

## 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
<b>Brace:</b> Bivalved cylinder cast Custom medial unloader or hinged soft tissue brace	X	X	X	X	X	X	X	X	X
<b>Range of motion minimum goals:</b> 0°-90° 0°-110° 0°-120° 0°-130°	X	X	X	X	X				
<b>Weight bearing:</b> None Toe touch – 25% body weight 25% to 50% body weight Full, cane support Full	X	X	X	X	X				
<b>Patella mobilization</b>	X	X	X	X					
<b>Modalities:</b> Electrical muscle stimulation Pain/edema management (cryotherapy)	X	X	X	X	X	X	X	X	X
<b>Stretching:</b> Hamstring, gastroc-soleus, iliotibial band, quadriceps	X	X	X	X	X	X	X	X	X
<b>Strengthening:</b> 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
<b>Balance/proprioceptive training:</b> Weight-shifting, cup walking, BBS BBS, BAPS, perturbation training, balance board, mini-trampoline				X	X	X	X	X	X
<b>Conditioning:</b> UBC Bike (stationary) Aquatic program Swimming (kicking) Walking Stair climbing machine Ski machine		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)**

<b>General Observation</b>	<ul style="list-style-type: none"> <li>- Non-weight bearing, maximum protection</li> <li>- Bivalved cylinder cast</li> <li>- Must avoid hyperextension, varus loads, lateral joint opening</li> </ul>	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>Pain</li> <li>Hemarthrosis</li> <li>Patellar mobility</li> <li>ROM minimum</li> <li>Quadriceps contraction &amp; patella migration</li> <li>Soft tissue contracture</li> </ul>	<p align="center"><b>Goals</b></p> <ul style="list-style-type: none"> <li>Controlled</li> <li>Mild</li> <li>Good</li> <li>0°-90°</li> <li>Good</li> <li>None</li> </ul>
<p><b>Frequency</b></p> <ul style="list-style-type: none"> <li>3-4 x/day</li> <li>10 minutes</li>   <li>3 x/day</li> <li>15 minutes</li>   <li>As required</li> </ul>	<p><b>Range of motion</b></p> <ul style="list-style-type: none"> <li>ROM (passive, 0°-90°)</li> <li>Patella mobilization</li> <li>Ankle pumps (plantar flexion with resistance band)</li> <li>Hamstring, gastroc-soleus stretches</li> </ul> <p><b>Strengthening</b></p> <ul style="list-style-type: none"> <li>Straight leg raises (flexion)</li> <li>Active quadriceps isometrics</li> <li>Knee extension (active-assisted, 90°-30°, per quad control)</li> </ul> <p><b>Modalities</b></p> <ul style="list-style-type: none"> <li>Electrical muscle stimulation</li> <li>Cryotherapy</li> </ul>	<p align="center"><b>Duration</b></p> <ul style="list-style-type: none"> <li>5 reps x 30 secs</li>   <li>3 sets x 10 reps</li> <li>1 set x 10 reps</li> <li>3 sets x 10 reps</li>   <li>20 minutes</li> <li>20 minutes</li> </ul>
<b>Goals</b>	<ul style="list-style-type: none"> <li>ROM 0°-90°</li> <li>Adequate quadriceps contraction</li> <li>Control inflammation, effusion</li> </ul>	

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

<b>General Observation</b>	Non-weight bearing, maximum protection Bivalved cylinder cast Must avoid hyperextension, varus loads, lateral joint opening	
<b>Evaluation</b>	Pain Effusion Patellar mobility ROM minimum Quadriceps contraction & patella migration Soft tissue contracture	<b>Goals</b> Controlled Mild Good 0°-90° Good None
<b>Frequency</b> 3-4 x/day 10 minutes  2-3 x/day 20 minutes  2 x/day 10 minutes  As required	<b>Range of motion</b> ROM (passive, 0°-90°) Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches  <b>Strengthening</b> Straight leg raises (flexion) Isometric training: multi-angle (0°, 60°) Knee extension (active-assisted, 90°-30°, per quad control)  <b>Aerobic conditioning</b> UBC  <b>Modalities</b> Electrical muscle stimulation Cryotherapy	<b>Duration</b>  5 reps x 30 secs  3 sets x 10 reps 1 set x 10 reps 3 sets x 10 reps   20 minutes 20 minutes
<b>Goals</b>	ROM 0°-90° Control inflammation, effusion Muscle control	

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

<b>General Observation</b>	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	
<b>Evaluation</b>	Pain Effusion Patellar mobility ROM Muscle control Inflammatory response	<b>Goals</b> Mild/No RSD Minimal Good 0°-110° 3/5 None
<b>Frequency</b> 3 x/day 10 minutes  2 x/day 20 minutes  2 x/day 10 minutes  As required	<b>Range of motion</b> ROM (passive, 0°-110°) Patella mobilization Hamstring, gastroc-soleus stretches  <b>Strengthening</b> 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°)  <b>Aerobic conditioning</b> (patellofemoral precautions) UBC Stationary bicycling  <b>Gait retraining</b> (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  <b>Modalities</b> Electrical muscle stimulation Cryotherapy	<b>Duration</b>  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
<b>Goals</b>	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)**

<b>General Observation</b>	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	
<b>Evaluation</b>	Pain Effusion Patellar mobility ROM Muscle control Inflammatory response	<b>Goals</b> Mild/No RSD Minimal Good 0°-120° 4/5 None
<b>Frequency</b> 2 x/day 10 minutes  2 x/day 20 minutes  3 x/day 5 minutes  1-2 x/day 15 minutes  As required	<b>Range of motion</b> ROM (0°-120°) Patella mobilization Hamstring, gastroc-soleus stretches  <b>Strengthening</b> 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°)  <b>Balance training</b> Cup walking  <b>Aerobic conditioning</b> UBC Stationary bicycling  <b>Gait retraining</b> Progress program Continue to observe for varus thrust, hyperextension  <b>Modalities</b> Electrical muscle stimulation Cryotherapy	<b>Duration</b>  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
<b>Goals</b>	Full weight bearing Muscle control Control inflammation, effusion ROM 0°-120°	

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

<b>General Observation</b>	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	
<b>Evaluation</b>	Pain Manual muscle test Hamstrings, quadriceps, hip abductors/adductors/flexors/extensors Swelling Patellar mobility Crepitus Gait	<b>Goals</b> Minimal/No RSD 4/5  Minimal Good None/slight Symmetrical
<p><b>Frequency</b> 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><b>Range of motion</b> Hamstring, gastroc-soleus, quad, ITB stretches</p> <p><b>Strengthening</b> 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><b>Balance training</b> Cup walking</p> <p><b>Aerobic conditioning</b> (patellofemoral precautions) Water walking Swimming (straight leg kicking) Stationary bicycling Stair machine (low resistance, low stroke)</p> <p><b>Modalities</b> Cryotherapy</p>	<p><b>Duration</b></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>
<b>Goals</b>	Increase strength and endurance ROM 0°-130° Normal gait without varus, hyperextension	

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

<b>General Observation</b>	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	
<b>Evaluation</b>	Pain Manual muscle test Swelling Patellar mobility Crepitus Gait	<b>Goals</b> Minimal/No RSD 4/5 Minimal Good None/slight Symmetrical
<b>Frequency</b> 2 x/day 10 minutes  2 x/day 20 minutes  1-3 x/day 5 minutes  3 x/week 20 minutes  As required	<b>Range of motion</b> Hamstring, gastroc-soleus, quad, ITB stretches  <b>Strengthening</b> 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°)  <b>Balance training</b> Balance board/2 legged Single leg stance  <b>Aerobic conditioning</b> (patellofemoral precautions) Stationary bicycling Water walking Swimming (kicking) Walking Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance)  <b>Modalities</b> Cryotherapy	<b>Duration</b>  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
<b>Goals</b>	Increase strength and endurance	

