

## Sports Rehabilitation & Performance Center Tibial Tubercle Transfer Guidelines© \*

The following TTT guidelines were developed by the Sports Rehabilitation and Performance Center team at Hospital for Special Surgery. Progression is both criteria-based and patient specific. Phases and time frames are designed to give the clinician a general sense of progression. Concomitant procedures such as cartilage procedure, lateral release, medial patellofemoral ligament repair/reconstruction, as well as chronicity of condition will alter the guideline.

### Follow physician's modifications as prescribed

#### PHASE I: PROTECTION PHASE (WEEKS 0-6)

##### GOALS:

- Independence in home therapeutic exercise (HEP) program
- Promote healing
- Control post-operative pain / swelling
- Prevent quadriceps inhibition: fair quadriceps contraction
- Straight leg raise (SLR) without lag, pain-free
- ROM: 0° KE to ≥90° KF
- Independent ambulation NWB with crutches and brace locked in extension, on level surfaces and stairs

##### Emphasize

- Non weight bearing status
- Improving quadriceps contraction
- Controlling pain/effusion
- PROM KE
- Compliance with home instructions: cold therapy unit, CPM, bone stimulator, quad re-ed with estim unit

##### PRECAUTIONS:

- Weight bearing status
- Avoid AA-AROM KE
- Symptom provocation: quadriceps shut down, joint effusion, active inflammation
- KF ROM as per surgeon's guidelines

##### TREATMENT RECOMMENDATIONS:

- Emphasize patient compliance to HEP and weight bearing precautions/progression
  - ✓ NWB with brace locked in extension with crutches on level surfaces and stairs
  - ✓ Cryotherapy: home cold therapy unit
  - ✓ Continuous Passive Motion: 3-4 hours/ day; with cartilage procedure: 6-8 hours/ day
  - ✓ Bone stimulator: 20 minutes/ day (2-3x)
  - ✓ Electrical stimulation for quadriceps re-education: towel roll under knee
- Sitting knee ROM exercise: A/AAROM KF, PROM for KE
- Quad set with towel roll under knee
- Patella mobilization as per MD guidelines
- Hip progressive resisted exercises: pain-free SLR with brace until no lag
- Distal strengthening (elastic band for triceps surae)
- Flexibility exercises (hamstrings, gastrocnemius)

##### MINIMUM CRITERIA FOR ADVANCEMENT TO NEXT PHASE:

- Radiographic evidence of adequate healing, and clearance from surgeon
- Fair quadriceps contraction
- Good patellar mobility
- ROM: 0° knee extension to ≥90° KF
- 0/10 pain at rest
- Able to SLR pain-free without quadriceps lag

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### PHASE II: GAIT PHASE (WEEKS 7-12)

#### GOALS:

- Independence in HEP, as instructed
- Control pain, inflammation, effusion
- Promote healing
- ROM 0° KE-110° KF (8 wks.), 130°KF (12 wks.) to full ROM
- Good patella mobility
- Good quadriceps contraction
- Normalize gait without an assistive device
- 0/10 pain with ADLs, therapeutic exercise: Establish pain-free arc of motion
- Weight bearing progression as per surgeon's guidelines based on radiographic evidence of healing

#### Emphasize

- Symptom control with ADLs, therex
- Minimizing knee effusion
- Normal gait pattern
- Postural stability, alignment, n-m control in single limb stance

#### PRECAUTIONS:

- Sign and symptom provocation: pain, inflammation, quadriceps shut down, joint effusion
- Cartilage procedure
- Progression of weight bearing as per surgeon's prescription
- Pathological gait pattern (quadriceps avoidance; bent knee)
- Pain-free arc of motion during exercise

#### TREATMENT RECOMMENDATIONS:

- HEP: advance as tolerated. Continue phase I exercises, as appropriate
- Patient education: Activity modification, progression of gait training, cryotherapy
- Patellar mobilization, as per surgeon's guidelines
- ROM exercises:
  - Sitting PROM - AAROM KE in a pain free arc of motion, (no cartilage injury) to AROM - AAROM KF
  - KF: sitting progressing to supine wall ROM, as tol (~125°KF in sitting, quadriceps control, pain-free)
- Gait training: wks 7-8 =WBing progression, MD directed with crutches and brace locked in extension. Wks 9-10: WBAT with brace locked in extension without an assistive device. Wks 11-12: normalize gait pattern with brace open or functional brace and assistive device to ensure KF during loading response; hydro-treadmill (adequate wound healing) or anti-gravity treadmill. Retro-walking to encourage n-m control with KF during loading response
- Quadriceps strengthening progression in pain-free arc of motion (esp. w/ known cartilage injury/ procedure)
  - Continue with Estim, biofeedback, submaximal multi angle isometrics
  - Leg press: monitor arc of motion (bilateral, eccentric in latter phase)
- Bicycle: progressing from short crank to standard crank as ROM allows (115° KF in sitting), 80 RPMs
- Flexibility exercises - evaluation-based: AROM KF with hip extension in standing
- Advance proximal strengthening and core: (i.e. hip extension with knee flexion, side planks, bridge)
- Hydrotherapy for gait, single limb alignment and stability, strengthening
- Initiate balance and proprioceptive training: double limb support on progressively challenging surfaces to single limb support on level surface only with demonstration of good alignment, stability and n-m control

#### MINIMUM CRITERIA FOR ADVANCEMENT:

- ROM 0° KE→ 130° KF
- Normal gait pattern without assistive device
- Good patella mobility
- Postural stability, alignment and neuromuscular control in single limb stance
- 0/10 pain with ADLs and therapeutic exercise
- Independent HEP

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### PHASE III: STRENGTHENING (WEEKS 13-24+)

#### GOALS:

- Independent HEP
- Patient education
- Control pain, effusion and inflammation
- 0/10 pain with ADLs, therapeutic exercise
- ROM: WNLs
- Normalize gait on level surfaces and stairs
- Good single limb dynamic balance
- Good eccentric quadriceps control
- Pelvic control during step down

#### Emphasize

- Normal gait
- Identifying and addressing muscle/ soft tissue imbalances
- Neuromuscular control
- Functional progression
- Quality of movement

#### PRECAUTIONS:

- Sign and symptom provocation: pain, and active inflammation/ effusion, quadriceps shutdown
- Gait deviations  
“Too much, too soon” progression
- Overloading the joint
- Disregarding quality of movement

#### TREATMENT RECOMMENDATIONS:

- HEP, as instructed
- Educate patient: Activity modification, individualized, and cryotherapy
- Quadriceps strengthening: progress as tol, monitor arc of motion, closed chain preferred
  - Forward Step Up (FSU) progression: pain-free, 6” step progressing to 8” step (patient height dependent)
  - Eccentric leg press progressing to:
  - Forward step down (FSD) progression: 6” step progressing to 8” step (dependent on patient height)
  - Squat progression: chair squats, [ball squats if necessary (with buttocks moving under ball)], to free squats
- ROM exercises:
  - (AA)ROM KE (monitor arc of motion) to AAROM KF in sitting and supine wall slides to stair stretch
- Gait training to emphasize heel-toe gait pattern with emphasis on loading response
  - Treadmill: utilize small grade elevation (%) to encourage loading response
  - Retro-walking for neuromuscular control during loading response
- Advance proximal strength through functional activities: (bridging progression, hip extension with KF, clock, RDL, windmill, lawnmower) and core training (planks, side planks, Sahrman progression)
- Balance progression with postural alignment and N-M control (static to dynamic, introduce different planes of motion)
- Address muscle imbalances – evaluation-based: (i.e. 2 joint hip flexor length)
- Cross training: elliptical trainer initiated with good strength/ quality during 6” FSU, bicycle (80 RPMs), swimming (crawl, back stroke)

#### CRITERIA FOR ADVANCEMENT:

- ROM WNLs
- No pain or swelling
- Normalize gait
- Ability to demonstrate alignment, control, stability in single limb stance during dynamic activities
- Core stability: Single leg bridge = 30s, Sahrman >- level 3
- Able to ascend 6”/ 8” step with good control, and alignment
- Able to descend 6”/ 8” step with good control, and alignment
- Symmetry, quality, alignment during selected movement patterns
- Independence in a home exercise program

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### PHASE IV: ADVANCED STRENGTHENING AND FUNCTION (~8 WEEKS DURATION)

#### GOALS:

- Control pain with sport specific movements
- 0/10 pain with ADLs, therapeutic exercise
- Strength and flexibility to meet demands of sport
- Isokinetic test: 180° / sec and 300° / sec 85% limb symmetry index (LSI)
- Ability to demonstrate movement strategy, symmetry, quality, control and alignment during selected movement patterns: squat, jump (vertical and horizontal), single leg squat
- Good single limb dynamic balance
- Cardiovascular fitness to meet demands of sport

#### PRECAUTIONS:

- Pain with therapeutic exercise & functional activities
- Inadequate strength, functional strength, ROM, flexibility, for progression

#### TREATMENT RECOMMENDATIONS:

- Continue to advance LE strengthening, flexibility, dynamic single limb stability & agility
- Continue to address muscle imbalances – evaluation-based
- Advance core stability
- Cross training
- Initiate plyometric program: with MD clearance and evidence of good eccentric quadriceps control
  - ✓ Vertical jumping progression: Jump up progressing to Jump in place progressing to Jump down
- Initiate running program: with evidence of eccentric quadriceps control during 8" FSD and MD clearance
  - ✓ Start with 30 second intervals

#### CRITERIA FOR ADVANCEMENT:

- Good single limb dynamic balance
- Isokinetic test at 180° / sec and 300° / sec: 85% limb symmetry index (LSI)
- Medical clearance by surgeon for return to play progression
- Demonstrate symmetrical, quality, alignment during selected movement patterns
- Cardiovascular fitness, flexibility to meet demands of sport
- Independence with gym program for progression of therapeutic exercise program

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### PHASE V: RETURN TO PLAY (~8 WEEKS DURATION; 36-52 WEEKS)

#### GOALS:

- Lack of pain, apprehension with sport specific movements
- Maximize strength and flexibility as to meet demands of individual's sport activity
- Ability to decelerate with good control, and alignment on single limb
- Symmetry, quality, alignment during selected movement patterns
- Ability to demonstrate hip strategy, alignment, and control, with take-off and landing
- Isokinetic test: 180° / sec and 300° / sec 85% limb symmetry index (LSI)
- Cardiovascular fitness to meet demands of sport

#### PRECAUTIONS:

- Pain with therapeutic exercise & functional activities
- Inadequate strength, functional strength, ROM, flexibility, fitness when returning to sport

#### TREATMENT RECOMMENDATIONS:

- Continue to advance LE strengthening, flexibility, dynamic single limb stability, core stability & agility
- Advance plyometric program: with MD clearance
  - ✓ Horizontal jumping progression: Broad jump to Hop to opposite to Single leg hop
- Advance cutting, deceleration training
- Progress cardiovascular fitness to meet demands of sport

#### CRITERIA FOR DISCHARGE:

- Isokinetic test: 180° / sec and 300° / sec 85% limb symmetry index (LSI)
- Ability to decelerate with good control, and alignment on single limb
- Medical clearance by surgeon for return to play
- Hop Test  $\geq$  85% limb symmetry
- Lack of apprehension with sport specific movements
- Flexibility to meet demands of sport
- Independence with gym program for maintenance and progression of therapeutic exercise program
- Demonstrate quality of movement with required sports specific activities