ACLR and meniscectomy (not repair), pushing for symmetrical flexion is generally appropriate.
- **Weight Bearing and Exercise Restrictions:**
 - No loaded open kinetic chain knee extension beyond 45 degrees for 8 weeks.
 - No CKC (Closed Kinetic Chain) exercises >90° for 8 weeks.
 - No weight-bearing (WB) therapeutic exercise >90° for 8 weeks.
- **Partial Weight Bearing (PWB):**
 - PWBing x 4 weeks for concomitant root, radial, and/or horizontal cleavage meniscus repairs only.
 - All other types of meniscus repairs will be FWBing (Full Weight Bearing).
 - Always refer to the “post-op plan” section of the operative note for clarification regarding meniscus repair specifics.