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Anterior Cruciate Ligament Repair
(BEAR Implant)

This rehabilitation protocol has been designed for patients who have undergone an ACL Repair using the BEAR Implant. This is not an ACL Reconstruction Protocol. Please follow this specialized BEAR Implant Rehabilitation Protocol in the pages that follow, unless instructed differently by Dr. Stewart.

Physical Therapists: For questions and to be connected with the BEAR Implant rehab consultant through Miach Orthopaedics, call 1-800-590-6995 or info@miachortho.com

Weight Bearing Status:

- Partial Weight Bearing (up to 50% of body weight) for 4
- Brace locked in extension for 4 weeks
- With clearance from PT and Dr. Stewart, patient may advance to WBAT with crutch wean at 4 weeks only if the following criteria are met:
    - Able to ambulate with normal gait pattern
    - No Pain
    - No Extensor Lag
    - Good Quad Control
    - Ability to safely ascend/descend stairs without noteworthy pain or instability (reciprocal stair climbing)

Bracing Instructions:

TROM for weightbearing activities.

- Locked for ambulation at 0° for the first 4 weeks post-op
- Locked for sleep at 0° for the 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 patient is comfortable doing so and if they demonstrate appropriate quadricep control (should not flex past 90° until after week 4)

Brace Range:

Timeframe	Degree Range
First 24 hours only	Brace Locked at 0° or until 1st Post-Op 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 when Active Range of Motion (AROM) is 0 to ≥ 110°

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Recommendations:

- No scar massage until phase 3
- No manual PROM during any point in phase 1-3 of the protocol/rehabilitation
- No CPM
- 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 Dr. Stewart
- The only modality for muscular stimulation to be used is NMES and option low intensity Blood Flow Restriction strength training for patients limited by pain or poor load toleranace
- **If stiffness is observed at any phase, please contact Dr. Stewart and…**
    - Ensure proper post-op management of pain and swelling
    - Ensure patient is following the recommended BEAR Implant rehab protocol
        - If Dr. Stewart recommends a specific protocol deviation, please consult his office before action is taken.

Additional Instructions:

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Phase 0: Prior to surgery and immediately after

Phase Goals:

- Full active (AROM) and passive (PROM) knee extension
- Knee Flexion ROM within 10° of uninvolved limb
- Trace to zero knee effusion
- No knee extension lag with straight leg raise (SLR)
- Quadriceps Strength Index (QI) >80% of uninvolved limb– Retain values for post-operative comparison to minimize over estimation of strength
- Teach the Home Exercises to patient/guardian(s) at the last pre-operative visit (see After Surgery Instructions document). Also highlight the importance of rehabilitation compliance.
- Educate on brace, crutch use, and PWB\

Patient Education:

- Importance of prehab for optimal post-operative outcomes
- What to do immediate after surgery (0-48 hours)
- Anticipated return to sports or high intensity activities: 9-12 months
- Expected outcomes: Return to prior level of competition is often difficult, but possible
- Osteoarthritis Risk

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Phase 1: Weeks 0 to 4

Home Program w/PT supervision & Post-Operative Visit with Dr. Stewart

Important Instructions for Phase 1

- Facilitated by PT: The After Surgery Instructions and Home Exercises should be reviewed and taught again at the first post-op clinic visit with Dr. Stewart and again with PT at their weeks 1 and 2 post-op visits.

Recommendations

Area	Instructions
Crutch Use	• Beginning the day of surgery, patients are cleared for PWB (up to 50% body weight) with crutches and brace locked to 0° for weightbearing and unlocked in flexion (see chart on page 1) 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 TROM instructions after the first 24 hours post-op • While seated (at rest) and for ROM exercises the 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 and gait training and ADL's • For sleep the brace should be locked at 0° for 4 weeks

Muscle Performance Exercises	**Patient should begin these within the first week after surgery. Do not flex past specified degrees.**
	• Extension and Flexion Exercises that are allowed in this phase are wall slides
	  • Extension **~4-5 mins, 2x per day**
	  • Flexion **~1 or 2 sets x10 reps with a 5-10 second hold, at least 2x per day**
	• Quad set/quad with superior patellar glide based on visual inspection and palpation isometric ic contraction: **3 sets x10 reps, 2 or 3x per day**
	• Patellar mobilizations: medial/lateral mobilization initially followed by 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 (no fasciculations observed on visual inspection) with evidence of superior patellar glide • Continue to increase stimulus amplitude to the patient's maximum tolerance level • 10-15 10s contractions with a 50s rest between contractions.
Cryotherapy	• Cold with compression/elevation (Breg Polar Care Wave) • First 24 hours or until inflammation is controlled: every hour for 15 minutes • After acute inflammation is controlled: 3 times a day for 15 minutes • If using the Breg Polar Care **CUBE**, keep a layer of fabric or ace wrap between the skin and icing device at all times. If using the WAVE, this is built into the sleeve.

»	Criteria for progression to Phase 2
	4 weeks post surgery

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Phase 2: Weeks 4-7

Early Post-Operative Physical Therapy Phase

Goals:

- Full Extension
- Flexion ROM > 90°
- Good isometric quadriceps contraction
- Minimize Pain and Swelling

Area	Instructions
Crutch Use	• With clearance from Dr. Stewart and the PT, may advance to WBAT with crutch wean at 4 weeks and only if the following criteria are met: normal gait pattern, no pain, no extensor lag (as measured by full SLR without 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	• TROM: Brace range set to 0-90° for weeks 2-4; 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 prone hang minimizing co-contraction an nociceptor response as indicated. • Gentle 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° • Straight Leg Raise (SLR) emphasizing no lag • Start reciprocal stair training at 4-6 weeks.
NMES	• Continue until quad limb symmetry index is 80%

Recommendations

Stiffness has been observed in this phase most associated with "fear avoidance" and rehab deviation, i.e., patients with adjunct 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 (please contact Dr. Stewart before in any action is taken in the case where the patient's protocol has been altered for any reason).
- Additional Modalities/Exercises are recommended
    - Continue recommended exercises, patella moblizations (high grade, more often), supine bag hangs (weighted)

»	Criteria for progression to Phase 3
	7 weeks post surgery
	ROM– Full extension to > 90°

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Phase 3: Weeks 7 to 12

Post-Operative Physical Therapy

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

Recommendations

Area	Instructions
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)
Brace Use	• TROM: 0-110° at week 7. • Should 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.)
Range of Motion	• Extension: Low load, long duration stretching (~5 minutes) such as heel prop or weighted prone hang minimizing co-contraction an nociceptor response • Flexion: AROM/AAROM exercises (e.g., wall slides, heel slides, seated active-assisted knee flexion (**NO MANUAL PASSIVE ROM)** • Bike: Rocking-for-range
Muscle Activation and Strengthening	• Quadriceps sets emphasizing vastus lateralis and vastus medialis activation • Straight Leg Raise (SLR) emphasizing no lag • Double–leg wall slides or mini squats without knee over foot • Hamstring sets: Hamstring curls—do not flex knee more than 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 to QI is >80%
Neuromuscular Control	• Weight Shift • Joint Angle Repositioning

»	Criteria for progression to Phase 4
	Minimum of 12 weeks post surgery
	20 no lag SLR
	Normal Gait
	Crutch D/C
	ROM: No greater than 5° active extension lag and 90° active flexion
	QI = 60-80%

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Phase 4: Weeks 12 to 20

Early Strengthening & Rehabilitation Phase

Goals:

- Full ROM, flexion ROM with 10° of uninvolved knee
- Improve Muscle Strength
- Progress Neuromuscular Retraining

Recommendations

Area	Instructions
Range of Motion	• Low Load, long duration (assisted prn) • Heel Slides/Wall Slides • Heel Prop/Prone Hang (Minimize co-contraction/nociceptor response) • Bike (rocking-for-range + riding with high seat height until comfortable and then bringing seat down as ROM improves) • Flexibility stretching of all major muscle groups
Strengthening Quadriceps	• Quad Sets (Mini squats/wall squats) • Step-Ups • Leg Press; Shuttle press without jumping action • PRE's knee extension of dynamometer knee extension machine, bag weights
Strengthening Ham-string	• Hamstring Curls • Resistive back SLR with sports cord for hamstring (not quad)
Strengthening Other Musculature	• Hip adduction/abduction; side lying SLR or with equipment • Standing heel raises progress from double to single leg support • Seated calf press against resistance • Multi-hip machine in all directions with proximal pad placement • Swimming with flutter kicks only
Neuromuscular Training	• Wobble board, Rocker board, Single-leg stance with or without equipment (e.g., instrumented balance system), slide board
Cardiopulmonary	• Bike, Elliptical trainer, Stairmaster, flutter kicking in pool start at week 12 • Transition to straight line running on treadmill (zero gravity or traditional) or in a protected environ-ment after clearance by operating surgeon and QI > 80%, zero effusion and full ROM. Otherwise, hold off on straight line running until Phase 5.

»	Criteria for progression to Phase 5
	Minimum 20 weeks post surgery
	Full ROM
	Minimal Effusion and Pain
	Functional strength and control in daily activities (QI > 80%)
	Clearance for running, given by Dr. Stewart

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Phase 5: Weeks 20 to 30

Strengthening and Control Phase

Goals:

- Maintain Full ROM
- Running without pain or swelling
- Hopping without pain, swelling, or giving way

Recommendations

Area	Instructions
Strengthening	• OKC Knee Extension • Squats • Leg Press • Hamstring Curl • Step-Ups/Down • Shuttle • Sports Cord • Wall Squats • Progress to single leg squats
Agility Drills	• Double leg jumping progressing to hopping as tolerated
Neuromuscular Training	• Wobble board, Rocker board, • Perturbation training, Instrument testing systems, varied surfaces
Cardiopulmonary	• Begin or continue running progression on treadmill or protected environment after clearance by Dr. Stewart and QI = 80%, to trace effusion and full ROM. • NO cutting or pivoting • All other cardiopulmonary equipment ok

»	Criteria for progression to Phase 6
	Minimum 30 weeks post surgery
	Running without pain or swelling
	Able to hold single leg balance for 60 seconds
	50% hop height on operative leg (hop test in brace)
	Completion of functional hop testing and clearance by Dr. Stewart
	Neuromuscular and strength training exercises without difficulty

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Phase 6: Weeks 30 to 36

Advanced Training Phase

Goals:

- Running patterns (Figure 8, pivot drills, etc.) at 75% speed without difficulty
- Jumping without difficulty
- Hop tests at 80% contralateral values (single leg hop for distance, triple hop for distance, crossover hope for distance, 6 meter timed hop)

Recommendations

Area	Instructions
Strengthening	• Squats • Lunges • Plyometrics
Agility Drills	• Shuffling • Hopping • Carioca • Vertical Jumps • Running patterns at 50-75% speed
Neuromuscular Training	• Wobble Board/Rocker board/roller board
Cardiopulmonary	• Running • Other cardiopulmonary exercises

»	Criteria for progression to Phase 7
	Maximum vertical jump without pain or instability
	85% of contralateral leg on hop tests
	Run at 85% speed without difficulty
	IKDC Question #10 (Global Rating of Knee Function) score of >8
	Completion of functional hop testing showing 85% function and clearance by Dr. Stewart
	QI > 85%

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Phase 6: Weeks 36 to 52

Return to Sport Phase

Goals:

- 90% contralateral strength
- 90% contralateral on hop tests
- Sports specific training without pain, swelling, or difficulty

Recommendations

Area	Instructions
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 Recommendations	• Balance test—single leg balance for 6seconds without touchdown for each leg • Single Leg Squat—get to 60° of flexion, 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%

»	Criteria for Return-to-Sports Criteria
	No functional complaints
	Confidence when running, cutting, jumping at full speed
	90% contralateral values on hop tests
	QI > 90%
	IKDC Question #10 (Global Rating of Knee Function) score of ≥9
	Clearance by operating surgeon