



7858 Shrader Rd

Richmond, Virginia 23294

Tibial Tubercle Realignment Rehabilitation

Tibial Tubercle Realignment Post-Operative Guidelines

The following are guidelines for patients who have undergone Tibial Tubercle Osteotomy. 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.



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POST-OPERATIVE PHASE I: Protection Phase (Week 0-6)

GOALS	<ul style="list-style-type: none">▪ 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° Knee Extension to $\geq 90^\circ$ Knee Flexion▪ Independent ambulation NWB with crutches and brace locked in extension, on level surfaces and stairs
PRECAUTIONS	<ul style="list-style-type: none">▪ Maintain weight bearing status▪ Avoid Symptom provocation: quadriceps shut down, joint effusion, active inflammation
TREATMENT RECOMMENDATIONS	<ul style="list-style-type: none">▪ Emphasize patient compliance to HEP and weight bearing precautions/progression



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- **NWB with brace** locked in extension with crutches on level surfaces and stairs
- Cryotherapy: home cold therapy unit
- 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
- Hip progressive resisted exercises: pain-free SLR with brace until no lag
- Distal strengthening (elastic band for triceps surae)
- Flexibility exercises (hamstrings, gastrocnemius)

EMPHASIZE

- Non weight bearing status
- Improving quadriceps contraction
- Controlling pain/effusion
- Achieving Full Knee Extension
- Patellar Mobility



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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 $\geq 90^\circ$ KF
- No pain at rest
- Able to SLR pain-free without quadriceps lag



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POST-OPERATIVE PHASE II: Gait Phase (Week 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

PRECAUTIONS

- Sign and symptom provocation: pain, inflammation, quadriceps shut down, joint effusion
- Progression of weight bearing as per surgeon's prescription



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TREATMENT RECOMMENDATIONS

- Pathological gait pattern (quadriceps avoidance; bent knee)
- Pain-free arc of motion during exercise
- 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:
 - Weeks 7-8 =WBing progression, MD directed with crutches and brace locked in extension.



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- Weeks 9-10: WBAT with brace locked in extension without an assistive device.
 - Weeks 11-12: normalize gait pattern with brace open or functional brace and assistive device to ensure 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)
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- Initiate balance and proprioceptive training
 - Double limb progress to single limb

EMPHASIZE

- Symptom control with ADLs
- Minimizing knee effusion
- Normal gait pattern
- Postural stability
- Neuromuscular control

MINIMUM CRITERIA FOR ADVANCEMENT TO NEXT PHASE

- ROM 0° KE - 130° KF
- Normal gait pattern without assistive device
- Good patella mobility
- Postural stability, alignment and neuromuscular control in single limb stance
- No pain with ADLs and therapeutic exercise
- Independent HEP



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POST-OPERATIVE PHASE III: Strengthening (Week 13-24)

GOALS	<ul style="list-style-type: none">▪ 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
PRECAUTIONS	<ul style="list-style-type: none">▪ Sign and symptom provocation: pain, and active inflammation/ effusion, quadriceps shutdown▪ Gait deviations▪ "Too much, too soon" progression▪ Overloading the joint
TREATMENT RECOMMENDATIONS	<ul style="list-style-type: none">▪ HEP, as instructed▪ Progress Quadriceps strengthening<ul style="list-style-type: none">○ Monitor arc of motion○ Closed chain preferred



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- 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



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- Retro-walking for neuromuscular control during loading response
- Advance proximal strength through functional activities
- 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)

EMPHASIZE

- Normal gait
- Identifying and addressing muscle/ soft tissue imbalances
- Neuromuscular control

MINIMUM CRITERIA
FOR ADVANCEMENT
TO NEXT PHASE

- Full ROM
- Normalize gait



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- Ability to demonstrate alignment, control, stability in single limb stance during dynamic activities
- 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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POST-OPERATIVE PHASE IV: Advanced Strengthening and Function

GOALS

- Control pain with sport specific movements
- Pain-free with ADLs, therapeutic exercise
- Strength and flexibility to meet demands of sport
- Isokinetic test: 85% limb symmetry index (LSI)
- Good single limb dynamic balance

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



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- 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

MINIMUM CRITERIA FOR ADVANCEMENT TO NEXT PHASE

- 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



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- Independence with gym program for progression of therapeutic exercise program



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POST-OPERATIVE PHASE V: Return to Play

GOALS

- Lack of pain, apprehension with sport specific movements
- Maximize strength and flexibility as to meet demands of individual's sport activity
- 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



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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

MINIMUM CRITERIA FOR ADVANCEMENT TO NEXT PHASE

- 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 > 85% limb symmetry
- Lack of apprehension with sport specific movements
- Flexibility to meet demands of sport



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- Independence with gym program for maintenance and progression of therapeutic exercise program
- Demonstrate quality of movement with required sports specific activities