ClinicalEvidence

Tennis elbow

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ABSTRACT

INTRODUCTION: Lateral pain in the elbow affects up to 3% of the population, and is considered an overload injury of the extensor tendons of the forearm where they attach at the lateral epicondyle. Although usually self-limiting, symptoms may persist for over 1 year in up to 20% of people. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical question: What are the effects of treatments for tennis elbow? We searched: Medline, Embase, The Cochrane Library, and other important databases up to August 2006 (BMJ Clinical Evidence reviews are updated periodically, please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 30 systematic reviews, RCTs or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review we present information relating to the effectiveness and safety of the following interventions: acupuncture, corticosteroid injections, exercise and mobilisation, extracorporeal shock wave therapy, non-steroidal anti-inflammatory drugs (oral and topical), orthoses (bracing), and surgery.

QUESTIONS

INTERVENTIONS

Key points

- Lateral pain in the elbow affects up to 3% of the population, and is usually an overload injury that often follows minor trauma to extensor forearm muscles.

  Although usually self-limiting, symptoms may persist for over 1 year in up to 20% of people.

- Corticosteroid injections improve pain from tennis elbow in the short term compared with placebo, local anaesthetic, orthoses, physiotherapy, and oral NSAIDs.

  We don't know which corticosteroid regimen leads to greatest pain relief.

  In the long term, physiotherapy or oral NSAIDs may be more effective than corticosteroid injections at reducing pain.

  Topical NSAIDs lead to short-term pain relief, but long-term effects are unknown.

- Extracorporeal shock wave therapy is unlikely to be more effective than placebo at improving pain, and may be less effective than injected corticosteroids.

  We don't know whether acupuncture orexercise and mobilisation reduce symptoms of tennis elbow as few studies have been found, and they gave conflicting results.

We don't know whether orthoses (braces) reduce symptoms compared with no treatment or other treatments, as few studies have been found.

We don't know whether open or percutaneous surgical techniques improve pain and function, as no good-quality studies have been found.

DEFINITION

Tennis elbow has many analogous terms, including lateral elbow pain, lateral epicondylitis, rowing elbow, tendonitis of the common extensor origin, and peritendinitis of the elbow. Tennis elbow is characterised by pain and tenderness over the lateral epicondyle of the humerus, and pain on resisted dorsiflexion of the wrist, middle finger, or both. For the purposes of this review, tennis elbow is restricted to lateral elbow pain or lateral epicondylitis.

INCIDENCE/ PREVALENCE

Lateral elbow pain is common (population prevalence 1–3%), [1] with peak incidence occurring at 40–50 years of age. In women aged 42–46 years, incidence increases to 10%. [2] [3] In the UK, the Netherlands, and Scandinavia the incidence of lateral elbow pain in general practice is 4–7/1000 people a year. [3] [4] [5]

AETIOLOGY/ RISK FACTORS

Tennis elbow is considered an overload injury, typically after minor and often unrecognised trauma of the extensor muscles of the forearm. Despite the title tennis elbow, tennis is a direct cause in only 5% of people with lateral epicondylitis. [6]

PROGNOSIS

Although lateral elbow pain is generally self-limiting, in a minority of people symptoms persist for 18 months to 2 years, and in some cases for much longer. [7] The cost, therefore, both in terms of lost productivity and healthcare use, is high. In a general practice trial of an expectant waiting policy, 80% of people with elbow pain of already greater than 4 weeks' duration had recovered after 1 year. [8]

AIMS OF INTERVENTION

To reduce lateral elbow pain and improve function, with minimal adverse effects.

OUTCOMES

Pain at rest, with activities and resisted movements (visual analogue scale or Likert scale); function (validated disability questionnaire, includes 30-point Disabilities of the Arm, Shoulder, and Hand questionnaire, or visual analogue scale or Likert scale); quality of life (validated questionnaire); grip strength (dynamometer); return to work, normal activities, or both; overall participant-reported improvement; adverse effects (participant or researcher report); Roles–Maudsley subjective pain score.

METHODS

BMJ Clinical Evidence search and appraisal August 2006. The following databases were used to identify studies for this review: Medline 1966 to March 2006, Embase 1980 to March 2006, and The Cochrane Library 2006, Issue 3. Additional searches were carried out using these websites: NHS Centre for Reviews and Dissemination (CRD) — for Database of Abstracts of Reviews of Effects (DARE) and Health Technology Assessment (HTA), Turning Research into Practice (TRIP), and NICE clinical guidelines. Abstracts of the studies retrieved were assessed independently by two information specialists using predetermined criteria to identify relevant studies. Study design criteria for inclusion in this review were: published systematic reviews and RCTs in any language, at least single blinded, and containing more than 20 individuals of whom more than 80% were followed up. There was no minimum length of follow-up required to include studies. We excluded all studies described as "open"," "open label", or not blinded unless blinding was impossible. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the FDA and the UK Medicines and Healthcare products Regulatory Agency (MHRA), which are added to the review as required. In the extracorporeal shock wave therapy option, the authors included their Cochrane systematic review (search date 2005), [9] in addition to references identified by a hand search of relevant journals over the last 5 years. [10] We included RCTs of any of the listed interventions in people older than 16 years with lateral elbow pain for greater than 3 weeks' duration, and no history of significant trauma or systemic inflammatory conditions, such as rheumatoid arthritis. We included trials in people with various soft-tissue diseases and pain due to tendinitis at all sites, provided that the lateral elbow pain results were presented separately, or that more than 90% of people had lateral elbow pain. We have performed a GRADE evaluation of the quality of the evidence for interventions included in this review (see table, p 18).

QUESTION What are the effects of oral drug treatment?

OPTION NSAIDS (ORAL)

Pain relief

Compared with placebo Oral NSAIDs may be more effective at improving pain in the short term, but we don't know whether they are more effective at improving pain at 4 weeks, 6 months, or 1 year (very low-quality evidence).

Compared with corticosteroid injection We don't know whether oral NSAIDs are more effective at improving pain at 4 weeks, but they may be more effective at improving pain at 26 weeks (very low-quality evidence).

Global improvement
Compared with corticosteroid injections Oral NSAIDs may be less effective at increasing self-reported perception of benefit at 4 weeks (very low-quality evidence).

Functional improvement
Compared with placebo Oral NSAIDs may be no more effective at improving functional impairment (very low-quality evidence).

For GRADE evaluation of interventions for tennis elbow, see table, p 18 .

Benefits:

We found one systematic review (search date 2001) [11] and no subsequent RCTs. None of the RCTs in the review evaluated the effect of NSAIDs on return to work or quality of life.

Oral NSAIDs versus placebo:
The review included two RCTs. [11] The RCTs were not pooled, because one reported means and standard deviations, and the other reported medians and ranges. One RCT (129 people) found limited evidence that NSAIDs (diclofenac) improved pain in the short term compared with placebo, but did not assess long-term results (pain WMD –13.9, 95% CI –23.2 to –4.6 on 100-point scale). [11] The second RCT (164 people) found no significant difference between NSAIDs (naproxen) and vitamin C placebo in pain over 4 weeks, 6 months, or 1 year, or in functional impairment at 6 months or 1 year (median pain measured from 0 = lowest to 9 = highest [baseline], at 4 weeks: 4 with NSAIDs *v* 3.5 with placebo; 6 months: 1 with NSAIDs *v* 1 with placebo; 12 months: 0 with NSAIDs *v* 0 with placebo; median functional impairment measured from 0 = lowest to 9 = highest [baseline = 4 for both groups]: at 4 weeks: 3 with NSAIDs *v* 2 with placebo; at 6 months: 0 with NSAIDs *v* 0.5 with placebo; at 12 months: 0 with NSAIDs *v* 0 with placebo; significance not reported). [11]

Oral NSAIDs versus corticosteroid injection:
The review included three RCTs. [11] Because of incomplete reporting of results, only two RCTs were included in the meta-analysis. The first of these RCTs compared naproxen 500 mg versus methylprednisolone 20 mg plus lidocaine (lignocaine); and the second RCT compared naproxen 500 mg (initial high dose, then 250 mg) versus betamethasone 6 mg plus pilocaine plus placebo tablets. Meta-analysis of self-reported perception of benefit found a significant difference at 4 weeks in favour of corticosteroid injection (2 RCTs, subjective assessment of improvement at 4 weeks: RR 3.06, 95% CI 1.55 to 6.06). [11] The third RCT, which was not included in the meta-analysis because of skewed data, found lower pain and functional impairment at 4 weeks in the corticosteroid-injection group than in the NSAIDs group (median pain measured from 0 = lowest to 9 = highest [baseline]: 1 with corticosteroids *v* 4 with NSAIDs; significance not reported; median functional impairment measured from 0 = lowest to 9 = highest [baseline]: 0 with corticosteroids *v* 3 with NSAIDs; significance not reported). [11] The greater benefit of corticosteroid injection compared with NSAID (naproxen) was only found in the short term (up to 4 weeks). The largest RCT (53 people in smallest group; see comments) found significantly greater improvement in pain at 26 weeks with an NSAID (RR 1.71, 95% CI 1.17 to 2.51). It found no significant difference in grip strength, and results were not reported for global improvement.

Harms:

Oral NSAIDs versus placebo:
The review identified one trial of oral NSAIDs, which found an increased risk of abdominal pain and diarrhoea with oral NSAIDs compared with placebo (abdominal pain: 19/64 [30%] with oral NSAIDs *v* 6/64 [9%] with placebo; RR 3.17, 95% CI 1.35 to 7.41; diarrhoea: 25/64 [39%] with oral NSAIDs *v* 13/64 [20%] with placebo; RR 1.92, 95% CI 1.08 to 3.14). [11] One systematic review (search date 1994, 12 RCTs of NSAIDs in a variety of disorders) [12] found that the overall relative risk of complications from oral NSAIDs was 3.0–5.0. Adverse effects were predominantly gastrointestinal. See important differences between available NSAIDs in our review on NSAIDs.

Oral NSAIDs versus corticosteroid injection:
The review gave no information about the adverse effects of oral NSAIDs compared with corticosteroid injection. [11]

Comment:

See comment on topical NSAIDs, p 4 .

QUESTION What are the effects of topical drug treatment?

OPTION NSAIDS (TOPICAL)

Pain relief
Compared with placebo Topical NSAIDs seem more effective at improving pain at 4 weeks (moderate-quality evidence).

Global improvement
Compared with placebo Topical NSAIDs may be more effective at reducing the proportion of people who report a "poor/no overall" effect of treatment (low-quality evidence).

Functional improvement
Compared with placebo Topical NSAIDs may be no more effective at improving grip strength or range of motion (low-quality evidence).

For GRADE evaluation of interventions for tennis elbow, see table, p 18 .

Benefits:

We found one systematic review (search date 2001) [11] and no subsequent RCTs. None of the RCTs in the review evaluated the effect of NSAIDs on return to work or quality of life.

Topical NSAIDs versus placebo:
The review found that topical NSAIDs significantly improved pain at up to 4 weeks compared with placebo (3 RCTs, 130 people; pain [scale 0–10; 0 = no pain; 10 = maximum pain]: 1.73–2.10 with topical NSAIDs *v* 3.00–3.83 with placebo; WMD –1.88, 95% CI –2.54 to –1.21) and significantly reduced subjective reports of ”poor/no overall” effect (2 RCTs, 119 people; proportion of people reporting ”poor/no overall” effect: 12.5–27% with topical NSAIDs *v* 51–78% with placebo; RR 0.39, 95% CI 0.23 to 0.66). [11] Inclusion of unblinded trials did not significantly change the results. The review found no significant differences between topical NSAIDs and placebo for grip strength (further data not reported; reported as non-significant) or range of motion (1 RCT, 40 people; proportion of people reporting no improvement in range of motion: 15/17 [88%] with topical NSAIDs *v* 20/23 [87%] with placebo; RR for limitation of movement 1.01, 95% CI 0.80 to 1.28). It found that NSAIDs significantly improved pain, tenderness, or swelling compared with placebo (3 RCTs, 157 people; proportion of people reporting no improvement in pain, tenderness, or swelling: 54/77 [70%] with topical NSAIDs *v* 66/80 [83%] with placebo; RR 0.83, 95% CI 0.70 to 0.99) and decreased doctor's opinion of ineffectiveness (1 RCT, 85 people: doctor's opinion of poor/no effect: 15/44 [34%] with topical NSAIDs *v* 23/41 [56%] with placebo; RR 0.61, 95% CI 0.37 to 0.99). The topical NSAIDs used were diclofenac (2 RCTs) and benzydamine (1 RCT).

Harms:

Topical NSAIDs:
Pooled results from two RCTs included in the review [11] found that topical NSAIDs significantly increased adverse events compared with placebo (RR 2.26, 95% CI 1.04 to 4.94). Adverse effects were mild (foul breath and minor skin irritation). In one of the RCTs [13] nine people were withdrawn from the study after premature discontinuation of treatment, including eight people in the treatment group with burns, blisters, rashes, and skin thickening.

Comment:

Further placebo-controlled and comparative trials of topical compared with oral NSAIDs would help to clarify the effects of NSAIDs in the treatment of tennis elbow. Few trials used intention to treat analysis, and the sample size of most was small (populations range from 18–128 people for trials included in the meta-analysis). [11]

Clinical guide:
Both topical and oral NSAIDs may provide short-term relief of pain in tennis elbow, although topical NSAIDs may be associated with fewer adverse effects.

QUESTION What are the effects of local injections?

OPTION CORTICOSTEROID INJECTIONS

Pain relief
Compared with placebo or no treatment Corticosteroid injections may be more effective at improving pain at 8 weeks and 6 months in people who have had symptoms for less than 4 weeks (very low-quality evidence).

Compared with exercise plus mobilisation Corticosteroid injection may be more effective than physiotherapy at improving pain scores at 6 weeks, but not at 52 weeks (very low-quality evidence).

Compared with oral NSAIDs We don't know whether corticosteroid injection is more effective at improving pain at 4 weeks, but corticosteroid injection may be less effective at improving pain at 26 weeks (very low-quality evidence).

Different types of corticosteroid injections versus each other We don't know whether dexamethasone 21-palmitate lipid microsphere injection is more effective than conventional dexamethasone 21-acetate crystal suspension injection at improving pain outcomes (low-quality evidence).

Corticosteroid injection plus local anaesthetic injection compared with oral NSAIDs or placebo We don't know whether corticosteroid injection plus local anaesthetic injection is more effective at improving pain at 5 days (very low-quality evidence).

Corticosteroid injection plus local anaesthetic injection compared with extracorporeal shock wave therapy A single corticosteroid injection plus local anaesthetic injection may be more effective at improving pain at 6 weeks and 3 months (low-quality evidence).

Single versus multiple corticosteroid plus local anaesthetic injections We don't know whether single injections of betamethasone plus pilocarpine are more effective than repeated injections at improving pain (very low-quality evidence).

Global improvement

Compared with placebo or no treatment Corticosteroid injections may be more effective than placebo at increasing "short-term" global improvement (timescale not defined), and at improving people's "main complaint" at 3 and 6 weeks compared with watchful waiting, but we don't know whether they are more effective than watchful waiting at improving people's "main complaint" in the longer term (12–52 weeks) (very low-quality evidence).

Compared with local anaesthetic injection Corticosteroid injection may be more effective at improving short-term global improvement at 4 weeks (very low-quality evidence).

Compared with orthoses (splint or elbow band) Corticosteroid injection may be more effective at increasing the proportion of people who rate their global improvement as "good" or "excellent" at 2 weeks, but not at 6 or 12 months (low-quality evidence).

Compared with exercise plus mobilisation Corticosteroid injection may be more effective than physiotherapy at increasing global improvement scores at 6 weeks, but not at 52 weeks. We don't know whether corticosteroid injection is more effective than physiotherapy at improving the "main complaint" (very low-quality evidence).

Compared with oral NSAIDs Corticosteroid injection may be more effective at increasing self-reported perception of benefit at 4 weeks (very low-quality evidence).

Functional improvement

Compared with placebo or no treatment Corticosteroid injection may be more effective than watchful waiting at improving functional disability at 3 and 6 weeks, but not in the longer term (from 12–52 weeks). We don't know whether it is more effective than placebo at improving grip strength (very low-quality evidence).

Compared with exercise plus mobilisation We don't know whether corticosteroid injection is more effective than physiotherapy at improving functional disability at 12 weeks (low-quality evidence).

For GRADE evaluation of interventions for tennis elbow, see table, p 18 .

Benefits:

We found two systematic reviews (search dates 1999 [14] and 2003 [15]) and three additional RCTs. [16] [17] [18] None of the RCTs evaluated the effects of corticosteroid injections on quality of life or return to work.

Corticosteroid injections versus placebo or no treatment:

The first review identified two RCTs comparing corticosteroid injection (1 mL methylprednisolone acetate) versus injection of saline solution. [14] The first RCT (29 people in smallest group; see comment below) found that corticosteroid injection significantly increased short-term global improvement compared with placebo (timescale not further specified; absolute numbers not reported; RR 0.11, 95% CI 0.04 to 0.33 [RR less than 1 favours corticosteroid injections]). [14] The RCT did not measure pain or grip strength. The second RCT (10 people in smallest group) found no significant difference in short-term pain, global improvement, or grip strength. The second review [15] identified one RCT (59 people in the smallest group), [19] which compared corticosteroid injection versus watchful waiting versus physiotherapy (for further details, see Corticosteroid injections versus exercise plus mobilisation). It found that corticosteroid injection significantly improved people's "main complaint" and functional disability at 3 and 6 weeks compared with watchful waiting (mean difference in "main complaint" at 6 weeks: 24%, 95% CI 14% to 35%). It found no significant difference between groups at 12, 26, or 52 weeks (at 52 weeks, mean difference in “main complaint” –9%,

95% CI –19% to +2%). [19] The first additional RCT (39 people with symptoms for less than 4 weeks) compared corticosteroid injection versus a control injection. [16] All people received rehabilitation. It found that corticosteroid injection significantly improved pain compared with control from 8 weeks to 6 months (improvement on 100-point visual analogue scale: 24.3 with corticosteroid injection *v* 8.9 with control injection; P = 0.04; CI not reported). It found no significant difference in other pain outcomes or in grip strength.

Corticosteroid injections versus local anaesthetic:
We found one systematic review (search date 1999), [14] which included two RCTs (containing 18 and 35 people in the smallest groups; see comment below) comparing corticosteroid injections versus local anaesthetic. Data could not be pooled because of heterogeneity. Both RCTs found greater global improvement with corticosteroid injections compared with local anaesthetic in the short term (RCT 1, global improvement at 4 weeks: SMD 0.32, 95% CI 0.10 to 0.98; RCT 2, global improvement: SMD 0.10, 95% CI 0.03 to 0.31). [14] The first RCT compared 1 mL hydrocortisone acetate 25 mg versus 1 mL procaine 2%, and the second RCT compared 1 mL methylprednisolone acetate versus 1 mL xylocaine. The review did not report the proportion of people followed up in each RCT, and the follow-up period for the second RCT was unclear.

Corticosteroid injections versus orthoses:
See benefits of orthoses, p 10 .

Corticosteroid injections versus exercise plus mobilisation:
We found one systematic review (search date 1999), [14] which included one RCT (53 people in the smallest group; see comment below) comparing corticosteroid injections (1 mL triamcinolone acetate 1% plus 1 mL lidocaine [lignocaine]) versus physiotherapy (friction massage plus a manipulation technique). It found that corticosteroid injection significantly increased global improvement and pain scores at 6 weeks compared with physiotherapy (global improvement: RR 0.45, 95% CI 0.29 to 0.69; pain: RR 0.61, 95% CI 0.48 to 0.78), but found no significant difference in global improvement, pain, or grip strength at 52 weeks. [14] The second review [15] identified one RCT (59 people in the smallest group) [19] comparing corticosteroid injection versus physiotherapy (consisting of 9 sessions of ultrasound, deep friction massage, and an exercise programme over 6 weeks) versus no treatment. It found that corticosteroid injection significantly improved the "main complaint" and functional disability at 3 and 6 weeks compared with physiotherapy (at 6 weeks, mean difference in "main complaint" 20%, 95% CI 10% to 31%). However, there was no significant difference at 12 weeks. At 26 and 52 weeks, corticosteroid injections were significantly less effective at improving the "main complaint" compared with physiotherapy (at 52 weeks, mean difference in "main complaint" 15%, 95% CI 5% to 25%). [19]

Corticosteroid injections versus oral NSAIDs:
See oral NSAIDs versus corticosteroid injections, p 2 .

Different types of corticosteroid injections:
One additional RCT (246 people, published in German) compared dexamethasone 21-palmitate lipid microsphere versus conventional dexamethasone 21-acetate crystal suspension. [17] The RCT reported that both treatments improved pain outcomes, and found no significant difference between groups in the proportion of people reporting "strong" or "very strong" pain with pressure, pain after exercise, or resting pain at 2, 7, or 21 days (P values 0.266 or over for all comparisons). [17]

Corticosteroid plus local anaesthetic versus oral NSAIDs or versus placebo:
One RCT identified by the first review [14] compared corticosteroid plus local anaesthetic injection with vitamin C (used as placebo) and with naproxen. [20] A subsequent analysis of the first 5 days of treatment found an increase in reported pain for the first 24 hours of treatment in the injection group compared with baseline, but the differences between groups did not reach statistical significance (mean change in pain score –0.51; 95% CI –1.56 to +0.54). [21]

Corticosteroid plus local anaesthetic injections versus extracorporeal shockwave therapy:
The second review [15] identified one RCT (93 people), [22] which compared a single corticosteroid plus local anaesthetic injection (20 mg triamcinolone made up to 1.5 mL with 1% lidocaine [lignocaine]) versus three sessions weekly of extracorporeal shock wave therapy (ESWT) (2000 shock waves). [22] Self-reported pain was measured at 6 weeks and 3 months, and treatment success was defined as over 50% reduction in pain from baseline. It found that corticosteroid plus local anaesthetic injections were significantly more effective at reducing pain at 6 weeks and 3 months compared with ESWT (treatment success rate: 21/25 [84%] with corticosteroid plus local anaesthetic injection *v* 29/48 [60%] with ESWT; P less than 0.05). [22]

Single versus multiple corticosteroid plus local anaesthetic injections:
The fourth additional RCT (52 people, published in Turkish) compared single versus repeated injections (on average 4.2 times over 12 weeks) of 0.5 mL betamethasone diluted with 0.5 mL pilocaine. [18] It reported that both treatments significantly improved pain intensity and patient satisfaction at 6 and 12 weeks (P less than 0.01), but found no significant difference between treatments. Repeated injections significantly increased pain and patient dissatisfaction at 18 months. We await translation of this RCT for further data. [18]

Harms:

Corticosteroid injections versus placebo or no treatment:
The first systematic review (2 RCTs) found no significant difference in adverse effects between corticosteroid injections and control interventions (including facial flushes, post-injection pain, and local skin atrophy). [14] However, the review did not report P values. In the RCT [19] identified by the second review, [15] a higher proportion of adverse effects was reported with corticosteroids compared with no treatment, although most reported adverse reactions were mild (36/62 [58%] with corticosteroids *v* 10/59 [17%] with no treatment; significance not reported). Increased pain after treatment was reported more frequently for corticosteroid-injection groups (pain less than or equal to 1 day: 6/62 [10%] with corticosteroids *v* 1/59 [2%] with no treatment; significance not reported). [19] The subsequent analysis [21] of one RCT [20] identified by first systematic review [14] reported local skin atrophy at the lateral epicondyle in three patients, only one of whom had received corticosteroid injections. [21] Post-injection pain was slightly not significantly different between the two groups.The first additional RCT gave no information about adverse effects. [16]

Corticosteroid injections versus local anaesthetic:
The first systematic review (2 RCTs) found no significant difference in adverse effects between corticosteroid injections and control interventions (including facial flushes, post-injection pain, and local skin atrophy). [14] However, the review did not report P values.

Corticosteroid injections versus orthoses:
See harms of orthoses, p 10 .

Corticosteroid injections versus exercise plus mobilisation:
The first systematic review (1 RCT) found no significant difference in adverse effects between corticosteroid injections and control interventions (including facial flushes, post-injection pain, and local skin atrophy). [14] However, the review did not report P values. In the RCT [19] identified by the second review, [15] a lower proportion of adverse effects was reported with corticosteroids compared with physiotherapy (36/62 [58%] with corticosteroids *v* 41/64 [64%] with physiotherapy; significance not reported), although most reported adverse reactions were mild. [19] The frequency of other presumed adverse effects, such as facial flushes or skin irritations, was low, and similar for injections and physiotherapy. [19]

Corticosteroid injections versus oral NSAIDs:
See harms of oral NSAIDs, p 2 .

Corticosteroid injections versus extracorporeal shockwave therapy:
The RCT [22] included in the second review [15] gave no information about adverse effects, although it reported that 17/42 [40%] of people in the corticosteroid-injection group refused treatment after randomisation (reasons not stated).

Different corticosteroid injection regimens:
We await translation of the second and third additional RCTs. [17] [18]

Comment:

The first systematic review reported the number of people in the smallest group for each trial rather than the total number of people in the trial. The review found that, in the longer term, there was a high rate of improvement in all groups, including in the placebo group. [14] It found that, in general, the quality of the methodology of the RCTs was poor to modest. The corticosteroid suspensions used in these trials were methylprednisolone (2 RCTs), triamcinolone (4 RCTs), betamethasone (2 RCTs), hydrocortisone (5 RCTs), and dexamethasone (1 RCT). In one RCT, two different substances were used.

QUESTION What are the effects of non-drug treatment?

OPTION ACUPUNCTURE

Pain relief

Compared with sham acupuncture Needle acupuncture may be more effective at increasing pain relief duration after one treatment, or at improving pain after 10 acupuncture sessions at 2 weeks, but may be no more effective at improving pain at 3 or 12 months (low-quality evidence).

Manual compared with electroacupuncture Electroacupuncture may be more effective at improving pain (measured immediately after treatment) at 2 weeks (very low-quality evidence).

Global improvement
Compared with sham acupuncture We don't know whether needle or laser acupuncture is more effective at increasing the proportion of people who report "good" or "excellent" results or "cure" at 3–12 months, or whether it is more effective at decreasing the proportion of people who report "no improvement" or "worse" outcome at 3–12 months (very low-quality evidence).

Functional improvement
Compared with sham acupuncture Needle acupuncture may be more effective at improving functional impairment at 2 weeks (low-quality evidence).

For GRADE evaluation of interventions for tennis elbow, see table, p 18 .

Benefits:

We found three systematic reviews (search dates 2001, [23] 2003, [15] and 2004 [24]) about the effects of acupuncture on tennis elbow. The systematic reviews did not pool results of the RCTs because of considerable heterogeneity among trials. We have reported results for RCTs included in at least one of these reviews. We found no RCTs assessing the effects of acupuncture on quality of life, strength, or return to work.

Acupuncture versus placebo:
We found five RCTs comparing acupuncture versus placebo. [25] [26] [27] [28] [29] The first RCT (45 people) found that 10 acupuncture treatments significantly improved pain and functional outcomes at 2 weeks compared with sham treatment (see table 1, p 16). The second RCT (48 people) found that needle acupuncture significantly increased the duration of pain relief and the proportion of people with at least 50% reduction in pain after one treatment compared with sham acupuncture where needles were not inserted (see table 1, p 16) (see comment below). [26] The third RCT (82 people) found that, compared with sham treatment, needle acupuncture significantly increased the proportion of self-reported “good” or “excellent” results, and the pain threshold on gripping after 10 treatments, but found no significant difference at 3 or 12 months (see table 1, p 16). [27] A fourth RCT (49 people) found no significant difference in the proportion of people reporting either no improvement or a worsening of symptoms, after 10 sessions, and at 3 or 12 months, between laser acupuncture and sham treatment. It found a smaller proportion of “excellent” or “good” results in the laser group compared with the placebo group after 10 treatments, but not at 3 and 10 months; none of the differences was significant (see table 1, p 16). [28] A fifth RCT found no significant difference in cure rate (definition of cure not reported) between vitamin B12 injection plus acupuncture and vitamin B12 injection alone (see table 1, p 16). [29]

Manual versus electroacupuncture:
We found one small RCT (20 people) comparing manual versus electroacupuncture, which assessed pain immediately after a course of six treatments over 2 weeks. [30] It found that electroacupuncture significantly reduced pain compared with manual acupuncture (pain scored on 10 cm visual analogue scale; pain reduction: 50% with electroacupuncture *v* 32% with manual acupuncture; P less than 0.001).

Harms:

Long-term follow-up of one RCT [25] found that one person (1/45 [2%]) withdrew because of pain from acupuncture. [31] It found no other adverse events. The other RCTs gave no information about adverse effects. [26] [27] [28] [29] [30]

Comment:

There is conflicting evidence about the value of acupuncture for tennis elbow, although some trials have demonstrated a small short-term benefit. There may be differences in efficacy between different forms of acupuncture, such as manual and electroacupuncture.

OPTION EXERCISE AND MOBILISATION

Pain
Compared with control Exercise plus counselling may be more effective than sham ultrasound plus counselling at improving pain scores at 11 months (very low-quality evidence).

Compared with corticosteroid injection Physiotherapy may be less effective at improving pain scores at 6 weeks but not at 52 weeks (very low-quality evidence).

Compared with ultrasound plus friction massage Exercise may be more effective at improving pain at 6–8 weeks (very low-quality evidence).

Exercise plus massage plus ultrasound compared with no treatment Combined physical intervention (exercise plus massage plus ultrasound) may be no more effective than watchful waiting at improving pain at 6 weeks or at 52 weeks (very low-quality evidence).

Eccentric strengthening with stretching compared with concentric strengthening with stretching and with stretching alone We don't know whether eccentric strengthening with stretching is more effective at 6 weeks at improving pain-free grip strength or pain (low-quality evidence).

Different manipulation techniques for mobilisation We don't know whether manipulation (of wrist or elbow) is more effective than control at improving pain-free grip strength (very low-quality evidence).

Global improvement

Compared with corticosteroid injection Physiotherapy may be less effective at increasing global improvement scores at 6 weeks, but not at 52 weeks. We don't know whether physiotherapy is more effective at improving the "main complaint" (very low-quality evidence).

Exercise plus massage plus ultrasound compared with no treatment Combined physical intervention (exercise plus massage plus ultrasound) may be no more effective than watchful waiting at increasing global improvement at 6 weeks or at 52 weeks (very low-quality evidence).

Functional improvement

Compared with control Exercise plus counselling may be more effective at 11 months than sham ultrasound plus counselling at improving function scores (very low-quality evidence).

Compared with corticosteroid injection We don't know whether physiotherapy is more effective at improving functional disability at 12 weeks (low-quality evidence).

Eccentric strengthening with stretching compared with concentric strengthening with stretching and with stretching alone Eccentric strengthening with stretching, concentric strengthening with stretching, and stretching alone seem equally effective at improving function at 6 weeks (moderate-quality evidence).

For GRADE evaluation of interventions for tennis elbow, see table, p 18 .

Benefits:

We found one systematic review (search date 2003, 5 RCTs) [15] and two additional RCTs [32] [33] comparing various physical interventions for tennis elbow.

Exercise versus control:

We found one RCT (62 people) comparing eccentric exercises plus proprioceptive neuromuscular facilitation plus counselling versus sham ultrasound plus counselling. [32] All participants were allowed to use an orthosis during painful activities. It found that exercise significantly improved pain and function scores after treatment and at 11 months compared with control (pain at end of treatment [baseline: 16 *v* 16]: 36.3 with exercise *v* 17.4 with placebo, P = 0.0001; pain at 11 months: 34.9 with exercise *v* 15.7 with placebo, P = 0.0001; function at end of treatment [baseline range: 14.4–14.9] 27.8 with exercise *v* 15.7 with placebo, P = 0.0001; function at 11 months: 26.7 with exercise *v* 14.9 with placebo, P = 0.0001). [32]

Exercise and mobilisation versus corticosteroid injection:

See benefits of corticosteroid injection, p 4 .

Exercise versus ultrasound plus friction massage:

We found one systematic review (search date 2003, 1 RCT). [15] The small RCT (36 people) identified by the review found that exercise significantly improved pain at 6–8 weeks compared with ultrasound plus friction massage (SMD 0.66, 95% CI 0.01 to 1.31). [15]

Exercise plus massage plus ultrasound versus no treatment:

We found one systematic review (search date 2003,1 RCT). [15] The RCT (183 people) included in the review was a three-arm trial comparing 6 weeks of combined physical intervention (exercise plus massage plus ultrasound) versus corticosteroid injection versus watchful waiting. It found no significant difference between combined physical intervention and watchful waiting at 6 weeks (global improvement: RR 1.46, 95% CI 0.93 to 2.29; pain: SMD 0.26, 95% CI −0.10 to +0.61) or at 52 weeks (global improvement: RR 1.09, 95% CI 0.95 to 1.25; pain: SMD 0.26, 95% CI −0.10 to +0.61). [15]

Eccentric strengthening with stretching versus concentric strengthening with stretching versus stretching alone:
We found one RCT (94 people, lateral elbow pain of more than 3 months) comparing eccentric strengthening plus stretching versus concentric strengthening plus stretching versus stretching alone. [33] It found no significant difference between groups at 6 weeks in pain-free grip strength, pain, or function (difference from baseline to 6 weeks in pain-free grip strength SD –4.2 ± 6.1 with eccentric strengthening plus stretching *v* –7.4 ± 8.3 with concentric strengthening plus stretching *v* –6.7 ± 7.0 with stretching alone, difference among groups P = 0.44; difference from baseline to 6 weeks in pain [visual analogue scale] SD 23 ± 24 with eccentric strengthening plus stretching *v* 14 ± 27 with concentric strengthening plus stretching *v* 23 ± 21 with stretching alone, difference among groups P = 0.33; difference from baseline to 6 weeks in Patient-rated Forearm Evaluation Questionnaire [PRFEQ] SD 1.2 ± 1.7 with eccentric strengthening plus stretching *v* 1.3 ± 1.8 with concentric strengthening plus stretching *v* 1.5 ± 1.6 with stretching alone, difference among groups P = 0.87; difference from baseline to 6 weeks in Disability of the Arm, Shoulder and Hand Scale [DASH] SD 9.3 ± 14 with eccentric strengthening plus stretching *v* 8.4 ± 10 with concentric strengthening plus stretching *v* 11 ± 12 with stretching alone, difference among groups P = 0.66). [33]

Different manipulation techniques for mobilisation:
The review identified four small RCTs on cervical, wrist, and elbow manipulation, one of which (in 15 people) was too small to meet our inclusion criteria for this review. [15] Pooled results for two RCTs (total of 48 people) investigating elbow manipulation versus control found a positive immediate effect on pain-free grip strength (SMD 1.28, 95% CI 0.84 to 1.73). One RCT (28 people) found no significant benefit from wrist manipulation versus friction massage plus ultrasound plus exercise (pain-free grip strength: SMD 0.43, 95% CI −0.32 to +1.19).

Harms: The systematic review gave no information about adverse effects. [15] The second additional RCT reported that four people withdrew from the trial because of worsening symptoms, but these people were distributed evenly between the treatment groups (one in stretching alone, two in the concentric group, and one in the eccentric group). [33] We are awaiting translation of the first additional RCT. [32]

Comment: None.

OPTION ORTHOSES (BRACING)

Pain relief
Compared with physiotherapy Orthoses may be less effective at 6 weeks than physiotherapy at improving pain in people who have pain as their main complaint (very low-quality evidence).

Global improvement
Compared with corticosteroid injection Orthoses (splint or elbow band) may be less effective at increasing the proportion of people who rate their global improvement as "good" or "excellent" at 2 weeks, but not at 6 or 12 months (low-quality evidence).

Compared with physiotherapy Orthoses may be less effective at improving patient satisfaction scores at 6 weeks (low-quality evidence).

Functional improvement
Compared with physiotherapy Orthosis may be more effective at improving the ability to perform daily activities at 6 weeks (low-quality evidence).

Note
We found no direct information about whether orthoses are better than no active treatment.

For GRADE evaluation of interventions for tennis elbow, see table, p 18 .

Benefits: We found one systematic review (search date 1999) [34] and one additional RCT. [35]

Orthoses versus placebo or no treatment:
The review identified no RCTs. [34]

Orthoses versus corticosteroid injections:
The review [34] identified two RCTs comparing orthoses versus corticosteroid injections. [36] [37] Results of the systematic review were not pooled, because of considerable heterogeneity among trials. The review reported that validity scores for the included RCTs ranged from low to medium. [34] The first RCT (16 people) compared an orthotic device versus corticosteroid injections. [36]

However, the trial was very small and people were not blinded to treatment, so it was therefore excluded from this review. The second RCT (70 people, 4 treatment groups) found that corticosteroid injection significantly increased the proportion of people rating global improvement as "good" or "excellent" at 2 weeks, but found no significant difference at 6 or 12 months (global improvement rated as "good" or "excellent", at 2 weeks: 3/37 [8%] pooled results for splint and elbow band *v* 13/19 [68%] with injection, RR 2.9, 95% CI 1.8 to 5.7; 6 months: 19/37 [51%] *v* 14/19 [74%], RR 0.70, 95% CI 0.46 to 1.05; 12 months: 22/37 [59%] *v* 13/19 [68%], RR 0.90, 95% CI 0.60 to 1.03). [37]

Orthoses versus physiotherapy:
We found one additional RCT (180 people), a three-arm trial comparing orthoses versus physiotherapy (ultrasound plus friction massage plus exercise) versus a combination of orthoses plus physiotherapy. [35] It found that, over the short term, orthosis was less effective at reducing pain among people with pain as their main complaint (34–45% of the study population at 6 weeks) compared with physiotherapy (mean pain score on a scale of 0 = no complaint to 100 = severe complaints among people with pain as main complaint at 6 weeks: mean difference in improvement 18 with orthosis *v* 31 with physiotherapy; mean difference 13, 95% CI 3 to 21), improving Pain-Free Function Questionnaire [38] scores (mean improvement [scale of 0–100; baseline range: 48–51]: mean difference in improvement 10 with orthoses *v* 17 with physiotherapy; mean difference 7, 95% CI 1 to 12), and improving patient satisfaction scores (mean improvement [scale of 0–100; baseline range not reported]: mean difference in improvement 66 with orthoses *v* 75 with physiotherapy; mean difference 9, 95% CI 1 to 18). However, it found that orthoses were more effective than physiotherapy at improving ability to perform daily activities (mean improvement [scale of 0–100; baseline range: 59–64]: mean difference in improvement 26 with orthoses *v* 15 with physiotherapy; mean difference 11, 95% CI 1 to 21). It found no significant difference between orthoses and physiotherapy at 6 months and 12 months. [35]

Orthoses versus NSAID cream:
The review identified one small RCT (17 people) comparing an NSAID cream (details of cream not provided in review) with an elbow strap. [34] However, this trial failed to meet our inclusion criteria because of its small size.

Harms: The systematic review [34] and the first additional RCT [35] gave no information about adverse effects.

Comment: The review identified three RCTs comparing adding an orthotic device to corticosteroid injections or ultrasound. All three RCTs reported only short-term results, and data were insufficient, or the power of the study too low, to indicate the effect of orthoses. The additional RCT [35] was a high-quality trial, with conflicting results for short-term follow-up, and no significant differences in outcomes for intermediate- (6 months) and long-term (12 months) follow-up.

Orthoses versus placebo or no treatment:
We found one crossover design RCT (63 people with elbow pain for over 6 weeks) which compared brace treatment versus no treatment. [39] The researcher was not blinded to the interventions received by the people enrolled in the trial. After 12 weeks' treatment, the groups were switched for an additional 12 weeks. After the first 12 weeks, there was a significant improvement in pain (visual analogue scale), pain-free grip strength, and functionality in the brace group compared with no treatment (data presented graphically, P less than 0.042 [change with time for all outcomes]). The RCT reported low levels of withdrawals, none of which was directly related to adverse effects of treatment. [39]

Orthoses versus physiotherapy:
The review identified one poor-quality RCT (84 people) comparing an elbow support with an unspecified physical therapy. [34] It found limited evidence of no difference in short-term levels of self-reported satisfaction. This study had insufficient information to assess pain improvement, had a withdrawal rate of 30%, and did not report standard deviations or confidence intervals for results.

OPTION SURGERY

Functional improvement
Open compared with percutaneous release surgery Percutaneous release surgery may be more effective at improving function at 1 year, and at reducing the median time to return to work, in people who had not improved with 12 months of conservative treatment (very low-quality evidence).

Note
We found no direct information about whether surgery is better than no active treatment.

For GRADE evaluation of interventions for tennis elbow, see table, p 18 .

Benefits: We found one systematic review (search date 2001), [40] which identified no RCTs, and one subsequent RCT. [41]

Surgery versus no treatment:
We found no RCTs.

Surgery versus other treatments:
We found no RCTs comparing outcomes for surgery with those for other treatments.

Open versus percutaneous release surgery:
The subsequent RCT (not blinded, 47 people who had failed 12 months of conservative treatment) compared open release surgery (removal of the damaged portion of the common extensor origin) versus percutaneous release surgery (tenotomy). [41] The RCT measured function and pain using the Disabilities of Arm, Shoulder and Hand (DASH) scale. It found that percutaneous release significantly improved DASH scores at 1 year compared with open release (improvement in median DASH score: 20 with percutaneous release *v* 17 with open release; P = 0.001). [41] The clinical importance of this 3-point difference has been questioned, because the minimum clinically important difference has been reported to be 10–15 points. [42] The RCT also found that percutaneous release significantly reduced median time to return to work compared with open release (2 weeks with percutaneous release *v* 5 weeks with open release; P = 0.0001) and significantly improved measures of subjective satisfaction (P = 0.012). [41]

Harms: The RCT gave no information about adverse effects. [41]

Comment: Various open and percutaneous operations for lateral elbow pain have been described based on the surgeon's concept of the pathological entity. The most commonly described surgical procedures involve excision of abnormal tissue (comprising microscopic degeneration, rupture, or both, and immature reparative tissue) within the origin of the extensor carpi radialis brevis, release of the extensor carpi radialis brevis from the lateral epicondyle region, or both. Additional procedures include release of the anterior capsule, removal of inflamed synovial folds, resection of a third of the orbicular ligament, debridement of articular damage, release of the posterior interosseous nerve, denervation of the lateral epicondyle, denervation of the radiohumeral joint, and excision of a radiohumeral bursa. [43] [44] [45] [46] [47] [48] [49] [50] [51] [52] [53] [54] [55]

OPTION EXTRACORPOREAL SHOCK WAVE THERAPY

Pain relief
Compared with placebo Extracorporeal shock wave therapy (ESWT) seems no more effective at improving pain at 4–6 weeks, or at improving pain from resisted wrist extension at 12 weeks (moderate-quality evidence).

Compared with corticosteroid injection plus local anaesthetic injection ESWT may be less effective at improving pain at 6 weeks and 3 months compared with a single corticosteroid injection plus local anaesthetic injection (low-quality evidence).

Global improvement
Compared with placebo We don't know whether ESWT is more effective at improving "treatment success" (very low-quality evidence).

For GRADE evaluation of interventions for tennis elbow, see table, p 18 .

Benefits: **Extracorporeal shock wave therapy (with or without local anaesthetic) versus placebo:**
We found two systematic reviews (search date 2005, 9 RCTs, 1006 people, [9] and November 2001 to December 2004, 6 RCTs, 808 people [56]) and one subsequent RCT [10] comparing different extracorporeal shock wave (ESWT) regimens versus placebo. In the first review, [9] people in three of the RCTs also received local anaesthetic. The RCTs were of variable quality and some were poorly reported, although five were considered to be of moderate to high quality. Pooled results for six RCTs, in people with chronic unresponsive tennis elbow, found no significant difference between ESWT and placebo in 11/13 analyses. Pooled analyses found no significant difference in pain improvement between groups at 4–6 weeks (3 RCTs, 446 people, improvement in pain measured on a scale from 0–100: WMD 9.42; 95% CI –20.70 to +1.86). It also found no significant difference in improvement in pain from resisted wrist extension at 12 weeks (3 RCTs, 455 people, improvement in pain using the Thomsen test: WMD –9.04, 95% CI –19.37 to +1.28). [9] Three RCTs could not be pooled because two did not provide measures of variance, [57] [58] and one included people with short-term symptoms with no previous treatment. [59] However, their inclusion within the pooled analyses in people with chronic tennis elbow would not have altered the overall findings of the review. The first RCT (24 people) excluded from pooled analysis found that ESWT improved pain at 6 months compared with placebo (mean pain score at 6 months [baseline]: 3.0

[6.6] with ESWT *v* 6.2 [6.6] with placebo; improvement of 3 or greater in pain score at 6 months, measured on a 10-point visual analogue scale: 10/13 [77%] with ESWT *v* 1/11 [9%] with placebo; P values not reported, reported as significant). [58] However, these results should be interpreted with caution, as treatment allocation concealment was inadequate. The second excluded RCT (86 people) found no significant difference between the two treatment groups for any measured outcome at any time point, and no significant difference in the proportion of people who eventually required surgery (17/37 [46%] with ESWT *v* 16/37 [43%] with placebo; RR 1.06, 95% CI 0.64 to 1.77). [57] The third excluded RCT (60 people with previously untreated tennis elbow) found no significant difference between ESWT compared with placebo (treatment success at 5 weeks: 12/31 [39%] with ESWT *v* 9/29 [31%] with placebo; RR 1.65, 95% CI 0.62 to 2.51). [59] The review found a significantly higher level of treatment success (defined as at least 50% improvement in pain with resisted wrist extension) at 12 weeks with ESWT compared with placebo (2 RCTs, 192 people, RR 2.20, 95% CI 1.55 to 3.12), although this finding was not supported by four RCTs that could not be pooled, and which found no significant difference in treatment success between groups at 4–12 weeks. [9] The second review only included 6 of the 9 trials included in the first review. [56] While it did assess trial quality, results were not pooled. It also concluded that the available data does not provide strong and consistent evidence that ESWT improves outcomes. The subsequent RCT (62 people with chronic tennis elbow) compared radial shock wave therapy versus sham treatment once a week for 4 weeks. [10] It suggested that shock wave therapy was more effective than sham treatment at reducing pain, both after treatment and at 6 months. However, it is difficult to draw reliable conclusions from these results, because outcome assessment was not blinded, and because, for some parameters, such as pain at rest, pain with resisted movements, and tenderness, the control group was observed to worsen over time — an outcome inconsistent with both the self-limited nature of the condition and the usual expected placebo response.

ESWT versus corticosteroid injection:
See benefits of corticosteroid injection, p 4 .

Different ESWT regimens:
We found no RCTs comparing the effectiveness of early versus delayed ESWT, or comparing different modes of delivery with each other.

Harms:

ESWT versus placebo:
In the review, [9] four out of nine included RCTs, and the additional RCT, gave no information about adverse effects. [10] One RCT identified by the review reported significantly more adverse effects in the ESWT group compared with placebo (OR 4.3, 95% CI 2.9 to 6.3). [9] [60] However, no one stopped treatment or had their doses adjusted because of adverse effects. The most frequently reported adverse effects in the other five RCTs identified by the review were transitory reddening of the skin, transient pain during treatment, petechiae, bleeding or haematomas, nausea, and migraine. [9] The additional RCT gave no information about adverse effects. [10]

ESWT versus corticosteroid injection:
See harms of corticosteroid injection, p 4 .

Comment:

The available data provide some evidence that shock wave therapy is no better than placebo at improving outcomes.

GLOSSARY

Eccentric exercises are strengthening exercises performed by slowing letting out the muscles — that is, controlled lengthening of muscle fibres.
Extracorporeal shock waves may be generated by electrohydraulic, electromagnetic, or piezoelectric systems that have an electroacoustic conversion mechanism and a device to focus the shock waves to the centre of the target zone.
Proprioceptive neuromuscular facilitation (PNF) Exercises to improve strength and coordination.
Radial shock waves are extracorporeal shock waves that are produced pneumatically through the acceleration of a projectile inside a handpiece and are transmitted radially from its tip to the target zone.
Roles–Maudsley score is a subjective pain score where 1 = excellent, no pain, full movement, full activity; 2 = good, occasional discomfort, full movement, and full activity; 3 = fair, some discomfort after prolonged activity; and 4 = poor, pain limiting activities.
Shock waves are single pulsed acoustic or sound waves that disperse mechanical energy at the interface of two substances with different acoustic impedance.
Concentric strengthening Exercises that involve shortening muscle fibres while contracting: that is, moving the relevant joint in the direction of the muscle action.
Disabilities of Arm Shoulder and Hand (DASH) functional index is a 30-item questionnaire designed to assess function in people with musculoskeletal disorders of the upper limb. Each item is scored from 1–5, and the total score is converted to a 1–100 scale.

Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Moderate-quality evidence Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Pain-Free Function Questionnaire A questionnaire assessing 10 activities that are frequently affected in patients with tennis elbow. Patients rate each activity on a scale from 0–4 (4 indicating severe discomfort) to give a total score ranging from 0–40. This score is then converted to a 0–100 scale for ease of comparison with other outcome measures.
Patient-Rated Forearm Evaluation Questionnaire (PRFEQ) (name changed to Patient-rated Tennis Elbow Evaluation [PRTEE] in 2005) is a tool developed to assess the outcome of treatment of lateral epicondylitis. It consists of 5 items to assess pain and 10 items to assess function during the previous week. Each item is scored on a visual numeric rating scale from 0 (no pain or difficulty) to 10 (the worst pain or difficulty imaginable). Each subscale (pain and function) contributes a score out of 50 to the total score (pain subscale + [function subscale]/2) for a total score of 0 (best score) – 100 (worst score).
Very low-quality evidence Any estimate of effect is very uncertain.

SUBSTANTIVE CHANGES

Corticosteroid injections (for short-term pain relief) One new subsequent analysis of an existing included RCT added; [21] categorisation unchanged (Likely to be beneficial).
Exercise and mobilisation One RCT added which found no difference at 6 weeks in pain-free grip strength, pain, or function between eccentric strengthening and stretching versus concentric strengthening and stretching versus stretching alone; [33] categorisation unchanged (Unknown effectiveness).

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Disclaimer

TABLE 1 **RCTs comparing acupuncture versus placebo for the treatment of tennis elbow.**

Ref	Population	Comparison	Outcome	Endpoint	Results
[25]	45 people	Acupuncture versus sham acupuncture (10 sessions)	Pain reduction from baseline, measured on a 30 mm VAS; baseline range: 16.46–17.17	2 weeks	–8.43 with acupuncture *v* –4.89 with sham treatment; P less than 0.05
			Functional impairment reduction from baseline, measured on the DASH scale from 1–100; baseline range: 33.72–38.08	2 weeks	–23.70 with acupuncture *v* –8.54 with sham treatment; P less than 0.05
[26]	48 people with chronic unilateral tennis elbow pain for over 2 months, average 15.4 months	Needle acupuncture *v* sham acupuncture (needles not inserted)	Pain relief duration	After one treatment	WMD 18.8 hours, 95% CI 10.1 to 27.5 hours
			Proportion of people with at least 50% reduction in pain	After one treatment	19/24 (79%) with acupuncture *v* 6/24 (25%) with placebo; RR 3.2, 95% CI 1.5 to 6.5
[27]	82 people with lateral epicondyle pain for 1 month or longer	Needle acupuncture *v* sham acupuncture	Proportion of self-reported "good" or "excellent" results	After 10 sessions	22/44 (50%) with acupuncture *v* 8/38 (21%) with sham treatment; P less than 0.01
			Proportion of self-reported "good" or "excellent" results	At 3 months	Data reported graphically; reported as NS
			Proportion of self-reported "good" or "excellent" results	At 12 months	Data reported graphically; reported as NS
			Increase in median pain threshold on gripping from baseline (range: 32–33)	After 10 sessions	32 with acupuncture *v* 10 with sham treatment; P less than 0.05
			Increase in median pain threshold on gripping from baseline (range: 32–33)	At 3 months	47 with acupuncture *v* 37 with sham treatment; reported as NS
			Increase in median pain threshold on gripping from baseline (range: 32–33)	At 12 months	62 with acupuncture *v* 55 with sham treatment; reported as NS
[28]	49 people with lateral elbow pain from 1 month to 3 years	Laser acupuncture *v* sham treatment	Proportion of people reporting "no improvement" or "worse" outcome	After 10 sessions	6/23 (26%) with laser *v* 5/26 (19%) with sham treatment; reported as NS; [28] RR 1.36, 95% CI 0.48 to 3.86 [23]
			Proportion of people reporting "no improvement" or "worse" outcome	At 3 months	2/22 (9%) with laser *v* 6/25 (24%) with sham treatment; reported as NS; [28] RR 0.38, 95% CI 0.09 to 1.69 [23]
			Proportion of people reporting "no improvement" or "worse" outcome	At 12 months	1/18 (6%) *v* 0/21 (0%) with sham treatment; reported as NS; [28] RR 3.47, 95% CI 0.15 to 80.36 [23]
			Proportion of people reporting "excellent" or "good" outcome	After 10 sessions	5/23 (22%) with laser *v* 12/26 (46%) with sham treatment; reported as NS
			Proportion of people reporting "excellent" or "good" outcome	At 3 months	12/22 (55%) with laser *v* 13/25 (52%) with sham treatment; reported as NS
			Proportion of people reporting "excellent" or "good" outcome	At 12 months	14/18 (78%) *v* 14/21 (67%) with sham treatment; reported as NS

Ref	Population	Comparison	Outcome	Endpoint	Results
[29]	30 people	Acupuncture plus vitamin B12 injection *v* vitamin B12 injection alone	Cure ("cure" not defined)	After 6 months	RR 0.44, 95% CI 0.15 to 1.29

DASH, Disabilities of the Arm, Shoulder, and Hand; Ref, Reference; NS, not significant; VAS, visual analogue scale

TABLE **GRADE evaluation of interventions for tennis elbow**

Important outcomes	Pain relief, global improvement, functional improvement, quality of life, adverse effects.								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
What are the effects of treatments for tennis elbow?									
2 (at least 49) [14] [16]	Pain relief	Corticosteroid injection *v* placebo or no treatment	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Directness point deducted for narrowness of population in one study
3 (at least 98) [19] [14]	Global improvement	Corticosteroid injection *v* placebo or no treatment	4	–3	0	–1	0	Very low	Quality points deducted for sparse data, poor methodologies, and incomplete reporting of results. Directness point deducted for outcome not fully defined
3 (at least 108) [14] [16] [19]	Functional improvement	Corticosteroid injection *v* placebo or no treatment	4	–2	–1	0	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Consistency point deducted for different results for different outcomes
1 (not stated) [20] [21]	Pain relief	Corticosteroid injection plus local anaesthetic injection *v* oral NSAID *v* placebo	4	–3	0	0	0	Very low	Quality points deducted for short follow-up, use of vitamin C as placebo, and incomplete reporting of results
2 (at least 53) [14]	Global improvement	Corticosteroid injection *v* local anaesthetic injection	4	–3	0	0	0	Very low	Quality points deducted for sparse data, uncertain follow-up, and incomplete reporting of results
1 (56) [37]	Global improvement	Corticosteroid injection *v* orthoses	4	–2	0	0	0	Low	Quality points deducted for sparse data and for pooling results from two arms in control group
1 (at least 53) [14]	Pain relief	Corticosteroid injection *v* exercise plus mobilisation	4	–3	0	0	0	Very low	Quality points deducted for sparse data, unclear definition of outcome, and incomplete reporting of results
2 (at least 112) [14] [19]	Global improvement	Corticosteroid injection *v* exercise plus mobilisation	4	–3	0	–1	0	Very low	Quality points deducted for sparse data, incomplete reporting of results, and poor methodologies. Directness point deducted for outcome not fully defined
1 (at least 59) [19]	Functional improvement	Corticosteroid injection *v* exercise plus mobilisation	4	–2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
1 (93) [22]	Pain relief	Corticosteroid injection plus local anaesthetic injection *v* ESWT	4	–2	0	0	0	Low	Quality point deducted for sparse data, and no intention-to-treat analysis
1 (246) [17]	Pain relief	Different types of corticosteroid injections *v* each other	4	–1	0	–1	0	Low	Quality points deducted for incomplete reporting of results. Directness point deducted for few comparators
1 (52) [18]	Pain relief	Single *v* multiple injections	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Directness point deducted for unclear outcome measurement
3 (175) [25] [26] [27]	Pain relief	Acupuncture *v* sham acupuncture	4	–2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
1 (161) [27] [28] [29]	Global improvement	Acupuncture *v* sham acupuncture	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Directness point deducted for unclear measurement of outcomes

Important outcomes	Pain relief, global improvement, functional improvement, quality of life, adverse effects.								
Number of studies (participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
1 (45) [25]	Functional improvement	Acupuncture *v* sham acupuncture	4	–1	0	–1	0	Low	Quality point deducted for sparse data. Directness point deducted for short follow-up
1 (20) [30]	Pain relief	Manual *v* electroacupuncture	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Directness point deducted for short follow-up
1 (62) [32]	Pain relief	Exercise *v* control	4	–1	0	–2	0	Very low	Quality point deducted for sparse data. Directness points deducted for unclear measurement of outcomes and inclusion of co-intervention
1 (62) [32]	Functional improvement	Exercise *v* control	4	–1	0	–2	0	Very low	Quality point deducted for sparse data. Directness points deducted for unclear measurement of outcomes and inclusion of co-intervention
1 (36) [15]	Pain relief	Exercise *v* ultrasound plus friction massage	4	–2	0	–1	0	Very low	Quality point deducted for sparse data and incomplete reporting of results. Directness point deducted for multiple interventions in comparison
1 (183) [15]	Pain relief	Exercise plus massage plus ultrasound *v* no treatment	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Directness point deducted for multiple interventions in comparison
1 (183) [15]	Global improvement	Exercise plus massage plus ultrasound *v* no treatment	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Directness point deducted for multiple interventions in comparison
1 (94) [33]	Pain relief	Eccentric strengthening plus stretching *v* concentric strengthening plus stretching *v* stretching	4	–2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting of results
1 (94) [33]	Functional improvement	Eccentric strengthening plus stretching *v* concentric strengthening plus stretching *v* stretching	4	–1	0	0	0	Moderate	Quality point deducted for sparse data
3 (76) [15]	Pain relief	Different manipulation techniques for mobilisation	4	–2	–1	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Consistency point deducted for conflicting results. Directness point deducted for inclusion of different comparators
2 (293) [11]	Pain relief	Oral NSAIDs *v* placebo	4	–3	–1	0	0	Very low	Quality point deducted for incomplete reporting of results, short follow-up, and use of vitamin C as placebo. Consistency point deducted for conflicting results
1 (164) [11]	Functional improvement	Oral NSAIDs *v* placebo	4	–3	0	0	0	Very low	Quality points deducted for sparse data, incomplete reporting of results, and use of vitamin C as placebo
2 (at least 53) [11]	Pain relief	Oral NSAIDs *v* corticosteroid injection	4	–3	–1	0	0	Very low	Quality points deducted for sparse data, unclear definition of outcome, and incomplete reporting of results. Consistency point deducted for conflicting results
2 (not stated) [11]	Global improvement	Oral NSAIDs *v* corticosteroid injection	4	–3	0	0	0	Very low	Quality points deducted for sparse data, incomplete reporting of results, and subjective assessment of outcome

Important out-comes	Pain relief, global improvement, functional improvement, quality of life, adverse effects.								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evi-dence**	**Quality**	**Con-sisten-cy**	**Direct-ness**	**Effect size**	**GRADE**	**Comment**
1 (180) [35]	Pain relief	Orthoses *v* physiotherapy	4	–1	0	–2	0	Very low	Quality points deducted for sparse data. Directness points deducted for inclusion of different comparators and sub-group analysis
1 (180) [35]	Global improvement	Orthoses *v* physiotherapy	4	–1	0	–1	0	Low	Quality points deducted for sparse data. Directness point deducted for inclusion of different comparators
1 (180) [35]	Functional improve-ment	Orthoses *v* physiotherapy	4	–1	0	–1	0	Low	Quality points deducted for sparse data. Directness point deducted for inclusion of different comparators
1 (47) [41]	Functional improve-ment	Open *v* percutaneous release surgery	4	–3	0	0	0	Very low	Quality points deducted for sparse data, not blinded, and uncertainty about clinical relevance of improvement
3 (130) [11]	Pain relief	Topical NSAIDs *v* placebo	4	–1	0	0	0	Moderate	Quality points deducted for sparse data
2 (119) [11]	Global improvement	Topical NSAIDs *v* placebo	4	–2	0	0	0	Low	Quality points deducted for sparse data, and subjective assessment of outcomes
2 (at least 40) [11]	Functional improve-ment	Topical NSAIDs *v* placebo	4	–2	0	0	0	Low	Quality points deducted for sparse data and incomplete re-porting of results
6 (618) [9] [57] [58] [10]	Pain relief	ESWT *v* placebo	4	0	0	–1	0	Moderate	Directness point deducted for inclusion of other intervention
7 (at least 252) [59] [9]	Global improvement	ESWT *v* placebo	4	–2	–1	–1	0	Very low	Quality point deducted for incomplete reporting of results and poor methodologies. Consistency point deducted for conflicting results. Directness point deducted for inclusion of other interventions

Type of evidence: 4 = RCT; 2 = Observational; 1 = Non-analytical/expert opinion. ESWT, extracorporeal shock wave therapy
Consistency: similarity of results across studies
Directness: generalisability of population or outcomes
Effect size: based on relative risk or odds ratio