ATHLETE'S EDGE
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Achilles Tendinopathy:
Current Concepts in Treatment and Rehabilitation

The Achilles tendon is the **largest and strongest tendon** in the human body and was named after a mythologic Greek warrior who was seemingly indestructible.

A tendon is a tough cord that attaches muscles to bones. The Achilles tendon attaches the **calf muscles** (gastrocnemius and soleus) to the **heel** (calcaneus). The tendon is covered by a thin sheath (paratendon sheath) which enhances the ability of the tendon to glide up and down.

The Achilles tendon is responsible for plantar flexion (i.e. the same movement that occurs when you press on the gas pedal) and therefore is important for activities such as **walking, running, jumping, and dancing**. During these movements there is a repetitive lengthening and shortening of the Achilles tendon complex.

The Achilles tendon is **prone to injury** because it is used for walking and in many sports.

In addition, there is an area of the tendon that has a poor blood supply that further diminishes with age. As a result the tendon is less resilient to repetitive small injuries and is more likely to become irritated, degenerated or to rupture.

Tendinopathy is the preferred term used to describe various tendon pathologies or overuse injuries of the Achilles tendon. The condition was previously called **Achilles tendinitis** as it was once thought to be an inflammatory condition. However, recent evidence proves that it is not.

Causes of Tendinopathies

Injury to Achilles tendon occurs when the load applied to the tendon over a period of time or during a single episode, exceeds the ability of the tendon to withstand that load. Factors that may predispose to Achilles tendinopathy include:

- Years of running
- Change of surface
- Increase in activity (distance, speed, gradient)
- Decrease in recovery time between sessions
- Change of footwear
- Poor foot wear
- Excessive pronation (turning out of foot)
- Calf weakness
- Genetic predisposition
- Poor calf muscle flexibility
- Decreased range of motion

Thus, this condition should be referred to **Achilles tendinopathy.** (See below)

In athletes, Achilles tendinopathy is a common overuse injury. It affects joggers, tennis, squash and soccer players as well as others who participate in a **running, jogging or walking activities**. However, recent research indicates it also occurs in people who are not physically active. It can occur in both men and women of all ages, but especially in "middle aged" men (35-55 years).

"Achilles Tendinopathy" Vs. "Achilles Tendinitis"

The exact aetiology of tendinopathies is not known. Some researchers believe that it is a degenerative lesion and/or a failed healing response. Research indicates that there maybe a loss of normal fiber structure within the tendon and collagen disarray. Abnormal vasculature is also thought to play a role.

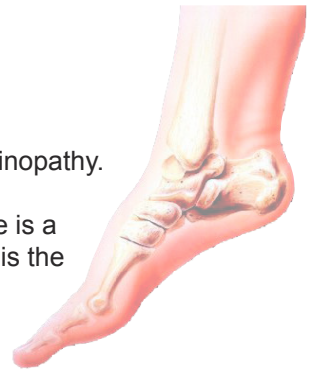
As discussed in the article above, "Achilles tendinitis" is not actually an inflammatory condition as once thought. A Canadian researcher, Karim Khan, from UBC, has been instrumental in reviewing the research and evidence that demonstrates that the pain and symptoms from "tendinitis" is not caused by inflammation, but breakdown and degeneration of tendon cells that is known as "tendinosis".

It follows then, that the traditional treatment for this problem — which was aimed at decreasing inflammation (e.g. NSAID medication, physiotherapy modalities, rest, etc) needs to be updated. This issue summarizes an updated approach to the treatment of Achilles tendinopathy as described by a Swedish sports medicine specialist Dr. Hakan Alfredson. Lastly a brand new topical treatment using a Nitro patch is introduced.

Signs & Symptoms

An overuse tendinopathy may result in the gradual development of symptoms — the patient typically complains of morning stiffness and pain after increasing their activity level. Walking or the application of heat generally diminishes the pain. In most cases, pain decreases during a training session, however, it recurs several hours afterwards.

Treatment Options



Many types of treatment have been proposed for treating tendinopathy. Developing an effective treatment for tendinopathies poses a significant problem for health care professionals because there is a lack of consensus of what causes tendinopathies. Hence, this is the reason why treatment plans have changed over the years. This newsletter will discuss treatment options currently recommended, including:

- **Eccentric training**
- **NSAIDS (Non-Steroidal Anti-Inflammatory Drugs)**
- **Physiotherapy • Massage Therapy**
- **Orthotics, Shoe Selection and Splinting**
- **Topical Glycerol Trinitate (Nitro-Dur)**

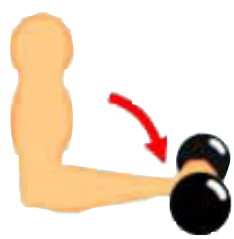
Dr. Hakan Alfredson is a sports medicine specialist from Umea, Sweden. He is a pioneer in the latest research on treating Achilles tendon injury. He first described this type of exercise program in 1998. It has now become known as the "Alfredson Painful Heel-Drop Protocol."

Dr. Alfredson's findings was inspired by the work of Canadians Dr. Sandra Curwin and Dr. William Stanish. In 1984 they established the term eccentric training as therapy for tendon injuries. From this base, Alfredson and colleagues made some modifications to this original program.

Eccentric Exercise

New evidence points towards the use of **eccentric exercise strengthening programs** as part of the strength training in rehabilitation, specifically in the treatment of tendinopathy of the Achilles tendon.

Eccentric movements are often defined as those exercise movements **involving the lengthening of muscle fibers.** For example, an eccentric contraction occurs with the downward movement of a dumbbell in a biceps curl.



Eccentric exercise training in tendinopathy has been applied since the 1980's. The original research that looked at the effectiveness of eccentric exercise on Achilles Tendinosis was published by Dr. Hakan Alfredson (see box) and colleagues in 1998. The results from this pioneering study were very promising.

Their research demonstrated **the positive effects of 12 weeks of eccentric training** in 15 recreational athletes. Prior to the study, 15 athletes had a diagnosis of chronic Achilles tendinosis (degenerative changes) despite conventional treatment (rest, NSAIDS, changes of shoes or orthoses, physical therapy and ordinary training programs).

These athletes also had Achilles tendon pain, thus not allowing for running activity. They also had significantly lower muscle strength on the injured side compared to the uninjured side. After the 12 weeks of eccentric training, all patients were back to their pre-injury running activity. **Calf muscle strength increased significantly** and did not differ significantly from that of the non-injured side. There was also a significant **decrease in pain during activity after treatment**. All patients were satisfied and **no patient had to be treated surgically.**

There was also a comparison group of 15 recreational athletes with the same diagnosis and a long duration of symptoms who were treated conventionally (as described above).

The conventional treatment was not successful and all patients in the conventional group were eventually treated surgically.

How Good Is This Evidence?

Research is still very new in this area of eccentric training. A small number of studies have been published, however many have problems with their study design (e.g. small number of subjects, lack of randomization, combination with other treatments, etc.). Therefore, although the clinical benefits of eccentric exercise cannot be fully determined at this time, the overall trend from published research suggests that it has positive effects for patients with tendinopathy.

How Does Eccentric Exercise Help?

It is not clear why eccentric overload training produces beneficial effects for patients. However, there are several possible explanations, but none have yet been proven.

Eccentric exercise may counteract the failed healing response thought to cause tendinopathies, by promoting collagen fibre cross linkage formation within the tendon. This may facilitate tendon remodelling. Another theory, is that stretching of the tendon from eccentric training may result in lengthening of the muscle-tendon unit resulting in less strain during ankle joint motion.

The effects of loading the muscle-tendon unit might result in hypertrophy (increased size) and increased tensile strength in the tendon. Loading that is repetitive and lengthening of the muscle-tendon unit may also improve the capacity of the musculotendinous unit to effectively absorb-load. Other research suggests that it may affect the vasculature and nerves in the tendon. More research is needed to determine the specific pain relieving results seen with eccentric exercise.

Eccentric Training Model

There are two eccentric exercises:

Exercise #1 – Gastrocnemius Drop
Begin with the heel raised and the knee fully extended (no bending of the leg). Lower the heel so that the foot is in parallel with the ground. (Figure A & B)

Exercise #2 – Soleus Drop
Begin with the heel raised and knee flexed to 45 degrees (knee should be bent). Lower the heel so that the foot is in parallel with the ground. (Figure C & D)

Initially, these exercises will be completed without any weight. The "loading" will consist of the body weight. Stand with entire body weight on the injured leg and use the uninjured leg to get back to the start position.

After the exercise can be done without experiencing any minor pain or discomfort, increase the "load" by adding weight (progressively add up to 60 Kg).

Add weight: Weight can be added by putting weights in a backpack. (Figure E)

• Complete 3 sets of 15 reps of each exercise (3 X 15 repetitions).

• This should be done
2 times daily
7 days/week
For 12 weeks

Remember ...
Use your uninjured leg to get back to the start position.

• The repetitions should be completed at slow speed.

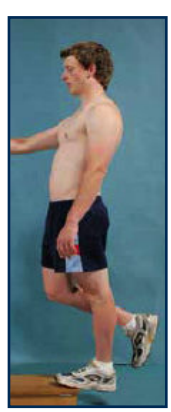
"No Pain No Gain"

When performed properly, this exercise program is going to **cause some tendon and muscle soreness**, especially during the first one to two weeks. Studies have shown that it is a safe training program with no risk of new injuries.

Please STOP the program and contact your physician or physiotherapist if you experience significant pain or discomfort.

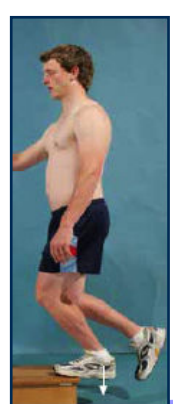
A

B



C

D



E

Achilles Tendinopathy ... More treatments

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NSAIDS (Non-Steroidal Anti- Inflammatory Drugs)

NSAIDS are used to reduce inflammation. A common example is Advil (ibuprofen). In the past, NSAIDS were part of the standard treatment regime. However, because new evidence reports that tendinopathy is no longer thought to be inflammatory in nature, the use of NSAIDS is controversial. Still their ability to treat pain means they may still play a role in the treatment of tendinopathy.

Physiotherapy and Massage Therapy

Physiotherapists will treat an Achilles tendinopathy with an initial, thorough physical and biomechanical assessment. Treatment can include using modalities like ultrasound, TENS and interferential current. Correcting any biomechanical deficiency and providing an individualized stretching and strengthening program is important. Massage therapists provide not only local treatment (ice, heat, frictions, stretching) but also treat muscle groups that surround the achilles (e.g. gastrocnemius, soleus, tibialis posterior).

Orthotics , Shoe Selection, and Splinting

Custom foot orthotics, combined with appropriate footwear can help biomenchanically correct malaligment of the lower extremity (e.g. gait overpronation). Proper biomechanics can take some of the load and stress away from the injured Achilles tendon. A "night splint" that can keep the foot and ankle in a position of dorsiflexion (e.g. keep the ankle at right angle) will offer a constant stretch to the calf and Achilles tendon. Patients can wear this while sleeping, and the splint reduces the stiffness and pain that commonly occurs the first few steps out of bed in the morning.

Topical Glyceryl Trinitrate/Nitric Oxide

There is new evidence that the use of nitric oxide (NO) commercially available as a glyceryl trinitrate patch (Nitro-Dur) applied locally to tendons may enhance the clinical recovery from a tendinopathy. You may have heard of nitro patches used previously to improve the blood supply to the heart for patients with angina.

How does the Glyceryl Trinitrate Work?

The mechanism by which glyceryl trinitrate/nitric oxide may work is not yet known. Glyceryl trinitrate/nitric oxide is likely important in a number of processes, including local blood flow and host defence. It may play a role in collagen synthesis and pain modulation. Currently, it has been proven that glyceryl trinitrate/nitric oxide is important during tendon healing.

What is the evidence?

Recent research has demonstrated that topical glyceryl trinitrate/ nitric oxide is effective in reducing pain, tenderness, strength, and improving clinical outcomes significantly in patients suffering from Achilles tendinopathy. These improvements are in addition to the effects of current best practice in tendon rehabilitation.

Research into effectiveness of treating other tendinopathies with glyceryl trinitrate/nitric oxide has also been proven effective.

Are there any side effects?

Recent research reports that there are no irreversible side effects with topical glyceryl trinitrate/ nitric oxide. There is a low side effect profile. Headache is the main side effect reported in the current research. Therefore, your physician may prescribe another medication to help with headaches if they occur as a side effect. Other side effects that were reported included rash at the application site, an increase in tinnitus (ringing in ears), increased sweating, facial flushing and a perception of apprehension.

Please advise your physician of any medications that you are currently taking because they can interfere with the nitro patch.

Medical Disclaimer
The information contained in this newsletter is for educational purposes and does not replace the advice, diagnosis or treatment provided by a physician or therapist. Should you have any health-related questions, please call WSM or consult your physician.

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