TENDINOPATHY WORKBOOK

TO BE FOLLOWED AS PART OF A PHYSIOTHERAPY LED PROGRAM

TENDINOPATHY

INTRODUCTION

Tendons join muscle to bone. When the muscle is contracted or loaded, it shortens pulling the tendon which in turn moves the bone. Therefore, tendons need to be able to withstand a high volume of tensile forces. The biomechanical structure of tendons is designed for this purpose.
Tendons differ from muscles in their response to injury: when muscle tissue is injured it goes through a triphasic response including (1) the inflammatory phase characterized by swelling, redness, heat and pain, (2) the regenerative phase and lastly (3) remodelling of the injured tissue. However, tendons do not follow this logical progression and if not managed correctly, may end up in a permanent state of failed healing which can persist for up to twelve months or longer in some cases.

Both Achilles and Patella tendinopathy are characterized by a history of insidious onset often with a change in activity such as increased frequency (more exercise sessions per week), duration (increase in length of exercise session) and increase in the exercise load (i.e. hill running). During running and jumping activities tendons can be exposed to forces ranging from six to 14 times body weight.

Athletes with tendinopathy often report pain local to the tendon after loading it. In the initial stages, pain is apparent at the beginning of the exercise session and subsides with continued activity. However, with progression of the condition, pain can be felt throughout the entire session and eventually leads to cessation of the activity. Another common feature of tendinopathy (especially in the Achilles tendon) is morning pain or stiffness.

Stages of tendon dysfunction

Tendinopathy occurs on a continuum according to it stage and severity. Researchers propose that there are 3 stages to this continuum.

1. Reactive tendinopathy
2. Tendon disrepair
3. Degenerative tendinopathy.

They suggest that the tendon can move up and down this continuum and this can be achieved through adding or removing load to the tendon especially in the early stages of tendinopathy. By reducing the load it may allow the tendon to return to the previous stage on the continuum.

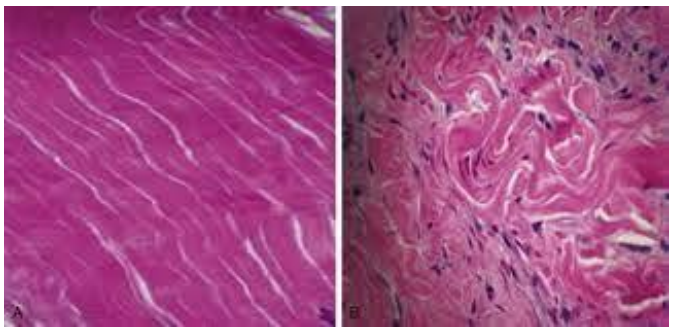
However, the relationship between the structure, pain and function of tendons is still not fully understood making this condition difficult to manage.

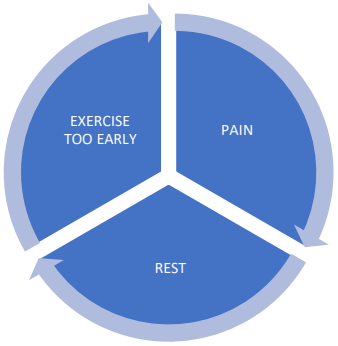
Reactive tendinopathy

A reactive tendon is the first stage on the tendon continuum and occurs as a result of compressive or tensile overload or after sudden increased stress or direct impact to the tendon. The collagen (matter that makes up the tendon) integrity is usually maintained although some separation has been noted. The tendon may appear thickened and swollen. At this stage of injury, the tendon has the potential to revert back to the normal tendon.

Tendon disrepair

The progression of the reactive tendinopathy can occur if the tendon is not offloaded and allowed to regress back to the normal state. During this phase, there is the continuation of increased protein production which has been shown to result in separation of the collagen and disorganisation within the cell matrix (see picture). There may also be infiltration of new blood vessels and nerves into the damaged tendon as a result of attempted healing. Tendon disrepair occurs as a result of continued loading whist in the reactive phase or returning to play too soon.





Degenerative tendinopathy

This is the final stage on the continuum and is suggested that at this stage there is a poor prognosis for the tendon and changes are now irreversible. The tendon can be thickened and present with nodular sections on palpations. Clinically this tendon is present in the older individual who has had ongoing problems with tendinopathy, or the younger individual who has continued to overload the tendon.

How do I get it better?

Successful rehabilitation of tendinopathy involves the gradual exposure to loads that mimic functional activities. It is very important to ensure that the body is working efficiently and not overloading any particular structure. Therefore, a comprehensive physio assessment and rehabilitation plan is very important if symptoms are to resolve.

There are three important components in the assessment and treatment of tendinopathy.

1. Tendon specific loading
2. Kinetic chain function
3. Lumbo pelvic control (Core stability)

Your Physio assessment will establish a base level for loading the affected tendon and also identify aberrant movement and control patterns.

Rehab principles:

- Remove the cause (usually unaccustomed loading)
- Adapt training volume and resting periods to the amount that the tendon can safely handle at that moment
- Pain behaviour the day after loading is the critical load response test
- Integration of tendon specific loading, kinetic chain rehabilitation and core stability
- Use metronomes to maximize the effects of the workout.
- VISA scales to monitor progress monthly.
- Exercise should be regular and progressive working towards functional activities
- Both strength and endurance should be addressed.
- There must be an increase in speed of exercises to mimic functional activities.
- The programme must be maintained until full function is restored.
- A maintenance programme must continue even after return to full function.

TENDON SPECIFIC LOADING

Pain during loading

Tendon specific loading in aimed at restoring the structural properties of the tendon in order for it to return to pre-injury function. There are many other adjuncts to the treatment of tendon pathology, however, unless the tendon undergoes a mechanical loading program, it will not adapt to the nature of the loading required. Exercise rehabilitation in the form of loading is therefore gold standard in the management of tendon pathology.

Exercise rehabiltation is often painful and this can reduce compliance with long term exercise programs. We all have different responses to the pain associated with exercise. Where one athlete may carry on regardless of pain, another may stop earlier as a result of the pain experienced. This suggests that pain is highly individual and may have negative influences on recovery if loading is stopped too early or the condition made worse if pain is ignored.

THIS IS THE MOST IMPORTANT PART:

To avoid under/overloading a pain monitoring diary is crucial in the recovery from tendon pain. This protocol advocates documenting your pain levels alongside a progressive treatment model to help you understand and progress safe levels of mechanical loading in order to stimulate optimal tendon healing and avoid overloading and re-injury.

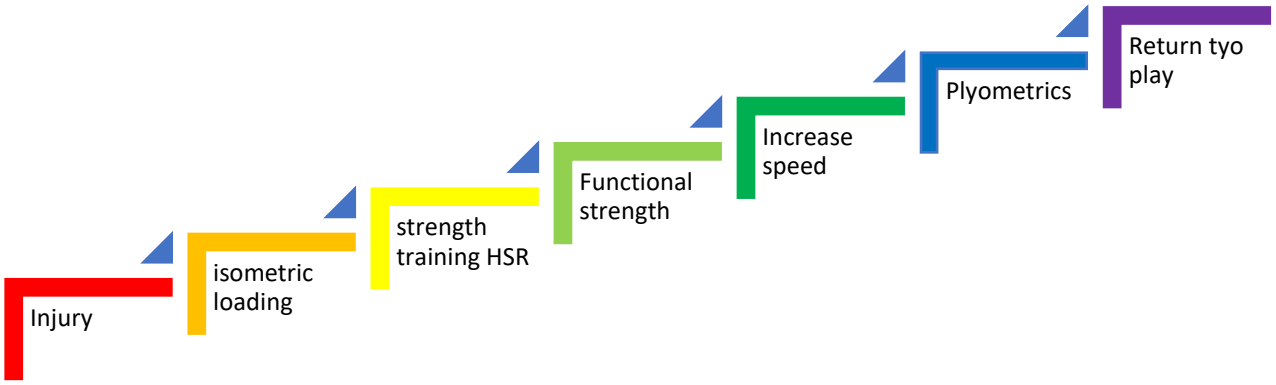
The Tendon Specific Loading program follows a progressive exposure to exercise starting from isometric loading to high end loading. This ensures progressive adaptaions and avoids return to play too early leading to re-injury.

NO PAIN **ACCEPTABLE PAIN** **STOP EXERCISING**

PAIN MONITORING DIARY

DATE	PHASE	EXERCISE Double/ single leg	SETS	REPS/ seconds	REST	Times per day	NPRS	NPRS +24	NPRS +48	NPRS +72
01.01.22	isometrics	Double standing heel raise	4	30	1 min	3	4/10	2/10	0/10	/

6 STEP APPROACH



Step 1: Isometric loading
Isometric exercises involve a muscle contraction but with no movement. The aim of these exercises is to:

- commence your rehabilitation program at an early stage
- gain understanding of your injury and of pain-monitoring model
- Commence Kinetic chain and core stability work.

Isometrics can be performed every day, however, adherence to the pain monitoring tool will guide you.

Step 2: Strength training
This takes the form of the 12-week Heavy Slow Resistance (HSR) training program.
Maintain the pain monitoring tool and the load diary.

Step 3 & 4: Functional strength & Speed
On completion of the HSR program, you will commence strength work progressing towards functional loading. This is largely single leg work with progressive speed.

Step 5: Plyometrics
One of the effects of lower limb plyometric training is an increase in leg stiffness increasing the transfer of power and making movement more efficient.

Step 6: Return to Play

You will also have a maintenance program and advice on how to reduce injury recurrence.

2. KINETIC CHAIN REHABILITATION

The kinetic chain refers to several joints in the body within series interacting to produce functional movements. This requires controlled activation of the associated musculature of these joints to provide stability and mobility whilst under load. For example, a standing jump requires the interaction of the hip, knee and ankle musculature in order to produce upwards movement. Dysfunction of one of these joints would not only reduce the height that you can jump but would also increase the demands upon the other joints.

When playing sports, training or performing functional movements, it is important to consider integration of all the joints in the kinetic chain to perform at your best. Poor functioning of the kinetic chain can cause overloading and subsequent injury at any point of the kinetic chain and is therefore very important in the rehabiltation from injury where we reintegrate an injured body part back to its function.

Muscle, tendon, fascia and ligaments are arranged in 'slings' along the length of the kinetic chain. These are often referred to as 'Myofascial slings *(Myo = muscle; and fascia = the soft tissue connecting muscle tissue).* Muscle activity at one point can contribute to increased tension across the whole myofascial sling and therefore contributes to the overall stability and movement of the kinetic chain. Several myofascial slings have been identified across the body and when these slings are in balance, joints of the kinetic chain are able to work optimally and produce effective movements. However, altered tension (i.e. muscle tightness, joingt stiffness) at any point across the myofascial sling can create poor joint alignment, increased tension of the muscle and tendons and altered movement patterns leading to overload and injury.

For example, stiffness at the ankle joint may cause increased spinal flexion during a squatting movement leading to overloading of the spinal and pelvic joints.

The achilles and patella tendons play a vital role in the transmissin of forces through the kinetic chain especially when performing dynamic or ballistic movements. In order to re-train injured tendon to perform at this high level, we can use kinetic chain exercises early in the rehabilitation process. This will help to (1) re-enforce functional movement patterns within the central nervous system, (2) distribute forces evenly across the body and (3) regain optimal mobility of the injured tendon within the kinetic chain.

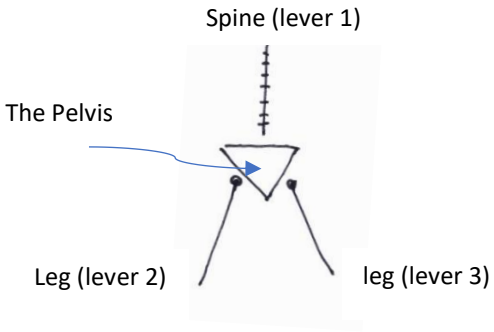
Therefore alongside specific exercises designed to reduce pain and increase the load capacity of the tendon by improving its structural and mechanical properties, we must integrate kinetic chain rehabilitation within the rehabilitation process in order to integrate the tendon within its functional role.

End stage rehabilitation will utilize the elastic properties of tendons to recycle stored energy within the kinetic chain which increases biomechanical efficiency of the body and increased performance.

3. CORE STABILITY

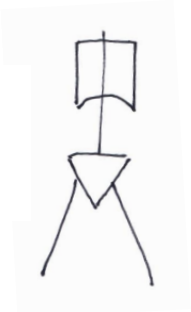
Your pelvis can be seen as a point where three levers converge. These levers are your spine and two legs. Therefore, your pelvis has a vital role in controlling and transferring forces whilst performing functional activities such as running or throwing a ball. Dysfunction at one of these levers will have an effect upon the balance of the other two levers often resulting in overloading. Conversely, poor control by the pelvic musculature (also referred to as the core musculature) can also have an effect on how the levers interact and often results in hip, knee and ankle pain, or upper limb pain.

Picture 1: the interaction between the three levers at the pelvis



Stability at the core is also influenced by structures further up the kinetic chain where the spine articulates with the ribs to form the thoracic cage (see picture 3). The thoracic cage not only protects our vital organs (heart and lungs) but also expands and relaxes to assists the diaphragm in drawing air into our lungs during respiration. Poor core functioning can increase demands upon the thoracic cage and diaphragm altering our breathing patterns at rest and during exercise as well as become a source of pain. The scapular (shoulder blades) rest and articulate upon the thoracic cage and may also become affected by poor thoracic functioning causing upper limb pain.

Picture 3
The relationship between the pelvis and thoracic cage

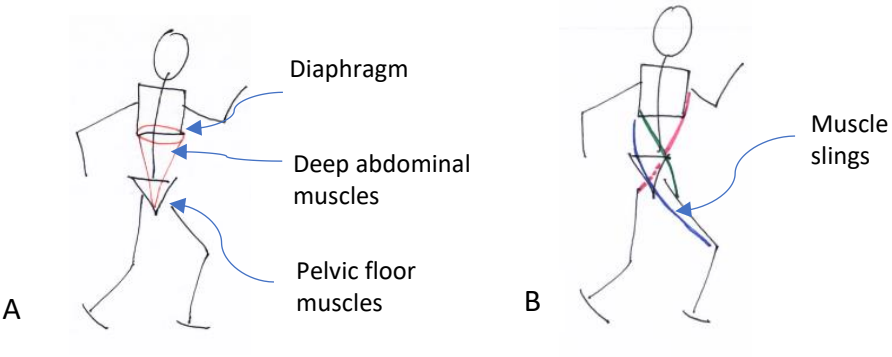


Picture 4
The position of the scapular and attachment of the upper limbs to the thoracic cage

Interaction of the three levers and between the pelvis and thoracic cage is dependent upon muscular contractions and passive stabilizing structures (ligaments) and this is co-ordinated by the nervous system to provide optimal stability for a specific task. During high level activities such as heavy lifting, greater muscular contractions to increase bracing at the spine is required. However, we also need to be mobile at the spine in order to perform more dynamic tasks. Therefore, muscular contractions need to brace or stabilize the spine as well as mobilize the spine during dynamic activities. To that end we can identify two types of muscles that contribute to stability at the spine; these are the inner (or stabilizing muscles) consisting of the diaphragm, deep abdominal and trunk muscles and pelvic

floor muscles and outer or mobilizing units that form slings of muscles acting over the trunk and limbs.

Picture 2
A: the inner muscle unit and B: the outer units:



Core stability therefore not only refers to strength at the abdominal region as commonly accepted, but the interaction between the three levers to allow optimal lower limb movements. The relationship between the pelvis and the thoracic cage is a huge consideration when assessing your core function (including posture, muscle imbalance and movement patterns) and forms the initial assessment of your core stability before progressing to more demanding activities.

The gluteal musculature is very important in maintaining stability at the core whilst performing functional activities. Due to their position on the pelvis, they play a role in maintaining stability during the gait cycle (i.e. when we are supporting ourselves on one leg) allowing the other leg to swing forwards into the next step. Poor functioning of these muscles leads to excessive drop of the pelvis on the opposite side to the supporting leg and can increase load or demand through other joints in the body leading to injury.

- Primary hip stabilizer especially when standing on one leg
- Active in sideways movements and stability
- Adjust and hold femoral head over acetabular.
- Helps reduce unwanted movements of the femoral head.
- Proprioceptive role
- Responsible for fine adjustments at the hip joint with low force

An assessment of your core functioning is very important in the management of lower limb tendinopathy and exercises to ensure optimal core functioning will be discussed with your physio.

STEP 1: ISOMETRIC LOADING

Complete the VISA

Exercise selection (with physio)

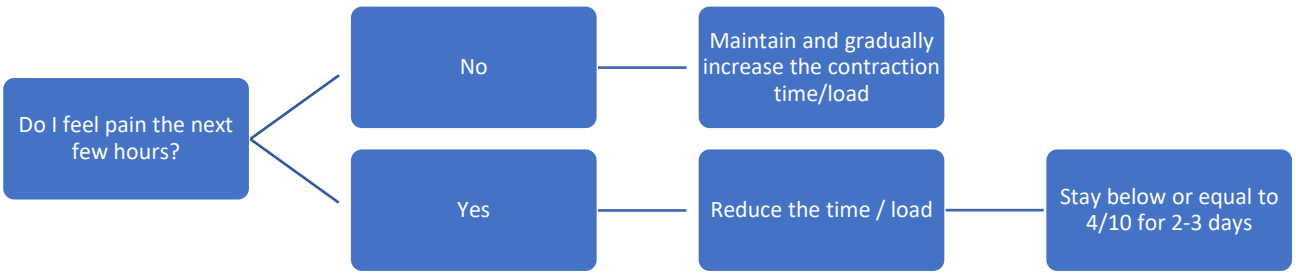
4 – 5 holds

30 – 60 secs,

Rest 1 min between sets

x3-5 per day

High loads best results, avoid fatigue



Weekly plan

Mon	Tue	Wed	Thu	Fri	Sat	Sun
ISOMETRIC	ISOMETRIC	ISOMETRIC	ISOMETRIC	ISOMETRIC	ISOMETRIC	ISOMETRIC

Notes:

Step 2: STRENGTH TRAINING

Complete the VISA

Select up to 3 exercises with your physio.

Use metronomes to maximize the effects of the workout.

VISA scales to monitor progress at the beginning of the program and at weeks 4, 8 and 12

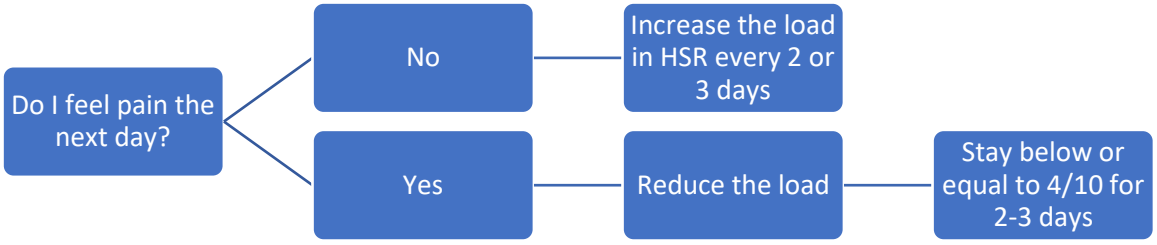
Pain behaviour the day after loading is the critical load response test – complete the load monitoring tool and discus with physio regularly.

12-week training programme:

	Reps	Sets	Tempo
Week 1	15	4	3:3
Week 2-3	12	4	3:3
Week 4-5	10	4	3:3
Week 6-8	8	4	3:3
Week 9-12	6	4	3:3

Weekly plan

Mon	Tue	Wed	Thu	Fri	Sat	Sun
HSR	ISOMETRIC	ISOMETRIC	HSR	ISOMETRIC	ISOMETRIC	ISOMETRIC



Notes:

Step 3 & 4: FUNCTIONAL STRENGTH & INCREASED SPEED

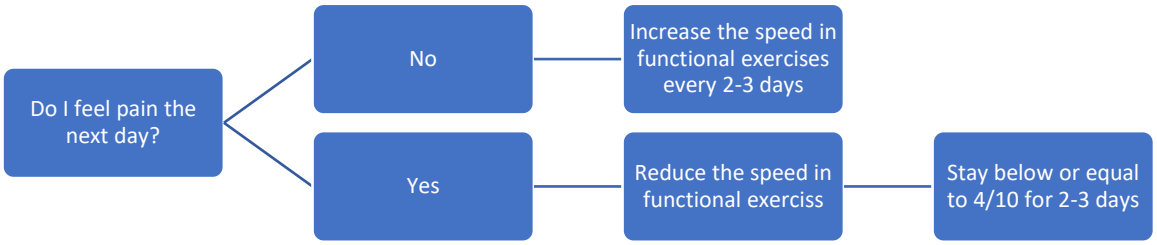
Complete the VISA

This aspect is highly individualized and progressed according to your response to previous stages of rehabilitation.

Neuromuscular Training

- Jump landing training
- Alternating foot positions
- Work capacity training

Load tolerance testing protocol
Consider commencing running training



Weekly plan

Mon	Tue	Wed	Thu	Fri	Sat	Sun
HSR	NMT	ISOMETRIC	HSR	ISOMETRIC	NMT	ISOMETRIC

Notes:

Step 5: PLYOMETRICS (Energy storage work)

Complete the VISA

Every 3 days.

3 sets of fast con: ecc contractions (explosive)

Rest 2 minutes between sets

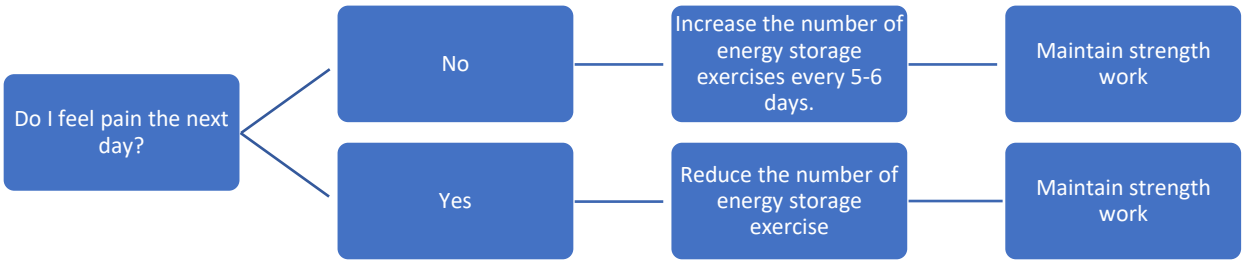
Once per day, every 3 days.

Alternating FDE with SDE and isometric loading Day 1 FDE, day 2 SDE, day 3 isometrics.

Go through exercises with physio

Weekly plan

Mon	Tue	Wed	Thu	Fri	Sat	Sun
ISOMETRIC	PLYO	ISOMETRIC	HSR	ISOMETRIC	PLYO	ISOMETRIC
Mon	Tue	Wed	Thu	Fri	Sat	Sun
HSR	ISOMETRIC	PLYO	ISOMETRIC	HSR	ISOMETRIC	PLYO



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