Novel Physiotherapies

Alfredson, J Nov Physiother 2014, 4:3
http://dx.doi.org/10.4172/2165-7025.1000213

Mini Review Open Access

Good Results with Painful Eccentric Calf Muscle Training for Patients with Painful Midportion Achilles Tendinosis-Implications for New Treatments

Håkan Alfredson*

Department of Surgical and Perioperative Science, Sports Medicine Unit, Umeå University, SE-90187 Umeå, Sweden

***Corresponding author:** Håkan Alfredson, Department of Surgical and Perioperative Science, Sports Medicine Unit, Umeå University, SE-90187 Umeå, Sweden, Tel: +46702288441; Fax: +4690135692; E-mail: hakan.alfredson@idrott.umu.se

Rec date: Jan 17, 2014; **Acc date:** May 27, 2014; **Pub date:** May 30, 2014

Abstract

Chronic painful tendons were previously considered to be treated with more or less pain-free rehabilitation exercises. These tendons were considered "degenerative and weak", and should be handled carefully. The concept of painful eccentric loading for the chronic painful midportion Achilles was started by a co-incidence, and the successful clinical results were unexpected. This is a short review about painful eccentric training-the Umeå model- and how the results of this treatment model broke the ice for new research, research findings providing a basis for inventions of new successful treatment methods.

Keywords: Achilles tendinosis; Immunohistochemical analyses; Achilles

Background

In 1995 I suffered from midportion Achilles tendinosis on the left side. Ultrasound examination showed a thickened Achilles midportion (11 mm) with structural abnormalities located on the ventral side of the tendon. I was a recreational runner and couldn´t run because of severe tendon pain. Conservative management with rest and alternative training for 3-4 months was without effect on the painful condition. At that time, on our clinic patients with this condition were treated with open surgery (central longitudinal tenotomy, excision of macroscopically abnormal tendon tissue), followed by immobilization in a cast for 6 weeks and altogether a 4-6 months rehabilitation period. The chief at our clinic, Professor Ronny Lorentzon, refused to operate my Achilles because at that time I was needed in the daily clinical work. Instead I had to look for an alternative non-surgical method, and found the proposal raised by Curwin and Stanish, saying that eccentric training should be included in the treatment of chronic tendon conditions. I tried the eccentric exercises over a step, and found these exercises very painful to perform. The pain actually got worse during the first week of training, but then it subsided and I could add more load before it again was painful to perform the exercises. Interestingly, I found that I gradually could load more and more, and after althogether about 6 weeks I was more or less pain-free and could go back to light jogging. The good results achieved with this painful treatment method on my own Achilles was the start of our research on eccentric training as a treatment model for patients with chronic painful midportion Achilles tendinosis. "If Professor Lorentzon had not refused to operate my Achilles, we would never have started this research".

Painful Eccentric Calf Muscle Training

Our group designed an eccentric training regimen to be tried on patients suffering from chronic painful midportion Achilles tendinosis, and at the waiting list for surgical treatment. First, a pilot study on 15 patients was done [1]. The training program included eccentric training over a step-3x15 reps with straight and flexed knee performed 2 times/day, 7 days/week, for 3 months. Very unexpected, all patients were satisfied with the treatment, and didn´t want to have surgery. After one year, one patient had regained pain symptoms and this patient was surgically treated. All the other 14 patients were still satisfied and active in Achilles tendon loading activities at 10 year telephone follow-ups. The results of this pilot study were much better than we ever had expected, and because there were no complications like partial or total ruptures, despite this relatively tendon demanding type of treatment, we were not worried to go on and use the method in larger patient groups. After this pilot study we performed more studies on the effects of painful eccentric training for patients with chronic painful midportion Achilles tendinosis [2,3]. Overall the results were very good, with around 80% satisfied and pain-free patients. However, it was obvious that high level athletes, especially spike shoe runners and jumpers, had less good results with this treatment. Also, we found it to be of significant importance to establish that the patients had a correct diagnosis before this treatment was instituted. A partial rupture has to be excluded, because eccentric training on a patient with a partial rupture can cause a worsening, possibly a lengthening of the Achilles tendon, a condition that is very difficult to treat. An interesting observation was that in the successfully treated patients the tendon thickness decreased over time, and the structure looked more normal sonographically [4,5]. Interestingly, it seems that eccentric calf muscle training has a potential to remodel, and possible also regenerate, the tendinosis tendon. The ultrasound follow-up findings, together with the tolerated high eccentric loads, show that the tendinosis tendon is not a so-called degenerative and weak tendon. It might very well instead be a strong tendon? The new concept of painful eccentric loading of chronic painful tendons created a worldwide high interest, and for physiotherapists this was a new and potentially very helpful tool for treatment of this difficult condition. The good results achieved from our research group were re-produced by several groups in different countries.

New Research

The successful results using painful eccentric training as treatment for the chronic painful midportion Achilles were not expected, and

more or less against previous thinking on treatment of chronic painful tendons. To try to better understand the pain mechanisms involved in the chronic painful midportion Achilles extensive research was started.

Using ultrasound+Doppler examinations we found high blood flow inside and outside ventral side in chronic painful midportion Achilles tendinosis tendons, but not in normal tendons [6]. In a following study ultrasound+Doppler-guided biopsies was taken from the region with high blood flow inside and outside the Achilles midportion, and immunohistochemical analyses of these biopsies showed nerves in close relation to blood vessels outside the tendon, but very few nerves inside the tendon [7]. Interestingly, there were mainly sympathetic, but also sensory, nerves [8]. Following ultrasound+Doppler-guided injections of small volumes of the local anaestetic xylocain +Adrenaline, targeting the regions with high blood flow outside the tendon, temporarily cured the tendon pain [7].

Ultrasound+Doppler-guided Sclerosing Polidocanol Injections

Based on our new research findings, a new treatment method was invented-ultrasound+Doppler-guided injections of the sclerosing substance polidocanol, targeting the regions with high blood flow outside the tendon. This type of treatment showed good clinical results in pilot studies and in a randomized placebo-controlled study [9,10]. Following ultrasound+Doppler follow-ups showed decreased tendon thickness and improved structure over time [11], showing a high potential in the soft tissues outside the ventral side of the Achilles tendon. The limitations with ultrasound+Doppler-guided polidocanol injections are that it is technically demanding, having a relatively long learning curve, and that multiple [2,3] injection treatments are needed for a good clinical result.

Ultrasound+Doppler-guided Mini-surgical Scraping

Recently, a mini surgical scraping treatment was invented. Guided by the ultrasound+Doppler findings a minor surgical procedure, done in local anaestesia, were the ventral side of the tendon was scraped in the regions with high blood flow and nerves, was performed [12]. This is a one stage and more radical approach than the polidocanol injection treatment. Because there is no intra-tendinous trauma, a relatively fast (4-6 weeks) rehabilitation can be used. The clinical results are very good without any side major effects, and the use of this method has been increased to large numbers of patients on different activity levels, also including professional athletes [13]. Interestingly, the sometimes nearby located plantaris tendon occasionally seems to be involved in the painful condition. These patients have medial side pain, and often respond poor to eccentric training. Therefore, the surgical technique was modified to always use a medial approach for accurate evaluation of a possible interference between the plantaris and Achilles tendons [14,15]. Also using this method, ultrasound +Doppler follow-ups have shown a decreased tendon thickness and a more normal structure over time (submitted).

Conclusions

Because of a co-incidence our research group started to use painful eccentric calf muscle training for patients with chronic painful midportion Achilles tendinopathy, and today this method is used by physiotherapists and doctors with good clinical results all over the world. The good clinical results started intensive research on the basic biology, and today we know that there are no (or very few) nerves inside the chronic painful tendon, instead the nerves are found outside the ventral side of the tendon. This knowledge has led to the invention of new mini-invasive treatment methods used outside the tendon, to be used on the patients that have a poor result of eccentric training. Today, with the use of these methods, there is a very good chance to be cured from chronic painful midportion Achilles tendinosis.

References

1. Alfredson H, Pietilä T, Jonsson P, Lorentzon R (1998) Heavy-load eccentric calf muscle training for the treatment of chronic Achilles tendinosis. Am J Sports Med 26: 360-366.
2. Mafi N, Lorentzon R, Alfredson H (2001) Superior short-term results with eccentric calf muscle training compared to concentric training in a randomized prospective multicenter study on patients with chronic Achilles tendinosis. Knee Surg Sports Traumatol Arthrosc 9: 42-47.
3. Fahlström M, Jonsson P, Lorentzon R, Alfredson H (2003) Chronic Achilles tendon pain treated with eccentric calf-muscle training. Knee Surg Sports Traumatol Arthrosc 11: 327-333.
4. Ohberg L, Lorentzon R, Alfredson H (2004) Eccentric training in patients with chronic Achilles tendinosis: normalised tendon structure and decreased thickness at follow up. Br J Sports Med 38: 8-11.
5. Ohberg L, Alfredson H (2004) Effects on neovascularisation behind the good results with eccentric training in chronic mid-portion Achilles tendinosis? Knee Surg Sports Traumatol Arthrosc 12: 465-470.
6. Ohberg L, Lorentzon R, Alfredson H (2001) Neovascularisation in Achilles tendons with painful tendinosis but not in normal tendons: an ultrasonographic investigation. Knee Surg Sports Traumatol Arthrosc 9: 233-238.
7. Alfredson H, Öhberg L. Forsgren S (2003) Is vasculo-neural ingrowth the cause of pain in chronic Achilles tendinosis?-An investigation using ultrasonogrphy and colour doppler, immunohistochemistry, and diagnostic injections. Knee Surg, Sports Traumatol, Arthrosc 11:334-338.
8. Andersson G, Danielson P, Alfredson H, Forsgren S (2007) Nerve-related characteristics of ventral paratendinous tissue in chronic Achilles tendinosis. Knee Surg Sports Traumatol Arthrosc 15: 1272-1279.
9. Ohberg L, Alfredson H (2002) Ultrasound guided sclerosis of neovessels in painful chronic Achilles tendinosis: pilot study of a new treatment. Br J Sports Med 36: 173-175.
10. Alfredson H, Ohberg L (2005) Sclerosing injections to areas of neo-vascularisation reduce pain in chronic Achilles tendinopathy: a double-blind randomised controlled trial. Knee Surg Sports Traumatol Arthrosc 13: 338-344.
11. Lind B, Ohberg L, Alfredson H (2006) Sclerosing polidocanol injections in mid-portion Achilles tendinosis: remaining good clinical results and decreased tendon thickness at 2-year follow-up. Knee Surg Sports Traumatol Arthrosc 14: 1327-1332.
12. Alfredson H, Ohberg L, Zeisig E, Lorentzon R (2007) Treatment of midportion Achilles tendinosis: similar clinical results with US and CD-guided surgery outside the tendon and sclerosing polidocanol injections. Knee Surg Sports Traumatol Arthrosc 15: 1504-1509.
13. Alfredson H (2011) Ultrasound and Doppler-guided mini-surgery to treat midportion Achilles tendinosis: results of a large material and a randomised study comparing two scraping techniques. Br J Sports Med 45: 407-410.
14. Alfredson H (2011) Midportion Achilles tendinosis and the plantaris tendon. Br J Sports Med 45: 1023-1025.
15. Spang C, Alfredson H, Ferguson M, Roos B, Bagge J, et al. (2013) The plantaris tendon in association with midportion Achilles tendinosis-Tendinosis-like morphological features and presence of a non-neuronal cholinergic system. Histol Histopathol 28: 623-632.