

Noyes Knee Institute Rehabilitation Protocol: Posterolateral Knee Reconstruction

	Postoperative Weeks					Postop Months			
	1-2	3-4	5-6	7-8	9-12	4	5	6	7-12
Brace: Bivalved cylinder cast Custom medial unloader or hinged soft tissue brace	X	X	X	X	X	X	X	X	X
Range of motion minimum goals: 0°-90° 0°-110° 0°-120° 0°-130°	X	X	X	X	X				
Weight bearing: None Toe touch – 25% body weight 25% to 50% body weight Full, cane support Full	X	X	X	X	X				
Patella mobilization	X	X	X	X					
Modalities: Electrical muscle stimulation 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 sit, 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 X
Balance/proprioceptive training: Weight-shifting, cup walking, BBS BBS, BAPS, perturbation training, balance board, mini-trampoline				X	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
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: 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	- Non-weight bearing, maximum protection - Bivalved cylinder cast - Must avoid hyperextension, varus loads, lateral joint opening	
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 3 x/day 15 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) Active quadriceps isometrics Knee extension (active-assisted, 90°-30°, per quad control) 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 20 minutes 20 minutes
Goals	ROM 0°-90° Adequate quadriceps contraction Control inflammation, effusion	

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

General Observation	Non-weight bearing, maximum protection Bivalved cylinder cast Must avoid hyperextension, varus loads, lateral joint opening	
Evaluation	Pain Effusion 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 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) Isometric training: multi-angle (0°, 60°) Knee extension (active-assisted, 90°-30°, per quad control) 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 20 minutes 20 minutes
Goals	ROM 0°-90° Control inflammation, effusion Muscle control	

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

General Observation	Partial (25-50%) weight bearing when: - Pain controlled without narcotics - Hemarthrosis controlled - ROM 0-100° - Muscle control throughout ROM Custom medial unloader brace or hinged soft tissue brace Avoid hyperextension, varus loads	
Evaluation	Pain Effusion Patellar mobility ROM Muscle control 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 (flexion: ankle weight, < 10% of body weight) Isometric training: multi-angle (90°, 60°, 30°) Closed-chain - Mini-squats Knee extension (active, 90°-30°) Aerobic conditioning (patellofemoral precautions) UBC Stationary bicycling Gait retraining (high risk for stretching reconstruction with resumption of weight bearing) Muscle control quads & hams Walk with toe-out gait, avoid toe-in varus position Observe gait for any varus thrust or hyperextension Smooth stance phase flexion pattern Modalities Electrical muscle stimulation Cryotherapy	Duration 5 reps x 30 secs 3 sets x 10 reps 2 sets x 10 reps 3 sets x 20 reps 3 sets x 10 reps 20 minutes 20 minutes
Goals	ROM 0°-110° Control inflammation, effusion Muscle control Early recognition complications (motion, RSD, patellofemoral) 50% weight bearing	

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

General Observation	Full weight bearing with cane when: - Pain controlled - Hemarthrosis controlled - ROM 0-120° - Voluntary quad contraction achieved Custom medial unloader brace or hinged soft tissue brace	
Evaluation	Pain Effusion Patellar mobility ROM Muscle control 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°) Patella mobilization Hamstring, gastroc-soleus stretches Strengthening Straight leg raises (flexion, extension, abduction, adduction) Straight leg raises, rubber tubing Knee extension (active, 90°-30°) Closed-chain - Wall sits - Mini-squats (rubber tubing, 0°-30°) Balance training Cup walking Aerobic conditioning UBC Stationary bicycling Gait retraining Progress program Continue to observe for varus thrust, hyperextension Modalities Electrical muscle stimulation 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 20 minutes
Goals	Full weight bearing Muscle control Control inflammation, effusion ROM 0°-120°	

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

General Observation	Full weight bearing (wk 12) when: - Pain, effusion controlled - Muscle control throughout ROM ROM 0°-135° Custom medial unloader brace or hinged soft tissue brace	
Evaluation	Pain Manual muscle test Hamstrings, quadriceps, hip abductors/adductors/flexors/extensors Swelling Patellar mobility Crepitus Gait	Goals Minimal/No RSD 4/5 Minimal Good None/slight Symmetrical
<p>Frequency 2 x/day 10 minutes</p> <p>2 x/day 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 Straight leg raises, rubber tubing Hamstring curls (week 12, active, 0°-90°) Knee extension with resistance (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)</p> <p>Balance training Cup walking</p> <p>Aerobic conditioning (patellofemoral precautions) Water walking Swimming (straight leg kicking) Stationary bicycling Stair machine (low resistance, low stroke)</p> <p>Modalities Cryotherapy</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</p> <p>to fatigue x 3 3 sets x 20 reps 3 sets x 10 reps 3 sets x 10 reps</p> <p>20 minutes</p>
Goals	Increase strength and endurance ROM 0°-130° Normal gait without varus, hyperextension	

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

General Observation	No effusion, painless ROM, joint stability Performs activities of daily living, can walk 20 minutes without pain ROM 0°-130° Custom medial unloader brace or hinged soft tissue brace	
Evaluation	Pain Manual muscle test Swelling Patellar mobility Crepitus 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	Increase strength and endurance	

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

General Observation	No effusion, painless ROM, joint stability Performs ADL, can walk 20 minutes without pain Custom medial unloader brace or hinged soft tissue brace	
Evaluation	Isometric test (% diff quads & hams) Swelling Patellar mobility Crepitus	Goals 10-15 None Good None/slight
Frequency	Range of motion Hamstring, gastroc-soleus, quad, ITB stretches	Duration 5 reps x 30 secs
2 x/day 10 minutes		
1 x/day 20-30 minutes	Strengthening Straight leg raises, rubber tubing (high speed) Hamstring curls (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°)	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
1-3 x/day 5 minutes	Balance training Balance board/2 legged Single leg stance	
3 x/week 20-30 minutes	Aerobic conditioning (patellofemoral precautions) Stationary bicycling Water walking Swimming (kicking) Walking Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance)	
3 x/week 15-20 minutes	Running program (9 mos. minimum, straight, 30% deficit isometric test) Jog Walk Backward run	1/4 mile 1/8 mile 20 yards
3 x/week	Cutting program (12 mos. minimum, 20% deficit isometric test) – Lateral, carioca, figure 8's	20 yards
3 x/week	Functional training (12 mos. minimum) Plyometric training: box hops, level, double-leg Sport specific drills (10-15% deficit isometric test)	15 secs, 4-6 sets
As required	Modalities Cryotherapy	20 minutes
Goals	Increase function Return to previous activity level Maintain strength, endurance	