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**Review**

# Acupuncture for the alleviation of lateral epicondyle pain: a systematic review

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***Objectives*. Lateral epicondyle pain is a common complaint in North America. In the past 10 yr acupuncture has become increasingly recognized as an alternative treatment for pain, including epicondyle pain. This review evaluates the effectiveness of acupuncture as a treatment for lateral epicondylitis using the appropriate analysis.**

***Methods*. Online bibliographic database searches in any language from Medline, PsychINFO, CINAHL, Healthstar, PMID, CAM, EMBASE, Cochrane Database of Systematic Review (3rd quarter 2003), articles listed in reference lists of key articles and the author's personal files were performed. Randomized and quasi-randomized controlled trials examining the effects of acupuncture on lateral epicondyle pain were selected. From the six studies that met inclusion criteria, the first author, year of publication, population studied, dropout rate, treatment plan, assessment scale and outcome measures were extracted. Study quality was determined by using the Jadad scale, in which all studies were rated as high quality. A best evidence synthesis approach was used to analyse the data presented in the six studies.**

***Results*. All the studies suggested that acupuncture was effective in the short-term relief of lateral epicondyle pain. Five of six studies indicated that acupuncture treatment was more effective compared to a control treatment.**

***Conclusions*. There is strong evidence suggesting that acupuncture is effective in the short-term relief of lateral epicondyle pain.**

KEY WORDS: Epicondylitis, Elbow pain, Tennis elbow, Acupuncture, Systematic review, Best evidence synthesis approach.

Lateral epicondylitis or lateral epicondyle pain, commonly known as tennis elbow, is an inflammatory condition of the extensor carpi radialis brevis tendon. The condition is often caused by repetitive use of the arm or sudden injury. Onset of pain is usually gradual on the lateral side of the elbow or below the joint's bony prominence [1]. Daily activities such as carrying, lifting and gripping are commonly affected by such pain [2]. With a prevalence of 1–3% [3] and a higher incidence of non-sport-related injury, there are major economic costs. In Quebec alone, over 1500 workers have made claims to the Worker's Compensation Board for lateral epicondyle pain, which generated a cost of $8000 CDN and an average of 62 days of work absenteeism [4].

There are several conventional therapies for tennis elbow, including transcutaneous electrical nerve stimulation, braces, conventional physiotherapy (such as stretching and strengthening exercises), corticosteroid injections [3] and surgery [5]. These interventions are believed to relieve pain, promote tissue healing and improve joint mechanics [1]. However, there is conflicting information regarding the effectiveness of these therapies [6]. Three systematic reviews on the conventional therapies for lateral elbow pain have been published in the Cochrane Review Series [5, 7, 8]. All three reviews concluded that there was little evidence supporting the effectiveness of these treatments. For instance, according to Buchbinder *et al.* [5] the results for surgical intervention were inconclusive due to the lack of randomized controlled trials. A second review by Buchbinder *et al.* [7] examined the efficacy of shock-wave therapy for lateral elbow pain. No conclusions could be drawn, due to conflicting results. Furthermore, the limited number of trials using orthotic devices in the review by Struijs *et al.* [8] prevented any definitive conclusions from being made.

Outside of the Cochrane Review Series, three systematic reviews of conventional therapies and corticosteroid injections for lateral epicondyle pain have been published [9–11]. These reviews also found little evidence on which to base clinically relevant conclusions for the effective treatment of lateral epicondyle pain, due to factors such as methodological weaknesses and heterogeneity. It was therefore difficult to formulate unequivocal clinical conclusions.

In the past 10 yr, acupuncture has gained wider acceptance for treating pain [3, 12]. Recently, in a publication by the National Institutes of Health (NIH), it was determined that results were promising enough to support the use of acupuncture. Areas in which the NIH felt acupuncture might be an acceptable alternative are low back pain, stroke rehabilitation, asthma, addiction and tennis elbow. In the Cochrane Review Series, there was one review examining the effectiveness of acupuncture treatments in lateral elbow pain [13]. The authors, Green *et al.*, concluded that there was insufficient evidence to support the use of acupuncture in achieving long-term results for lateral epicondyle pain. The results did indicate that acupuncture provided short-term relief from such pain; however 'this finding is based on the results of two small trials, the results of which were not able to be combined in meta-analysis'.

From the authors' experience in this area, we felt that the Cochrane review by Green *et al.* on lateral epicondyle pain was heterogeneous, in which case meta-analysis might not be the most appropriate method of synthesizing the evidence. Since the

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Cochrane review, four new clinical trials meeting inclusion criteria have been identified [4, 14, 15; D. Irnich, H. Karg, N. Behrens, M. A. Schreiber, M. Krauss, P. Kroling, personal communication]. Therefore, we decided to conduct a systematic review of acupuncture and lateral epicondylitis using either a meta-analysis or the best evidence synthesis approach (BESA), depending whether the newly identified trials could be combined quantitatively or qualitatively, respectively. If the studies were clinically homogeneous, the results could be pooled statistically. On the contrary, if the studies were clinically heterogeneous it would be inappropriate to pool the studies statistically. Therefore, a qualitative analysis of the results using BESA would be employed. Furthermore, it has been over 2 yr since Green *et al.* published their paper, and because more recent studies have been published on this topic we feel that this was the right time to revisit this topic.

## Methods

### *Data sources/search strategies*

Comprehensive searches were made of Medline (1966 to January 2004), PsychINFO (1984 to January 2004), CINAHL (1992 to January 2004), Healthstar, PMID, EMBASE (1980 to January 2004), the Complementary and Alternative Medicine (CAM) database (1980 to January 2004), the Cochrane Database of Systematic Reviews (3rd quarter 2003) and the authors' personal files. Search restrictions included human subjects only. The search strategy was as follows: (1) lateral epicondyle pain.mp. [mp = ti, tc, sh, ab, it, kw, rw]; (2) lateral epicondylitis.mp.; (3) epicondylitis.mp.; (4) epicondyle pain.mp.; (5) tennis elbow.mp.; (6) elbow pain.mp.; (7) tendonitis; (8) 1 or 2 or 3 or 4 or 5 or 6 or 7; (9) acupuncture.mp.; (10) NSAID; (11) analgesics; (12) anti-inflammatory drug; (13) ultrasound; (14) treatments.mp; (15) 9 or 10 or 11 or 12 or 13 or 14; (16) prognosis.mp.; (17) disease free survival.mp.; (18) randomized controlled trial.mp.; (19) placebo; (20) cohort study.mp.; (21) natural history.mp.; (22) 17 or 18 or 19 or 20 or 21 or 22; (23) 8 and 15 and 22.

### *Selection criteria and outcome*

Two independent reviewers assessed all the identified articles based on the following inclusion criteria: (i) the article described an original study; (ii) the study included patients with pain resulting from tennis elbow, lateral epicondyle pain, lateral elbow pain, lateral epicondylitis, or any description of pain originating from the common origin of the extensor tendon; (iii) patients were randomly or quasi-randomly assigned to the treatment groups; and (iv) needle acupuncture was used as the primary intervention.

Because of our prior knowledge of the small number of studies on this topic, we decided to include both randomized and quasi-randomized studies. There was no language restriction in the inclusion criteria; translators were contacted if necessary.

Exclusion criteria included (i) patients with elbow problems other than lateral epicondyle pain, such as fractures or neurological conditions, and (ii) patients concurrently receiving other treatments.

### *Data analysis*

Using the ChiSquare program, we calculated the agreement between investigators for the assessment of validity. The kappa statistic was used to measure agreement. Results less than zero reflect poor agreement, 0–0.20 slight agreement, 0.21–0.40 fair agreement, 0.41–0.60 moderate agreement, 0.61–0.80 substantial agreement and 0.81–1.00 almost perfect agreement [16].

Using a random effects model, the standard mean difference (SMD) and 95% confidence interval was calculated for outcomes reported in a continuous data format. SMD was used because different measures were frequently used to address the same clinical outcome. For instance, some studies measured pain intensity with a visual analogue scale while others measured pain unpleasantness with a 0–10 scale. The effect size (SMD) is a unitless measure reported in standard deviation units. Generally, an effect size can be interpreted as small (−0.20), medium (−0.50) and large (−0.80), as defined by Cohen [17]. The SMD needs to be considered carefully as both positive and negative SMD can indicate a positive effect. For example, a negative SMD can reflect a reduced pain level or increased function, while a positive SMD can reflect a decrease in pain intensity or improved disability.

Dichotomous data were extracted for outcomes when continuous data were not available. Using a random effects model, the relative risk and the outcome rate in the treated *vs* control group was calculated. For undesirable outcomes, such as pain intensity on a VAS, a relative risk less than one represented a beneficial treatment.

Clinical judgement was used regarding the similarity of sample populations, types of elbow pain, interventions, durations of treatment, and outcomes used for assessment. Statistical pooling could be used to combine the treatment effects of studies with similar clinical features. If the studies were too dissimilar in clinical features, no statistical pooling should be used. Statistical method for pooling should also not be used if the test of homogeneity was statistically significant. In these instances, a qualitative review was performed as follows: Level 1, strong evidence—generally consistent findings in multiple (two or more) high-quality randomized controlled trials; Level 2, moderate evidence—generally consistent findings in one high-quality randomized control trial and one or more low-quality randomized controlled trials; Level 3, limited evidence—generally consistent findings in one high-quality randomized controlled trial or more than one low-quality randomized controlled trial; Level 4, no evidence—one low quality randomized controlled trial, no randomized control trials, or contradictory results among different trials.

Several other systematic reviews have adopted this approach [18, 19]. Consistency was defined *a priori* as over 60% of the trials agreeing on the direction of the results. For our overall conclusion, we also considered other issues, such as quality of the original studies, adequate sample size, and precision of the studies other than just the actual proportion of positive studies. Quality of the studies was determined with the Jadad scale of validity assessment [20], as described below.

### *Assessment of validity*

The quality of the randomized controlled trials was assessed using Jadad's scale [20, 21]. Two reviewers independently rated the quality of the studies. If there were any disagreements, they were resolved through consensus by discussion and clarification of different opinions. If disagreements continued, they were resolved through arbitration by a third reviewer. The calculated kappa value was 0.72. The Jadad scale determined the quality of the trials [20, 21]. Trials were classified as higher quality if their scores were 3 or higher and as lower quality if their scores were 2 or lower on the five-point Jadad scale. When using the Jadad scale, studies were each given a point for randomization, appropriateness of randomization, double-blinding, appropriateness of blinding, and mentioning withdrawals and dropouts [22]. According to Jadad [21], successful double-blinding requires that the participants and the investigators assessing the intervention outcome are unaware of the intervention each participant is to receive.

## Results

### *Selection of studies*

Out of the 53 articles identified, six met the selection criteria, from which data were extracted (Table 1) [4, 14, 15, 23, 24; D. Irnich, H. Karg, N. Behrens, M. A. Schreiber, M. Krauss, P. Kroling, personal communication]. Two further studies were also selected,

Table 1. Study characteristics

| Author and year | Study type | Sample population | Dropout rate | Intervention | Treatment plan | Assessment scale | Outcome measures |
|---|---|---|---|---|---|---|---|
| Davidson, 2001 | Randomized, single-blind trial | 17 patients with lateral epicondylitis | 1 in the Ultrasound group | *Treatment group* ($n=8$)<br>Needle acupuncture producing Teh Chi<br>Points LI4, TW5, LI10, LI11, LI12<br>*Ultrasound group* ($n=9$)<br>Pulsed ultrasound for 10 min | 8 treatments 2–3 times/ week | Visual analogue pain scale before each treatment<br>Pain-free grip strength scores<br>Functional impairment assessed via DASH questionnaire | Significant pain reduction and functional improvement in both groups following treatment<br>No significant difference between groups |
| Fink, 2002 | Randomized, controlled double-blind trial | 45 patients with lateral epicondylitis | 3 at 2-week and 2 more at 2-month follow-up | *Treatment group* ($n=23$)<br>Needle acupuncture producing De Qi<br>One Ashi point and LI 4, LI 10, LI 11, Lu 5, SJ 5<br>*Control group* ($n=22$)<br>Sham needle acupuncture<br>Points 5 cm away from the points used above | 10 treatments 2 times/week | Pain assessed at rest, in motion, during exertion, as well as duration and frequency on 0–5 scale<br>Functional impairment assessed with DASH questionnaire | Pain: treatment group improved significantly more than control at 2 weeks (both groups significantly improved at all follow ups)<br>Functional impairment: treatment group improved significantly more than control at 2 weeks and 2 months |
| Grua, 1999 | Randomized trial | 40 patients with lateral epicondylitis | None | *Treatment group* ($n=20$)<br>Needle acupuncture<br>Points LI4, LI 10, LI 11, LI 12, LI 15, P5, P7, GB 20, GB21, GB34, ST37, ST38<br>*Ultrasound group* ($n=20$)<br>Pulsed ultrasound therapy over central and peripheral area of lateral epicondyle for 5 min | *Treatment group*<br>10 treatments<br>1–2 times/ week for 2 months<br>*Ultrasound group*<br>12 treatments<br>1 treatment/ day for 12 days | Visual analogue scale (1–10) measuring pain<br>Maigne functional recovery test | Pain improvement and functional recovery significant after treatment and at 6-month follow-up for treatment group compared with ultrasound group |

Table 1. Continued

(*continued*)

| Author and year | Study type | Sample population | Dropout rate | Intervention | Treatment plan | Assessment scale | Outcome measures |
|---|---|---|---|---|---|---|---|
| Haker, 1990 | Randomized, double blinded trial | 82 patients with lateral elbow pain | 4 after 10th treatment, another 5 at 3 months | *Group A: treatment* ($n=44$)<br>Teh Chi needle acupuncture<br>Points LI 10, LI 11, LI 12, Lu5, SJ10<br>*Group B: control* ($n=38$)<br>Superficial needle insertion<br>Same points as group A | 10 treatments 2–3 times/ week | 5-point scale describing present condition<br>1 = excellent<br>2 = good<br>3 = improved<br>4 = slightly improved<br>5 = unchanged/worse | Pain improvement after treatment:<br>*Group A*<br>10 days — 3 months<br>$n=44$ — $n=43$<br>1/2 22 (50%) — 33 (77%)<br>3 17 (39%) — 3 (07%)<br>4/5 5 (11%) — 7 (16%)<br>*Group B*<br>10 days — 3 months<br>$n=38$ — $n=35$<br>1/2 8 (21%) — 22 (60%)<br>3 17 (45%) — 9 (26%)<br>4/5 13 (34%) — 5 (14%) |
| Irnich, 2002 | Double blinded, quasi-randomized trial | 50 patients with lateral epicondylitis | None | *Treatment group* ($n=25$)<br>Acupuncture TCM<br>Points LI4, 10, SI3, SJ5, GB34<br>*Control group* ($n=25$)<br>Sham needle acupuncture<br>Points one thumb-width away from those used above | 3 treatments within 10 days | Pressure pain threshold<br>Pain-free grip strength<br>Impairment caused by pain (0–10) | At 14-day follow-up:<br>*Treatment group*<br>59% had decrease in impairment<br>7 subjects had full recovery<br>*Control group*<br>24% had decrease in impairment<br>0 subjects had full recovery |
| Molsberger, 1994 | Randomized placebo-controlled, double-blinded trial | 48 patients with lateral epicondylitis | None | *Treatment group* ($n=24$)<br>Needle acupuncture<br>Non-segmental distal point GB34 (on ipsilateral leg)<br>*Placebo group* ($n=24$)<br>Suggestive acupuncture therapy (stimulation with pencil-like probe to simulate needle insertion)<br>Acupuncture point UB13 | 1 treatment | 11-point box scale (0–10) | Immediately after treatment:<br>*Treatment group*<br>19 reported pain relief of $\geq$50%<br>55.8% mean pain reduction<br>*Placebo group*<br>6 reported pain relief of $\geq$50%<br>15% mean pain reduction |

TABLE 2. Jadad scores of the Davidson, Fink, Grua, Haker, Irnich and Molsberger studies

| Category | Davidson | Fink | Grua | Haker | Irnich | Molsberger |
|---|---|---|---|---|---|---|
| Randomization | 1 | 1 | 1 | 1 | 1 | 1 |
| Appropriateness of randomization | 1 | 1 | 1 | 0 | −1 | 0 |
| Double-blinding | 0 | 1 | 0 | 1 | 1 | 1 |
| Appropriateness of double-blinding | 0 | 1 | 0 | 1 | 1 | 1 |
| Withdrawals and dropouts | 1 | 1 | 1 | 1 | 1 | 1 |
| Total (out of 5) | 3 | 5 | 3 | 4 | 3 | 4 |

Coding: 1 = yes; 0 = no/not mentioned/insufficient detail; −1 = inappropriate method.
Total score: 0–2 = low-quality study; 3 or greater = high-quality study.

but were later excluded. One study described the injury as lateral epicondylitis; however, subjects with medial epicondylitis were also included. The results did not distinguish between the two types of injury [3]. A second study included a vitamin B12 and herbal injection in conjunction with the acupuncture treatment [24].

### *Quality of the study*

Results of the quality assessment are shown in Table 2. Only one study had a perfect Jadad score [14]. In two studies, the method/appropriateness of randomization was not mentioned and therefore received a zero [22, 23]. In one quasi-randomized study the patients were grouped alternately; odd- and even-numbered patients were allocated to the acupuncture and ultrasound treatment group respectively [D. Irnich, H. Karg, N. Behrens, M. A. Schreiber, M. Krauss, P. Kroling, personal communication]. Consequently, this study received a score of −1 for appropriateness of randomization. Two studies received a zero for method/appropriateness of double-blinding because the patients and treatment providers/assessors could not be blinded to the treatment [4, 15]. The six studies being assessed were considered consistent high-quality randomized controlled trials because they were all within the 3–5 range on the Jadad scale.

### *Data synthesis*

Of the six studies that were included, all of them indicated that acupuncture was effective in relieving lateral epicondyle pain. Five of the six studies indicated that acupuncture treatment was more effective compared to a control treatment. The four trials comparing acupuncture with a form of sham acupuncture indicated that acupuncture treatment was more effective in alleviating lateral epicondylitis. One study suggested that it was also effective for long-term pain relief of up to 1 yr [14]. Using the Jadad scale, all of these studies were considered to be of high quality. We felt that these data were too clinically heterogeneous for us to combine using statistical pooling. Therefore, using the BESA and a priori of 60% for consistency, there is strong evidence suggesting that acupuncture is effective in short-term pain relief for patients with lateral epicondyle pain. Moreover, sample size, quality of the treatment protocol and quality of the research methodology were also taken into consideration.

## Discussion

There are several limitations to this review. A consistent definition of lateral epicondyle pain did not exist in the literature. In our review, two studies described the condition in some detail as 'chronic unilateral tennis elbow pain for more than 2 months' [23] and as 'well established lateral epicondylitis symptoms of at least three weeks in duration' [4]. The latter study included a detailed description of the inclusion and exclusion criteria. Similarly, Fink *et al*. [14] and Grua *et al*. [15] also included details of the inclusion and exclusion criteria. However, both studies described the condition as chronic lateral epicondylitis (based on the final follow-up assessment). In the final two studies, the condition was simply described as 'lateral epicondylitis' [D. Irnich, H. Karg, N. Behrens, M. A. Schreiber, M. Krauss, P. Kroling, personal communication] and lateral elbow pain [22] without further explanation. Without a consistent definition of the condition, the population in the studies was probably heterogeneous with regard to the cause.

Although all the studies used acupuncture as the primary intervention, the type of acupuncture administered appeared to be different in terms of dosing, such as the total number of treatments, frequency and duration of treatments, number of needles being used and the type of acupuncture (classical *vs* anatomical), etc. Therefore, the interventions were also heterogeneous.

The third area of heterogeneity identified was the outcomes used. There was no uniform definition of pain relief. Even though pain relief is important, especially from the patient's perspective, it is rather subjective. More objective measures, such as recovery of function and returning to work, were also important variables. Although Davidson's study [4] examined the recovery of function, no other study addressed the issue of returning to work. Looking at pain relief itself, there was great variability among these studies in terms of the definition of improvement for pain relief. In particular, the definition of short-term pain alleviation varied from immediately after one treatment to 3 months after a series of treatments. Nevertheless, even after we took the sample size, quality of the treatment protocol and quality of the research methodology into consideration, the evidence continued to support acupuncture's ability to alleviate epicondyle pain.

Furthermore, there is much debate at the moment in regard to what defines a reasonable sham control [25]. The selected studies used various sham controls (or sham acupuncture), including superficial needling [22], suggestive needling (stimulating the area with a pencil-like probe to simulate needle insertion and extraction) [23] and needling at non-traditional points [14; D. Irnich, H. Karg, N. Behrens, M. A. Schreiber, M. Krauss, P. Kroling, personal communication]. Sham acupuncture might in fact produce non-specific analgesic effects. According to Ezzo *et al*. [19], the proportion of improvement reported in the sham groups was significantly higher than that reported in inert placebo groups. However, in Ezzo's review, no studies specifically examining lateral epicondyle pain were included. Research is ongoing and will hopefully will one day give clearer guidance for the selection of appropriate sham controls [26–28]. Finally, the sample size in the studies was small, the largest sample of 82 patients being in the study of Haker and Lundeberg [22].

Future research is recommended to resolve the issues discussed. There is a need for a larger scale multicentre study that will also

address the issue of adequate sham control, uniformity of the definition of lateral epicondylitis, optimal acupuncture treatments, and the use of more objective outcomes.

## Conclusion

Using the BESA, there is strong evidence suggesting that acupuncture is effective in short-term pain relief for lateral epicondyle pain. However, caution is needed because of the great clinical heterogeneity between the studies. Further research is required to determine the optimal acupuncture treatment for short-term pain relief and whether it is also effective when assessed using more objective outcomes.

The authors have declared no conflicts of interest.

| *Rheumatology* | Key messages |
|---|---|
| | • Acupuncture can successfully help manage pain.<br>• Evidence suggests that acupuncture effectively alleviates lateral epicondylitis on a short-term basis. |

## References


1. Reid DC. Elbow region. Sports injury assessment and rehabilitation. New York: Churchill Livingstone, 1992:1013–23.
2. Richardson J, Iglarsh Z. Clinical orthopedic physical therapy. Philadelphia: W. B. Saunders, 1994.
3. Brattberg G. Acupuncture therapy for tennis elbow. Pain 1983; 16:285–8.
4. Davidson JH, Vandervoort A, Lessard L, Miller L. The effect of acupuncture versus ultrasound on pain level, grip strength and disability in individuals with lateral epicondylitis: a pilot study. Physiother Can 2001;53:195–202.
5. Buchbinder R, Green S, Bell S, Barnsley L, Smidt N. Surgery for lateral elbow pain. Cochrane Database Syst Rev 2001;1:1–12.
6. Labelle H, Guibert R, Joncas J, Newman N, Fallaha M, Rivard C. Lack of scientific evidence for the treatment of lateral epicondylitis of the elbow. An attempted meta-analysis. J Bone Joint Surg 1992;74:646–51.
7. Buchbinder R, Green S, White M, Barnsley L, Smidt N. Shock wave therapy for lateral elbow pain. Cochrane Database Syst Rev 2001;1:1–12.
8. Struijs P, Smidt N, Arola H, Van Dijk C, Buchbinder R, Assendelft W. Orthotic devices for the treatment of tennis elbow. Cochrane Database Syst Rev 2001;1:1–18.
9. Assendelft W, Hay E, Adshead R, Bouter L. Corticosteroid injections for lateral epicondylitis: a systematic overview. Br J Gen Pract 1996;46:209–16.
10. Hudak P, Cole D, Haines A. Understanding prognosis to improve rehabilitation: the example of lateral elbow pain. Arch Phys Med Rehabil 1996;77:586–92.
11. LeBlanc ES, Janowsky J, Chan BKS *et al.* Hormone replacement therapy and cognition: systematic review and meta-analysis. J Am Med Assoc 2000;285:1489–99.
12. National Institutes of Health. NIH consensus conference: acupuncture. JAMA 1998;280:1518–24.
13. Green S, Buchbinder R, Hall S *et al.* Acupuncture for lateral elbow pain in adults. Cochrane Database Syst Rev 2002;1: CD003527.
14. Fink M, Wolkenstein E, Luennemann M, Gutenbrunner C, Gehrke A, Karst M. Chronic epicondylitis: effects of real and sham acupuncture treatment: a randomised controlled patient- and examiner-blinded long-term trial. Forsch Komplementarmed Klass Naturheilkd 2002;9:210–5.
15. Grua D, Mattioda A, Quirico P, Lupi G, Allais G. L'agopuntura nel trattamento dell'epicondilite laterale: valutazione dell'efficacia e confronto con ultrasuonoterapia. [Acupuncture in the treatment of lateral epicondylitis: evaluation of the effectiveness and comparison with ultrasound therapy]. G Ital Riflessot Agopunt 1999;11:63–9.
16. Landis J, Koch G. The measurement of observer agreement for categorical data. Biometrics 1977;33;159–74.
17. Cohen J. Statistical power analysis for the behavioural sciences. 2nd edn. Hillsdale (NJ): Lawrence Erlbaum, 1988.
18. Van Tulder MW, Koes BW, Bouter L. Conservative treatment of acute and chronic nonspecific low back pain: a systematic review of randomized controlled trials of the most common interventions. Spine 1998;22:2128–56.
19. Ezzo J, Berman B, Hadhazy VA, Jadad AR, Lao L, Singh BB. Is acupuncture effective for the treatment of chronic pain? A systematic review. Pain 2000;86:217–25.
20. Jadad AR, Moore RA, Carroll D *et al.* Assessing the quality of randomized clinical trials: is blinding necessary? Control Clin Trials 1996;17:1–12.
21. Jadad A. Randomised controlled trials. London: BMJ Books, 1998.
22. Haker E, Lundeberg T. Acupuncture treatment in epicondylalgia: a comparative study of two acupuncture techniques. Clin J Pain 1990;6:221–6.
23. Molsberger A, Hille E. The analgesic effect of acupuncture in chronic tennis elbow pain. Br J Rheumatol 1994;33:1162–5.
24. Wong Y. Acupuncture and injection for the treatment of tennis elbow: 30 cases. Shanghai Acupunct J 1997;16:20.
25. Trinh K. The challenges of nonpharmacological trials: blinding and other issues using acupuncture research as an example. Drug Information J 2002;36:509–11.
26. Streitberger K, Kleinhenz J. Introducing a placebo needle into acupuncture research. Lancet 1998;352:364–5.
27. White AR, Ernst E. A systematic review of randomized controlled trials of acupuncture for neck pain. Rheumatology 1999;38:143–7.
28. Park J, White A, Lee H, Ernst E. Development of a new sham needle. Acupunct Med 1999;17:110.