Academy of PHYSICAL MEDICINE

Broadcast Summary

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Lower Limb Tendinopathy
With Daniel Lawrence

About Daniel Lawrence

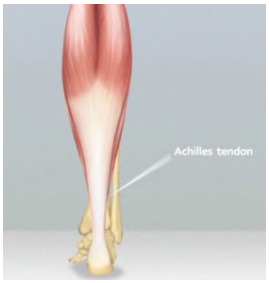
- A UK Chartered Physiotherapist, published author and international lecturer. Holds separate post-graduate qualifications in musculoskeletal medicine and education.
- Completed 10 years as a University lecturer for Plymouth University based in Truro, currently combines teaching and writing with running an NHS-funded clinic in his local area.
- Delivered lectures and workshops on tendon-related subjects throughout the UK including private physio groups, Therapy Expo, COPA, the Shoulder Symposium, South West Seminars, and the British Fascia Symposium 2018.
- Currently on the board of directors for RockTape UK, StickMobility UK and PhysioBooks Ltd.

Tendons

- The dry content of the tendon is primarily type 1 collagen. Tendons have high tensile strength and act as elastic bands or spring which make people more efficient as runners and/or walkers.
- A healthy tendon rarely ruptures, usually it is the muscles that rupture. Tendon ruptures are usually due to some pre-existing degeneration. Before this happens, people usually get a painful/dysfunctional tendon for a period of time. They tend to have done something that suddenly stressed it.

- Strengthening the tendon involves putting a load through it. This will improve the overall function of both tendon and muscle.

Achilles Tendon



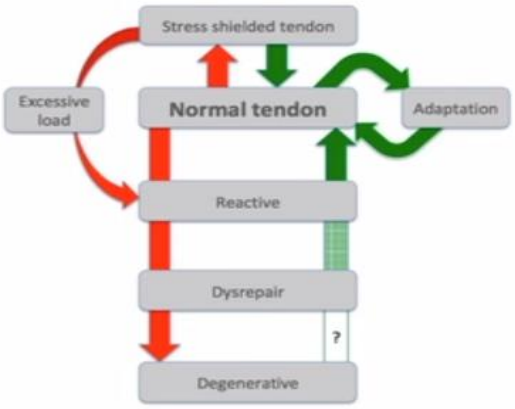
- It is the largest tendon in the body. It is an elastic structure and is unique because of its ability to store and release energy - allowing people to move efficiently. Other tendons do this, but not in the same way the Achilles.

- Can store and release about 90% of the collisional energy. The other 10 percent, called hysteresis, is lost in the form of heat. Little research on this.

- Collagen fibres = proteoglycans. Decorin – good at tensile strength. Connected by glycosaminoglycans (GAG) chains adding to tensile strength.

- The tenocytes (tendon cells) facilitate the functional adaptation of the proteoglycan and collagen network to mechanical requirements. If they change their behaviour, they can change the makeup of the tendon.

- The Achilles tendon has an adequate blood supply, but less than the muscle. Blood supply comes from the outer elements and from the musculotendinous



- The figure above shows the pathology flow of tendon problems. Normally, a tendon will adapt to a stimulus such as weight training, running, jumping, etc. and effectively stays normal.

- Cook and Purdum have proposed the tendon continuum when approaching tendon pain. They proposed the following 3 stages to this continuum. The Reactive tendinopathy, the tendon disrepair and the degenerative tendinopathy. They suggested 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.

1. **Reactive:** There will be some stasis and equilibrium. However, if the tendon is stressed too much and overloaded, it becomes reactive (i.e. painful). The tendon pain can be variable and people tend to continue to aggravate it. With the correct management plan and adequate rest, the tendon can return back to normal.

2. **Disrepair**: Where the tendon is trying to heal itself but it is not quite getting it right. It can still get back to normal from that stage but there may be a slightly reduced recovery from that. The physiological changes going on within the collagen makeup of the tendon may potentially be irreversible.

3. **Degeneration**: Occurs in pockets of the tendon and there is still potential for it to improve function.

- Stress shielding is when a tendon has undergone tendinopathy and the area of degeneration has been shielded from a load. The tendon may load up differently so that some fibres of the tendon are compensating for the other degenerative fibres. The latter, because they are not subjected to load, may potentially make it worse.

junctions. Its inner core and mid-section have the least blood flow – this is normal for the tendon.

- The Achilles tendon takes up about 9 times body weight while the ankle joint takes up about 13 times body weight when people are jumping.

Tendinopathy

- Tendonitis is inflammation of a tendon. Tendinopathy (i.e. non-inflammatory) is more of a clinical diagnosis of pain and dysfunction. It is a cellular response to loading and overuse. The cellular response is triggered by the tenocytes. The inflammatory component may be an early precursor to tendinopathy, but when it is in full flow, there are no clear inflammatory mediators to it.

- A low level inflammatory process occurring (asymptomatic) may not cause the individual any symptoms.

- Patients with tendinopathy have a swollen tendon (not inflammation, just swelling). It is swollen because the versican has drawn water into the tendon. The pain substances within the tendon in reactive tendinopathy could potentially be a part of the pain problem.

- Mechanotransduction is the mechanical force/mechanical stimulation that changes the shape of the cell. When the latter happens, there will be changes in its behaviour based on its shape change.

- A tendon in disrepair is more active than a degenerative tendon. It is attempting to heal itself.

- In disrepair the tendon produces the wrong type of collagen: Type 3 collagen - thinner and not structurally good at holding the tensile strength.

- Degenerative tendon is stuck in degenerative structural change and needs intervention to stimulate healing. Often settles and becomes non-painful. The danger is when the patient starts to get active again when the tendon is still structurally weak, causing an increased rupture risk.

- Research indicates that there is a reduced opportunity for the degenerative tendon to structurally heal but should not confuse the lack of structural reversal with the other changes, such as better function of the muscle, improved function of the surrounding tissue that is not degenerative, and reduced pain.

- A reactive tendon is painful but calms down eventually. With degenerative tendon, if it ensued, would spread to a larger pocket within the tendon.

Treating tendinopathy

- The treatment of tendinopathy is about loading. The types of loading that are helpful for tendons are slow, isometric, or heavy, relative to an individual's capacity. Slow loading, even with considerable weight is quite safe for the tendon.

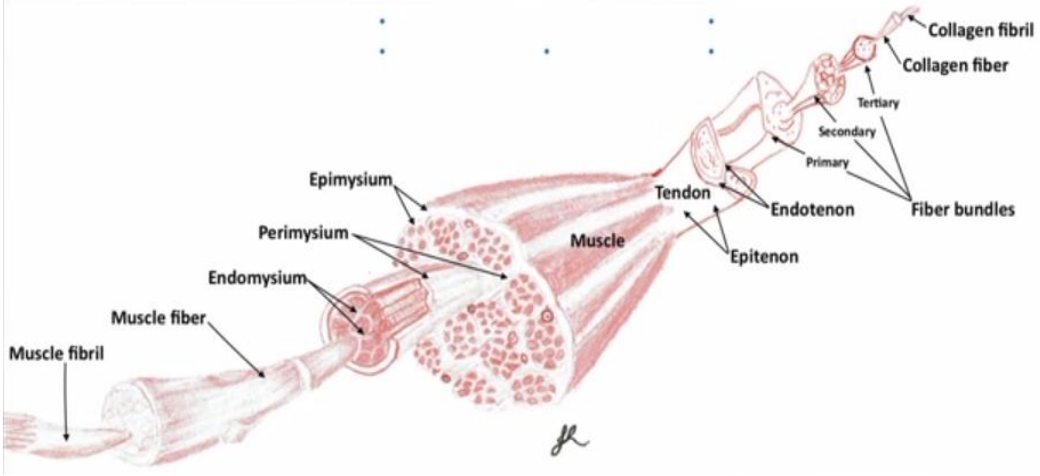
- The types of loading that could potentially over-stimulate a tendon are rapid loading or unaccustomed loading such as running and jumping.

- Patients tend to be very cautious and apprehensive about loading for fear that their tendons are going to rupture. Loading hurts and people associate the pain with damage.

- Degenerative tendon needs stimulation (something that would shock it) to get the healing phase going again. Loading can then be added to address the issue.

- Ibuprofen can positively influence the changes to the proteoglycans. A GP commonly prescribes it for a tendinopathy problem. It helps but not for inflammation issues.

- Even with a degenerative tendon, people should not be kept from being active and pursuing their sport like running. The latter involves multiple muscles which are adaptable. If the problem is with a key element, work with all the other elements to support running or any form of active movement. The degenerative tendon is not the whole tendon.



The image above shows the muscle and tendon continuity. The muscle and the tendon are difficult to show as a system that is independent of each other. The strength of their bond is akin to an interlocked fingers.

- Tendons must not be isolated. Different authors have identified myofascial continuities (i.e. kinetic/mechanical chain). At the micro level, there is continuity between the tendon and the muscle. Tendons are not just connected to the muscles, they are rather glued/bolted to the muscles and are therefore very much a part of the latter.

- There is very little that a therapist can do to the tendon. Key is influencing the connective contractile tissues, the muscles, because they are one of the easiest tissues in the body to work with.

- There are different tissue levels in the Achilles tendon (i.e. the continuity is from the tendon which is an elastic flexible structure to the bone which is an inelastic, inflexible structure). Within that fibro-osseous junction, the greatest stresses to the tendons are where they attach to the bone, is a key area of problems.

- Most tendinopathies can be treated by a combination of very simple exercises. Key to treating/managing tendinopathy is identifying the aggravating factors before introducing the right loading patterns. Patients should be taught to stop doing the wrong loading patterns.

- The musculotendinous junction has a better blood supply and therefore heals much quicker than a normal acute injury would.

Practical demonstration

(*44:18 – 1:03:00 in the broadcast recording*)

- Achilles tendon issues are often in the middle of the cord of the tendon, known as the midsubstance – where the classic tendinopathy can occur (shown on the right photo).

- The thickening is caused by water. It is not an inflammatory process. There is no reddening which goes with an inflammation (sometimes reddening occurs due to rubbing on the back of the shoe cup).

- The commonest types of tendinopathy issues are insertional tendinopathy and enthesopathy.

Dorsiflexion issue

- If patients get a lot of pain with dorsiflexion, the problem may be in front of the tendon. It may be a retrocalcaneal issue (i.e. bursitis or a fat pad irritation). A simple treatment is to reduce the dorsiflexion of the foot (i.e. wear heel raises or footwear with a slight heel).

- The heel height would depend on how symptomatic the patient is (7mm is generally the maximum). Footwear choice can make a difference as well for the tendinopathy.

- It takes a couple of months for dorsiflexion issue to resolve. Patients can then go back to wearing their normal footwear and activity.

Achilles tendon issue

- Key symptoms are morning pain and stiffness. In the absence of pain, the Achilles is stiff and sore and it eases as the patient starts moving.
- In the absence of the symptoms above, the issue is not tendinopathy. It could either be plantar fasciopathy, tibialis posterior issue, a plantaris issue, or a calf strain. The differentiators vary.

Posterior impingement

- A pain with plantar flexion (i.e. pain when patients fully plantar flex) with passive overpressure, is an indication of posterior impingement (i.e. a bony collision - the calcaneus on the back of the talus).
- For pain with plantar flexion, a simple activity modification can help (i.e. reduce excessive plantar flexion). If the pain cannot be managed conservatively, further imaging is required and perhaps surgical intervention. For dancers and swimmers who require a lot of plantar flexion, surgical intervention is done to address the issue.

Afredson's Protocol

- The concept of eccentric loading of the tendon to improve its ability to withstand force, based on discovery that overloading a tendon with the aim of provoking rupture led to repair. This led to loading programmes for other tendinopathy issues (e.g. the long lever bridge exercise, and exercises for rotator cuff tendinopathy).
- Initial success led to protocol being rigidly adhered to, but when tested, after initial success, it caused pain and aggravated the tendon. Protocols do not fit with clinical reasoning.

Chronic plantar fasciitis

- There is an anatomical continuity between the Achilles tendon, the periosteum, the plantar fascia, and the short toe flexors.
- The plantar fascia issue and the Achilles tendon issue can sometimes go together. Loading is very helpful and the loading programmes for both and are very much the same.
- The loading can be a trigger. There may have been a sudden increase in loading or unaccustomed loading which has triggered the plantar fascia issue or the Achilles tendon issue – or both.
- With a plantar fascia problem, putting less load and strain through the foot (i.e. reduced plantar flexion) means putting less load and strain through the gastrocs and the Achilles tendon.

- When the plantar fascia recovers there is definitely an interrelationship in the muscle/tendon structures that continues even after the pathology has cleared up which may trigger another issue.

Patella tendinopathy (knee)

- It is associated with running and jumping. It is a common issue among runners and those that have reached muscular/skeletal maturity. It is often a precise pinpoint pain at the apex of the platella. Because it is a precision pain, patients are not presented with a morning pain and stiffness in the same way they will have for an Achilles issue.

- If patients have a more diffused spreading, burning pain around the knee, it is not patella tendinopathy.

- Youngsters are more likely to suffer from Osgood-Shlatters or another growth plate issue at the tip of the platella (i.e. Sinding-Larsen-Johansson syndrome).

Gluteal tendinopathy (hip)

- The gluteal tendinopathy (i.e. tendon of the gluteus medius and gluteus minimus) is the most common low limb tendinopathy. This is common among the older population (age 60 above).

- Unlike hip arthritis, those with gluteal tendinopathy have a good flexion, good internal rotation with no clear capsular pattern, and no groin pain. The hip clinically moves nicely.

- With FABER test, patients with gluteal tendinopathy still have a reasonable range. The other differentiator is when patients struggle putting on their socks and shoes. They will get hip pain with that if they have a degenerative hip joint.

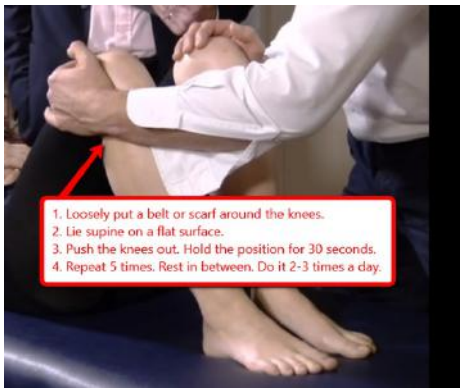
- With gluteal tendinopathy, patients will often feel pain around the gluteal region i.e. over the greater trochanter – just posterior to that and at the midsection into the gluteus medius. They will also be sore in the superior fibres of the gluteus maximus.

Hip test: External de-rotation test

This test is unlikely to provoke an arthritic hip, but will be painful for those with hip tendinopathy.

With the hip in external rotation, ask the patient to internally rotate against your resistance. The process loads up the gluteus medius minimus tendons and can cause pain in the presence of gluteal tendinopathy.

Recommended exercise for patients with gluteal tendinopathy



- Activates the gluteal muscles by isometric abduction. Within 2 weeks, muscles get stronger and functional. Tendons should desensitise as patients get exercise-induced hyperalgesia. Pain reduces.

What to avoid:

- Stressing the tendons: low seats, deep squats, or hip flexion past 90 degrees.
- "Hanging" on the hip (leaning on one hip to take the weight). Research shows this is an aggravator for gluteal tendinopathy.
- Crossing their legs. At night, they should try putting a pillow between their knees, as this is often very helpful.

Activity modification with simple exercise prescribed above resolves the symptoms in 95% of the patients.

- If the hip is struggling to stabilise, there is often some compensatory work from the tensor fasciae latae and the superior fibres of the gluteus maximus - because they attach onto the iliotibial band will do excessive work stabilising the hip.

- Soft tissue work around the glutes can give patients immediate relief. If they experience that, they will more likely go into the recommended exercise programme designed for them.

- Gluteal tendinopathy more often occurs independently from SIJ problems.

Hamstring tendinopathy

- This affects the ischial tuberosity. Pain on sitting is one of the key symptoms if patients have hamstring tendinopathy (i.e. they report uncomfortable pain in the area after 10-20 minutes of driving or sitting in the office).

  Long lever bridge: This exercise is recommended for those with hamstring tendinopathy.

	
1. Lie supine on a flat surface. 2. Knees stay straight or slightly bent. 3. Feet are raised on a flat surface (e.g. chair).	4. Lift the pelvis up into a bridge position. 5. Hold the position for 30 seconds to a minute. Do it 4-5 times.

- Any exercise that involves excessive hip flexion stresses the hamstrings and potentially compresses the hamstring tendon onto the ischial tuberosity.

- Deep squat aggravates or can be the cause of hamstring tendinopathy because it gives a lot of flexion at the hip and compression of the tendon over that region. While the tendon is quite able to tolerate the compression, too much of it (i.e. unaccustomed or uncontrolled compression) can cause tendinopathy.

Exercise programme

- Rehab exercises have to be progressional – start off by reducing running (not stopping) and then pursue a loading programme (from static loading to dynamic loading through to heavier and faster loading).

- Jumping is a useful late-stage rehab exercise, before returning to normal running.

- For treating abductor tendinopathy in a well-muscled rugby player, start with looking at the isometrics – go with slow dynamics but work the muscle through the range with load.

Imaging

- Tendon degeneration cannot be palpated. Ultrasound imagery is useful for excluding other things with tendons but not useful for identifying and managing tendon problems.

- The ultrasound tissue characterisation is where changes in the tendon can be looked at and matched with the rehabilitation. The purpose is to see if the structural changes are ensuing. However, the structure often does not relate to the pain that the patient is feeling.

- Without imagery most tendon problems can be assessed:

- It is reactive if it is a new issue and patients have done something which they are not accustomed to.

- It is disrepair if the issue has been going on for a while, it had been badly managed and patients have not dealt with it properly.

- It is degenerative if patients have a long history of tendon issues.

Shockwave therapy

- Note difference between radial- and focused shockwave therapy. Radial (very common) is not a true shock wave, but a pressure wave. About 145psi at point of impact, radiating outward and diminishing by the time it reaches deep tissue.

- Focused shockwave delivers maximum power when it reaches the target tissue. It can be damaging (originally developed for lithotripsy - to break down kidney stones). The pressure involved is 14,500 psi.

- Radial shockwave is not helpful for tendons in the reactive phase (it is like irritating an irritated tendon). But irritating a tendon in the degenerative phase is helpful because it can restimulate the healing process.

- With the correct load management, shockwave can be helpful for tendinopathies but not for acute tendinopathy as it might cause further irritation.

Barefoot walking

- This is not for everybody. The feet undergo a lot of stress before they get stronger with barefoot walking or running.

- If people adapt wrong to minimalist footwear, they will overstress their feet (i.e. too much load and not enough recovery time).

- People tend to suddenly make the switch from traditional footwear to minimalist footwear and continue to cover the same distances and time. This overloads the tissues too quickly.

Communication

- Explaining to patients that their tendons are very strong is a key buy-in for them to proceed with an exercise plan that is useful and beneficial for them.

- Patients with degenerative tendinopathy tend to pick up the word 'degeneration' and worry that their tendon is degenerating as the days go by.

- Using non-threatening lay terms for the patients is key to get them on board a rehab plan. The least fit patient has the most potential to improve.

- It is more difficult to deal with elite athletes, because they are already at the outside edge of their performance envelope and a slight change could push them over that edge. There is a need to make micro-adjustments in order to help them.

- To reduce patients' apprehension about rehab, inform them that the force their tendon takes up when doing calf raises or walking/ running, for example, is far below what it has to deal with when they are jumping (i.e. the Achilles tendon takes up about 9 times body weight). The exercise programme is very slow, static repetitions which are far below that load it can actually carry.

Case 1: Patient with tendinopathy issue was advised by consultant orthopaedic surgeon not to run anymore.

Recommendation:

1. No running for 2-3 months. Focus on strengthening the whole lower limbs (isolate the gastro-soleus complex and the Achilles)

2. After 2-3 months, engage in a walk-run (interspersed with jogging) programme. Slowly build up the confidence to run again.

Relevant notes:

- Stretching is not a solution to tendinopathy problems. It does not cause any harm in most cases but it is loading that makes the cellular and structural changes necessary for the healing.

- Calcification within the distal Achilles tendon is a later part of the degenerative process, more likely in older patients. This does not occur acutely.

- There is not much evidence that shows the efficacy of prolotherapy on degenerative tendinopathy. While it helps with the pain and loading, it is not recommended to use because it would just be unnecessary and potentially harmful.

- Convey to patients that the loading in any rehab exercise may be painful initially but is very safe and very sublevel compared to what they do to their tendon on a regular basis.

- There is evidence that the free lipids in the bloodstream and the excess body mass/weight can be risk factors for tendinopathy. But clinicians should not light up the wrong idea or offend the patient by commenting on their weight. The latter tend to become less receptive to other relevant information necessary for their rehab/healing journey.