This rehabilitation program is designed to return the individual to their full activities as quickly and safely as possible, following Tibial Tubercle Osteotomy. Modifications to this guideline may be necessary dependent on physician specific instruction or other procedures performed. This evidence-based guideline is criterion-based; time frames and visits in each phase will vary depending on many factors. The therapist may modify the program appropriately depending on the individual's goals for activity following this surgery.

This guideline is intended to provide the treating clinician a frame of reference for rehabilitation. It is not intended to substitute clinical judgment regarding the patient's post-operative care based on exam/treatment findings, individual progress, and/or the presence of concomitant procedures or post-operative complications. If the clinician should have questions regarding post-operative progression, they should contact the referring physician.

Phase	Suggested Interventions	Goals/Milestones for Progression
Phase I *Pre Surgery*	*Educate:* Anatomy, existing pathology, post-op rehab schedule, bracing, and expected progressions *Instruct on Pre-Op exercises:* - Home safety - Equipment recommendations *Overview of hospital stay:* -Nursing care -Therapy services -Discharge planning	*Goals of Phase:* 1. Understanding of pre-op exercises, instructions and overall plan of care *Criteria to Advance to Next Phase:* 1. Surgery
Phase II Immediately Post op Phase duration: 0-6 weeks	*Immediate Post-operative instructions:* Patient/family education and training for: - Safety with mobility/transfers - Icing and elevation - Home Exercise Program - Appropriate Home Modifications *Precautions:* - Brace locked in extension for gait and activities of daily living (ADL's). May unlock brace when sitting - Non-weight bearing or toe touch weight bearing (20%) for the first 6 weeks (with brace locked in extension) - ROM limitations as stated below	*Goals of Phase:* Functional goals: 1. Protection of the post-surgical knee 2. Restore normal knee range of motion (ROM) 3. Normalize gait 4. Eliminate effusion 5. Restore leg control *Criteria to Advance to Next Phase:* 1. Safe gait with crutches and brace unlocked

	- No driving *Range of Motion(Knee AAROM/PROM)* ***– Passive extension only****:* - Week: 0-4: 0-90 degrees - Week: 4-6: 0-120 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 *Suggested therapeutic exercise* - Assisted range of motion (seated knee flexion or supine wall slides) within above guidelines - Knee extension ROM (avoid hyperextension past 5°) - Ankle pumps progressing to resisted ankle ROM - Patellar mobilizations - Quad sets - 10 second sustained - Straight leg raises in multiple directions (with brace until elimination of quad lag) - Supine wall pushes - Mini squats - Weight shifting drills - glute sets, clam shell, Hamstring stretch, ITB stretch, gastroc-soleus stretch *Modalities:* - NMES for quadriceps re-education/biofeedback - Cryotherapy for swelling and pain management - Taping – pain and swelling management	2. No effusion 3. 0-120 degrees Knee ROM 4. Abel to perform SLR without Quadriceps lag

Phase III Protection Phase (7-12 weeks after surgery) Continue with phase I interventions as needed	*Precautions:* - *Avoid over-stressing fixation by beginning close chain movements in a shallow arc of motion (starting 0-30, working up to 0-60) and using un-weighting techniques (pool/ Alter G)* - *Avoid post-activity swelling* - *WBAT per MD, based on xray* - *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* - *Discontinue brace when patient has good single leg stand control and good quadriceps control* - *No weight bearing stretching into knee flexion until week 8* - *Avoid exercises/activities with excessive patellofemoral compression forces (deep squats, resisted open chain terminal knee extension)* - *Do not overload the surgical site* - *No running, jumping or plyometrics until 4-6 months post-surgery* *Suggested Therapeutic Exercise:* - Gait drills (begin with Alter G treadmill or pool) - Functional single plane closed chain movements (begin with Alter G treadmill pool) - Continued gradual progression of ROM - Balance and proprioception exercises - ROM: progress PROM/AAROM/AROM of knee as tolerated - Stretching hamstring, gastroc, TFL, Prone quadriceps with strap - Strengthening: • TKE – 0-40 degrees • Leg press • Partial range wall squats (0-45 degrees) • Forward step ups, lateral step ups, step downs(forward, lateral , retro) • Bridge with physioball	*Goals of Phase:* 1. Single leg stand control 2. Good control and no pain with short arc functional movements, including steps and partial squat 3. Good quadriceps control 4. Restore full ROM by week 8-12 weeks 5. Progress weight bearing *Criteria to Advance to Next Phase:* 1. Normal gait on level surfaces 2. Good leg control without extensor lag, pain or apprehension 3. Single leg balance greater than 15 seconds 4. Quad strength > 70% of uninvolved leg

	• Romanian dead lift – week 7 – standing upright to weight just below knees • Band walks – Week 8 • Stool walks – week 8 • BOSU partial squat – week 9 (0-60 degrees) • Prone hamstring curl – week 10 (begin with ankle weights then progress to weight machine) • Aquatic therapy: flutter kicks, straight leg scissor kicks • Running in waist deep water - *Cardiovascular:* • *Stationary Bike – light resistance* • *Treadmill – forward and backward walking* • *Elliptical – week 9-10* *Modalities:* - NMES for quadriceps re-education – as needed - Cryotherapy for edema and pain management	
Phase IV Advanced strengthening Phase (13-16 weeks after surgery) *continue with Phase I-II interventions	*Precautions:* - Avoid closed chain exercises on land past 90° of knee flexion to avoid overstressing the repaired tissues and increased PF forces - Avoid post-activity swelling - No running, jumping, or plyometrics till 4-6 months post op *Suggested Therapeutic Exercise:* - Continue ROM exercises and stationary bike, elliptical, and treadmill walking - Closed chain strengthening begin with single plane progress to multi-plane - Single leg press - Balance and proprioception exercises; single leg stand, balance board - Hip and core strengthening. - Stretching for patient specific muscle imbalances	Goals of Phase: 1. Normal gait without crutches 2. Full ROM 3. No effusion 4. Improve quadriceps strength 5. Improve proximal hip and core strength 6. Improve balance and proprioception *Criteria to Advance to Next Phase:* 1. Normal gait without crutches 2. Full ROM 3. No effusion 4. No patellar apprehension 5. Single leg balance with 30° knee flexion greater than 15 seconds 6. Good control and no pain with squats and lunges

	- Hamstring isotonic exercises through full ROM, quadriceps isotonic exercises, single leg balance (stable/unstable surfaces, with leg swings, with ball toss, with UE perturbations)	
Phase V Early Return to Sport phase (16+ weeks after surgery)	Precautions: - Post-activity soreness should resolve within 24 hours - Avoid post-activity swelling *Suggested Therapeutic Exercise:* - Impact control exercises beginning 2 feet to 2 feet, progressing from 1 foot to other and then 1 foot to same foot - Movement control exercise beginning with low velocity, single plane activities and progressing to higher velocity, multi-plane activities - Sport/work specific balance and proprioceptive drills - Hip and core strengthening - Stretching for patient specific muscle imbalances - *Running*: begin at 4 months • Start with light gentle slow paced running (may benefit from Alter G) • Treadmill running (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 - *Plyometrics:* begin at 4 to 5 months • Start with double leg drills • Progress slowly to single leg drills • Ensure good form and proper hip and knee alignment - *Agility Drills:* begin at 4.5 to 5 months • Sub-max foot placement drills • Ladder, cutting, deceleration drills • Line hops	Goals of Phase: 1. Good eccentric and concentric multi-plane dynamic neuromuscular control (including impact) to allow for return to sport/work 2. Progress to higher level activities – based on functional demands and MD approval 3. Return to vocational, recreational and/or sport activities Return to Sport/Play: (7 to 9 months) 1. Patient may return to sport after receiving clearance from the orthopedic surgeon and the physical therapist/athletic trainer. Progressive testing will be completed. 2. Quad and hamstring strength 90% of uninvolved 3. Full symmetrical knee ROM 4. No knee joint effusion 5. Single leg hop test: limb symmetry of 90% 6. Triple hop test: limp symmetry of 90% 7. Cross-over hop test: limb symmetry of 90% 8. Refer to Lower Extremity Functional Scale