Interventions for treating acute and chronic Achilles tendinitis

(Review)

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ABSTRACT

Background
Achilles tendinitis is one of the most common of all sports injuries. There is no consensus on treatment.

Objectives
To assess the effectiveness of various treatment interventions for acute and chronic Achilles tendinitis in adults.

Search strategy
The Cochrane Musculoskeletal Injuries Group specialised register (December 2000), Cochrane Controlled Trials Register (The Cochrane Library Issue 4, 2000), MEDLINE (1966 to December 2000), EMBASE (1980 to 2001 wk 04), CINAHL (1982 to December 2000), and reference lists of identified trials were searched.

Selection criteria
Randomised or quasi-randomised trials of treatment interventions for acute and chronic Achilles tendinitis in adults. Studies focusing on pathological tendinitis were excluded. Excluded were those trials that compared different dosages of the same drug or drugs within the same class of drugs, for example different non-steroidal anti-inflammatory drugs (NSAIDs).

Data collection and analysis
Three reviewers independently assessed trial quality, by use of a ten item check list, and extracted data. Requests were sent for separate data for Achilles tendinitis patients in studies within trials of mixed patient populations. Where possible, quantitative analysis and limited pooling of data were undertaken.

Main results
Nine trials, involving 697 patients, met the inclusion criteria of the review. Methodological quality was adequate in most of the trials with regards to blinding but the assessment of outcome was incomplete and short-term.

There was weak but not robust evidence from three trials of a modest benefit of NSAIDs for the alleviation of acute symptoms. There was some weak evidence of no difference compared with no treatment of low dose heparin, heel pads, topical laser therapy and peritendonous steroid injection, but this could not be fully evaluated from the reports of four trials. The results of an experimental preparation of a calf-derived deproteinized haemodialysate, Actovegin, were promising but the severity of patient symptoms was questionable in the single small trial testing this comparison. The results of a comparison of glycosaminoglycan sulfate with a NSAID were inconclusive.

Authors’ conclusions
There is insufficient evidence from randomised controlled trials to determine which method of treatment is the most appropriate for the treatment of acute or chronic Achilles tendinitis. Further research is warranted.

SYNOPSIS

Not enough evidence about the best way to relieve a painful Achilles tendon
The Achilles tendon is at the back of the ankle. A swollen and painful Achilles tendon can result from a change in the type and intensity of activity. When severe, it is very painful to walk. Rest, restricted activity, drugs to relieve swelling and pain as well as wearing inserts in footwear are common treatments. Other remedies, including surgery, are used when the pain and swelling continue. The review of trials did not find enough evidence to show which methods of healing painful Achilles tendons are effective.

**BACKGROUND**

Overuse in a tendon has been defined as the situation where a tendon has been repeatedly strained until it is unable to withstand further loading, at which point damage occurs (Renstrom 1994). At a molecular level this is where the collagen cross-links begin to break. Owing to its structure and functional demands the Achilles tendon is extremely susceptible to acute and chronic injury.

Although there are specific causes for symptoms such as cholesterol deposits and seronegative arthropathies (e.g. ankylosing spondylitis) the majority of consultations occur in athletes. Indeed, Achilles tendinitis is one of the most common injuries in sport accounting for six to 17 per cent of all running injuries (Plattner 1988; Soma 1994; Myerson 1999; Alfredson 2000). It typically affects mature male athletes engaged in a high degree of running and jumping. Risk factors can be intrinsic, including deformities such as tibia vara, an overly pronated foot, tight or underdeveloped hamstrings, a high arched (cavus) foot, or extrinsic such as inadequate training shoes and training techniques.

Modalities exist to measure tendoachilles function and visualise the injured area such as electromyography (EMG) and magnetic resonance imaging (MRI). The diagnosis however is a clinical one, being made from a history of pain in the tendon and the examination findings of the cardinal signs of inflammation, i.e. swelling, warmth, tenderness and loss of function. Histological studies have shown a spectrum of inflammatory and other changes in both the tendon proper and in its surrounding sheath, the paratenon, ranging from inflammation in the surrounding tissue only to degeneration of the tendon proper with calcification, necrosis and rupture of some fibres (Leadbetter 1990).

The difference between acute and chronic tendinitis is shown by the rapidity of onset of symptoms and their response to pre-activity warming-up. In the acute situation, symptoms are of rapid onset but can be helped markedly, if not totally, by warming-up exercises. Chronic tendinitis is of more insidious onset and symptoms are not helped by the warm-up (Renstrom 1994).

Treatment regimes in both acute and chronic tendinitis are primarily conservative utilising rest, ice, non-steroidal anti-inflammatory drugs (NSAIDs), local steroid injections, alterations in training activity and specific rehabilitation programmes. Surgical debridement of the tendon and paratenon stripping may be carried out in refractory chronic cases.

For the purpose of this systematic review Achilles tendinitis will be defined according to the clinical criteria of pain and inflammation as described above. Other terms for the clinical picture described above have been used. These include tenonitis, paratenonitis, paratenonitis, paratendinitis, pretenonitis, tenovaginitis, tenosynovitis and tendinosis. These will all be included under Achilles tendinitis in this review if the clinical picture in RCTs using these terms is compatible with that described above.

**OBJECTIVES**

This review aims to evaluate clinically effective ways of managing acute and chronic Achilles tendinitis.

The specific null hypotheses stated in the protocol were:

a) There is no difference in outcome between any method of treatment, including rest, ice, non-steroidal anti-inflammatory drugs (NSAIDs), physical therapy, training advice, alteration of footwear or surgical intervention, compared with any other treatment, no treatment or placebo.

b) There is no difference in outcome between NSAID therapy given systemically and that given topically.

c) Surgical treatment gives no better outcome than a conservative regime.

d) Offering advice on alterations in training activity leads to no improvement in outcome compared with offering no such advice.

If there was evidence from this review that NSAIDs were effective in treating Achilles tendinitis then we envisaged a subsequent review including comparisons of NSAIDs administered by the same route.

**CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW**

**Types of studies**

Any randomised or quasi-randomised clinical trials of therapeutic interventions meeting the specifications below will be considered. Trials comparing one NSAID with another administered by the same route will be excluded as will those in which one dosage of a type of NSAID is compared with another.
**Types of participants**
Males and females who have been diagnosed clinically as having either acute or chronic Achilles tendinitis, as defined in the Background section, excluding those due to specific causes such as tumour, cholesterol deposition and seronegative arthropathies. Trials with mixed populations with less than five patients with Achilles tendinitis in each arm of the study were excluded. Also excluded were trials of mixed populations for which separate data for Achilles tendinitis patients could not be obtained.

**Types of intervention**
Any programme of treatment, including changes in training regime, conservative therapeutic (oral or topically administered drugs) or surgical, which has been utilised to treat acute and chronic Achilles tendinitis.

**Types of outcome measures**
Data for the following primary outcome measures were sought:
1. Return to pre-injury level of activity
2. Recurrent injury/symptoms
3. Pain (including on palpation)
4. Complications of interventions including tendon rupture

Data from other outcomes of clinical relevance, including validated functional outcome measures, were also sought and collected where available.

**SEARCH STRATEGY FOR IDENTIFICATION OF STUDIES**
See: Bone, Joint and Muscle Trauma Group search strategy

The search for trials was conducted in several stages and was concluded in December 2000.

A. The following subject specific searches were carried out:

The Cochrane Musculoskeletal Injuries Group’s specialised register was searched up to December 2000.

The Cochrane Controlled Trials Register (The Cochrane Library Issue 1, 1999 and Issue 4, 2000) was searched using the term “achilles”.

MEDLINE - SilverPlatter (1966-June 1999) was searched using the following subject specific search terms in conjunction with the first two sections of the optimal MEDLINE search strategy for randomised trials (Dickersin 1994):

1. explode ANKLE-INJURIES/
2. explode ATHLETIC-INJURIES/
3. explode SOFT-TISSUE-INJURIES/
4. explode SPRAINS-AND-STRAINS/
5. explode TENDON INJURIES/
6. (#1 or #2 or #3 or #4 or #5) and achilles
7. tendonitis or tendinitis
8. (achilles near (tendin?itis or paratend?nitis or tendinosis or tenosynovitis or ruptur*))
9. achillobursitis
10. (bursitis adj (tendo-achilles or retrocalcaneal))
11.(#6 or #7 or #8 or #9 or #10) and Level 1 of the Cochrane Optimal Strategy
12.(#6 or #7 or #8 or #9 or #10) and Level 2 of the Cochrane Optimal Strategy

EMBASE (1980 to 1997) and CINAHL (1982 to 1997) were searched using a modification of the above strategy.

We updated the search in MEDLINE - OVID WEB (1997 to December Week 4 2000) using the following revised strategy:
1. Achilles Tendon/
2. Tendinitis/
3. Tenosynovitis/
4. or/2-3
5. and/1,4
6. ((achilli#s or calcane$) adj5 (tend#nitis or tend#nosis or tend#nopathy or tenovaginitis or paratend#nitis or peritend#nitis or tenosynovitis)).tw.
7. ((tendo-achill#s or tendoachill#s or retrocalcaneal) adj bursitis).tw.
8. achillobursitis.tw.
9. or/6-8
10. or/5,9
11. Combined with Levels 1 and 2 of the Cochrane Optimal Trial Search Strategy

EMBASE - OVID WEB (1997 to 2001 week 04) and CINAHL - OVID WEB (1982 to December 2000) were also searched (see Table 01 and Table 02 for search strategies).

B. The bibliographies of all papers identified by these strategies were searched.

Papers outside the English language were considered if they could be translated.

**METHODS OF THE REVIEW**

Selecting trials for inclusion:

Eligible trials identified via the search strategy were scrutinised for consideration for the review by GM and HH. Trial inclusion was by consensus. Decisions of trial inclusion for mixed population trials with sufficient and identifiable numbers of Achilles tendinitis patients were deferred allowing for time for a reply to a request to the trialists for further information.

Assessment of methodological quality:

Methodological quality was independently assessed, without masking of the source and authorship of the trial reports, by three reviewers using a piloted, subject-specific modification of
the generic evaluation tool used by the Cochrane Musculoskeletal Injuries Group. Any disagreement was resolved by discussion. The scoring scheme for the ten aspects of trial validity covered by this tool plus brief notes of coding guidelines for selected items are given below:

A. Was the assigned treatment adequately concealed prior to allocation?
2 = method did not allow disclosure of assignment.
1 = small but possible chance of disclosure of assignment or unclear.
0 = quasi-randomised or open list/tables.

Cochrane code: Clearly Yes = A; Not sure = B; Clearly No = C (see Characteristics of Included Studies Table)

B. Were the outcomes of patients who withdrew described and included in the analysis (intention to treat)?
2 = withdrawals well described and accounted for in analysis.
1 = withdrawals described and analysis not possible, or no withdrawals inferred.
0 = no mention, inadequate mention, or obvious differences and no adjustment.

C. Were the outcome assessors blinded to treatment status?
2 = effective action taken to blind assessors.
1 = small or moderate chance of unblinding of assessors.
0 = not mentioned or not possible.

D. Were important baseline characteristics reported and comparable?
The principal confounders were considered to be: previous tendon rupture/tendinitis, current tendon injury, duration of symptoms /time from injury, level of activity, age and sex.
2 = good comparability of groups, or confounding adjusted for in analysis.
1 = confounding small; mentioned but not adjusted for.
0 = large potential for confounding, or not discussed.

E. Were the subjects blind to assignment status after allocation?
2 = effective action taken to blind subjects.
1 = small or moderate chance of unblinding of subjects.
0 = not possible, or not mentioned (unless double-blind), or possible but not done.

F. Were the treatment providers blind to assignment status?
2 = effective action taken to blind treatment providers.
1 = small or moderate chance of unblinding of treatment providers.
0 = not possible, or not mentioned (unless double-blind), or possible but not done.

G. Were care programmes, other than the trial options, identical? Examples of clinically important differences in other interventions which could act as active measures for treatment of Achilles tendinitis were considered to be: training programmes, drug therapy, advice on activity/immobilisation, use of orthotics / other devices, programme of rehabilitation, footwear.
2 = care programmes clearly identical.
1 = clear but trivial differences.
0 = not mentioned or clear and important differences in care programmes.

H. Were the inclusion and exclusion criteria clearly defined?
2 = clearly defined.
1 = inadequately defined.
0 = not defined.

I. Was follow-up systematic (active and at set times rather than passive, for example on a referral basis) and comprehensive with recording of at least the following four primary outcomes: return to pre-injury level of activity, recurrent injury/ symptoms, pain and complications.
2 = clearly systematic and comprehensive.
1 = probably systematic, three out of four outcomes (or their equivalents) measured.
0 = not systematic or not defined.

J. Was the duration of surveillance clinically important?
2 = optimal, (1 year and above).
1 = adequate, (3 months < 1 year).
0 = not defined, not adequate (< 3 months).

Categorical and overall quality scores were calculated in the anticipation of sensitivity analyses.

Data collection:
Data were independently extracted by all three reviewers using a pre-derived data extraction form and entered into RevMan by two reviewers (GM and HH). As indicated above, separate results for Achilles tendinitis patients in trials evaluating treatment for soft tissue injuries were requested. Trialists were also contacted when no quantitative results were presented.

Data synthesis:
Heterogeneity between comparable trials was tested using the chi-square test available in the RevMan software. For each study, relative risks and 95 per cent confidence limits were calculated for dichotomous outcomes, and mean differences and 95 per cent confidence intervals for continuous outcomes. Where appropriate, the results of comparable groups of trials were pooled using both fixed and random effects models, producing estimates of the combined relative risk and their 95% confidence intervals. Sensitivity and sub-group analyses mainly based on trial methodology, primarily allocation concealment and blinding, and the duration of symptoms (acute or chronic) were planned but not done.

In cross-over trials, the results from the first treatment period were used. However, the longer term outcomes of trial participants and, in particular, of “treatment failures” who were crossed-over were also noted.
DESCRIPTION OF STUDIES

Twenty-two randomised trials, identified via the search strategy, were put forward for consideration. Of these trials, nine were included, 12 excluded for reasons presented in the Characteristics of Excluded Trials Table and one mixed population trial is in Studies awaiting assessment. Ten excluded trials, eight of which investigated the use of non-steroidal anti-inflammatory drugs (NSAIDs), involved mixed populations of soft-tissue injuries. Requests to trialists for separate data for the five studies with an unknown number or at least five patients with Achilles tendinitis in each treatment group were unsuccessful. Similarly the requests for clarification of the results of one other excluded study evaluating the use of electrical stimulation (Chapman Jones 1996) and two included studies (DaCruz 1988; Lowden 1984) were unsuccessful. Separate information is being sought for 20 Achilles tendinitis patients in a recently identified NSAID trial currently in studies awaiting assessment.

Two studies were multicentre; one (Darre 1994) involving four army bases in Denmark and the other (Auclair 1989) involving eight centres in three countries (Belgium, France, Germany). Of the single centre trials, two (Jakobsen 1988; Larsen 1987) were based in Denmark; one (Pforringer 1994) in Germany; two in Sweden (Astrom 1992; Sundqvist 1987) and two in the UK (DaCruz 1988; Lowden 1984). A translation from Danish was obtained for Darre 1994. All were full journal reports.

The nine included trials involved a total of 697 patients with Achilles tendinitis. Each study defined Achilles tendinitis differently: Astrom 1992 in terms of painful lesions of the Achilles tendon or its insertion; Auclair 1989 in terms of intensity and duration of pain with activity and rest; DaCruz 1988, pain and its onset; Darre 1994, soreness following activity; Jakobsen 1988, crepitation on palpitation; Larsen 1987, pain on exercise and / or rest plus two other clinical symptoms (palpable tenderness; ankle dorsiflexion pain; swelling; crepitation); Pforringer 1994, symptoms of achillodynia supported by evidence of two millimetre thickening on ultrasound examination; and Sundqvist 1987, clinically diagnosed tendinitis, graded 0 to 5, based on a scale applied to assessment of ‘jumper’s knee’. Lowden 1984 offered no definition aside from the tendinitis being sports induced.

The patient groups generally involved active, mainly young and / or middle aged adults, with over 80 per cent being male. Over 400 patients were competitive or recreational athletes and 189 from three trials (Darre 1994; Jakobsen 1988; Larsen 1987) were army personnel. Trial participants in the three army trials were on average younger (around 20 years) than those in the other trials with more heterogeneous populations, with mean ages 28 to 35 years (range 11 to 59 years).

The duration of symptoms varied. Four trials set explicit upper limits, these being six months in Astrom 1992, 40 days in Auclair 1988, 48 hours in Jakobsen 1988 and three months in Pforringer 1994. Duration was not mentioned in Darre 1994, who only included soldiers with first time presentation of symptoms. There was no apparent limit in DaCruz 1988, Larsen 1987, Lowden 1984 or Sundqvist 1987. However, Larsen 1987 aimed to treat acute tendinitis and the mean duration of symptoms was around ten days.


Co-interventions were mainly activity restriction. Exercises, usually stretching, were prescribed in three trials (Astrom 1992; Lowden 1984; Sundqvist 1987) and ultrasound employed in DaCruz 1988 and Lowden 1984. All patients received heel supports in DaCruz 1988 and Pforringer 1994, but only those with ‘biomechanical errors’ received orthotic devices or were advised to use heel lifts in Sundqvist 1987. Optional footwear for indoor duties was prescribed to military conscripts in Larsen 1987. DaCruz 1988 also applied ice packs.

Further details of these nine trials are provided in the Characteristics of Included Studies Table.

METHODOLOGICAL QUALITY

On the whole, the methodological quality of the included trials was adequate with the majority attaining over half of the maximum overall total (20). The scores for the 10 aspects of quality assessment (items A to J) for the included trials are shown below.

A B C D E F G H I J Total Trial

1 1 2 2 2 2 2 1 0 1 4 Astrom 1992
1 0 1 1 2 2 2 1 0 1 0 Auclair 1989
1 0 2 0 1 2 2 1 1 1 2 DaCruz 1988
1 1 2 2 2 2 0 2 1 0 1 3 Darre 1994
1 1 0 2 1 2 2 1 0 1 2 Jakobsen 1988
2 1 2 2 2 2 2 1 0 1 6 Larsen 1987
1 1 2 0 0 2 1 1 0 8 Lowden 1984
2 1 0 1 2 2 2 1 0 1 3 Pforringer 1994
Eight of the trials, all placebo controlled, claimed to be double-blind. However, only three trials (Larsen 1987; Pförringer 1994; Sundqvist 1987) gave some details of their method of randomisation and / or adequate safeguards against unblinding; these were deemed sufficient to confirm allocation concealment (item A) in Larsen 1987 and Pförringer 1994.

No study attained a full score for intention to treat analysis (item B). This was mainly due to failing to provide full information for post-randomisation exclusions. The percentages of patients excluded from analysis ranged from probably zero per cent in Larsen 1987 and Pförringer 1994 to 22 per cent in DaCruz 1988.

The blinding of the outcome assessors (item C) was difficult to ascertain for most of the studies, but appeared to be so for four studies (DaCruz 1988; Darre 1994; Larsen 1987; Lowden 1984). In general we interpreted the use of the expression “double-blind” and placebo control to include blinding of trial participants (item E) and treatment providers (item F). However, the mention of adequate safeguards and / or explicit statements of participant and care-provider masking, were needed for a top score in these two items. Participant and care-provider blinding were not options for Lowden 1984.

Baseline data appeared equivalent (item D) in most studies but trials did not attain a top score where the absence of data for post-randomisation exclusions could have changed this result. Two trials scored zero; DaCruz 1988 due to insufficient data and Lowden 1984 because of an important difference in the duration of symptoms of the no treatment group compared with the two heel pads groups.

Identical care programmes (item G) other than the trial interventions were provided in all trials except Darre 1994 where it was likely but not mentioned. Details of the co-interventions are provided in the above section.

Only Lowden 1984 did not provide sufficient description of the trial inclusion / exclusion criteria; in particular, there was no definition of Achilles tendinitis.

Details of the times of follow-up of trial participants and outcome measures are provided in the Characteristics of Included Studies Table. Systematic follow-up (item I) at set times was reported in all trials. However, the measurement of outcome was considered to be fully comprehensive in that it recorded all four primary outcomes (see Types of outcome measures) in just one trial (Sundqvist 1987). The recording of recurrent injury / recurrent symptoms as opposed to recovery / residual symptoms is made possible by the longer follow-up period in the trial.

The length of follow-up (item J) was too short, to assess recovery and / or progression / recurrence of the condition, in all of the studies except Sundqvist 1987 where participants were followed-up for one year. With the exception of Larsen 1987 and Pförringer 1994, follow-up only covered the treatment period in the other six trials with inadequate length of follow-up. Follow-up was only for 10 days in Jakobsen 1988 where all cases were acute. Notably, Pförringer 1994, Astrom 1992 and Auclair 1989 all had follow-up of less than a month despite having patients with chronic symptoms in their studies.

Results

The outcomes reported in the nine trial reports are shown in the Characteristics of Included Studies Table. Only limited pooling of data was done; even in the trials testing NSAIDs there were few comparable data available. Usually, ill-defined or undefined assessments of overall therapeutic efficacy by patients or clinical examiners were considered only where trial results for primary outcomes were unavailable.

- Topical NSAID (Niflumic acid) versus placebo

In Auclair 1989, no baseline data were provided for the 16 (6.6%) participants excluded from the analyses for various reasons including non-compliance. However, all but five of these 16 participants were included in the analysis of adverse effects.

Similar proportions of patients in the two groups had returned to sport by the end of three weeks (non return: 25/114 versus 24/101; relative risk (RR) 0.92, 95% confidence interval (CI) 0.56 to 1.51). However, significantly fewer placebo group participants had attained their previous level of activity by then (63/114 versus 72/101; RR 0.78, 95% CI 0.63 to 0.95). An exploratory analysis (not shown) to investigate the robustness of this result in which the number of participants who were not active in sports were added to the denominators but not to the numerators resulted in a loss of statistical significance (63/117 versus 72/110; RR 0.82, 95% CI 0.66 to 1.02).

The difference between the two groups, in favour of the niflumic acid group, in the improvement of pain on palpation of the tendon, as assessed on a 100mm visual analogue scale, was statistically significant at one week (mean difference 11.20mm, 95% CI 1.25 to 21.15mm). However at this time, of those who reported pain on foot dorsiflexion, similar numbers in both groups reported that this was unchanged or had worsened (20/95 versus 23/92; RR 0.84, 95% CI 0.63 to 0.95). An exploratory analysis (not shown) to investigate the robustness of this result in which the number of participants who were not active in sports were added to the denominators but not to the numerators resulted in a loss of statistical significance (63/117 versus 72/110; RR 0.82, 95% CI 0.66 to 1.02).

A few patients reported complications in each group (5/123 versus 6/116); including one patient in the niflumic acid group who had to withdraw because of a skin reaction.

- Oral NSAID (piroxicam) versus placebo

Astrom 1992 reported that by the end of four weeks there was no difference between the groups in the number of patients who were better or worse. Slightly fewer patients taking piroxicam had not returned to normal activities (22/34 versus 26/33; RR 0.82; 95% CI 0.61 to 1.11; not significant), but the numbers who were judged...
as being unable to return to normal activities were the same (15 versus 15). Symptoms were unaltered or worse in nine patients in each group (9/34 versus 9/33). Two people in the piroxicam group had severe tenderness in the Achilles tendon at 28 days compared with four in the placebo group (RR 0.49; 95% CI 0.10 to 2.47). Precise figures could not be extracted from graphs of overall pain scores (on a 100mm visual analogue scale), range of ankle movement or swelling shown in the trial report. However there were no obvious differences in these parameters between the two groups.

No differences were reported between the two groups in medication or side effects (4/34 versus 4/33) which were mainly slight dyspeptic symptoms. No patient stopped treatment due to side-effects.

Separate data were not available for the 25 patients with Achilles tendinitis treated with piroxicam in Jakobsen 1988.

- **Oral NSAID (Tenoxicam) versus placebo**

Separate data for Achilles tendinitis patients for this comparison in Jakobsen 1988 were presented in a later report (Jakobsen 1989). Jakobsen 1988 evaluated “overall efficacy and tolerance” using a four point ordinal scale (excellent, good, moderate, bad) based on measurements of pain, tenderness, swelling, functional limitation and adverse reactions. There was no indication how this arbitrary scale was derived. Significantly fewer placebo group patients achieved a good or excellent rating by the time they ended the treatment at 10 days (moderate / poor outcome: 7/24 versus 11/16; RR 0.42, 95% CI 0.21 to 0.86). This result is no longer statistically significant if it is assumed that all six tenoxicam group patients excluded from the analyses because they failed to complete their treatment had a moderate or poor rating (RR 0.63, 95% CI 0.37 to 1.07).

Separate data for adverse effects of treatment, mainly epigastric, mild and transient, suffered by Achilles tendinitis patients were not provided. It was not possible to determine from the trial report whether the two patients who stopped tenoxicam due to transient epigastric discomfort were Achilles tendinitis patients.

- **Any NSAID administered by any route versus placebo**

Only limited pooling could be undertaken for this overall comparison. From the data from just two trials, significantly fewer placebo group patients had returned to normal activities by three to four weeks follow-up (85/148 (57%) versus 98/134 (73%); RR 0.79, 95% CI 0.66 to 0.93). However, this is no longer statistically significant when a worse case scenario analysis is conducted where it is assumed that all of the piroxicam patients excluded from the previous analysis had not returned to normal activities whereas all of the excluded placebo group patients had returned (RR 0.93; 95% CI 0.78 to 1.10). Similar numbers of patients suffered complications (9 versus 10).

- **Peritendonous steroid versus placebo**

DaCruz 1988 compared a peritendinous steroid (methyl prednisolone acetate) injection versus a placebo injection in 36 patients with Achilles paratendonitis. All patients received physiotherapy involving ice packs and ultrasound, and heel inserts but no enforced activity restriction. Patients who failed to respond to initial treatment were crossed-over to the other group at 12 weeks. Eight patients were excluded from the analysis, baseline data being given for only 28 patients, six of whom had bilateral symptoms. Most of the results were presented by tendon and not by patient. Similar numbers of patients (5 steroid versus 6 placebo), all with unilateral paratendonitis, in the two groups were deemed to have recovered fully (normal activity and no symptoms); all belonged to the group of patients with comparatively mild symptoms. The other 17 patients (23 tendons), who were considered to have failed treatment at 12 weeks, were crossed over into the opposite treatment. Ultimately all 17 patients were still considered treatment failures and 11 of these opted for surgical stripping of the paratendon. There was no rupture of Achilles tendon.

- **Low dose heparin versus placebo**

In a small study of 20 military conscripts with Achilles peratendonitis, Larsen 1987 compared subcutaneous low dose heparin, injected once a day for five consecutive days with placebo injections. At 15 days after the start of treatment, three heparin group patients and four placebo group patients had not resumed normal activities (full military training): RR 0.75; 95% CI 0.22 to 2.52. Larsen 1987 derived an overall “symptom score” from the non validated combination of weighted scores of six outcome measures including subjective pain, swelling and palpable crepitation. There was no statistically significant difference between the mean total symptom scores of the two groups (data in analysis derived from graph). Two patients in the heparin group reported bruises at the injection site (abdomen).

- **Actovegin injection versus placebo**

In their study of 60 patients with Achilles paratendonitis, Pfirringer 1994 reported statistically significantly fewer patients treated with Actovegin with severe pain on full athletic activity at three weeks (2/30 versus 18/30; RR 0.11; 95% CI 0.03 to 0.44). Reduction in pain was also significantly higher in the Actovegin group (mean difference: 39.4%; 95% CI 27.2% to 51.6%). No adverse drug effects were recorded within the three week follow-up period.

- **Topical laser therapy versus placebo**

Darre 1994 compared low-energy laser treatment with sham treatment in 98 patients. Nine patients were excluded for inadequate attendance. No data could be extracted from six charts showing stiffness, mean pain, redening, swelling, mean soreness and crepitation for each visit, up to 12 visits, presented in the trial report. Data were also unavailable for the other outcomes measured in this trial. Thus, it was not possible to test the reported lack of
statistically significant differences in outcome between the two groups.

- Heel pads versus no heel pads

Lowden 1984 compared two types of heel pads (Sorbothane and Molefoam) with a control group; all 39 patients with unilateral Achilles tendinitis received ultrasound. Six patients were excluded post randomisation due to inadequate follow-up data or "the necessity for a radical change in treatment". There was also an important difference in the duration of symptoms between the two heel pads groups (mean duration: 13.8 weeks and 15.2 weeks) and control group (4.2 weeks) which occurred despite randomisation. Thus even if the results indicating improvements in all three pain and activity had been available for quantitative analysis, the important difference in the duration of symptoms between the two groups, but greater in the control group, in swelling, tenderness, and activity had been available for quantitative analysis, the important difference in patients' characteristics, the exclusion of six patients and small sample size could have concealed a treatment benefit of heel pads.

- Glycosaminoglycan polysulfate (GAGPS) injection versus oral NSAID (indomethacin)

In a double placebo-controlled trial, Sundqvist 1987 compared local injections of GAGPS with oral indomethacin over a two week period in 60 patients with Achilles peritendinitis. All patients were prescribed activity restriction and simple stretching exercises. Orthotic devices were prescribed after two weeks for 39 of the 47 patients considered to have biomechanical problems, and the others recommended to use heel lifts. Patients who failed to respond to initial treatment or had sustained a recurrence were crossed-over to the other group at two weeks. The treatment group allocation was not identified for the excluded patient who had an initially undetected tendon rupture, nor for five of the 30 treatment failures at two weeks who declined to cross-over. These and the issue of carry-over of effects in cross-over trials have restricted the results presented in this review primarily to those at two weeks. These showed no difference between the two groups in the numbers with moderate or severe pain on palpation of the Achilles tendon (13/29 versus 7/30; RR 1.92, 95% CI 0.89 to 4.12); nor in those who were considered by the physician not to have benefited from the treatment (no benefit: 26/29 versus 27/29). Sundqvist 1987 reported that of the 25 patients that crossed over treatment, the eight patients taking indomethacin as a second treatment showed no improvement whereas six of the 17 patients taking GAGPS as the second treatment benefited. By one year, nine of the 25 patients were free, or nearly free, from symptoms whereas 13 had undergone surgery. Six patients receiving GAGPS reported side effects but none withdrew. Ten patients treated with indomethacin reported side effects and one patient stopped taking the tablets after eight days due to stomach pain.

Though it is plausible that the two drugs under test have different modes of action and may have different indications, the distinction between the outcome in acute and chronic cases drawn in Sundqvist 1987 was not evident at two weeks, nor was there sufficient evidence to show a difference in the sub-group of 25 patients who consented to cross-over.

**Discussion**

Achilles tendinitis is a complaint seen commonly in even only moderately athletic individuals and indeed can occur in fairly sedentary individuals. There is evidence that acute and chronic tendinitis are different clinical entities, probably requiring different therapeutic approaches (Renstrom 1994). Authors also differentiate between insertional symptoms relating to the junction of the tendon with the os calcis and non-insertional symptoms relating to the substance of the tendon (Myerson 1999). Currently there is no consensus on the best form of treatment for Achilles tendinitis, although an array of non-surgical interventions - NSAIDs, rest, stretching and strengthening exercises, heel lifts and other orthotic devices etc - are commonly applied in the first instance. Surgery is more often considered for refractory cases.

Eight of the nine trials included in this review each defined Achilles tendinitis in a different way, and the ninth trial (Lowden 1984) did not provide a definition. One study (Astrom 1992) specifically included insertional tendonitis and another (DaCruz 1988) specifically excluded it. There was great variation in the duration of symptoms and in their severity, where reported. Only acute tendinitis was included in Jakobsen 1988, and this may have applied in Darre 1994 and Larsen 1987. However, Auclair 1989 was likely to have included some patients with chronic tendinitis. The patient population in Sundqvist 1987 was divided into acute / subacute and sub-chronic / chronic categories based on symptoms under or greater than three months. Based on this criterion, the imbalance in the duration of symptoms between the heel pads groups and the control group in Lowden 1984 becomes more evident; the condition was predominantly chronic in heel pads group patients but almost exclusively acute in the control group.

The trial populations fell into two categories, young adult male army personnel and older mainly male adults who were mainly competitive or recreational athletes. This is a reasonably representative sample of people who are at greatest risk of Achilles tendinitis, although the actual numbers of trial participants were comparatively few, particularly as these were split between several comparisons.

Six of the eight trials comparing an intervention with no intervention, usually placebo, tested pharmaceutical interventions. Three of these, involving more than half the patients in this review, evaluated a NSAID. Just two investigated a non-pharmaceutical intervention and no trials investigated the effectiveness of surgery. The remaining trial (Sundqvist 1987) compared two pharmaceutical interventions. Thus we were only able to address, albeit in a limited way, one of the specific null hypotheses stated in the objectives.
The co-interventions adopted by the nine trials reflect the more commonly used interventions and usually included activity restriction. Probably all trials had comparable care programmes, aside from the interventions under test, including the use of these co-interventions but, in our assessment of this, it should be pointed out that some interventions, such as the optional footwear in Larsen 1987, were viewed as advice for use rather than actual use. Some trials also explicitly prohibited use of other interventions, sometimes applying these as exclusion criteria for trial entry (e.g. previous NSAID in Astrom 1992). Related to this is the carry-over of effects of treatments in cross-over trials in that the previous treatment could in part act as a co-intervention to the subsequent treatment.

Although the methodological quality of most of the nine trials was enhanced by being double-blind, the measurement and presentation of outcome were usually inadequate and intention to treat analysis was not confirmed in any trial report. As noted above, the short duration of follow-up of most trials was especially inappropriate. The cross-over nature of the two trials (DaCruz 1988; Sundqvist 1987) with longer follow-ups hampered the interpretation of their results after their cross-over times. Unit of analysis problems in DaCruz 1988 also made their trial results difficult to interpret. The final results of these two trials serve more to illustrate the poor outcome of many of the trial participants and the eventual recourse to surgical treatment in 24 (25 per cent of trial participants) of these. A recently published eight year follow-up prognosis study of patients originally treated non-operatively for Achilles tendinopathy of duration under six months reported a similar proportion of patients who had been operated on during the subsequent follow-up period (Paavola 2000).

None of the studies provided conclusive evidence of effect or of no effect. Separate and pooled data from three trials of NSAIDs showed, at best, a modest effect on acute symptoms in the short term, but these findings were not robust. Other data, including those for 151 patients in the excluded trials, from trials testing NSAIDs in mixed populations were not available for this review but are unlikely to help provide a conclusive result. The difficulties in interpretation of the results of DaCruz 1988 and Sundqvist 1987, and the important imbalance of patients’ characteristics in Lowden 1984 have already been referred to, but like the rest of these small trials aside from Pförringer 1994, there was insufficient robust evidence from these to conclude an absence of effect of the interventions under test. The highly favourable but short term and incomplete results for the group given injections of calf-derived deproteinized haemodilysate in Pförringer 1994 were “remarkable”, but need to be viewed with particular care. This preparation is not a standard and accepted treatment, and is not found in the British National Formulary and probably not in those of other countries. The fact that all patients were apparently able to perform full athletic activity, although some were stated as being in severe pain, raises some questions as to the severity of the condition in these patients.

**AUTHORS’ CONCLUSIONS**

**Implications for practice**

There is insufficient evidence from randomised controlled trials to determine which method of treatment is the most appropriate for the treatment of acute or chronic Achilles tendinitis.

**Implications for research**

The fact that a common condition such as Achilles tendinitis has no agreed treatment suggests that none is particularly effective in changing the natural history of the condition. The lack of consensus could also result from the variety of underlying clinical entities.

Further randomised trials are necessary to help determine the most appropriate treatment for this condition. As well as adhering to good quality methodology including the allocation concealment, assessor blinding and intention to treat analysis, any such trials should include a clear definition of the condition under test. Where appropriate, at minimum such trials should stratify by acute and chronic tendinitis and conduct and present sub-group analyses of these two groups. Stratification based on previous athletic activity would probably also be beneficial. A reasonable length of follow-up (at least one year or above) is required to detect recurrence and long term outcome. Validated scoring systems for symptoms such as pain and tenderness as well as activity levels should be used. The resource implications of any interventions should be recorded. Since large sample sizes are likely to be required to provide conclusive evidence for most of the interventions in current use, multicentre trials should be considered.

Although the best treatment for Achilles tendinitis may be found to involve a combination of various therapies, it is more manageable and remains appropriate to conduct trials of individual interventions. Trials of physical interventions are often more difficult to do well compared with pharmaceutical interventions; blinding to treatment may not be possible and standardisation of interventions is often less easy to achieve. However, there is a particular need for comprehensive evaluation of commonly used physical interventions such as heel inserts, other devices aimed at the correction of malalignment, and physiotherapy including stretching and strengthening exercises. Surgical intervention for severe chronic cases also requires evaluation; any such trials should consider a longer term follow-up.

**ACKNOWLEDGEMENTS**

The authors are grateful to Mrs Kathryn Quinn and Mr Graham Tytherleigh-Strong for their help with the first stages of this review. We thank Ms Leeann Morton for her careful checks of the review and Mrs Lesley Gillespie for developing search strategies and providing copies of recent studies. We thank Prof Bill Gillespie, Mr
Potential Conflict of Interest

None known

Sources of Support

External sources of support
- No sources of support supplied

Internal sources of support
- No sources of support supplied

References

References to studies included in this review

Astrom 1992 [published data only]

Auclair 1989 [published data only]

DaCruz 1988 [published data only]

Darre 1994 [published data only]

Jakobsen 1988 [published data only]


Larsen 1987 [published data only]

Lowdon 1984 [published data only]

Pfortinger 1994 [published data only]

Sundqvist 1987 [published data only]

References to studies excluded from this review

Akerman 1990
Akerman C, Forsskahl B. Topical indomethacin in overuse injuries in athletes. A randomized double-blind study comparing Elmetacin...

**Chapman Jones 1996**  

**Dreiser 1991**  

**Klaiman 1998**  

**Lopez 1997**  

**Memeo 1992**  

**Noble 1981**  

**Parrini 1992**  

**Pendergast 1998**  

**Russell 1991**  

**Siebert 1987**  

**Thorling 1990**  

**References to studies awaiting assessment**

**Benez 1996**  

**Additional references**

**Alfredson 2000**  

**Dickersin 1994**  

**Jakobsen 1989**  

**Leadbetter 1990**  

**Myerson 1999**  

**Paavola 2000**  

**Plattner 1988**  

**Renstrom 1994**  

**Soma 1994**  

* Indicates the major publication for the study
### Characteristics of included studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Double-blind randomised controlled trial; method not stated.</td>
<td>Malmo General Hospital, Malmo, Sweden.</td>
<td>28 day treatment period, first 14 days compulsory, second 14 days only if symptoms demanded.</td>
<td>Length of follow-up: 28 days; also assessed 1, 3, 7 and 14 days.</td>
</tr>
<tr>
<td></td>
<td>Assessor blinding: not mentioned, possible.</td>
<td>70 consecutive patients (50 males) aged 18-58 years, mean 35 years with acute or chronic unilateral painful lesion of Achilles tendon or its distal insertion.</td>
<td>a. 40mg of piroxicam for 2 days then 20mg thereafter</td>
<td>1. Overall assessment: symptoms and return to normal activities</td>
</tr>
<tr>
<td></td>
<td>Three patients were excluded for three different reasons.</td>
<td>52 involved in sport, more than half to competitive level.</td>
<td>b. Placebo in identical tablets.</td>
<td>2. Pain: use of 100mm visual analogue scale</td>
</tr>
<tr>
<td></td>
<td>Intention to treat not possible.</td>
<td>Exclusion criteria: bilateral symptoms, previous surgery, symptoms &gt;6 months, treatment with NSAID during previous 6 months, contraindications to use of NSAIDs.</td>
<td>All were encouraged to discontinue sport for 14 days and all had adjunct treatment of stretching and strengthening exercises.</td>
<td>3. Pain on palpation / tenderness: 5 point scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Completed: 34/33</td>
<td>6. Complications</td>
<td></td>
</tr>
</tbody>
</table>

#### Notes
- Allocation concealment: B

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Interventions for treating acute and chronic Achilles tendinitis (Review)
Characteristics of included studies (Continued)

| Interventions | 7 day treatment period, gel given 3 times a day after washing area with soap and water.  
| a. 5g sachet of 2.5% niflumic acid gel  
| b. 5g sachet of placebo gel  
| No other interventions in way of drugs or physiotherapy aids allowed. All patients stopped their sporting activities and rested the affected joint.  
| Assigned: ??  
| Completed: 117/110 (adverse effects: 123/116) |

| Outcomes | Length of follow-up: 21 days; also assessed at trial entry and 7 days.  
| 1. Pain on palpation of Achilles tendon: 100mm visual analogue scale  
| 2. Pain on dorsiflexion of foot: 5 point scale  
| 3. Resumption of sporting activity at 21 days and level of activity  
| 4. Complications |

| Study | DaCruz 1988 |
| Methods | Double-blind randomised controlled trial with a cross-over at 12 weeks for treatment failures; method not stated.  
| Assessor blinding: very likely - follow-up claimed to have been conducted on a “double-blind basis”.  
| Eight excluded from analysis (for non compliance)  
| No intention to treat analysis performed. |

| Participants | Accident and Emergency Dept, Leicester Royal Infirmary, UK  
| 36 patients presenting with pain and tenderness in Achilles tendon of gradual onset. No time limit. Of 28 patients with a mean age of 28 years (range 22 - 46 years) included in analysis, 18 were male, 6 had bilateral problem.  
| Exclusion criteria: pain at musculotendonous junction or calcaneal insertion. Previous treatment for condition.  
| Interventions | a. Locally administered peri-tendonous injection of 40mg methylprednisolone acetate (Depo Medrone) in 1ml 0.25% marcaine  
| b. Placebo injection of 2ml 0.25% marcaine.  
| All patients were asked to attend twice-weekly sessions of physiotherapy involving application of an ice pack and ultrasound. Heel insert provided at first attendance. No activity restriction - just within pain limit - but advice to run at half pace and on soft surface with heel insert.  
| Assigned: ??  
| Completed: 19/15 (19/15 tendons) |

| Outcomes | Length of follow-up: at least 12 weeks and probably longer (24 weeks?) for treatment failures; also assessed at 3, 6, 12 weeks.  
| 1. Overall pain score: use of a 10cm visual analogue scale  
| 2. Tenderness on a 4 point scale  
| 3. Activity level scale (25%, 50%, 75%, 100% of normal activity)  
| 4. Treatment failure: cross over at 12 weeks (pain, demonstrable tenderness, non return to normal activity)  
| 5. Ankle flexion (no data)  
| 6. Tendon rupture |

| Notes | Allocation concealment B |

| Study | Darre 1994 |
| Methods | Double-blind randomised controlled trial; method not stated.  
| Assessor blinding: yes, therapists were blinded. |
### Characteristics of included studies (Continued)

Nine patients excluded for inadequate attendance.
No intention to treat analysis performed.

### Participants

<table>
<thead>
<tr>
<th>Four Army bases, Zealand, Denmark.</th>
</tr>
</thead>
<tbody>
<tr>
<td>98 male army conscripts aged 18-22 years who presented with untreated tendinitis at one of four army bases.</td>
</tr>
<tr>
<td>Tendinitis was defined as a painful condition involving soreness in the Achilles tendon following physical exertion.</td>
</tr>
<tr>
<td>Exclusion criteria: previous history of Achilles tendinitis, wounds above the Achilles tendon or suspected rupture of the tendon.</td>
</tr>
</tbody>
</table>

### Interventions

<table>
<thead>
<tr>
<th>Five sessions a week, up to a maximum of 12 sessions were scheduled.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Low-energy laser (gallium-aluminum-arsenic laser). A maximum of 16 Joules, given in 4 Joule doses for each tender spot on the tendon, was applied each session.</td>
</tr>
<tr>
<td>b. Placebo group; inactive laser.</td>
</tr>
<tr>
<td>The laser group had an average of 7 consultations and the placebo group an average of 6, but the time scale is not clear.</td>
</tr>
<tr>
<td>During initial consultation the patients were excused any training which might put a strain on the tendon.</td>
</tr>
<tr>
<td>Assigned: ?/?</td>
</tr>
<tr>
<td>Completed: 46/43</td>
</tr>
</tbody>
</table>

### Outcomes

Length of follow-up: not stated, probably up to 3 weeks.
Patients were examined clinically at each session.
1. Pain: use of a 0-10 visual analogue scale was used to assess pain
2. Soreness: on a scale of 1 to 3
3. Swelling, reddening and crepitation were also noted
4. Fitness for duty
5. “Lasting improvement”: improvement maintained for 2 subsequent consultations following the initial noting of improvement

### Notes

Translation from Danish by MOD, UK
Allocation concealment: B

### Study: Jakobsen 1988

Methods
Double-blind randomised controlled trial, not stratified; method not stated.
Assessor blinding: not mentioned.
Six Achilles tendinitis patients who did not complete treatment were excluded.
No intention to treat analysis performed.

Participants
Military personnel at the Army base in Farum, Denmark.
71 Achilles tendinitis patients in a study of 212 patients with soft tissue injury. Achilles tendinitis was diagnosed by a 6 to 48 hour history of pain and tenderness with crepitation on palpation of the Achilles tendon. No age and sex breakdown given for Achilles tendinitis subgroup, but overall trial population was predominantly male (208/212) with a median age 20.5 years, range 19 - 29 years.
Exclusion criteria: < 15 years; pregnancy, nursing mothers, women of childbearing age, patients with a gastrointestinal ulcer or severe systemic disorder, patients under anticoagulant medication. Also patients with recurrent injuries, patients already being treated or had already participated in the trial.

Interventions
a. 20mg of oral tenoxicam
b. 20mg of oral piroxicam
c. Placebo
All single daily doses for ten days. Apart from rest, no other therapy.
Assigned: 30/25/16
Completed: 24/?/16

Outcomes
Length of follow-up: 10 days; also assessed at trial entry and 2 and 7 days.
Characteristics of included studies (Continued)

1. Evaluation of spontaneous pain, tenderness, pain on movement, swelling, functional limitation and adverse reactions were combined to give a level on a four point ordinal scale of excellent, good, moderate or bad. There was no indication given of the weighting of the components or the way in which the scale was calculated.
2. Adverse effects
3. Compliance

Notes
Separate data for the subgroup of tendinitis patients were provided in the 1989 publication. However only results for the tenoxicam and placebo groups were provided.

Allocation concealment

<table>
<thead>
<tr>
<th>Study</th>
<th>Larsen 1987</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods</td>
<td>Randomised packages supplied by manufacturer. Randomisation code not broken until end of the trial. Double-blind. Assessor blinding: not mentioned, but very likely. Intention to treat - likely but not stated.</td>
</tr>
<tr>
<td>Participants</td>
<td>Military conscripts undergoing training at Royal Life Guards (Sandholm Camp), Denmark. 20 with calcaneal (Achilles) peritendinitis. Criteria were pain on exercise and / or resting pain in heel, plus two of the following: tenderness to direct touch of tendon, pain on tendon extension, peritendinous swelling, palpable crepitation. All male with mean age 20 years. Exclusion criteria: Suspicion of other Achilles tendon problems (e.g. rupture, tendinitis); atopy; bleeding tendency; heart, liver, kidney diseases; hypertension; expectation of non-cooperation.</td>
</tr>
<tr>
<td>Interventions</td>
<td>Five subcutaneous injections into abdomen), given once daily over five days. a. Low dose heparin (5000IU) b. Placebo: saline. All conscripts exempted from usual training. “Indoor duties” with optional footwear prescribed for 7 days from first attendance. Assigned: 10/10 Completed: 10/10</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Length of follow-up: 15 days; also assessed at trial entry and 1, 2, 3, 4, 5 and 8 days. 1. Return to full military training 2. Total “symptom score” based on resting pain (0-10); exercise pain (0-10); tenderness to touch (0-3); pain at extension (0-3); palpable crepitation (0-3); swelling (0-3); 0 = worst in all outcome scales. 3. Adverse effects</td>
</tr>
</tbody>
</table>

Notes

<table>
<thead>
<tr>
<th>Study</th>
<th>Lowden 1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods</td>
<td>Randomised controlled trial; method not stated. Assessor blinding: blind observer (clinician and bioengineer). Six patients excluded due to inadequate follow-up or need for radical change in treatment. No intention to treat analysis performed.</td>
</tr>
<tr>
<td>Participants</td>
<td>Sports Injury Clinic, Nuffield Hospital, Oxford, UK. 39 consecutive patients attending clinic with unilateral tendinitis. No definition of tendinitis and no mention of length of symptoms. Of 33 patients, aged 11 to 59 years, 20 were male. Exclusion criteria: committed heel pad users, unable or unwilling to conform to trial requirements.</td>
</tr>
<tr>
<td>Interventions</td>
<td>a. Wedged Sorbothane heel pads provided for use in all sports and walking shoes for 2 months. (Standard heel pads) b. Soft sponge rubber pads of “Molefoam” of 15 mm thickness, used in same way. c. No pads. Control group.</td>
</tr>
</tbody>
</table>
### Characteristics of included studies (Continued)

All patients also received a course of ultrasound, and were instructed on standard stretching and strengthening exercises and encouraged to maintain a gradual and progressive program of training, provided no increase in symptoms.

**Assigned:** 30/30  
**Completed:** 30/30

#### Outcomes

- Length of follow-up: 2-23 days; also assessed at 3-4 and 9-10 days.
- Overall pain score 0 - 10 using dolorimeter
- Pain on tiptoes / squatting and local tenderness: 4 point scale
- Tolerance of athletic activity (no, mild, severe symptoms)
- Subjective assessment of treatment success
- Adverse effects

#### Notes

- The mean duration of symptoms in the control group (4.2 weeks) was significantly shorter than for the two heel pads groups (13.8 and 15.2 weeks).
- Allocation concealment: A

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### Study: Pforringer 1994

#### Methods

- Randomisation list of coded medications from manufacturer. Double-blind.
- Assessor blinding: not mentioned.
- Intention to treat - likely but not stated and all figures given as percentages.

#### Participants

- Staatliche Orthopadische Klinik, Munich, Germany.
- 60 patients, competitive and recreational athletes with clinical unilateral or bilateral Achillodynia; ultrasound used to measure swelling of tendon (2mm or more for inclusion). Mean age 33 years.
- Exclusion criteria: clinical symptoms over 3 months duration, age <18 years or >55 years, high performance athletes, intratendinous calcinosis or necrosis, Achilles bursitis, prior invasive treatment of Achillodynia, allergy to drug, diabetic, haemophiliac, acute infection, pregnancy, nursing mother, poor contraceptive record, participation in study in previous 30 days.

#### Interventions

- 20-23 day treatment period, 3 paratendinous injections at day 0, day 3-4 and day 9-10.
- a. 5ml haemodialysate ("Actovegin" from calf blood) injection and 5ml 1% mepivacaine.
- b. 5ml placebo injection and 5ml 1% mepivacaine.
- No other intervention allowed except soft heel pad.

**Assigned:** 30/30  
**Completed:** 30/30

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### Study: Sundqvist 1987

#### Methods

- Double-blind randomised controlled trial with a cross-over at 12 weeks for treatment failures; use of a random number code.
- Assessor blinding: not mentioned, possible.
- One patient excluded due to undetected tendon rupture. Five withdrawals at cross-over not split by treatment.
- No intention to treat analysis possible

#### Participants

- Dept Orthopaedic Surgery, Sabbatberg’s Hospital Stockholm, Sweden.
Characteristics of included studies (Continued)

60 recreational or competitive athletes with clinical symptoms of Achilles peritendinitis, both acute (<= 3 months) and chronic (> 3 months). Of 59 patients, mean age 33 years, 51 were male. Degree of severity of symptoms determined on 5 point scale.

Exclusion criteria: steroids (systemic or injection) or GAGPS within 40 days, NSAIDs within 7 days, pregnancy, nursing mothers, age <18 years, contraindications to use of either drug.

Interventions

Six treatments given over 14 days.
a. Glycosaminoglycan polysulfate (GAGPS) (50mg in 1ml) injection plus placebo tablets.
b. Indomethacin (3 x 50mg) tablets plus placebo injections.

All patients given stretching program and restricted training. 17/29 GAGPS patients and 22/30 indomethacin patients given orthotic device.

Assigned: 29/30 (ignoring exclusion)
Completed: 29/30 (1 year)

Outcomes

Length of follow-up: 1 year; also assessed at 2 and 4 weeks and 6 months. Clinician assessed at 2 and 4 weeks; patients questioned at two later times.
1. Pain on palpation: 4 point scale (2 and 4 weeks)
2. Overall therapeutic effect (based on symptoms) (2 and 4 weeks)
3. Recurrence/non-response
4. Complications/side effects

Notes

Five out of 30 patients who did not respond to treatment or had a recurrence at 2 weeks, did not cross-over.
Trial allocation remained double-blind at cross-over.

Allocation concealment  B

Dept = department
MOD = Ministry of Defence
NSAID = Non steroidal anti-inflammatory drug
OA = Osteoarthritis
RA = Rheumatoid arthritis
VAS = Visual analogue scale

Characteristics of excluded studies

Akermark 1990  There were 21 patients with Achilles tendinitis out of 70 athletes with overuse injuries in a trial comparing Elmetacin versus indomethacin versus placebo. Separate results for patients with Achilles tendinitis not reported. No response from trialist to letter sent April 1997.


Dreiser 1991  There were 10 patients with Achilles tendinitis out of 59 patients in a trial comparing niflumic acid gel versus placebo. Separate results for patients with Achilles tendinitis not reported. No response from trialist to letter sent June 1998.

Klaiman 1998  There were only five patients with Achilles tendinitis out of 50 patients with soft tissue injury, in a trial comparing phonophoresis with ultrasound.

Lopez 1997  There were 16 patients with Achilles tendinitis out of 73 patients with acute tendinitis in a trial comparing oral niflumic acid versus placebo. Separate results for patients with Achilles tendinitis not reported. No response from trialist to letter sent May 1998.

Memeo 1992  There were only two patients with Achilles tendinitis out of 100 patients with acute musculo-tendinous trauma, in a trial comparing a flurbiprofen patch versus placebo.
Characteristics of excluded studies (Continued)

Noble 1981  There were 12 patients with Achilles tendinitis out of 100 patients in a trial comparing fenbufen versus control. Separate results for patients with Achilles tendinitis not reported, however only four patients were in the treatment group.

Parrini 1992  There were 33 patients with tendinitis out of 169 patients in a trial comparing ketoprofen foam versus placebo. Number of patients with Achilles tendinitis not stated. No response from trialist to letter sent May 1998.

Penderghast 1998  There were no Achilles tendinitis patients in this trial.

Russell 1991  There were only six patients with Achilles tendinitis out of 200 outpatients with unilateral soft tissue injury, in a trial comparing piroxicam topical gel versus placebo.

Siebert 1987  The number of patients with Achilles tendinitis, if present, were not stated in a trial comparing low level laser versus placebo in 64 patients with mainly epicondylopathy of the arm.

Thorling 1990  There were 51 patients with tendinitis out of 120 patients in a trial comparing naproxen gel versus placebo. Number of patients with Achilles tendinitis not stated. No response from trialist to letter sent June 1998.

ADDITIONAL TABLES

Table 01. EMBASE (OVID WEB) search strategy

Search strategy

1. Achilles Tendon/
2. Tendinitis/
3. Tenosynovitis/
4. or/2-3
5. and/1,4
6. ((achill#s or calcane$) adj5 (tend#nitis or tend#nosis or tend#nopathy or tenovaginitis or paratend#nitis or peritend#nitis or tenosynovitis)).tw.
7. ((tendo-achill#s or tendoachill#s or retrocalcaneal) adj bursitis).tw.
8. achillobursitis.tw.
9. or/6-8
10. or/5,9
11. exp Randomized Controlled trial/
12. exp Double Blind Procedure/
13. exp Single Blind Procedure/
14. exp Crossover Procedure/
15. or/11-14
16. ((clinical or controlled or comparative or placebo or prospective$ or randomi#ed) adj3 (trial or study)).tw.
17. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw.
18. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw.
19. (cross?over$ or (cross adj1 over$)).tw.
20. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw.
21. or/16-20
22. or/15,21
23. limit 22 to human
24. and/10,23
Table 02. CINAHL (OVID WEB) search strategy

Search strategy

1. Achilles Tendinitis/
2. Achilles Tendon/
3. Tendinitis/
4. Tenosynovitis/
5. or/3-4
6. and/2,5
7. or/1,6
8. ((achill#s or calcane$) adj5 (tend#nitis or tend#nisis or tend#nopathy or tenovaginitis or paratend#nitis or peritend#nitis or tenosynovitis)).tw.
9. ((tendo-achill#s or tendoachill#s or retrocalcaneal) adj bursitis).tw.
10. achillobursitis.tw.
11. or/8-10
12. or/7,11
13. exp Clinical Trials/
14. exp Evaluation Research/
15. exp Comparative Studies/
16. exp Crossover Design/
17. clinical trial.pt.
18. or/13-17
19. ((clinical or controlled or comparative or placebo or prospective or randomi#ed) adj3 (trial or study)).tw.
20. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw.
21. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw.
22. (cross?over$ or (cross adj1 over$)).tw.
23. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw.
24. or/19-23
25. or/18,24
26. and/12,25

GRAPHS

Comparison 01. Topical NSAID (Niflumic acid) vs placebo

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Non return to previous sporting activity at 3 weeks</td>
<td>1</td>
<td>215</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.92 [0.56, 1.51]</td>
</tr>
<tr>
<td>02 Unable to return to previous level of sports activity at 3 weeks</td>
<td>1</td>
<td>215</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.78 [0.63, 0.95]</td>
</tr>
<tr>
<td>03 Improvement in pain on palpation at 7 days (100mm visual analogue scale)</td>
<td>1</td>
<td>227</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>11.20 [1.25, 21.15]</td>
</tr>
<tr>
<td>04 Pain unchanged/worse on ankle dorsiflexion at 7 days</td>
<td>1</td>
<td>187</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.84 [0.50, 1.43]</td>
</tr>
</tbody>
</table>
Comparison 02. Oral NSAID (Piroxicam) vs placebo

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-return to normal activities at 4 weeks</td>
<td>1</td>
<td>67</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.82 [0.61, 1.11]</td>
</tr>
<tr>
<td>Symptoms unaltered/worse at 4 weeks</td>
<td>1</td>
<td>67</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.97 [0.44, 2.14]</td>
</tr>
<tr>
<td>Severe tenderness on palpation at 4 weeks</td>
<td>1</td>
<td>67</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.49 [0.10, 2.47]</td>
</tr>
<tr>
<td>Side-effects - complications of treatment</td>
<td>1</td>
<td>67</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.97 [0.26, 3.56]</td>
</tr>
</tbody>
</table>

Comparison 03. Oral NSAID (Tenoxicam) vs placebo

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate/poor outcome (with exclusions) at 10 days</td>
<td>1</td>
<td>40</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.42 [0.21, 0.86]</td>
</tr>
<tr>
<td>Moderate/poor outcome (no exclusions)</td>
<td>1</td>
<td>46</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.63 [0.37, 1.07]</td>
</tr>
</tbody>
</table>

Comparison 04. NSAID vs placebo - pooled data

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-return to normal activities at 3-4 weeks</td>
<td>2</td>
<td>282</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.79 [0.66, 0.93]</td>
</tr>
<tr>
<td>Non-return to normal activities at 3-4 weeks (+ exclusions)</td>
<td>2</td>
<td>309</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.93 [0.78, 1.10]</td>
</tr>
<tr>
<td>Side effects - complications of treatment</td>
<td>2</td>
<td>306</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.86 [0.36, 2.04]</td>
</tr>
</tbody>
</table>

Comparison 05. Low dose heparin vs placebo

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non return to full activities at 15 days</td>
<td>1</td>
<td>20</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.75 [0.22, 2.52]</td>
</tr>
<tr>
<td>Overall symptom score (low scores worse) at 15 days</td>
<td>1</td>
<td>20</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-11.20 [-45.77, 23.37]</td>
</tr>
</tbody>
</table>
### Comparison 06. Actovegin (haemodialysate injection) vs placebo

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Severe pain on full athletic activity at 3 weeks</td>
<td>1</td>
<td>60</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.11 [0.03, 0.44]</td>
</tr>
<tr>
<td>02 Percentage pain reduction at 3 weeks</td>
<td>1</td>
<td>60</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>39.40 [27.22, 51.58]</td>
</tr>
</tbody>
</table>

### Comparison 07. Glycosaminoglycan vs indomethacin

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Moderate/severe pain on palpation at 2 weeks</td>
<td>1</td>
<td>59</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>1.92 [0.89, 4.12]</td>
</tr>
<tr>
<td>02 No or only slight therapeutic effect at 2 weeks</td>
<td>2</td>
<td>58</td>
<td>Relative Risk (Fixed) 95% CI</td>
<td>0.96 [0.83, 1.12]</td>
</tr>
</tbody>
</table>

### INDEX TERMS

**Medical Subject Headings (MeSH)**
- Achilles Tendon
- Acute Disease
- Anti-Inflammatory Agents, Non-Steroidal [therapeutic use]
- Chronic Disease
- Exercise Therapy
- Multicenter Studies
- Randomized Controlled Trials
- Tendinitis [rehabilitation]

**Medical MeSH check words**
- Female
- Humans
- Male

### COVER SHEET

**Title**
Interventions for treating acute and chronic Achilles tendinitis

**Authors**
McLauchlan GJ, Handoll HHG

**Contribution of author(s)**
George McLauchlan initiated the review and was the main author of the protocol. Both authors and Graham Tytherleigh-Strong reviewed the included trials. Kathryn Quinn performed the main search for trials before 1997, obtained copies of the trials and with Graham Tytherleigh-Strong helped with the early stages of the review as part of another project. Helen Handoll carried on the search for trials, compiled the reference lists and contacted trialists. George McLauchlan wrote the first draft of the review text. Helen Handoll and George McLauchlan compiled the analyses and included trials tables and wrote subsequent revisions of the text. Both authors contributed to the final manuscript and are the guarantors of this review.

**Issue protocol first published**
1996/3

**Review first published**
2001/2

**Date of most recent amendment**
30 December 2000

**What's New**
Information not supplied by author
Graphs and Other Tables

Fig. 1. Comparison 01. Topical NSAID (Niflumic acid) vs placebo

01.01 Non return to previous sporting activity at 3 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auclair 1989</td>
<td>25/114</td>
<td>24/101</td>
<td>1.02</td>
<td>100.0</td>
<td>0.92 [ 0.56, 1.51 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>114</td>
<td>101</td>
<td></td>
<td>100.0</td>
<td>0.92 [ 0.56, 1.51 ]</td>
</tr>
</tbody>
</table>

Total events: 25 (NSAID), 24 (Placebo)
Test for heterogeneity: not applicable
Test for overall effect z=0.32, p=0.7
Fig. 2. Comparison 01. Topical NSAID (Niflumic acid) vs placebo

01.02 Unable to return to previous level of sports activity at 3 weeks

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 01 Topical NSAID (Niflumic acid) vs placebo
Outcome: 02 Unable to return to previous level of sports activity at 3 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auclair 1989</td>
<td>63/114</td>
<td>72/101</td>
<td>0.78 [ 0.63, 0.95 ]</td>
<td>100.0</td>
<td>0.78 [ 0.63, 0.95 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>114</td>
<td>101</td>
<td></td>
<td>100.0</td>
<td>0.78 [ 0.63, 0.95 ]</td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable
Test for overall effect z=2.42  p=0.02

Fig. 3. Comparison 01. Topical NSAID (Niflumic acid) vs placebo

01.03 Improvement in pain on palpation at 7 days (100mm visual analogue scale)

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 01 Topical NSAID (Niflumic acid) vs placebo
Outcome: 03 Improvement in pain on palpation at 7 days (100mm visual analogue scale)

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID N</th>
<th>Mean(SD)</th>
<th>Placebo N</th>
<th>Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auclair 1989</td>
<td>117</td>
<td>59.20 (35.80)</td>
<td>110</td>
<td>48.00 (40.40)</td>
<td>11.20 [ 1.25, 21.15 ]</td>
<td>100.0</td>
<td>11.20 [ 1.25, 21.15 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>117</td>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td>100.0</td>
<td>11.20 [ 1.25, 21.15 ]</td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable
Test for overall effect z=2.21  p=0.03

Interventions for treating acute and chronic Achilles tendinitis (Review)

Copyright ©2005 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd
### Fig. 4. Comparison 01. Topical NSAID (Niflumic acid) vs placebo

**01.04 Pain unchanged/worse on ankle dorsiflexion at 7 days**

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID (n/N)</th>
<th>Placebo (n/N)</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auclair 1989</td>
<td>20/95</td>
<td>23/92</td>
<td></td>
<td>100.0</td>
<td>0.84 [0.50, 1.43]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>95</td>
<td>92</td>
<td></td>
<td>100.0</td>
<td>0.84 [0.50, 1.43]</td>
</tr>
<tr>
<td>Total events:</td>
<td>20 (NSAID), 23 (Placebo)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable
Test for overall effect: z=0.64 p=0.5

### Fig. 5. Comparison 01. Topical NSAID (Niflumic acid) vs placebo

**01.05 Side effects - complications of treatment**

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID (n/N)</th>
<th>Placebo (n/N)</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auclair 1989</td>
<td>5/123</td>
<td>6/116</td>
<td></td>
<td>100.0</td>
<td>0.79 [0.25, 2.51]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>123</td>
<td>116</td>
<td></td>
<td>100.0</td>
<td>0.79 [0.25, 2.51]</td>
</tr>
<tr>
<td>Total events:</td>
<td>5 (NSAID), 6 (Placebo)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fig. 6. Comparison 02. Oral NSAID (Piroxicam) vs placebo

02.01 Non-return to normal activities at 4 weeks

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 02 Oral NSAID (Piroxicam) vs placebo
Outcome: 01 Non-return to normal activities at 4 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrom 1992</td>
<td>22/34</td>
<td>26/33</td>
<td>0.82 [0.61, 1.11]</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>34</td>
<td>33</td>
<td>0.82 [0.61, 1.11]</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Total events: 22 (NSAID), 26 (Placebo)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for heterogeneity: not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect z=1.27  p=0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 7. Comparison 02. Oral NSAID (Piroxicam) vs placebo

02.02 Symptoms unaltered/worse at 4 weeks

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 02 Oral NSAID (Piroxicam) vs placebo
Outcome: 02 Symptoms unaltered/worse at 4 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrom 1992</td>
<td>9/34</td>
<td>9/33</td>
<td>0.97 [0.44, 2.14]</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>34</td>
<td>33</td>
<td>0.97 [0.44, 2.14]</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Total events: 9 (NSAID), 9 (Placebo)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for heterogeneity: not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect z=0.07  p=0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Fig. 8. Comparison 02. Oral NSAID (Piroxicam) vs placebo**

*02.03 Severe tenderness on palpation at 4 weeks*

**Review:** Interventions for treating acute and chronic Achilles tendinitis  
**Comparison:** 02 Oral NSAID (Piroxicam) vs placebo  
**Outcome:** 03 Severe tenderness on palpation at 4 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrom 1992</td>
<td>2/34</td>
<td>4/33</td>
<td></td>
<td>100.0</td>
<td>0.49 [0.10, 2.47]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>34</td>
<td>33</td>
<td></td>
<td>100.0</td>
<td>0.49 [0.10, 2.47]</td>
</tr>
</tbody>
</table>

Total events: 2 (NSAID), 4 (Placebo)  
Test for heterogeneity: not applicable  
Test for overall effect $z=0.87$  
*p=0.4

**Fig. 9. Comparison 02. Oral NSAID (Piroxicam) vs placebo**

*02.04 Side-effects - complications of treatment*

**Review:** Interventions for treating acute and chronic Achilles tendinitis  
**Comparison:** 02 Oral NSAID (Piroxicam) vs placebo  
**Outcome:** 04 Side-effects - complications of treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrom 1992</td>
<td>4/34</td>
<td>4/33</td>
<td></td>
<td>100.0</td>
<td>0.97 [0.26, 3.56]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>34</td>
<td>33</td>
<td></td>
<td>100.0</td>
<td>0.97 [0.26, 3.56]</td>
</tr>
</tbody>
</table>

Total events: 4 (NSAID), 4 (Placebo)  
Test for heterogeneity: not applicable  
Test for overall effect $z=0.04$  
*p=1
### Fig. 10. Comparison 03. Oral NSAID (Tenoxicam) vs placebo

**03.01 Moderate/poor outcome (with exclusions) at 10 days**

**Review:** Interventions for treating acute and chronic Achilles tendinitis

**Comparison:** Oral NSAID (Tenoxicam) vs placebo

**Outcome:** Moderate/poor outcome (with exclusions) at 10 days

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jakobson 1988</td>
<td>7/24</td>
<td>11/16</td>
<td></td>
<td>100.0</td>
<td>0.42 [ 0.21, 0.86 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>24</td>
<td>16</td>
<td></td>
<td>100.0</td>
<td>0.42 [ 0.21, 0.86 ]</td>
</tr>
</tbody>
</table>

Total events: 7 (NSAID), 11 (Placebo)
Test for heterogeneity: not applicable
Test for overall effect z=2.38  p=0.02

### Fig. 11. Comparison 03. Oral NSAID (Tenoxicam) vs placebo

**03.02 Moderate/ poor outcome (no exclusions)**

**Review:** Interventions for treating acute and chronic Achilles tendinitis

**Comparison:** Oral NSAID (Tenoxicam) vs placebo

**Outcome:** Moderate/ poor outcome (no exclusions)

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jakobson 1988</td>
<td>13/30</td>
<td>11/16</td>
<td></td>
<td>100.0</td>
<td>0.63 [ 0.37, 1.07 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>30</td>
<td>16</td>
<td></td>
<td>100.0</td>
<td>0.63 [ 0.37, 1.07 ]</td>
</tr>
</tbody>
</table>

Total events: 13 (NSAID), 11 (Placebo)
Test for heterogeneity: not applicable
Test for overall effect z=1.72  p=0.09
### Fig. 12. Comparison 04. NSAID vs placebo - pooled data

04.01 Non-return to normal activities at 3-4 weeks

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 04 NSAID vs placebo - pooled data
Outcome: 01 Non-return to normal activities at 3-4 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrom 1992</td>
<td>22/34</td>
<td>26/33</td>
<td>25.7</td>
<td>0.82</td>
<td>[0.61, 1.11]</td>
</tr>
<tr>
<td>Auclair 1989</td>
<td>63/114</td>
<td>72/101</td>
<td>74.3</td>
<td>0.78</td>
<td>[0.63, 0.95]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>148</td>
<td>134</td>
<td>100.0</td>
<td>0.79</td>
<td>[0.66, 0.93]</td>
</tr>
</tbody>
</table>

Total events: 85 (NSAID), 98 (Placebo)
Test for heterogeneity chi-square=0.10 df=1 p=0.76 I² =0.0%
Test for overall effect z=2.73 p=0.006

### Fig. 13. Comparison 04. NSAID vs placebo - pooled data

04.02 Non-return to normal activities at 3-4 weeks (+ exclusions)

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 04 NSAID vs placebo - pooled data
Outcome: 02 Non-return to normal activities at 3-4 weeks (+ exclusions)

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrom 1992</td>
<td>23/35</td>
<td>26/35</td>
<td>26.0</td>
<td>0.88</td>
<td>[0.65, 1.20]</td>
</tr>
<tr>
<td>Auclair 1989</td>
<td>72/123</td>
<td>72/116</td>
<td>74.0</td>
<td>0.94</td>
<td>[0.77, 1.16]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>158</td>
<td>151</td>
<td>100.0</td>
<td>0.93</td>
<td>[0.78, 1.10]</td>
</tr>
</tbody>
</table>

Total events: 95 (NSAID), 98 (Placebo)
Test for heterogeneity chi-square=0.12 df=1 p=0.76 I² =0.0%
Test for overall effect z=0.85 p=0.4
**Fig. 14. Comparison 04. NSAID vs placebo - pooled data**

*04.04 Side effects - complications of treatment*

**Review:** Interventions for treating acute and chronic Achilles tendinitis  
**Comparison:** 04 NSAID vs placebo - pooled data  
**Outcome:** 04 Side effects - complications of treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>NSAID n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrom 1992</td>
<td>4/34</td>
<td>4/33</td>
<td>0.97 [0.26, 3.56]</td>
<td>39.7</td>
<td></td>
</tr>
<tr>
<td>Auclair 1989</td>
<td>5/123</td>
<td>6/116</td>
<td>0.79 [0.25, 2.51]</td>
<td>60.3</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td>157</td>
<td>149</td>
<td>0.86 [0.36, 2.04]</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 9 (NSAID), 10 (Placebo)  
Test for heterogeneity chi-square=0.06 df=1 p=0.81 I² =0.0%  
Test for overall effect z=0.34 p=0.7

---

**Fig. 15. Comparison 05. Low dose heparin vs placebo**

*05.01 Non return to full activities at 15 days*

**Review:** Interventions for treating acute and chronic Achilles tendinitis  
**Comparison:** 05 Low dose heparin vs placebo  
**Outcome:** 01 Non return to full activities at 15 days

<table>
<thead>
<tr>
<th>Study</th>
<th>Heparin n/N</th>
<th>Placebo n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larsen 1987</td>
<td>3/10</td>
<td>4/10</td>
<td>0.75 [0.22, 2.52]</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td>10</td>
<td>10</td>
<td>0.75 [0.22, 2.52]</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 3 (Heparin), 4 (Placebo)  
Test for heterogeneity: not applicable  
Test for overall effect z=0.46 p=0.6
Fig. 16. Comparison 05. Low dose heparin vs placebo

05.02 Overall symptom score (low scores worse) at 15 days

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 05 Low dose heparin vs placebo
Outcome: 02 Overall symptom score (low scores worse) at 15 days

<table>
<thead>
<tr>
<th>Study</th>
<th>Heparin</th>
<th>Placebo</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larsen 1987</td>
<td>10</td>
<td>34.10 (33.50)</td>
<td>10</td>
<td>45.30 (44.60)</td>
<td>-11.20 [ -45.77, 23.37 ]</td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable
Test for overall effect $z=0.63$ $p=0.5$

Fig. 17. Comparison 06. Actovegin (haemodialysate injection) vs placebo

06.01 Severe pain on full athletic activity at 3 weeks

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 06 Actovegin (haemodialysate injection) vs placebo
Outcome: 01 Severe pain on full athletic activity at 3 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>Actovegin</th>
<th>Placebo</th>
<th>Relative Risk (Fixed)</th>
<th>Weight</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pforringer 1994</td>
<td>2/30</td>
<td>18/30</td>
<td>0.11 [ 0.03, 0.44 ]</td>
<td>100.0</td>
<td>0.11 [ 0.03, 0.44 ]</td>
</tr>
</tbody>
</table>

Total (95% CI) 30 30
Test for heterogeneity: not applicable
Test for overall effect $z=3.14$ $p=0.002$
Fig. 18. Comparison 06. Actovegin (haemodialysate injection) vs placebo

**06.02 Percentage pain reduction at 3 weeks**

**Comparison:** 06 Actovegin (haemodialysate injection) vs placebo

**Outcome:** 02 Percentage pain reduction at 3 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>Actovegin</th>
<th>Placebo</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>Pforringer 1994</td>
<td>30</td>
<td>30</td>
<td>66.20 (25.10)</td>
<td>30</td>
<td>26.80 (23.00)</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>30</strong></td>
<td><strong>30</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td><strong>39.40 [ 27.22, 51.58 ]</strong></td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable

Test for overall effect z=6.34 p<0.00001

Fig. 19. Comparison 07. Glycosaminoglycan vs indomethacin

**07.01 Moderate/severe pain on palpation at 2 weeks**

**Comparison:** 07 Glycosaminoglycan vs indomethacin

**Outcome:** 01 Moderate/severe pain on palpation at 2 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>GAGPS</th>
<th>NSAID</th>
<th>Relative Risk (Fixed)</th>
<th>Weight</th>
<th>Relative Risk (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/N</td>
<td>n/N</td>
<td></td>
<td>95% CI</td>
<td>(%)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Sundqvist 1987</td>
<td>13/29</td>
<td>7/30</td>
<td>1.92 [ 0.89, 4.12 ]</td>
<td>100.0</td>
<td>1.92 [ 0.89, 4.12 ]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>29</strong></td>
<td><strong>30</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td><strong>1.92 [ 0.89, 4.12 ]</strong></td>
</tr>
</tbody>
</table>

Total events: 13 (GAGPS), 7 (NSAID)

Test for heterogeneity: not applicable

Test for overall effect z=1.67 p=0.09
Fig. 20. Comparison 07. Glycosaminoglycan vs indomethacin

07.02 No or only slight therapeutic effect at 2 weeks

Review: Interventions for treating acute and chronic Achilles tendinitis
Comparison: 07 Glycosaminoglycan vs indomethacin
Outcome: 02 No or only slight therapeutic effect at 2 weeks

<table>
<thead>
<tr>
<th>Study</th>
<th>GAGPS n/N</th>
<th>NSAID n/N</th>
<th>Relative Risk (Fixed)</th>
<th>Weight (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sundqvist 1987</td>
<td>10/12</td>
<td>10/12</td>
<td>37.0</td>
<td>1.00</td>
<td>[0.70, 1.43]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>12</td>
<td>12</td>
<td>37.0</td>
<td>1.00</td>
<td>[0.70, 1.43]</td>
</tr>
<tr>
<td>Total events: 10 (GAGPS), 10 (NSAID)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for heterogeneity: not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect z=0.00 p=1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02 Chronic symptoms (&gt; 3 months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sundqvist 1987</td>
<td>16/17</td>
<td>17/17</td>
<td>63.0</td>
<td>0.94</td>
<td>[0.84, 1.06]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>17</td>
<td>17</td>
<td>63.0</td>
<td>0.94</td>
<td>[0.84, 1.06]</td>
</tr>
<tr>
<td>Total events: 16 (GAGPS), 17 (NSAID)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for heterogeneity: not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect z=1.00 p=0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>29</td>
<td>29</td>
<td>100.0</td>
<td>0.96</td>
<td>[0.83, 1.12]</td>
</tr>
<tr>
<td>Total events: 26 (GAGPS), 27 (NSAID)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for heterogeneity chi-square=0.19 df=1 p=0.67 I² =0.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect z=0.48 p=0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interventions for treating acute and chronic Achilles tendinitis (Review)

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