Acupuncture for the Treatment of Common Pain Conditions: Chronic Back Pain, Osteoarthritis, and Headache
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Abstract

Objective: To review the effects of acupuncture for 3 common chronic pain conditions: chronic back pain, osteoarthritis (OA), and headache.

Methods: Review of meta-analyses, systematic reviews, and various recent well-conducted studies.

Results: Overall, acupuncture appears superior to no treatment or usual care for persons with chronic back pain, OA, or headache. However, these findings vary depending on the specific outcome and follow-up period. The magnitude of the effect varies but is consistent, with a small to moderate effect size in most cases. Moreover, acupuncture is not clearly superior to sham acupuncture, although the latter is a controversial control therapy. Acupuncture has a favorable safety profile, with relatively few side effects. Limited evidence suggests that acupuncture is cost-effective.

Conclusions: The evidence suggests that acupuncture is a reasonable therapeutic option for chronic back pain, OA, and headache but is not the clear therapy of choice for any of these conditions. Acupuncture may be especially valuable for patients who prefer it to other options or those concerned about using analgesic medications.

Chronic pain is the most common reason for using complementary and alternative medical (CAM) therapies [1], and pain is a common reason for using acupuncture [2,3]. Use of acupuncture is relatively uncommon among Americans, with 4.1% reporting ever use and 1.1% indicating recent use of acupuncture; however, increased use was seen among adults between 2002 and 2007 [1]. Among a national sample of recent acupuncture users, 34% reported use for back pain, 16% for joint pain or stiffness, and 9% for severe headaches or migraine [2]. Sherman et al [3] found that back symptoms, headache, and knee pain were among the most common symptoms treated by acupuncturists in 2 U.S. states. Although a variety of CAM therapies have been used to treat pain conditions, this article focuses on the use of acupuncture for 3 common and costly pain conditions: chronic back pain, osteoarthritis (OA), and headache.

Over the last decade, several large, rigorously designed studies have been conducted on acupuncture for chronic back pain, OA, and/or headache in the United States and Europe [4–11]. To assist the reader in placing the findings in a practical context, this article discusses some of the complexities in the practice of acupuncture and how key elements in study design impact acupuncture studies. In addition, this article critically reviews recent evidence, focusing on the most recent reviews and large, well-designed studies.

Practice Patterns in the United States

In the United States, acupuncture is typically delivered by nonphysician providers who are trained in acupuncture and oftentimes herbal medicine. These providers are licensed or regulated in 43 states [12]. In addition, more than 3000 physicians and an unknown number of chiropractors are believed to practice acupuncture [13,14].

Nonphysician acupuncturists commonly practice acupuncture using a non-Western conceptual framework, most commonly the principles of traditional Chinese medicine. Patients with a single biomedical diagnosis may be found to have a variety of East Asian medicine diagnoses. Treatments, including specific acupuncture points, are customized to the individual patient based on the patient’s East Asian diagnoses and sometimes their symptom profiles. Substantial variability exists in needling techniques and point prescriptions. Besides acupuncture needles, treatments typically include other therapeutic elements, such as heat, East Asian massage, herbs, and/or lifestyle advice [3]. In a study of the treatment of chronic back pain, Sherman et al [15] reported that traditional Chinese medical treatments most commonly included acupuncture needling of the body with elicitation of de qi, the dull, achy sensation believed by acupuncturists...
to be important for ensuring therapeutic benefits. Needling was typically supplemented with heat (ie, moxibustion or heat lamps), East Asian massage, herbs, and/or cupping as well as self-care recommendations. Although some acupuncture point locations are more commonly needled than others for patients with back pain, a review of texts used in U.S. acupuncture schools revealed recommendations of over 100 distinct acupuncture points for chronic back pain.

A nationwide survey conducted by Kalauokalani et al [16] found that physician acupuncturists most commonly used trigger point acupuncture or electrical stimulation for back pain but also frequently used other medical treatments, such as referrals to physical therapy or massage. In a survey of graduates of 1 training program for physician acupuncturists, Yeh et al [17] found that physician acupuncturists preferred to use Japanese acupuncture. MacPherson et al [18] reported that acupuncturists included a variety of therapeutic elements beyond needling in back pain treatments. These elements included building a therapeutic relationship, which was believed to serve as a basis for successful results from treatment, individualizing treatment to the patient’s condition, and actively involving the patient in their recovery by assisting them in making appropriate lifestyle and behavioral changes.

“Nonresponders” to Acupuncture
Clinicians should be aware that acupuncturists anecdotally report that roughly 15% to 30% of persons with pain conditions are “nonresponders” to acupuncture. A similar phenomenon has been seen in laboratory rats given electroacupuncture [19]. These animals have been found to have higher levels of the cholecystokinin octapeptide, a molecule that acts as an antiproprioceptive and has been shown experimentally to attenuate electroacupuncture analgesia [19].

Controversies in the Design of Acupuncture Studies
The plethora of treatments that fall under the rubric of acupuncture, coupled with lack of knowledge regarding the optimal number and spacing of treatments, has made it difficult to achieve consensus about the optimal design of treatment regimens in therapeutic studies of acupuncture. Thus, it is hard to know when adequate acupuncture has been provided in a trial or how representative the trial treatments are for patients in the community.

In addition to the challenges in defining appropriate and representative treatments for acupuncture studies, even more controversy exists regarding appropriate comparison groups. Although researchers have typically used a variety of “misplaced needling” and/or “shallow needling” control groups, the lack of clarity on the active ingredient(s) of acupuncture (eg, stimulation of an acupuncture point, needle insertion, depth of insertion, the synergy of a variety of treatments delivered by acupuncturists) and the variability in practice has made it impossible to create consensus regarding the most appropriate type of sham or placebo acupuncture. For example, apart from the wide variability in needle locations and depth of insertion used when treating patients with pain, some styles of acupuncture include noninsertive needling as part of their practice [20]. Thus, needling controls and even noninsertive controls could be considered inappropriate comparison groups. Moreover, some researchers argue that acupuncture is part of a holistic system of care, not solely needle insertion [21]. In this view, the decision to investigate needling efficacy is misguided because it does not yield useful information about the benefits of acupuncture.

For studies of the effectiveness of acupuncture for pain conditions, acupuncture is typically compared with no treatment (eg, a wait list control that typically allows use of medications), some sort of “sham” physical treatment (ie, typically needle insertion), or another medical treatment, which could include a complementary or biomedical therapy. Acupuncture may also be studied as an adjunct to another type of medical care. Necessarily, these different comparisons answer different sets of questions, but there are few available studies to answer the questions. Further obstructing firm conclusions from many studies is the clinical importance of multiple outcomes (eg, functional status, pain levels, global outcomes, reduction in medication use) as well as the importance of multiple follow-up periods (eg, just after treatment, several months posttreatment, 6 months to 1 year or more posttreatment). Because few studies measure all important outcomes at all relevant follow-up periods, the findings across various comparisons are often inconsistent.

Chronic Back Pain
Back pain is one of the most common health problems in developed countries. More than 50% of adults are bothered by back pain each year, and 70% to 80% of adults are afflicted at some time in their lives [22,23]. Moreover, back pain may persist substantially longer than previously thought. In a recent study of persons with a new episode of back pain, about a third of patients still had back symptoms 1 year after the episode began [24]. Once back pain becomes chronic, it appears to persist [25].

Back pain is the most costly ailment of working-age adults, with an estimated $26 billion spent annually for patient care [26] and an estimated cost of $19.8 billion due to lost worker productivity [27]. Despite a vast array of treatments for chronic back pain, both conventional and complementary, no clear consensus exists on how to treat this problem [28,29]. Eisenberg et al [30] found that most
people with back problems considered CAM therapies to be superior to conventional therapies for back pain.

Although acupuncture appears to confer benefits as an adjunctive treatment to usual medical care for individuals with back pain, it is not superior to sham acupuncture, massage, or chiropractic care [31]. One study found acupuncture to be superior to guideline-driven best conventional care [11].

In a meta-analysis of 22 trials of acupuncture for chronic back pain (published before 2004), Manheimer et al [32] found that in the short term, acupuncture was statistically and clinically superior to sham acupuncture (standardized mean difference, 0.58 [95% confidence interval (CI), 0.36–0.8]; 4 trials with 343 patients) and no additional treatment (standardized mean difference, 0.69 [95% CI, 0.4–0.98]; 8 trials with 586 patients). The authors concluded that data were insufficient to draw conclusions about the short-term effectiveness of acupuncture as compared with most other treatments. Additionally, the authors note that the results were preliminary, there was heterogeneity in the trials, and publication of results from ongoing major trials would have a major effect on the evidence.

Ammendolia et al [31] performed the most recent systematic review of acupuncture needling for chronic back pain, including studies published through July 2006. Nineteen trials were included involving a total of 4998 patients (median no. of patients/study, 60 [range, 20–3093 patients/study]); most studies included needle acupuncture only. Studies included in this systematic review compared acupuncture with no treatment (3 trials), sham acupuncture (7 trials), other therapies (4 trials), and was evaluated as an adjunctive treatment (7 trials). Improvements in pain and functional status were evaluated immediately after treatment (< 1 week) and in the short (up to 3 months), intermediate (3–12 months), and longer term (> 1 year). Immediately after treatment, 3 trials found that acupuncture appeared more effective than no treatment in improving pain relief and functional status. However, acupuncture was rarely superior to sham acupuncture for pain relief (ie, in 1 of 6 trials immediately posttreatment, in 2 of 3 trials for short-term outcomes, in 0 of 4 trials with intermediate outcomes, and in the single trial that evaluated long-term outcomes). Functional status among persons receiving acupuncture and sham acupuncture was similar at short-term follow-up. Among 4 trials comparing acupuncture with other treatments, massage proved superior to acupuncture in reducing pain and improving functional status at 1 year, chiropractic care proved superior to acupuncture in reducing pain and improving functional status in the short term, and the 2 studies comparing acupuncture and transcutaneous electrical nerve stimulation were inconsistent. Acupuncture was evaluated as an adjunctive treatment in 7 trials. The primary treatments were exercise (2 trials), usual or standard care (3 trials), physiotherapy (1 trial), and orthopedic care (1 trial). In all trials for virtually all follow-up periods, patients receiving adjunctive acupuncture had better outcomes as compared with those who received only the other treatments.

The results of 1 additional large, patient- and observer-blinded, randomized controlled trial (n = 1162) [11] have been published since Ammendolia et al [31] compiled trials for their systematic review. Haake et al [11] found that acupuncture was superior to guideline-driven best conventional care but not superior to sham acupuncture for at least 6 months. Nearly twice as many patients receiving acupuncture or sham acupuncture showed clinically relevant response as compared with patients in the conventional care group. Although some studies have shown that acupuncture is more effective for chronic back pain and patients are more optimistic about its effects [33,34], other studies have not [4].

Acupuncture appears to be relatively safe for individuals with back pain, with only 6% to 8% of over 13,000 patients reporting side effects in 12 trials and 1 large observational study [10,31,35]. Most side effects were minor (eg, increased back pain, drowsiness, dizziness, local bleeding), and no deaths, permanent disability, or hospitalizations were reported. This adverse event profile is similar to that of some large prospective studies evaluating the safety of acupuncture in routine practice [36–38].

Both trials that included cost-effectiveness analyses of acupuncture for back pain found that costs were greater in the acupuncture group than in the usual care group, primarily a result of the cost of acupuncture [10,39]. However, these costs were relatively modest and the average incremental gains per quality-adjusted life-year (QALY) were substantially lower than internationally accepted thresholds for cost-effectiveness. Authors of both studies concluded that acupuncture is a cost-effective intervention for back pain.

Osteoarthritis

Arthritis is the most common cause of disability in older Americans [40]. OA is the most common type of arthritis, and knee OA is a major cause of OA-related impairment [41]. Because arthritis cannot be cured, the goal of both conventional and CAM therapy is pain control and improvement in function while avoiding the toxic effects of medications [42], including nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen [43]. CAM therapies, including acupuncture, are often used for patients with OA to help relieve related pain [44,45].

In several studies, acupuncture appeared superior to usual care or wait list controls for persons with OA [46–48]. However, acupuncture was not better than advice and exercise in 1 large recent trial [49]. Overall, while acupuncture is statistically superior to sham acupuncture, the magnitude of the difference is clinically unimportant.
In a systematic review of manual and electroacupuncture for peripheral joint OA, Kwon et al [46] found that 10 of 18 trials reported greater pain reduction in acupuncture groups as compared with various control groups. The trials varied widely in the number of acupuncture treatments provided, with 5 to 45 total treatments provided (median, 10 treatments; mean, 11.8 treatments) over 2 to 26 weeks (median, 4 weeks; mean, 6.1 weeks), with 1 to 5 treatments per week (median, 2 treatments; mean, 2.5 treatments). Acupuncture was more effective in pain reduction than no treatment (2 trials) or sham controls (3 of 4 trials). White and colleagues [47] conducted a systematic review of acupuncture for chronic knee pain. Thirteen trials were included, and 8 provided “adequate acupuncture” and thus were included in a meta-analysis. Acupuncture was superior in improving function and reducing pain in the short and long term as compared with sham controls (5 studies with 1334 patients) and no additional treatment controls (4 studies with 927 patients). As compared with sham acupuncture, the effect size of acupuncture for relieving pain in the short term (0.4 [95% CI, 0.1–0.6]) was similar to that of NSAIDs in a recent meta-analysis (0.32 [95% CI, 0.24–0.39]) [50]. The authors believed the evidence was sufficiently robust such that acupuncture should be encouraged more widely to relieve knee pain.

The most recent systematic review of acupuncture for OA was conducted by Manheimer et al [48], which included 11 trials published before February 2007; 9 studies were used in a meta-analysis. Several studies were large trials not included in the White et al [47] review. Individuals receiving acupuncture reported clinically relevant short-term improvements in pain and function compared with those receiving usual care or wait-list controls (standardized mean difference for pain, −0.96 [95% CI, 1.21 to −0.70]; standardized mean difference for function, −0.93 [95% CI, −1.16 to −0.69]). Compared with sham controls, acupuncture was related to clinically irrelevant but statistically significant short- and long-term improvements in pain and function. The discrepancy in the results was thought to be in part due to placebo or expectation effects.

Since the publication of the Manheimer review, 2 large trials on OA and acupuncture have been published [49,51]. In a study by Foster et al [49] in which participants with a clinical diagnosis of knee OA received advice and exercise (n = 116), up to 6 acupuncture treatments over 3 weeks (n = 117), or a similar number of treatments with nonpenetrating sham needles (n = 119), no additional pain reduction was seen in the acupuncture group after treatment, at 6 months, or at 12 months [49]. In persons awaiting knee replacement surgery, 6 weeks of acupuncture or physiotherapy both led to short-term reductions in an OA composite score posttreatment as compared with standardized advice, but benefits did not persist at 12-week follow-up [51].

Cost-effectiveness of acupuncture has been evaluated in 1 trial assessing short-term relief for OA [52]. Although acupuncture treatment modestly increased costs compared with usual care, the incremental improvement in QALYs was considered cost-effective by international standards.

**Headache**

Among the general adult population in developed countries, approximately 40% of persons report tension-type headache [53], 12% to 18% report migraine [54,55], and 4% to 6% report chronic daily headache [56–58]. Given the general lack of efficacy of pharmacologic management strategies in the treatment of tension-type headache and chronic daily headache and the risks associated with many migraine-specific medications for patients with cardiovascular disease [59,60], CAM therapies have the potential to play an important role in the management of primary headache disorders.

Overall, acupuncture appears superior to usual care for persons with tension-type headache [61], migraine [62], or chronic daily headache [5,63–66]. However, it is not consistently better than sham acupuncture for persons with tension-type headache or migraine. The effectiveness of acupuncture for the prevention of tension-type headache and migraine was recently evaluated in Cochrane reviews [61,62]. The published literature also includes another meta-analysis of sham acupuncture–controlled clinical trials of acupuncture for tension-type headache [67] and 3 reviews of acupuncture for the treatment of migraine [68–70]. There are no systematic reviews of acupuncture for chronic daily headache; however, in 5 studies involving patients with either chronic headache or chronic daily headache, acupuncture was more effective than no acupuncture, but none of these studies compared true acupuncture with a placebo acupuncture procedure [5,63–66].

Linde et al [61] recently completed a comprehensive review and meta-analysis of 11 trials involving 2317 patients (median, 62 patients [range, 10–1265 patients]) of acupuncture for tension-type headache. Comparison groups included usual care only, sham acupuncture, and other treatments, including conventional medical management. Compared with no acupuncture, participants receiving acupuncture had statistically and clinically significant improvements at 3 to 4 months postrandomization in relative risk of improvement (range, 2.68–11.36), number of headache days (range, 5.4–99 days), headache intensity (range, 2.9–4.0), analgesic use, and headache score. Compared with sham control, statistically significant but clinically questionable improvements at 3 to 4 months postrandomization were found for fewer outcomes (eg, response rate, headache days, and analgesic use).

In a Cochrane review of 22 trials of acupuncture for migraine involving 4419 patients (median, 42 [range, 27–1715 patients]) [62], findings were similar with those of other
reviews on migraine [63,68,69] and the Linde et al [61] Cochrane review on tension-type headache. The pooled relative risk for positive response to acupuncture compared with no acupuncture at 3 to 4 months after randomization was 2.33 (95% CI, 2.01–2.69). Acupuncture was associated with statistically significantly fewer headache days (range, 4.2–12.1), fewer migraine attacks (range, 1.5–2.4), and significantly lower headache scores (range, 2.1–18; pooled standard mean difference, –1.19 [95% CI, –2.12 to –0.25]). In contrast, when acupuncture was compared with sham acupuncture control, statistically significant differences were not seen as frequently at 3 to 4 months. However, headache frequency, number of migraine attacks, and migraine days improved in the acupuncture study arms as compared with sham acupuncture control.

Two studies of acupuncture compared with usual care for headache have included a cost-effectiveness analysis [71,72]. Both studies included individuals with either tension-type headache or migraine. Although total costs of treatment were higher for persons receiving acupuncture in both trials, the costs per QALY were lower than accepted international thresholds for cost-effectiveness. Both studies concluded that acupuncture was relatively cost-effective for persons with headache.

**Recommendations for Future Research**

Some fundamental clinical questions remain for future studies. For each of these conditions, information is lacking on how many acupuncture treatments should be provided and time frame for optimal therapeutic effects. With this information, future reviews could focus on summarizing studies that actually provided sufficient treatment. Most studies of acupuncture have lacked follow-up of more than several months posttreatment. Longer-term follow-up is critical to completely understand the role of acupuncture in the treatment of chronic back pain, OA, and headache. Although several outcomes are important for each of these conditions (eg, pain and function for back pain), most published studies have focused on only a few outcomes. Future studies should measure the full range of appropriate outcomes for each condition. Some important questions, such as whether acupuncture is more effective among those with more severe pain or among other subgroups of patients, probably require individual patient-level data for meta-analyses using the largest studies. Finally, acupuncture is often delivered as part of a package of care. Studies should compare interventions that include acupuncture with other evidence-based interventions to see which, if any, are superior.

Although some neuroimaging data suggest that acupuncture modulates a network of brain areas [73] and other physiologic data suggest that many neurotransmitters are involved in the analgesic effects of acupuncture [19], much remains to be discovered about the physiologic underpinnings of this ancient therapy. As these mechanisms become better understood, a clearer picture of how to design and deliver optimal clinical treatments may emerge.

**Summary and Clinical Recommendations**

Although some large studies of acupuncture for chronic back pain, OA, and headache are currently being conducted or are not yet published, it is unlikely that multiple large trials on acupuncture will be conducted in the near future, largely due to their associated costs and challenges in interpreting the results. Thus, clinicians are left with a conundrum regarding the value of acupuncture for these 3 common pain conditions. From already published trials, acupuncture appears superior to no additional treatment, usual medical care, and optimal conventional care (ie, for patients with back pain). However, acupuncture is not superior to other CAM treatments for back pain and confers no additional benefits for persons with OA receiving advice and exercise. While acupuncture is typically not clinically superior to sham acupuncture, the lack of a well accepted but physiologically inert “mock acupuncture” control makes this finding difficult to interpret. Nonetheless, for clinicians who believe that proving treatment efficacy requires double-blind, placebo-controlled trials, benefits from acupuncture could well be viewed as a placebo therapy [74]. Interestingly, both acupuncture and placebo analgesics are at least partially mediated by endogenous opioid release [19]. Given the uncertainty raised regarding the value of acupuncture compared with placebo therapy, a pragmatic approach may prove most useful for patients with back pain, OA, or headache.

For back pain, OA, and headache, there are few proven options for monotherapy. Acupuncture has a favorable safety profile and modest (most often for chronic back pain and OA) to moderate (most often for headache) benefits on average. A reasonable view of the current evidence would add acupuncture to the therapeutic armamentarium as an option but not as the clear therapy of choice for any of these conditions. Acupuncture may be especially valuable for patients who prefer it to other options or for those concerned about using analgesic medications. Acupuncture might also be useful as part of multi-therapy care for some patients.

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References


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