Acupuncture in Patients With Carpal Tunnel Syndrome
A Randomized Controlled Trial

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Objectives: To investigate the efficacy of acupuncture compared with steroid treatment in patients with mild-to-moderate carpal tunnel syndrome (CTS) as measured by objective changes in nerve conduction studies (NCS) and subjective symptoms assessment in a randomized, controlled study.

Methods: A total of 77 consecutive and prospective CTS patients confirmed by NCS were enrolled in the study. Those who had fixed sensory complaint over the median nerve and thenar muscle atrophy were excluded. The CTS patients were randomly divided into 2 treatment arms: (1) 2 weeks of prednisolone 20 mg daily followed by 2 weeks of prednisolone 10 mg daily (n = 39), and (2) acupuncture administered in 8 sessions over 4 weeks (n = 38). A validated standard questionnaire as a subjective measurement was used to rate the 5 major symptoms (pain, numbness, paresthesia, weakness/clumsiness, and nocturnal awakening) on a scale from 0 (no symptoms) to 10 (very severe). The total score in each of the 5 categories was termed the global symptom score (GSS). Patients completed standard questionnaires at baseline and 2 and 4 weeks later. The changes in GSS were analyzed to evaluate the statistical significance. NCS were performed at baseline and repeated at the end of the study to assess improvement. All main analyses used intent-to-treat.

Results: A total of 77 patients who fulfilled the criteria for mild-to-moderate CTS were recruited in the study. There were 38 in the acupuncture group and 39 in the steroid group. The evaluation of GSS showed that there was a high percentage of improvement in both groups at weeks 2 and 4 ($P < 0.01$), though statistical significance was not demonstrated between the 2 groups ($P = 0.15$). Of the 5 main symptoms scores (pain, numbness, paresthesia, weakness/clumsiness, nocturnal awakening), only 1, nocturnal awakening, showed a significant decrease in acupuncture compared with the steroid group at week 4 ($P = 0.03$). Patients with acupuncture treatment had a significant decrease in distal motor latency compared with the steroid group at week 4 ($P = 0.012$). Acupuncture was well tolerated with minimal adverse effects.

Conclusions: Short-term acupuncture treatment is as effective as short-term low-dose prednisolone for mild-to-moderate CTS. For those who do have an intolerance or contraindication for oral steroid or for those who do not opt for early surgery, acupuncture treatment provides an alternative choice.

Key Words: acupuncture, carpal tunnel syndrome, CTS, steroid, global symptom score (GSS)

(*Clin J Pain* 2009;25:327–333)

Carpal tunnel syndrome (CTS), which results from the compression of the median nerve at the wrist, can be caused by many different factors. Any condition that reduces the dimensions of the tunnel or increases the volume of its content will predispose individuals to CTS, and many medical associations have been reported (ie, diabetes mellitus, renal failure, thyroid disease, rheumatoid arthritis), but most cases are idiopathic.[1–3] The typical symptoms of CTS include sensory impairments, such as numbness or pain in the wrist, hand and fingers, which often occur during sleep and awaken CTS patients occasionally. Shaking or rubbing the hands usually relieves the symptoms. The motor symptoms of CTS include weakness of the thenar muscle, and loss of hand dexterity and function. Both objective and subjective symptoms can occur unilaterally or bilaterally. The best way to confirm the diagnosis is to carry out a median nerve conduction study (NCS) across the transverse carpal ligament. A characteristic of the condition is a focal conduction slowing in NCS across the wrist segment.[3–5]

Many conservative treatments are commonly used in mild and moderate CTS. For these patients, short-term nonsurgical management may be desirable and may reduce the number of patients undergoing surgical intervention. Among the conservative treatments, there is strong evidence that local corticosteroid injections, and to a lesser extent oral corticosteroids, provide short-term relief for CTS sufferers.[6,7] In addition, splints are effective, especially if used full time[6,7]; however, many CTS patients report that splinting restricts hand activity and hinders their ability to work or perform daily activities.[8] Local steroid injections into the carpal tunnel may result in initial relief, but relapses are frequent, and mechanical or chemical nerve injury can occur.[7,8] Oral steroids are better than nonsteroid anti-inflammatory drugs and diuretics, but they can produce side effects, which preclude their routine use for CTS.[7] Acupuncture is a complementary medical technique

Received for publication May 25, 2008; revised September 14, 2008; accepted September 20, 2008.

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Supported by KTGH grant.

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used for the treatment of painful disorders. However, at present, there is no conclusive evidence of the efficacy of acupuncture in treatment of CTS.[6,8] In an attempt to investigate whether acupuncture is as effective and safe as steroid in the treatment of mild-to-moderate CTS, we conducted a prospective, randomized clinical study under conditions similar to routine care.

PATIENTS AND METHODS

The study protocol was approved by the institutional review board of our hospital.

Patients

The patients, aged from 18 to 85, enrolled in this study had clinical symptoms and signs of CTS. CTS was diagnosed clinically based on the presence of at least one of the following primary symptoms: (1) numbness, tingling pain, or paresthesia in the median nerve distribution; (2) precipitation of these symptoms by repetitive hand activities, which could be relieved by resting, rubbing, and shaking the hand; and (3) nocturnal awakening by such sensory symptoms. The diagnosis was often supported by a positive Tinel sign. All patients with clinically diagnosed CTS demonstrated median neuropathy at the wrist, confirmed by the presence of 1 or more of the following standard electrophysiologic criteria: (1) prolonged distal motor latency (DML) to the abductor pollicis brevis (APB) (abnormal ≥ 4.7 ms, stimulation over the wrist, 8 cm proximal to the active electrode); (2) prolonged antidromic distal sensory latency (DSL) to the second digit (abnormal ≥ 3.1 ms; stimulation over the wrist, 14 cm proximal to the active electrode); and (3) prolonged antidromic wrist-palm sensory nerve conduction velocity (W-P SNCV) at a distance of 8 cm (W-P SNCV, abnormal < 45 m/s).[9–12] If the patients fulfilled the criteria and gave written informed consent before randomization, they were enrolled in the study. Possible side effects were fully explained. At their first visit, we assessed their medical and neurologic history, gave them detailed physical and neurologic examinations, biochemical and endocrine screenings (ie, fasting blood sugar, thyroid stimulating hormone, free T4), NCS and needle electromyography. Before treatment, the patients were followed-up for 1 month. If improvement occurred during observational periods, patients were excluded from this study. After enrollment, the patients were randomized into 2 treatment arms: (1) a group receiving 2 weeks of 20 mg prednisolone daily followed by 10 mg daily for another 2 weeks; and (2) a group receiving acupuncture in 8 sessions over 4 weeks. The randomization was carried out according to computer-generated randomly allocated treatment codes and data were kept by a person not involved in the care or evaluation of the patients or in the data analysis. All patients received complete global symptom score (GSS) measurements at baseline, 2, and 4 weeks and NCS at baseline and 4 weeks later performed by the same blinded evaluator throughout the entire study period. All patients were scheduled so as to avoid any overlap during which they could share clinical information and experiences with each other.

Acupuncture Treatment

Acupuncture consisted of 8 sessions of 30-minute duration, administrated over 4 weeks (2 sessions/wk). Each patient had fixed and classic acupuncture points [PC-7 (Daling), PC-6 (Neiguan)] on the affected side in their 8 sessions without modification for the specific symptoms of the patients. We placed patients in the supine position to make them more comfortable. Sterile disposable steel needles (gauge and size: 0.25×40 mm) were used without electrical stimulation or moxibustion. At each point, the skin was wiped with alcohol and needles were inserted perpendicularly at PC-6 to a depth of 1.0 to 1.5 inch and at PC-7 they were inserted from 0.5 to 1.0 inch according to the thickness of the patient's wrist. The needles were manipulated by twirling with lifting-thrusting methods to produce a characteristic sensation known as De Qi (an awareness of numbness, soreness, swelling, heaviness, or radiating feeling from the point of needling deemed to indicate proper needle position and effective needling) and were then left in place for 30 minutes. For patients with bilateral CTS, both wrists were needled and data were reported separately.

However, we included only the more-affected hand with a higher GSS in each individual for data analysis. As only 1 hand with a higher GSS score from each individual was used for analysis, the number of participants was equal to the number of affected arms enrolled in the analysis set. All treatments were performed at the same facility by 1 acupuncturist. Additionally, the acupuncturist was asked to have the least possible communication with patients to minimize bias. Complete details of the intervention are presented in Table 1 in conformance to the standards for reporting interventions in controlled trial of acupuncture.[13]

Measures

Electrophysiologic Assessment

The median and ulnar nerves were studied with no abnormality in the ulnar nerves. Motor and sensory NCS were performed using standard techniques of supramaximal percutaneous stimulation and surface electrode recording. DML and DSL, motor nerve conduction velocity, compound muscle action potential (CMAP), sensory nerve action potential (SNAP) amplitudes, and W-P SNCV were measured using the methods described by Delisa et al.[9] The

TABLE 1. Standards for Reporting Interventions in Controlled Trials of Acupuncture (STRICTA)

Acupuncture rationale	A fixed and classic acupuncture points (PC-7 (Daling), PC-6 (Neiguan) in their 8 sessions
	Unilateral or bilateral points
	Needling details
	Depth of insertion: standard to each point according to classic acupuncture point
	Responses elicited: de qi sensation
	Manual: twirling with lifting-thrusting method stimulation
	Needles retained for 30 min
	Needle type: C&G, gauge and size: 0.25×40 mm
Treatment regimen	Twice per week for 4 wk
Cointervention	None: no herbs, moxibustion, cupping, rehabilitation advice regarding dietary or lifestyle modifications
Practitioner background	License-certificated
Control intervention	Nil

electromyographic recording (Viking IV; Nicolet WI, Madison, WI) of motor conduction studies were made with the filter band pass at 2 to 10 Hz, a sweep speed of 2 ms/cm, and the amplifier gain adjusted for full reviewing of the CMAP. For measurement of SNAP, the instrument settings were: filters, 20 Hz to 10 kHz; sweep, 2 ms/cm; gain, 10 to 20 μV/cm.

Patients were excluded if any of the following were present: (1) symptoms occurring less than 3 months before the study or symptoms improving during the 1-month initial observation period (to exclude patients who might have spontaneous resolution of symptoms); (2) severe CTS that had progressed to visible muscle atrophy; (3) in our study, mild CTS referred to patients with decreased conduction velocity over the palm-wrist segment and delayed DSL, with normal median SNAP amplitude and CMAP amplitude of the APB. Moderate CTS referred to patients with abnormally delayed DML and DSL with either decreased median SNAP amplitude or decreased CMAP amplitude of the APB muscle. Thus, CTS patients with the presence of either fibrillation potentials or reinnervation on needle EMG in the APB were excluded (to ensure the inclusion of only mildly or moderately affected individuals); (4) clinical or electrophysiologic evidence of accompanying conditions that could mimic CTS or interfere with its evaluation, such as cervical radiculopathy, proximal median neuropathy, or significant polyneuropathy; (5) evidence of obvious underlying causes of CTS such as diabetes mellitus, rheumatoid arthritis, hypothyroidism (acromegaly), pregnancy, alcohol abuse or drug usage (steroids or drugs acting through the central nervous system), use of vibrating machinery, and suspected malignancy or inflammation or autoimmune disease were documented as underlying causes for CTS; (6) recent peptic ulcer or history of steroid intolerance; (7) prior unpleasant experience with acupuncture or a bleeding diathesis; or (8) cognitive impairment interfering with the patient's ability to follow instructions and describe symptoms.

Clinical Assessments

Clinical assessments included the symptomatic questionnaire modified from that used by Herskovitz et al[14] and by us in our previous study.[10,11] We rated symptoms from 0 (no symptoms) to 10 (very severe symptoms) in each of 3 categories: pain, numbness, and paresthesia. Nocturnal awakening was scored by times awakened in 1 week: never, 0; once or twice, 2; 3 or 4 times, 4; 5 to 7 times, 6; 8 to 10 times, 8; more than 10 times, 10. Weakness was scored according to the severity of the weakness: none, 0; mild, 2; moderate, 3; severe, 4; very severe, 5; and assessed for clumsiness by difficulty in manipulating small objects: none, 0; mild, 2; moderate, 3; severe, 4; very severe, 5. The total of the scores of the 5 main symptoms was the GSS. Each patient was directly questioned, and each score was based on the patient's subjective answers. Therefore, the maximum score was 50 (most severe symptoms) and the minimum score was 0 (absence of symptoms). Furthermore, to ensure consistency, the evaluating physician was the same person on each occasion for each patient. Follow-up assessments identical to the baseline procedure were performed at 2 and 4 weeks later.

At the end of the study, neurologic examinations were repeated, along with the same biochemical and endocrine examinations as at baseline. To obtain objective evidence of improvement, we repeated NCS at the end of the assessment for those patients who completed the study. But for the patients lost to follow-up and those who received surgery, we decided not to repeat the NCS. Additional treatments (such as splinting and local injections) or alterations in daily activities were not permitted during the study.

Safety Assessments

Patients reported all serious adverse events with side effects of both oral steroids treatment at weeks 2 and 4 and acupuncture treatment in each session. We recorded adverse side effects such as nausea, epigastric pain, tarry stools, leg edema, cushingoid appearance, blood pressure, blood sugar along with ecchymosis, local paresthesia, or bleeding to treat analysis for all enrolled patients.

Statistical Analysis

A last-observation-carried-forward approach was used to input missing data with the intent-to-treat analysis principle. Independent 2-sample t test was performed to compare the efficacy of the objective changes in nerve conduction and subjective symptoms assessment between the 2 groups for the baseline, 2-week and 4-week evaluations. Repeated measures analysis of variance with Bonferroni adjustment for multiple testing was used to compare the changes in subjective symptoms assessment between week 2 or 4 data and baseline data within each treatment group. Paired t test was performed for objective changes in nerve conduction between week 4 data and baseline data within each treatment group. For 5 main symptoms score of GSS and 6 measures of NCS, Bonferroni adjustment was made to control for type I error. All hypothesis testing were 2-tailed and level of significance was set at 0.05. All statistical analyses were performed using SPSS Version 15.0 for Windows (SPSS Inc, Chicago, IL).

RESULTS

Enrollment of Patients and Baseline Characteristics

A total of 77 patients who fulfilled the inclusion and exclusion criteria agreed to participate in our study and were randomly allocated to either the steroid or acupuncture treatment group. The baseline characteristics of the 2 groups were similar in the intention-to-treat population (Table 2). Of the 77 patients, 3 patients in the acupuncture group dropped out due to inability to take time off work, and 4 patients in the steroid group did not finish the study due to intolerance of side effects of epigastric pain with nausea. No patients received surgery before the end of the

TABLE 2. Summary of Baseline Characteristics of Study Patients

	Acupuncture Group	Steroid Group
Number of patients	38	39
Age (y)	49.3 (8.9)	49.9 (10.3)
Sex (female/male)	38/6	39/8
Duration (mo)	7.6 (3.8)	7.7 (3.2)
Baseline GSS	16.0 (8.7)	14.3 (7.5)

Values are number or mean (standard deviation, SD).
GSS indicates global symptom score.

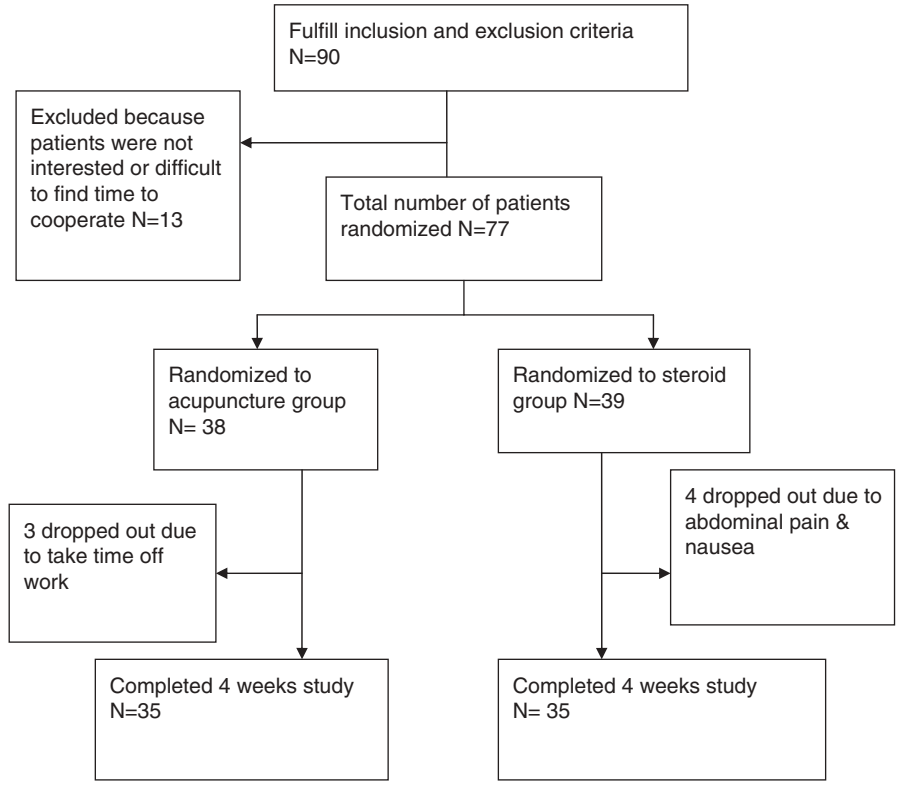

FIGURE 1. Flow chart of process and disposition of patients.

study. The dropout rate was low for both the steroid and acupuncture groups. We substituted baseline values for the missing data of the 7 patients who did not complete the study (thus, setting differences compared with baseline to zero). Figure 1 illustrates patient enrollment and random allocation of patients to study groups. There was no difference in age, sex, or duration of symptoms between treatment groups.

Outcome of Treatment

Table 3 shows the changes in GSS for the 77 patients who were available for the efficacy analysis. There was no significant difference between the 2 groups before treatment. At the end of the study, there was a high percentage of improvement in both the acupuncture and steroid groups at weeks 2 and 4 (all $P < 0.01$ for both groups), though statistical significance was not achieved between the 2 groups ($P = 0.15$) (Fig. 2A). Of the 5 parameter scores (pain, numbness, paresthesia, weakness/clumsiness, nocturnal awakening), only 1, nocturnal awakening showed a significant decrease between the 2 groups. Patients with acupuncture treatment had significantly better improvement in nocturnal awakening compared with the steroid group at week 4 ($P = 0.03$) (Fig. 2B).

TABLE 3. Cumulative Data of Global Symptom Score (GSS) Changes

	GSS Score		Numbness	Pain	Paresthesia	Weakness	Nocturnal Awakening
Baseline							
Acupuncture	16.1 (8.8)		6.9 (3.1)	0.8 (2.2)	1.5 (2.8)	3.3 (3.5)	3.5 (3.8)
Steroid	14.3 (7.5)		7.1 (2.0)	0.6 (1.1)	1.0 (2.6)	2.6 (3.2)	3.0 (3.7)
	Change*	% Change†	Change*	Change*	Change*	Change*	Change*
Week 2							
Acupuncture	− 8.6 (6.3)	− 51.6 (22.4)	− 3.7 (2.5)	− 0.6 (1.9)	− 0.9 (1.9)	− 2.0 (2.5)	− 2.7 (3.5)
Steroid	− 7.3 (5.7)	− 51.1 (24.7)	− 3.3 (1.6)	− 0.3 (0.7)	− 0.7 (1.9)	− 1.5 (2.5)	− 1.9 (3.0)
Week 4							
Acupuncture	− 11.7 (7.6)	− 70.0 (24.6)	− 4.9 (2.8)	− 0.8 (2.2)	− 1.4 (2.7)	− 3.0 (3.3)	− 3.5 (3.8)‡
Steroid	− 9.3 (6.7)	− 64.7 (27.6)	− 4.0 (2.0)	− 0.3 (0.8)	− 0.8 (2.2)	− 1.9 (2.8)	− 1.5 (1.9)

*Week 2 or 4—baseline.
†Week 2 or 4—baseline/baseline.
‡$P < 0.05$ after Bonferroni adjustment.
Values are mean (standard deviation, SD).

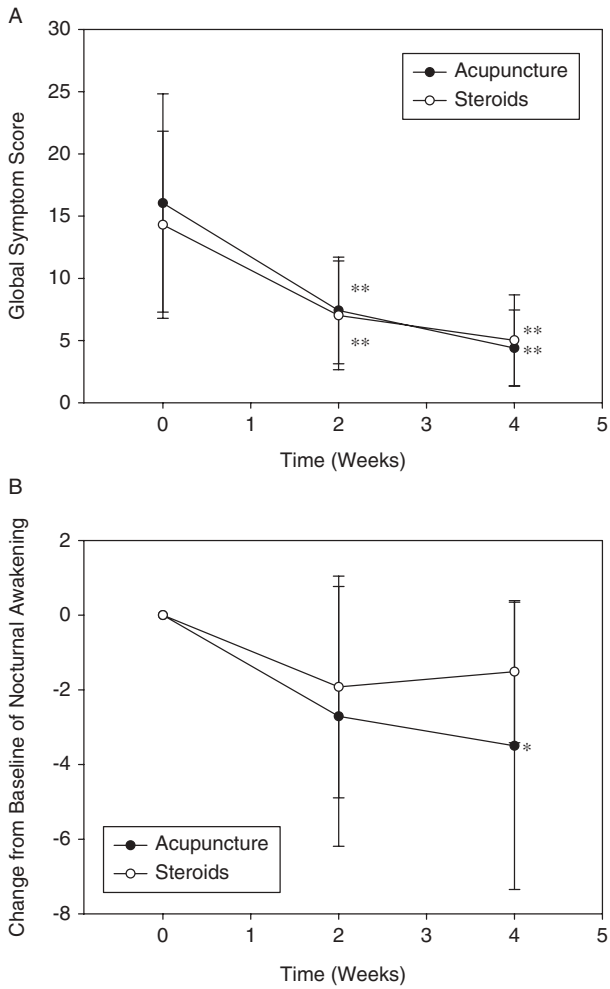

FIGURE 2. A, Change of total global symptom score for acupuncture and steroid groups over time. A significant difference from baseline for weeks 2 and 4 were observed by repeated measures analysis of variance for both groups ($P<0.01$);**$P<$ 0.01 (B) Change of nocturnal awakening for acupuncture and steroid groups over time. A significant difference between acupuncture and steroid groups at week 4 was observed ($P<0.05$) by independent 2-sample t test. *$P<$ 0.05.

Table 4 illustrates the outcome and severity of NCS findings including DML, CMAP amplitude of APB muscle, motor nerve conduction velocity, DSL, W-P SNCV, and SNAP amplitudes of median nerves before and after treatment in both groups. There was no significant difference between the 2 groups before treatment. After treatment, there was a significant decrease in DML and DSL, and a significant increase in W-P SNCV and SNAP amplitudes within each treatment group ($P < 0.05$) for both steroid and acupuncture groups. In addition, there was significantly increased CMAP amplitude of the APB muscle in the steroid group ($P < 0.05$). Patients with acupuncture treatment had significantly better improvement in DML compared with steroid group at week 4 ($P = 0.012$) (Fig. 3).

Adverse Side Effects

No serious adverse effects were noted. In the acupuncture treatment group, side effects were reported by 5% of the patients. Most adverse effects were related to the local insertion of the needles, such as local pain after session, ecchymosis, and local paresthesia during session. Acupuncture was well tolerated by patients and no one discontinued prematurely because of needle-related side effects. In the steroid treatment group, the most frequently noted adverse effects were nausea and epigastralgia. Side effects from steroid were reported by 18% of the patients. Four patients dropped out due to intolerance of severe epigastralgia with nausea.

DISCUSSION

The present study is one of the most rigorous trials of the efficacy of acupuncture treatment versus proven standard drugs on CTS available. Its strength includes interventions based on expert consensus by qualified and experienced medical acupuncturists, assessment of the credibility of interventions, and outcome measurements as recommended in guidelines for trials on CTS. The results of the current study showed that there was a high percentage of improvement in both groups at week 4 with subjective measurement of GSS, though statistical significance was not achieved between the 2 groups. Furthermore, patients with acupuncture treatment had significantly better improvement in the main symptoms score of nocturnal awakening compared with the steroid group at week 4. In the assessment with objective measurement of NCS, patients with acupuncture treatment had significantly better improvement in DML compared with the steroid group at week 4. It can be concluded that acupuncture treatment had at least equal, and in some cases, superior efficacy when compared with steroid treatment not only in objective changes in nerve conduction but also in subjective symptoms assessment. However, the disadvantage of acupuncture is that it is time-consuming.

Several large surveys have also provided evidence that acupuncture is a relatively safe treatment.[15–18] Acupuncture treatments were well tolerated by our patients. Indeed, most patients found participation in the study to be pleasant and rewarding. Needle-related side effects like bruising and soreness were more common in the acupuncture group than in the steroid group, but these were mild and did not affect treatment. No patient withdrew due to adverse effects. However, in the steroid group, 4 patients dropped out due to intolerance of severe epigastralgia with nausea. Some might ask why patients with acupuncture treatment had significant improvement not only in objective changes in NCS but also in subjective symptoms assessment. Acupuncture treatment is an invasive manual procedure; thus, separating the specific effects from nonspecific effects is extremely difficult.[19] Various neurophysiologic and psychophysiologic mechanisms underlying the analgesic effectiveness of acupuncture have been hypothesized.[19] However, even though acupuncture therapy has been used extensively, its mechanisms of action in CTS are not precisely known, in part because the pathophysiology of CTS itself is not well understood. CTS etiology is thought to involve compression of the distal median nerve due to an elevated interstitial fluid pressure in the carpal tunnel. Ischemic injury and mechanical deformity of the median nerve produced by elevated pressure within the carpal tunnel leads to anoxic capillary damage, which in turn leads to increased membrane permeability, exudative edema, and subsequent fibrosis.[14,20–22] Steroids are effective at reducing

TABLE 4. Improvement in Electrodiagnostic Measurements in Patients With Carpal Tunnel Syndrome who had Symptom Relief

	Acupuncture Group		Steroid Group		
Electrodiagnostic Variable, With Normal Result	**Baseline**	**After Treatment**	**Baseline**	**After Treatment**	***P*†**
DML (ms), < 4.7	5.6 (0.9)	4.0 (0.7)*	5.6 (1.3)	4.7 (1.0)*	0.012
CMAP (mv), > 6.5	7.2 (2.9)	7.2 (2.7)	7.2 (2.8)	7.6 (2.8)*	NS
MNCV (mv), > 50	53.1 (4.5)	53.7 (3.8)	51.9 (4.1)	52.4 (3.6)	NS
DSL (ms), < 3.1	3.7 (1.0)	3.3 (0.7)*	3.4 (0.8)	3.0 (0.6)*	NS
W-P SNCV (m/s), > 45	40.0 (8.6)	43.9 (8.0)*	43.3 (9.5)	48.6 (6.2)*	NS
SNAP (μv), > 15	15.4 (9.0)	18.4 (9.8)*	17.4 (9.3)	20.8 (9.9)*	NS

*$P < 0.05$ compared with baseline within group by paired t test with Bonferroni adjustment.
†The change from baseline was compared between groups with independent t test.
Values are mean (standard deviation, SD).
CMAP indicates compound muscle action potential; DML, distal motor latency; DSL, distal sensory latency; MNCV, motor nerve conduction velocity; NS, non-significant; SNAP, sensory nerve action potential; W-P SNCV, wrist-palm sensory nerve conduction velocity.

swelling because of their anti-inflammatory action. It is thus reasonable to use oral steroids in the treatment of CTS and a short-term course of low-dose steroids can be of great benefit in the treatment of mild-to-moderate CTS.[10,12,13,23,24] A recent study suggests that acupuncture may possess anti-inflammatory action via release of neuropeptides from nerve endings.[25] There is also evidence that acupuncture processing in the brains of CTS patients differs from that of healthy controls.[26] It would be of great interest to know what roles the peripheral and the central mechanisms play in CTS patients after acupuncture treatment, although it is beyond the scope of this article. In traditional Chinese medical literature, the acupuncture point Neiguan has been shown to relieve insomnia.[27] This may explain why patients who received acupuncture treatment had significantly better improvement in nocturnal awakening compared with the steroid group at week 4.

The investigators are aware of and capable of using sham acupuncture[28,29]; however, the reason for our preference for an active drug rather than placebo was less ethical problem to adopt an active treatment arm for patients who looked for a treatment for their discomforts.

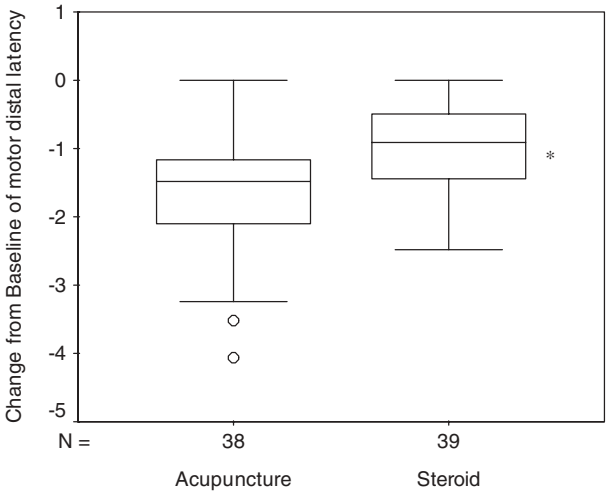

FIGURE 3. Change from baseline of motor distal latency (DML) between acupuncture and steroid groups by independent sample t test. *$P < 0.05$.

Furthermore, if both treatments are possibly effective, it is easy to explain and encourage patients to be recruited in current study. Recently, a Japanese study found that most people in Asian countries have knowledge about acupuncture and have received acupuncture treatment, and 60% of the patients could distinguish between sham and genuine needling.[30] Our patients were also able to make this distinction, so we did not choose sham acupuncture in our study. Steroid treatment is one of the most common used drugs in clinical practice for treatment of mild-to-moderate CTS. But in our society, most people are reluctant to take it. So, we set out to answer the clinically relevant question, "does acupuncture improve outcomes among patients with mild-to-moderate CTS comparable to steroid treatment?" This is substantially different from the question, "does acupuncture improve outcomes comparable to a sham procedure that appears to be similar to, but isn't really, acupuncture?" Therefore, an active instead of placebo control was used in this study, and the steroid treatment for CTS was chosen as a comparison.

The natural history in CTS patients was not well characterized until a recent study by Padua et al.[31] In their study of 441 hands afflicted with idiopathic CTS, they found that 21% of hands improved over 10 to 15 months of follow-up without active intervention. Thus any therapeutic intervention should attempt to achieve a better than 21% improvement rate.[31] Genuine acupuncture is widely accepted in Taiwan and oral steroid is considered as an alternative conservative in previous studies.[10,12,13,23,24] Though there is no real placebo group in current study, however, a placebo effect or spontaneous resolution would have been less likely to occur due to the patients' more than 21% improvement in GSS in both groups. In addition, there was improvement in the objective measures, NCS, in patients after acupuncture and steroid treatment. Furthermore, in 1 previous study, nearly a quarter of the patients had relief of symptoms within the first month of initial assessment.[32,33] To decrease this confounding effect, any patient whose symptoms occurred less than 3 months before the study or whose symptoms improved during the first observation period was excluded from current study. Only 4 patients had marked relief of symptoms during the observation period and they were excluded.

Although we conclude that short-term acupuncture treatment is an effective and safe treatment for symptomatic relief in CTS, some questions remain unanswered:

1. Is acupuncture therapy effective for long-term symptom relief of CTS?
2. Do symptoms recur once acupuncture is discontinued, and is further acupuncture therapy effective in patients experiencing a recurrence?
3. What is the mechanism of acupuncture on CTS?

To answer these questions, we are currently conducting other studies. Future studies may also consider additional assessments using validated commonly used disability scales such as the SF-36, Disability of Arm, Shoulder and Hand questionnaire to make comparison of the data to other published literature more relevant.

CONCLUSIONS

Despite the limitations, this randomized, controlled study indicates that short-term acupuncture treatment is as effective as short-term low-dose steroid for mild-to-moderate CTS. For those who do not tolerate oral steroid or for those who do not opt for surgery, acupuncture treatment provides an alternative choice. We now need to assess the long-term effects of acupuncture on mild-to-moderate CTS in a large clinical trial.

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