

# Rehabilitation Guidelines for Achilles Tendon Repair

The Achilles tendon is the strongest and thickest tendon in the body. It attaches the calf muscles (soleus and gastrocnemius) to the heel bone (calcaneus). The tendon transmits force from the contracting calf muscles to the calcaneus to cause the foot action of plantar flexion (foot pointed down) that is important in walking, running, jumping and change of direction activities. Although the Achilles tendon is the strongest tendon in the body, it is also the tendon most commonly torn or ruptured. The most common causes of rupture are:

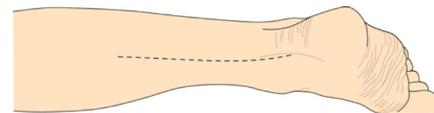
- Sudden plantar flexion (foot moving downward) such as taking off to jump.
- Unplanned or forced dorsiflexion (foot moving upward) such as landing a jump or stepping into a hole.
- Direct trauma to the tendon.

Most Achilles tendon ruptures occur in sports that require running, jumping, and change of direction. The typical age for rupture occurs between 30–40 years of age and is significantly more common in males than females. Older adults can also rupture the Achilles tendon and are more inclined to have degenerative partial tearing of the tendon. Other risk factors for Achilles tendon rupture include use of

Fluoroquinolone antibiotics and direct steroid injections into the tendon.<sup>1</sup>

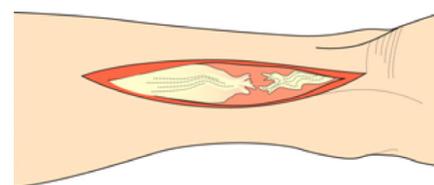
The diagnosis of an Achilles tendon rupture is made from clinical history, physical exam and diagnostic testing. Most patients who sustain an Achilles tendon rupture report a pop and a feeling of being kicked or shot in the back of the leg. On exam, there is a palpable divot or gap in the area of the rupture along with significant swelling. Patients will demonstrate a positive Thompson test, performed by squeezing the calf muscle while the patient lies prone. This test is positive when the calf is squeezed and plantarflexion does not occur. Diagnostic testing such as an Ultrasound or MRI (magnetic resonance imaging) may be used to determine if there is a complete or partial tear.

Treatment options for an Achilles tendon rupture include surgical repair and conservative non surgical rehabilitation. Decision making is based on age, past medical history, and desired level of functional return. Conservative non-surgical treatment includes rehabilitation with initial immobilization followed by gentle range of motion and progressive strengthening to regain function. Most surgical procedures to repair a torn Achilles tendon include an open longitudinal incision medial to the Achilles tendon (Figure 1).<sup>2</sup>



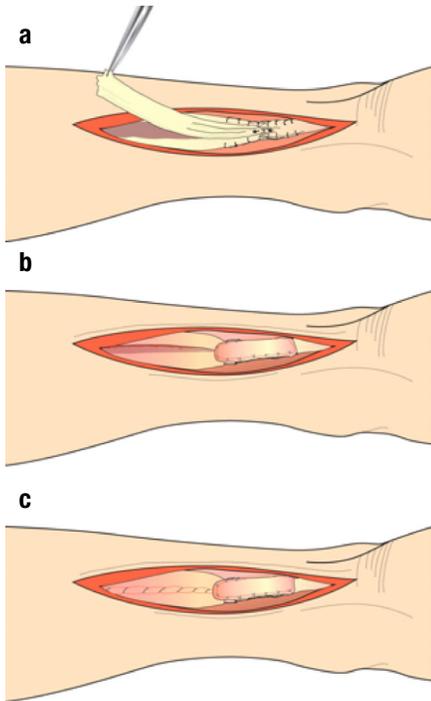
**Figure 1** The dotted line represents the longitudinal incision used to expose the ruptured Achilles tendon during surgical repair.

The incision is made medial to the tendon to improve skin healing and to reduce the risk of scarring to the underlying tendon repair. Once the incision is made and the rupture is identified (Figure 2), clamps are used to match the ends together in an optimal tendon length. A primary repair of the two ends of the tendon is performed by stitching them together. There are many different stitching techniques to repair the tendon. The type used will depend on the surgeon, the type of rupture, and tissue quality.



**Figure 2** Torn Achilles tendon.

Sometimes the repair is augmented or strengthened using fascia or tendon. A gastrocnemius aponeurosis augmentation is performed when a 1–2 cm wide by 8 cm long flap is made and turned down over the repair and



**Figure 3** – **a:** Flap from the gastroc fascia (calf muscle sheath) is surgically freed up above the Achilles tendon repair, **b:** This flap is then “turned down” and sutured over the Achilles tendon repair, **c:** After turn down of the flap the resultant defect in the fascia is sutured together.

sutured to reinforce the repair. The area that the flap was harvested from is then stitched together (Figure 3).

Historically it has been thought that a surgically repaired Achilles tendon offered a significantly smaller risk of re-rupture rate and increased strength in comparison to non-surgical treatment.<sup>5</sup> The major risks associated with surgery include infection, deep vein thrombosis (DVT) and difficulty with wound closure. Recent studies suggest similar rupture rates, strength, and mobility between surgery and non-surgery approaches to the management of Achilles tendon ruptures.<sup>3, 4</sup>

The best approach varies for each individual. Your surgeon and you will determine what is best for you by discussing your specific injury and goals.

Rehabilitation following Achilles tendon repair is vital in regaining motion, strength and function. Initially a walking boot is used for the first 4–5 weeks. Gradually more weight bearing and mobility is allowed to prevent stiffness post-operatively. The rehabilitation progresses slowly into strengthening, gait and balancing activities. Rehabilitation guidelines are presented in a criterion based progression. General time frames refer to the usual pace of rehabilitation. However, individual patients will progress at different rates depending on their age, associated injuries, pre-injury health status, rehab compliance, tissue quality and injury severity. Specific time frames, restrictions and precautions may also be given to enhance wound healing and to protect the surgical repair/reconstruction.

## Rehabilitation Guidelines for Achilles Tendon Repair

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

<b>Appointments</b>	<ul style="list-style-type: none"> <li>Rehabilitation appointments begin 14-16 days after surgery</li> </ul>
<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>Protection of the surgically repaired tendon</li> <li>Wound healing</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>Continuous use of the boot in locked plantarflexion (20-30°)</li> <li>Touchdown weight bearing using the axillary crutches</li> <li>Keep the incision dry</li> <li>Watch for signs of infection</li> <li>Avoid long periods of dependent positioning of the foot during the first week to assist in wound healing</li> </ul>
<b>Cardiovascular Exercise</b>	<ul style="list-style-type: none"> <li>Upper Body Ergometer (UBE) circuit training</li> </ul>
<b>Progression Criteria</b>	<ul style="list-style-type: none"> <li>Two weeks after surgery</li> </ul>

### PHASE II (begin after meeting Phase 1 criteria, usually 2 to 4 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 weight bearing as tolerated (WBAT) using the boot and axillary crutches</li> <li>Protection of the post-surgical repair</li> <li>Active dorsiflexion to neutral</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li><u>Post-operative week 2-3</u>: Continuous use of the boot with 10° of plantar flexion with 1-2 ¼ inch heel lifts, except during rehabilitation</li> <li><u>Post-operative week 3-4</u>: Continuous use of the boot with 0° of plantar flexion with 1-2 ¼ inch heel lifts, except during rehabilitation</li> <li>WBAT (based on pain, swelling and wound appearance) using the axillary crutches and boot</li> <li>Do not soak the incision (i.e. no pool or bathtub)</li> <li>Watch for signs of poor wound healing</li> </ul>
<b>Suggested Therapeutic Exercises</b>	<ul style="list-style-type: none"> <li>Pain-free active ankle range of motion (ROM), including ankle alphabet, ankle pumps, etc.</li> <li>Pain-free isometric ankle inversion, eversion, dorsiflexion and sub-max plantarflexion</li> <li>Open chain hip and core strengthening</li> </ul>
<b>Cardiovascular Exercise</b>	<ul style="list-style-type: none"> <li>Upper body ergometer or upper extremity circuit training</li> </ul>
<b>Progression Criteria</b>	<ul style="list-style-type: none"> <li>Four weeks post-operatively</li> <li>Pain-free active dorsiflexion to 0°</li> <li>No wound complications; however if wound complications occur then consult with a physician</li> </ul>

## Rehabilitation Guidelines for Achilles Tendon Repair

### PHASE III (begin after meeting Phase II criteria, usually 4 to 8 weeks after surgery)

<b>Appointments</b>	<ul style="list-style-type: none"> <li>• Rehabilitation appointments are once a week</li> </ul>
<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Normalize gait on level surfaces without boot or heel lift</li> <li>• Single leg stand with good control for 10 seconds</li> <li>• Active ROM between 5° of dorsiflexion and 40° of plantarflexion</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>• Slowly wean from use of the boot: Begin by using 1-2 ¼ inch heel lifts in tennis shoes for short distances on level surfaces then gradually remove the heel lifts during the 5<sup>th</sup> and 8<sup>th</sup> week depending on the surgeon</li> <li>• Avoid over-stressing the repair (avoid large movements in the sagittal plane; any forceful plantarflexion while in a dorsiflexed position; aggressive passive ROM; and impact activities)</li> </ul>
<b>Suggested Therapeutic Exercises</b>	<ul style="list-style-type: none"> <li>• Frontal and sagittal plane stepping drills (side step, cross-over step, grapevine step)</li> <li>• Active ankle ROM</li> <li>• Gentle gastroc/soleus stretching</li> <li>• Static balance exercises (begin in 2 foot stand, then 2 foot stand on balance board or narrow base of support and gradually progress to single leg stand)</li> <li>• 2 foot standing nose touches</li> <li>• Ankle strengthening with resistive tubing</li> <li>• Low velocity and partial ROM for functional movements (squat, step back, lunge)</li> <li>• Hip and core strengthening</li> <li>• Pool exercises if the wound is completely healed</li> </ul>
<b>Cardiovascular Exercise</b>	<ul style="list-style-type: none"> <li>• Upper body ergometer or upper extremity circuit training</li> </ul>
<b>Progression Criteria</b>	<ul style="list-style-type: none"> <li>• Normal gait mechanics without the boot</li> <li>• Squat to 30° knee flexion without weight shift</li> <li>• Single leg stand with good control for 10 seconds</li> <li>• Active ROM between 5° of dorsiflexion and 40° of plantarflexion</li> </ul>

## Rehabilitation Guidelines for Achilles Tendon Repair

### PHASE IV (begin after meeting Phase III criteria, usually 8 weeks after surgery)

<b>Appointments</b>	<ul style="list-style-type: none"> <li>• Rehabilitation appointments are once every 1 to 2 weeks</li> </ul>
<b>Rehabilitation Goals</b>	<ul style="list-style-type: none"> <li>• Normalize gait on all surfaces without boot or heel lift</li> <li>• Single leg stand with good control for 10 seconds</li> <li>• Active ROM between 15° of dorsiflexion and 50° of plantarflexion</li> <li>• Good control and no pain with functional movements, including step up/down, squat and lunges</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>• Avoid forceful impact activities</li> <li>• Do not perform exercises that create movement compensations</li> </ul>
<b>Suggested Therapeutic Exercises</b>	<ul style="list-style-type: none"> <li>• Frontal and transverse plane agility drills (progress from low velocity to high, then gradually adding in sagittal plane drills)</li> <li>• Active ankle range of motion</li> <li>• Gastroc/soleus stretching</li> <li>• Multi-plane proprioceptive exercises – single leg stand</li> <li>• 1 foot standing nose touches</li> <li>• Ankle strengthening – concentric and eccentric gastroc strengthening</li> <li>• Functional movements (squat, step back, lunge)</li> <li>• Hip and core strengthening</li> </ul>
<b>Cardiovascular Exercise</b>	<ul style="list-style-type: none"> <li>• Stationary Bike, Stair Master, Swimming</li> </ul>
<b>Progression Criteria</b>	<ul style="list-style-type: none"> <li>• Normal gait mechanics without the boot on all surfaces</li> <li>• Squat and lunge to 70° knee flexion without weight shift</li> <li>• Single leg stand with good control for 10 seconds</li> <li>• Active ROM between 15° of dorsiflexion and 50° of plantarflexion</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 to 2 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 Exercise</b>	<ul style="list-style-type: none"> <li>• Replicate sport or work specific energy demands</li> </ul>
<b>Return to Sport/Work 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 between Dan Enz PT, LAT, (denz@uwhealth.org) and the UW Health Sports Medicine physician group.

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**References**

1. Paul van der Linden et. Al. "Increased Risk of Achilles Tendon Rupture with Quinolone Antibacterial Use" *Arch Intern Med* 2003; 163: 1801-1807.
2. Baer GS, Keene JS. "Tendon Injuries of the Foot and Ankle: Achilles Tendon Ruptures." *In Orthopedic Sports Medicine: Principles and Practice.* (Third Edition) Ed. DeLee and Drez, Saunders, Philadelphia, PA, 2010 2002-2011.
3. Twaddle, Poon. "Early motion for Achilles Tendon Ruptures: Is Surgery Important?" *AJSM* 2007 2033-2038.
4. Nilsson-Helander et al. " Acute Achilles Tendon Rupture: A Randomized, Controlled Study Comparing Surgical and Nonsurgical Treatments Using Validated Outcome Measures" *AJSM* 2010.
5. Bhandari et al. Treatment of acute Achilles tendon ruptures: a systematic overview and metaanalysis *Clin orthop Relate Res* 2002 190-200.

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