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**Total Knee Replacement: Rehabilitation Protocol**

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This rehabilitation protocol was developed for patients who have had a cemented total knee arthroplasty. Patients who have had a prior patellectomy or failed total knee replacement may require modifications in regards to the progression of weight bearing and knee motion as discussed in this protocol.

The protocol is divided into 6 phases according to postoperative weeks (for instance, Phase I = Postoperative Weeks 1-2). Each phase has several categories including:

- ⑤ *General observation* of the patient's condition (weight bearing, pain, hemarthrosis, muscle control)
- ⑤ *Evaluation* of specific variables with *goals* identified for each
- ⑤ Treatment and exercise program, according to *frequency* and *duration*
- ⑤ *Rehabilitation goals* which must be achieved to enter into the next phase

The **overall goals** of the operation and rehabilitation are to:

- ⑤ Control joint pain, swelling, hemarthrosis (minimal or none)
- ⑤ Regain normal knee flexion and extension
- ⑤ Regain a normal gait pattern and neuromuscular stability for ambulation
- ⑤ Regain normal quadriceps, hamstring lower extremity muscle strength
- ⑤ Regain normal proprioception, balance, and coordination for desired activities
- ⑤ Achieve optimal functional outcome based on orthopaedic and patient goals

The supervised rehabilitation program is supplemented with a *home self-management program* which the patient performs on a daily basis. The therapist must evaluate the patient thoroughly to implement the enclosed protocol and should see the patient in the clinic for therapeutic procedures and modality treatments which are required for rehabilitation. The majority of this protocol can be accomplished at home provided patient cooperation and follow through are present. The approximate number of rehabilitation visits required for each phase are provided. Additional supervision may be required if a complication develops.

**Important postoperative signs** to monitor include:

- ⑤ Swelling of the knee joint or soft tissues
- ⑤ Abnormal pain response
- ⑤ Abnormal gait pattern with or without assistive device
- ⑤ Insufficient flexion or extension
- ⑤ Weakness (strength/control) of the lower extremity, especially the quads/hamstrings
- ⑤ Insufficient lower extremity flexibility
- ⑤ Return of pain to the compartment of the arthroplasty

### **Physical Therapy Visit Timeline\***

Phase	Weeks Postoperative	Minimum # Visits	Maximum # Visits
1	1-2	2	4
2	3-4	2	4
3	5-6	1	2
4	7-8	1	2
5	9-12	1	2
6	13-26	2	3
Total		9	17

### **\*Physician Notification**

The physician will be notified if the patient (1) fails to meet the expected goals for each phase of the protocol, (2) has a persistent joint effusion, (3) develops a chronic pain syndrome, (4) has difficulty with ambulation, (5) has a limitation of knee motion, or (6) develops other complications associated with surgery.

These problems could result in a modification of this protocol and necessitate further visits to the physical therapist.

Patients desiring to return to recreational activities may require 4-6 more physical therapy visits after postoperative week 26 for advanced neuromuscular, strength, and activity-specific training to prevent reinjury.

### **Discharge Criteria**

- ⑤ 0-120° of knee motion
- ⑤ Normal gait
- ⑤ Manual quadriceps and hamstrings strength of 5/5
- ⑤ No swelling, giving-way, or pain with desired level of activity
- ⑤ Radiographic evidence of correct position/alignment of prosthesis

### **Return to Activities Warning**

Return to strenuous activities after total knee arthroplasty carries the definite risk of failure of the prosthesis. These risks cannot always be scientifically assessed. Patients are warned to avoid running, twisting, turning, and jumping activities and to return to only light recreational or work activities. Additionally, patients are asked to avoid any activity in which symptoms of pain, swelling, or a feeling of instability are present. Return to any athletic activities should be attempted only after discussion with the physician and therapist



Cincinnati Sportsmedicine and Orthopaedic Center  
**Rehabilitation Protocol Summary for  
 Total Knee Replacement**

	Postoperative Weeks					Postop Months		
	1-2	3-4	5-6	7-8	9-12	4	5	6
<b>Brace:</b> High risk patients only (concurrent patellar realignment, MCL repair, lack quad control, difficulty with balance/coordination)	X	X						
<b>Range of motion minimum goals:</b> 0°-100° 0°-120°	X	X						
<b>Weight bearing:</b> Toe touch - 1/2 body weight Full	X	X						
<b>Patella mobilization</b>	X	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	X X	X X
<b>Stretching:</b> Hamstring, gastroc-soleus, iliotibial band, quadriceps	X	X	X	X	X	X	X	X
<b>Strengthening:</b> Quad isometrics, straight leg raises 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	X X	X X	X X
<b>Balance/proprioceptive training:</b> Weight-shifting, mini-trampoline, BAPS, BBS, plyometrics		X	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	X X	X X	X 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).

**Cincinnati Sportsmedicine and Orthopaedic Center Rehab Protocol: OA Procedures**  
*Phase I. Weeks 1-2 (Visits: 2-4)*

<b>General Observation</b>	<ul style="list-style-type: none"> <li>⑤ Toe-touch to 1/2 weight bearing with crutches/walker 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>⑤ Pain</li> <li>⑤ Hemarthrosis</li> <li>⑤ Patellar mobility</li> <li>⑤ ROM minimum</li> <li>⑤ Quadriceps contraction &amp; patella migration</li> <li>⑤ Soft tissue contracture</li> </ul>	<p align="center"><b>Goals</b></p> Controlled Mild Good 0°-90° Good None
<p><b>Frequency</b></p> 6 x/day 10 mins. 3 x/day 15 minutes  3 x/day 15 minutes  As required	<p><b>Range of motion</b></p> ROM (0°-90°) – hang 10-20 lbs. of wt. if < 0° Patella mobilization Ankle pumps (plantar flexion with resistance band) Hamstring, gastroc-soleus stretches  <p><b>Strengthening</b></p> Straight leg raises (flexion) Active quadriceps isometrics (based on ROM limits) Knee extension (active-assisted, range as tolerated)  <p><b>Brace</b></p> High risk patient, 0°-90°  <p><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 10 reps 3 sets x 10 reps  20 minutes 20 minutes
<b>Goals</b>	<ul style="list-style-type: none"> <li>⑤ ROM 0°-90°</li> <li>⑤ Adequate quadriceps contraction</li> <li>⑤ Control inflammation, effusion</li> </ul>	



**Cincinnati Sportsmedicine and Orthopaedic Center Rehab Protocol: OA Procedures**  
**Phase 3. Weeks 5-6 (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 controlled without narcotics</li> <li>- ROM 0-100°</li> </ul> </li> <li>- Hemarthrosis controlled</li> <li>- 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> 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 5 minutes  1-2 x/day 10 minutes  As required	<p><b>Range of motion</b>  ROM (passive, 0°-110°)  – continue overpressure program if &lt; 0°-100°  Patella mobilization  Hamstring, gastroc-soleus stretches</p> <p><b>Strengthening</b>  Straight leg raises (ankle wt. 2.5-10 lbs.)  Isometric training: multi-angle (0°, 30°, 60°, 90°)  Heel raise/toe raise  Knee extension (active, 90°-0°)  Knee flexion (active, 0°-90°)  Leg press (70°-10°)  Multi-hip machine (flexion, extension, abduction, adduction)  Closed-chain: wall sits (0°-30°)</p> <p><b>Balance training</b>  Weight shift side/side and forward/backward  Balance board/2-legged  Cup walking  Single leg stance</p> <p><b>Aerobic conditioning</b>  UBC  Stationary bicycling (high seat, low resistance)  Water walking (water thigh to waist high)</p> <p><b>Modalities</b>  Electrical muscle stimulation  Cryotherapy</p>	<p align="center"><b>Duration</b></p> 6 x/day  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 3 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps 5 reps  20 minutes 20 minutes
<b>Goals</b>	<ul style="list-style-type: none"> <li>Ⓢ ROM 0°-110°</li> <li>Ⓢ Control inflammation, effusion</li> <li>Ⓢ Muscle control</li> <li>Ⓢ Early recognition complications (motion, RSD, patellofemoral)</li> <li>Ⓢ Full weight bearing</li> </ul>	

**Cincinnati Sportsmedicine and Orthopaedic Center Rehab Protocol: OA Procedures**  
**Phase 4. Weeks 7-8 (Visits: 1-2)**

<b>General Observation</b>	<ul style="list-style-type: none"> <li>Ⓢ Independent ambulation</li> <li>Ⓢ Can stand/walk for 30 minutes</li> </ul>	<ul style="list-style-type: none"> <li>Ⓢ ROM 0°-120°</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> Mild/No RSD Minimal Good 0°-120° 4/5 None	
<b>Frequency</b>			<b>Duration</b>
2 x/day 10 minutes	<p><b>Range of motion</b>  ROM (0°-120°)  Hamstring, gastroc-soleus stretches</p>		5 reps x 30 secs
2 x/day 20 minutes	<p><b>Strengthening</b>  Straight leg raises (flexion, extension, abduction, adduction)  - Weights or rubber tubing  Closed-chain  - Wall sits  - Mini-squats (rubber tubing, 0°-30°)  Hamstring curls (resistance, 0°-90°)  Knee extension (resistance, 90°-0°)  Leg press (70°-10°)  Multi-hip machine (flexion, extension, abduction, adduction)</p>		3 sets x 10 reps  5 reps 3 sets x 20 reps 3 sets x 10 reps 3 sets x 10 reps 3 sets x 10 reps
2 x/day 5 minutes	<p><b>Balance training</b>  Balance board/2-legged  Single leg stance</p>		
1-2 x/day 10-15 minutes	<p><b>Aerobic conditioning</b>  UBC  Water walking  Stationary bicycling  Stair machine (low resistance, low stroke)  Ski machine (short stride, level, low resistance)</p>		
As required	<p><b>Modalities</b>  Cryotherapy</p>		20 minutes
<b>Goals</b>	<ul style="list-style-type: none"> <li>Ⓢ Full weight bearing</li> <li>Ⓢ Muscle control</li> <li>Ⓢ Control inflammation, effusion</li> <li>Ⓢ ROM 0°-120°</li> </ul>		

**Cincinnati Sportsmedicine and Orthopaedic Center Rehab Protocol: OA Procedures**  
*Phase 5. Weeks 9-12 (Visits: 1-2)*

<b>General Observation</b>	<ul style="list-style-type: none"> <li>Ⓢ Independent ambulation</li> <li>Ⓢ ROM 0°-120°</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>Ⓢ Gait</li> </ul>	<p align="center"><b>Goals</b></p> <p>Minimal/No RSD 4/5</p> <p>Minimal Good Symmetrical</p>
<p><b>Frequency</b> 2-3 x/day 10 minutes</p> <p>1-2 x/day 20 minutes</p> <p>2 x/day 5 minutes</p> <p>1-2 x/day 15 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 - weights or rubber tubing Hamstring curls (resistance, 0°-90°) Knee extension (resistance, 90°-0°) 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> Balance board/2-legged Single leg stance</p> <p><b>Aerobic conditioning</b> Water walking Swimming (straight leg kicking) Stationary bicycling Walking Stair machine (low resistance, low stroke) Ski machine (short stride, level, low resistance)</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 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>	<ul style="list-style-type: none"> <li>Ⓢ Increase strength and endurance</li> <li>Ⓢ Increase balance/coordination</li> <li>Ⓢ ROM 0°-120°</li> </ul>	



**Cincinnati Sportsmedicine and Orthopaedic Center Rehab Protocol: OA Procedures**  
**Phase 6. Weeks 13-26 (Visits: 2-3)**

<b>General Observation</b>	<ul style="list-style-type: none"> <li>⑤ No effusion, painless ROM</li> <li>⑤ Performs activities of daily living, can walk 20 minutes without pain</li> <li>⑤ ROM 0°-120°</li> </ul>	
<b>Evaluation</b>	<ul style="list-style-type: none"> <li>⑤ Pain</li> <li>⑤ Manual muscle test</li> <li>⑤ Swelling</li> <li>⑤ Patellar mobility</li> <li>⑤ Gait</li> </ul>	<p align="center"><b>Goals</b></p> <p>Minimal/No RSD 4/5 Minimal Good Symmetrical</p>
<b>Frequency</b>		<b>Duration</b>
1-2 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 minutes	<p><b>Strengthening</b> Straight leg raises, rubber tubing Hamstring curls (resistance, 0°-90°) Knee extension (resistance, 90°-0°) 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>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>
2 x/day 5 minutes	<p><b>Balance training</b> Balance board/2 legged Single leg stance</p>	
1 x/day 20 minutes	<p><b>Aerobic conditioning</b> 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>	20 minutes
<b>Goals</b>	<ul style="list-style-type: none"> <li>⑤ Increase strength and endurance</li> <li>⑤ Increase balance/coordination</li> <li>⑤ ROM 0°-120°</li> </ul>	