

Stretching: hamstring, gastrocnemius-soleus, iliotibial band, quadriceps	X	X	X	X	X	X	X	X	X
Strengthening:									
Quadriceps isometrics, straight-leg raises, active knee extension	X	X	X	X					
Closed-chain: gait retraining, toe raises, wall-sits, mini-squats	X	X	X	X	X				
Knee flexion hamstring curls (90 degrees)	X	X	X	X	X	X	X	X	X
Knee extension quadriceps (90-30 degrees)	X	X	X	X	X	X	X	X	X
Hip abduction-adduction, multihip	X	X	X	X	X	X	X	X	X
Leg press (70-10 degrees)	X	X	X	X	X	X	X	X	X
Balance/proprioceptive training:									
Weight shifting, cup walking, Biodex Balance System	X	X	X	X					
Biodex Balance System, Biomechanical Ankle Platform System, perturbation training, balance board, minitrampoline				X	X	X	X	X	

Conditioning:									
UBC	X	X	X						
Bike (stationary)		X	X	X	X	X	X	X	X
Aquatic program		X	X	X	X	X	X	X	X
Swimming (kicking)				X	X	X	X	X	X
Walking				X	X	X	X	X	X
Stair-climbing machine			X	X	X	X	X	X	X
Ski machine			X	X	X	X	X	X	X
Elliptical machine				X	X	X	X	X	X
Running: straight					X	X	X	X	X
Cutting: lateral carioca, figure-eights						X	X	X	X
Plyometric training						X	X	X	X
Full sports							X	X	X

PHASE 1: WEEKS 1-2	
General Observation	<p>50% weight bearing with two crutches when:</p> <ul style="list-style-type: none"> • Postoperative pain controlled • Hemarthrosis controlled • Voluntary quadriceps contraction achieved
Factors Evaluated (Goal)	<p>Pain (controlled) Hemarthrosis (mild) Patellar mobility (good) ROM (minimum, 0-110 degrees) Quadriceps contraction and patella migration (good) Soft tissue contracture (none) Joint arthrometry day 14 (<3 mm)</p>

Activity	Frequency	Duration
ROM	3-4 ×/day, 10 min	
Passive (0-90 degrees)		
Patella mobilization		
Ankle pumps (plantar flexion with resistance band)		
Hamstring, gastrocnemius-soleus stretches		5 reps × 30 sec each
Strengthening	3 ×/day, 15 min	
Straight-leg raises (flexion, extension, abduction, adduction)		3 sets × 10 reps
Active quadriceps isometrics (full extension)		1 set × 10 reps
Knee flexion (active, 0-90 degrees)		3 sets × 10 reps
Knee extension (active assisted, 90-30 degrees)		3 sets × 10 reps
Multihip machine (flexion, extension, abduction, adduction)		3 sets × 10 reps
Leg press (70-10 degrees)		3 sets × 10 reps

Closed-chain: minisquats (0-45 degrees, 50% weight bearing)		3 sets × 20 reps
Balance Training	3 ×/day, 5 min	
Weight shift side-side and forward-back		5 sets × 10 reps
Aerobic Conditioning		
UBC	1-2 ×/day, 5 min	
Modalities	As required	
EMS		20 min
Cryotherapy		20 min
Goals	<ul style="list-style-type: none"> • ROM 0-110 degrees • Adequate quadriceps contraction • Control inflammation and effusion • 50% weight bearing 	

PHASE 2: WEEKS 3-4

General Observation	<p>Full weight bearing with one crutch when:</p> <ul style="list-style-type: none"> • Pain controlled without narcotics • Effusion controlled • ROM 0-100 degrees • Muscle control throughout ROM
Factors Evaluated (Goal)	<p>Pain (mild) Effusion (mild) Patellar mobility (good) ROM (minimum, 0-120 degrees) Muscle control (3/5) Inflammatory response (none) Joint arthrometry, day 28, 20 lb (<3 mm)</p>

Activity	Frequency	Duration
ROM	3-4 ×/day, 10 min	
Passive (0-120 degrees)		
Patella mobilization		
Ankle pumps (plantar flexion with resistance band)		
Hamstring, gastrocnemius-soleus stretches		5 reps × 30 sec each
Strengthening	2-3 ×/day, 20 min	
Straight-leg raises (flexion, extension, adduction, abduction)		3 sets × 10 reps
Isometric training, multiangle (90, 60, 30 degrees)		1 set × 10 reps
Heel raise/toe raise		3 sets × 10 reps
Hamstring curls (active, 0-90 degrees)		3 sets × 10 reps
Knee extension (active, 90-30 degrees)		3 sets × 10 reps

Closed-chain:		
Wall-sits		5 reps
Minisquats		3 sets × 20 reps
Multihip machine (flexion, extension, abduction, adduction)		3 sets × 10 reps
Leg press (70-10 degrees)		3 sets × 10 reps
Balance Training	3×/day, 5 min	
Weight shift side-side, forward-back		5 sets × 10 reps
Balance board, two legged		
Cup walking		
Single-leg stance (level surface)		5 reps
Aerobic Conditioning	2×/day, 5 min	
UBC		
Water walking		
Stationary bicycling (patellofemoral precautions)		
Modalities	As required	
EMS		20 min
Cryotherapy		20 min
Goals	<ul style="list-style-type: none"> • ROM 0-125 degrees • Muscle control • Arthrometer within 3 mm • Control inflammation, effusion • 100% weight bearing 	

PHASE 3: WEEKS 5-6

General Observation	Independent ambulation when: <ul style="list-style-type: none"> • Pain controlled • Effusion controlled • ROM 0-120 degrees • Muscle control throughout ROM 	
Factors Evaluated (Goal)	Pain (no CRPS) Effusion (minimal) Patellar mobility (good) ROM (0-135 degrees) Muscle control (4/5) Inflammatory response (none) Gait, symmetric	
Activity	Frequency	Duration
ROM	3 ×/day, 10 min	
ROM passive (0-135 degrees)		
Patella mobilization		
Hamstring, gastrocnemius-soleus stretches		5 reps × 30 sec
Strengthening	1-2 ×/day, 20 min	
Straight-leg raises (ankle weight, <10% of body weight)		3 sets × 10 reps
Straight-leg raises with rubber tubing		3 sets × 10 reps
Isometric training, multiangle (90, 60, 30 degrees)		2 sets × 10 reps
Heel raise/toe raise		3 sets × 20 reps
Hamstring curls (active, 0-90 degrees)		3 sets × 10 reps
Knee extension (90-30 degrees, with resistance)		3 sets × 10 reps

Closed-chain:		
Wall-sits		5 reps
Minisquats		3 sets × 20 reps
Multihip machine (flexion, extension, abduction, adduction)		3 sets × 10 reps
Leg press (70-10 degrees)		3 sets × 10 reps
Balance Training	3 ×/day, 5 min	
Balance board, two legged		
Lateral step-ups, 2- to 4-inch block		
Aerobic Conditioning (Patellofemoral Precautions)	2 ×/day, 10 min	
UBC		
Water walking		
Stationary bicycling		
Stair machine (low resistance and stroke)		
Ski machine (short strike and level, low resistance)		
Modalities	As required	
EMS		20 min
Cryotherapy		20 min
Goals	<ul style="list-style-type: none"> • ROM 0-135 degrees • Control inflammation and effusion • Recognition of complications (motion loss, CRPS, increased anteroposterior displacement) • Muscle endurance • Recognition of patellofemoral changes • Full weight bearing, normal gait 	

PHASE 4: WEEKS 7-8

General Observation	<ul style="list-style-type: none"> • No effusion • Painless ROM (0-135 degrees) • Joint stability • Performs activities of daily living • Full weight bearing • Can walk 20 min without pain 	
Factors Evaluated (Goal)	Manual muscle test (hamstrings, quadriceps, all hip muscles; 4/5) Swelling (none) Joint arthrometry, 8 weeks (<3 mm) Patellar mobility (good) Crepitus (none/slight)	
Activity	Frequency	Duration
ROM	2 ×/day, 10 min	
Hamstring, gastrocnemius-soleus stretches		5 reps × 30 sec
Strengthening	1-2 ×/day, 20 min	
Straight-leg raises, rubber tubing		3 sets × 30 reps
Hamstring curls (active, 0-90 degrees)		3 sets × 10 reps
Knee extension with resistance (90-30 degrees)		3 sets × 10 reps
Leg press (70-10 degrees)		3 sets × 10 reps
Multihip machine (flexion, extension, abduction, adduction)		3 sets × 10 reps

Closed-chain:		
Wall-sits		5 reps
Minisquats		3 sets × 20 reps
Dynamic hip and core program		
Balance Training	3 ×/day, 5 min	
Balance board, two legged		
Single-leg stance		
Resistance band walking		
PlyoBack ball toss		
Perturbation training		
Aerobic Conditioning (Patellofemoral Precautions)	1-2 ×/day, 15-20 min	
Stationary bicycling		
Water walking		
Swimming (straight-leg kicking)		
Walking		
Stair machine (low resistance and stroke)		
Ski machine (short stride and level, low resistance)		
Elliptical machine (low resistance)		
Modalities	As required	
Cryotherapy		20 min
Goals	Increase strength and endurance	

PHASE 5: WEEKS 9-12

General Observation	<ul style="list-style-type: none"> • No effusion, painless ROM (0-135 degrees), joint stability • Performs ADLs, can walk 20 min without pain • Full weight bearing 	
Factors Evaluated (Goal)	<p>Manual muscle test (4/5) Isometric test, 12 weeks, mean average torque/% deficit in quadriceps and hamstrings (30%) Swelling (none) Joint arthrometry, 12 weeks (<3 mm) Patellar mobility (good) Crepitus (none/slight)</p>	
Activity	Frequency	Duration
ROM	2 ×/day, 10 min	
Hamstring, gastrocnemius-soleus, quadriceps, ITB stretches		5 reps × 30 sec
Strengthening	2 ×/day, 20 min	
Straight-leg raises with rubber tubing		3 sets × 30 reps
Hamstring curls (active, 0-90 degrees)		3 sets × 10 reps
Knee extension with resistance (90-30 degrees)		3 sets × 10 reps
Leg press (70-10 degrees)		3 sets × 10 reps
Multihip machine (flexion, extension, abduction, adduction)		3 sets × 10 reps

Closed-chain:		
Wall-sits		5 reps
Minisquats		3 sets × 20 reps
Lateral step-ups (2- to 4-inch block)		3 sets × 10 reps
Dynamic hip and core program		
Balance Training	3 ×/day, 5 min	
Balance board, two legged		
Single-leg stance		
Resistance band walking		
PlyoBack ball toss		
Perturbation training		
Aerobic Conditioning (Patellofemoral Precautions)	3 ×/wk, 15-20 min	
Stationary bicycling		
Walter walking		
Swimming (kicking)		
Walking		

Stair machine (low resistance and stroke)		
Ski machine (short stride and level, low resistance)		
Elliptical machine (low resistance)		
Running Program (Straight)	3 x/wk, 10 min	
Jog		$\frac{1}{4}$ mile
Walk		$\frac{1}{8}$ mile
Backward walk		20 yards
Modalities	As required	
Cryotherapy		20 min
Goals	Increase strength and resistance	

PHASE 6: WEEKS 13-26	
General Observation	<ul style="list-style-type: none"> • No effusion • Painless ROM • Joint stability • Performs ADLs • Can walk 20 min without pain
Factors Evaluated (Goal)	<p>Isokinetic test (isometric + torque 300 degrees/sec, % difference in quadriceps and hamstrings, tested monthly)</p> <p>Swelling (none)</p> <p>Joint arthrometry (<3 mm)</p> <p>Patellar mobility (good)</p> <p>Crepitus (none/slight)</p> <p>Single-leg function tests (hop distance, timed hop, % difference between involved and noninvolved side)</p>

Activity	Frequency	Duration
ROM	2 ×/day, 10 min	
Hamstring, gastrocnemius-soleus, quadriceps, ITB stretches		5 reps × 30 sec
Strengthening	1 ×/day, 20-30 min	
Straight-leg raises, rubber tubing (high speed)		3 sets × 30 reps
Hamstring curls (active, 0-90 degrees)		3 sets × 10 reps
Knee extension with resistance (90-30 degrees)		3 sets × 10 reps
Leg press (70-10 degrees)		3 sets × 10 reps
Multihip machine (flexion, extension, abduction, adduction)		
Dynamic hip and core program		

Balance Training	3 ×/day, 5 min	
Balance board, two legged to single legged		
Single-leg stance on unstable platform		
Aerobic Conditioning (Patellofemoral Cautions)	3 ×/wk, 20-30 min	
Stationary bicycling		
Water walking		
Swimming (kicking)		
Walking		
Stair machine (low resistance and stroke)		
Ski machine (short stride and level, low resistance)		
Elliptical machine (low resistance)		
Running Program (Straight)	3 ×/wk, 15-20 min	
Jog (progress speed from $\frac{1}{2}$ to $\frac{3}{4}$ to full)		$\frac{1}{4}$ to 1 mile
Walk		$\frac{1}{8}$ mile
Backward run		20 yards
Cutting Program (Lateral, Carioca, Figure-Eights)	3 ×/wk	20 yards
Functional Training	3 ×/wk	
Plyometric training (box hops, level, double leg)		15 sec, 4-6 sets
Sport-specific drills		
Modalities	As required	
Cryotherapy		20 min
Goals	Increase strength and endurance	

PHASE 7: WEEKS 27-52

General Observation	<ul style="list-style-type: none">• No effusion• Painless ROM• Joint stability• Performs ADLs• Can walk 20 min without pain	
Factors Evaluated (Goal)	Isokinetic test (torque at 180 and 300 degrees/sec, % difference in quadriceps and hamstrings, tested quarterly; isometric if symptomatic patellofemoral joint) (10%-15%) Swelling (none) Joint arthrometry (<3 mm) Patellar mobility (good) Crepitus (none/slight) Single-leg functional test (hop distance, timed hop, % difference between noninvolved and involved side) ($\leq 15\%$)	
Activity	Frequency	Duration

ROM	2 ×/day, 10 min	
Hamstring, gastrocnemius-soleus, quadriceps, ITB stretches		5 reps × 30 sec
Strengthening		
Straight-leg raises, rubber tubing (high speed)	3-4 ×/wk, 20-30 min	3 sets × 30 reps
Hamstring curls (active, 0-90 degrees)		1-2 sets × 8-12 reps
Knee extension with resistance (90-30 degrees)		1-2 sets × 8-12 reps
Leg press (70-10 degrees)		1-2 sets × 8-12 reps
Multihip machine (flexion, extension, abduction, adduction)		1-2 sets × 8-12 reps
Dynamic hip and core program		

Balance Training	3 ×/day, 5 min	
Balance board, two legged to single legged		
Single-leg stance on unstable platform with secondary activity		
Aerobic Conditioning (Patellofemoral Precautions)	3 ×/wk, 20-30 min	
Stationary bicycling		
Water walking		
Swimming (kicking)		
Walking		
Stair machine (low resistance and stroke)		

Ski machine (short stride and level, low resistance)		
Running Program (Straight)	3 ×/wk, 20 min	
Interval training		20, 40, 60, 100 yards
Walk/rest phase (3 : 1 rest/work)		20 yards
Backward run		20 yards
Cutting Program (Lateral, Carioca, Figure-Eights)	3 ×/wk	20 yards
Functional Training	3 ×/wk	
Plyometric training (box hops, level, double leg)		15 sec, 4-6 sets
Sport-specific drills		
Modalities	As required	
Cryotherapy		20 min
Goals	<ul style="list-style-type: none"> • Increase function, strength, and endurance • Return to previous activity level 	