PHASE I: Immediately post-operatively to week 4

Goals:
• Protect graft and graft fixation with use of brace and specific exercises
• Minimize effects of immobilization
• Control inflammation and swelling
• Full active and passive extension/hyperextension range of motion. Caution: avoid hyperextension greater than 10°
• Educate patient on rehabilitation progression
• Flexion to 90° only in order to protect graft fixation
• Restore normal gait on level surfaces

Brace:
• 0-1 week- post-op brace locked in full extension for ambulation and sleeping
• 1-3 weeks- unlock brace (<90°) as quad control allows
• 3-4 weeks- wean from brace as patient demonstrates good quad control and normal gait mechanics
• 4-8 weeks- patient should only use brace in vulnerable situations (e.g. crowds, uneven terrain, etc)

Weight bearing Status:
• 0-1 week- partial weight bearing with two crutches to assist with balance
• 1-4 weeks- partial weight bearing progressing to full weight bearing with normal gait mechanics
• Wean from crutches/brace for ambulation by 4 weeks as patient demonstrates normal gait mechanics and good quad control as defined as lack of quadriceps lag

Exercises:
• Active-assisted leg curls 0-1 week. Progress to active as tolerated after 1 week. Delay strengthening for 12 weeks.
• Heel slides (limit to 90°)
• Quad sets (consider NMES for poor quad sets)
• Gastroc/Soleus stretching
• Very gentle hamstring stretching at 1 week
• SLR, all planes, with brace in full extension until quadriceps strength is sufficient to prevent extension lag- add weight as tolerated to hip abduction, adduction and extension.
• Quadriceps isometrics at 60° and 90°

• If available, aquatic therapy (one week after sutures removed) for normalizing gait, weight bearing strengthening, deep-water aqua jogging for ROM and swelling
**PHASE II: Post-operative weeks 4 to 12**

**Criteria for advancement to Phase II:**
- Full extension/hyperextension
- Good quad set, SLR without extension lag
- Flexion to 90°
- Minimal swelling/inflammation
- Normal gait on level surfaces

**Goals:**
- Restore normal gait with stair climbing
- Maintain full extension, progress toward full flexion range of motion
- Protect graft and graft fixation
- Increase hip, quadriceps, and calf strength
- Increase proprioception

**Brace/Weight bearing Status:**
- If necessary, continue to wean from crutches and brace.

**Exercises:**
- Continue with range of motion/flexibility exercises as appropriate for the patient
- Initiate CKC quad strengthening and progress as tolerated (wall sits, step-ups, mini-squats, Leg Press 90°-30°)
- Progressive hip, hamstring, calf strengthening (gradually add resistance to open chain hamstring exercises at week 12)
- Continue hamstring, Gastroc/Soleus stretches
- Stairmaster (begin with short steps, avoid hyperextension)
- Nordic Trac, Elliptical machine for conditioning
- Stationary Biking (progressive time and resistance)
- Single leg balance/proprioception work (ball toss, balance beam, mini-tramp balance work)
- If available, begin running in the pool (waist deep) or on an un-weighted treadmill at 10-12 weeks

**Phase III: Post-operative weeks 12 to 18-20 (4 1/2-5 months)**

**Criteria to advance to Phase III include:**
- No patellofemoral pain
- Minimum of 120° of flexion
- Sufficient strength and proprioception to initiate running (un-weighted or in pool)
- Minimal swelling/inflammation

**Goals:**
- Full range of motion
• Improve strength, endurance, and proprioception of the lower extremity to prepare for sport activities
• Avoid overstressing the graft. Progressively increase resistance for hamstring strengthening
• Protect the patellofemoral joint
• Normalize running mechanics
• Strength approximately 70% of the uninvolved lower extremity per isokinetic evaluation

**Exercises:**
• Continue flexibility and ROM exercises as appropriate for patient
• Initiate open kinetic chain leg extension (90°-30°), progress to eccentrics as tolerated
• Isokinetics (with anti-shear device)- begin with mid range speeds (120°/sec-240°/sec)
• Progress toward full weight bearing running at about 16 weeks
• Begin swimming if desired
• Recommend isokinetic test with anti-shear device at 14-16 weeks to guide continued strengthening
• Progressive hip, quad, hamstring, calf strengthening
• Cardiovascular/endurance training via Stairmaster, elliptical, bike
• Advance proprioceptive activities

**Phase IV: Post-operative months 4 1/2 or 5 through 6-7**

**Criteria for advancement to Phase IV:**
• No significant swelling/inflammation
• Full, pain-free ROM
• No evidence of patellofemoral joint irritation
• Strength approximately 70% of uninvolved lower extremity per isokinetic evaluation
• Sufficient strength and proprioception to initiate agility activities
• Normal running gait

**Goals:**
• Symmetric performance of basic and sport specific agility drills
• Single hop and three hop tests 85% of uninvolved leg
• Quadriceps and hamstring strength at least 85% of uninvolved lower extremity per isokinetic strength test

**Exercises:**
• Continue and progress flexibility and strengthening program based on individual needs and deficits
• Initiate plyometric program as appropriate for patient’s athletic goals
• Agility progression including, but not limited to:
  • Side steps
  • Crossovers
  • Figure 8 running
Shuttle running
One leg and two leg jumping
Cutting
Acceleration/deceleration/springs
Agility ladder drills
• Continue progression of running distance based on patient needs
• Initiate sport-specific drills as appropriate for patient

**Phase V: Begins at post-operative months 6 or 7**

**Criteria for advancement to Phase V:**
• No patellofemoral or soft tissue complaints
• Necessary joint ROM, strength, endurance, and proprioception to safely return to work or athletics
• Physician clearance to resume partial or full activity

**Goals:**
• Safe return to athletics/work
• Maintenance of strength, endurance, proprioception
• Patient education with regards to any possible limitations

**Exercises:**
• Gradual return to sports participation
• Maintenance program for strength, endurance

**Bracing:**
• Functional brace generally not used, but may be recommended by the physician on an individual basis