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Rehabilitation Protocol for Tibial Tubercle Osteotomy

PHASE I: *Immediate Postoperative Phase (0-6 WEEKS AFTER SURGERY)*

Rehabilitation Goals	<ul style="list-style-type: none"> • Protect the anatomic repair • Monitor wound healing • Minimize knee effusion • Increase tibial-femoral and patella-femoral mobility • Restore quadriceps control • Gently increase ROM per guidelines – emphasis on extension
Weight-bearing	<ul style="list-style-type: none"> • NWB/TDWB with brace locking in extension
Brace	<ul style="list-style-type: none"> • Hinged knee brace locked in 0 degrees extension for all mobility and gait until at least 4 weeks post-op, full knee extension achieved and good quad control. • Brace may be unlocked when sitting or in bed
Precautions	<ul style="list-style-type: none"> • No active knee extension • No resisted closed chain or open chain until 6 weeks post-op
Intervention	<p><i>Range of Motion</i></p> <ul style="list-style-type: none"> • Knee AAROM/PROM – Passive extension only <ul style="list-style-type: none"> ○ 0-90 degrees ○ Prone hangs, supine knee extension with heel prop, heel slides with PROM for knee extension, knee flexion in sitting with P/AAROM for knee extension <p><i>Strengthening</i></p> <ul style="list-style-type: none"> • Quad sets, co-contraction, ankle pumps • 2 weeks: Begin floor based core, hip, and glutes work <p><i>Manual Therapy</i></p> <ul style="list-style-type: none"> • Patella mobilizations – immediately post-op • Gentle STM – 2-3 weeks post-op <p><i>Modalities</i></p> <ul style="list-style-type: none"> • NMES for quadriceps re-education/biofeedback. • Cryotherapy for swelling and pain management. • Taping – pain and swelling management
Criteria to Progress	<ul style="list-style-type: none"> • Knee PROM: 0-90 degrees • Adequate pain control • Minimal swelling • Able to perform SLR without quadriceps lag

PHASE II: *Protection Phase (6-12 WEEKS AFTER SURGERY)*

Rehabilitation Goals	<ul style="list-style-type: none"> • Increase mobility • Restore quadriceps control • Restoration of full ROM by week 8-12 • Progress weight bearing • Normalize gait pattern without assistive device • Gradual progression of therapeutic exercises for strengthening, stretching and balance
Weight-bearing	<ul style="list-style-type: none"> • Progress to PWB weeks 6-8 <ul style="list-style-type: none"> ◦ 25% then 50% • WBAT after week 8
Brace	<ul style="list-style-type: none"> • Brace unlocked for ambulation if there is good quad control, crutches as needed • Hinge brace until week 8 then replace with patellofemoral brace with lateral buttress
Precautions	<ul style="list-style-type: none"> • No weight bearing stretching into knee flexion until week 8 • Avoid descending stairs reciprocally until adequate quadriceps control as demonstrated by SLR • Avoid exercises/activities with excessive patellofemoral compression forces (deep squats, resisted open chain terminal knee extension) • Avoid medial collapse due strengthening and functional activities • No running, jumping or plyometrics until 4-6 months post-surgery • Do not overload the surgical site • Modify activity level if increased pain, edema or catching occurs
Intervention -Continue with Phase I interventions as needed	<p><i>Modalities</i></p> <ul style="list-style-type: none"> • NMES for quadriceps re-education – as needed • Cryotherapy for edema and pain management Manual Therapy • Patella mobilizations • Soft tissue mobilization <p><i>Range of Motion</i></p> <ul style="list-style-type: none"> • Progress PROM/AAROM/AROM of knee as tolerated <p><i>Stretching</i></p> <ul style="list-style-type: none"> • Hamstring • Gastroc-Soleus • Prone Quadriceps with strap <p><i>Strengthening</i></p> <ul style="list-style-type: none"> • TKE – 0-40 degrees • Leg press • Partial range wall squats <ul style="list-style-type: none"> ◦ 0-45 degrees • Forward step ups, Lateral step ups • Forward, Lateral, Retro step downs • Bridge with physioball • Romanian Deadlifts – Week 8 <ul style="list-style-type: none"> ◦ Standing upright to weight just below knees. • Band walks – Week 8

	<ul style="list-style-type: none"> • Stool walks – Week 8 • BOSU Partial squat – Week 9 <ul style="list-style-type: none"> ◦ 0-60 degrees • Prone Hamstring curl – 10 weeks <ul style="list-style-type: none"> ◦ Begin with ankle weights and progress to weight machine <p><i>Cardiovascular Exercise</i></p> <ul style="list-style-type: none"> • Stationary Bike – light resistance • Treadmill – week 8, forward and backwards • Elliptical – week 9-10 <p><i>Aquatic Therapy (if available)</i></p> <ul style="list-style-type: none"> • Flutter kicks • Straight leg scissor kicks • Running in waist deep water <p><i>Balance - week 8</i></p> <ul style="list-style-type: none"> • Progress from double to single leg balance • Progress from static to dynamic: <ul style="list-style-type: none"> ◦ BAPS ◦ Ball toss ◦ Body blade ◦ Fitter ◦ Slide board
Criteria to Progress	<ul style="list-style-type: none"> • Full range of motion • Elimination of swelling • Restoration of normal gait • Quad strength > 70% of uninvolved leg

PHASE III: Advanced Strengthening (12-16 WEEKS AFTER SURGERY)

Rehabilitation Goals	<ul style="list-style-type: none"> • Normal tibial-femoral and patella-femoral mobility • Restoration of quadriceps control • Progress muscle strength, endurance, and balance activities
Precautions	<ul style="list-style-type: none"> • No running, jumping or plyometrics till 4-6 months post-op • May continue with patellofemoral hinged brace until 12 months post-op for lighter level activities
Intervention -Continue with Phase I-II interventions	<p><i>Strengthening</i></p> <ul style="list-style-type: none"> • Total leg strengthening • Single leg strengthening • Hamstring isotonic exercises through full ROM • Quadriceps isotonic exercises <p><i>Proprioception</i></p>

	<ul style="list-style-type: none"> • Single leg balance <ul style="list-style-type: none"> ◦ Stable and unstable surfaces • Single leg balance with leg swings • Single leg balance with ball toss • Single leg balance with UE perturbations <p><i>Cardiovascular Exercise</i></p> <ul style="list-style-type: none"> • Bike, elliptical • Treadmill walking
Criteria to Progress	<ul style="list-style-type: none"> • Full, symmetrical pain-free ROM • Strength: 80%+ of uninvolved leg • Satisfactory clinical exam

PHASE IV: Early Return to Sport Phase (16+ WEEKS AFTER SURGERY)

Rehabilitation Goals	<ul style="list-style-type: none"> • Progress to higher level activities – based on functional demands • Return to vocational, recreational and/or sport activities. • Run 2 miles at easy pace – if appropriate
Interventions <i>-Continue with Phase III interventions</i>	<p><i>Running: begin at 4 months</i></p> <ul style="list-style-type: none"> • Start with light gentle slow-paced running • Treadmill running <ul style="list-style-type: none"> ◦ Must demonstrate good running form for 5 minutes with equal audibly rhythmic foot strike. • Aquatic running • Backwards and forward running • Initiate Return to running protocol <p><i>Plyometrics: 4.5 –to 5 months</i></p> <ul style="list-style-type: none"> • Start with double leg drills • Progress slowly to single leg drills • Ensure good form and proper hip and knee alignment <p><i>Agility Drills: 4.5 to 5 months</i></p> <ul style="list-style-type: none"> • Sub-max foot placement drills • Ladder drills • Line hops
Criteria to Progress	<p>Return to sport/play: 7 to 9 months</p> <ul style="list-style-type: none"> • Quad and hamstring strength 90% of uninvolved • Full symmetrical knee range of motion • No knee joint effusion • Single leg hop test: Limb symmetry of 90% • Triple hop test: limb symmetry of 90% • Crossover hop test: limb symmetry of 90%

Protocol adapted from Mass General Sports Medicine Physical Therapy Rehabilitation Protocols. See <https://www.massgeneral.org/orthopaedics/sports-medicine/physical-therapy/sports-rehab-protocols>