ATTENTION PHYSICAL THERAPISTS—STRESS IMPORTANCE OF THE FOLLOWING:

- **Place patient in brown compression stocking (20-30 mmHg) at first PT appointment. Wear during daytime only and d/c at night—instruct patient/family member how to don/doff stocking**
- **May discharge when no swelling or effusion- typically 3-4 weeks p/o**
- **Stress early knee extension. Should reach full knee ext by 2 weeks post-op.**
- **Stress no pillows under popliteal fossa. Always under calf/heel only to progress knee extension.**
- **All multi-ligament reconstructions on ASA 325 p/o daily X2 weeks unless contraindicated (i.e. Coumadin, Bloodthinners, Allergies)**

WEIGHT BEARING STATUS

- Partial Weight Bearing initially
- Brace locked in extension for partial weight bearing for 4 weeks
- With clearance from PT and surgeon, patient may advance to WBAT with crutch wean at 4 weeks, only if the following criteria are met
  - able to walk with normal gait pattern
  - no pain
  - no extensor lag
  - good quad control
  - ability to safely ascend/descend stairs without noteworthy pain or instability

BRACING INSTRUCTIONS

ACL hinged knee brace (TROM or equivalent) for weight bearing activities

- Locked for ambulation at 0° for the first 4 weeks post-op
- Locked for sleep at 0° for first 6 weeks post-op
- Unlock for range of motion (ROM) to specified degrees when seated or at physical therapy for gait training after 2 weeks
- Advance to unlocked brace for PWB ambulation at week 4 if the patient is comfortable doing so and if they demonstrate appropriate quadriceps control (should not flex past 90° until week 4)

Brace Range

Timeframe	Degree Range
First 24 hours only	Brace locked at 0° or until 1st post-op surgeon visit for adolescents
0 to 2 Weeks	0 - 45°
2 to 4 Weeks	0 - 90°
4 to 6 Weeks	Progress to full ROM as tolerated
6 to 14 Weeks	Change to functional brace (if requested by surgeon) when Active Range of Motion (AROM) is 0 to ≥110°

RECOMMENDATIONS

- No scar massage until phase 3
- No manual PROM during any point in phase 1-3 of the protocol/rehabilitation
- Driving: No driving until patient is off all narcotics; for patient with RIGHT leg procedure, no driving until the patient is full weight bearing without crutches and has at least 60° of flexion
- Jobs with physical labor: Restrictions per operating surgeon and in the following PT protocol
- The only modalities for muscular strengthening to be used are NMES (NeuroMuscular Electrical Stimulation) and optional low intensity Blood Flow Restriction (BFR) strength training for patients limited by pain or poor load tolerance.
- If stiffness is observed at any phase, please contact the operating surgeon and:
    - Ensure proper post-op management of pain and swelling
    - Ensure patient is following the recommended BEAR Implant rehab protocol

REHABILITATION GUIDELINES
ACL-BEAR RECONSTRUCTION

PHASE 1: 0-4 WEEKS **DOS:**

Crutch Use	Beginning the day of surgery, patients are cleared for PWB (begin up to 50% body weight) with crutches and brace locked to 0° for weight bearing and unlocked in flexion until criteria are met as early as 4 and no later than 6 weeks post operatively
Bracing	• Brace locked at 0° for the first 24 hours after surgery, then progress as instructed above. • While seated (at rest) and for ROM exercises, brace range should be set to 0 - 45° for weeks 0 to 2 and then 0 - 90° for weeks 2 to 4. ○ Do not flex the knee past the specified degrees • For ambulation and weightbearing, brace should be locked at 0° for 2 weeks and then unlocked for ambulation gait training and ADLs • For sleep, brace should be locked at 0° for 4 weeks

Muscle Performance Exercises	• Extension and Flexion exercises that are allowed in this phase are wall slides within restrictions
	  ○ Extension ~4-5min, 2x per day
	  ○ Flexion ~1 or 2 sets x10 reps with a 5 – 10 sec hold, at least 2x per day
	• Quad set/quad with superior patellar glide based on visual inspection and palpation isometric contraction 3 sets x10 reps, 2 or 3x per day
	• Patellar mobilizations: medial/lateral mobilization, superior/inferior direction

NMES	• With knee in full extension on a treatment table, increase stimulation amplitude so that at a minimum it would result in a full tetanic contraction of the quadriceps
	  ○ Continue to increase the stimulus amplitude to the patient's maximum tolerance level
	  ○ 10-15 10s contractions with a 50s rest between contractions

Cryotherapy	• Cold with compression/elevation (e.g., Cryo-cuff, Don Joy Iceman device or equivalent) • First 24 hours or until acute inflammation is controlled: every waking hour for 15 minutes • After acute inflammation is controlled: 3 times a day for 15 minutes • Do not sleep with automated device running while on the knee • Keep a layer of fabric or ace wrap between skin and ice at all times

PHASE 2: WEEKS 4-7	DATE:
Goals	• Full knee extension • Flexion ROM >90° • Good quadriceps isometric contraction • Minimize pain and swelling
Crutch Use	• With clearance from PT and surgeon, may advance from PWB to WBAT with crutch wean at 4 weeks when the following criteria are met: normal gait pattern, no pain, SLR no extensor lag, and good quad control. (Walking practice in the clinic should occur to normalize gait during this phase to facilitate normal walking pattern beginning 2 weeks after surgery.)
Bracing	○ Hinged Knee Brace: Brace range set to 0 - 90° for weeks 2 to 4; once 90° ROM is met, patient may advance brace range to allow for full ROM ○ Unlocked for weight bearing and ambulation if good quad control has returned. ○ At 6 weeks brace is no longer required for sleeping
Range of Motion	○ Extension: Low load, long duration stretching (~5 minutes) such as heel prop. The patient can now add bag hang minimizing co-contraction and nociceptor response as indicated ○ Patellar mobilization: medial/lateral mobilization initially followed by superior/inferior direction while monitoring reaction to effusion and ROM ○ No manual Passive Range of Motion into flexion
Muscle Activation and Strengthening	○ Quadriceps sets emphasizing whole muscle activation ○ Long arc quad exercises 90 to 0 deg ○ Straight Leg Raise (SLR) emphasizing no lag ○ Start reciprocal stair training at 4 to 6 weeks
NMES	○ Continue until quad limb symmetry index is 80%

Stiffness has been observed in this phase and is most associated with "fear avoidance," rehab non-compliance, and in patients with concomitant procedures such as meniscal repair. In the case of stiffness, the following should be implemented:

- Ensure proper post-op management of pain and swelling
- Ensure patient is compliant with the recommended protocol
- Additional modalities/exercises are recommended:
  - Continue recommended exercises
  - Patella mobilizations: high grade more often
  - Supine bag hangs (weighted)

PHASE 3: WEEKS 7-12	DATE:
Goals	• Minimize pain and swelling • Full knee extension ROM; flexion to within 15° of the contralateral • Good quadriceps control (≥20 no lag SLR) • Normal gait pattern
Crutch Use	• WBAT; can continue crutch wean as appropriate • Crutch D/C criteria = normal gait pattern; ability to safely ascend/descend stairs without noteworthy pain or instability (reciprocal stair climbing)
Bracing (T-Scope of Functional ACL	• Okay to change to functional ACL brace (if required by surgeon) when AROM in flexion is 110° or more

Brace)	• Can be in either a hinged knee brace or functional ACL brace for walking and any other weight bearing and closed chain activity (bike, elliptical, leg press, wall slides, mini squats, etc.)
Muscle Activation and Strengthening	• Quadriceps sets emphasizing vastus lateralis and vastus medialis activation • SLR emphasizing no lag • Electric Stimulation: Continue until quadriceps QI is ≥80% • Double-leg wall slides or mini-squats without knee over foot • Hamstring sets: For hamstring curls, do not flex knee more than is comfortable for patient. • Proximal Hip Strengthening: e.g., side-lying hip adduction/abduction, Prone Hip Extension • Quadriceps/hamstring co-contraction supine • Open chain knee extension progressive resistance • Reciprocal stair training • Aqua jogging in pool okay starting at 8 weeks post op
NMES	• Continue until QI is ≥80% • Continue until quad limb symmetry index is 80%
Neuromuscular Control	• Weight shift • Joint angle repositioning
Progression Criteria	• 20 reps no lag SLR • Normal gait • Crutch/immobilizer d/c • ROM: No greater than 5 deg ext lag and 90 deg active flexion • QI: 60-80%

PHASE 4: 12-20 WEEKS	**DATE:**
Goals	• Maintain full ROM • Running without pain or swelling • Hopping without pain, swelling or giving way
Strengthening	• OKC knee extension • Squats • Leg press • Hamstring curl • Step-ups/down • Shuttle • Sports cord • Wall squats • Progress to single leg squats
Agility	• Double leg jumping progressing to hopping as tolerated
Neuromuscular	• Wobble board/rocker board/roller board • Perturbation training, instrumented testing systems, varied surfaces
Cardiopulmonary	• Begin or continue running progression on treadmill or in protected environment after clearance by operating surgeon and QI = 80%, to trace effusion and full ROM • NO cutting or pivoting • All other cardiopulmonary equipment
Progression	• Running without increase in pain or swelling

Criteria	• Able to hold SLS for 60 sec • 50% hop height on operated leg *hop test in brace • Clearance by surgeon • QI >80%

PHASE 5: WEEKS 30-36	DATE:
Goals	• Running patterns (figure-8, pivot drills, etc.) at 75% speed without difficulty • Jumping without difficulty • Hop tests at 85% contralateral values (Cincinnati hop tests: single-leg hop for distance, triple-hop for distance, crossover hop for distance, 6-meter timed hop)
Strengthening	• Squats • Lunges • Plyometrics
Agility	• Shuffling • Hopping • Cariocas • Vertical jumps • Running patterns at 50 to 75% speed • Initial sports specific drill patterns at 50 to 75% effort
Neuromuscular	• Wobble board/rocker board/roller board • Perturbation training, instrumented testing systems, varied surfaces
Cardiopulmonary	• Running • Other cardiopulmonary exercises
Progression Criteria	• Max vertical jump without pain or instability • 85% of contralateral limb on hop tests • Run at 85% speed without difficulty • Clearance by surgeon • 85% QI

PHASE 6: WEEKS 36-52	DATE:
Goals	• 90% contralateral quad strength • 90% contralateral on hop tests • Sport-specific training without pain, swelling or difficulty
Strengthening	• Squats, Lunges, Plyometrics
Sports Specific Activities	• Interval training programs • Running patterns in football, Sprinting, Change of direction, Pivot and drive-in basketball, Kicking in soccer, Spiking in volleyball, Skill/biomechanical analysis with coaches and sports medicine team
Return to Sports Evaluation	• Balance test: Single leg balance for 60 seconds without touchdown for each leg • Single leg squat: Get to 60° of flexion, able to do without IR at the hip or valgus at the knee • Hop tests (single leg hop for distance) to be 95% of contralateral side • QI ≥90% • No functional Complaints • Confidence with running, cutting, and jumping at full speed • Clearance by physician