**Phase I: 0-4 Weeks**

**Precautions:** Flexion ROM limited to 90° KF x 2 weeks; No OKC quad strengthening (to avoid pull at osteotomy site through patellar tendon); Observe for wound healing

<table>
<thead>
<tr>
<th>Weight Bearing</th>
<th>Brace</th>
<th>ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWB (≤50% BW)</td>
<td>On &amp; locked at 10-15° KF at all times except w/CPM or P/AAROM exercises</td>
<td>Emphasize full extension</td>
</tr>
<tr>
<td>May stand in tandem for brief periods</td>
<td>Discontinue brace for sleep at 4 weeks per comfort level (unless otherwise instructed by MD)</td>
<td>Progress flexion to ≤90°KF multiple times per day</td>
</tr>
<tr>
<td>Use bilateral axillary crutches or other appropriate assistive device for proper weight bearing</td>
<td>Open when seated</td>
<td>CPM per MD instruction</td>
</tr>
</tbody>
</table>

**Therapeutic Exercise and Activity**

- Establish high quality quad set
  - Superior translation of the patella
  - Avoid co-contraction with hamstrings and proximal gluteal musculature
  - Utilize NMES as needed
- SLR x 4
  - Flexion: begin in standing → reclined standing → supine
  - Progress per quad control, no extensor lag, NO pain at osteotomy site
  - Abduction, Adduction, Extension
- Beginner mat exercises for abdominal/lumbopelvic control and proximal hip strength
- Gentle double legged partial squats to 30° KF max, with support or light leg press with double limb
- Standing TKE with resistance band

**Goals:** Control effusion and pain; ROM 0-90°; Attain a strong quad set; SLR w/NO lag; Able to perform ≥30 reps prior to fatigue w/leg lifting; **progression to phase II dictated by MD clearance**
**Phase II: 4-8 Weeks**

**PROGRESSION TO PHASE II DICTATED BY MD CLEARANCE**

<table>
<thead>
<tr>
<th>Precautions: RETURN TO FULL WEIGHT BEARING DICTATED BY MD CLEARANCE AND RADIOGRAPHIC HEALING; No OKC quad through arc of motion – observe for pain and/or increased pain or swelling at osteotomy site – contact MD if present; No isolated pushing through flexed knee until MD radiographic clearance (i.e. stair climbing or step drills); Avoid end range quad stretching x 8 weeks</th>
<th>Weight Bearing</th>
<th>Brace</th>
<th>ROM</th>
</tr>
</thead>
</table>
| • 4-6 weeks – up to 75% weight bearing  
• 6-8 weeks – transition to full weight bearing (see precaution) | • On with gait – gradually open per quad control  
• Lock outdoors if not confident with surroundings or w/fatigue | • Full extension  
• Progress flexion toward full ROM – may initiate stationary bike for ROM | |

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**Therapeutic Exercise and Activity (Phase II continued)**

- Initiate bridging with legs over exercise ball/bolster (no plank poses yet)
- Increase repetitions w/proximal hip strength and abdominals
- Initiate basic 2 legged CKC strength drills  
  *Shallow (0-45°) KF angles for ↓PFJ stress
- Initiate 2 legged L/E proprio/balance
- Emphasize terminal knee extension control in CKC

**Goals:** Effusion resolving; No pain at osteotomy site; Full extension ROM; Flexion ROM ≥120°; Multi-planar L/E hip strength = MMT grade 5/5

**NOTE:** Distal transfer of tubercle may need extended time to heal. Pain with weight bearing at osteotomy site dictates slower progression.

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**Phase III: 8-12 Weeks**

**Precautions: Caution w/extended periods of walking in FWB (per MD ok & symptoms);** Maintain effusion/pain control with WB and HEP progression; Avoid pivoting on a planted foot; Instruct proper knee/hip alignment with CKC drills; Observe for quadriceps control of terminal knee extension with CKC drills and ADL mobility

<table>
<thead>
<tr>
<th>Weight Bearing</th>
<th>Brace</th>
<th>ROM</th>
</tr>
</thead>
</table>
| • FWB, unless instructed differently by MD  
  *Normalize gait pattern, avoiding knee hyperextension in early stance  
• Return to normal stair climbing (if healing confirmed) | • Open per quad control  
• Protective use when out of home: environmental hazards, crowds | • Full, symmetrical ROM |

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**Therapeutic Exercise and Activity**

- Progress core activities – side plank from knees, bridging w/ or w/o ball, basic 2 legged prone plank and hip strength

Jill Monson, PT, OCS  
Liz Niemuth, DPT, OCS  
eniemu1@fairview.org  
Tibial Tubercle Osteotomy  
Dr. Elizabeth Arendt
• Initiate basic low impact cardio with bike, elliptical, walking (15-20 minutes, minimal intensity, steady pace)
• Progress CKC drills – step, lunge, leg press
  *Deeper KF angles (>45°) with 2 legged support
  *Early KF angles (0-45°) with 1 legged support per control/tolerance
• Progress L/E proprio/balance drills: single limb per control/tolerance

**Goals:** Effusion resolved; No pain at osteotomy site; ROM WNL; Progressing toward normal gait pattern in FWB; Able to perform ≥30 reps prior to fatigue with leg lifting; Normal LE kinematics w/2 legged CKC activities

<table>
<thead>
<tr>
<th>Phase IV: 12-16 Weeks*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Precautions:</strong> Increased pain at osteotomy site indicates need to reduce level of physical activity (fitness, ADL activity, rehab progression); Observe/instruct proper L/E alignment w/CKC drills (avoid functional valgus); Avoid pivoting on a planted foot</td>
</tr>
<tr>
<td><strong>Cardiovascular Fitness</strong></td>
</tr>
</tbody>
</table>
| • Progress low impact cardio per symptoms – increase one variable at a time (intensity level, intervals, duration)  
  *15-20 min minimal intensity, steady pace to begin | • Progress drills: Add surface challenge/perturbation on DL  
  • Single limb activities on level surface  
  • Directional reaching and stepping drills | • Advance progression of core stabilization and bridging as tolerated |

**Strengthening**

• Increase workload with CKC drills:
  *Add resistance with 2 legged squatting  
  *Progress depth with single limb (step, lunge, leg press)  
  *Initiate large muscle group weight training (HS curls, leg press, calf raises, dead lift, etc.)

**Goals:** Restore normal mechanics with single leg CKC activities; Gait speed and distance normalizing; Able to perform 2 legged squat ≥60° x 20 reps w/kinematic & symptom control; Able to maintain single leg balance ≥60 seconds; Restore normal stair climbing

*Timeframes in later phases of rehabilitation are estimates only. Patients may be progressed faster/slower based on their ability to attain goals for each phase.

**Patient to return to University of Minnesota Health Clinics and Surgery Center for physical performance testing at approximately 16 weeks post-surgery**
## Phase V: 16-24 Weeks*

**Precautions:** Observe for return of effusion and/or pain with increased activity levels; Observe kinematic control w/CKC activities

<table>
<thead>
<tr>
<th>Cardiovascular Fitness</th>
<th>Proprioception/Balance</th>
<th>Core Stability</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Progress cardio with bike, elliptical, walking (20-25 minutes, moderate intensity, steady pace)</td>
<td>• Add Surface Challenge or Perturbation</td>
<td>•Intermediate→ Advanced Core poses per control</td>
<td>•Reps to fatigue w/CKC strength drills (squat, lunge) per symptoms for muscular endurance</td>
</tr>
<tr>
<td>•Initiate running program if scores ≥ 85% w/Level II Testing</td>
<td>•BOSU, Dynadisc, trunk and/or extremity movement, perturbation</td>
<td></td>
<td>• Progress CKC drills with directional challenge (lunging, resisted side stepping)</td>
</tr>
<tr>
<td></td>
<td>•2→1 limb support</td>
<td></td>
<td>• Progress weight training to single leg (First eccentric phase only, then both eccen/conc)</td>
</tr>
</tbody>
</table>

**Phase V Goals:** Quad girth returning; Normalized walking speed and distance; Restore normal stair climbing; Able to perform 2 leg squats to ≥60° KF x 20 reps w/proper alignment (per symptoms); Able to perform a single leg squat ≥45° knee flexion with normal mechanics; Improving low-impact cardio base

*Timeframes in later phases of rehabilitation are estimates only. Patients may be progressed faster/slower based on their ability to attain goals for each phase.

*RETURN TO RUN program initiation must be cleared by MD, likely around 6 months post op

### Attention:
Progression to Phases VI and VII only pertinent to patients with an athletic history who desire to return to pounding/pivoting activities. Progression based on PF joint chondral health, symptom tolerance, and patient’s return of strength, fitness and coordination.

NOTE: Distal transfer of tubercle osteotomy may need extended time to heal. Pain with weight-bearing at osteotomy site dictates slower progression. NO pounding activities until cleared by MD.
**Phase VI: 24-28 weeks**

**Precautions:** Closely observe/instruct alignment with plyometric, agility, cutting and sport drills; Modify intensity of exercises per symptoms and L/E alignment control; Advise return to running per criteria below*

<table>
<thead>
<tr>
<th>Cardiovascular Fitness</th>
<th>Proprioception/ Balance</th>
<th>Core Stability</th>
<th>Strength/ Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 25-40 minute workout (moderate intensity) w/3-5 brief near-maximal intensity bursts w/recovery periods</td>
<td>- 1 leg stance w/surface challenge/perturbation</td>
<td>- Advanced Core Stability Poses</td>
<td>- Initiate basic 2 leg plyometric drills (emphasize controlled landing into deep squat with good alignment)</td>
</tr>
<tr>
<td>- Once able to run x 20 minutes symptom-free, initiate sprint drills</td>
<td>- 1 leg stance w/sport simulation activity</td>
<td>- Add challenge w/Exercise/BOSU ball under legs/trunk</td>
<td>- Initiate basic agility/footwork drills (initiate quick foot chopping, feet and hips move together, no pivoting on a planted foot)</td>
</tr>
<tr>
<td>*Linear</td>
<td>*Dynamic movement elements:</td>
<td>*Add dynamic mvmt, plyometric elements</td>
<td></td>
</tr>
<tr>
<td>*Focus on acceleration phase</td>
<td>*Dot drills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Progress % intensity per fatigue, symptoms</td>
<td>*Reaching drills</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Goals:** Normal quad girth; Able to perform 2 leg squat to 90° x 20 reps & 1 leg squat ≥60° KF x 20 reps w/kinematic & symptom control; Good self-awareness of proper kinematics w/CKC drills

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**Phase VII: 28+ Weeks**

**Precautions:** Observe for return of effusion and/or pain with increased activity level and modify HEP; Closely observe alignment with plyometric, agility, cutting and sport drills

<table>
<thead>
<tr>
<th>Cardiovascular Fitness</th>
<th>Proprioception/ Balance</th>
<th>Core Stability</th>
<th>Strength/ Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Continue regular cardio workouts 4-6x/wk</td>
<td></td>
<td>- Blend upper body/lower body strengthening elements into core stability poses</td>
<td></td>
</tr>
<tr>
<td>- Progress sprint drills:</td>
<td>- Blend strength elements (CKC L/E, OKC U/E) into balance drills per control</td>
<td></td>
<td>- Progress plyometrics:</td>
</tr>
<tr>
<td>*Increase % intensity</td>
<td>- Continue to progress dynamic challenge elements</td>
<td></td>
<td>*Increase intensity</td>
</tr>
<tr>
<td>*Add direction change in acceleration</td>
<td></td>
<td></td>
<td>-2 1 leg take-off/land</td>
</tr>
<tr>
<td>- Add deceleration drills</td>
<td></td>
<td></td>
<td>-Traveling</td>
</tr>
<tr>
<td>*Add direction change in deceleration</td>
<td></td>
<td></td>
<td>-Direction change</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-Surface challenge on landings (BOSU)</td>
</tr>
</tbody>
</table>

**Goals:** Patient to become independent with exercise program and demonstrate good self-awareness of proper L/E alignment with high level drills

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*Patient will return to University of Minnesota Health Clinics and Surgery Center for physical performance testing to dictate final clearance by MD for return to sport and occupation*

*Physical Therapy Post-Operative Guidelines*

*Dr. Elizabeth Arendt*
Return to Run Guidelines & Progression – Post-Operative Knee

Criteria to be met prior to initiation of return to run program

- Trace to no effusion
- Normal ROM
- Sufficient chondral health of tibiofemoral and patellofemoral joints
- Previous history of regular running
- No increased knee pain or effusion with progression of therapeutic activities to date
- ≥90% LSI with single leg squat (max depth) and/or star excursion balance test (anterior reach)
- Able to perform 20 reps off 6” box with ≤2 breaks
- Able to tolerate 20 minutes of walking at a brisk, continuous pace without symptom provocation

<table>
<thead>
<tr>
<th>Week</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Run 1 min; walk 4 min 25 min total*</td>
<td>Run 1 min; walk 4 min 25 min total</td>
<td>Run 1 min; walk 4 min 30 min total</td>
</tr>
<tr>
<td>2</td>
<td>Run 2 min; walk 3 min 25 min total</td>
<td>Run 2 min; walk 3 min 25 min total</td>
<td>Run 2 min; walk 3 min 30 min total</td>
</tr>
<tr>
<td>3</td>
<td>Run 3 min; walk 2 min 25 min total</td>
<td>Run 3 min; walk 2 min 25 min total</td>
<td>Run 3 min; walk 2 min 30 min total</td>
</tr>
<tr>
<td>4</td>
<td>Run 4 min; walk 1 min 25 min total</td>
<td>Run 4 min; walk 1 min 25 min total</td>
<td>Run 20 min continuously</td>
</tr>
</tbody>
</table>

- *If 1 min of jogging is too tenuous, begin with less time, e.g. 30 seconds
- Do not run on consecutive days
- Focus on strengthening and proprioception exercises on non-running days
- Discontinue return to run program and consult PT if:
  - Sharp pain exists in the knee
  - Swelling in the knee
  - Pain worsens as the run progresses
  - Pain is worse later or the following day
- At end of progression, increase slowly with mileage, speed and frequency of running (increase one interval at a time, no more than 10% per week)
- Change footwear every 300-400 miles; base footwear choice primarily on comfort