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CLINICAL TRIAL REPORT

Clinical Efficacy of Electroacupuncture in the Treatment of Chronic Neck Pain: A Randomized Clinical Trial

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Purpose: Chronic neck pain (CNP) is a common but challenging symptom in clinical practice. Acupuncture is widely used in alleviating the symptoms of CNP. The main objective of this study was to evaluate the efficacy and safety of electroacupuncture (EA) in patients with CNP and to quantify the specific effects of EA by controlling for placebo effects.

Patients and Methods: A randomized sham-controlled trial was conducted at the outpatient departments of single hospital in China from November 2019 to November 2020 and a total of 105 participants with CNP were enrolled. Participants were randomly assigned (1:1:1) to the EA group, sham electroacupuncture (SEA) group and waiting list (WL) group. The primary outcome was change in the Northwick Park Neck Pain Questionnaire (NPQ). Secondary outcomes included McGill Pain Questionnaire (MG), visual analogue scale (VAS) and pain threshold (PT).

Results: This randomized clinical trial included 98 patients. The EA group demonstrated a greater reduction in NPQ scores compared to the SEA group after 10 sessions (−7.2564, 95% CI=−12.2875 to −2.2253, P=0.0054) and at 3-month follow up (−7.0090, 95% CI=−10.5039 to −3.5140, P=0.0002). After 10 sessions, the EA and SEA groups exhibited greater reductions in NPQ scores compared to the WL group (EA vs WL: P<0.001, [95% CI=6.570 to 15.503]; SEA vs WL: P=0.027, [95% CI=0.578 to 9.580]). However, the EA group achieved clinically significant NPQ improvements (>25%), whereas the SEA group failed to meet this criterion.

Conclusion: This randomized clinical trial found that, in patients with CNP, EA significantly improved the symptoms compared with SEA and WL groups both immediately and cumulatively (at 5 weeks), and these benefits persisted through week 17. These comparisons demonstrated that EA's clinical benefits exceeded placebo effects.

Keywords: electroacupuncture, chronic neck pain, randomized controlled trial, placebo effect, analgesic effect

Introduction

Neck pain, which may eventually lead to substantial disability, is a common but challenging symptom in clinical practice,[1] with a lifetime prevalence rate of 48.5%.[2] Between 22% and 70% of adults experience neck pain or stiffness at some point in their lives.[3] Chronic neck pain (CNP) is associated with a substantial economic burden on healthcare systems.[4] Conventional treatment for CNP, including pharmacotherapy, intra-articular injections, and surgical interventions, provide moderate efficacy but are often accompanied by severe adverse effects.[5,6] Non-pharmacological interventions, such as physical exercise, have gained recognition as a viable pain management strategy.[7] Furthermore, complementary and alternative medicine therapies, such as manual therapy, osteopathic manipulation, and Qigong, have witnessed a surge in popularity.[2] Acupuncture, an essential component of complementary and integrative therapies, offers a potentially beneficial approach to current pain management. A systematic review identified acupuncture as one of

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the most widely used tools in complementary medicine for treating CNP.[8] Furthermore, a meta-analysis confirmed that acupuncture significantly alleviates CNP symptoms,[9] with electroacupuncture (EA) demonstrating enhanced analgesic effects compared to traditional acupuncture.[6]

The mechanisms underlying EA's analgesic effects involve triggering bioactive molecules through the central and peripheral nervous systems via distinct pathways.[10] In addition to specific effects, the role of placebo effects in these outcomes remains controversial. A Cochrane review found moderate-quality evidence that acupuncture relieved pain more effectively than sham acupuncture,[3] whereas a randomized controlled trial attributed its benefits entirely to placebo responses.[11] Placebo effects of EA include contextual and non-specific effects.[12–14] Notably, sham acupuncture often elicits stronger placebo effects than pharmacological placebos due to the tactile component of the intervention.[15] Therefore, it remains a challenge to distinguish the specific effects of acupuncture therapies from the placebo effect in randomized controlled trials of acupuncture.[16]

Moreover, the waiting list (WL) control group, commonly used in acupuncture trials, is designed to control for non-specific effects by accounting for observation and assessment (Hawthorne effects), the natural course of the illness, and regression to the mean.[12] A meta-analysis demonstrated that WL groups often produce positive effects in clinical studies compared to intervention groups.[17,18] However, delaying acupuncture treatment may have negative consequences for CNP patients, such as worsening symptoms or increased psychological stress. To address these concerns, our study included a WL group to investigate both the non-specific effects in untreated subjects and the potential adverse effects of delayed treatment.

The main objective of this study was to evaluate the efficacy and safety of EA compared with sham electroacupuncture (SEA) and WL groups in patients with CNP. Furthermore, the study sought to quantify the specific therapeutic effects of EA by controlling for placebo effects by utilizing the SEA and WL groups.

Materials and Methods

Study Design

This single-center, randomized controlled trial was conducted at Guangdong Provincial Hospital of Chinese Medicine from November 2019 to November 2020. This trial was reviewed and approved by the Ethics Committee of Guangdong Provincial Hospital of Chinese Medicine (ZF2019-182-01) and was registered with the Chinese Clinical Trial Registry (ChiCTR1900027838). The trial complied with the Declaration of Helsinki. All the enrolled subjects were required to provide written informed consent. Subjects were informed about their equal chance of allocation to each group. Participants in EA and SEA groups received a total of 10 treatment sessions over a period of 5 weeks, with a 12-week follow-up. The efficacy and safety outcomes of the EA and SEA group were prospectively evaluated at baseline, after 5 sessions of treatment, after 10 sessions of treatment and at the 3-month follow-up visit. Data for participants in the WL group were collected at baseline and after 5 weeks (Figure 1).

Setting and Participants

Volunteers were enrolled by posting advertisements in the Second Affiliated Hospital of Guangzhou University of Chinese Medicine and on social networks. All recruited subjects underwent a physical examination and radiographic assessment to confirm the clinical diagnosis of CNP, and the trial details were explained to them. The diagnosis of cervical spondylosis in accordance with the base guideline for Clinical Guidelines for Chiropractic Practice in Canada.[2] Subjects were included only if they met the eligibility criteria and signed an informed consent form. The inclusion criteria were aged between 18 and 60 years; diagnosis of cervical spondylosis supported by cervical radiography; neck pain symptoms were present, such as pain in the neck, shoulders and occipital area, or limited head and neck movement due to the pain or tension or tenderness of neck muscles, with limited head movement, with disease duration >3 months.[19] The exclusion criteria were pregnancy or lactation; diagnosis of other types of cervical spondylosis based on clinical manifestations or X-rays; complications of severe systematic diseases such as cardiovascular, cerebrovascular, hepatic, or nephrotic diseases or tumors; complications of severe chronic diseases, such as neurosis, dementia, or osteoporosis; complications of hemopathy, such as leukemia, thrombocytopenia, or tendency to bleed; considered

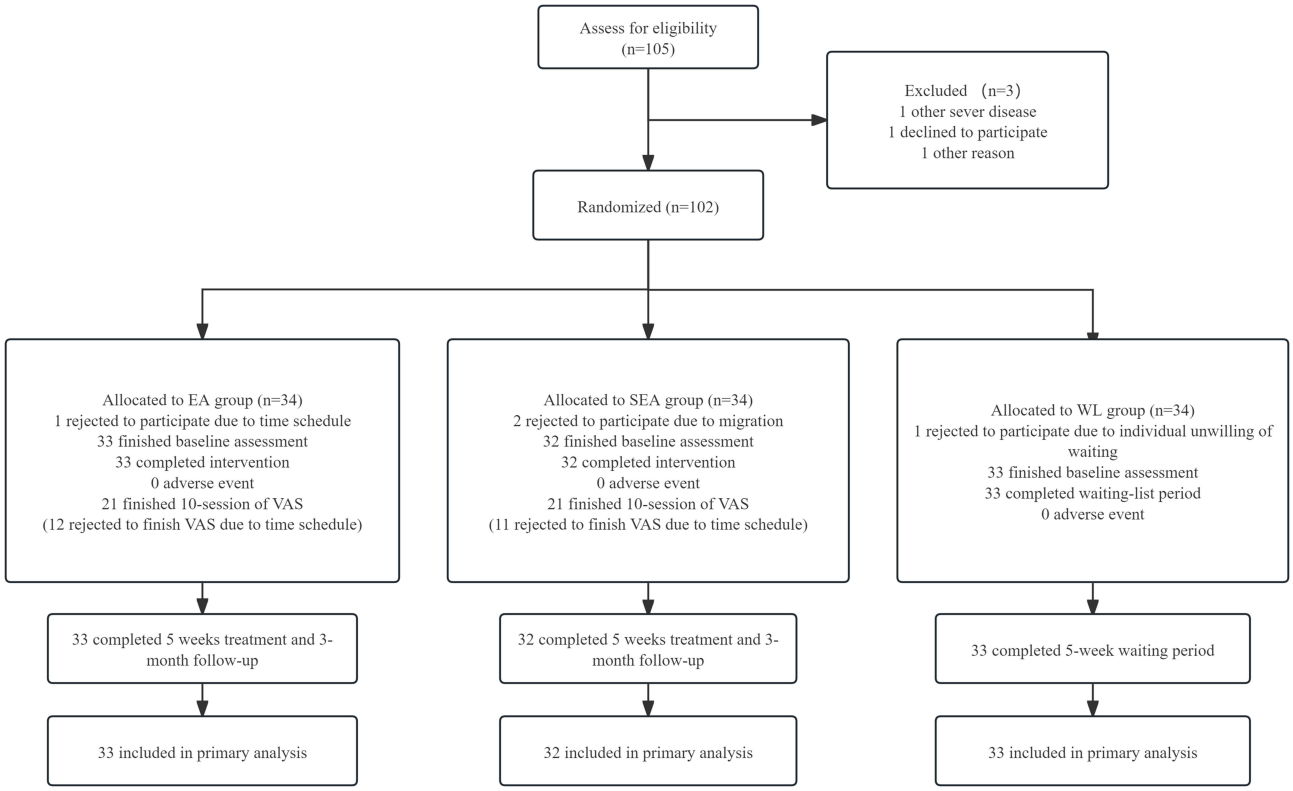

Figure 1 CONSORT flow diagram.
Abbreviations: EA, electroacupuncture; SEA, sham electroacupuncture; WL, waiting list group; VAS, Visual analogue scale.

unsuitable to participate in the trial by the researchers; rejection or incompatibility regarding acupuncture; history of neck trauma, cervical fracture, cervical surgery, neurologic impairment, or congenital spinal abnormality.

Randomization and Blinding

Eligible patients were randomized and assigned to one of the EA, SEA, or WL groups at a ratio of 1:1:1 without stratification. Random numbers (total number of subjects=105, number of treatment groups=3) were generated using PEMS3.1 software and placed in sealed opaque envelopes. Throughout the duration of the trial, blinding was attempted for the participants in the EA and SEA groups. The persons responsible for outcome measurement, data collection and analyses were blinded to group allocation. The WL group and acupuncturists were not blinded, as it was not feasible to implement blinding during the treatment.

Interventions

The subjects were randomly divided into three groups. After baseline assessment, EA and SEA groups received 10 treatment sessions (twice per week). Each session lasted about 30 minutes with an interval of 3–4 days. Acupuncture treatments was performed by licensed practitioners of traditional Chinese medicine with a minimum of five years of professional experience.

The EA group received traditional acupuncture therapy involving electrical stimulation. The following four acupoints were selected based on our previous study:[20] Jingbailao (EX-HN15, bilateral, located in the neck) and Jianzhongshu (SI15, bilateral, located on the back) (Figure 2). The name and location of the acupoints followed the World Health Organization (WHO) standards.[21,22] Disposable stainless steel acupuncture needles (0.3×25 mm; Suzhou Tianxie Acupuncture Instruments Co. Ltd., SuZhou City, China) were inserted into the muscular tissue of the acupoints through the fixed foam. The angle and depth of the needles were adjusted until subjects achieved a "De qi" sensation (soreness, numbness, distention, heaviness, or other acupuncture sensation), and quantitative measurement was conducted during

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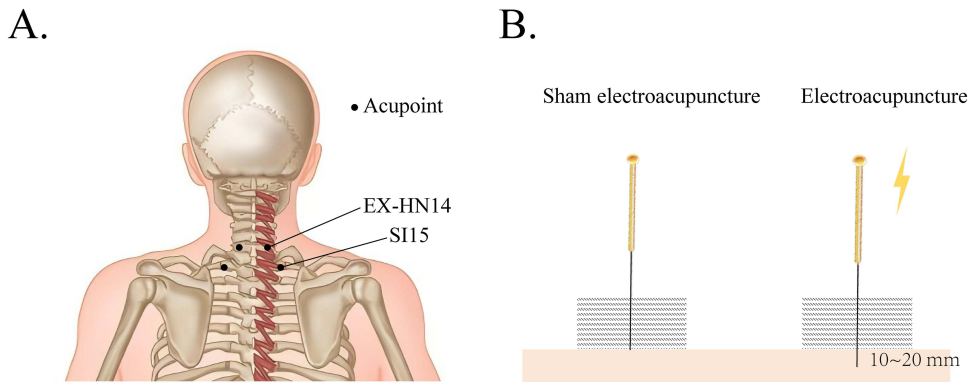

Figure 2 The details of electroacupuncture and sham electroacupuncture. (**A**) Black circles were the location of main acupoints. (**B**) The manipulation of electroacupuncture and sham electroacupuncture.

the treatment to ensure that the De qi sensation was maintained.[23] Next, a Han's Acupoint Nerve Stimulator (HANS-200A, Nanjing, China) was connected to deliver electrical stimulation to the acupoints for 30 minutes using a dense-and-disperse wave at a frequency of 2/100 hz, which has been shown to effectively alleviate pain.[24]

The SEA group received non-invasive sham needles, a method previously demonstrated to provide reliable placebo control in acupuncture trials.[25] This device involved the use of a blunted needle and a cube of elastic foam for needle positioning. The acupuncturist first fixed the foam on the same acupoints as those used for the EA group. In contrast to the verum acupuncture device, in which the sharp needle was inserted into the skin through the foam, the placebo device held the blunted needle within the foam. These needles did not penetrate the skin but stayed upright over the skin. Next, Han's Acupoint Nerve Stimulator was connected using the same method as in the EA group without electrical output. The sham needles were retained for 30 minutes.

Participants assigned to the WL group did not receive any treatment but were informed they would receive 10 sessions of complimentary acupuncture after 5 weeks.

Outcomes

The primary outcome was change in the Northwick Park Neck Pain Questionnaire (NPQ). The NPQ is a 9-parameter tool for assessing pain and functional performance in patients with neck pain, with higher scores representing greater neck disability. It has been validated in various study populations.[26,27]

The short-form McGill Pain Questionnaire (MG), visual analogue scale (VAS) and pain threshold (PT) were used as the secondary outcome measures. The MG is a valid, reliable, and well-established tool, with 15 descriptors that can be used to assess the quality of pain in three dimensions (affective, evaluative, and sensory).[28] The VAS (a 10-cm line oriented horizontally) was used for assessing pain intensity. Subjects are asked to mark the line according to their current pain intensity, with 0 indicating no pain and 10 indicating the worst pain.[29] To assess the PT, which is an important measure in chronic pain, we placed the anode electrode of a BIO-EVF3 device (Friends Honesty Life Sciences Co. Ltd., Hong Kong, China) on the neck pain location, with the cathode on the leg.[30] A gradually increasing current (0–2 mA) was administered and the subject pressed the stop button as soon as they felt pain. The mean of three current intensities (mA) was recorded as the PT.

Data Collection

In EA and SEA group, VAS score was assessed before and immediately after each treatment session and at the 3-month follow-up, while NPQ, MG scores and PT were assessed at baseline, after the 5th and after 10th treatment sessions, and at the 3-month follow-up. In WL group, NPQ, MG, VAS scores and PT were assessed at baseline and after 5 weeks. The following data were also collected: baseline characteristics, EA current intensity in each EA session, medications taken, and adverse events (AEs).

Sample Size Calculation

The sample size was calculated based on α=0.05 (5% chance of a type 1 error), 1-β=0.80 (power of 80%), and the mean and standard deviation (SD) of NPQ scores in our pilot study (the protocol and the statistical analysis plan are available in Supplementary Material 1). The means of the NPQ score in the EA, SEA, and WL groups of our pilot study were 13.99, 19.00 and 21.89 respectively and a pooled SD was 9.65. The minimum required number of subjects per group was determined to be 30. Given a predicted 15% follow-up loss rate, the final required sample size was determined to be 105 (35 subjects per group).

AEs

We planned to record any expected or unexpected AEs during the treatment period. The expected AEs included the following: dizziness on needle insertion, severe pain during the treatment, bleeding or ecchymoma at the acupoints, convulsion, needle breakage, and localized infection. We planned to report all AEs immediately to the primary investigator and ethics committee, who were to decide whether withdrawal of the subject was necessary.

Statistical Analyses

Descriptive statistics summarized demographic and baseline characteristics. The Shapiro–Wilk test was used to assess normality. Baseline differences between groups were analyzed using ANOVA for normally distributed continuous variables, the Kruskal–Wallis *H*-test for non-normally distributed variables, and the Chi-square test for categorical variables. For the EA and SEA groups, efficacy was assessed at four-time points: pre-treatment, after the 5th and 10th sessions, and at the 3-month follow-up, using repeated measures ANOVA, Bonferroni tests will be used to adjust for multiple comparisons where appropriate. For the EA, SEA, and WL groups, between-group efficacy was compared at pre-treatment and after the 10th session using ANOVA, and within-group comparisons were conducted using paired *t*-tests or Wilcoxon signed-rank tests. Clinical significance for the NPQ score, the primary outcome, was defined as a >25% reduction from baseline.[31] All data were presented as mean ± SD, with the significance level set at 0.05. Post hoc analyses were performed as needed. All statistical analyses were performed using SPSS 20.0.

Results

Participants

Out of 105 potential participants screened, 102 patients with CNP (mean [SD] age, 34.83 [13.79] years) were randomly assigned to the EA group (n = 33), the SEA group (n = 32) or the WL group (n = 33). Of the 102 randomized participants, 98 completed the study, and 65 provided VAS score data after each of the 10 treatment sessions in the EA and SEA groups (Figure 1). No significant difference was found in age, gender, duration of forward head per day, frequency of pain per week, lasting hours per week, course of disease, NPQ score, MG score, VAS score and PT score between groups (Table 1). No AEs were reported during the study.

Table 1 Demographic and Clinical Characteristics of Patients

	Electroacupuncture	Sham Electroacupuncture	Waiting-List
Sex (female), N(%)	15 (33.3%)	14 (31.1%)	16 (35.6%)
Age (year), mean (SD)	36.24±15.18	34.31±13.53	33.93±12.87
Duration of forward head per day (hours), mean (SD)	5.12±2.34	6.19±2.35	5.76±2.6
Frequency of pain per week, mean (SD)	3.44±3.96	2.94±1.46	2.41±1.24
Lasting hours per week (hours), mean (SD)	3.89±5.57	3.72±5.58	4.32±7.99
Course of disease (months), mean (SD)	54.03±47.29	42.69±34.08	40.12±26.43
NPQ score, mean (SD)	23.55±11.67	24.85±11.22	24.11±10.59
MG score, mean (SD)	15.79±7.12	13.24±5.27	13.92±9.00
VAS score, mean (SD)	4.52±1.47	3.76±1.40	4.17±1.45
PT score, mean (SD)	154.30±77.42	148.33±57.50	148.87±46.43

Abbreviations: NPQ, Northwick Park Neck Pain Questionnaire; MG, McGill Pain Questionnaire; VAS, Visual analogue scale; PT, Pain threshold.

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Primary Outcome

NPQ Scores

The reduction of NPQ scores differed significantly between the EA and SEA groups over the course of the study (F=3.6228, *P*=0.0179). In the EA group, there was a significant reduction of 6.2203 (95% CI, 2.5595 to 9.8811, *P*<0.001) and 11.1864 (95% CI, 7.0896 to 15.2831, *P*<0.001) in NPQ scores from baseline after both the 5 and 10 sessions, respectively, with a further significant decrease of 4.9660 (95% CI, 2.0430 to 7.8892, *P*<0.001) in NPQ scores between these two-time points. At the 3-month follow-up, a significant reduction of 9.3736 (5.0496 to 13.6976) was observed. In contrast, compared to baseline, the SEA group showed a significant decrease of 4.1048 (95% CI=0.3873 to 7.8224, *P*=0.0227) in NPQ scores after the 5 sessions, which persisted through the 10 sessions (95% CI=1.0688 to 9.3893, *P*=0.0065). However, no significant difference was observed between the 5th and 10th sessions within the SEA group. After 5 sessions, no significant difference was observed between the EA and SEA groups. However, the EA group demonstrated a greater reduction in NPQ scores compared to the SEA group after 10 sessions (−7.2564, 95% CI= −12.2875 to −2.2253, *P*=0.0054) and at 3-month follow-up (−7.0090, 95% CI=−10.5039 to −3.5140, *P*=0.0002) (Table 2 and Figure 3). Interestingly, the EA group achieved a clinically significant reduction in NPQ, with a decrease of over 25% after 5 sessions (26.42%) and 10 sessions (47.50%). In contrast, the SEA group only induced a 21.04% reduction in NPQ after 10 sessions. We then compared the effects on the NPQ scale across the EA, SEA and WL groups. After 10 sessions, both the EA and SEA groups exhibited a greater reduction in NPQ scores compared to the WL group (EA vs WL: *P*<0.001, [95% CI=6.570 to 15.503]; SEA vs WL: *P*=0.027, [95% CI=0.578 to 9.580]) (Table 3 and Figure 3). Compared to the WL group, the EA group demonstrated an effect size of 1.16 in Cohen's d test. When compared to the SEA group, the effect size for the EA group was 0.67 in Cohen's d test.

Secondary outcomes

MG

The reduction of MG scores differed significantly between the EA and SEA groups over time (F=3.6354, *P*=0.0176). In the EA group, a significant reduction in MG scores was observed from baseline following both the 5 sessions (5.2939, *P*<0.001, 95% CI=2.8133 to 7.7746), 10 sessions (8.1969, *P*<0.001, 95% CI=5.2711 to 11.1229) and at 3-month follow up (7.6515, *P*<0.001, 95% CI=3.7722 to 11.5308), with an additional notable decrease in MG scores occurring between the 5th sessions and 10th sessions (2.9030, *P*<0.001, 95% CI=1.0979 to 4.7081) (Table 4 and Figure 3). In the SEA group, similar to the NPQ scores, MG scores significantly decreased after 5 sessions (*P*=0.0278, 95% CI=0.1965 to 5.2347) and remained stable through the 10th session (*P*=0.0208, 95% CI=0.3413 to 6.2837), with no significant difference was observed between the 5th and 10th sessions or at 3-month follow up. However, no significant difference observed between the EA and SEA group after 5 sessions, 10 sessions and at 3-month follow up respectively (Table 4 and Figure 3).

After 10 sessions, compared to the WL group, both the EA (*P*<0.001, 95% CI=5.1219 to 11.2539) and SEA group (*P*=0.0364, 95% CI=0.2135 to 6.3933) demonstrated a significant reduction in MG scores (Table 3 and Figure 3).

Table 2 Primary Outcome

Time	NPQ Score, Mean (SD)		Mean Change in NPQ Score from Baseline (95% CI)[a]		Electroacupuncture vs Sham Electroacupuncture		Group x Time Interaction	Time	Group
	Electroacupuncture (n=33)	Sham Electroacupuncture (n=32)	Electroacupuncture	Sham Electroacupuncture	Difference (95% CI)	*P* value[b]			
Baseline	23.5506 (11.6725)	24.8497 (11.2244)	NA	NA	NA	NA	F=3.6228, *P*=0.0179	F=19.3768, *P*<0.001***	F=7.3230, *P*=0.0087
5 sessions	17.3303 (9.1610)	20.7448 (8.6696)	6.2203 (2.9868 to 9.4538)	4.1048 (1.9637 to 6.2460)	−3.4145 (−7.8382 to 1.0091)	0.1279			
10 sessions	12.3642 (10.2457)	19.6206 (10.0456)	11.1864 (7.9869 to 14.3858)	5.2291 (2.2641 to 8.1941)	−7.2564 (−12.2875 to −2.2253)	0.0054			
3-months follow-up	14.1770 (6.0295)	21.1859 (7.9662)	9.3736 (5.0496 to 13.6976)	3.6638 (−1.7161 to 9.0436)	−7.0090 (−10.5039 to −3.5140)	0.0002			

Notes: [a]On the VAS, higher scores indicate worse pain. [b]Compared using Bonferroni correction. ***P<0.001.
Abbreviations: NA, not applicable; NPQ, Northwick Park Neck Pain Questionnaire.

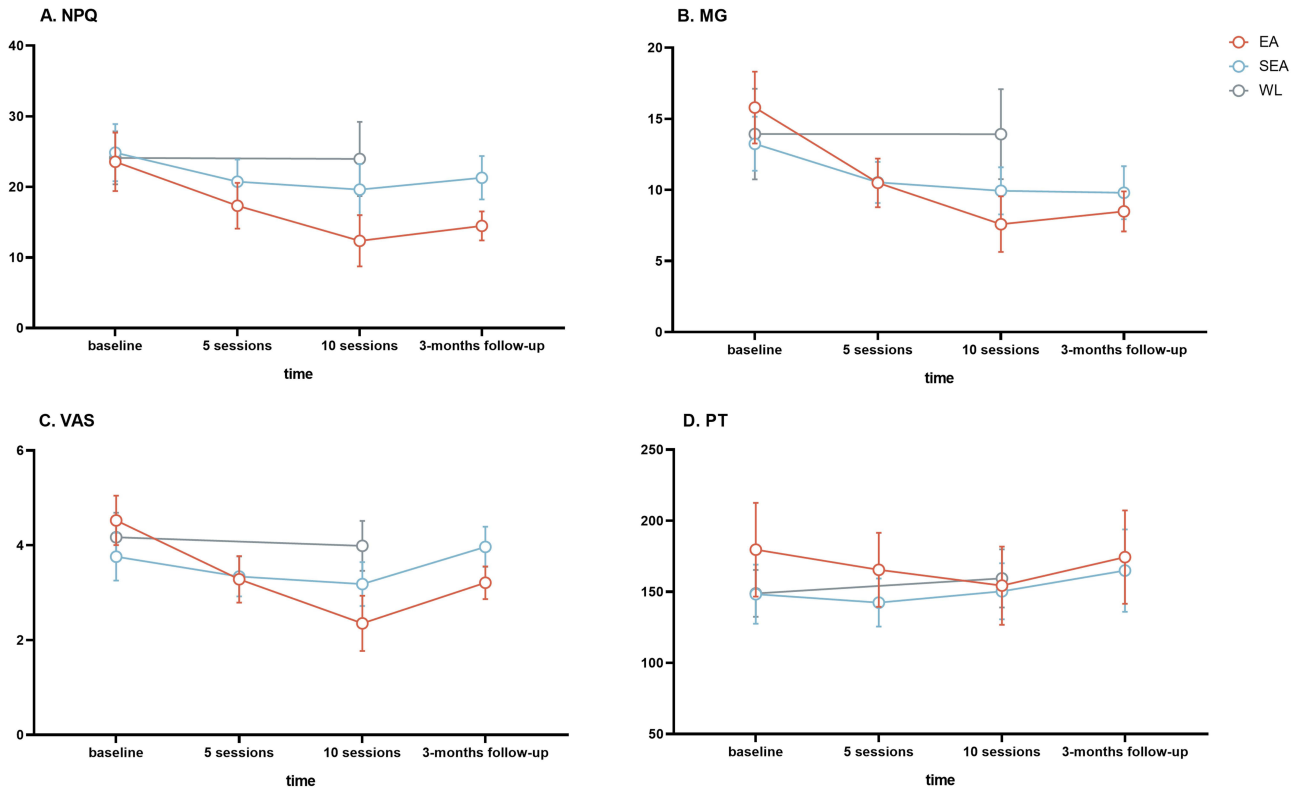

Figure 3 The effects between EA, SEA and WL groups. (**A**–**D**) The change of NPQ, MG, VAS and PT scores between EA, SEA and WL groups during the study. All values plotted were group means (EA: n=33; SEA: n=32; WL: n=33), error bars represent 95% CIs.
Abbreviations: NPQ, Northwick Park Neck Pain Questionnaire; MG, McGill Pain Questionnaire; VAS, Visual analogue scale; PT, Pain threshold; EA, electroacupuncture; SEA, sham electroacupuncture; WL, waiting list group.

VAS

The reduction of VAS scores differed significantly between the EA and SEA groups over time (F=6.1167, P=0.0010). In the EA group, a significant reduction in VAS scores was observed from baseline following both the 5 (1.2424, *P*<0.001, 95% CI=0.7188 to 1.7660) and 10 sessions (2.1727, *P*<0.001, 95% CI=1.4453 to 2.9001]), with an additional notable

Table 3 After 10 EA Treatments, Comparisons Between Electroacupuncture and Waiting-List Groups, as Well as Sham Control and Waiting-List Groups, Respectively

	Difference (95% CI)			Electroacupuncture Versus Waiting-list		Sham Electroacupuncture Versus Waiting-List	
	Electroacupuncture (n=33)	Sham Electroacupuncture (n=32)	Waiting-List (n=33)	Difference (95% CI)	*P* value	Difference (95% CI)	*P* value
NPQ Change after 10 EA treatments	−11.1857 (−14.3847 to −7.9868)	−5.2291 (−8.1941 to −2.2641)	−0.1503 (−3.7140 to 3.4134)	11.0361 (6.5696 to 15.5025)	**<0.001*****	5.0788 (0.5775 to 9.5800)	0.0274
MG Change after 10 EA treatments	−8.1970 (−10.4994 to −5.8945)	−3.3125 (−5.4099 to −1.2151)	−0.0091 (−2.3040 to 2.2858)	8.1879 (5.1219 to 11.2539)	**<0.001*****	3.3034 (0.2135 to 6.3933)	0.0364
VAS Change after 10 EA treatments	−2.1727 (−2.7329 to −1.6126)	−0.5781 (−1.1136 to −0.0427)	−0.1818 (−0.4843 to 0.1207)	1.9909 (1.3342 to 2.6476)	**<0.001*****	0.3963 (−0.2655 to 1.0581)	0.2375
PT Change after 10 EA treatments	25.3133 (0.8029 to 49.8237)	1.9691 (−11.7298 to 15.6679)	10.5388 (−6.8066 to 27.8842)	−14.7727 (−44.2853 to 14.7398)	0.3205	−10.5424 (48.9175 to 8.5154)	0.4323

Note: ****P*<0.001.

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Table 4 Secondary Outcomes

Time	Mean (SD)		Mean Change in Score from Baseline (95% CI)[a]		Electroacupuncture vs Sham Electroacupuncture		Group x Time Interaction	Time	Group
	Electroacupuncture (n=33)	Sham Electroacupuncture (n=32)	Electroacupuncture	Sham Electroacupuncture	Difference (95% CI)	*P* value			
MG									
Baseline	15.7879 (7.1177)	13.2438 (5.2655)	NA	NA	NA	NA	F=3.6354, *P*=0.0176	F=18.3370, *P*<0.001***	F=0.2529, *P*=0.6167
5 sessions	10.4939 (4.8239)	10.5281 (4.0092)	5.2939 (2.8132 to 7.7746)	2.7156 (0.1965 to 5.2347)	−0.0342 (−2.2363 to 2.1680)	*P*=0.9753			
10 sessions	7.5909 (5.5134)	9.9313 (4.5892)	8.1970 (5.2711 to 11.1229)	3.3125 (0.3413 to 6.2837)	−2.3403 (−4.8588 to 0.1781)	*P*=0.0680			
3-months follow-up	8.1364 (3.7318)	10.0781 (5.1229)	7.6515 (3.7722 to 11.5308)	3.1656 (−0.7738 to 7.1051)	−1.9418 (−4.1583 to 0.2747)	*P*=0.0849			
VAS									
Baseline	4.5242 (1.4669)	3.7594 (1.3979)	NA	NA	NA	NA	F=6.1167, *P*=0.0010	F=20.2254, *P*<0.001***	F=0.6426, *P*=0.4257
5 sessions	3.2818 (1.3848)	3.3406 (1.1681)	1.2424 (0.7188 to 1.7660)	0.4188 (−0.1130 to 0.9505)	−0.0588 (−0.6948 to 0.5771)	*P*=0.8539			
10 sessions	2.3515 (1.6422)	3.1813 (0.2280)	2.1727 (1.4453 to 2.9001)	0.5781 (−0.1605 to 1.3168)	−0.8297 (−1.5632 to −0.0962)	*P*=0.0273			
3-months follow-up	3.2364 (0.1759)	3.8906 (0.2042)	1.2879 (0.4520 to 2.1237)	−0.1312 (−0.9800 to 0.7175)	−0.6542 (−1.1917 to −0.1168)	*P*=0.0178			
PT									
Baseline	154.2970 (77.4206)	148.3309 (57.5028)	NA	NA	NA	NA	F=0.4496, *P*=0.5933	F=1.4392, *P*=0.2417	F=2.1175, *P*=0.1506
5 sessions	165.4576 (73.3117)	142.4050 (46.7925)	−11.1606 (−29.6491 to 7.3279)	5.9259 (−12.8492 to 24.7011)	23.0526 (−7.5393 to 53.6444)	0.1371			
10 sessions	179.6121 (92.9467)	150.3000 (54.6112)	−25.3152 (−51.8773 to 1.2470)	−1.9691 (−28.9430 to 25.0049)	29.3121 (−8.6265 to 67.2507)	0.1276			
3-months follow-up	179.2485 (96.3855)	160.4665 (77.0195)	−24.9515 (−76.6035 to 26.7005)	−12.1356 (−64.5875 to 40.3182)	18.7829 (−24.5453 to 62.1110)	0.3896			

Note: ***P<0.001.

Abbreviations: NPQ, Northwick Park Neck Pain Questionnaire; MG, McGill Pain Questionnaire; VAS, Visual analogue scale; PT, Pain threshold.

decrease in NPQ scores occurring between these two intervals (0.9303, $P<0.001$, 95% CI=0.3395 to 1.5211). The EA group had a higher significant reduction than the SEA group after 10 sessions (P=0.0273) and at 3-month follow-up (P=0.0178) (Table 4 and Figure 3). After 10 sessions, the EA group demonstrated a significant reduction in VAS scores compared to the WL groups ($P<0.001$, 95% CI=1.3342 to 2.6476) (Table 3 and Figure 3).

The Immediate Effect of the VAS Score After Each of the 10-Session

A subset of participants from the EA (21/33) and SEA (21/33) groups participated in our subsequent trial, which involved testing a 10-session VAS protocol. No significant difference was found in age, gender, duration of forward head per day, frequency of pain per week, lasting hours per week, course of disease and VAS score between groups. We found a reduction of VAS scores differed significantly between the EA and SEA groups over time (F=2.778, $P=0.016$). An immediate effect was observed in the EA group of each session except the 5th one. While immediate effect in the SEA group was only observed in the 1st and the 8th sessions (Figure 4).

PT

No significant change was found between the EA and SEA groups over time (Tables 3, 4 and Figure 3).

Discussion

This randomized clinical study demonstrates that EA exhibits significantly greater efficacy than both SEA and WL groups in reducing neck pain. The EA group demonstrated a consistent decrease in NPQ scores throughout the 10 sessions, surpassing the clinically significant threshold of 25% after five treatments and achieving a 48% improvement upon completion of the intervention. Although the SEA group showed NPQ score reductions after 5 sessions, it did not reach the clinically significant threshold. Both EA and SEA groups demonstrated greater NPQ score reductions compared to the WL group after 10 sessions. Furthermore, the VAS scores consistently indicated that EA provided more frequent and immediate pain relief compared to SEA across all 10 sessions. The findings suggested that EA delivered both immediate analgesia and a cumulative effect, in which the effect extended pain-relieving benefits beyond 3 months. No serious AEs occurred in any of the three groups.

Pain is a complex phenomenon encompassing sensory-discriminative, affective-motivational, and cognitive-evaluative components. Pain assessment presents unique challenges due to its inherently subjective nature, as outcomes typically rely on patient self-reporting. Patient expectations and suggestions may influence these outcomes more significantly than objective measurements such as weight or muscle strength, which external observers can quantify.[32] To address these concerns, our study employed multiple validated rating scales to provide a more comprehensive and

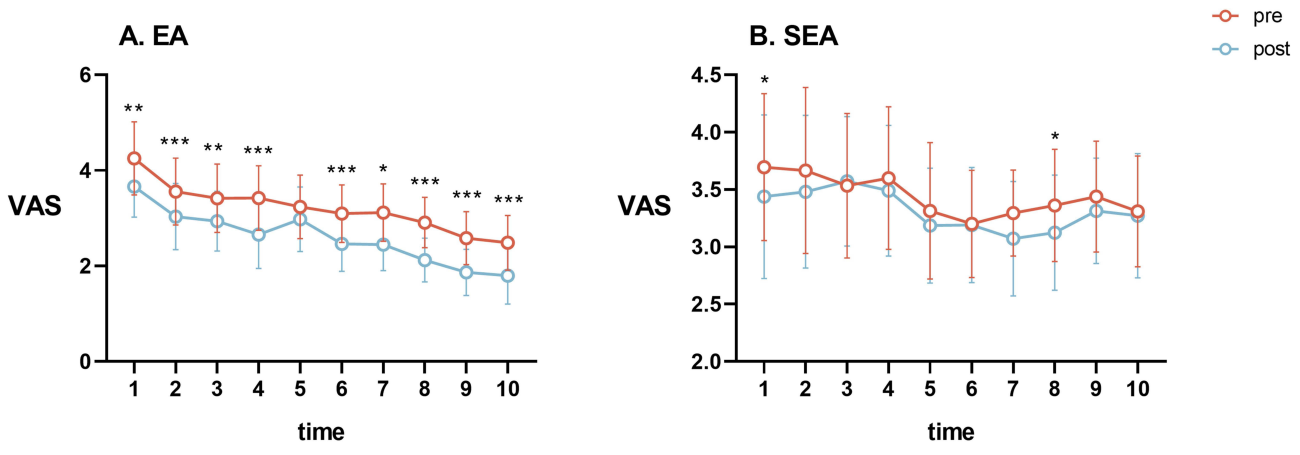

Figure 4 The immediate effect of VAS scale from the baseline time to the 10 sessions. (**A**) The immediate effect was observed in the EA group of the 1st, 2nd, 3rd, 4th, 6th, 7th, 8th, 9th and the 10th session. (**B**) The immediate effect were observed in the SEA group of the 1st and the 8th session. All values plotted were group means (EA: n=21; SEA: n=21), error bars represent 95% CIs. * indicate significant differences from baseline (pre). *P < 0.05; **P < 0.01; ***P < 0.001.
Abbreviations: VAS, Visual analogue scale; EA, electroacupuncture; SEA, sham electroacupuncture.

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nuanced assessment of the clinical effects of acupuncture, aiming to mitigate the potential biases related to subjective evaluations. Four distinct assessments, NPQ, MG, VAS, and PT, were used to evaluate the severity of neck pain. Our results demonstrate that score trends of NPQ, MG and VAS exhibited similar patterns across the EA, SEA, and WL groups, providing multidimensional evidence for measuring neck pain.

Analgesic treatments consist of two components: the treatment specific effect from the physical or pharmacological interventions and the placebo component,[33] which are mediated by distinct mechanisms. Previous research has demonstrated that real acupuncture is more effective than sham acupuncture in reducing neck pain.[3,34–36] Our findings align with these studies. EA demonstrated significantly greater effective than both SEA and WL groups in alleviating neck pain after 5 weeks, maintaining statistically significant at week 17. The immediate analgesic effect occurred more frequent and consistently in the EA group than in the SEA group. The SEA group exhibited a short-term reduction in NPQ scores, though this effect proved unsustainable and failed to achieve clinical significance. Current clinical evidence and animal studies confirm distinct underlying mechanisms between EA and SEA. Research on carpal tunnel syndrome revealed differential effects of real and sham acupuncture on the somatosensory cortex, a key region targeted by acupuncture.[37] An fMRI study further revealed significant differences in brain network activity between real and sham acupuncture. Real acupuncture engages distinct regulatory mechanisms in chronic pain patients, whereas the placebo effect involves emotional modulation pathways.[33] This placebo effect of SEA might be attributed to the subtle tactile sensation on the skin's surface.[38] An fMRI study found that tactile sensations may stimulate the insular region and produce an underlying emotional, hormonal, and affiliative response to caress-like skin-to-skin contact between individuals.[39] Unmyelinated tactile afferents may mediate this response by contributing to pain relief and homeostasis via specific biochemical pathways.[40] Recent high-quality animal studies have deepened our understanding of placebo-like anticipatory pain relief. For instance, one study demonstrated that neurons in the rostral anterior cingulate cortex projecting to the pontine nucleus mediate this phenomenon, offering insights into the central mechanisms underlying placebo analgesia.[41] The placebo effect illustrates the intricate interplay between mind and body, underscoring the role of psychological and physiological factors in therapeutic outcomes.

Among the placebo effect, contextual factors such as patients' expectations, therapists' expectations and the patient-practitioner relationship could impact the effectiveness of acupuncture.[42] Expectation effects are particularly pronounced in pain and depression studies.[43] In pain perception, the expectation of relief alone can reduce pain sensations (placebo analgesia). This effect may exert limited influence on sensory-dominated pain, such as osteoarthritis, but it is more effective in alleviating the affective component of pain, as seen in migraines.[41,44–46] Furthermore, the patients' positive expectations can amplify the analgesic efficacy of opioids and acute antimigraine drugs.[47] Therapists' expectations also influence outcomes, as their attitudes, practices, and beliefs about acupuncture can create variability in clinical scenarios, further shaping patient responses.[48] Patient-practitioner interaction can also be critical to the impact of an intervention.[49,50] In China, traditional acupuncture emphasizes the integration of body and mind, where the patients' attitude, the practitioners' attitude and the patient-practitioner relationship significantly affect therapeutic efficacy. These findings underscore the need for better methodological designs in acupuncture research and clinical practice. Systematically assessing and incorporating patient expectations into standard treatment regimens could optimize therapeutic outcomes, reduce misuse of analgesics like opioids, and mitigate side effects.

A major limitation in evaluating the impact of interventions for CNP is the absence of a no-intervention control in many existing studies. In cases where the effectiveness of a comparison treatment is merely assumed rather than confirmed, it becomes unclear whether either intervention is helpful, neutral, or possibly even detrimental. Incorporating a placebo or no-treatment control would yield a more definitive understanding of an intervention's effectiveness.[35] To address this, we included a wait-list control group in our experiment. Patients with neck pain were monitored for adverse effects before and after the waiting period. By comparing the results of the WL group with those of the EA and SEA groups, the study aimed to further validate the efficacy of electrotherapy for the treatment of neck pain. Recent acupuncture studies reported that WL groups exhibited a certain degree of improvement in some outcome measures. Bower et al found that a WL group experienced a moderate effect on pain intensity.[51] Zernicke et al revealed that a WL group exhibited significant changes in mood and stress.[52] Lisón et al reported that a WL group of hypertension patients experienced a moderate effect on aerobic exercise capacity.[53] Lastly, an acupuncture trial of patients with mild

hypertension reported that the WL group experienced the same effect as the acupuncture group regarding certain outcomes.[54] These results were worthy of further clinical verification. However, our results showed that the WL group did not cause significant changes in the main CNP outcome measures.

Acupuncture has served as a treatment for CNP in China for thousands of years. However, the mechanisms underlying EA's analgesic effects remain debated. Our randomized clinical trial demonstrated that EA effectively reduced neck pain after 5 weeks, with effects persisting through week 17. Furthermore, this research distinguished EA's specific effect by isolating it from the placebo response. The findings indicate that CNP treatment requires consideration of both clinical and psychosocial factors through a comprehensive acupuncture therapy approach. Beyond EA's primary therapeutic effect, practitioners should consider patient-related factors including communication, expectations, and adherence to the multi-session treatment protocol.

Limitations

This trial adopted a single-center, randomized controlled trial. To enhance the generalizability of the findings and minimize potential biases associated with a single-center study, future studies should include patients from multiple centers to explore the analgesic effects of EA in a larger population.

The validity of SEA as a control has been challenged from the aspect of physiological inertness, primarily because physical contact is inevitable during the application of placebo needles. This tactile stimulation is capable of not only evoking latent emotional and hormonal reactions but also modulating these responses, which may contribute to pain alleviation and homeostasis through specific biochemical pathways. Currently, achieving true placebo acupuncture in actual practice remains an arduous task. It is imperative to conduct additional trials on sham acupuncture and develop more sophisticated devices for sham acupuncture applications.

In this study, identical acupoints in patients' restricted visual areas were selected for both the EA and SEA groups to maintain consistency, which likely enhanced blinding success. Notably, the drop-out rate of the SEA group did not differ significantly from other groups, indirectly validating the blinding. However, whether participants could distinguish between the real and sham treatments remains unclear. Future research should incorporate blinding tests to evaluate blinding effectiveness.

Conclusion

This randomized clinical trial found that in patients with CNP, EA significantly improved the symptoms compared with sham SEA and WL groups both immediately and cumulatively (at 5 weeks), and these benefits persisted through 3-month follow-up. These comparisons demonstrated that EA has specific clinical benefits that exceed placebo effects. Future studies should explore the analgesic effects of EA in a larger population.

Abbreviations

CNP, Chronic neck pain; EA, Electroacupuncture; SEA, Sham electroacupuncture; WL, waiting list; NPQ, Northwick Park Neck Pain Questionnaire; MG, McGill Pain Questionnaire; VAS, Visual analogue scale; PT, Pain threshold; AEs, Adverse events.

Data Sharing Statement

The original paper-version CRFs will be preserve in a locked cabinet at the Guangdong Provincial Hospital of Chinese Medicine for at least 6 years after publication of the study results. The datasets are available from the corresponding author on reasonable request.

Ethics Approval and Informed Consent

This trial was reviewed and approved by the Ethics Committee of Guangdong Provincial Hospital of Chinese Medicine (ZF2019-182-01) and was registered with the Chinese Clinical Trial Registry (ChiCTR1900027838). All the enrolled subjects were required to provide written informed consent.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

References

1. Cohen SP. Epidemiology, diagnosis, and treatment of neck pain. *Mayo Clin Proc*. 2015;90(2):284–299. doi:10.1016/j.mayocp.2014.09.008
2. Cheng ZJ, Zhang SP, Gu YJ, et al. Effectiveness of Tuina Therapy combined with Yijinjing exercise in the treatment of nonspecific chronic neck pain: a randomized clinical trial. *JAMA Network Open*. 2022;5(12):e2246538. doi:10.1001/jamanetworkopen.2022.46538
3. Trinh K, Graham N, Irnich D, Cameron ID, Forget M. Acupuncture for neck disorders. *Cochrane Database Syst Rev*. 2016;2016(5):Cd004870.
4. Cohen SP, Hooten WM. Advances in the diagnosis and management of neck pain. *BMJ*. 2017;358:j3221. doi:10.1136/bmj.j3221
5. White AP, Arnold PM, Norvell DC, Ecker E, Fehlings MG. Pharmacologic management of chronic low back pain: synthesis of the evidence. *Spine*. 2011;36(21 Suppl):S131–143. doi:10.1097/BRS.0b013e31822f178f
6. Seo SY, Lee KB, Shin JS, et al. Effectiveness of acupuncture and electroacupuncture for chronic neck pain: a systematic review and meta-analysis. *Am J Chin Med*. 2017;45(8):1573–1595. doi:10.1142/S0192415X17500859
7. Chiaramonte R, Pavone V, Testa G, et al. The role of physical exercise and rehabilitative implications in the process of nerve repair in peripheral neuropathies: a systematic review. *Diagnostics*. 2023;13(3):364. doi:10.3390/diagnostics13030364
8. Chen L, Michalsen A. Management of chronic pain using complementary and integrative medicine. *BMJ*. 2017;357:j1284. doi:10.1136/bmj.j1284
9. Vickers AJ, Vertosick EA, Lewith G, et al. Acupuncture for chronic pain: update of an individual patient data meta-analysis. *J Pain*. 2018;19(5):455–474. doi:10.1016/j.jpain.2017.11.005
10. Zhang R, Lao L, Ren K, Berman BM. Mechanisms of acupuncture-electroacupuncture on persistent pain. *Anesthesiology*. 2014;120(2):482–503. doi:10.1097/ALN.0000000000000101
11. Haake M, Müller HH, Schade-Brittinger C, et al. German Acupuncture Trials (GERAC) for chronic low back pain: randomized, multicenter, blinded, parallel-group trial with 3 groups. *Arch Intern Med*. 2007;167(17):1892–1898. doi:10.1001/Archinte.167.17.1892
12. Kaptchuk TJ, Kelley JM, Conboy LA, et al. Components of placebo effect: randomised controlled trial in patients with irritable bowel syndrome. *BMJ*. 2008;336(7651):999–1003. doi:10.1136/bmj.39524.439618.25
13. Kaptchuk TJ. Powerful placebo: the dark side of the randomised controlled trial. *Lancet*. 1998;351(9117):1722–1725. doi:10.1016/S0140-6736(97)10111-8
14. Fei YT, Cao HJ, Xia RY, et al. Methodological challenges in design and conduct of randomised controlled trials in acupuncture. *BMJ*. 2022;376:e064345. doi:10.1136/bmj-2021-064345
15. Linde K, Niemann K, Meissner K. Are sham acupuncture interventions more effective than (other) placebos? A re-analysis of data from the Cochrane review on placebo effects. *Forsch Komplementmed*. 2010;17(5):259–264. doi:10.1159/000320374
16. Teixeira MZ, Guedes CH, Barreto PV, Martins MA. The placebo effect and homeopathy. *Homeopathy*. 2010;99(2):119–129. doi:10.1016/j.homp.2010.02.001
17. Hesser H, Weise C, Rief W, Andersson G. The effect of waiting: a meta-analysis of wait-list control groups in trials for tinnitus distress. *J Psychosom Res*. 2011;70(4):378–384. doi:10.1016/j.jpsychores.2010.12.006
18. Posternak MA, Miller I. Untreated short-term course of major depression: a meta-analysis of outcomes from studies using wait-list control groups. *J Affect Disord*. 2001;66(2–3):139–146. doi:10.1016/S0165-0327(00)00304-9
19. Nicholas M, Vlaeyen JWS, Rief W, et al. The IASP classification of chronic pain for ICD-11: chronic primary pain. *Pain*. 2019;160(1):28–37. doi:10.1097/j.pain.0000000000001390
20. Chen L, Li M, Fan L, et al. Optimized acupuncture treatment (acupuncture and intradermal needling) for cervical spondylosis-related neck pain: a multicenter randomized controlled trial. *Pain*. 2021;162(3):728–739. doi:10.1097/j.pain.0000000000002071
21. Lim S. WHO standard acupuncture point locations. *Evid Based Complement Alternat Med*. 2010;7(2):167–168. doi:10.1093/ecam/nep006
22. Yin CS, Park HJ, Seo JC, Lim S, Koh HG. Evaluation of the cun measurement system of acupuncture point location. *Am J Chin Med*. 2005;33(5):729–735. doi:10.1142/S0192415X05003284

23. MacPherson H, Asghar A. Acupuncture needle sensations associated with De Qi: a classification based on experts' ratings. *J Altern Complement Med*. 2006;12(7):633–637. doi:10.1089/acm.2006.12.633
24. Li X, Zhu J, Li P, et al. A preliminary report on adjuvant analgesic efficacy of HANS in opioid tolerant patients with cancer pain. *Chin J Cancer Res*. 2014;26(2):174–182. doi:10.3978/j.issn.1000-9604.2014.04.02
25. Dos Santos Maciel LY, Dos Santos Leite PM, Neto ML, et al. Comparison of the placebo effect between different non-penetrating acupuncture devices and real acupuncture in healthy subjects: a randomized clinical trial. *BMC Complement Altern Med*. 2016;16(1):518. doi:10.1186/s12906-016-1477-2
26. Vernon H, Mior S. The northwick park neck pain questionnaire, devised to measure neck pain and disability. *Br J Rheumatol*. 1994;33(12):1203–1204. doi:10.1093/rheumatology/33.12.1203
27. Misailidou V, Malliou P, Beneka A, Karagiannidis A, Godolias G. Assessment of patients with neck pain: a review of definitions, selection criteria, and measurement tools. *J Chiropr Med*. 2010;9(2):49–59. doi:10.1016/j.jcm.2010.03.002
28. Melzack R. The short-form McGill pain questionnaire. *Pain*. 1987;30(2):191–197. doi:10.1016/0304-3959(87)91074-8
29. Price DD, McGrath PA, Rafii A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. *Pain*. 1983;17(1):45–56. doi:10.1016/0304-3959(83)90126-4
30. Amiri M, Alavinia M, Singh M, Kumbhare D. Pressure pain threshold in patients with chronic pain: a systematic review and meta-analysis. *Am J Phys Med Rehabil*. 2021;100(7):656–674. doi:10.1097/PHM.0000000000001603
31. Sim J, Jordan K, Lewis M, Hill J, Hay EM, Dziedzic K. Sensitivity to change and internal consistency of the Northwick Park neck pain questionnaire and derivation of a minimal clinically important difference. *Clin J Pain*. 2006;22(9):820–826. doi:10.1097/01.ajp.0000210937.58439.39
32. Haanstra TM, van den Berg T, Ostelo RW, et al. Systematic review: do patient expectations influence treatment outcomes in total knee and total hip arthroplasty? *Health Qual Life Outcomes*. 2012;10:152. doi:10.1186/1477-7525-10-152
33. Kong J, Kaptchuk TJ, Polich G, et al. Expectancy and treatment interactions: a dissociation between acupuncture analgesia and expectancy evoked placebo analgesia. *NeuroImage*. 2009;45(3):940–949. doi:10.1016/j.neuroimage.2008.12.025
34. Verhagen AP, Scholten-Peeters GG, de Bie RA, Bierma-Zeinstra SM. Conservative treatments for whiplash. *Cochrane Database Syst Rev*. 2004;1:Cd003338. doi:10.1002/14651858.CD003338.pub2
35. Leaver AM, Refshauge KM, Maher CG, McAuley JH. Conservative interventions provide short-term relief for non-specific neck pain: a systematic review. *J Physiother*. 2010;56(2):73–85. doi:10.1016/S1836-9553(10)70037-0
36. Saueressig T, Pedder H, Owen PJ, Belavy DL. Contextual effects: how to, and how not to, quantify them. *BMC Med Res Methodol*. 2024;24(1):35. doi:10.1186/s12874-024-02152-2
37. Maeda Y, Kim H, Kettner N, et al. Rewiring the primary somatosensory cortex in carpal tunnel syndrome with acupuncture. *Brain*. 2017;140(4):914–927. doi:10.1093/brain/awx015
38. Birch S, Lee MS, Kim TH, Alraek T. On defining acupuncture and its techniques: a commentary on the problem of sham. *Integr Med Res*. 2022;11(2):100834. doi:10.1016/j.imr.2022.100834
39. Olausson H, Lamarre Y, Backlund H, et al. Unmyelinated tactile afferents signal touch and project to insular cortex. *Nat Neurosci*. 2002;5(9):900–904. doi:10.1038/nn896
40. Marshall AG, McGlone FP. Affective touch: the enigmatic spinal pathway of the C-tactile afferent. *Neurosci Insights*. 2020;15:2633105520925072. doi:10.1177/2633105520925072
41. Chen C, Niehaus JK, Dinc F, et al. Neural circuit basis of placebo pain relief. *Nature*. 2024;632(8027):1092–1100. doi:10.1038/s41586-024-07816-z
42. Bishop F, Al-Abbadey M, Roberts L, et al. Direct and mediated effects of treatment context on low back pain outcome: a prospective cohort study. *BMJ open*. 2021;11(5):e044831. doi:10.1136/bmjopen-2020-044831
43. Kirsch I. Placebo effect in the treatment of depression and anxiety. *Front Psychiatry*. 2019;10:407. doi:10.3389/fpsyt.2019.00407
44. Colloca L, Benedetti F. Placebo analgesia induced by social observational learning. *Pain*. 2009;144(1–2):28–34. doi:10.1016/j.pain.2009.01.033
45. Fields HL. How expectations influence pain. *Pain*. 2018;159(Suppl 1):S3–s10. doi:10.1097/j.pain.0000000000001272
46. Wager TD, Atlas LY. The neuroscience of placebo effects: connecting context, learning and health. *Nat Rev Neurosci*. 2015;16(7):403–418. doi:10.1038/nrn3976
47. Bingel U, Wanigasekera V, Wiech K, et al. The effect of treatment expectation on drug efficacy: imaging the analgesic benefit of the opioid remifentanil. *Sci Transl Med*. 2011;3(70):70ra14. doi:10.1126/scitranslmed.3001244
48. Efverman A. Implementation of acupuncture in routine oncology care: a comparison of physicians', nurses', physiotherapists' and acupuncturists' practice and beliefs. *Integr Cancer Ther*. 2022;21:15347354221132834. doi:10.1177/15347354221132834
49. MacPherson H, Thorpe L, Thomas K. Beyond needling--therapeutic processes in acupuncture care: a qualitative study nested within a low-back pain trial. *J Altern Complement Med*. 2006;12(9):873–880. doi:10.1089/acm.2006.12.873
50. Blasini M, Peiris N, Wright T, Colloca L. The role of patient-practitioner relationships in placebo and nocebo phenomena. *Int Rev Neurobiol*. 2018;139:211–231.
51. Bower JE. Mindfulness interventions for cancer survivors: moving beyond wait-list control groups. *J Clin Oncol*. 2016;34(28):3366–3368. doi:10.1200/JCO.2016.68.2468
52. Zernicke KA, Campbell TS, Speca M, McCabe-Ruff K, Flowers S, Carlson LE. A randomized wait-list controlled trial of feasibility and efficacy of an online mindfulness-based cancer recovery program: the eTherapy for cancer applying mindfulness trial. *Psychosom Med*. 2014;76(4):257–267. doi:10.1097/PSY.0000000000000053
53. Lisón JF, Palomar G, Mensorio MS, et al. Impact of a web-based exercise and nutritional education intervention in patients who are obese with hypertension: randomized wait-list controlled trial. *J Med Internet Res*. 2020;22(4):e14196. doi:10.2196/14196
54. Zheng H, Li J, Li Y, et al. Acupuncture for patients with mild hypertension: a randomized controlled trial. *J Clin Hypertens*. 2019;21(3):412–420. doi:10.1111/jch.13490