

ACHILLES TENDINOPATHY

THINGS RUNNERS NEED TO KNOW

BACKGROUND

The Achilles tendon (AT) is a remarkable structure that originates from the soleus muscle (AKA “powerhouse” of distance running) and merges with the two bellies of the gastrocnemius before inserting onto the calcaneus or heel bone. It transmits forces from the calf muscle complex to the foot and ankle. Fortunately, the AT is the largest and strongest tendon in the human body as it has to withstand upwards of 12x body weight load during running.¹ Given the demands placed on the AT, it's not surprising that it's commonly afflicted among runners.

This often manifests as a “tendinopathy,” which is an umbrella term used to describe pain and dysfunction irrespective of pathology.² While middle-aged, male distance runners are the most likely to deal with Achilles tendinopathy it can occur across a variety of demographics and stem from a multitude of factors (i.e. age, genetics, medication). Athletes dealing with an Achilles tendinopathy can be expected to return to sport anywhere from six weeks up to one year though symptoms can sometimes persist to varying degrees for years.^{3,4}

TYPES (based on anatomic location of symptoms)

- **MID-PORTION** – 2-6cm above its insertion on the calcaneus & most common presentation^{5,6}
- **INSERTIONAL** – junction where the tendon attaches to the calcaneus⁷

HALLMARK FEATURES:

- Pain with squeezing the tendon (mid-portion) or applying pressure to the heel bone (insertional)
 - *Does not exclude other presentations such as irritation of the sural nerve or involvement of the paratenon
- Pain with progressive loading (progressing from heel raise to hopping)⁸
- Increased pain when loading from a greater degree of dorsiflexion in the context of an insertional tendinopathy
- Compromised function (i.e. strength, endurance, & performance)
- Often swollen and thickened as seen in the image to the right
- Morning stiffness with initial steps
- Tends to “warm-up” with activity^{8,9}
- Minimal pain at rest⁹



COMMON CAUSES/RISK FACTORS:

- **EXTRINSIC:** Hill running, speed work, racing, poor recovery, abrupt transition to minimalist shoes or barefoot running, alcohol consumption, and ofloxacin use^{5,10,11}
- **INTRINSIC:** Increased or decreased ankle dorsiflexion range of motion and plantarflexion weakness^{10,12}

PAIN PROVOCATION & LOAD TESTS/ ASSESSMENTS:

- **CALF RAISE TEST**¹³⁻¹⁵
- **POGO JUMPS**
- **SINGLE LEG HOPPING**¹³

**Aim to administer the selected daily load test @ same time of day throughout the rehab process.

MANAGEMENT STRATEGIES:

- Temporarily remove or reduce energy storage & release activities (i.e. running, skipping, hopping)
- Minimize positions of compression by inserting heel lifts or wear shoes with a greater heel to toe differential especially in the case of insertional AT¹⁶
- Exercise is supported with the highest level of evidence in terms of optimal management and should be the cornerstone of treatment for @ least 3 months before other interventions are considered¹⁷⁻¹⁹
- While interventions such as platelet rich plasma (PRP) injections, shockwave therapy, corticosteroids, NSAIDs, & sclerosing injections are often considered in the management, none of these options have been shown to be as effective as exercise therapy in isolation^{19,20}

EXERCISE CONSIDERATIONS:

- Exercising in the context of pain does not appear to have any (-) effect on recovery & may actually be important to ensure appropriate load to elicit adaptive change provided that the pain is “acceptable,” does not progressively worsen and returns to baseline within ~24hrs.^{3,17}
- When using a numeric pain rating scale (0 = no pain & 10 = worst imaginable pain)

0-2/10 = **SAFE** | 2-5/10 = **ACCEPTABLE** | >5/10 = **HIGH RISK**



- While compound movements (i.e. squat, deadlift) can be helpful as part of an overall program, heavy ($\geq 70\%$ of a 1RM), single-joint, isolated tasks such as a calf raise or seated soleus raise are essential to ensure focal loading to improve the mechanical properties (stiffness & Young's modulus) of the tendon^{21,22}

EXERCISE INTENSITY CLASSIFICATION²³

- **TIER 1** - bilateral calf raises
- **TIER 2** - single leg calf/heel raise, walking
- **TIER 3** - pogo jumps, running (stance)
- **TIER 4** - single leg hopping

RETURN TO RUNNING CONSIDERATIONS:

- Level ground should be prioritized considering that the forces are shifted to the calf muscle complex and AT with uphill running²⁴
- Running with a rear-foot strike (AKA “heelstrike”) pattern loads the AT to a lesser extent relative to a mid or forefoot strike, which has been shown to lead to an additional load of 48x body weight for each mile run²⁵
- Adopting a higher (5%) step rate (AKA cadence) for a given speed leads to a shorter step length, reduces AT stress, strain, and strain rate²⁶
- Overground running should generally be prioritized over a treadmill which has been shown to subject the AT to significantly greater load in terms of peak AT force, loading rate, and estimated cumulative AT force per 1 km of continuous running²⁷
- Running on stiffer surfaces is related to decreased injury risk of the AT so avoid surfaces such as sand²⁸

PATIENT-REPORTED OUTCOME MEASURES:

Victorian Institute of Sport Assessment - Achilles (**VISA-A**)

- Evaluates clinical severity of Achilles tendinopathy via pain/symptoms & physical activity²⁹
- Eight questions with a score range of 0-100 with 100 meaning no symptoms and full participation in physical activity.

RETURN TO RUNNING CONSIDERATIONS:

- AT Loads expressed in terms of body weight (BW)¹

Running - upwards of 12x | Jumping Rope - ~5x | Walking - ~3.5x | Cycling - ~1x

ACHILLES TENDON LOADING INDICES & METRICS FOR REHABILITATION EXERCISES

	Exercise	Loading Index	Loading Peak (BW)	Loading Impulse	Loading Rate
TIER 1	Seated heel raise (2-leg)	0,1	0.5 ± 0.2	0.6 ± 0.2	2.7 ± 1.0
	Seated heel raise (1-leg)	0,128	0.7 ± 0.2	0.7 ± 0.3	3.6 ± 1.5
	Squat	0,167	1.1 ± 0.3	0.8 ± 0.2	4.0 ± 1.9
	Low step up (leading leg)	0,213	1.6 ± 0.4	0.7 ± 0.3	10.1 ± 5.0
	High step up (leading leg)	0,241	1.8 ± 0.3	0.8 ± 0.2	11.4 ± 3.4
	Standing heel raise (2-leg)	0,248	1.6 ± 0.2	1.2 ± 0.2	8.7 ± 2.7
TIER 2	Rebounding heel raise (2-leg)	0,282	2.5 ± 0.7	0.5 ± 0.1	19.9 ± 10.6
	Lunge (leading leg)	0,285	2.1 ± 0.6	1.2 ± 0.5	8.4 ± 3.7
	Low step down (leading leg)	0,31	2.2 ± 0.5	0.9 ± 0.2	22.9 ± 6.1
	Low step up (trailing leg)	0,341	2.9 ± 0.4	1.1 ± 0.2	14.2 ± 4.7
	High step down (trailing leg)	0,342	2.6 ± 0.3	1.2 ± 0.2	16.6 ± 6.0
	Walk	0,359	3.3 ± 0.3	0.8 ± 0.1	18.7 ± 2.7
	Low step down (trailing leg)	0,369	2.9 ± 0.3	1.3 ± 0.3	15.1 ± 5.0
	Forward jump (2-leg)	0,414	3.2 ± 1.0	1.2 ± 0.4	25.4 ± 8.5
	High step down (leading leg)	0,429	3.2 ± 0.6	1.1 ± 0.2	34.2 ± 7.5
	High step up (trailing leg)	0,432	3.7 ± 0.6	1.1 ± 0.2	22.1 ± 7.0
	Lunge (trailing leg)	0,435	2.4 ± 0.5	2.4 ± 0.7	11.5 ± 3.3
	Counter movement jump (2-leg)	0,474	3.4 ± 0.3	1.5 ± 0.3	32.5 ± 5.3
	Rebounding heel raise (1-leg)	0,476	4.2 ± 0.9	1.1 ± 0.1	26.2 ± 10.5
	Standing heel raise (1-leg)	0,493	3.0 ± 0.3	2.5 ± 0.6	13.1 ± 3.4
TIER 3	Drop jump (2-leg)	0,519	3.6 ± 0.6	1.7 ± 0.3	34.4 ± 6.7
	Hopping (2-leg)	0,555	4.8 ± 1.8	0.6 ± 0.2	56.3 ± 26.0
	Run (stance)	0,6	5.2 ± 0.9	0.7 ± 0.1	58.1 ± 12.7
	Forward hopping (2-leg)	0,656	5.2 ± 2.6	1.3 ± 0.5	58.4 ± 33.4
	Counter movement jump (1-leg)	0,705	4.9 ± 0.6	2.4 ± 0.5	46.2 ± 7.1
	Forward jump (1-leg)	0,74	5.4 ± 1.1	2.3 ± 0.4	46.9 ± 11.1
TIER 4	Hopping (1-leg)	0,764	6.7 ± 1.6	1.3 ± 0.2	62.1 ± 16.9
	Drop jump (1-leg)	0,852	5.5 ± 0.8	3.0 ± 0.4	59.2 ± 9.1
	Lateral hopping (1-leg)	0,904	7.3 ± 2.4	2.1 ± 0.7	67.7 ± 25.9
	Forward hopping (1-leg)	0,924	7.3 ± 1.9	2.3 ± 0.3	67.1 ± 18.5

Adapted from Baxter et al. Med Sci Sports Exerc 2020

Loading index, the summation of scaled & normalized peak loading, loading impulse, & loading rate (± standard deviation).
BW - bodyweights.
1-leg -- single leg.
2-leg -- bilateral.

	Weights
Peak Loading	0,5
Loading Impulse	0,3
Loading Rate	0,2

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