

BEAR[®] Implant Rehabilitation Protocol

Date of surgery: _____
Name of operating surgeon: _____
Contact for operating surgeon: _____

Treatment:

This patient received the BEAR Implant as treatment for a torn ACL. This is not an ACL Reconstruction (ACLR) and the Rehabilitation Protocol is different. **Please follow this specialized BEAR Implant Rehabilitation Protocol in the pages that follow, unless instructed differently by the operating surgeon.**

Physical therapists: For questions and to be connected with our rehab consultant, please contact Miach Orthopaedics 1-800-590-6995 or Info@miachortho.com

Pre-Surgical Preparation for Surgical Team:

- The patient should begin their home exercises (see appendix) within the first week after surgery. Please teach these exercises to the patient at the last pre-operative visit.
 - They will review these exercises again at their first PT visit to ensure proper form and frequency
- Notify the patient at their last pre-op visit that they should schedule their first Physical Therapy visit to take place within first week post-op

Weight Bearing Status:

- Partial Weight Bearing (up to 50% of body weight) for 4 to 6 weeks
- Brace locked in extension for weight bearing for 4 weeks
- With clearance from PT and surgeon, patient may advance to WBAT with crutch wean at 4 to 6 weeks, only if the following criteria are met.
 - able to walk with normal gait pattern
 - no pain
 - no extensor lag
 - good quad control
- With clearance from PT and surgeon, patient may discontinue crutches when the following criteria are met.
 - normal gait pattern
 - ability to safely ascend/descend stairs without noteworthy pain or instability (reciprocal stair climbing)

Bracing Instructions:

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

- Locked for ambulation at 0 degrees for the first 4 weeks post-op
- Locked for sleep at 0 degrees for first 6 weeks post-op
- Unlock for range of motion (ROM) to specified degrees when seated or at physical therapy
- 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-degrees until after week 6)

Brace Range:

Timeframe	Degree Range
First 24 hours only	Brace locked at 0°
0 to 2 Weeks	0 - 30°
2 to 4 Weeks	0 - 60°
4 to 6 Weeks	0 - 90°
6 to 14 Weeks	Change to functional brace when Active Range of Motion (AROM) is 0 to ≥110°

Recommendations:

- No scar massage until 6 weeks post-op
- No manual PROM during any point in the protocol/rehabilitation
- No CPM
- Driving: No driving until patient is off all narcotics; for patient with RIGHT leg procedure – no driving for 2 weeks and able to achieve 60° of flexion
- Jobs with physical labor- restrictions per operating surgeon and in the following PT protocol
- The only modality for muscular stimulation to be used is E-Stim
- **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
 - If operating surgeon has specifically recommended a protocol deviation, please consult with the operating surgeon before action is taken

Additional Instructions:

Phase 0: Prior to surgery and immediately after

Pre-operative Recommendations:

1. Surgical team to review the After Surgery Instructions and teach the Home Exercises to patient/guardian(s) at the last pre-operative visit (see appendix). Also highlight the importance of rehabilitation compliance
2. Educate on brace, crutch use and PWB

Phase 1: Weeks 0 to 4

Home Program w/ PT supervision & 1-2 week visit w/ surgeon

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 surgeon and again with PT at their weeks 1 and 2 post- op visits.

RECOMENDATIONS

Area	Instructions
Crutch Use	<ul style="list-style-type: none"> Beginning the day of surgery, patients are cleared for PWB (up to 50% body weight) with crutches and brace locked to specified degrees (see chart above) until 4 to 6 weeks post operatively.
Bracing	<ul style="list-style-type: none"> Brace locked at zero-degrees for the first 24 hours after surgery Hinged Knee Brace instructions after the first 24 hours post-op <ul style="list-style-type: none"> ○ While seated and for ROM exercises the brace range should be set to 0 - 30° for weeks 0 to 2 and then 0 - 60° 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 4 weeks ○ For sleep the brace should be locked at 0° for 6 weeks
Exercises	<p>See appendix for detailed instruction, patient should begin these within the first week after surgery. Do not flex past specified degrees</p> <ul style="list-style-type: none"> Extension and Flexion exercises <ul style="list-style-type: none"> ○ 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 isometric contraction 3 sets x10 reps, 2 or 3x per day Double toe and heel raise 10 reps 2x per day Patellar mobilizations: medial/lateral mobilization initially followed by superior/inferior direction while monitoring reaction to effusion and ROM
Cryotherapy	<ul style="list-style-type: none"> Cold with compression/elevation (e.g., Cryo-cuff, Don Joy Iceman device or equivalent) First 24 hours or until acute inflammation is controlled: every 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 icing device at all times

★	Criteria for progression to Phase 2
	4 weeks out from surgery

Phase 2: Weeks 4 to 7

Early Post-Operative Physical Therapy Phase

GOALS:

1. Full knee extension
2. Good quadriceps isometric contraction
3. Minimize pain and swelling

RECOMENDATIONS

Area	Instructions
Crutch Use	<ul style="list-style-type: none"> • PWB with crutches (beginning the day of surgery, 50% maximum weight bearing until 4 to 6 weeks post-op) • With clearance from PT and surgeon, may advance to WBAT with crutch wean at 4 to 6 weeks and only if the following criteria are met: able to walk normally gait pattern, no pain, no extensor lag, and good quad control.
Bracing	<ul style="list-style-type: none"> • Hinged Knee Brace: Brace range set to 0 - 90 degrees for weeks 4 to 6; unlocked for weight bearing and ambulation if good quad control has returned. Do not flex the knee past the specified degree
Range of Motion	<ul style="list-style-type: none"> • Extension: Low load, long duration stretching (~5 minutes) such as heel prop. The patient can now add prone hang minimizing co-contraction and 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
Muscle Activation & Strengthening	<ul style="list-style-type: none"> • Quadriceps sets emphasizing vastus lateralis and vastus medialis activation • Straight Leg Raise (SLR) emphasizing no lag • Electric Stimulation: Optional if unable to perform no lag SLR; Discontinue use when able to perform 20 no lag SLR • Ankle pumps with TheraBand • Heel raises (calf press) • Start reciprocal stair training at 4 to 6 weeks in preparation for crutch D/C

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 consult the operating surgeon before 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 mobilizations
- Prone leg hangs (weighted, moist heat on back of knee, patella two finger breadths off table)
- Acupressure/Acupuncture and Manual therapy for edema control and soft tissue mobilization as indicated and appropriate

★	Criteria for progression to Phase 3
	7 weeks out from surgery

Phase 3: Weeks 7 to 12

Early Post-Operative Phase

GOALS

1. Minimize pain and swelling
2. Full knee extension ROM
3. Good quadriceps control (≥ 20 no lag SLR)
4. Normal gait pattern

RECOMENDATIONS

Area	Instructions
Crutch Use	<ul style="list-style-type: none"> • 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)
Hinged Knee Brace: T-Scope or Functional ACL Brace	<ul style="list-style-type: none"> • 0 - 110 degrees at week 7. Okay to change to functional ACL brace when AROM in flexion is 110° or more • 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	<ul style="list-style-type: none"> • Extension: Low load, long duration (~5 minutes) stretching (e.g., heel prop, prone hang minimizing co-contraction and 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 Activities and Strengthening:	<ul style="list-style-type: none"> • Quadriceps sets emphasizing vastus lateralis and vastus medialis activation • SLR emphasizing no lag • Electric Stimulation: Optional if unable to perform no lag SLR Discontinue use when able to perform 20 no lag SLR • Double-leg wall slides or mini-squats without knee over foot • Hamstring sets: 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 • Ankle pumps with TheraBand • Heel raises (calf press) • Reciprocal stair training • Aqua jogging in pool okay starting at 8 weeks post op

★	Criteria for progression to Phase 4
	Minimum of 12 weeks from surgery
	20 no lag SLR
	Normal gait
	Crutch/Immobilizer D/C
	ROM: No greater than 5° active extension lag and 90° active flexion

Phase 4: Weeks 12 to 20

Early Rehabilitation Phase

GOALS:

1. Full ROM
2. Improve muscle strength
3. Progress neuromuscular retraining

RECOMENDATIONS

Area	Instructions
Range of Motion	<ul style="list-style-type: none"> • 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 height down as ROM improves) • Flexibility stretching of all major muscle groups
Strengthening Quadriceps	<ul style="list-style-type: none"> • Quad sets (Mini squats/wall squats) • Step-ups • Leg press; Shuttle press without jumping action
Strengthening Hamstring	<ul style="list-style-type: none"> • Hamstring curls • Resistive back SLR with sports cord for hamstring (not quad)
Strengthening Other Musculature	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Wobble board, Rocker board, Single-leg stance with or without equipment (e.g., instrumented balance system), Slide board
Cardiopulmonary	<ul style="list-style-type: none"> • Bike, Elliptical trainer, Stairmaster, Flutter kicking in pool starting at week 12 • Transition to straight line running on treadmill or in a protected environment after clearance by operating surgeon (NO cutting or pivoting) can begin around 18 weeks (4.5 months) if PT feels patient is ready to progress. Otherwise, hold off on straight line running until Phase 5

★	Criteria for progression to Phase 5
	Full ROM
	Minimal effusion and pain
	Functional strength and control in daily activities
	Clearance for running, given by operating surgeon
	Minimum 20 weeks out from date of surgery

Phase 7: Weeks 20 to 30

Strengthening & Control Phase

GOALS

1. Maintain full ROM
2. Running without pain or swelling
3. Hopping without pain, swelling, or giving way

RECOMENDATIONS

Area	Instructions
Strengthening	<ul style="list-style-type: none"> • Squats • Leg press • Hamstring curl • Step-ups/down • Shuttle • Sports cord • Wall squats • Progress to single leg squats
Agility Drills	<ul style="list-style-type: none"> • Double leg jumping progressing to hopping as tolerated
Neuromuscular Training	<ul style="list-style-type: none"> • Wobble board/rocker board/roller board • Perturbation training, Instrumented testing systems, Varied surfaces
Cardiopulmonary	<ul style="list-style-type: none"> • Straight line running on treadmill or in protected environment after clearance by operating surgeon • NO cutting or pivoting • All other cardiopulmonary equipment

★	Criteria for progression to Phase 6
	Running without pain or swelling
	Neuromuscular and strength training exercises without difficulty
	Able to hold single leg balance for 10 seconds
	50% hop height on operated leg (hop test in brace)
	Completion of functional hop testing and clearance by operating surgeon
	Minimum of 30 weeks out from date of surgery

Phase 8: Weeks 30 to 36

Advanced Training Phase

GOALS

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

RECOMENDATIONS

Area	Instructions
Strengthening	<ul style="list-style-type: none"> • Squats • Lunges • Plyometrics
Agility Drills	<ul style="list-style-type: none"> • Shuffling • Hopping • Carioca • Vertical jumps • Running patterns at 50 to 75% speed • Initial sports specific drill patterns at 50 to 75% effort
Neuromuscular Training	<ul style="list-style-type: none"> • Wobble board/rocker board/roller board • Perturbation training, Instrumented testing systems, Varied surfaces
Cardiopulmonary	<ul style="list-style-type: none"> • Running • Other cardiopulmonary exercises

★	Criteria for progression to Phase 7
	Maximum vertical jump without pain or instability
	85% of contralateral on hop tests
	Run at 85% speed without difficulty
	IKDC Question # 10 (Global Rating of Knee Function) score of ≥ 8 (<i>Suggested Criteria, See page 10</i>)
	Completion of functional hop testing showing 85% function and clearance by operating surgeon

Phase 7: Weeks 36 to 52

Return-to-Sport Phase

GOALS

1. 85% contralateral strength
2. 85% contralateral on hop tests
3. Sport specific training without pain, swelling or difficulty

RECOMENDATION

Area	Instructions
Strengthening	<ul style="list-style-type: none"> • Squats • Lunges • Plyometrics
Sports Specific Activities	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Balance test – single leg balance for 30 seconds without touchdown for each leg • Single leg squat – get to 60 degrees 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

★	Return-to-Sports Criteria
	No functional complaints
	Confidence when running, cutting, jumping at full speed
	95% contralateral values on hop tests
	IKDC Question # 10 (Global Rating of Knee Function) of ≥ 9 (<i>Suggested Criteria, See page 10</i>)
	Clearance by operating surgeon

CURRENT FUNCTION OF YOUR KNEE: DAILY ACTIVITIES

IKDC QUESTION #10

How would you rate the function of your knee on a scale of 0 to 10, with 10 being excellent function and 0 being the inability to perform any of your usual daily activities which may include sports?

Cannot perform

No limitation

0	1	2	3	4	5	6	7	8	9	10
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Tests include: *Patient should bring ACL functional brace for this testing.

1. Dynamometer strength testing of hamstring and quadriceps
2. KT testing for AP laxity
3. Single, triple, crossover, and timed hop tests

Appendix

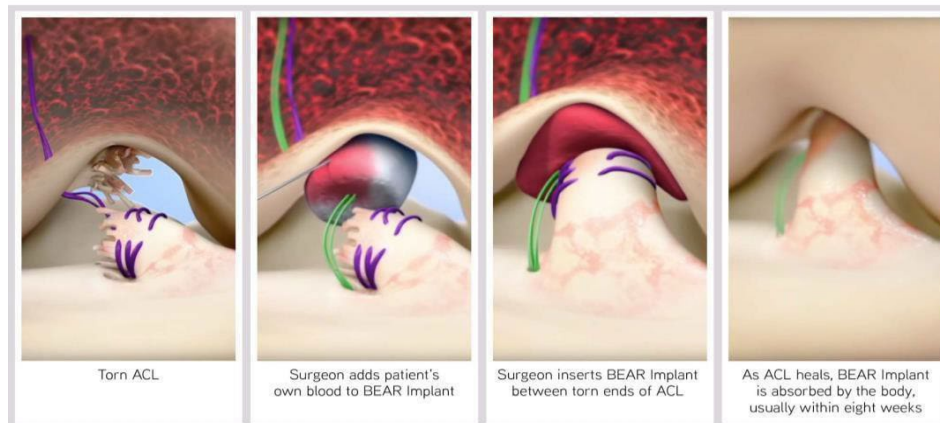
After Surgery Instructions for BEAR® Implant patients

Instructions for Surgical Team: Please review the contents of this document with the patient and/or guardian, including the home exercises, at the last preoperative appointment.

Congratulations, you just received the BEAR Implant. Below are the important things you need to know and do as you progress through the stages of ACL healing and rehabilitation.

What you need to know:

1. **The BEAR Procedure is different than ACL reconstruction (ACLR).** The BEAR Implant and Procedure are designed to help your body restore your own ACL, not replace it.
2. Following your BEAR Procedure, your body will be working hard to replace the BEAR Implant with your own ACL tissue. During this time your new ACL is delicate, so attention should be given to protecting your injured knee.
3. The BEAR Implant rehabilitation protocol is carefully designed to meet important rehabilitation goals. To obtain the best result, please follow this protocol and any instructions from your surgeon.



What you need to do:

1. **Prior to surgery, ensure your physical therapist (PT) receives the BEAR Rehabilitation Protocol.**
2. **Schedule your first physical therapy visit within the first week after your surgery.** At this visit your physical therapist will review and provide instruction for your home exercises.
3. To meet your range of motion (ROM) goals, **begin the Home Exercises within the first week after your surgery.** Your surgical team will teach you these exercises at your last preoperative visit.
4. **Carefully read and follow the Instructions** in the pages that follow.
5. If you have any **questions or concerns, please contact your surgeon's office.**

AFTER SURGERY INSTRUCTIONS FOR PATIENTS

There are clinical scenarios when your surgeon may alter your specific rehabilitation protocol, like in the case of a secondary procedure to the BEAR Implant, such as a meniscal repair or additional ligament reconstruction or repair. In these cases, please follow the instructions you receive from your surgeon/surgical team.

Cryotherapy and Elevation:

- Keep your operative leg elevated and apply cold compression for the first 24 hours or until post-operative swelling is controlled
- Apply cold compression device once every hour for 15 minutes. After that period, apply the cold compression device 3 times per 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 icing device at all times

Crutch Use Instructions:

- Beginning the day after surgery, you will be partial weight bearing (PWB) with crutches while walking and standing.
- Your goal is to be able to put half or 50% of your total body weight on your operative leg without pain.
 - *For example, if you weight 150lbs, your goal is to put 75lbs of weight on your operative leg while standing and walking.*
- To help you get a feel for what “partial weight bearing” feels like, you may do one or both of the following tests:
 - 1) *Using your crutches, stand with all your body weight on your non-operative leg. Gradually shift small amounts of weight to your operative leg until both feet are flat on the floor and your weight evenly distributed.*
 - 2) *Using your crutches and a floor scale, stand with all your weight on your non-operative leg. Place your operative leg on the scale. Gradually shift small amounts of weight to your operative leg until the scale reaches half of your total bodyweight*
- Use a “heel-toe-gait” while walking with your crutches.
 - *A “heel-to-toe” gait means that the heel of your foot on your operative side should hit the floor first. Then roll to the ball of your foot, then toes.*
- Under the direction of your physical therapist (PT) and operating surgeon, you may begin to wean off crutches between 4 to 6 weeks, some people may take longer. Follow the instruction provided by your PT to do this safely.



Knee Brace Instructions:

- Keep your brace locked fully straight (zero-degrees) for the first 24 hours after surgery.
- After 24 hours, allow your knee to bend to the specified degrees in the chart below during non-weight bearing activities (sitting activities) such as watching TV, riding in car, sitting at computer, eating meals, and while performing your rehab exercises at home and with your PT.
 - Gaining and maintaining your knees Range of Motion (ROM) is important for leg strength, gait, and stability
- During this time also continue to work on getting your leg fully straight (see leg exercises below)
- Manual manipulation, also known as manual Passive Range of Motion (PROM), to bend or straighten your operative leg is not recommended.

Time Frame	Brace range setting	Description
First 24 hours	Keep brace lock at zero-degrees	Keep your brace locked at zero degrees until 24 hours after your surgery
After the first 24 hours until 2 weeks after your surgery	Set your brace range 0 to 30- degrees	Set your brace so that it allows your knee to bend from fully straight to 30-degrees while non-weightbearing and performing rehab exercises. Lock your brace at zero while walking for the first 4 weeks and while sleeping for 6 weeks
From weeks 2 to 4 after your surgery	Set your brace range 0 to 60-degrees	Set your brace so that it allows your knee to bend from fully straight to 60-degrees while non-weightbearing and performing rehab exercises. Lock your brace at zero while walking for the first 4 weeks and while sleeping for 6 weeks
From weeks 4 to 6 after your	Set your brace range 0 to 90-degrees	Set your brace so that it allows your knee to bend from fully straight to 90-degrees while non-weightbearing and performing rehab exercises. Lock your brace at zero while walking for the first 4 weeks and while sleeping for 6 weeks
After weeks 6	PT will advise	Your physical therapist and surgeon will evaluate your range of motion (ROM) and provide further instruction.

Glossary of Terms:

- **Flexion/Extension:** Leg bent/ leg straight
- **Partial Weight Bearing (PWB):** Only putting a portion of your body weight on your operative leg (example: Half your body weight (50%) on your surgical leg)
- **Range of Motion (ROM):** The measure of flexion and extension for a specific joint
- **Passive Range of Motion (PROM):** The manual manipulation of a joint (example: your PT manually bends your leg as opposed to allowing your own muscles to bend your leg for you)
- **Active Range of Motion (AROM):** Using your own muscles to bend and extend your leg (example: you bend your leg to achieve a 60-degree bend)

Home Exercises

Begin within the first week after surgery

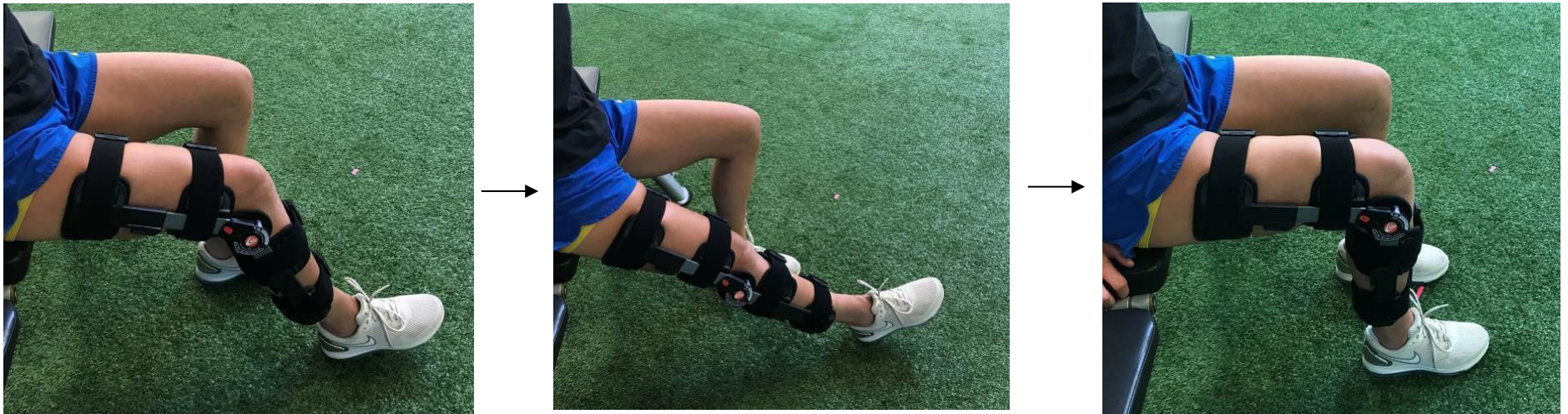
Knee Straightening Exercise: Wearing your brace set to the specified degrees, perform the following exercise. You can do this in one of following two ways. 1) Sit in a chair and rest the foot of your operative leg on an adjacent chair. Then gradually let your leg relax so that you feel a gentle stretch on the back of your knee. 2) Put a small roll, pillow or rolled towel under your ankle so the back of your leg is lifted off the bed or floor. Then gradually let your leg relax so that you feel a gentle stretch on the back of your knee. You should not push on the top of your knee or force your knee manually, just allow the weight of your leg to do the work. **Do this two times per day for 4 to 5 minutes**



Home Exercises

Begin within the first week after surgery

Knee Bending Exercise: Wearing your brace set to the specified degrees. Sit in a chair with your operative leg out in front of you. Slide your foot along the floor back towards yourself to slowly bend your knee. When the knee starts to feel tight, stop and rest for 3 to 5 minutes. Then try to slide the foot back another inch. Wait again. Then try to slide it back another inch. Keep repeating for twenty minutes (may be best to do while reading, in class or watching TV). Do not flex your knee past the specified degrees in the chart above (30, 60 or 90), depending on the number of days you are out from your date of surgery. **Do 1 to 2 sets of 10 repetitions with a 5 to 10 second hold, at least 2 times per day**



Home Exercises

Begin within the first week after surgery

Quad set, also called Isometric Contraction Exercise: While lying flat on a table with knee straight, place heel on a rolled towel. Heel must be high enough so that your thigh and calf are off the table or ground. Tighten your quadriceps muscles on the front of your thigh by pressing your knee down into the bed. Hold this position (muscle contraction) for 10 seconds, then release. **To properly perform this exercise, hold the position for 10 second for 3 sets, do this 10 times in a row. Do these 2 to 3 times per day.**

*****If comfortable doing so, you may remove your brace for this exercise only, then put back on immediately.**



Your quadriceps are a group of muscles on the front of the thigh located above your knee. They are responsible for extending your leg and helping with movements such as walking and jumping.

Home Exercises

Begin within the first week after surgery

Double toe and heel raise: For this exercise, use a table or chair for stabilization. Gently raise your toes off the floor, balancing on your heel, then ease slowly back down. Then gently raise your heel off the ground, balancing on the balls of your feet, then slowly ease back down.

Do 10 double toe heel raises 2 times per day.

