Rehabilitation Protocol for High Tibial Osteotomy Reconstruction

This protocol is intended to guide clinicians through the post-operative course for High Tibial Osteotomy reconstruction. This protocol is time based (dependent on tissue healing) as well as criterion based. Specific intervention should be based on the needs of the individual and should consider exam findings and clinical decision making. The timeframes for expected outcomes contained within this guideline may vary based on surgeon's preference, additional procedures performed, and/or complications. If a clinician requires assistance in the progression of a post-operative patient, they should consult with the referring surgeon.

The interventions included within this protocol are not intended to be an inclusive list. Therapeutic interventions should be included and modified based on the progress of the patient and under the discretion of the clinician.

Considerations for the Post-operative
Many different factors influence the post-operative high tibial osteotomy rehabilitation outcomes, including the presence of additional surgical procedures. It is recommended that clinicians collaborate closely with the referring physician regarding protocol.

If the patient develops a fever, unresolving numbness/tingling, excessive drainage from the incision, uncontrolled pain or any other symptoms you have concerns about, the referring physician should be contacted.

PHASE I: IMMEDIATE POST-OP (0-6 WEEKS AFTER SURGERY)

Rehabilitation Goals	• 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
Precautions	• No active knee extension • No resisted closed chain or open chain until 6 weeks post-op
Weight Bearing	• Week 0-4: **NWB/ TDWB with brace locked in extension** • Week 4-6: **TDWB with brace locked in extension progressing to PWB** ○ Progress to brace unlocked in PWB if have full extension and good quadriceps control
Brace	• 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

Interventions	*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
	
	Strengthening
	• Quad sets
	• Gluteal sets
	• Ankle pumps
	• Side-lying hip ABD – with brace until elimination of quad lag

	• Prone Hip Extension – with brace until elimination of quad lag
	• SLR – **per MD recommendation, depending on surgical approach, may be inappropriate**
	  o Perform with brace locked in extension, D/C brace when performed without a lag
	• Side-lying Hip Adduction – with brace until elimination of quad lag
	• Clam shell
	• Hamstring stretch
	• ITB stretch
	• Gastroc-soleus stretch
	• Bike – No resistance
	
	Aquatic therapy – if available
	• Deep water (chest/shoulder height) – walking and ROM exercises
	  o Core stability and UE exercises
	
	Manual Therapy
	• Patella mobilizations – immediately post-op
	• Gentle STM – 2-3 weeks post-op
	
	Modalities
	• NMES for quadriceps re-education/biofeedback.
	• Cryotherapy for swelling and pain management.
	• Taping – pain and swelling management.

Criteria to Progress	• Knee PROM: 0-120 degrees • Adequate pain control • Minimal swelling • Able to perform SLR without quadriceps lag

PHASE II: PROTECTION PHASE (7-12 WEEKS AFTER SURGERY)

Rehabilitation Goals	• Increase mobility • Restore quadriceps control • Restoration of full ROM by week 8-12 • Progress weight bearing • Normalize gait pattern without assistive device – goal of 2 miles at 15min/mile pace on a treadmill • Gradual progression of therapeutic exercises for strengthening, stretching and balance
Precautions	• 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 patella-femoral 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
Weight Bearing	• WBAT per MD, based on X-ray
Brace	• 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
Additional Interventions **Continue with Phase I interventions as needed*	*Modalities* • NMES for quadriceps re-education – as needed • Cryotherapy for edema and pain management *Manual Therapy* • Patella mobilizations • Soft tissue mobilization

	Range of Motion
	• Progress PROM/AAROM/AROM of knee as tolerated
	Stretching
	• Hamstring
	• Gastroc -Soleus
	• Prone Quadriceps with strap
	
	Strengthening
	• TKE – 0-40 degrees
	• Leg press
	• Partial range wall squats
	  ○ 0-45 degrees
	• Forward step ups, Lateral step ups
	• Forward, Lateral, Retro step downs
	• Bridge with physioball
	• Romanian Deadlifts – 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 – 10 weeks
	  ○ Begin with ankle weights and progress to weight machine
	
	Cardiovascular Exercise
	• Stationary Bike – light resistance
	• Treadmill – forward and backwards
	• Elliptical – week 9-10
	
	Aquatic Therapy
	• Flutter kicks
	• Straight leg scissor kicks
	• Running in waist deep water
	
	Balance
	• Progress from double to single leg balance
	• Progress from static to dynamic:
	  ○ BAPS
	  ○ Ball toss
	  ○ Body blade
	  ○ Fitter
	  ○ Slide board

Criteria to Progress	• Full range of motion • Elimination of swelling • Restoration of normal gait • Quad strength ≥ 70% of uninvolved leg

PHASE III: ADVANCED STRENGTHENING (13-16 WEEKS AFTER SURGERY)

Rehabilitation Goals	• Normal tibial-femoral and patella-femoral mobility • Restoration of quadriceps control • Progress muscle strength, endurance, and balance activities
Precautions	• 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 – Based on MD recommendation.

Additional Interventions **Continue with Phase I-II Interventions*	*Strengthening* • Total leg strengthening • Single leg strengthening • Hamstring isotonic exercises through full ROM • Quadriceps isotonic exercises *Proprioception* • Single leg balance ○ Stable and unstable surfaces • Single leg balance with leg swings • Single leg balance with ball toss • Single leg balance with UE perturbations *Cardiovascular Exercise* • Bike, elliptical • Treadmill walking
Criteria to Progress	• Full, symmetrical pain-free ROM • Strength: 80%+ of uninvolved leg • Satisfactory clinical exam • MD approval to progress to next phase

PHASE IV: EARLY RETURN TO SPORT PHASE (16+ WEEKS AFTER SURGERY)

Rehabilitation Goals	• Progress to higher level activities – based on functional demands and MD approval • Return to vocational, recreational and/or sport activities. • Run 2 miles at easy pace – if appropriate
Additional Interventions **Continue with Phase III interventions*	*Running:* **begin at 4 months** • Start with light gentle slow-paced running • 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:* **4.5 –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:* **4.5 to 5 months** • Sub-max foot placement drills • Ladder drills • Line hops
Criteria to Progress	Return to sport/play: **7 to 9 months** • 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% • Cross-over hop test: limb symmetry of 90% • Refer to lower extremity functional assessment

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