

**REHABILITATION PROTOCOL:
AFTER QUADRICEPS OR PATELLAR TENDON REPAIR**

Phase 1: Immobilization – 0-2 weeks

Bracing

- Hinged knee brace fixed in full extension
- All activities, including exercise, are done in the brace through postoperative week 6. The brace can be removed for bathing or showering once the surgical incision is healed.

Edema control

- The patient is instructed on aggressive edema management including the use of cold, compression, and elevation throughout the initial postoperative period.

Weight bearing

- Touchdown weight bearing with axillary crutches and hinged knee brace.

Placement of a heel lift in the *opposite* shoe will facilitate swing-through of the involved leg during gait.

Therapeutic exercises

- Quadriceps isometrics (postoperative day 1).
- Ankle pumps and gluteal and hamstring isometric exercises.
- Isometric exercises are done for four sets of six repetitions twice daily. Each repetition is held for 5 sec followed by a 2-sec set.

Active ankle dorsiflexion has been shown to be effective in facilitating quadriceps muscle contraction force and may help decrease discomfort.

- Use of electrical stimulation is recommended, especially if the patient is unable to generate a strong quadriceps muscle contraction. Electrical stimulation should be provided for 15 min per session, three to five times per week.

A burst modulated medium frequency current has been found to be most effective in producing muscle force.

- Gentle patellar mobilizations using both inferior-superior and medial-lateral glides to maintain normal patellofemoral joint mobility.
- Maintenance of aerobic fitness through the use of an upper body ergometer.

Phase 2: Range of motion – 3-6 weeks

Weight-bearing

- Crutch ambulation is progressed to weight-bearing as tolerated with the brace locked in full extension.
- Progression to full weight-bearing should be achieved by week 6.

Range of motion

- Active knee flexion, 0-45 in the hinged knee brace. ***Knee extension should be passive.*** Active knee flexion range is increased 15 degrees per week. Knee flexion range to 90-100 degrees should be achieved by week 6. ROM exercises should be done for 3 min, three times per day.
- A stationary bike for passive knee ROM once 95-105 degrees of knee flexion has been achieved at week 6. ***No pedal resistance should be used.***

Therapeutic exercises

- Resistive exercise routine for hip abduction and adduction and prone hip extension applying resistance at the knee.
- Resistive ankle plantar flexion exercise with a band or sport cord.
- Edema management and patellar mobilization are continued.
- Modalities such as hot packs or TENS can be used to decrease pain and facilitate movement.
- Closed-chain exercises in the brace may be considered once full weight-bearing has been achieved.
- Appropriate exercises include weight-shifting, standing bilateral heel raises, and standing balance and proprioceptive exercises.

Phase 3: Strengthening – 7-12 weeks

Weight-bearing

- Crutch ambulation, full weight-bearing with hinged knee brace allowing 0-60 degrees of active knee flexion.
- Use of axillary crutches is gradually discontinued as the patient is able to demonstrate a normal, symmetrical gait pattern.
- Bracing is discontinued once the patient is able to perform an SLR without an extensor lag.

Therapeutic exercises

- Closed-chain exercises, including double-leg mini-squats, heel raises, and leg press (0-60 degrees of knee flexion). In addition to strengthening critical muscles, these exercises are designed to introduce coordinated movement patterns and normal joint forces. Therefore, the patient should be encouraged to perform these exercises in a slow, controlled fashion while maintaining proper trunk and limb alignment.
- Multiangle, *submaximal* quadriceps isometrics as tolerated. Exercises are done at 0, 30, 60, and 90 degrees of knee flexion.

- ❑ Open-chain quadriceps exercise program, such as short arc quadriceps (from 0-30 degrees), and SLR. Resistance is gradually added, using a PRE protocol as the patient is able to tolerate.
- ❑ Quadriceps sets and SLR are discontinued when patient is able to lift 10 pounds with PREs.
- ❑ Double-leg balance and proprioception tasks on firm, level surfaces (e.g, pillow, balance board).
- ❑ Progressive addition of resistance to stationary bike program for lower extremity conditioning.
- ❑ Lower extremity stretching program for quadriceps, hamstring, calf, and iliotibial band flexibility as appropriate.

Weeks 9-12

- ❑ Ambulation on a treadmill at comfortable walking speeds. Continue to emphasize a normal, symmetrical gait pattern. **To encourage a normal gait pattern, use a mirror to provide visual feedback.**
- ❑ Progression of closed-kinetic chain exercises from double leg to single leg as tolerated. Two-inch lateral step-ups, side steps with band resistance, lunges, and wall sitting as pain allows.
- ❑ Gradual multi-angle *maximum* quadriceps isometrics.
- ❑ Progression of open-kinetic chain quadriceps PRE program. Exercise should be done two to three times per week, three sets of 8 to 12 repetitions. Load is increased when 12 repetitions per set are attained, with 1- to 2-min rest periods between sets. Exercise range is increased to 0-60 degrees. Isokinetic strengthening program of the quadriceps and hamstrings (concentric only) at 180 degrees/sec through a full knee ROM once the patient is able to ambulate with good quadriceps control.
- ❑ Edema management to control postexercise pain and swelling.

Phase 4: Sport-specific functional rehabilitation – 4-6 months

Therapeutic exercises

- ❑ Closed-chain and open-chain exercises two to three times per week, progressing resistance as tolerated.
- ❑ Multispeed isokinetic exercise program (90, 180, and 300 degrees/sec) for quadriceps and hamstring musculature.
- ❑ Plyometric exercises, beginning with double-leg activities such as jumping jacks and double-leg landing off of 4-, 6-, and 8-inch steps. Gradual progression to advanced plyometric exercises including single-leg jumping tasks, hopping, and bounding as patient tolerates.
- ❑ Plyometric exercises are initiated after the patient demonstrates normal balance and controlled limb movements with all single-leg closed-chain exercises.
- ❑ **Running program** once the following criteria are met:
 - Quadriceps strength 65% of uninvolved extremity (determined by isokinetic testing).

- Normal leg and trunk alignment maintained during all closed-chain exercises.
- Symmetrical gait pattern.

Initially, the running program should be limited to 5 min on a firm, level surface three to five times per week. Jogging time should be progressed 5 min per week until the patient is able to tolerate continuous jogging for 15 min (or 1 mile). The patient should not advance running time or distance if significant pain, effusion, or movement asymmetry is experienced.

- If strengthening and running programs are done on the same day, running should precede strengthening.
- Speed and agility training should include sprints, rapid starts and stops, and figures-of-eight. Speed and agility drills should be tailored to meet sport-specific demands.

This protocol provides you with general guidelines for the rehabilitation of the patient following repair of a quadriceps or patellar tendon rupture.

Specific changes in the program will be made by the physician as appropriate for the individual patient.

Questions regarding the progress of any specific patient are encouraged, and should be directed to Dr. Lervick at **952-456-7111**.

REFERENCE:

Clinical Orthopaedic Rehabilitation, 2nd edition. SB Brotzman, KE Wilk. Mosby 2003.