

Appendices

Appendix 1: Assessment Guides

Achilles Tendinopathy

Subjective

Risk factors: previous injury; Age >30; gender; menopause; strength deficits; flexibility deficits; obesity; carrying a loaded rucksack; rheumatoid arthritis; diabetes, fluoroquinolone antibiotics.

Pain behaviour: Morning stiffness and pain; diffuse or focal; mid-substance or insertional; chronic or acute; sudden pain/sensation; pain increase with recent loading; VISA-A, if time allows.

Loading history: Increase or rapid fluctuations; frequency; intensity; type (shoes/sport/surface); time.

Consider:

1. Any indication of a partial or full rupture?
2. Are morning stiffness and pain present?
3. Is pain insertional or mid-substance?
4. What stage is it? Reactive, disrepair, degenerative?

Objective

Observation: Posture; muscle bulk; tendon thickening.

Loading: Single-leg heel raise performed slowly; progress to single-leg hops, if appropriate.

Lower-limb function: Squat × 3; one-leg squat × 3, right + left; gait analysis (walking).

Joint testing: Dorsi + plantar flexion range?

Examination: Plantar fascia to gastrocnemius; pain location; muscle tone/bulk/trigger points.

Special tests: Simmonds–Thompson; posterior impingement; plantaris (medial, more superior); sural nerve (lateral) flexor hallucis longus; tibialis posterior; accessory soleus (medial); foot posture.

Gait analysis: Change in running style towards a forefoot strike pattern; recent switch to minimalist footwear; bounding with large vertical displacement.

Analysis:

- Stage: reactive, disrepair or degenerative?
- Has the loading or training history identified any contributing factors?
- Are there any strength or functional deficits?
- What risk factors were identified?

Note: This guide only includes most of the key risk factors, signs, and symptoms, and should be used alongside your usual assessment procedures.

Note: The stages are not protocols and should be interpreted for patients on an individual basis. Stages 1 and 2 may be implemented together in a disrepair or degenerative tendon.

Stage 1 (pain reduction):

- Time frame: up to four weeks.
- Frequency: daily – determined by pain reduction and daily activities.
- Aims: settle the tendon by reducing elastic loading; maintain regular load; reduce pain and sensitivity.
- Education: highly important for adherence and regime success.
- Exercises: inner-range isometric contractions of the calf musculature using a moderate and tolerable load for 30–60 seconds, 1–3 repetitions.
- Two to three times per day, depending on the duration of pain reduction after each exercise.
- Do the exercise when doing normal daily tasks, such as brushing teeth, making a drink, or while on the phone.
- Exercise should offer rapid and sustained pain relief.
- Adjunctive treatments: analgesic options can be used. Avoid interventions that stimulate the tendon during the initial reactive phase.

Stage 2 (increasing strength):

- Time frame: from four to six weeks and performed in conjunction with the pain reduction exercises.
- Frequency: twice-weekly for beginners and in-season; 3–4 weekly for strength-trained individuals; 4+ for highly active individuals.
- Aims: increase the maximal capacity of the plantar flexor muscles and stimulate structural changes within the musculotendinous unit.
- Exercises: 3–4 sets of 6–10 repetitions performed at a slow pace to avoid stimulating the elastic energy storage capacity of the tendon. A range of motion that avoids excessive dorsiflexion should be taught. Allow rest period of approximately 1 minute between sets.

Tips:

- Add load, not repetitions or sets. Aim for 75–85% of 1 repetition maximum (1RM).
- Hold a wall or handrail to avoid challenging balance.

Stage 3 (functional strength):

- Time frame: based on symptomatic and functional assessment following stages 1 and 2.
- Frequency: every other day.
- Aims: continue to apply sustained loads to the tendon with the addition of more functional training.
- Reintroduce running with specific form training 2–3 times per week.
- Exercises: progress the exercises by gradually increasing the load.

Tips:

- Increase the range of motion.
- Increase the resistance.
- Do not progress too rapidly.
- Monitor and manage the total training volume.

Stage 4 (develop speed):

- Time frame: based on symptomatic and functional assessment following stages 1, 2, and 3.

- Frequency: every 2–3 days. Keep strength training on the non-speed training days.
- Aims: introduce functional speed; begin stressing the stretch/shorten capability of the tendon.
- Exercises: use exercises akin to the individual's sporting function. Ensure that the range of motion does not stress the enthesis by controlling any risk of excessive dorsiflexion.

Tips:

- Begin with short sessions using a low load.
- Partial weight-bearing is an option.

Stage 5 (athletic function):

- Time frame: based on symptomatic and functional assessment following stages 1, 2, 3, and 4.
- Frequency: athletic function days incorporated into a weekly programme containing strength and speed exercise days. The week should consist of a small cycle of **high, medium, and low loading days**.
- Aims: combine the development of strength and speed into usable athletic function in preparation for full training.
- Exercises: advanced running form drills; propulsion activities; acceleration/deceleration; eccentric, concentric turnarounds; speed/agility/quickness (SAQ)-style training drills.

Advice and monitoring:

- Pain during activity does not correlate well with clinical outcome or pathology.
- Careful monitoring of morning pain and stiffness using a diary should be used to ascertain the appropriate speed of programme progression.
- Remember the cellular response to loading usually takes around >24 hours.
- Consider the programme's start and end points.
- This is a guide, not a protocol: consider activities of daily living (ADLs) and adapt the programme accordingly.
- Recovery speed can fluctuate.
- Cycle high, low, and medium days.

Patellar Tendinopathy

Subjective

Risk factors: Jumping or running activities; previous patellar tendon anterior cruciate ligament graft; age >30; menopause; strength deficits; flexibility deficits; obesity; increased weight-bearing; leg length discrepancy; rheumatoid arthritis; diabetes, fluoroquinolone antibiotics.

Pain behaviour: stiffness and pain in the morning or after prolonged sitting; focal pain below the patellar apex; complete VISA-P if time allows.

Loading history: jumping activities; increase or rapid fluctuations in frequency; intensity; type (shoes/sport/surface); time.

Consider:

1. Do the symptoms indicate patellofemoral pain or patellar tendinopathy?
2. Are stiffness and pain present?
3. What recent changes has your patient made to their exercise regime?
4. What stage is it? Reactive, disrepair, degenerative?

Objective

Observation: posture; quadriceps muscle bulk.

Loading: squats; single-leg squats; step down; single-leg hop; repeat three times if asymptomatic; perform a single or double-leg decline or standard squat, recording pain-free range and board decline setting.

Joint testing: ankle dorsi to plantar flexion range; hip joint range.

Examination: tibial tuberosity to rectus femoris origin; pain location over the patellar apex; muscle tone/bulk/trigger points; quadriceps and hamstring flexibility; leg length discrepancy; foot posture.

Special tests: knee extensions to test the infrapatellar fat pad; patellar glide to test for reduced patellofemoral pain during resisted flexion.

Gait analysis (running): Overstriding; slow step rate; large vertical displacement; excessive heel strike pattern.

Analysis:

- Which stage: reactive, disrepair, or degenerative?
- Does the loading and training history identify any contributing factors?
- Were there any strength or functional deficits?
- What risk factors were identified?

Note: This guide only includes most of the key risk factors, signs, and symptoms, and should be used alongside your usual assessment procedures.

Note: The stages are not protocols and should be interpreted for patients on an individual basis. Stages 1 and 2 may be implemented together in a disrepair or degenerative tendon.

Stage 1 (pain reduction):

- Time frame: up to four weeks.
- Frequency: daily – determined by pain reduction and daily activities.
- Aims: settle the tendon by reducing elastic loading; maintain regular load; reduce pain and sensitivity.
- Education: highly important for adherence and regime success.
- Exercises: ski squat with knees above 60 degrees for 30–60 seconds and repeat if tolerated; attempt one-leg static squat, adding decline 15–25 degrees or using a leg extension or leg press machine if available; exercise start point is determined by personal ability and athletic level.
- Two to three times per day depending on the length of pain reduction following each exercise.
- The exercises should not challenge balance; the focus should be on consistent tendon loading.
- This exercise should offer rapid and sustained pain relief.
- Adjunctive treatments: analgesic options can be used; avoid interventions that stimulate the tendon during the initial reactive phase.

Stage 2 (increase strength):

- Time frame: from four to six weeks and performed with the pain reduction exercises.
- Frequency: two sessions per week for beginners and in-season; 3–4 sessions per week for strength-trained individuals.
- Aims: increase strength and endurance capacity of the whole musculotendinous unit.
- Improve tendon structure and stiffness.
- Exercises: squat-based exercises to 60-degree knee flexion; 3–4 sets of 6–10 repetitions performed at a slow pace to avoid any stimulus of the elastic energy storage capacity of the tendon. Rest for approximately 2 minutes between sets.

Tips:

- Add load not repetitions or sets.
- Use a resistance 75–85% of 1RM.

Stage 3 (functional strength):

- Time frame: based on symptomatic and functional assessment following stages 1 and 2.
- Frequency: every other day.
- Aims: continue to apply sustained loads to the tendon with the addition of more functional postures. Improve landing mechanics and gait re-education.
- Progress the retraining of motor pattern deficits.
- Reintroduce running with specific form training; 2–3 times per week; short sessions, avoid running downhill.
- Exercises: include a larger variety of squat and lunge variations.

Tips:

- Encourage balance and stability of the whole body when supported by the lower limb.
- Increase the resistance while continuing to focus on endurance.

Stage 4 (develop speed):

- Time frame: based on symptomatic and functional assessment following stages 1, 2, and 3.
- Frequency: every 2–3 days. Keep strength training on the non-speed training days.
- Aims: introduce functional speed and begin stressing the rapid loading capability of the tendon.

- Exercises: jump squat; split squat; power cleans.

Tips:

- Begin with just body weight or a barbell.
- Practise repetitive movement patterns first.

Stage 5 (athletic function):

- Time frame: based on symptomatic and functional assessment following stages 1, 2, 3, and 4.
- Frequency: athletic function days will be incorporated into a weekly programme containing the strength and speed exercise days. The week should consist of a small cycle of **high, medium, and low loading days**.
- Aims: combine the development of strength and speed into usable athletic function in preparation for full training.
- Exercises: running form drills; jumping activities; acceleration/deceleration; eccentric, concentric turnarounds; SAQ-style training drills.

Advice and monitoring:

- Pain during activity does not correlate well with clinical outcome or pathology.
- Careful monitoring of pain and stiffness using a diary should be used to ascertain the appropriate speed of programme progression.
- Remember the cellular response to loading usually takes around >24 hours.
- Consider the programme's start and end points.
- This is a guide, not a recipe: consider ADLs and adapt the programme accordingly.
- Recovery speed can fluctuate.
- Cycle high, low, and medium days.
- Reassess running form regularly to avoid technique regression.

Hamstring Tendinopathy

Subjective

Risk factors: previous hamstring muscle or tendon injury; middle-to-long-distance running; hill running; deep squatting; lunging activities; poor hamstring strength or flexibility; obesity; rheumatoid arthritis; diabetes; menopause; fluoroquinolone antibiotics.

Pain behaviour: gradual onset of deep buttock pain. Possible posterior thigh referral. Increases with prolonged sitting and hip flexion under load; pain may increase with uphill running. Referred pain of sciatic distribution. VISA-H if time allows.

Loading history: introduction of hill running; repetitive deep squats or lunging; sustained hip flexion positions.

Consider:

1. Tendinopathy or muscle strain? Based on pain location, onset, and behaviour.
2. Is there buttock pain with prolonged sitting, with or without sciatic distribution?
3. What stage is it? Reactive, disrepair, degenerative?
4. Are there any contributing risk factors?

Objective

Observation: anterior pelvic tilt.

Loading: maximum voluntary contraction test; single-leg, long lever bridge test.

Lower-limb function: squat; deadlift; straight leg deadlift.

Joint testing: lumbar spine; hip and sacroiliac joint (SIJ) extension.

Examination: hamstring muscle and proximal attachment; pain location; muscle tone/bulk/trigger points; piriformis muscle.

Special tests: modified slump; hamstring stretch; H-test; Laslett's SIJ test; prone hip extension.

Gait analysis: overstriding; poor hip extension.

Analysis:

- Stage: reactive, disrepair, or degenerative?
- Is there sciatic nerve involvement?
- Does the loading or training history identify any contributing factors?
- Were strength and functional deficits identified?
- What risk factors are evident?

Note: This guide only includes most of the key risk factors, signs, and symptoms, and should be used alongside your usual assessment procedures.

Note: The stages are not protocols and should be interpreted for patients on an individual basis. Stages 1 and 2 may be implemented together in a disrepair or degenerative tendon.

Stage 1 (pain reduction):

- Time frame: immediately; ongoing during the subsequent stages.
- Avoid: prolonged sitting on a hard surface; sitting or squatting with the knees above the hips; overstriding when walking or running; hill walking.
- Aim: reduce symptoms and risk factors.
- Isometric exercises: prone leg curl hold; long lever bridge holds; static straight leg deadlifts. Two to three times per day depending on the duration of pain reduction following each exercise. Isometric exercises should offer rapid and sustained pain relief.
- Gait re-education: identify and modify any gait-related causes.
- Joint restrictions: improve hip extension range and power.
- Adjunctive treatments: analgesic options can be used; avoid interventions that stimulate the tendon during the initial reactive phase.

Stage 2 (increase strength):

- Time frame: from four to six weeks and performed in conjunction with the pain reduction exercises.
- Frequency: two sessions per week for beginners and in-season; 3–4 sessions per week for strength-trained individuals.
- Aims: increase hamstring strength; flexibility if required. Improve hip extension muscle patterning.
- Improve tendon structure and stiffness.
- Exercises: long lever bridge; straight leg deadlift (half-range); gluteal hip extension exercises. Rest for approximately 2 minutes between sets.

Tips:

- Increase the load not the repetitions or sets.
- Use a resistance 75–85% of 1RM.
- Avoid excessive hip flexion.

Stage 3 (functional strength):

- Time frame: based on symptomatic and functional assessment following stages 1 and 2.
- Frequency: replace approximately half the exercises from phase 2 with more functional phase 3 exercises.
- Aims: continue to apply sustained loads to the tendon with the addition of more functional movement patterns.
- Progress the retraining of motor pattern deficits.
- Reintroduce running with specific form training; 2–3 times per week; short sessions; avoid running up hill.
- Exercises: include a larger variety of squat and lunge variations.

Stage 4 (develop speed):

- Time frame: based on symptomatic and functional assessment following stages 1, 2, and 3.
- Frequency: every 2–3 days. Keep strength training on the non-speed training days.
- Aims: introduce functional speed and begin stressing the rapid loading capability of the hamstring.
- Exercises: sprint drills; kicking drills; weight training – power cleans.

Tips:

- When weight training, use just body weight or a barbell.
- Begin sprint and kicking drills at a submaximal pace.

Stage 5 (maintenance programme):

- Time frame: based on symptomatic and functional assessment following stages 1, 2, 3, and 4.
- Frequency: specific exercises from the previous stages should form part of a short maintenance session to be performed 2–3 times per week.
- Aims: maintain strength and flexibility gains; maintain positive changes to running form.
- Exercises: specific strength training exercises; functional exercises; gait assessment and feedback.

Advice and monitoring:

- Pain during activity does not correlate well with the clinical outcome or pathology.
- Careful monitoring of pain and stiffness using a diary should be used to ascertain the appropriate speed of programme progression.
- Remember the cellular response to loading usually takes around >24 hours.
- Consider the programme's start and end points.
- This is a guide, not a recipe: consider ADLs and adapt the programme accordingly.
- Recovery speed can fluctuate.
- Cycle high, low, and medium days.
- Reassess running form regularly to avoid technique regression.

Gluteal Tendinopathy

Subjective

Risk factors: Age >40; female/male = 4:1; menopause; low activity levels; seated exercise habits; endurance running; hip adduction stance; poor lower-limb muscle strength; Trendelenburg sign; coxa vara; hip osteoarthritis; obesity; fluoroquinolones antibiotics.

Pain behaviour: lateral hip pain with possible lateral thigh referral. Pain may increase with: adducted hip in standing; sitting cross-legged; sleeping side-lying; standing from a seat; stairs ascent and descent. Running and walking can be painful in severe cases. VISA-G, if time allows.

Loading history: changes in training, recently beginning a running programme.

Consider:

1. Can your patient flex forward to tie their shoelaces? No indicates hip osteoarthritis.
2. Are gluteal weakness and hip instability present?
3. What stage on the continuum: reactive, disrepair, degenerative?
4. Are there any risk factors that can be easily modified?

Objective

Observation: Habitual postures, such as standing in hip adduction, sitting cross-legged, Trendelenburg gait.

Lower-limb function: side-lying hip abduction; one-leg squat; gait analysis (walking).

Joint testing: FABER (Flexion, ABduction and External Rotation; differentiating test for osteoarthritis).

Examination: tensor fasciae latae to posterior gluteal muscles; pain location; muscle tone/bulk/trigger points.

Special tests: 30-second single-leg stance test; resisted derotation test; modified Trendelenburg part 1 and 2.

Gait analysis (walking and running): Overstriding; slow step rate; heavy heel strike; poor hip extension; high vertical displacement; Trendelenburg gait.

Analysis:

- Osteoarthritis or gluteal tendinopathy or both?
- Which stage: reactive, disrepair, or degenerative?
- Were there any identifiable training errors?
- Were any deficits identified in hip and lower-limb stability?
- Were any risk factors identified?

Note: This guide only includes most of the key risk factors, signs, and symptoms, and should be used alongside your usual assessment procedures.

Note: The stages are not protocols and should be interpreted for patients on an individual basis. Stages 1 and 2 may be implemented together in a disrepair or degenerative tendon.

Stage 1 (pain reduction):

- Time frame: immediately; ongoing during the subsequent stages.
- Avoid: hanging on the hip – standing habitually on an adducted leg; sitting with legs crossed; overstriding when walking or running; sitting in low chairs.
- Aims: reduce symptoms and risk factors.
- Isometric exercises: abductor wall push; double-abductor hold; side-lying isometric hip adduction; 1–4 sets of 30–60 seconds performed 2–3 times per day depending on the duration of pain reduction following each exercise. Isometric exercises should offer rapid and sustained pain relief.
- Gait re-education: identify and modify any gait-related causes. These may include: overstriding, slow step rate; heavy heel strike; poor hip extension; high vertical displacement; Trendelenburg gait.
- Adjunctive treatments: analgesic options can be used. Avoid interventions that stimulate the tendon during the initial reactive phase.

Stage 2 (increase strength):

- Time frame: from four to six weeks and performed in conjunction with stage 2.
- Frequency: two sessions per week for beginners and in-season; 3–4 sessions per week for strength-trained individuals.
- Aims: improve hip stability, specifically hip abductors, to reduce hip drop during walking, running, and single-limb tasks.
- Exercises: clam; side-lying hip abduction; band walk; kneeling hip stability.
- Rest for approximately 1 minute between sets.

Tips:

- Increase the load not the repetitions or sets.
- If possible, use a resistance 75–85% of 1RM, which should allow 6–10 repetitions for the initial set.
- Performing inner-range muscle action may aid the shortening of elongated muscles.

Stage 3 (functional strength):

- Time frame: based on symptomatic and functional assessment following stages 1 and 2.
- Frequency: continue to perform exercises from stages 1 and 2, with the addition of 1 or 2 modified functional exercises.
- Aims: the addition of more functional movement patterns, modified to stimulate the hip abductors through a functional range.
- Progress the retraining of motor pattern deficits.
- Reintroduce walking or running, with specific form training focusing on reduced leg adduction and reduced stride length; 2–3 times per week; short sessions; avoid hills and off-camber surfaces.
- Exercises: squat and deadlift activities with added abductor resistance using a band around the

knees.

Stage 4 (advanced rehabilitation):

- Time frame: based on symptomatic and functional assessment following stages 1, 2, and 3.
- Frequency: 3–5 times per week in addition to chosen exercises and techniques from the previous stages.
- Aims: instil corrected movement patterns using a combination of analgesia, risk factor avoidance, strengthening, gait re-education and education.
- Exercises: one-leg squat and deadlift if your patient has a suitable fitness level. Use the previous exercises alongside gait re-education with real-time (mirror) and post-training feedback.

Tip:

- Short, high-quality and regular training sessions provide the best results.

Advice and monitoring:

- Pain during activity does not correlate well with clinical outcome or pathology.
- Careful monitoring of morning pain and stiffness using a diary should be used to ascertain the appropriate speed of programme progression.
- Remember the cellular response to loading usually takes around >24 hours.
- Consider the programme's start and end points.
- This is a guide, not a recipe: consider ADLs and adapt the programme accordingly.
- Recovery speed can fluctuate.
- Reassess walking and running technique regularly to avoid technique regression.

Appendix 2: Gait Assessment Form

Gait Assessment Form

Assessment surface:	Treadmill/road/track/trail		
Assessment method:	Video/visual		
Shoe type:	None/minimalist/cushioned		
Pain during assessment	Yes – Location?		No

Step rate	<175	175–200	>200
Foot strike pattern	Heel	Mid-foot	Forefoot
Initial foot contact	Clearly anterior to the body's centre of mass (COM)	Under or slightly anterior to COM	Under COM
Pronation	Overpronating	Neutral	Underpronating
Vertical displacement (use head as a reference point)	Large amount of displacement. Bouncy bounding style of running	Small amount of displacement	Minimal displacement
Pelvic stability	Large amount of contralateral drop	Small amount of drop equal on both sides	Irregular unilateral drop
Hip internal rotation (knee reference point)	Noticeable internal rotation	Minimal to zero internal rotation	Unilateral internal rotation
Midline crossover	Crossover	Minimal crossover	No crossover
Hip extension	None	Normal	Spinal extension compensation

Notes:

Plan: