

Noyes Knee Institute Rehabilitation Protocol: Posterior Cruciate Ligament Reconstruction

	Postoperative Weeks					Postoperative Months			
	1-2	3-4	5-6	7-8	9-12	4	5	6	7-12
Hinged long-leg p.o. brace	X	X	X						
Patellar knee sleeve				X	X	X	X		
Functional brace								X	X
Range of motion minimum goals:									
0°-90°	X								
0°-110°		X							
0°-120°			X						
0°-135°				X					
Weight bearing:									
25% body weight	X								
50% body weight		X							
Full			X						
Patella mobilization	X	X	X	X					
Modalities:									
Electrical muscle stimulation (EMS)	X	X	X	X	X				
Pain/edema management (cryotherapy)	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	X	X	X	X	X				
Closed-chain: gait retraining, toe raises, wall sits, mini-squats			X	X	X	X	X	X	
Knee flexion hamstring curls (90°-0°)					X	X	X	X	X
Knee extension quads (90°-30°)		X	X	X	X	X	X	X	X
Hip abduction-adduction, multi-hip		X	X	X	X	X	X	X	X
Leg press (70°-10°)			X	X	X	X	X	X	X
Balance/proprioceptive training:									
Weight-shifting, cup walking, BBS			X	X					
BBS, BAPS, perturbation training, balance board, mini-trampoline				X	X	X	X	X	X
Conditioning:									
UBC	X	X	X	X	X				
Bike (stationary)			X	X	X	X	X	X	X
Aquatic program					X	X	X	X	X
Swimming (kicking)						X	X	X	X
Walking					X	X	X	X	X
Stair climbing machine					X	X	X	X	X
Ski machine					X	X	X	X	X
Running: straight								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).

SOURCE: Noyes FR, Barber-Westin SD, Heckmann TP: Chapter 23: Rehabilitation of posterior cruciate ligament and posterolateral reconstructive procedures. *Noyes' Knee Disorders: Surgery, Rehabilitation, Clinical Outcomes*, Saunders, Philadelphia, 2009, pp. 631-657.

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

General Observation	Toe-touch to 25% weight bearing Brace	
Evaluation	Pain Hemarthrosis Patellar mobility ROM minimum Quadriceps contraction & patella migration Soft tissue contracture	Goals Controlled Mild Good 0°-90° Good None
Frequency 3-4 x/day 10 minutes	Range of motion ROM 0°-90° (active extension/passive flexion with 10 lb. anterior drawer) Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches	Duration 20 cycles 10 x/30 secs 5 reps x 30 secs
3 x/day 15 minutes	Strengthening Straight leg raises (flexion, 0-5 lb ankle wt.) Active quadriceps isometrics Knee extension (active-assisted, 70°-0°, 0-7.5 lb wt.)	3 sets x 10 reps 1 set x 10 reps 3 sets x 10 reps
2 x/day 10 minutes	Aerobic conditioning UBE	
As required	Modalities Electrical muscle stimulation Cryotherapy	20 minutes 20 minutes
While sleeping	Activities of daily living Knee brace to avoid sudden knee flexion while asleep	
Goals	ROM 0°-90° Adequate quadriceps contraction Control inflammation, effusion Prevent tissue contracture Protect ligament reconstruction at insertion sites	

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

General Observation	50% weight bearing when: - Pain controlled - Hemarthrosis controlled - Muscle control throughout ROM Brace	
Evaluation	Pain Effusion Patellar mobility ROM minimum Quadriceps contraction & patella migration Soft tissue contracture	Goals Controlled Mild Good 0°-110° Good None
Frequency 3-4 x/day 10 minutes 2-3 x/day 20 minutes 2 x/day 10 minutes As required While sleeping	Range of motion ROM (passive, 0°-110°, 10# anterior drawer) Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches Strengthening Straight leg raises (flexion, adduction, abduction) Isometric training: multi-angle (0°, 60°) Knee extension (active-assisted, 90°-0°, 0-7.5 lbs. wt.) Aerobic conditioning UBC Modalities Electrical muscle stimulation Cryotherapy Activities of daily living Knee brace to avoid sudden knee flexion while asleep	Duration 20 cycles 10 x, 30 secs 5 reps x 30 secs 3 sets x 10 reps 1 set x 10 reps 3 sets x 10 reps 20 minutes 20 minutes
Goals	ROM 0°-110° Control inflammation, effusion Muscle control Prevent soft tissue contracture Protect ligament reconstruction at insertion sites	

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

General Observation	Full weight bearing when: - Pain controlled without narcotics - Hemarthrosis controlled - Muscle control throughout ROM Brace	
Evaluation	Pain Effusion Patellar mobility ROM Muscle control Inflammatory response Joint arthrometer (6 weeks), 20° 89N and 70° 89N	Goals Mild/No RSD Minimal Good 0°-120° 3/5 None < 3 mm
Frequency 3-4 x/day 10 minutes 3 x/day 15 minutes 3 x/day 5 minutes 2 x/day 10 minutes As required While sleeping	Range of motion ROM (passive, 0°-120°) 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°) Knee extension (active, 90°-0°) Closed-chain - Heel raise/toe raise - wall sits Multi-hip machine (flexion, extension, abduction, adduction) Leg press (50°-10°) Balance training Weight shift side/side and forward/back Balance board/2 legged Cup walking Single let stance Aerobic conditioning (patellofemoral precautions) UBC Stationary bicycling Modalities Electrical muscle stimulation Cryotherapy Activities of daily living Knee brace to avoid sudden knee flexion while asleep	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 20 reps 5 reps 3 sets x 10 reps 3 sets x 10 reps 5 sets x 10 reps 20 minutes 20 minutes
Goals	ROM 0°-120° Control inflammation, effusion Muscle control Early recognition complications (motion loss, RSD, increased AP displacement, patellofemoral)	

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

General Observation	Full weight bearing Brace	
Evaluation	Pain Effusion Patellar mobility ROM Muscle control Inflammatory response Joint arthrometer (8 weeks), 20° 89N and 70° 89N	Goals Mild/No RSD Minimal Good 0°-135° 4/5 None < 3 mm
Frequency 3-4 x/day 10 minutes	Range of motion ROM (passive, 0°-135°) Patellar mobilization Hamstring, gastroc-soleus stretches	Duration 5 reps x 30 secs
3 x/day 15 minutes	Strengthening Straight leg raises (flexion, abduction, adduction) Straight leg raises, rubber tubing Knee extension (active, 90°-0°) Knee flexion (active 0° to 90°) Leg press (50°-10°) Closed-chain - Wall sits - Mini-squats (rubber tubing, 0°-30°) Multi-hip machine (flexion, extension, abduction, adduction)	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
3 x/day 5 minutes	Balance training Balance board/2 legged Single leg stance	5 reps 3 sets x 20 reps 3 sets x 10 reps
2 x/day 10-15 minutes	Aerobic conditioning UBC Stationary bicycling	
As required	Modalities Electrical muscle stimulation Cryotherapy	20 minutes 20 minutes
While sleeping	Activities of daily living Knee brace to avoid sudden knee flexion while asleep	
Goals	Full weight bearing, normal gait Control inflammation, effusion Muscle control ROM 0°-135°	

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

General Observation	No effusion, painless ROM, joint stability Performs activities of daily living without pain ROM 0°-135° Brace optional	
Evaluation	Pain Manual muscle test Quadriceps, hip abductors/adductors/flexors/extensors Swelling Joint arthrometer (12 weeks) 20° 134N and 70° 89N Patellar mobility Crepitus Gait	Goals Minimal/No RSD 4/5 Minimal 3 mm Good None/slight Symmetrical
<p>Frequency 3-4 x/day 10 minutes</p> <p>3 x/day 15-20 minutes</p> <p>3 x/day 5 minutes</p> <p>1 x/day 15-20 minutes</p> <p>As required</p>	<p>Range of motion Hamstring, gastroc-soleus, quad, ITB stretches</p> <p>Strengthening Straight leg raises (add extension) Straight leg raises, rubber tubing Hamstring curls Knee extension with resistance (90°-30°) Knee flexion (active 0° to 90°) Leg press (50°-10°) Closed-chain - Wall sits - Mini-squats (0°-40°) - Lateral step-ups (2-4" block) Multi-hip machine (flexion, extension, abduction, adduction)</p> <p>Balance training Balance board/2 legged Single leg stance</p> <p>Aerobic conditioning (patellofemoral precautions) Stationary bicycling Water walking UBC Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance)</p> <p>Modalities Electrical muscle stimulation Cryotherapy</p> <p>Activities of daily living Avoid squats, walking down hills & ramps, running down stairs, sudden deceleration movements</p>	<p>Duration</p> <p>5 reps x 30 secs</p> <p>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 3 sets x 10 reps</p> <p>to fatigue x 3 reps 3 sets x 20 reps 3 sets x 10 reps 3 sets x 10 reps</p> <p>20 minutes 20 minutes</p>
Goals	Increase strength and endurance ROM 0°-135° Return to normal gait, ADL	

