

ACI/Cartilage Transplantation +/- HTO Rehabilitation Rehab Protocol

- I. 0-2 Weeks
 - a. Non weight bearing
 - b. ROM Goals: 0-110 degrees by end of Week 2
 - c. CPM 6 hours/day x 3 weeks (goal -10 to 120 degrees)
 - d. Patella Mobilization exercises
 - e. EMS/E-Stim
 - f. Cryotherapy
 - g. Stretches: Hamstring/Gastro-soleus, iliotibial band, quadriceps
 - h. Strengthening:
 - i. Isometrics: Quads,
 - ii. Closed-Chain: gait retraining, toe raises, wall sits, mini-squats
- II. 2-4 Weeks
 - a. Add:
 - b. Toe touch/flat foot weight bearing
 - c. ROM: 0-130 degrees
- III. 4-6 Weeks
 - a. Full ROM 0-135 degrees by end of week 6
 - b. Partial Weight bearing (25-50%)
- IV. 6-8 Weeks
 - a. Advance to Regular Weight Bearing off of crutches
 - b. Continue with brace unlocked fully
 - c. Strengthening:
 - i. Continue Quad isometrics, straight leg raises
 - ii. Close Chain: gait retraining, toe raises, wall sits, mini-squats
 - d. Conditioning: Aquatic Program as Available
- V. 9-12 Weeks
 - a. Strengthening:
 - i. Close Chain: gait retraining, toe raises, wall sits, mini-squats
 - ii. Leg Press (70-10 deg)
 - iii. Knee Flexion hamstring curls (90 deg)
 - iv. Knee Extension quads (90 to 30 deg)
 - v. Hip abduction-adduction, multi-hip
 - b. Proprioceptive training (weight shifting, mini-tramp, plyometric)
 - c. Conditioning: Stationary Bike, Swimming (kicking), Walking, Stair climb, ski machine as available
- VI. 12-16 Weeks
 - a. Out of Brace
 - b. Progress Strengthening Activities as Tolerated
- VII. 7-12 Months
 - a. Begin Running as tolerated, cutting activities, and return to sporting activities

	Postoperative Weeks					Postop Months			
	1-2	3-4	5-6	7-8	9-12	4	5	6	7-12
Brace: Bledsoe OA unloader	X	X	X	X	X			X	X
Range of motion minimum goals: 0°-110° 0°-135°	X	X							
Weight bearing: None Toe touch - 1/4 body weight 1/4 to 1/2 body weight Full	X	X	X	X					
Patella mobilization	X	X	X	X					
Modalities: Electrical muscle stimulation (EMS) Pain/edema management (cryotherapy)	X X	X X	X X	X X	X	X	X	X	X
Stretching: Hamstring, gastroc-soleus, iliotibial band, quadriceps	X	X	X	X	X	X	X	X	X
Strengthening: Quad isometrics, straight leg raises Active knee extension Closed-chain: gait retraining, toe raises, wall sits, mini-squats Knee flexion hamstring curls (90°) Knee extension quads (90°-30°) Hip abduction-adduction, multi-hip Leg press (70°-10°)	X	X	X	X X X	X X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X
Balance/proprioceptive training: Weight-shifting, mini-trampoline, BAPS, BBS, plyometrics					X	X	X	X	X
Conditioning: UBC Bike (stationary) Aquatic program Swimming (kicking) Walking Stair climbing machine Ski machine		X	X	X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X	X X X X X X
Running: straight									X
Cutting: lateral carioca, figure 8's									X
Full sports									X

BAPS = Biomechanical Ankle Platform System (Camp, Jackson, MI), BBS = Biodex Balance System (Biodex Medical Systems, Inc, Shirley, NY), UBC = upper body cycle (Biodex Medical Systems, Inc, Shirley, NY).

Phase 1. Weeks 1-2
(Visits: 2-4)

General Observation	- v Non weight bearing - v Brace locked at 0°	
Evaluation	- v Pain - v Hemarthrosis - v Patellar mobility - v ROM minimum - v Quadriceps contraction & patella migration - v Soft tissue contracture	Goals Controlled Mild Good 0°-60° Good None
Frequency 3-4 x/day 10 minutes 3 x/day 15 minutes As required	Range of motion ROM (passive, 0°-60°) Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches Strengthening Straight leg raises (flexion) Active quadriceps isometrics Modalities Electrical muscle stimulation Cryotherapy	Duration 5 reps x 30 secs 3 sets x 10 reps 1 set x 10 reps 20 minutes 20 minutes
Goals	- v ROM 0°-60° - v Adequate quadriceps contraction - v Control inflammation, effusion	

Phase 2. Weeks 3-4
(Visits: 2-4)

General Observation	- v Non weight bearing - v Brace locked at 0°	
Evaluation	- v Pain - v Effusion - v Patellar mobility - v ROM minimum - v Quadriceps contraction & patella migration - v Soft tissue contracture	Goals Controlled Mild Good 0°-90° Good None
Frequency 3-4 x/day 10 minutes 2-3 x/day 20 minutes 2 x/day 10 minutes As required	Range of motion ROM (passive, 0°-90°) Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches Strengthening Straight leg raises (flexion, extension, abduction, adduction) Isometric training: multi-angle (0°, 60°) Aerobic conditioning UBC Modalities Electrical muscle stimulation Cryotherapy	Duration 5 reps x 30 secs 3 sets x 10 reps 1 set x 10 reps 20 minutes 20 minutes
Goals	- v ROM 0°-90° - v Control inflammation, effusion - v Muscle control	

Phase 3. Weeks 5-6
(Visits: 1-2)

General Observation	v Partial (25%) weight bearing when: - Pain controlled without narcotics - Hemarthrosis controlled - ROM 0°-90° - Muscle control throughout ROM	
Evaluation	v Pain v Effusion v Patellar mobility v ROM v Muscle control v Inflammatory response	Goals Mild/No RSD Minimal Good 0°-110° 3/5 None
Frequency 3 x/day 10 minutes 2 x/day 20 minutes 2 x/day 10 minutes As required	Range of motion ROM (passive, 0°-110°) Patella mobilization Hamstring, gastroc-soleus stretches Strengthening Straight leg raises (ankle weight, not to exceed 10% of body weight) Isometric training: multi-angle (90°, 60°, 30°) Aerobic conditioning (patellofemoral precautions) UBC Modalities Electrical muscle stimulation Cryotherapy	Duration 5 reps x 30 secs 3 sets x 10 reps 2 sets x 10 reps 20 minutes 20 minutes
Goals	v ROM 0°-110° v Control inflammation, effusion v Muscle control v Early recognition complications (motion, RSD, patellofemoral) v 25% weight bearing	

Phase 4. Weeks 7-8 (Visits: 1-2)

General Observation	v Partial (25-50%) weight bearing when: - Pain controlled - Hemarthrosis controlled - ROM 0°-110° - Voluntary quad contraction achieved	
Evaluation	v Pain v Effusion v Patellar mobility v ROM v Muscle control v Inflammatory response	Goals Mild/No RSD Minimal Good 0°-120° 4/5 None
Frequency 2 x/day 10 minutes 2 x/day 20 minutes 3 x/day 5 minutes 1-2 x/day 15 minutes As required	Range of motion ROM (0°-120°) Hamstring, gastroc-soleus stretches Strengthening Straight leg raises (flexion, extension, abduction, adduction) Straight leg raises, rubber tubing Isometric training – multi-angle (90°, 60°, 30°) Closed-chain - Wall sits (exclude in patellofemoral patients) - Mini-squats (rubber tubing, 0°-30°) Balance training Cup walking Aerobic conditioning UBC Water walking Modalities Cryotherapy	Duration 5 reps x 30 secs 3 sets x 10 reps 3 sets x 30 reps 3 sets x 10 reps to fatigue x 3 3 sets x 20 reps 20 minutes
Goals	v 50-75% weight bearing v Muscle control v Control inflammation, effusion v ROM 0°-120°	

Phase 5. Weeks 9-12 (Visits: 1-2)

General Observation	v Full weight bearing when: v ROM 0°-135° - Pain, effusion controlled - Muscle control throughout ROM	
Evaluation	v Pain v Manual muscle test Hamstrings, quadriceps, hip abductors/adductors/flexors/extensors v Swelling v Patellar mobility v Crepitus v Gait	Goals Minimal/No RSD 4/5 Minimal Good None/slight Symmetrical
Frequency 2 x/day 10 minutes 2 x/day 20 minutes 3 x/day 5 minutes 1 x/day 15-20 minutes As required	Range of motion Hamstring, gastroc-soleus, quad, ITB stretches Strengthening Straight leg raises Straight leg raises, rubber tubing Hamstring curls (active, 0°-90°) Knee extension quads (active, 90°-30°) Leg press (70°-10°) Closed-chain - Wall sits - Mini-squats (rubber tubing, 0°-40°) - Lateral step-ups (2-4" block) Multi-hip machine (flexion, extension, abduction, adduction) Balance training Cup walking Balance board/2-legged Single leg stance Aerobic conditioning (patellofemoral precautions) Water walking Swimming (straight leg kicking) Stationary bicycling Walking Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance) Modalities Cryotherapy	Duration 5 reps x 30 secs 3 sets x 10 reps 3 sets x 30 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps to fatigue x 3 3 sets x 20 reps 3 sets x 10 reps 3 sets x 10 reps 20 minutes
Goals	v Increase strength and endurance v ROM 0°-135°	

Phase 6. Weeks 13-26 (Visits: 2-3)

General Observation	- v No effusion, painless ROM, joint stability - v Performs activities of daily living, can walk 20 minutes without pain - v ROM 0°-135°	
Evaluation	- v Pain - v Manual muscle test - v Swelling - v Patellar mobility - v Crepitus - v Gait	Goals Minimal/No RSD 4/5 Minimal Good None/slight Symmetrical
Frequency 2 x/day 10 minutes 2 x/day 20 minutes 1-3 x/day 5 minutes 3 x/week 20 minutes As required	Range of motion Hamstring, gastroc-soleus, quad, ITB stretches Strengthening Straight leg raises, rubber tubing (high speed) Hamstring curls (active, 0°-90°) Knee extension with resistance (90°-30°) Leg press (70°-10°) Multi-hip machine (flexion, extension, abduction, adduction) Closed-chain: Mini-squats (rubber tubing, 0°-40°) Balance training Balance board/2 legged Single leg stance Aerobic conditioning (patellofemoral precautions) Stationary bicycling Water walking Swimming (kicking) Walking Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance) Modalities Cryotherapy	Duration 5 reps x 30 secs 3 sets x 30 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 20 reps 20 minutes
Goals	v Increase strength and endurance	

Phase 7. Weeks 27-52 (Visits: 2-3)

General Observation	v No effusion, painless ROM, joint stability v Performs ADL, can walk 20 minutes without pain	v ROM 0°-135°	
Evaluation	v Pain v Manual muscle test v Swelling v Patellar mobility v Crepitus v Gait v Isometric test (peripheral, % difference quads & hams)	Goals Minima/No RSD 4/5 Minimal Good None/slight Symmetrical 20-30	
Frequency 2 x/day 10 minutes 1 x/day 20-30 minutes 1-3 x/day 5 minutes 3 x/week 20-30 minutes 3 x/week 15-20 minutes As required	Range of motion Hamstring, gastroc-soleus, quad, ITB stretches Strengthening Straight leg raises, rubber tubing (high speed) Hamstring curls (active, 0°-90°) Knee extension with resistance (90°-30°) Leg press (70°-10°) Multi-hip machine (flexion, extension, abduction, adduction) Closed-chain: Mini-squats (rubber tubing, 0°-40°) Balance training Balance board/2 legged Single leg stance Aerobic conditioning (patellofemoral precautions) Stationary bicycling Water walking Swimming (kicking) Walking Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance) Running program (in unloader brace, 6 mos., straight) Jog Walk Backward run Modalities Cryotherapy	Duration 5 reps x 30 secs 3 sets x 30 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 20 reps 1/4 mile 1/8 mile 20 yards 20 minutes	
Goals	v Increase function v Maintain strength, endurance		

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