

## ACL RECONSTRUCTION

Phase I: 0-6 weeks	Immediate post op maximum protection phase
<b>Goals</b>	<ul style="list-style-type: none"> <li>• Protect surgical graft</li> <li>• Minimize knee joint effusion</li> <li>• Gently increase ROM per guidelines, emphasis on extension</li> <li>• Encourage quadriceps function</li> <li>• Prevent negative effects of immobilization</li> <li>• Normalization of walking with good heel-toe pattern</li> </ul>
<b>Brace</b>	<ul style="list-style-type: none"> <li>• Not all patients will utilize a post-operative brace.</li> <li>• wks 0-1: 0-90 deg, locked for ambulation and sleeping</li> <li>• wks 1+: 0-120 deg, unlocked for ambulation when good quadriceps control and ext ROM</li> <li>• wk 4: D/C brace</li> </ul>
<b>ROM</b>	<ul style="list-style-type: none"> <li>• wks 0-2: 0-90 degrees, emphasis on extension initially with gradual progression of flexion</li> <li>• wks 2-3: 0-110 degrees</li> <li>• wks 3-4: 0-120 degrees</li> <li>• wks 6+: Full ROM</li> </ul>
<b>WB</b>	<ul style="list-style-type: none"> <li>• wk 0-1: WBAT with brace locked into extension</li> <li>• wk 1-4: WBAT with brace unlocked if good quadriceps control and knee extension ROM. D/C crutches when can ambulate with normal heel-to-toe pattern.</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>• If hamstring/gracilis autograft, no isolated resistance to knee flexion until wk 6. Start isometrics at wk 5. Progress to isotonics at wk 6. Also apply ice to posterior knee to minimize muscle spasm.</li> <li>• Encourage AROM and WB to promote healing, prevent atrophy of soft tissue and bone, prevent a decrease in collagen content, and to align fibroblast and collagen fibrils.</li> <li>• Emphasis on regaining extension ROM ASAP to prevent arthrofibrosis and decrease stress to the PF joint during ambulation.</li> <li>• Avoid descending stair reciprocally until adequate quadriceps control and lower extremity alignment</li> <li>• Avoid twisting and pivoting motions for 6-8 weeks to minimize shear forces to the healing graft.</li> <li>• Avoid any isolated OKC resisted knee extension until 6 weeks</li> </ul>
<b>Modalities</b>	<ul style="list-style-type: none"> <li>• Cryotherapy 15 minutes in duration 3x/day</li> <li>• IFC for pain/effusion if needed</li> <li>• NMES quadriceps if needed</li> </ul>

<p><b>Treatment Recommendations</b></p> <p>Guidelines for progression based on tolerance</p>	<ul style="list-style-type: none"> <li>• Active warm-up (Bike AAROM progress to Bike with resistance, Nu Step)</li> <li>• Stretching to attain full extension with gradual progression of flexion. Goal of full ROM by wk 6. Emphasis on full return of knee extension ASAP. <ul style="list-style-type: none"> <li>Low-load long duration stretching for extension with heat if needed (1<sup>st</sup> TERT= Total End Range Time)</li> <li>Manual stretching for extension with overpressure / recurvatum</li> <li>Patellar mobilizations</li> <li>PROM / AAROM / AROM</li> <li>Manual stretching into flexion (initially limited by knee joint effusion)</li> </ul> </li> </ul> <p>wk 4: WB stretch on leg press for knee flexion ROM</p> <ul style="list-style-type: none"> <li>• Flexibility exercises for hamstring, gastroc-soleus</li> <li>• Scar tissue massage</li> <li>• Therapeutic exercises. Gentle strengthening protecting the surgical graft. Exercise in a pain-free manner. Encourage quadriceps activation. Avoid dynamic valgus during strengthening and functional activities (focus on hip abductor and external rotator strengthening). Incorporate total leg strengthening and balance / proprioception exercises. No isolated OKC resisted knee extension. <ul style="list-style-type: none"> <li>Biofeedback QS, SLR (if no lag), CKC knee extension</li> <li>Hip 4 way SLR, sidelying hip ER</li> <li>Gastroc soleus strengthening</li> <li>Hamstring OKC isotonic 0-90 deg in seated position</li> <li>CKC exercises: Heel raises, weight shifts, leg press and wall squats (0-60 deg)</li> </ul> </li> </ul> <p>wk 2: Leg press and wall squats (0-90 deg), lateral step-overs, step-ups, partial BW squats with UE support as needed, retro TM walking for knee ext, forward TM walking for gait training</p> <p>wk 3: Partial lunges front and lateral, leg press 2:1, BW squats progress ROM and balance</p> <p>wk 4: Elliptical Runner, leg press 2:1 and 1:1</p> <p>wk 5: Resisted sidestep with T-band, partial dead lifts, Bosu partial squats 0-60 deg</p> <p>Total leg strengthening</p> <p>Balance / Proprioception training: Double leg progress to single leg, static progressing to dynamic activities. Perturbation exercises</p> <p>CV conditioning / Core Stability</p> <ul style="list-style-type: none"> <li>• IFC for pain/effusion, NMES for quadriceps activation and control as needed</li> <li>• Ice (in stretch for extension if needed) 2<sup>nd</sup> TERT</li> <li>• HEP for 3<sup>rd</sup> TERT</li> </ul>
<p><b>Phases of graft remodeling</b></p>	<p>Revascularization and ligamentization occur over 12 month period with peak maturity evident between 6 to 12 months following surgery.</p> <ul style="list-style-type: none"> <li>• wk 0-3: Graft necrosis with gradual replacement cells. Graft is nourished by synovial fluid so ROM is crucial.</li> <li>• wk 1-6-16: Graft revascularization begins, continuing through wk 16. (Based on canine study)</li> <li>• wk 3-24: Cellular repopulation begins, continuing through wk 24.</li> <li>• wk 6-52: Collagen structural formation with remodeling occurring up to 1 year.</li> </ul>

<b>Phase II: 6-12 weeks</b>	<b>Moderate protective phase</b>
<b>Goals</b>	<ul style="list-style-type: none"> <li>• Minimize knee joint effusion</li> <li>• Gently increase ROM with goal of full ROM by 6-8 weeks</li> <li>• Gradual progression of therapeutic exercises for strengthening, stretching, and balance</li> </ul>
<b>ROM</b>	<ul style="list-style-type: none"> <li>• Progress to full ROM by 6-8 weeks.</li> <li>• Knee sleeve may be utilized depending on patient activities</li> </ul>
<b>Brace</b>	
<b>Modalities</b>	<ul style="list-style-type: none"> <li>• Cryotherapy 15 minutes in duration 1-2x/day</li> <li>• IFC for pain/effusion if needed</li> <li>• NMES quadriceps if needed</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>• Avoid quick twisting and pivoting motions for 10-12 wks to minimize shear forces.</li> <li>• Implement quadriceps isotonic strengthening from 30-90 deg to avoid shear forces to the healing graft.</li> </ul>
<b>Treatment Recommendations</b>  Guidelines for progression based on tolerance	<ul style="list-style-type: none"> <li>• Active warm-up: Bike with resistance, Nu Step, Treadmill walking</li> <li>• Stretching for full extension and flexion as needed.  Low-load long duration stretching with heat if needed  (1<sup>st</sup> TERT= Total End Range Time)  Manual stretching for extension and/or flexion  Leg press stretch for flexion</li> <li>• Flexibility exercises for hamstring, gastoc-soleus, iliopsoas,</li> <li>• Therapeutic exercises: Exercise in a pain-free manner. Avoid dynamic valgus during strengthening and functional activities. Incorporate total leg strengthening and balance / proprioception exercises.  Biofeedback  Total leg strengthening  Hip strengthening  Heel raises  Hamstrings isotonics prone 0-90 deg  Wk 9: Quadriceps isotonics 30-90 deg if minimal chondrosis  Isokinetic quadriceps/hamstrings 30-90 deg; VSRP 180-300 deg/sec sub-max to max; progressing to 60-300 deg/sec.  CKC exercises: Leg press 1:1, step-ups/step downs, Squats, Bosu 90 deg squats  wk 7: Lunges to 90 deg, dead lifts, sideshuffle with T-band  wk 8: Stairmaster, Euroglide, hamstring curls with physio ball  wk 9: Sub-max impact activities,  Balance / Proprioception training: Single leg stance activities  static progressing to dynamic activities. Perturbation exercises  CV conditioning / Core Stability</li> <li>• IFC for pain/effusion / NMES for quadriceps activation and control as needed</li> <li>• Ice (in stretch if needed) 2<sup>nd</sup> TERT</li> <li>• HEP for 3<sup>rd</sup> TERT if needed</li> </ul>
<b>Independent strengthening</b>	<ul style="list-style-type: none"> <li>• wk 8-10: Progress to independent strengthening program with monthly rechecks if good ROM, minimal effusion or pain, and good muscle control</li> </ul>

<b>Phase III: 12+ wks</b>	<b>Advanced strengthening and Return to activity phase</b>
<b>Goals</b>	<ul style="list-style-type: none"> <li>• Progress muscle strength, endurance, and balance activities. Ideally 3x/week of exercises at a fitness center, step-down, or home program</li> <li>• Progress to higher level activities depending on functional demands and MD approval</li> <li>• Return back to vocational, recreational, and sport activities</li> </ul>
<b>Brace</b>	<ul style="list-style-type: none"> <li>• Your MD may recommend a knee sleeve or functional brace to be used until 12 months from your surgery for higher level activities</li> </ul>
<b>Modalities</b>	<ul style="list-style-type: none"> <li>• Cryotherapy 15 minutes 1x/day or after strenuous activity</li> </ul>
<b>Treatment Recommendations</b>	<ul style="list-style-type: none"> <li>• Active warm-up: Bike, Elliptical Runner, Nu Step, Treadmill walking</li> <li>• Continue with stretching and flexibility exercises as needed</li> <li>• Strengthening and endurance exercises: Advance as tolerated with emphasis on functional strengthening. Avoid dynamic valgus during strengthening and functional activities. <ul style="list-style-type: none"> <li>Total leg strengthening</li> <li>Hip strengthening</li> <li>Heel raises</li> <li>Hamstring full ROM isotonic</li> <li>4 months: Quadriceps isotonic 0-full flexion if minimal chondrosis</li> <li>Isokinetic quadriceps/hamstrings 0-full flexion if minimal chondrosis</li> <li>CKC exercises: Leg press, multiple direction lunges and step-ups, squats, sideshuffle with T-band</li> <li>Gastroc soleus exercise</li> <li>Stairmaster, Euroglide</li> </ul> </li> <li>• Dynamic balance exercises</li> <li>• CV conditioning and core stability</li> <li>• Ice</li> </ul>
<b>Testing</b>	<ul style="list-style-type: none"> <li>• wk 12 (3 months): Linea, Biodex 30-full flexion at 60 deg/sec, Biodex 0-full flexion at 180 and 300 deg/sec, KT 1000</li> <li>• wk 20-24 (5-6 months): Linea, Biodex 0-full flexion at 60 or 90, 180, 300 deg/sec, KT 1000, Functional testing</li> </ul>
<b>Return to sport / work guidelines</b>	<ul style="list-style-type: none"> <li>• wk 12 (3 months): Return to running program if MD clearance, no pain or effusion, strength scores on Linea and Biodex of 75%</li> <li>• wk 16 (4 months): Plyometrics, agility drills, pivoting and cutting maneuvers</li> <li>• wk 20-24 (5-6 months): Return back to sports progression based on MD approval, minimal pain at rest or with activity, no knee joint effusion, full pain-free ROM, isokinetic strength and functional testing at 90 % compared to uninvolved side, good performance on functional testing (90% compared to normative data or contralateral extremity) and adequate performance on sport-specific drills</li> <li>• Sports progression may take 2-4 weeks for full clearance back to full competition</li> </ul>