**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 exercisesTREATMENT 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