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High Tibial Osteotomy Protocol

Phase 1: Immediate Post-Op (0-2 WEEKS)

GOALS

- Non weight bearing 6-8 weeks, hinge knee brace (FROM)
- Decrease pain and swelling
- Full immediate ROM
- Maintain flexibility of hamstrings, calves
- Gluteal and quadriceps activation
- Patella mobility

EXERCISE SUGGESTIONS

ROM & Flexibility

- Heel slides (+/- slider board) in supine and in seated position
- Seated active assisted knee flexion (towel slides with heel on floor)
- Seated calf stretch with towel - knee bent (soleus), knee straight (gastrocnemius)
- Seated hamstring stretch (back straight)

Muscle Strength & Endurance

Quadriceps:

- Quadriceps isometrics lying

Hip/Gluteals:

- Gluteal squeezes supine or standing
- Standing hip flexion/extension, abduction/adduction

Calves:

- Ankle pumping +/- with leg elevation

Modalities

- Ice / Cryo-cuff 15-25 minutes
- Interferential current therapy (pain relief)

Phase II: Non-Weight Bearing Strengthening (2-6 WEEKS)

GOALS

- NWB for 6-8 weeks post op
- FROM
- Non weight-bearing strengthening exercises: hip, hamstrings, quadriceps, calves

EXERCISE SUGGESTIONS

ROM

- Continue as needed with slider board, up wall

Extension

- Sitting passive leg extension with roll under heel
- Prone leg hangs off end of bed/plinth
- Continue with hamstring/calf stretches

Flexion

- Supine with legs up wall – heels slides (knee flexion) with gravity assisted
- Supine legs up on swiss ball – roll heels towards buttocks
- Prone assisted knee flexion (belt, opposite leg)
- Bike pendulums: high seat ½ circles forward/backward → full circles – lower seat as tolerate

Muscle Strength & Endurance

Quadriceps:

- Quadriceps isometrics in standing/sitting/lying +/- muscle stimulation or biofeedback
- Quads over roll
- Standing closed-chain terminal extension with tubing at knee – forward facing (active terminal extension) and backward facing (passive terminal extension)

Hip/Gluteals/Hamstrings:

- Straight leg raise (on bed) with pelvic stability (all 4 planes)
- S/L clam shells
- Standing hip flexion/extension, abduction/adduction → progress to pulleys/bands (watch for excessive trunk shift/sway)
- Prone knee flexion
- Quadruped fire hydrant
- Supine bridging: 2 legs → 1 leg
- Supine bridging on swiss ball: 2 legs → 1 leg

Calves:

- Ankle plantar flexion with theraband

Modalities

- Ice/IFC/Game Ready

Phase III: Progressive Weight-Bearing and Strengthening (6-12 WEEKS)

GOALS

- Continue with surgeon instructed weight-bearing limit
- Crutches: partial weight bearing progress to full weight bearing
- Brace at surgeon discretion
- Monitor, normalize and retrain gait over given timeframe
- Full and pain free knee range of motion
- Initiate cardiovascular conditioning
- Baseline proprioceptive/balance re-education
- Weight-bearing strengthening of lower extremity muscle groups

EXERCISE SUGGESTIONS

ROM

- Patellar and/or tibial-femoral joint mobilizations if needed to achieve terminal ROM
- Continue with bike

Flexibility

- Assisted quadriceps stretch in side-lying, prone or in standing as tolerated
- Standing stretches (partial to full weight-bearing as tolerated) for gastrocnemius (knee straight) and soleus (knee bent), ensure back foot is straight

Weight Bearing & Gait

- Progress from 2 crutches → single crutch → full weight bearing, always maintaining normal walking pattern
- Weight shifting (the allowed weight) on affected leg by use of 2 weigh scales (side-to-side and forward/backward) → progress to equal weight bearing as tolerated
- Weigh scales: when 50%WB mini squat with equal weight bearing

Muscle Strength & Endurance

Quadriceps:

- Mini wall squat (30°) progress to 60°-90° (+/-wall)
- Shuttle: (one bungee cord) – 2 leg squat (¼ - ½ range) and 2 leg calf raises, may progress slowly and as tolerated from 2-1 leg squats/calf raises, increasing ROM and resistance
- Sit to stand 2 legs with high seat height – progress by decreasing height of seat +/- with muscle stimulation
- Leg press machine: low weight 2 legs (½ – ¾ range)
- Bungee cord walking: forward/backward/side step with slow control on return as tolerated
- Static Lunge (¼ - ½ range) → progress to dynamic lunge step (¼ - ½ range) with proper alignment (shoulders over knees over toes) as tolerated
- Step ups and down 2-4": lateral, forward

Hamstrings/Gluteals:

- Continue hip strengthening with increased weights/tubing resistance
- Tubing kickbacks (mule kicks)
- Supine on floor legs on swiss ball: bridging plus knee flexion (heels to buttocks)
- Chair walking/stool pulls
- Prone active hamstring curls – progress with 1-2 lb weights
- Sitting hamstring curls with light tubing/pulley system for resistance

Calves:

- Standing 2 legged calf raises with/without support progress raises from 2-1 foot
- Toe walking as tolerated (when full weight bearing)

Proprioception

With balance drills on unstable surfaces, be aware of and correct poor balance responses such as hip hiking with INV/EVER and trunk extension with DF/PF.

GOAL: maintain stance on board regardless of ability to control board position

Wobble boards with support (table, bars, poles) through full ROM: side-to-side, forward/backward

- Standing on ½ foam roller: balance → rocking forward/backward
- Single leg stance 30-60 seconds (when full WB) → progress to unstable surface, with and without vision

Cardiovascular Fitness

- Bike with increasing time parameters
- Elliptical trainer

Modalities

- Ice/IFC

Phase IV: Return to Activity (3-6+ Months)

GOALS

- Continue and advance strengthening: lower chain concentric/eccentric strengthening of gluteals, quadriceps & hamstrings
- Dynamic lower chain strengthening
- Progress cardiovascular conditioning
- Progress proprioception
- Sport specific training

EXERCISE SUGGESTIONS

Muscle Strength & Endurance

Quadriceps:

- Sit to stand → lower bed height (watch mechanics) → single leg
- Progress resistance of Shuttle working on strength & endurance, 2 → 1 leg
- Lunging in Bungee → add speed and direction change as tolerated
- Static Lunge (full range) → dynamic lunge → lunge walking
- Forward and lateral step-ups 4-6-8" (watch for hip hiking or excessive ankle dorsiflexion)
- Eccentric lateral step down on 2-4-6" step with control (watch for hip hiking or excessive ankle dorsiflexion)

Hamstrings/Gluteals:

- Fitter: hip abduction and extension (poles for support) → progress side-to-side
- Shuttle standing kick backs (hip/knee extension)
- Tubing kickback (mule kicks) increased tension
- Stool pulls/Chair walking
- Standing hamstrings curls – weights/pulleys/ Bungee
- Continue hip strengthening with increased weights/tubing resistance

Calves:

- Shuttle eccentric heel drops 2legs → 1 leg
- Calf raises with heel drop off steps 2 legs → 1 leg

Proprioception

- Continue on wobble boards and begin to add basic upper body skills (i.e. throwing, use of racquet in hand)
- Single leg stance on unstable surface i.e. pillow, mini-tramp, BOSU, Airex, Dynadisc with/without support - progress to no vision
- Standing 747 eyes open/closed – progress to mini trampoline
- Single leg stance performing higher end upper body skills specific to patient goal(s)

Cardiovascular Fitness

- Bike: increasing time or resistance progress to outdoor cycling
- Treadmill – walk +/- incline → quick walk → increased speed

- Swimming or pool running in shallow water
- Functional sport patterning with increased speed, reps etc...as needed/tolerated

HTO: Guidelines for Manual Therapy and Exercise Phase I	Phase II	Phase III	Phase IV
ROM & Flexibility:			
Ankle pumping +/- leg elevation		●	
Heel Slides (+/-slider board, up wall)	●		●
Seated active assisted knee flexion	●		●
Seated calf & hamstring stretches	●		●
Passive extension with roll under heel		●	
Prone hangs (leg off bed)		●	
Stationary bike	●		●
Joint Mobilizations (patellar, tib-femoral)		●	
Quad stretches		●	
Standing weight-bearing calf stretches: gastroc, soleus		●	
Muscle Strength & Endurance			
Quadriceps:			
Isometric quads	●		●
Quad over roll		●	
Closed chain terminal extension with tubing: forward and backward facing	●		●
Squats: wall, mini, 60°-90°	●		●
Shuttle: leg press & calf press - 2 legs, 1leg	●		●
(progress with ↑resistance/reps)			
Sit to stand: high seat, low seat, 2 legs, single leg	●		●
Leg press machine: 2-1 leg	●		●
Bungee cord walking: forward, backward, side step, lunging	●		●
Static Lunge: ¼-½-full, dynamic	●		●
Step ups (concentric):2-4-6-8"	●		●
Step down (eccentric):2-4-6-8"	●		●
Hamstrings.Gluteals:			
Gluteal squeezes (supine or standing)	●		●
Standing hip flexion/extension, abduction/adduction	●	●	●
Supine SLR x four directions		●	
S/L: clam shells		●	
Prone knee flexion		●	
Quadruped fire hydrant		●	
Supine bridging: double, single, ball, +knee flexion	●	●	●
Hamstring curls: prone, sitting,	●		●

standing

Chair walking/stool pulls	●	●
Hip strengthening: weights, pulleys, tubing	●	●
Tubing kickbacks (mule kicks)	●	●
Shuttle standing kick backs (hip/knee extension)		●
Pro-fitter (abduction, extension, side-to-side)		●

References on site

<http://fowlerkennedy.com/wp-content/uploads/2015/11/HIGH-TIBIAL-OSTEOTOMY-HTO-PROTOCOL-November-2015.pdf>