

Pain Enduring Eccentric Exercise for the Treatment of Chronic Achilles Tendinopathy

Claire Dixon
Laureen Holloway
Janice Meier
Nick Lo
Teresa Lee

Supervisors: W Darlene Reid Ph.D. & Sunita Mathur Ph.D.

Outline

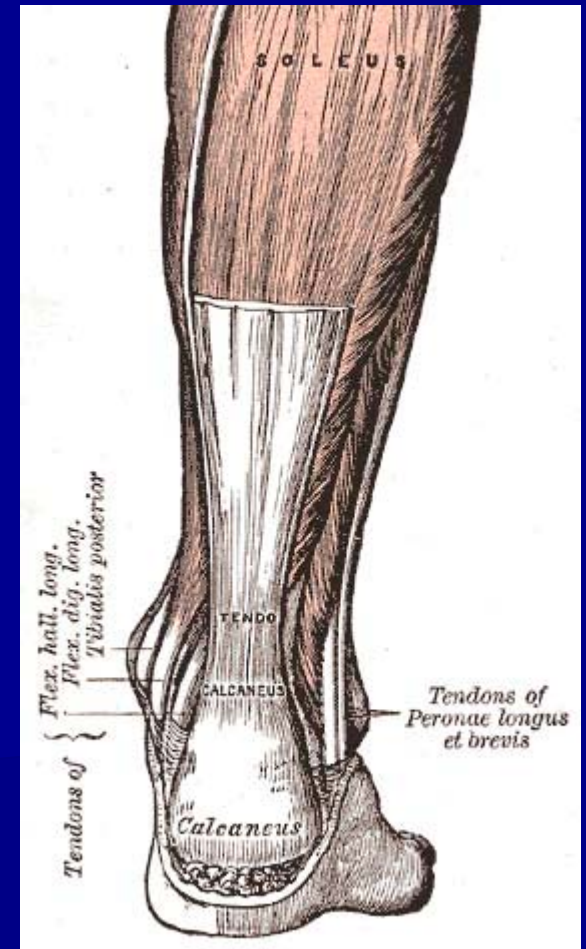
- Introduction
- Methods
- Results
- Discussion
- Recent Research

Why we chose this topic

- Increased interest in pain enduring eccentric exercise as a focus of treatment for chronic Achilles tendinopathy
- Closer examination of the literature needed due to ethical concerns of pushing patients through pain
- Update on current body of knowledge and consensus on treatment

Introduction to the Topic

Achilles Tendinopathy (Tendinosis, Partial Rupture, Tendinitis)



Background

- One of the most common injuries in runners and other sports participants (Kvist, 1994); also seen in sedentary individuals (Afredson & Lorentzon, 2000)
- Risk factors, but no definitively known etiology

Predisposing factors

- Weak plantar flexors, larger inversion angle on touchdown, over-pronation (McCrory et al., 1999)
- Decreased dorsiflexion range (Kaufmann et al., 1999)
- Increase in level of activity (Cook et al., 2002)
- Running- inconsistent stretching, many years of running (McCrory et al., 1999)
- Poor footwear (Hess et al., 1989)

Pathology

- Irregular tendon structure with collagen degeneration and increased glycosaminoglycans (Alfredson & Lorentzon, 2003)
- Neovascularization in area, with increase in glutamate and lactate levels (Ohberg & Alfredson, 2004)
- No inflammatory cells (Ohberg & Alfredson, 2004)

Signs and Symptoms

- Mild or severe pain
- Tenderness on palpation, nodule?
- Decreased strength
- Decreased range of movement
- Decreased function
- Pain may be gradual or more sudden;
most often associated w/tendon loading

Conventional treatments

- Joint and soft tissue mobilizations
- Concentric exercises
- Stretching exercises
- Ultrasound
- Ice
- Iontophoresis
- Laser
- Friction massage
- Splinting
- Orthotics
- NSAIDs
- Corticosteroids
- Activity modification
- Rest
- Surgery

Pivotal Article

- Increased interest in 1998 with Alfredson et al's study out of Sweden
- Initiated a series of studies

Methods



Chronic Achilles Tendinosis

Operational definition

- Chronic- greater than 3 months
- Degenerative changes 2-7cm above the calcaneal tendon



Literature Search

- Electronic databases, reference lists, experts in the field, hand searches, gray literature searches
- Results:
 - 4 RCT's
 - 4 Cohorts
- Not a lot of information, relatively new topic

Article Selection

259 articles found initially



- X 154 not Achilles
- X 32 not primary research
- X 21 not eccentric intervention
- X 20 inappropriate outcome measures
- X 15 surgical patients
- X 3 did not push through pain
- X 2 subjects not human
- X 2 in a language other than English
- X 2 same study, different journal!



✓ 8 appropriate articles

Quality Assessment and Levels of Evidence

- Adapted Megens and Harris Scale
 - Scores of <5 were 'Weak'
 - Scores of 5, 6, 7 were 'Moderate'
 - Scores of 8, 9, 10 were 'Strong'
- Sackett's Levels of Evidence
 - 1 to 5 scale

Results



Subjects

- Age: Range 19-77 yrs, average 47 yrs
- Sex: average ratio of M:F 21:10
- Location:
 - mid-portion 7/8 papers
 - mixed mid and insertional 1/8 papers
- Duration of Symptoms:
 - Average 16.4 months
- Activity levels:
 - Wide variety but all appeared to be active prior to injury

Method of Diagnosis

- Clinical exam and ultrasonography
 - 5/8 studies
- Clinical exam and MRI
 - 1/8 studies
- Clinical exam alone
 - 2/8 studies



Intervention

- Alfredson et al 1998 eccentric protocol:
 - 3 sets of 15 reps eccentric heel drops 2x/day, 7days/week for 12 weeks
 - Work through non-disabling pain
 - Progressively add weight



Intervention

- 6/8 studies used the Alfredson eccentric protocol
- 1/8 used a variation of the Alfredson protocol
 - gradually increased reps to reduce soreness
- 1/8 used a 12 week series of primarily eccentric exercises

'Control' Groups

- Conventional Treatments:
 - Surgery
 - Pain free concentric exercises
 - Pain free stretching
 - Night splint
 - Night splint with eccentric exercises
- Others:
 - Insertional tendinopathies
 - Contralateral tendon
- No control!



Outcome Measures

- Pain outcome measures:
 - VAS
 - Questionnaires
 - Subjective expression of pain
- Function outcome measures:
 - Ability to return to pre-injury activity
 - Jumping height
 - Plantar flexion ROM at the ankle
 - Calf muscle strength
 - Global assessment



Results: Pain

- At 12 weeks:
 - In 5/8 studies pain was significantly improved by an average of 42%
 - In 2/8 studies a significant difference was not apparent at 12 weeks, but was apparent at 6 weeks, 6 months and 1 year
 - In 1/8 studies pain was only qualitatively recorded; after an average of 3.8 years it did not interfere with subjects' pre-injury activities

Results: Pain

- In 5/8 studies improvements were seen in both the eccentric and control groups
- Results were on average 34% better in the eccentric groups
- 2/8 studies showed no difference between the groups; both of these studies involved stretching in the control group

Results: Function

- At 12 weeks function improved an average of 42% from baseline in the eccentric groups
- The control groups also improved an average of 33% from baseline

Quality Assessment & Levels of Evidence

	Quality	Levels of Evidence
Alfredson et al 1998	4/10	4
Mafi et al 2001	3.5/10	2b
Silbernagel et al 2001	10/10	2b
Fahlstrom et al 2003	3.5/10	4
Ohberg et al 2004	3.5/10	4
Roos et al. 2004	8.5/10	2b
Shalabi et al. 2004	3.5/10	4
Norregaard et al 2006	8/10	2b

Quality Assessment & Levels of Evidence

- Sackett's Levels of Evidence
 - 4 low quality RCTs (Level 2b)
 - 4 prospective cohort studies (Level 4)
 - 100% interrater agreement
- Adapted Megens and Harris Scale
 - 3 studies considered strong
 - 5 studies considered weak
 - Average score of all 8 studies was 5.56/10
 - 100% interrater agreement

Discussion

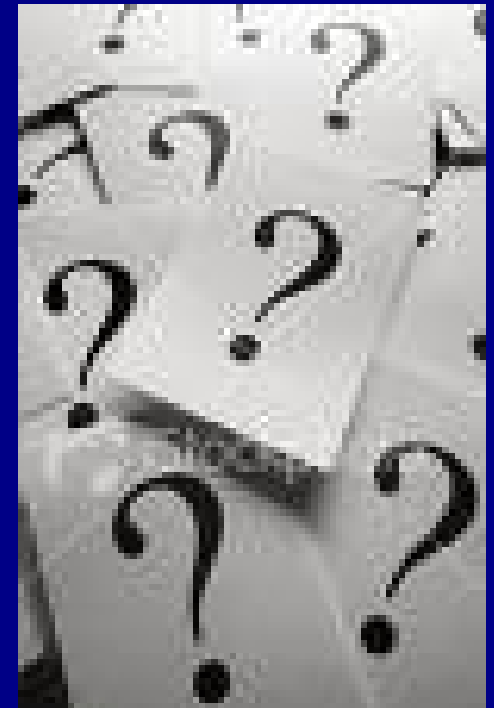


General Critique

- Most studies NOT randomized, controlled or blinded - relatively low quality
- Many studies out of the same centers
- Varying methods of diagnosis
- Variety of 'control' groups
- Variety of outcome measures used

Discussion points

- Mid-portion vs. insertional tendinopathy
 - In 2/8 studies, eccentric exercise protocol LESS effective on insertional tendinopathy
 - Why?
 - More studies needed to confirm



Discussion points

- Disproportionately higher number of men to women
- Is conventional treatment significantly less effective? What about stretching?
- Ethical responsibility?

Conclusions

- Shift towards heavy-load eccentric exercise as a therapeutic intervention
- The evidence base on the whole is persuasive
- Suggesting that pain enduring eccentric exercise is superior to conventional treatments



Clinical Recommendations

- Initial conservative, non-surgical treatment recommended
- As it stands evidence is not strong enough to ethically allow us, as practitioners, to encourage patients to push through pain

Update

- Sayana & Maffuli, 2006
- Determine effectiveness of eccentric exercise protocol for non-athletic patients with achilles tendinosis
- Prospective study, 34 patients

Update

- Langberg et al, 2006
- Proposed mechanism for why heavy load eccentric exercise is effective
- Suggest link between collagen metabolism and recovery from tendon injury

New Research

- VISA-A questionnaire as outcome measure (Victorian Institute of Sports Assessment – Achilles)
- Reliable and valid
- Available in Swedish and English
- Can be used in research, and clinically

References

- Kvist M. Achilles tendon injuries in athletes. *Sports Med* 1994;18:173-201.
- Cook JL, Khan KM, Purdam C. Achilles tendinopathy. *Man Ther* 2002;7:121-130.
- Alfredson H, Lorentzon R. Chronic achilles tendinosis: Recommendations for treatment and prevention. *Sports Med* 2000;29:135-146.
- Maffulli N, Kader D. Tendinopathy of tendo achillis. *J Bone Joint Surg Br* 2002;84:1-8.
- McCrory JL, Martin DF, Lowery RB. Etiologic factors associated with achilles tendinitis in runners. *Med Sci Sports Exerc* 1999;31:1374-1381.
- Kaufman KR, Brodine SK, Shaffer RA, et al. The effect of foot structure and range of motion on musculoskeletal overuse injuries. *Am J Sports Med* 1999;27:585-593.
- Brukner P, Khan K. *Clinical Sports Medicine*. 4th ed. Sydney, Australia: McGraw-Hill; 2001.
- Alfredson, H. Chronic midportion Achilles tendinopathy: an update on research and treatment. *Clin Sports Med* 2003;22:727-741.
- Alfredson H, Pietila T, Jonsson P, Lorentzon R. Heavy-load eccentric calf muscle training for the treatment of chronic achilles tendinosis. *Am J Sports Med* 1998;26:360-366.
- Baechle TR, Earle RW. *Essentials of Strength Training and Conditioning*. 2nd ed. Champaign: Human Kinetics; 2000.
- Centre for Evidence-Based Medicine. Levels of Evidence and Grades of Recommendation. Available at: http://www.cebm.net/levels_of_evidence.asp. Accessed June 20, 2006.

References

- Medlicott MS, Harris SR. A systematic review of the effectiveness of exercise, manual therapy, electrotherapy, relaxation training, and biofeedback in the management of temporomandibular disorder. *Phys Ther* 2006; 86(7):955-973.
- Mafi N, Lorentzon R, Alfredson H. 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* 2001;9:42-47.
- Silbernagel KG, Thomee R, Thomee P, Karlsson J. Eccentric overload training for patients with chronic achilles tendon pain - a randomized controlled study with reliability testing of the evaluation methods. *Scand J Med Sci Sports* 2001;11:197-206.
- Fahlstrom M, Jonsson P, Lorentzon R, Alfredson H. Chronic achilles tendon pain treated with eccentric calf-muscle training. *Knee Surg Sports Traumatol Arthrosc* 2003;11:327-333.
- Ohberg L, Lorentzon R, Alfredson H. Eccentric training in patients with chronic Achilles tendinosis: normalised tendon structure and decreased thickness at follow up. *Br J Sports Med* 2004;38:8-11.
- Roos E, Engstrom M, Lagerquist A, Soderberg B. Clinical improvement after 6 weeks of eccentric exercise in patients with mid-portion achilles tendinopathy - a randomized trial with 1 year follow-up. *Scand J Med Sci Sports* 2004;14:286-295.
- Shalabi A, Kristoffersen-Wilberg M, Svensson L. Eccentric training of the gastrocnemius-soleus complex in chronic achilles tendinopathy results in decreased tendon volume and intratendinous signal as evaluated by MRI. *Am J Sports Med* 2004;32:1286-1296.

References

- Norregaard J, Larsen CC, Bieler T, Langberg H. Eccentric exercise in treatment of Achilles tendinopathy [serial online] 2006;4:[17 screens]. Available from: <http://www.blackwell-synergy.com/doi/full/10.1111/j.1600-0838.2006.00545.x>. Accessed May 14, 2006.
- Maffulli N, Kenward MG, Testa V, Capasso G, Regine R, King JB. Clinical diagnosis of Achilles tendinopathy with tendinosis. *Clin J Sport Med* 2003;13(1):11-15.
- Khan KM, Forster BB, Robinson J, Cheong Y, Louis L, Maclean L, Taunton JE. Are ultrasound and magnetic resonance imaging of value in assessment of Achilles tendon disorders? A two year prospective study. *Br J Sports Med* 2003;37:149-153.
- Åström M, Gentz CF, Nilsson P, Rausing A, Sjöberg S, Westlin N. Imaging in chronic achilles tendinopathy: a comparison of ultrasonography, magnetic resonance imaging and surgical findings in 27 histologically verified cases. *Skeletal Radiol* 1996;25:615-620.
- Silbernagel KG, Thomeé R, Karlsson J. Cross-cultural adaptation of the VISA-A questionnaire, an index of clinical severity for patients with Achilles tendinopathy, with reliability, validity and structure evaluations. *BMC Musculoskelet Disord* 2005;6:12.
- Robinson JM, Cook JL, Purdam C, Visentini PJ, Ross J, Maffulli N, Taunton JE, Khan KM. The VISA-A questionnaire: a valid and reliable index of the clinical severity of Achilles tendinopathy. *Br J Sports Med* 2001;35(5):335-341.
- Sayana MK, Maffulli N. Eccentric calf muscle in non-athletic patients with Achilles tendinopathy. *J Sci Med Sport* 2006.
- Langberg H, Ellingsgaard H, Madsen T, Jansson J, Magnusson SP, Aagaard P, Kjaer M. Eccentric rehabilitation exercise increases peritendinous type I collagen synthesis in humans with Achilles tendinosis. *Scand J Med Sci Sports* 2006.

Thank you

