



## Cincinnati SportsMedicine and Orthopaedic Center Rehabilitation Protocol Summary for Meniscus Transplantation

	Postoperative Weeks					Postoperative Months			
	1-2	3-4	5-6	7-8	9-12	4	5	6	7-12
<b>Brace:</b> Bledsoe postoperative	X	X	X	X					
<b>Range of motion minimum goals:</b> 0°-90° 0°-120° 0°-135°	X	X	X						
<b>Weight bearing:</b> Toe touch – 1/4 body weight 1/2 to 3/4 body weight Full	X	X	X						
<b>Patella mobilization</b>	X	X	X						
<b>Modalities:</b> Electrical muscle stimulation (EMS) Pain/edema management (cryotherapy)	X X	X 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 sits, 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, mini-trampoline, BAPS, KAT, plyometrics			X	X	X	X	X	X	X
<b>Conditioning:</b> UBE Bike (stationary) Aquatic program Swimming (kicking) Walking Stair climbing machine Ski machine		X	X	X	X	X	X	X	X
<b>Light recreational sports</b>									X

BAPS = Biomechanical Ankle Platform System (Camp, Jackson, MI), KAT = Kinesthetic Awareness Trainer (Breg, Inc., Vista, CA), UBE = upper body ergometer.

**References:**

Heckmann T, Barber-Westin SD, Noyes FR: Meniscal repair and transplantation: Indications, techniques, rehabilitation, and clinical outcome. *J Orthop Sports Phy Therapy* 36, 2006.  
 Noyes FR, Barber-Westin SD, Rankin M: Meniscal transplantation in symptomatic patients less than fifty years old: Surgical technique. *J Bone Joint Surg* 87A (Suppl 1, Part 2): 149-165, 2005.  
 Noyes FR, Barber-Westin SD, Rankin, M.: Meniscus transplantation in symptomatic patients under fifty years of age. *J Bone Joint Surgery* 68A: 1392-1404, 2004.  
 Noyes FR, Barber-Westin SD: Meniscus transplantation: Indications, techniques, clinical outcomes. In Pellegrini VD (ed.): *Instructional Course Lectures*, Vol. 54, American Academy of Orthopaedic Surgeons, Rosemont, IL., 2005.

**Cincinnati SportsMedicine and Orthopaedic Center Rehab Protocol: Meniscus Transplant**  
**Phase 1. Weeks 1-2 (Visits: 2-4)**

<b>General Observation</b>	<ul style="list-style-type: none"> <li>■ Toe touch to 1/4 weight bearing when:               <ul style="list-style-type: none"> <li>- Pain controlled</li> <li>- Full extension achieved</li> </ul> </li> <li>- Hemarthrosis controlled</li> <li>- Voluntary quadriceps contraction achieved</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> <p>Controlled Mild Good 10°-90° Good None</p>
<p align="center"><b>Frequency</b></p> <p>3-4 x/day 10 minutes</p> <p>3 x/day 15 minutes</p> <p>As required</p>	<p><b>Range of motion</b> ROM (passive, 0°-90°) Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches</p> <p><b>Strengthening</b> Straight leg raises (flexion) Active quadriceps isometrics Knee extension (active-assisted)</p> <p><b>Modalities</b> Electrical muscle stimulation Cryotherapy</p>	<p align="center"><b>Duration</b></p> <p>5 reps x 30 secs</p> <p>3 sets x 10 reps 1 set x 10 reps 3 sets x 10 reps</p> <p>20 minutes 20 minutes</p>
<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>	

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

<b>General Observation</b>	<ul style="list-style-type: none"> <li>■ 1/2 to 3/4 weight bearing when:               <ul style="list-style-type: none"> <li>- Pain controlled</li> <li>- Hemarthrosis controlled</li> <li>- Voluntary quadriceps contraction achieved</li> </ul> </li> </ul>	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>■ Pain</li> <li>■ Effusion</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> Controlled Mild Good 0°-120° Good None
<p align="center"><b>Frequency</b></p> 3-4 x/day 10 minutes  2-3 x/day 20 minutes  2 x/day 10 minutes  As required	<p align="center"><b>Range of motion</b></p> ROM (passive, 0°-120°) Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches  <p align="center"><b>Strengthening</b></p> Straight leg raises (flexion, extension, adduction) Isometric training: multi-angle (0°, 60°) Knee extension (active, 90°-30°)  <p align="center"><b>Aerobic conditioning</b></p> UBE  <p align="center"><b>Modalities</b></p> Electrical muscle stimulation Cryotherapy	<p align="center"><b>Duration</b></p>   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>	<ul style="list-style-type: none"> <li>■ ROM 0°-120°</li> <li>■ Muscle control</li> <li>■ Control inflammation, effusion</li> <li>■ Early recognition complications (motion loss, RSD, patellofemoral)</li> </ul>	

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

<b>General Observation</b>	<ul style="list-style-type: none"> <li>■ Full weight bearing when:</li> <li>- Pain controlled                      - Hemarthrosis controlled</li> <li>- ROM 0°-135°                              - Muscle control throughout ROM</li> </ul>	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>■ Pain</li> <li>■ Effusion</li> <li>■ Patellar mobility</li> <li>■ ROM</li> <li>■ Muscle control</li> <li>■ Inflammatory response</li> </ul>	<p align="center"><b>Goals</b></p> <p>Mild/No RSD  Minimal  Good  0°-135°  3/5  None</p>
<p><b>Frequency</b></p> <p>3 x/day 10 minutes</p> <p>2 x/day 20 minutes</p> <p>2 x/day 10 minutes</p> <p>As required</p>	<p><b>Range of motion</b>  ROM (passive, 0°-135°)  Patella mobilization  Hamstring, gastroc-soleus stretches</p> <p><b>Strengthening</b>  Straight leg raises (ankle weight, not to exceed 10% of body weight)  Isometric training: multi-angle (90°, 60°, 30°)  Knee extension (active, 90°-30°)  Multi-hip machine (flexion, extension, abduction, adduction)</p> <p><b>Aerobic conditioning</b>  UBE</p> <p><b>Modalities</b>  Electrical muscle stimulation  Cryotherapy</p>	<p align="center"><b>Duration</b></p> <p>5 reps x 30 secs</p> <p>3 sets x 10 reps  2 sets x 10 reps  3 sets x 10 reps  3 sets x 10 reps</p> <p>20 minutes  20 minutes</p>
<b>Goals</b>	<ul style="list-style-type: none"> <li>■ ROM 0°-135°</li> <li>■ Control inflammation, effusion</li> <li>■ Muscle control</li> <li>■ Early recognition complications (motion loss, RSD, patellofemoral)</li> </ul>	

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

<b>General Observation</b>	<ul style="list-style-type: none"> <li>■ Full weight bearing when:</li> <li>- Pain controlled      - Hemarthrosis controlled</li> <li>- ROM 0°-135°      - Voluntary quad contraction achieved</li> </ul>	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>■ Pain</li> <li>■ Effusion</li> <li>■ Patellar mobility</li> <li>■ ROM</li> <li>■ Muscle control</li> <li>■ Inflammatory response</li> </ul>	<b>Goals</b> Mild/No RSD Minimal Good 0°-135° 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> 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°) Multi-hip machine (flexion, extension, abduction, adduction)  <b>Balance training</b> Balance board/2 legged Single leg stance Cup walking  <b>Aerobic conditioning</b> UBE Stationary bicycling  <b>Modalities</b> Cryotherapy	<b>Duration</b>  5 reps x 30 secs  3 sets x 10 reps 3 sets x 30 reps 3 sets x 10 reps  3 sets x 20 reps to fatigue x 3 3 sets x 10 reps         20 minutes
<b>Goals</b>	<ul style="list-style-type: none"> <li>■ Full weight bearing, normal gait</li> <li>■ Control inflammation, effusion</li> <li>■ Muscle control</li> <li>■ ROM 0°-135°</li> </ul>	

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

<b>General Observation</b>	<ul style="list-style-type: none"> <li>■ Full weight bearing when: <ul style="list-style-type: none"> <li>- Pain, effusion controlled</li> <li>- Muscle control throughout ROM</li> </ul> </li> <li>■ ROM 0°-135°</li> </ul>	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>■ Pain</li> <li>■ Manual muscle test Hamstrings, quadriceps, hip abductors/adductors/flexors/extensors</li> <li>■ Swelling</li> <li>■ Patellar mobility</li> <li>■ Crepitus</li> <li>■ Gait</li> </ul>	<p align="center"><b>Goals</b></p> <p>Minimal/No RSD 4/5</p> <p>Minimal Good None/slight Symmetrical</p>
<b>Frequency</b>		<b>Duration</b>
2 x/day 10 minutes	<p><b>Range of motion</b> Hamstring, gastroc-soleus, quad, ITB stretches</p>	5 reps x 30 secs
2 x/day 20 minutes	<p><b>Strengthening</b>  Straight leg raises  Straight leg raises, rubber tubing  Hamstring curls (active, 0°-90°)  Knee extension (active, 90°-30°)  Leg press (70°-10°)  Closed-chain  <ul style="list-style-type: none"> <li>- Wall sits</li> <li>- Mini-squats (rubber tubing, 0°-40°)</li> <li>- Lateral step-ups (2-4" block)</li> </ul> Multi-hip machine (flexion, extension, abduction, adduction)</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>3 sets x 20 reps to fatigue x 3</p> <p>3 sets x 10 reps</p>
3 x/day 5 minutes	<p><b>Balance training</b>  Balance board/2 legged  Single leg stance</p>	
1 x/day 15-20 minutes	<p><b>Aerobic conditioning</b> (patellofemoral precautions)  Stationary bicycling  Water walking  Walking</p>	
As required	<p><b>Modalities</b>  Cryotherapy</p>	20 minutes
<b>Goals</b>	<ul style="list-style-type: none"> <li>■ Increase strength and endurance</li> <li>■ ROM 0°-135°</li> </ul>	

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

<b>General Observation</b>	<ul style="list-style-type: none"> <li>■ No effusion, painless ROM, joint stability</li> <li>■ Performs activities of daily living, can walk 20 minutes without pain</li> <li>■ ROM 0°-135°</li> </ul>	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>■ Pain</li> <li>■ Swelling</li> <li>■ Patellar mobility</li> <li>■ Crepitus</li> <li>■ Gait</li> </ul>	<p align="center"><b>Goals</b></p> <p>Minimal/No RSD  Minimal  Good  None/slight  Symmetrical</p>
<p align="center"><b>Frequency</b></p> <p>2 x/day 10 minutes</p> <p>2 x/day 20 minutes</p> <p>1-3 x/day 5 minutes</p> <p>3 x/week 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, rubber tubing (high speed)  Hamstring curls with resistance (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°)</p> <p><b>Balance training</b>  Balance board/2 legged  Single leg stance</p> <p><b>Aerobic conditioning</b> (patellofemoral precautions)  Stationary bicycling  Water walking  Swimming (kicking)  Walking</p> <p><b>Modalities</b>  Cryotherapy</p>	<p align="center"><b>Duration</b></p> <p>5 reps x 30 secs</p> <p>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</p> <p>20 minutes</p>
<b>Goals</b>	<ul style="list-style-type: none"> <li>■ Increase strength and endurance</li> </ul>	

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

<b>General Observation</b>	<ul style="list-style-type: none"> <li>■ No effusion, painless ROM, joint stability</li> <li>■ Performs ADL, can walk 20 minutes without pain</li> </ul>	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>■ Isokinetic test (isometric + torque 300°/sec, % diff quads &amp; hams)</li> <li>■ Swelling</li> <li>■ Patellar mobility</li> <li>■ Crepitus</li> </ul>	<p align="center"><b>Goals</b></p> <p>10-15 None Good None/slight</p>
<b>Frequency</b>		<b>Duration</b>
2 x/day 10 minutes	<p><b>Range of motion</b> Hamstring, gastroc-soleus, quad, ITB stretches</p>	5 reps x 30 secs
1 x/day 20-30 minutes	<p><b>Strengthening</b> Straight leg raises, rubber tubing (high speed) Hamstring curls with resistance (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°)</p>	<p>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</p>
1-3 x/day 5 minutes	<p><b>Balance training</b> Balance board/2 legged Single leg stance</p>	
3 x/week 20-30 minutes	<p><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)</p>	
As required	<p><b>Modalities</b> Cryotherapy</p> <p><b>Light recreational sports (12 months)</b></p>	20 minutes
<b>Goals</b>	<ul style="list-style-type: none"> <li>■ Increase function</li> <li>■ Maintain strength, endurance</li> </ul>	