

# Rehabilitation Guidelines for Patellar Tendon and Quadriceps Tendon Repair

The knee consists of four bones that form three joints. The femur is the large bone in the thigh and attaches by ligaments and a capsule to the tibia, the large bone below the knee commonly referred to as the shin bone. Next to the tibia is the fibula, which runs parallel to the tibia on the outside of the leg. The patella, commonly called the knee cap, is embedded in the quadriceps and patellar tendon which articulates with the front of the femur, forming the patellofemoral joint (Figure 1). The patella acts as a pulley to increase the amount of force that the quadriceps muscle can generate and helps direct the force in the desired upward direction.<sup>1</sup>

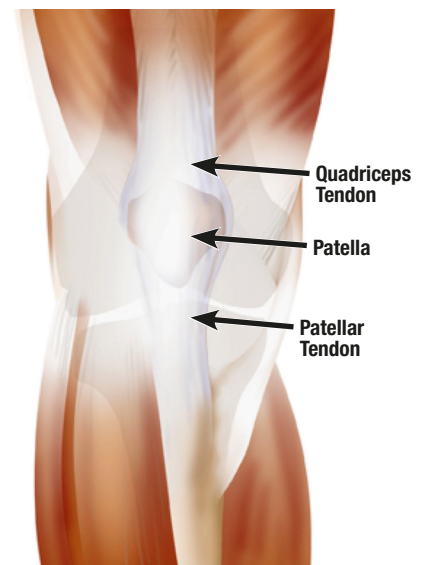
Complete ruptures or partial tears of the patellar tendon or quadriceps tendon can result from landing from a jump, a fall causing excessive knee flexion or other heavy loading of the tendon. Quadriceps tendon ruptures usually occur in people older than 40 years of age. One review article cited 88% of patients with quadriceps tendon rupture were 40 and older. In contrast, most patellar tendon ruptures occur in patients younger than 40. One study reported the average age for patellar tendon rupture to be 28. In both cases

it is more likely to occur in males than females. Chronic tendinopathy from repetitive sporting activity; chronic diseases (i.e. renal failure, hyperparathyroidism, diabetes) that compromise blood supply to the tendon; or chronic steroid use may weaken the quadriceps tendon or patellar tendon and make it more susceptible to rupture. The nature and size of the tear, the age of the patient and the activity level of the patient are all important factors in determining the safest and most effective treatment. Good outcomes can be obtained with non-surgical treatment for many small, partial tears. This may involve a short period of immobilization, followed by supervised rehabilitation with a physical therapist or athletic trainer.

Surgical repair is usually necessary to obtain the optimal outcome for large, partial tears and complete ruptures. Most often the torn tendon is re-attached to the knee cap by passing the tendon through drill holes in the knee cap for fixation. In some cases graft tissue may be added to the repair to obtain the desired length of the repaired tendon. In rare cases an “end to end” tendon repair may be done. This technique is used when the tendon is ruptured in the mid-

portion as opposed to near the bony insertion. In either operation, often times a “relaxing suture” is placed to provide extra protection to the repaired tendon by taking some tension off the repair during the initial healing phase (Figure 2).

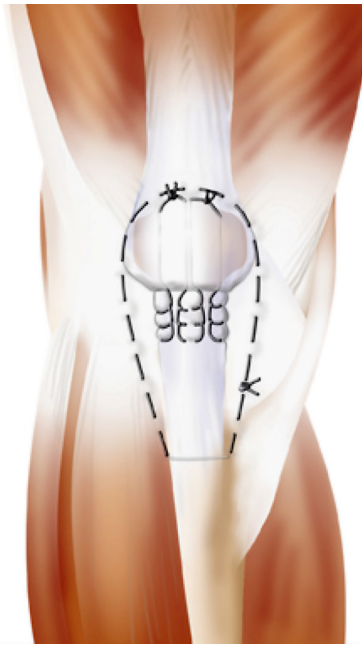
The outcome from surgical repair is dependent on several variables. People who have their surgery performed early after the injury generally do better than people who have delayed surgery.



**Figure 1.** Front view of normal knee anatomy, showing the quadriceps tendon above the patella (knee cap) and patellar tendon below the patella.

Most people should be able to return to their previous occupation and level of daily activity. Return to sports will be dependent on the sport to which the individual is returning, age, severity of the injury and return of strength.

Supervised and structured post-operative rehabilitation is an integral component to obtaining an optimal outcome. Research from our institution has shown that early rehabilitation and mobilization are safe and effective for maximizing outcome.<sup>3</sup> Our rehabilitation guidelines are presented in a criterion based progression program. General time frames are given for reference to the average, but individual patients will progress at different rates depending on their age, associated injuries, pre-injury health status, rehabilitation compliance, tissue quality, and injury severity. Specific time frames, restrictions and precautions may also be given to protect healing tissues, and the surgical repair/reconstruction.



**Figure 2.** Front view of knee after patellar tendon repair. The primary sutures repair the torn tendon and the relaxing suture encompasses the repair and goes around the patella, providing initial protection to the repaired portion of the tendon.

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### PHASE I (surgery to 2 weeks after surgery)

<b>Appointments</b>	<ul style="list-style-type: none"> <li>Rehabilitation appointments begin 3-5 days after surgery</li> </ul>
<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>Protect the post-surgical repair</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>Ambulate with crutches</li> <li>Continually use the dial brace locked in extension and crutches for weight bearing as tolerated (WBAT) for ambulation. The brace must be worn and locked at all times other than when performing rehabilitation exercises</li> <li>Follow range of motion guidelines</li> <li>Keep the incision and sutures dry</li> </ul>
<b>Range of Motion</b>	<ul style="list-style-type: none"> <li>Knee range of motion (ROM) from 0° to 30° of passive knee motion, unless specifically stated otherwise by the physician</li> </ul>
<b>Suggested Therapeutic Exercises</b>	<ul style="list-style-type: none"> <li>Ankle pumps, isometric quadriceps sets, hamstring sets, glut sets, and patellar mobilizations</li> </ul>
<b>Cardiovascular Exercises</b>	<ul style="list-style-type: none"> <li>Upper body circuit training or upper body ergometer (UBE)</li> </ul>
<b>Progression Criteria</b>	<ul style="list-style-type: none"> <li>Progress two weeks post-operatively</li> </ul>

### PHASE II (begin after meeting Phase I criteria, usually 2 - 6 weeks after surgery)

<b>Appointments</b>	<ul style="list-style-type: none"> <li>Rehabilitation appointments are 1-2 times per week</li> </ul>
<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>Normalize gait with WBAT with gradual progression, continuing to use the brace locked in extension, the ability to discontinue the crutches will be determined by the rehabilitation provider and physician based on your progress and leg control</li> <li>Protection of the post-surgical repair</li> </ul>
<b>Precautions and Range of Motion</b>	<ul style="list-style-type: none"> <li>Continually use the dial brace locked in extension and use crutches for WBAT, with gradual progression, for ambulation, the brace must be worn and locked at all times other than when performing rehabilitation exercises</li> <li>Weeks 3-6 = 0° to 90° of knee motion without active quadriceps extension (i.e. no active knee extension)</li> <li>Precautions and range of motion limits may be altered by the surgeon based on the integrity of the repair and associated injury, if applicable, these changes will be specifically stated by the surgeon</li> </ul>
<b>Suggested Therapeutic Exercises</b>	<ul style="list-style-type: none"> <li>Heel slides</li> <li>Knee extension range of motion with foot resting on a towel roll</li> <li>4-way leg lifts with brace locked in extension</li> <li>Gentle patellar mobilizations</li> <li>Weight shifting on to surgical side with brace on</li> </ul>

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<b>Cardiovascular Exercises</b>	<ul style="list-style-type: none"> <li>• Upper body circuit training or UBE</li> </ul>
<b>Progression Criteria</b>	<ul style="list-style-type: none"> <li>• Progress six weeks post-operatively</li> <li>• Knee ROM = 0°-0°-90° (i.e. avoid knee hyperextension)</li> </ul>

### PHASE III (begin after meeting Phase II criteria, usually 6 to 12 weeks after surgery)

<b>Appointments</b>	<ul style="list-style-type: none"> <li>• Rehabilitation appointments are once every 1-2 weeks</li> </ul>
<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Normalize gait on level surfaces using brace opened to 30-40° without crutches</li> <li>• Initiate active quadriceps contractions in weight bearing</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>• Gradual progression to weight bearing with knee flexion with avoidance of weight bearing knee flexion past 70 degrees for 12 weeks after surgery</li> <li>• Continue to follow range of motion limits for the specific time frame, as described below</li> </ul>
<b>Range of Motion</b>	<ul style="list-style-type: none"> <li>• Post-operative weeks 7-8: 0° to 115° of knee motion without active quadriceps knee extension</li> <li>• Post-operative weeks 9-10: 0° to 130° of knee motion. Active knee extension is now permitted</li> <li>• Precautions may be altered by the surgeon based on the integrity of the repair; if so these will be specifically stated by the surgeon</li> </ul>
<b>Suggested Therapeutic Exercises</b>	<ul style="list-style-type: none"> <li>• Active range of motion (AROM) for open chain knee flexion and extension</li> <li>• Closed chain quadriceps control from 0° to 40° with light squats and leg press, progressing to shallow lunge steps</li> <li>• Prone knee flexion</li> <li>• Stationary bike</li> <li>• Patellar mobilizations</li> <li>• Open chain hip strengthening</li> <li>• Core strengthening</li> </ul>
<b>Cardiovascular Exercises</b>	<ul style="list-style-type: none"> <li>• Upper body circuit training or upper body ergometer (UBE)</li> </ul>
<b>Progression Criteria</b>	<ul style="list-style-type: none"> <li>• Normal gait mechanics without crutches</li> <li>• Active knee ROM at least 0°-0°-110°</li> </ul>

**PHASE IV (Begin at 12 weeks after surgery and continue until progression criteria is met)**

<b>Appointments</b>	<ul style="list-style-type: none"> <li>• Rehabilitation appointments are once every week</li> </ul>
<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Normalize gait on all surfaces without brace</li> <li>• Single leg stand with good control for 10 seconds</li> <li>• Full knee ROM</li> <li>• Good control with squat to 70° of knee flexion</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>• Avoid any forceful eccentric contractions</li> <li>• Avoid impact activities</li> <li>• Avoid exercises that create movement compensations</li> </ul>
<b>Suggested Therapeutic Exercises</b>	<ul style="list-style-type: none"> <li>• Non-impact balance and proprioceptive drills</li> <li>• Stationary bike</li> <li>• Gait drills</li> <li>• Hip and core strengthening</li> <li>• Stretching for patient specific muscle imbalances</li> <li>• Quad strengthening – closed chain exercises, initially starting as a very short arc of motion and gradually progressing to 70° of knee flexion</li> <li>• Functional movements (squat, step back, lunge)</li> <li>• Hip and core strengthening</li> </ul>
<b>Cardiovascular Exercises</b>	<ul style="list-style-type: none"> <li>• Stationary bike, Stairmaster, swimming</li> </ul>
<b>Progression Criteria</b>	<ul style="list-style-type: none"> <li>• Normal gait mechanics without the brace on all surfaces</li> <li>• Squat and lunge to 70° of knee flexion without weight shift</li> <li>• Single leg stand with good control for 10 seconds</li> <li>• Full AROM for knee flexion and extension</li> </ul>

**PHASE V (begin after meeting phase IV criteria, usually 4 months after surgery)**

<b>Appointments</b>	<ul style="list-style-type: none"> <li>• Rehabilitation appointments are once every 1-3 weeks</li> </ul>
<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Good control and no pain with sport and work specific movements, including impact</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>• Post-activity soreness should resolve within 24 hours</li> <li>• Avoid post-activity swelling</li> <li>• Avoid running with a limp</li> </ul>
<b>Suggested Therapeutic Exercises</b>	<ul style="list-style-type: none"> <li>• Impact control exercises beginning 2 feet to 2 feet, progressing from 1 foot to other and then 1 foot to same foot</li> <li>• Movement control exercise beginning with low velocity, single plane activities and progressing to higher velocity, multi-plane activities</li> <li>• Sport/work specific balance and proprioceptive drills</li> <li>• Hip and core strengthening</li> <li>• Stretching for patient specific muscle imbalances</li> </ul>
<b>Cardiovascular Exercises</b>	<ul style="list-style-type: none"> <li>• Replicate sport or work specific energy demands</li> </ul>
<b>Return to Work/Sport Criteria</b>	<ul style="list-style-type: none"> <li>• Dynamic neuromuscular control with multi-plane activities, without pain or swelling</li> </ul>

These rehabilitation guidelines were developed collaboratively by Marc Sherry, PT, DPT, LAT, CSC (msherry@uwhealth.org) and the UW Health Sports Medicine Physician group.

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**References**

1. Neuman DA. *Kinesiology of the Musculoskeletal System: Foundations for Physical Rehabilitation*. 1st ed. St. Louis, MO: Mosby; 2002.
2. <http://orthoinfo.aaos.org>
3. West JL, Keene JS, Kaplan LD. Early motion after quadriceps and patellar tendon repairs: outcomes with single-suture augmentation. *Am J Sports Med*. 2008 Feb;36(2):316-23. Epub 2007. Oct 11.