

# ACL CLINICAL PRACTICE GUIDELINE

## Summary of Recommendations

<b>Precautions</b>	<ol style="list-style-type: none"> <li>1. No testing of repaired or reconstructed ligaments (Lachman, Anterior/Posterior Drawer, Varus/Valgus Stress) prior to 12 WEEKS</li> <li>2. No isotonic resisted hamstring exercises for 8 weeks with hamstring autograft</li> <li>3. No loaded open kinetic chain knee extension beyond 45 degrees for 8 WEEKS</li> <li>4. Meniscus Repair:             <ol style="list-style-type: none"> <li>a. No weight-bearing (WB) therapeutic exercise &gt;90° x 8 WEEKS</li> <li>b. PWB x4 WEEKS</li> <li>c. No forced flexion beyond 90° x4 WEEKS</li> </ol> </li> </ol>
<b>Outcome Tools</b>	<p>Collect at least one of the following at initial evaluation, monthly and discharge. Be consistent with which outcome tool is collected each time.</p> <ol style="list-style-type: none"> <li>1. IKDC</li> <li>2. KOOS</li> <li>3. ACL-RSI</li> <li>4. Tegner</li> </ol>
<b>Strength Testing</b>	<ol style="list-style-type: none"> <li>1. Isometric testing anytime- fixed at 90°</li> <li>2. Isokinetic testing no earlier than 12 weeks</li> </ol>
<b>Criteria to Discharge Assistive Device</b>	<ol style="list-style-type: none"> <li>1. <u>ROM</u>: Full active knee extension; no pain on passive overpressure</li> <li>2. <u>Strength</u>: Able to perform strong quad isometric with full tetany and superior patellar glide and able to perform 2x10 SLR without quad lag</li> <li>3. <u>Effusion</u>: 1+ or less is preferred (2+ acceptable if all other criteria are met)</li> <li>4. <u>Weight Bearing</u>: Demonstrates pain-free ambulation without visible gait deviation</li> </ol>
<b>Criteria to Initiate Running and Jumping</b>	<ol style="list-style-type: none"> <li>1. <u>ROM</u>: full, pain-free knee ROM, symmetrical with the uninvolved limb</li> <li>2. <u>Strength</u>: Isokinetic testing 80% or greater for hamstring and quad at 60°/sec and 300°/sec</li> <li>3. <u>Effusion</u>: 1+ or less</li> <li>4. <u>Weight Bearing</u>: normalized gait and jogging mechanics</li> <li>5. <u>Neuromuscular Control</u>: Pain-free hopping in place</li> </ol>
<b>Criteria for Return to Sport</b>	<ol style="list-style-type: none"> <li>1. <u>ROM</u>: full, painfree knee ROM, symmetrical with the uninvolved limb</li> <li>2. <u>Strength</u>: Isokinetic testing 90% or greater for hamstring and quad at 60°/sec and 300°/sec</li> <li>3. <u>Effusion</u>: No reactive effusion ≥ 1+ with sport-specific activity</li> <li>4. <u>Weight Bearing</u>: normalized gait and jogging mechanics</li> <li>5. <u>Neuromuscular control</u>: appropriate mechanics and force attenuation strategies with high level agility, plyometrics, and high impact movements</li> <li>6. <u>Functional Hop Testing</u>: LSI 90% or greater for all tests</li> <li>7. <u>Physician Clearance</u></li> </ol>

## Early Post-Operative Phase (Post-ACLR – 4 weeks)

<b>Appointments</b>	Post-operative evaluation should be performed 3-5 days following surgery. Follow-up appointments 1-2x per week, depending on progression towards goals.
<b>Precautions</b>	<ol style="list-style-type: none"> <li>1. No testing of repaired or reconstructed ligaments (Lachman, Anterior/Posterior Drawer, Varus/Valgus Stress) prior to 12 WEEKS</li> <li>2. No loaded open kinetic chain knee extension for 8 WEEKS</li> <li>3. Meniscus Repair: <ol style="list-style-type: none"> <li>a. No weight-bearing (WB) therapeutic exercise &gt;90° x 8 WEEKS</li> <li>b. PWB x4 WEEKS</li> <li>c. No forced flexion beyond 90° x4 WEEKS</li> </ol> </li> </ol>
<b>Pain and Effusion</b>	≥ 2+ (using Modified Stroke Test) Cryotherapy and compression (ie. Donut, ace wrap, limited WB therapeutic exercise)
<b>ROM</b>	<p><u>Extension</u>: Emphasis on achieving full knee extension immediately following surgery. If full extension is not achieved by 4 weeks, contact surgeon regarding ROM concerns.</p> <p><u>Flexion</u>: No forced flexion past 90° for meniscus repairs. ACLR and meniscectomy are able to push for symmetrical flexion as appropriate.</p>
<b>Therapeutic Exercise</b>	<ul style="list-style-type: none"> <li>• Emphasis on quad activation without gluteal co-contraction</li> <li>• Restore patellar mobility</li> <li>• Symmetrical ROM</li> <li>• Decrease effusion</li> <li>• Ambulation with appropriate joint loading and without obvious gait deviation</li> </ul>
<b>Suggested Interventions</b>	<ul style="list-style-type: none"> <li>• Extension ROM: bag hangs or prone hangs</li> <li>• Flexion ROM: heel slides, wall slides, upright bike</li> <li>• Patellar mobilization: superior, inferior, medial, lateral</li> <li>• Quad Isometrics; SLR 4-way</li> <li>• TKE: prone and standing</li> <li>• LAQ</li> <li>• Weight shifting, SL balance</li> <li>• Neuromuscular re-education using electrical stimulation (NMES) at 60° knee flexion</li> </ul>
<b>NMES Parameters</b>	<ul style="list-style-type: none"> <li>• NMES pads are placed on the proximal and distal quadriceps</li> <li>• Patient: Seated with the knee in at least 60° flexion, shank secured with strap and back support with thigh strap preferred. The ankle pad/belt should be two finger widths superior to the lateral malleoli</li> <li>• The patient is instructed to relax while the e-stim generates at least 50% of their max volitional contraction against a fixed resistance OR maximal tolerable amperage without knee joint pain</li> <li>• 10-20 seconds on/ 50 seconds off x 15 min</li> </ul>
<b>Criteria to Discharge Assistive Device</b>	<ol style="list-style-type: none"> <li>1. <u>ROM</u>: Full active knee extension; no pain on passive overpressure</li> <li>2. <u>Strength</u>: Able to perform strong quad isometric with full tetany and superior patellar glide and able to perform 2x10 SLR without quad lag</li> <li>3. <u>Effusion</u>: 1+ or less is preferred (2+ acceptable if all other criteria are met)</li> <li>4. <u>Weight Bearing</u>: Demonstrates pain-free ambulation without visible gait deviation</li> </ol>
<b>Criteria to Progress to Middle Phase of Rehab</b>	<p><u>ROM</u>: ≥ 0-120 degrees</p> <p><u>Strength</u>: Quadriceps set with normal superior patellar translation, SLR x 10 seconds without extensor lag</p> <p><b>Goals: (These do not limit progression to next phase; however, should be addressed with interventions)</b></p> <p><u>Effusion</u>: 2+ or less with Modified stroke test</p> <p><u>Weight Bearing</u>: Able to tolerate CKC therex program without increased pain and ≥ 2+ effusion</p>

## Middle Phase of Rehabilitation (4-12 weeks)

<b>Appointments</b>	Goal to increase lower extremity strength. 1-2 visits per week with emphasis on patient compliance with resistance training as part of HEP (2-3 days per week outside of therapy).
<b>Precautions</b>	Open Chain knee extension: <ul style="list-style-type: none"> <li>• Initiate submaximal leg extension 90-45 degrees</li> <li>• Initiate active knee ROM 90-0 degrees (modify if painful)</li> </ul> No isolated resisted hamstrings strengthening until 8 weeks
<b>Pain and Effusion</b>	Cryotherapy/compression as needed for reactive effusion. Patellar taping to reduce PF symptoms if present
<b>ROM</b>	<ul style="list-style-type: none"> <li>• Monitor and progress knee ROM, patellar mobility, and LE flexibility</li> <li>• Begin more aggressive techniques to achieve/maintain full knee extension (i.e. weighted bag hang) as needed</li> <li>• Continue bike for ROM and warm up</li> <li>• If full AROM knee extension is not achieved by 4 weeks, contact surgeon regarding ROM concerns.</li> </ul>
<b>Suggested Interventions and timelines</b>	<ul style="list-style-type: none"> <li>• Multi-angle knee isometrics from 60-90° for patients unable to tolerate high-intensity NMES</li> <li>• Initiate open chain knee extension exercises <ul style="list-style-type: none"> <li>○ Unweighted full range LAQ</li> <li>○ Protected range with isotonic progression</li> </ul> </li> <li>• Progress WB quadriceps and hamstring exercises with emphasis on proper LE mechanics (no isolated HS strengthening until 8 weeks)</li> <li>• Progress gluteal and lumbopelvic strength and stability</li> <li>• Progress single leg balance</li> <li>• Endurance: low impact - treadmill walking, stepper, elliptical (6 weeks)</li> <li>• Initiate PWB plyometrics on shuttle (8-10 weeks, see precautions to begin full WB plyometrics)</li> <li>• NMES (see parameters in week 1-4)</li> </ul>
<b>Criteria to d/c NMES</b>	<ul style="list-style-type: none"> <li>• &lt;20% quadriceps deficit on isometric or isokinetic testing</li> </ul> <b>OR- If a Biodex machine is not available:</b> <ol style="list-style-type: none"> <li>1. 10 SLR without quad lag</li> <li>2. Normal gait</li> <li>3. 10 heel taps to to 60 degrees with good quality</li> <li>4. 10 rep max on LP and similar effort bilaterally</li> <li>5. Inability to break quad MMT</li> </ol>
<b>Criteria to initiate Running and Jumping</b>	<ol style="list-style-type: none"> <li>1. <u>ROM</u>: full, pain-free knee ROM, symmetrical with the uninvolved limb</li> <li>2. <u>Strength</u>: Isokinetic testing 80% or greater for hamstring and quad at 60°/sec and 300°/sec</li> <li>3. <u>Effusion</u>: 1+ or less</li> <li>4. <u>Weight Bearing</u>: normalized gait and jogging mechanics</li> <li>5. <u>Neuromuscular Control</u>: Pain-free hopping in place</li> </ol>
<b>Criteria to Progress to Late Phase of Rehab</b>	<ol style="list-style-type: none"> <li>1. <u>ROM</u>: Maintain full, pain free AROM including PF mobility</li> <li>2. <u>Effusion</u>: 1+ or less</li> <li>3. <u>Strength</u>: Isometric or isokinetic quadriceps and hamstrings strength <math>\geq</math> 80%</li> <li>4. <u>Weight Bearing</u>: Able to tolerate therapeutic exercise program, including jogging progression, without increased pain or <math>&gt;1+</math> effusion</li> <li>5. <u>Neuromuscular Control</u>: Demonstrates proper lower extremity mechanics with all therapeutic exercises (bilaterally)</li> <li>6. <u>Outcome Tools</u>: <math>\geq</math>7/10 on #10 IKDC Questionnaire</li> </ol>

## Late Phase of Rehabilitation (weeks 12-Return to Sport)

<b>Appointments</b>	Increased frequency from previous stage to 1-2x per week when appropriate to initiate plyometric training and return to running program.
<b>Precautions</b>	<p>Criteria to initiate hopping</p> <ul style="list-style-type: none"> <li>• Full, pain free ROM</li> <li>• ≤ 1+ effusion</li> <li>• ≥ 7 /10 on #10 IKDC Questionnaire (Appendix A)</li> <li>• ≥ 80% isometric strength symmetry (hamstrings and quadriceps) OR 20 heel touches on 8 inch step with good mechanics</li> </ul> <p>Criteria to initiate jogging (in addition to above criteria)</p> <ul style="list-style-type: none"> <li>• Hop downs with appropriate landing mechanics</li> <li>• Audible rhythmic strike patterns and no gross visual compensation</li> </ul>
<b>Pain and Effusion</b>	Effusion may increase with increased activity, ≤1+ and/or non-reactive effusion for progression of plyometrics
<b>ROM</b>	Full, symmetrical to contralateral limb, and painfree with overpressure
<b>Therapeutic Exercise</b>	<ul style="list-style-type: none"> <li>• Performance of the quadriceps, hamstrings and trunk dynamic stability</li> <li>• Muscle power generation and absorption via plyometrics</li> <li>• Sport- and position-specific activities</li> <li>• Begin agility exercises between 50-75% effort (utilize visual feedback to improve mechanics as needed)</li> <li>• Advance plyometrics: Bilateral to single leg, progress by altering surfaces, adding ball toss, 3D rotations, etc.</li> </ul>
<b>Suggested Interventions</b>	<p>Therapeutic Exercise/Neuromuscular Re-education</p> <ul style="list-style-type: none"> <li>• Squats, leg extension, leg curl, leg press, deadlifts, lunges (multi-direction), crunches, rotational trunk exercises on static and dynamic surfaces, monster walks, PWB to FWB jumping</li> <li>• Single-leg squats on BOSU with manual perturbation to trunk or legs, Single-leg BOSU balance, single-leg BOSU Romanian deadlift</li> </ul> <p>Agility</p> <ul style="list-style-type: none"> <li>• Side shuffling, Carioca, Figure 8, Zig-zags, Resisted jogging (Sports Cord) in straight planes, backpedaling</li> </ul> <p>Plyometrics</p> <ul style="list-style-type: none"> <li>• 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</li> </ul>
<b>Criteria for Return to Sport</b>	<ol style="list-style-type: none"> <li>1. <u>ROM</u>: full, pain free knee ROM, symmetrical with the uninvolved limb</li> <li>2. <u>Strength</u>: Isokinetic testing 90% or greater for hamstring and quad at 60°/sec and 300°/sec</li> <li>3. <u>Effusion</u>: No reactive effusion ≥ 1+ with sport-specific activity</li> <li>4. <u>Weight Bearing</u>: normalized gait and jogging mechanics</li> <li>5. <u>Neuromuscular control</u>: appropriate mechanics and force attenuation strategies with high level agility, plyometrics, and high impact movements</li> <li>6. <u>Functional Hop Testing</u>: LSI 90% or greater for all tests</li> <li>7. <u>Physician Clearance</u></li> </ol>