

Modern management of tendon problems

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The management of tendon problems has evolved over the last 10 years as the pathologies involved are now better understood and management based on evidence is now available.

The terms tendinopathy and tendinosis have largely replaced the term tendinitis in the new paradigm, and this is based on the histopathology found in tendons.^{1,2}

Tendinopathy is a broad term indicating a problem with the tendon and its surrounding sheath or paratenon. The more specific terms now used are:

1. **Tendinosis** is a term which describes the macroscopic pathology of intra-tendon degeneration commonly due to a combination of microtrauma, ageing and vascular compromise. The histopathology includes collagen degeneration and fibre separation by increased mucoid ground substance, increased vascularity, neural ingrowth, focal necrosis and in some cases fatty and calcific deposits.
2. **Paratenonitis**. Here the pathology is inflammation of the paratenon or sheath whether synovial or not. The histopathology includes mild mucoid degeneration in areolar tissue with fibrous deposition and fibrinous exudate. This may produce crepitus or a squeaky tendon on examination. Commonly affects tibialis anterior, thumb and wrist tendons.
3. **Insertional tendinopathy** (enthesopathy) is another frustrating clinical problem commonly affecting the Achilles, groin, adductor tendon, hamstring origin and the

histopathology is not well understood. It seems there is damage to the origin or insertion of the four zones of tendon transition to bone.

4. **Tendon tears and ruptures**. Partial tears and complete tears are often found in tendons already affected by tendinosis. Commonly occur in Achilles, shoulder rotator cuff tendons, elbow tendons and patella tendons.

There are some common misconceptions about tendinosis, which can be compared with evidence-based findings (see Box 3).

The important clinical implications of the diagnosis of tendinosis are:

- It is common.
- It takes three to six months to recover.
- There is only an 80% likelihood of full recovery with/without surgery.
- The role of surgery is to excise abnormal tissue and stimulate healing process.
- Conservative therapy is designed to stimulate collagen synthesis, maturation and strength.

Diagnosis of tendinosis

1. History

Pain often arises insidiously and may or may not follow one specific activity. Pain will often be present initially, e.g. Achilles pain or stiffness on first arising, and will then disappear on warming up.

Pain may increase after cooling down.

If ignored the pain may become more constant, eventually affecting

daily activities and even become painful at rest.

Patients will often present with an identified area of tenderness and be partially informed via the internet.

2. Physical examination

Swelling may be visible especially of the Achilles, but the site and degree of tenderness is important. Mild tenderness can be normal, especially over the lateral epicondyle of the elbow and the Achilles, but moderate and severe tenderness is significant.

The tenderness is usually decreased in tendinosis if the tendon is stretched. This is because the damaged tendon is deep in the tendon and by tightening more superficial fibres the tender region is protected; e.g. squeeze the Achilles relaxed in plantar

Box 1. Tendinopathy classification

1. Tendinosis
2. Paratenonitis
3. Insertional tendinopathy (enthesopathy)
4. Tendon tears/ruptures

Box 2. Tendons affected by tendinosis

1. Achilles Tendon
2. Patellar Tendon
3. Shoulder rotator cuff and biceps
4. Extensor carpi radialis brevis = tennis elbow
5. Common flexor tendon at elbow = golfers' elbow
6. Tibialis posterior

flexion and then under tension with the foot dorsiflexed. The tenderness will be maximal in plantar flexion. The patella tendon tenderness is maximised with the knee extended and relaxed as opposed to the knee being flexed with the tendon tightened up.

Pain will usually be increased by the patient contracting the muscle of the affected tendon, e.g. a knee dip or squat for the patella tendon, or resisted wrist extension for lateral epicondylitis, which is extensor carpi radialis brevis tendinosis.

3. Investigation

Ultrasound to assess the structural changes is indicated only when an acute onset may suggest a significant tear, or if the patient has failed a conservative programme of three months' duration.

Tendinopathies are well visualised by diagnostic ultrasound and it is relatively uncommon for expensive MRI to add to the diagnosis or management. One exception may be in the shoulder, where multiple pathology such as labral tears and instability may co-exist with rotator cuff tendon problems.

Management of tendinosis

- Patient education
- Assessing cause
- Unloading strategies and devices
- Medication
- Physical and other therapies
- Strengthening
- Surgery consideration.

1. Patient education

The patient needs to appreciate the time required for recovery. Patients who present with a short history (three to six weeks) may become pain free in two/three months, but those with months of symptoms will need six/nine months for full recovery. Tendons need to sustain loads of up to 15 times body weight. They have less than 15% of the oxygen uptake of muscle and require over 100 days to synthesize the main structural protein. Significantly damaged tendons therefore need months to recover. Those patients with

Box 3. Common misconceptions about tendinosis compared with evidence-based findings

Misconceptions	Evidence-based Findings
Self-limiting condition taking a few weeks to resolve.	Usually recalcitrant to treatment taking months to resolve. Tendon takes over 100 days to synthesize collagen, its main structural protein.
Imaging (ultrasound or MRI) can predict prognosis.	Imaging does not predict prognosis or alter management.
Cystic changes in tendons (seen on ultrasound) are indication for surgery.	Surgery should be guided by individual factors. Tendon changes are seen in asymptomatic patients.
Surgery provides rapid and total relief of symptoms.	After surgery return to sport takes four/six months and only 80–85% return to previous level.

the earliest and least severe symptoms are at risk as they may continue to do damaging activities without appropriate interventions.

2. Assessing causes

Tendon degeneration usually results from tendon overload and a failure of the normal adaptive response. Overload may be due to tensile or compressive forces. Equipment, techniques used and muscle imbalance will often contribute, e.g. a stiff tennis racquet, stroke technique faults and overuse in tennis elbow. Similarly tight calf muscles, unsupportive shoes and rapid increases in training may contribute to Achilles tendon damage. Identifying these causative and/or contributing factors is vital to effecting a long-term recovery.

3. Unloading strategies and devices

Reducing excessive loads in tendinitis will mean that the patient needs to avoid high load, explosive activities. Controlled activity is important to encourage collagen remodelling and strengthening, and the strengthening programme will be described later.

Devices such as braces for elbow tendinosis, heel lifts for Achilles

problems and patellar tendon taping or bracing are examples of devices to unload the commonly affected tendons.

4. Medication

The degenerative rather than inflammatory nature of tendinosis dictates that anti-inflammatory medication has little role in treating the problem. However at times it is surprising how

much symptomatic relief can be experienced by patients. In some areas there may be para-tenonitis present and in the shoulder particularly impingement with subacromial bursitis may be present. There is also acceptance that some substance involved in necrosis may induce some sec-

ondary inflammatory reaction. Therefore it is reasonable to trial 10–14 days of anti-inflammatories to ascertain the response. The analgesic affect may also help patients if they are getting rest pain and in lower limb tendinosis the analgesia obtained may help the patient attain a normal gait and allow them to do the strengthening programme described later.

Corticosteroids are regarded as deleterious to collagen structure and it is not appropriate to inject around the main weight-bearing tendons, i.e.

Tendons have less than 15% of the oxygen uptake of muscle and require over 100 days to synthesize the main structural protein. Significantly damaged tendons therefore need months to recover

the Achilles and patella tendon. Occasionally an older patient not involved in explosive activities may be injected, but only around the tendon, not into the tendon substance.

However, the upper limb tendinosis areas can be injected if conservative treatment is not helping after eight to 10 weeks. The main benefit, especially in the tennis elbow patient, is more rapid relief of symptoms, although long-term follow-up suggests most patients are the same at 12 months whether injected or not. The reason corticosteroid injection works is not understood, but that does not matter to the builder, painter or butcher who cannot work and has a friend 'cured' by cortisone. It is vital to educate the patient that a steroid injection is only part of the treatment. Stopping the aggravating activity, strengthening the muscle-tendon unit once pain settles, and gradually returning to high loads perhaps with load-reducing devices such as an elbow brace are all part of a successful treatment regime associated with a corticosteroid injection.

5. Physical and other therapies

The common modalities include cryotherapy, electrotherapy, acupuncture, cross friction and massage.

Cryotherapy or icing two/three times daily can be useful. Ice has a vasoconstrictive effect and may decrease extravasation of protein and blood from the new capillaries. It is also useful for analgesia and is usually prescribed as 15–20 mins x three per day. One method I like is ice massage using a disposable plastic

Box 4. Diagnostic tip for tendinosis

Putting the tendon under stretch or tension will **decrease** tenderness in tendinosis.

For example: compare tendons of the Achilles with the foot in plantar flexion and then dorsiflexion.

Box 5. Eccentric programme

- Three sets of 15 repetitions twice daily for three months.
- Start slowly and increase speed of drop over 4/52.
- Concentric component is done by unaffected leg.
- Do not stop because of mild-moderate pain.
- Add weight (e.g. 5–10kg) to progress strength gains.

cup filled with water and left in the freezer. As the water freezes it expands and there is a knob of ice protruding from the top of the cup. This is then held upside down while massaging the tendon. Vaseline or baby oil is used for lubrication.

The various electrotherapies such as ultrasound, laser, high voltage galvanic stimulation have been shown in the laboratory and some animal studies to stimulate collagen synthesis, but there is no proof of their efficacy from good clinical studies.

Massage also stimulates fibroblast activity in rat tendon and cross frictions may have a role in tendinosis. Massage of muscles involved in the strengthening programmes will help prevent muscle stiffness.

Acupuncture has analgesic effects that can be helpful, but no direct affect on tendon healing has been shown.

Recently some reports have indicated that Shock Wave therapy may have a place in stimulating a healing

response. Also some success has been reported at least with symptomatic relief by injecting the neovascular region of the tendinosis with sclerosing agents.³

6. Strengthening

If there is one section of this paper to study and use in practice, this is it. There are an increasing number of studies showing that a programme of eccentric strengthening produces tendon remodelling, reduction in thickening and reverses the MRI/ultrasound changes seen in tendinosis.^{4,5,6,7}

The specific eccentric component of the programme is vital, but other parts of the kinetic change also need attention. For example, in tennis elbow the shoulder girdle muscle balance needs assessment and rehabilitation if necessary. Similarly in the lower limb, alignment of the leg both static and dynamic needs to be assessed, and strengthening of the pelvic girdle muscles, the thigh and lower leg muscles is required.

Figure 1 and 2. Achilles tendon technique



Figure 3. Patella tendon technique



A general description of the strengthening programme is shown below. In most cases this will take a minimum of three months and it is important to communicate this to the patient to avoid potential frustration for all concerned.

Strengthening programme

- Low resistance endurance
- Low resistance speed endurance
- High resistance endurance
- Sport specific strengthening.

The main programme for the specific eccentric exercises involves three sets of 15 repetitions done twice a day for three months (i.e. 90 repetitions per day). The patient needs to be encouraged to continue despite mild to moderate pain and the often slow resolution of symptoms.

Icing may be needed to help symptoms after the sessions but in most cases the pain settles within a few minutes.

Figures 1–3 show the positions for the Achilles tendon and patella tendon programme.

The Achilles programme is done with the affected foot on the edge of the step, allowing the heel to drop and then be stopped by the calf muscles acting eccentrically.

The movement is initially done slowly and speed of the drop is gradually increased over the first three/four weeks. The concentric component – i.e. rising back up to plantar flexion – is done by the unaffected leg. As progress is made weight, e.g. a back pack, can be added to increase the load and therefore the strengthening effect.

The patella tendon programme is done with the foot on 25° decline board or wedge. This reduces the calf muscle's work forcing the quadriceps and patella tendon to do more eccentric work. Some patients, if very uncomfortable, may need to start with the foot on a flat surface but should progress to the decline position.

The tennis elbow programme is performed with the elbow straight and dropping into flexion and catching near the end of the flexion range. A weight 0.5kg initially and progressing to 2–3kg should be attempted, similarly the speed of the drop should also be gradually increased.

The shoulder rotator cuff tendinosis, which is often asymptomatic until a sudden insult causes a tear, can also be treated with an appropriate strengthening programme, as can the groin adductor problems.

It is almost always the domain of a physiotherapist to supervise the patient on a weekly or fortnightly basis. This ensures that the patient has the technique correct and enables the physiotherapist to add the other exercises needed to correct any muscle imbalances (weaknesses or inflexibility) in the affected limb. If the patient reports back to you that the physiotherapist is using electrotherapy and not prescribing strengthening exercises then a call to the physiotherapist is appropriate.

Surgery considerations

Surgery is recommended only after a guided, thorough, conservative programme has failed. Patients need to be aware that while relief of symp-

toms is gained in over 90% of patients, return to previous high-level activities may be only 75–80%. The return to high-level sport will usually take at least six months and often up to 12 months.

The surgical technique has classically been an open tenotomy with excision of necrotic tissue and longitudinal incisions made to induce tendon healing.

Recently, arthroscopic techniques and even ultrasound guided multiple longitudinal incisions are now being trialled. Often more conservative surgical approaches include dry needling of the tendon to induce a healing response and injecting the patient's tendon with their own blood to produce the same effect.

The rehabilitation post-operatively is vital for good outcomes and indeed the surgeon's results may be directly proportional to the quality of rehabilitation programme. This is also true for complete tendon ruptures such as Achilles ruptures.

Summary

The vast majority of patients who present with tendon pain will have degenerative changes in the tendon, possibly complicated by a partial tear.

A conservative programme of at least three months duration supervised by an experienced rehabilitation physiotherapist should precede any surgical approach.

The less common paratenonitis problems affecting tibialis anterior or the wrist tendons are appropriately treated with NSAIDs, ice, restricted activity and have a good prognosis.

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