**Phase 0, Pre-operative phase**. Reduce pain and swelling, regain near full range of motion.

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| PRECAUTIONS | - Avoid pain with range of motion (ROM) and strengthening exercise  - Modify or minimize activities that increase pain and/or swelling  - Use appropriate assistive device as needed |
| Emphasize | - Familiarization with post-operative plan of care  - Quadriceps contraction  - Control swelling  - Knee ROM with focus on extension unless mechanically blocked |
| Assessment | - Lower Extremity Functional Scale (LEFS)  - International Knee Documentation Committee (IKDC)  - SANE  - ACL RSI  - Numeric pain rating scale (NPRS)  - Swelling and gait  - Quality of quadriceps contraction  - Lower extremity (LE) active and passive ROM (AROM & PROM)  - Single limb stance (SLS) if appropriate  - Current activity level/demands on LE |
| Treatment Recommendations | - Patient education  - Post-operative plan of care  - Edema control  - Activity modification  - Gait training with expected post-operative assistive device  \* Basic home exercise program (HEP)   * Ankle pumps, quadriceps sets, gluteal sets * Knee flexion and extension AAROM * Straight leg raises in multiple planes * LE flexibility exercises e.g. supine calf and hamstring stretches * Passive knee extension with towel roll under heel * Plantar flexion with elastic band or calf raises   \* Additional recommendations for patients attending multiple sessions pre-operatively   * Edema management * ROM exercises * LE flexibility exercises * LE progressive resistive exercises * Balance/proprioceptive training * Stationary bike |
| Goals of pre-operative phase | - Knee PROM: full extension to 120° degrees flexion  - Minimal to no swelling  - Active quadriceps contraction with superior patella glide  - Straight leg raise without an extensor lag  - Demonstrates normal gait  - Able to ascend stairs  - Able to verbalize/demonstrate post-operative plan of care |

**Day of Surgery**. Rest and recover.

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| PRECAUTIONS | - Avoid prolonged standing and walking  - Avoid advancing weight bearing (WB) too quickly which may prolong recovery  - Avoid pain with walking and exercises  - Avoid painful activities  - Avoid putting heat on knee  - Avoid weightbearing without brace  - Avoid ambulating without crutches  - Do not put a pillow under the operated knee- keep extended when resting and sleeping |
| Emphasize | - Control swelling  - Quadriceps contraction  - Independent transfers  - Gait training with appropriate assistive device  - P/AAROM (focus on extension)  - Appropriate balance of activity and rest |
| Assessment | - Mental status: Alert and Oriented x3  - NPRS  - Wound status  - Swelling  - P/AAROM of knee  - Post-anesthesia sensory motor screening  - Functional status including ability to manage brace |
| Treatment Recommendations | - Transfer training  - Gait training WBAT with assistive device on level surfaces and stairs  \* Patient education:   * Edema management * Activity modification * Brace management   \* Initiate and emphasize importance of HEP   * Quadriceps sets, gluteal sets, ankle pumps, * Seated knee AAROM * Straight leg raise with brace locked in extension, if able * Passive knee extension with towel roll under heel |
| Criteria for Discharge | - Independent ambulation with appropriate assistive device on level surfaces and stairs  - Independent brace management  - Independent with transfers  - Independent with HEP  - Independent with ADLs  - Independent with home exercise program (HEP) |

**Phase I, 0-2 weeks**. Pain and edema control, start flexibility and strengthening exercises.

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| PRECAUTIONS | - Do not put a pillow under the operated knee for comfort when elevating LE  - Avoid active knee extension 0° - 40° (i.e. open chain exercises)  - Avoid ambulation without brace locked at 0°  - Avoid heat application  - Avoid prolonged standing/walking  - Avoid ambulating without crutches |
| Emphasize | - Patellar mobility  - Full PROM knee extension  - Improving quadriceps contraction  - Controlling pain and swelling  - Compliance with HEP and precautions |
| **Special Considerations** | See **Appendix 1** for changes to weight bearing status and ROM restrictions based on any concomitant procedures performed (i.e. meniscal repair) |
| Assessment | - LEFS, IKDC, SANE, ACL RSI, NPRS  - Swelling  - Girth measurements  - Gait and Neurovascular assessment  - Wound status  - Patellar mobility  - Quality of quadriceps contraction  - LE AROM and PROM  - Straight leg raise (SLR) in supine  - Single leg stance, when appropriate |
| Treatment Recommendations | - Passive knee extension with towel under heel  - Quadriceps re-education: quadriceps sets with towel under knee with neuromuscular electric stimulation (NMES) or biofeedback  - Patellar mobilization  - AROM knee flexion to tolerance, AAROM knee extension to 0°  - SLR in all planes (With brace locked at 0° in supine)  - Hip progressive resistive exercises  - Calf strengthening (Unilateral elastic band & bilateral calf raises)  - Leg press bilaterally in 80°-5° arc if knee flexion ROM > 90°  - Initiate flexibility exercises  - Proprioception board/balance system (bilateral WB)  - Stationary bicycle:   * Short (90mm) crank ergometry (requires knee flexion > 85°) * Standard crank for ROM and/or cycle (requires 115° knee flexion)   - Upper extremity ergometry, as tolerated  - Gait training with progressive WB   * Gradual progression with brace locked at 0° with crutches   - Edema management, e.g. cryotherapy (no submersion), elevation, gentle edema mobilization avoiding incision  - Progressive home exercise program |
| Criteria for Advancement | - Ability to SLR without quadriceps lag or pain  - Knee ROM 0°-90°  - Pain and swelling controlled |

**Phase II, 2-6 weeks**. Progressive strengthening while protecting the repair.

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| PRECAUTIONS | - Do not put a pillow under the operated knee for comfort when elevating LE  - Avoid active knee extension 0° - 40° (i.e. open chain exercises)  - Monitor tolerance to load, frequency, intensity and duration  - Avoid heat application  - Avoid prolonged standing/walking  - Do not wean off crutches until sufficient control is obtained and gait is normalized  - Avoid ascending/descending stairs reciprocally until adequate quadriceps control & lower extremity alignment obtained |
| Emphasize | - Knee ROM  - Patella mobility  - Quadriceps contraction  - Normalizing gait pattern  - Activity level to match response and ability |
| **Special Considerations** | See **Appendix 1** for changes to weight bearing status and ROM restrictions based on any concomitant procedures performed (i.e. meniscal repair) |
| Assessment | - LEFS, IKDC, SANE, ACL RSI, NPRS  - Swelling  - Girth measurements  - Gait and Neurovascular assessment  - Wound status  - Patellar mobility  - Quality of quadriceps contraction  - LE AROM and PROM  - Straight leg raise (SLR) in supine  - Single leg stance, when appropriate |
| Treatment Recommendations | - Passive knee extension with towel under heel  - Quadriceps re-education: quadriceps sets with towel under knee with neuromuscular electric stimulation (NMES) or biofeedback  - Patellar mobilization  - AROM knee flexion to tolerance, AAROM knee extension to 0°  - Progression from seated to standing (wall slides) to bike ROM  - Straight leg raises (SLR) PRE's in all planes   * With brace locked at 0° in supine until no extension lag * Brace may be removed in other planes   - Leg press bilaterally in 80°-5° arc if knee flexion ROM > 90°   * Progression from bilaterally, to 2 up/1 down, to unilateral   - Functional strengthening   * Mini squats up to 0°-60°, initiating movement with hips * Forward step-up progression starting with 2”-4”   - Terminal knee extension in weight bearing  - Consider blood flow restriction (BFR) program  - Hip-gluteal progressive resistive exercises   * May introduce Romanian Dead Lift toward end of phase   - Hamstring strengthening  - Calf strengthening (Progression to unilateral calf raises)  - Flexibility exercises  TREATMENT RECOMMENDATIONS CONTINUED  - Proprioception board/balance system   * Progression from bilateral to unilateral weight bearing * Once single leg stance achieved with good alignment and control, progress from stable to unstable surfaces   - Stationary bicycle   * Standard crank for ROM and/or cycling (requires 115° knee flexion)   - Upper extremity ergometry, as tolerated  - Gait training WBAT; may still have brace locked at 0° and crutches (see appendix 2)  - Edema management, e.g. cryotherapy (no submersion until incision adequately healed), elevation, gentle edema mobilization avoiding incision  - Progressive home exercise program  - Patient education regarding monitoring of response to increase in activity level and weightbearing |
| Criteria for Advancement | - Knee ROM 0°-130°  - Good patellar mobility  - Minimal swelling  - Single leg stance full weight bearing without pain  - Non-antalgic gait  - Ascend 6” stairs with good control without pain |

**Phase III, 7-12 weeks**. Regain functional movement and strength.

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| PRECAUTIONS | - Do not put a pillow under the operated knee- keep extended when resting and sleeping  - Avoid pain with exercises, standing, walking and other activities  - Monitor tolerance to load, frequency, intensity and duration  - Avoid too much too soon  - Avoid active knee extension 0° - 40° (i.e. open chain exercises)  until post-op week 12 |
| Emphasize | - Address impairments  - Functional movement and strength  - Activity level to match response and ability |
| Assessment | - LEFS, IKDC, SANE, ACL RSI, NPRS  - Swelling  - Girth measurements  - Gait and Neurovascular assessment  - Wound status  - Patellar mobility  - Quality of quadriceps contraction  - LE AROM and PROM  - Straight leg raise (SLR) in supine  - Functional assessment, e.g. single leg stance, step ups/downs, squat, gait  - Balance testing, e.g. Star Excursion Test, Biodex Balance SystemTM  - Quadriceps isometrics testing with dynamometer at 60° at 12 weeks |
| Treatment Recommendations | - Patellar mobilization  - AROM knee flexion to tolerance  - AAROM knee extension to 0°  - SLR PRE's in all planes  - Isometric knee extension at 60°  - Open chain knee extension progression   * At week 12 initiate PRE in limited arc 90°-40°   - Leg press eccentrically  \*Functional strengthening   * Progress squats to 0°-90°, initiating movement with hips * Continue forward step-up progression * Initiate step-down progression starting with 2”-4” * Lateral step-ups, crossovers * Lunges   - Continue foundational hip-gluteal progressive resistive exercises  - Continue hamstring and calf strengthening  - Flexibility exercises and foam rolling  - Core and UE strengthening  - Consider BFR program  TREATMENT RECOMMENDATIONS CONTINUED  \* Proprioception training   * Continue foundational exercises * Progress to perturbation training   \* Cardiovascular conditioning   * Stationary bicycle * Elliptical when able to perform 6” step-up with good form   - Gait training WBAT  - Cryotherapy   * Ice with passive knee extension with towel under heel as needed to maintain ROM   - Progressive home exercise program  - Patient education regarding monitoring of response to increase in activity level |
| Criteria for Advancement | - Ability to perform 8” step-down with good control and alignment without pain  - Full symmetrical knee ROM  - Symmetrical squat to parallel  - Single leg bridge holding for 30 seconds  - Balance testing and quadriceps isometrics 70% of contralateral lower extremity |

**Phase IV, 13-26 weeks**. Begin job- or sport-specific training.

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| PRECAUTIONS | - Initiate return to running/sport only when cleared by physician  - Avoid pain with exercises and functional training  - Monitor tolerance to load, frequency, intensity and duration  - Avoid too much too soon |
| Emphasize | - Address impairments  - Return to normal functional activities |
| Assessment | - LEFS, IKDC, SANE, ACL RSI, NPRS  - Swelling  - Girth measurements  - LE AROM and PROM  - Functional assessment, e.g. single leg stance, step ups/downs, squat, gait  - Balance testing, e.g. Star Excursion Test, Biodex Balance SystemTM  - Quadriceps isometrics or isokinetic testing  - QMA – Quality of Movement Testing |
| Treatment Recommendations | \* Open chain knee extension progression   * At week 12 initiate PRE in limited arc 90°-40° * Progress to 90°-30° * Progress to 90°-0° by end of phase   - Progress leg press eccentrically  \* Functional strengthening   * Progress squats to 0°-90°, initiating movement with hips * Progress to single leg squats * Forward step-up and step-down progression * Progress lateral step-ups, crossovers * Progress lunges   - Initiate running progression (**see appendix 3**)  - Initiate plyometric progression (**see appendix** **4**)  - Continue foundational hip-gluteal progressive resistive exercises  - Continue hamstring and calf strengthening  - Flexibility exercises and foam rolling  - Core and UE strengthening  - Consider BFR program  \* Progress proprioception training   * Continue foundational exercises * Incorporate agility and controlled sports-specific movements   \* Progress cardiovascular conditioning   * Stationary bicycle * Elliptical   - Cryotherapy and/or compression therapy  - Progressive home exercise program  - Patient education regarding monitoring of response to increase in activity level |
| Criteria for Advancement | - No swelling  - Normal neurovascular assessment  - Normal scar and patellar mobility  - Normal quadriceps contraction  - Full LE ROM, flexibility and strength  - Quantitative assessments = 85% of contralateral lower extremity |

**Phase V, weeks 27 - discharge**. Return to full activity without impairment or restrictions.

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| PRECAUTIONS | - Note importance of gradual return to participation with load and volume monitoring under guidance of physical therapist, MD, athletic trainer and coach  - Avoid premature or too rapid full return to sport |
| Emphasize | - Return to participation  - Collaboration with Sports Performance experts |
| Assessment | - LEFS, IKDC, SANE, ACL RSI, NPRS  - Swelling  - LE AROM and PROM  - Balance testing, e.g. Star Excursion Test, Biodex Balance SystemTM  - Quadriceps isometrics or isokinetic testing  - Functional and Return to Sport tests, e.g. hop testing, QMA – Quality of Movement Testing |
| Treatment Recommendations | - Gradually increase volume and load to mimic load necessary for return to activity  - Progress movement patterns specific to patient's desired sport or activity  - Progression of agility work  - Increase cardiovascular load to match that of desired activity  - Collaborate with ATC, performance coach/strength and conditioning coach, skills coach and/or personal trainer to monitor load and volume as return to participation  - Consult with referring MD on timing return to sport including any recommended limitations |
| Criteria for Return to Sport | - Quantitative assessments = 90% of contralateral lower extremity  - Movement patterns, functional strength, flexibility, motion, endurance, power, deceleration and accuracy to meet demands of sport |

ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION GUIDELINES  
**Appendix 1**: Phase 1-2 – Gait and Assistive Device

ACLR with Meniscal Repair

- Weight Bearing Status

* Weeks 0-4: Toe-touch weight bearing
* Weeks 5-6: 50% partial weight bearing
* Weeks 6+: Weight bearing as tolerated
* The brace remains locked in extension for ambulation and sleep for 4 weeks

- Range of Motion

* Active ROM: Weeks 0-6 restricted from 0-90 degrees.
* Passive ROM: Weeks 0-4 restricted from 0-90 degrees, then progress as tolerated

ACLR with chondral procedures (i.e. Osteochondral Allograft)

- Weight Bearing Status (note that status may change per surgeon's preference)

* Weeks 0-2: Toe-touch weight bearing
* Weeks 3-4: 50% partial weight bearing
* Weeks 5-6: progressive weight bearing as tolerated

- Range of motion restrictions

* ROM without restrictions

ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION GUIDELINES  
**Appendix 2**: Phase 2 – Gait and Assistive Device

Begin ambulation WBAT with brace locked in full extension with assistive device at all times.

• Encourage slow progression of weight bearing to avoid increased symptoms.

• WBAT should consider pain, quadriceps control and edema both

• during gait and after.

• Any increase in symptoms should indicate a reduction of WB during gait or standing activities,

or decrease in overall volume of WB activities.

Beginning in phase 2 of rehab (week 3), patient may be evaluated for ambulation with unlocked

brace.

• Brace may unlocked for gait when full passive and active knee extension is achieved as

• demonstrated by a straight leg raise without quad lag for 15 repetitions.

• Brace should not be unlocked unless patient can demonstrate appropriate heel strike and

quadriceps control during gait.

• May consider only partially unlocking brace (e.g. if patient has 95° flexion, consider unlocking

brace to 90°).

• If flexion ROM deficits persist, brace may need to be unlocked to facilitate return to full ROM

while decreasing weight bearing.

Brace will be d/c'ed at the discretion of the physician.

Wean from assistive device with symmetrical gait pattern, full extension and full WB during stance

phase.

• Begin with no assistive device around home with progression complete discharge of assistive

device.

ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION GUIDELINES

**Appendix 3**: Phase 4 – Examples of Running Progression

Example 1

Week Run Rest/Walk Reps

1 30 sec 30 sec 3

2 1 min 1 min 3

3 2 min 1 min 2

4 4 min 2 min 1

5 4 min 2 min 2

6 8 min N/A 1

Example 2

1. Retro running 30” on treadmill or Alter-GTM run 30” 80% WB, progressing to 95% WB

2. Treadmill forward running 30”, advancing to 1' (note: not jogging, not sprinting, but running)

ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION GUIDELINES

**Appendix 4**: Phase 4 – Examples of Plyometrics Progression

Example 1

Week 1 Onto box

Week 2 In place and jumping rope

Week 3 Drop jumps

Week 4 Broad jumps

Week 5 Side to side hops

Week 6 Hop to opposite

Example 2

1. Bilateral plyometrics on leg press

2. Bilateral jumps onto a 6” box

3. Bilateral jumps in a cross pattern, e.g. clockwise and counterclockwise

1 2

1 4

4 3 2 3

4. Bilateral jumps on/off box 6” / 8” / 12”

5. Unilateral jumps in a cross pattern, e.g. clockwise and counterclockwise

1 2

1 4

4 3 2 3

6. Unilateral jumps on/off box