



Original article

Comparison of treatment effects on lateral epicondylitis between acupuncture and extracorporeal shockwave therapy

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Abstract

Background: Lateral epicondylitis is one of the most common overuse injuries, and has been reported to reduce function and affect daily activities. There is no standard therapy for lateral epicondylitis. In Hong Kong, acupuncture and extracorporeal shockwave therapy (ESWT) have been popular in treating lateral epicondylitis in recent years.

Objective: This study is to compare the treatment effects of acupuncture and ESWT on lateral epicondylitis.

Methods: In this study, we evaluated 34 patients (34 elbows) with lateral epicondylitis. Seventeen patients were treated by 3-week ESWT, one session per week. Another 17 were treated by 3-week acupuncture therapy, two sessions per week. The outcome measures included pain score by visual analogue scale, maximum grip strength by Jamar dynamometer, and level of functional impairment by disability of arms, shoulders, and hands questionnaire. Participants were assessed at three time points: baseline; after treatment; and 2-week follow-up.

Results: The two treatments showed no significant difference at any assessment time-point. Both treatment groups had significant improvement in pain score in longitudinal comparisons. No significant difference was found in maximum grip strength and functional impairment in either treatment group, but a trend of improvement could be observed. In addition, improvement in pain relief stopped when treatment ended for either groups.

Conclusions: The treatment effects of acupuncture and ESWT on lateral epicondylitis were similar. The pain relief persisted for at least two weeks after treatment.

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Keywords: conservative treatment; lateral epicondylalgia; lateral epicondylitis; tendinopathy; tennis elbow

Introduction

Lateral epicondylitis, known as tennis elbow, is one of the most common overuse injuries, with reported incidence of 1–3% in the general population^{1,2} and 2–23% among occupational populations.³ It has accounted for 4–7 out of 1000 patients among all general clinical cases.⁴ Patients with lateral

epicondylitis are aged from 45 years to 64 years, with higher incidence in women than men.³ The affected duration is reported to vary from 6 months to 2 years.^{5,6} Longer exposure to repetitive and forceful activities,³ and eccentric contraction of extensor carpi radialis brevis have been reported to be strongly associated with lateral epicondylitis.⁷ In short, senior female adults, who have worked with repetitive movements, have higher opportunity to develop lateral epicondylitis.

The symptom of lateral epicondylitis is a form of degenerative tendinopathy characterized with tenderness at lateral epicondyle of the humerus (LE).⁸ The degenerative tendinopathy symptoms are less precisely defined but frequently

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include local tenderness at the origin of extensor musculotendinous structure at the LE. The pain could be reproduced as follows: (1) palpation at facet of the LE; (2) resisted wrist extension with or without resisted third finger extension in elbow extension; and (3) grip an object.^{9–12} Lateral epicondylitis reduces function and affects daily activities.¹³

There is still no standard treatment for lateral epicondylitis. The choice of treatment depended on the general practice of medical institutions and clinics. Apart from surgical treatment, the physical interventions can be categorized into two aspects: electrotherapeutic and nonelectrotherapeutic. Electrotherapeutic interventions include ultrasound, laser therapy, extracorporeal shockwave therapy (ESWT), and ionization and electromagnetic field.¹⁴ Those exogenous energy sources in electrotherapeutic interventions are believed to increase membrane potential and in turn the general cell activity, which may lead to physiological changes and therapeutic benefits.¹⁵ Nonelectrotherapeutic interventions include acupuncture, manipulation treatment, exercise, taping, and bracing.¹⁴

In Hong Kong, the use of acupuncture and ESWT has been more popular in treating lateral epicondylitis in recent years. By stimulating certain acupoints, studies have shown that acupuncture can reduce sensitivity to pain and stress.¹⁶ Furthermore, it was reported to increase the release of adenosine, which has antinociceptive properties.¹⁷ In addition, it was found to improve local microcirculation which helps removal of swelling.¹⁸ However, the mechanism of its pain alleviation effect is still unclear.¹⁹ In contrast, ESWT is a noninvasive treatment with acoustic pressure disturbance produced to reduce pain through hyperstimulation and increased vascularity, also to stimulate and reactivate healing promotion of tendon, bones, and other soft tissues.^{20,21} Modulation of pain signals was also one of the proposed mechanisms.²²

Although both treatments have been used to treat lateral epicondylitis in general practice, their treatment effect is conflicting. Two systematic reviews indicated that acupuncture can only relieve pain for lateral epicondylitis in the short term.^{14,23} By contrast, ESWT was reported to have little or no effect on lateral epicondylitis in a meta-analysis.²⁴ However, this meta-analysis was criticized for overlooking the variation of generation principles of shock wave between studies, including the use of local anesthesia which may diminish the treatment effect of ESWT and acute cases included in studies.²⁵ A study investigating the duration of pain and success of ESWT also reported patients with chronic symptoms may benefit more from ESWT.²⁶ The use of ESWT was recommended for lateral epicondylitis for patients with symptoms lasting for at least 3 months. In short, more effort is needed to investigate the treatment effect of both acupuncture and ESWT on lateral epicondylitis.

Comprehensive evaluation of validated functional outcome was lacking in previous studies regarding the effect of ESWT.²⁴ There are other approaches available to access the functional outcome such as the disabilities of the arm, shoulder and hand questionnaire (DASH)²⁷ and upper extremity functional scale,²⁸ which are well-validated. In this study,

DASH was employed to help evaluate the treatment effect of acupuncture and ESWT on lateral epicondylitis.

The objective of this study is to compare the treatment effects of acupuncture and ESWT on lateral epicondylitis.

Materials and methods

This was a parallel-study design. Patients were randomly assigned to receive acupuncture or ESWT. Both treatments were performed by the same registered physiotherapy with qualifications in acupuncture.

Patient recruitment

Patients were diagnosed as lateral epicondylitis by registered physiotherapists and orthopedic specialists. Exclusion criteria included: (1) surgical treatment for lateral epicondylitis; (2) deformities of elbow, cervical radiculopathy; (3) referred pain from neck and shoulder; (4) treatment in the last 12 months for lateral epicondylitis with corticosteroid injection or extracorporeal shockwave or acupuncture; (5) patients with systemic conditions that involve joints and connective tissues; (6) hemophilia; or (7) patients who reject the acupuncture treatment for personal reasons. Patients with lateral epicondylitis diagnosed were classified into six phases in accordance to the Nirschl's classification.²⁹ No analgesia was prescribed in parallel to the treatment.

Patients recruited were given written consent form. And the study protocol was explained to patients preceding the treatment. The study protocol was approved by The Joint Chinese University of Hong Kong – New Territories East Cluster Clinical Research Ethics Committee. All experimental procedures were performed in accordance with the approved procedures.

Treatment protocol

In the ESWT group, an extracorporeal shockwave generator machine (focused extracorporeal shockwave Piezowave basic set; Richard Wolf, Knittlingen, Germany) was used to perform the treatment. ESWT was applied on the common extensor origin of the affected elbow.^{22,30} The whole treatment lasted for 3 weeks. According to previous studies,^{31–33} three sessions of treatment in total were assigned and performed once a week. Each treatment was initiated by a low energy level (1–3), and gradually increased to the patient's tolerance limit. The pulse for treatment was set to 2000 Hz. The energy flux density was within 0.032–0.822 mJ/mm², which varies according to the energy intensity applied.

Treatment protocols of lateral epicondylitis using acupuncture are too diversified among different studies.¹⁹ In the acupuncture group, the treatment protocol adopted was a standard protocol of the clinic, which had been shown to be effective in relief of pain provoked by lateral epicondylitis.³⁴ The six acupoints were point *Ah-shi*, LI.10, LI.11, Lu.5, LI.4, and SJ.5. The *Ah-shi*, LI.10, and LI.11 acupoints were over the muscular origin of the lateral extensor group of the forearm (Figure 1); Lu.5 was over the cubital region; and SJ.5 and LI.4

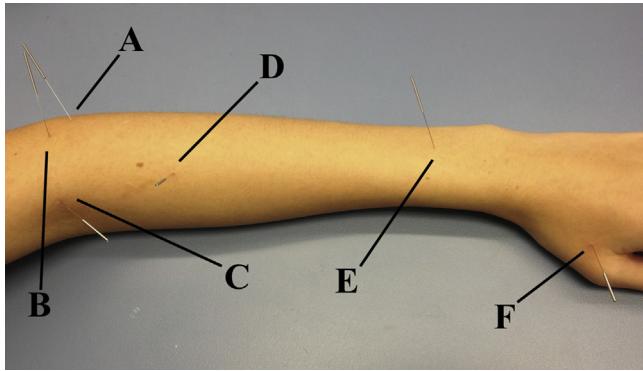


Figure 1. Acupoints used in the acupuncture protocol in treating lateral epicondylitis. Left forearm. (A) Ah-shi. (B) LI.11. (C) Lu.5. (D) LI.10. (E) SJ.5. (F) LI.4.

were the influential points for the upper limb. The insertion depth of acupuncture needle was 1.25–2.5 cm, up to musculature. The insertion duration was around 20 minutes. The *De qi* sensation was induced for every 5 minutes during the course of treatment. The treatment lasted for 3 weeks. Six sessions of treatment in total were assigned and arranged twice a week.

Outcome measures

Patients were assessed three times, which included: (1) the assessment before the first treatment (baseline); (2) after the whole course of treatments ended (after treatment); and (3) 2 weeks after treatments ended (2-week follow-up). Three outcome measures were examined by a registered physiotherapist at each time-point: pain intensity was measured by visual analogue scale (VAS); maximum grip strength was assessed by Jamar dynamometer (Patterson Medical, Sutton-in-Ashfield, Nottinghamshire, UK); level of functional impairment was self-assessed by DASH questionnaire.

Statistical analysis

The sample size calculation was based on the comparison of average baseline pain for the ESWT and control groups with respect to overall pain measured on the VAS.³⁵ A sample size of 17 patients per group would have 90% power at a significance level of 5% to detect 30% of pain reduction. The total required sample size is therefore 34 patients. Statistical analysis of results included Wilcoxon signed-ranked test for paired longitudinal comparisons and Mann–Whitney *U* test for between-group comparisons for the VAS and DASH score, while paired *t* test for paired longitudinal comparison and unpaired *t* test for between-group comparison for another parameter maximum grip strength. Statistical significance was attained when a *p* value is < 0.05 . Cohen's *d* was also included to assess the effect sizes.

Results

The VAS, maximum grip strength, and DASH score had no significant difference between two treatment groups at any assessment time-point (Figures 2–4).

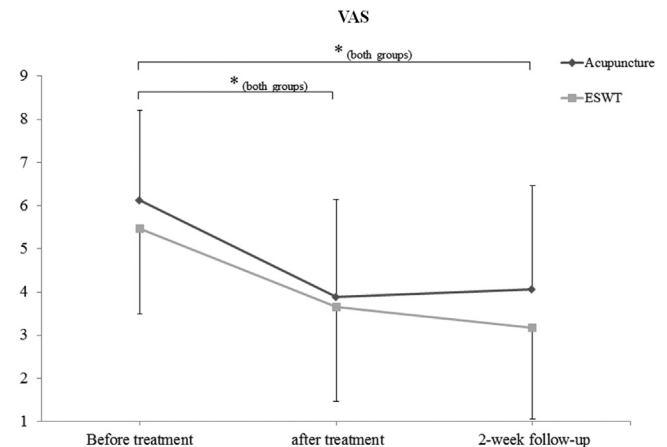


Figure 2. Longitudinal comparisons of visual analogue scale in both acupuncture and extracorporeal shockwave therapy group. Asterisk indicates the significance difference ($p < 0.05$). The *p* values were calculated from two tailed paired *t* tests to indicate significant difference.

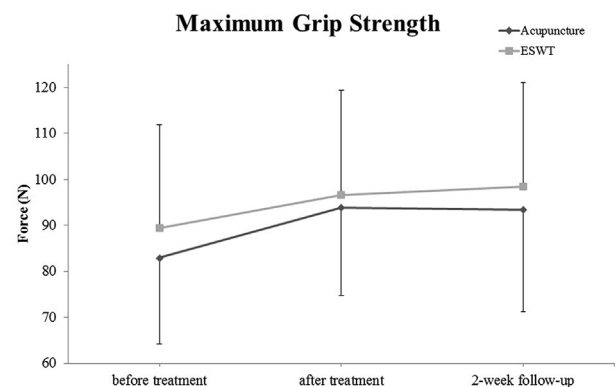


Figure 3. Longitudinal comparisons of maximum grip strength in both acupuncture and extracorporeal shockwave therapy groups.

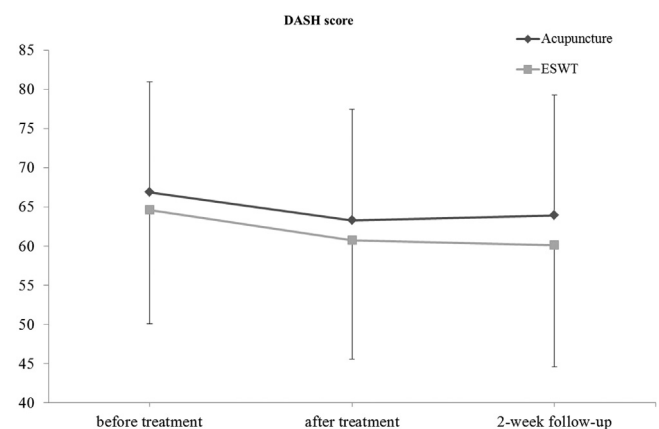


Figure 4. Longitudinal comparisons of disability of arms, shoulders and hands questionnaire score in both acupuncture and extracorporeal shockwave therapy groups.

For the longitudinal comparison, VAS showed significant difference in both acupuncture (effect size: 1.03) and ESWT group (effect size: 0.88) between baseline and after treatment. Also, it showed significant difference in both acupuncture

(effect size: 0.91) and ESWT group (effect size: 1.12) between baseline and at 2-week follow-up (Figure 2 and Table 1).

Maximum grip strength showed no significant difference in acupuncture group and in ESWT group between baseline and after treatment. In addition, it showed no significant difference either in acupuncture group or in ESWT group between baseline and 2-week follow-up, while neither group showed significant difference between after treatment and at 2-week follow-up (Table 1).

DASH score showed no significant difference in acupuncture group and ESWT group between baseline and after treatment. It showed no significant difference in acupuncture group and ESWT group between baseline and 2-week follow-up. DASH score showed no significant difference in either acupuncture or ESWT groups between after treatment and at 2-week follow-up (Table 1).

In short, our results have shown that the treatment effect to lateral epicondylitis has no significant difference between acupuncture and ESWT at all treatment time-points. Both treatments showed significant improvement in pain relief as shown in the longitudinal comparison. For maximum grip strength and DASH score, only a trend of improvement was observed but no significant difference was found (Tables 1 and 2).

In addition, improvement in pain relief stopped when the treatment ended for both groups, which can be shown in the comparison between after treatment and 2-week follow-up. The pain relief persisted for at least two weeks after treatment.

Discussion

This is the first study to compare the treatment effect between acupuncture and ESWT on the lateral epicondylitis with adequate samples ($n = 34$). Both treatments were effective in pain relief in treating lateral epicondylitis. No significant improvement of maximum grip strength and DASH was found in either acupuncture or ESWT.

In this study, significant improvement in pain score was found between baseline and 2-week follow-up in acupuncture group. This resembled the results of three systematic reviews.^{14,19,23} Although many studies only showed short-term effect of pain relief (0–12 weeks) by acupuncture, the comparison was made to placebo groups (sham acupuncture). Another systematic review stated that sham acupuncture may have effect of pain relief, which is higher than the inert placebo group.³⁶ Therefore, the so-called short-term pain relief

could be due to the comparison made to effective sham acupuncture placebo group. In addition, a study found that the pain relief effect by one single treatment session of acupuncture diminished within around 20 hours.³⁷ Based on the above-mentioned three systematic reviews, the effectiveness of acupuncture on lateral epicondylitis cannot be generally concluded. It is due to the poor study design and lack of knowledge regarding physiological responses to acupuncture. Moreover, due to the lack of standardization of outcome measures, together with variation in the timing of outcome measures, no meta-analysis or pooled analysis could be carried out regarding acupuncture for lateral epicondylitis. The definition of short-term pain relief varies from studies to studies; the period can range from immediately after one session and up to 3 months after whole prescribed treatment sessions.¹⁹ Nevertheless, the short-term beneficial treatment effect of acupuncture for lateral epicondylitis is convincing regardless of the definition of *short-term*; better study design and standardization of outcome measures are important for future work. For instance, outcome measures immediately after each session and right after the whole prescribed treatment should be recorded for the future analysis of mechanisms of pain alleviation.

One of the limitations in this study was no follow-up for long-term effect. The follow-up was only up to 2 weeks after treatment. This was limited by the general practice in our clinics. Another limitation is that there was no control group in this study. This is critical because there is still controversy between different studies^{24,25} regarding to the treatment effect of ESWT. In other words, the short-term pain alleviation effect of ESWT, which was shown in this study, is still uncertain. In this study, it can be only concluded that the treatment effect on lateral epicondylitis was similar between acupuncture and ESWT. The positive effect of ESWT can only be assumed, which was parallel to the acupuncture therapy in this study, by the proven effect of acupuncture in previous systematic reviews.^{14,23} Lastly, there was no record of self-administration of analgesia. This may lead to underestimation of pain relief of the treatment.

There are studies regarding the cost effectiveness of acupuncture, which have proven that acupuncture is of higher cost-effectiveness for some musculoskeletal problems such as chronic low back pain,³⁸ osteoarthritis pain,³⁹ and chronic neck pain.⁴⁰ In this study, we reported that the short-term treatment effect of acupuncture to lateral epicondylitis is similar to that of ESWT. Considering the price and setting of

Table 1
Results of 3 outcome measures.

Time point	VAS (mean $\pm$ SD)		Maximum grip strength (N) (mean $\pm$ SD)		DASH (score) (mean $\pm$ SD)	
	Acupuncture	ESWT	Acupuncture	ESWT	Acupuncture	ESWT
Baseline	6.12 $\pm$ 2.09	5.47 $\pm$ 1.97	82.96 $\pm$ 18.72	89.50 $\pm$ 22.42	66.88 $\pm$ 14.13	64.65 $\pm$ 14.56
After treatment	3.88 $\pm$ 2.26	3.65 $\pm$ 2.18	93.95 $\pm$ 19.13	96.57 $\pm$ 22.77	63.29 $\pm$ 14.15	60.76 $\pm$ 15.19
2-week follow-up	4.06 $\pm$ 2.41	3.18 $\pm$ 2.13	93.41 $\pm$ 22.06	98.39 $\pm$ 22.64	63.94 $\pm$ 15.34	60.12 $\pm$ 15.50

DASH = disability of arms, shoulders and hands questionnaire; N = Newton; VAS = visual analogue scale.

Table 2

Effect sizes of the outcome measures between different time-point within the treatment group.

Comparison	VAS		Maximum grip strength		DASH score	
	Acupuncture	ESWT	Acupuncture	ESWT	Acupuncture	ESWT
BL and AT	1.03*	0.88*	0.58	0.31	0.25	0.26
BL and 2WF	0.91*	1.12*	0.51	0.39	0.20	0.30
AT and 2WF	0.08	0.22	0.03	0.08	0.04	0.04

* indicates significance difference ($p < 0.05$) between time-points.

2WF = 2-week follow-up; AT = after treatment; BL = baseline; DASH = disability of arms, shoulders and hands questionnaire; ESWT = extracorporeal shockwave therapy; VAS = visual analogue scale.

ESWT equipment, this implicated the potential of acupuncture therapy as an advantageous alternative with higher cost-effectiveness and feasibility over ESWT to treat lateral epicondylitis. However, more information and details about labor involved and treatment procedure are necessary for further study of cost effectiveness.

In our study, 17.6% patients from the acupuncture group reported soreness after treatment. And, 29.4% patients from the ESWT group complained of pain. Adverse effect generated by ESWT has been reported by systematic reviews.^{14,24} The most frequent side effect was transitory reddening of the skin, pain, and small hematomas, while there was no frequent and characteristic adverse effect following acupuncture therapy reported. This indicates that acupuncture may be a better option for treating lateral epicondylitis with similar treatment effect.

Last but not least, most patients from both treatment groups (11 out of 17 from the acupuncture group and 8 out of 17 from the ESWT group) reported that they had applied massage by themselves during the period of treatment. In a systematic review, it showed some positive evidence about short-term effect of manipulative massage on lateral epicondylitis.¹⁴ Therefore, without the record of self-administration of massage treatment, it may induce bias that could possibly lead to underestimation of treatment effect in this study. It is impracticable to confine them from manipulative therapy; however, it should be recorded for bias analysis in the future.

Conclusion

The treatment effect on lateral epicondylitis was similar between acupuncture and extracorporeal shockwave therapy. Both treatments significantly improved pain score but no significant difference was found in maximum grip strength and functional outcome.

Conflicts of interest

All authors have no conflicts of interest to declare.

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