HEALTH
UNIVERSITY OF UTAH

R. Judd Robins, MD
Sports Medicine Division
Department of Orthopaedic Surgery
University of Utah Health
590 Wakara Way, Salt Lake City, UT 84108
(801) 587-9071

ACL Revision/ACL Allograft Reconstruction Rehabilitation Protocol

	Postoperative Weeks					Postoperative Months			
	1-2	3-4	5-6	7-8	9-12	4	5	6	7-12
Brace: postoperative & functional	X	X	X	X	(X)			X	X
Range of motion minimum goals:									
0°-90°	X	X							
0°-120°			X						
0°-135°				X					
Weight bearing:									
Flat Foot	X								
1/4 - 1/2 body weight		X							
3/4 - Full			X						
Patella mobilization	X	X	X						
Modalities:									
Electrical muscle stimulation	X	X	X	X	X	X	X	X	X
Pain/edema management (cryotherapy)	X	X	X	X					
Stretching:									
Hamstring, gastroc-soleus, iliotibial band, quadriceps	X	X	X	X	X	X	X	X	X
Strengthening:									
Quad isometrics, quad-ham isometrics	X	X	X	X	X		X	X	X
co-contraction, straight leg raises,						X	X	X	X
active knee extension							X	X	X
Closed-chain: gait retraining, toe raises,	X	X	X	X	X	X	X	X	X
wall sits, mini-squats						X			
Knee flexion hamstring curls (90°)			X	X	X	X			
Knee extension quads (90°-30°)			X	X	X	X			
Hip abduction-adduction, multi-hip			X	X	X				
Leg press (70°-10°)			X	X	X				
Balance/proprioceptive training:									
Weight-shifting, cup walking, BBS	X	X	X	X	X	X	X	X	X
BBS, BAPS, perturbation training,					X				
balance board, mini-trampoline									
Conditioning:									
UBC		X	X	X	X	X	X	X	X
Bike (stationary)			X	X	X	X	X	X	X
Aquatic program				X	X	X	X	X	X
Elliptical machine				X	X	X	X	X	X
Swimming (kicking)					X	X	X	X	X
Walking					X	X	X	X	X
Stair climbing machine					X	X	X	X	X
Ski machine									
Running: straight								X	X
Cutting: lateral carioca, figure 8's									X
Plyometric training									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 to 2

General Observation	Toe-touch weight bearing to 25% body weight when: - Pain controlled - Hemarthrosis controlled - Voluntary quadriceps contraction achieved - 0° extension	
Evaluation		**Goals**
	Pain	Controlled
	Hemarthrosis	Mild
	Patellar mobility	Good
	Range of motion minimum	10°-80°
	Quadriceps contraction & patella migration	Good
	Soft tissue contracture	None
Frequency		**Duration**
3-4 x/day 10 minutes	**Range of motion** Range of motion passive Meniscus repair (complex), MCL, revision, EA = 0°-90°	5 reps x 30 secs
3 x/day 15 minutes	Patellar realignment = 0°-75° Posterolateral procedure = 0°-90° (unless exam shows hyperelastic tissue type, then hold 15°-70° for 2 weeks postop)	3 sets x 10 reps 1 set x 10 reps 3 sets x 10 reps
As required	Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches	20 minutes 20 minutes
	Strengthening Straight leg raises (flexion) Active quadriceps isometrics (based on ROM limits) Knee extension (active-assisted)	
	Modalities Electrical muscle stimulation Cryotherapy	
Goals	Range of motion (see above, depends on procedure) Adequate quadriceps contraction Control inflammation, effusion	

EA, iliotibial band extra-articular procedure

Phase 2. Weeks 3 to 4

General Observation	50% weight bearing when: - Pain controlled - Hemarthrosis controlled - Voluntary quadriceps contraction achieved	
Evaluation	Pain Effusion Patellar mobility ROM minimum Quadriceps contraction & patella migration Soft tissue contracture Joint arthrometer (3 weeks, 20 lbs)	**Goals** Controlled Mild Good 0°-90° Good None < 3 mm
Frequency 3-4 x/day 10 minutes 2-3 x/day 20 minutes 2 x/day 10 minutes As required	**Range of motion** Range of motion passive, 0°-90° Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches **Strengthening** Straight leg raises (flexion, extension, adduction) Isometric training: Multi-angle (0°, 60°) Active quadriceps (full extension) Quad/ham co-contraction with EMS Toe raises/heel raises Knee extension (90°-45°, no resistance) Knee flexion (active, 0°- 90°) Multi-hip machine (flexion, extension, abduction, adduction) Leg press (70°-10°) Closed-chain - Mini-squats (0°-45°, 50% weight bearing) - Wall sits - Wall sits with EMS **Aerobic conditioning** UBC **Modalities** Electrical muscle stimulation Cryotherapy	**Duration** 5 reps x 30 secs 3 sets x 10 reps 1 set x 10 reps 3 sets x 10 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 to fatigue 20 minutes 20 minutes
Goals	Range of motion 0°-110° Control inflammation, effusion Adeqate quadriceps contraction 50% weight bearing	

Phase 3. Weeks 5 to 6

General Observation	Full weight bearing when: - Pain controlled without narcotics - Effusion controlled - ROM 0°-100° - Muscle control throughout ROM - Dynamic control varus/valgus	
Evaluation	Pain Effusion Patellar mobility Range of motion Muscle control Inflammatory response Joint arthrometer (6 weeks, 30 lb.s)	**Goals** Mild Minimal Good 0°-120° 3/5 None < 3 mm
Frequency 3 x/day 10 minutes 2-3 x/day 20 minutes 3 x/day 5 minutes 1-2 x/day 5 minutes 2 x/day 10 minutes As required	**Range of motion** Range of motion passive, 0°-120° Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches **Strengthening** Straight leg raises (ankle weight, < 10% of body weight) Isometric training: multi-angle (90°, 60°, 30°) Heel raise/toe raise Hamstring curls (active, 0°-90°) Knee extension (90°-45°, with resistance) Closed-chain - Wall sits - Mini-squats - Lunge (no resistance) Multi-hip machine (flexion, extension, abduction, adduction) Leg press (70°-10°) **Balance training** Weight shift side/side and forward/back Balance board/2 legged Cup walking Single leg stance – stable platform **Aerobic conditioning** UBC Water walking Stationary bicycling (patellofemoral precautions) **Modalities** Electrical muscle stimulation Cryotherapy	**Duration** 5 reps x 30 secs 3 sets x 10 reps 2 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps 5 reps 3 sets x 20 reps 3 sets x 10 reps 3 sets x 10 reps 5 sets x 10 reps 5 reps 20 minutes 20 minutes
Goals	ROM 0°-125° Control inflammation, effusion Muscle control Full weight bearing Early recognition complications (motion loss, RSD, increased AP displacement, patellofemoral)	

Phase 4. Weeks 7 to 8

General Observation	Independent ambulation when: - Pain controlled - Effusion controlled - ROM 0°-120° - Muscle control throughout ROM - Dynamic control varus/valgus	
Evaluation	Pain Effusion Patellar mobility Range of motion Muscle control Inflammatory response Gait Joint arthrometer (8 weeks)	**Goals** No RSD Minimal Good 0°-135° 4/5 None Symmetrical < 3 mm
Frequency 2 x/day 10 minutes 2 x/day 20 minutes 3 x/day 5 minutes 2 x/day 10 minutes As required	**Range of motion** Hamstring, gastroc-soleus stretches **Strengthening** Straight leg raises (ankle weight, < 10% body weight) Straight leg raises, rubber tubing Isometric training: multi-angle (90°, 60°, 30°) Heel raise/toe raise Hamstring curls (active, 0°-90°) Knee extension with resistance (90°-45°) Leg press (70°-10°) Closed-chain - Wall sits - Mini-squats (rubber tubing, 0°-30°) - Lunge Multi-hip machine (flexion, extension, abduction, adduction) Leg press (70°-10°) **Balance training** Balance board/2 legged Lateral step-ups: 2-4” **Aerobic conditioning** (patellofemoral precautions) UBC Stationary bicycling Water walking Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance) Ellipical machine (low resistance) **Modalities** Cryotherapy	**Duration** 5 reps x 30 secs 3 sets x 10 reps 3 sets x 30 reps 3 sets x 20 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 to fatigue x 3 3 sets x 10 reps 3 sets x 10 reps 20 minutes
Goals	ROM 0°-135° Full weight bearing, normal gait Control inflammation, effusion Muscle endurance Recognize complications (motion loss, RSD, increased AP displacement) Recognition patellofemoral changes	

Phase 5. Weeks 9 to 12

General Observation	Full weight bearing ROM 0°-135° No effusion, painless ROM, joint stability Performs ADL, can walk 20 minutes without pain	
Evaluation	Manual muscle test Hamstrings, quadriceps, hip abductors/adductors/flexors/extensors Swelling Joint arthrometer (12 weeks) Patellar mobility Crepitus	**Goals** 4/5 None 3 mm Good None/slight
Frequency 2 x/day 10 minutes 2 x/day 20 minutes 3 x/day 5 minutes 1-2 x/day 15-20 minutes As required	**Range of motion** Hamstring, gastroc-soleus, quad, ITB stretches **Strengthening** Straight leg raises, rubber tubing Hamstring curls (active, 0°-90°) Knee extension with resistance (90°-45°) Leg press (70°-10°) Closed-chain - Wall sits - Mini-squats (rubber tubing, 0°-40°) - Lunge Multi-hip machine (flexion, extension, abduction, adduction) **Balance training** Balance board/2 legged Single leg stance – unstable platform Perturbation training **Aerobic conditioning** (patellofemoral precautions) Stationary bicycling Water walking Swimming (straight leg kicking) Walking Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance) Ellipical machine (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 20 reps to fatigue x 3 3 sets x 10 reps 3 sets x 10 reps 20 minutes
Goals	Increase strength and endurance	

Phase 6. Weeks 13 to 26

General Observation	No effusion, painless ROM, joint stability Performs ADL, can walk 20 minutes without pain ROM 0°-135°	
Evaluation	Isometric test (% difference quads & hams) Swelling Joint arthrometer Patellar mobility Crepitus	**Goals** 30 None < 3 mm Good None/slight
Frequency 2 x/day 10 minutes 2 x/day 20 minutes 3 x/day 5 minutes 3 x/week 15-20 minutes 3 x/week 10 minutes As required	**Range of motion** Hamstring, gastroc-soleus, quad, ITB stretches **Strengthening** Straight leg raises, rubber tubing Hamstring curls (active, 0°-90°) Knee extension with resistance (90°-45°) Leg press (70°-10°) Multi-hip machine (flexion, extension, abduction, adduction) Closed-chain: Wall sits Mini-squats Lateral step-ups (2-4" block) **Balance training** Balance board/2 legged Single leg stance – unstable platform Plyoback – ball toss Perturbation training **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** (6 months, straight, 30% deficit isometric test) 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 5 reps 3 sets x 20 reps 3 sets x 10 reps 1/4 mile 1/8 mile 20 yards 20 minutes
Goals	Increase strength and endurance	

Phase 7.
Weeks 27 to 52

General Observation	No effusion, painless ROM, joint stability Performs ADL, can walk 20 minutes without pain	
Evaluation	Isokinetic test (isometric + torque 300°/sec, % diff quads & hams) Swelling Joint arthrometer Patellar mobility Crepitus Single-leg function tests (9 mos: hop distance, timed hop, % inv/uninv)	**Goals** 10-15 None 3 mm Good None/slight 85
Frequency 2 x/day 10 minutes 1 x/day 20-30 minutes 3 x/day 5 minutes 3 x/week 20-30 minutes 3 x/week 15-20 minutes 3 x/week 3 x/week 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°-45°) Leg press (70°-10°) Multi-hip machine (flexion, extension, abduction, adduction) **Balance training** Balance board/2 legged Single leg stance Perturbation training **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** (straight,) Jog – interval training (20, 40, 60, 100 yards) Walk Backward run **Cutting program** – lateral, carioca, figure 8's (20% deficit isokinetic test) **Functional training** Plyometric training: box hops, level, double-leg Sport specific drills (10-15% deficit isokinetic test) **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 1/4 mile 1/8 mile 20 yards 20 yards 15 secs, 4-6 sets 20 minutes
Goals	Increase function, strength, endurance Return to previous activity level	

SOURCE: Heckmann T, Noyes FR, Barber-Westin SD: Rehabilitation of primary and revision anterior cruciate ligament reconstructions. *Noyes' Knee Disorders: Surgery, Rehabilitation, Clinical Outcomes*, Saunders, Philadelphia, 2009, pp. 306-336.

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