Acupuncture Treatment of Substance Use Disorders

Review Article

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Abstract The use of acupuncture as a medical treatment over the course of thousands of years has led to the development of a variety of acupuncture administration techniques. Clinical trials testing the efficacy of acupuncture as a treatment for substance use disorder have produced contradictory results. This ambiguity may be, at least in part, the result of the numerous administration methods performed in the many acupuncture schools and protocols that exist today. Animal studies, which tend to employ more traditional acupuncture administration methods, have supported the application of acupuncture treatment for addiction disorders. In future clinical trials and animal studies, investigators should emphasize the details of the specific acupuncture administration methods applied in order to optimize the use of acupuncture in clinical practice.

Keywords Addiction, Addiction Treatment, NADA Protocol, Acupuncture

1. Introduction

Defining acupuncture remains challenging despite its long history of use in China and other Asian countries. Based on the definition offered on the NIH (NCCAM) website (http://nccam.nih.gov/health/acupuncture?nav=gsa), acupuncture involves the stimulation of anatomical points on the body using a variety of techniques. The most commonly studied acupuncture technique involves penetrating the skin with thin, solid, metallic needles that are subsequently manipulated by the hands of the acupuncturist or by electrical stimulation.

There are two key components of acupuncture administration: location and stimulation. Based on traditional Chinese acupuncture Meridian Theory, the "meridians", along which "qi and blood" flow, play an important role in maintaining the normal functions of the human body. According to traditional Chinese medicine theory, the balance of yin and yang is an essential component of the healthy body. When this balance becomes disrupted, the patient becomes ill. Acupuncture is administered with the aim of correcting these imbalances by stimulating identifiable points close to the skin.
Meridian theory postulates that there are 361 acupuncture points on the human body. In addition to these, there are also special points and A-shi points that are associated with specific disorders or individual patient cases.

Auricular acupuncture theory involves different concepts that guide acupuncture administration. In auricular acupuncture theory, the ear acts as a microsystem that reflects the entire body represented on the auricle (an inverted foetus, see Figure 1). A French neurologist by the name of Paul Nogier was the first to develop auriculotherapy. The results from the study Nogier conducted in 1957 suggest that stimulating specific points on the ear can be used as a form of treatment [1].

Just as acupuncture includes a variety of theories and acupoints that can be selected for use based on diagnosis, it also involves a number of stimulation techniques that employ different types of tools and manipulation methods. What used to be ancient sharp acupuncture stones have evolved into thick silver acupuncture needles and then further into fine stainless steel needles during the modern age. According to early Chinese acupuncture literature, the ancient Chinese developed nine types of needles to stimulate the acupuncture points, each with a number of different stimulation functions, including deep insertion, superficial stimulation, pressing and bleeding. With the aid of modern technology, electrical stimulation and laser stimulation have also risen in popularity in clinical practice. It is worth noting that although the purpose of all of the administration methods is to stimulate the points to achieve therapeutic effects, previous studies have suggested that different modes of acupuncture (manual acupuncture versus sham acupuncture) may work through different mechanisms [2-3] and each mode can elicit a variety of responses in individual patients [4].

Following insertion into the desired locations on the skin, acupuncture needles can either be manipulated or remain untouched. The sensations experienced by those who receive acupuncture in which the needles are manipulated have come to be known as “deqi” sensations. These sensations include, but are not limited to: tightness, soreness, numbness, heaviness and distension [5-6]. Based on traditional Chinese acupuncture theory, obtaining deqi is crucial to achieving a therapeutic effect [4].

The use of acupuncture as a treatment for addiction began with an incidental discovery in 1972 made by a neurosurgeon in Hong Kong named H. L. Wen [7-8]. Dr. Wen was studying a 50 year old man with a five year history of opium use who agreed to undergo cingulotomy to relieve withdrawal symptoms. Dr. Wen and colleagues used acupuncture analgesia before the operation instead of local anaesthesia. They inserted four needles into the right hand (acupoints IL-4 and SI-3) and arm (acupoints EH-4 and TB-9), and another two needles into the right ear (ear points, brainstem and shen men). After 30 minutes of electrical acupuncture stimulation, the patient claimed that he could no longer feel his withdrawal symptoms. The surgery itself was cancelled in light of the patient’s claim that his symptoms had vanished after a simple analgesic acupuncture treatment. The next day, when the withdrawal symptoms of the patient reappeared, Dr. Wen and colleagues repeated the analgesic procedure using acupuncture needles. Again, the patient felt relieved of his symptoms, so the cingulotomy was cancelled for a second time. Dr. Wen and Cheung pursued this unexpected finding by conducting a series of studies to examine the effect of acupuncture on heroin addiction. They eventually concluded that acupuncture could indeed be used to relieve heroin withdrawal syndrome [9-10].

Figure 1. A microsystem that reflects the entire body represented on the auricle.

Figure 2. Five points termed “kidney,” “liver,” “lung,” “shen men,” and “sympathetic” on the outer ear.
In 1974, Dr. Wen and Cheung introduced their electroacupuncture protocol to the Lincoln Recovery Center in the Bronx, NY. The recovery center suggested two modifications to the protocol: (1) acupuncture was to be applied only to the ear, not to the body. Specifically, five needles were to be inserted bilaterally into the outer ear or auricle at the “kidney,” “liver,” “lung,” “shen men,” and “sympathetic” points (See Figure 2); (2) since electric stimulation of the needles did not seem to increase the treatment’s effectiveness, it was not to be used.

In 1985, Dr. Michael Smith, the Director of the Detoxification Center, and his colleagues developed the National Acupuncture Detoxification Association (NADA) protocol. The creators of the NADA protocol agreed that the five auricular acupuncture points selected by the Lincoln Recovery Center would relieve withdrawal symptoms, prevent cravings, and increase patient participation rates in long-term treatment programs [11]. The leaders of NADA established an extensive training program in which an individual received 70 hours of training to become an “acupuncture detoxification specialist” (ADS). Currently, the treatments outlined in the NADA protocol are typically offered from three to five times per week and each lasts about 40 minutes. The patients undergoing these treatments are usually seen in groups of up to 20 individuals. Certified ADS’s are able to administer acupuncture for the NADA protocol, but are not licensed to perform full-body acupuncture.

This review article consists of two sections. In section one, we review the clinical trials testing the efficacy of acupuncture treatment on substance abuse. Specifically, we will review the clinical trials applying the NADA protocol and non-NADA protocol separately. In section two, we present several key hypotheses based on animal studies. The reader should also refer to other review articles on this topic for additional information [12-14].

2. Clinical trials testing the efficacy of acupuncture treatment for addiction

2.1 The NADA Protocol

Investigators have tested the efficacy of the NADA protocol extensively. Over 500 healthcare professionals currently practice acupuncture based on the NADA protocol [15], making it the most common form of acupuncture treatment for substance addiction in the US and Europe [16].

In one of the earliest studies using the NADA protocol, Bullock and colleagues performed a randomized trial of acupuncture on a group of 54 recidivist alcoholics [17]. The patients that received acupuncture treatment expressed significantly less need for alcohol and had fewer drinking episodes and admissions to the Detox Center during the study than did the control patients. The majority of treated patients felt that acupuncture had a definite impact on their desire to drink, whereas only a few control patients noted this effect (P<0.015).

In a subsequent study, in which investigators enrolled 80 severe recidivist alcoholics [18], 21 of the 40 patients in the treatment group (a three-needle subset of the NADA protocol plus one hand point) completed the program, while only one of the 40 subjects in the control group completed the program. The majority of the patients in the control group (sham needles inserted within 5 mm of the “true” sites) expressed a moderate to strong need for alcohol and had more than twice the number of both drinking episodes and admissions to the detoxification center.

Several years later, investigators at Yale Medical School [19] conducted a controlled study in which 82 patients addicted to cocaine and maintained on methadone underwent study treatments five times per week over the course of eight weeks. They also attended a weekly coping skills group and received standard care in the methadone program (methadone plus weekly individual counselling). The patients were randomized to either: (1) auricular acupuncture (a four-point subset of the NADA protocol, as used in the Bullock et al. [17] alcohol study); (2) needle insertion control (four needles inserted into the rim or helix of the auricle); or (3) relaxation control (nature videos with relaxing music). The investigators collected urine samples three times a week to assess the main outcome of cocaine use. The results showed that patients that received auricular acupuncture as outlined in the NADA protocol used significantly less cocaine over the course of the eight-week study than did the patients in the two control groups.

The positive results from these early pilot controlled studies with small sample sizes [20-21] seem to provide a foundation of credibility for acupuncture among clinicians and researchers and have contributed to the acceptance of auricular acupuncture for the treatment of addiction. However, when these types of studies expanded to include larger sample sizes, the results did not support the initial hypotheses.

For example, in 1999, Bullock et al. [22] conducted two studies in which they treated cocaine addiction with acupuncture in the context of a residential treatment setting. In the first of their studies, 236 patients addicted to cocaine and participating in either residential or day-treatment programs were randomized to receive either: (1) standard care (multicomponent psychosocial treatment); (2) true acupuncture (three of the NADA
points) plus standard care; or (3) sham acupuncture (three points within 5 mm of the NADA points) plus standard care. On the outcome measure of craving, the results from this study indicate no difference between groups. In the second study, patients in the same facility were randomized to 28, 16 or 8 treatments over the course of eight weeks. There were no differences among the three groups on any outcome measure.

A few years later, in 2002, Bullock et al. [23] conducted a large-scale randomized clinical trial of acupuncture for alcoholism with the goal of improving the sample size and internal validity of their earlier study. In this study, 503 patients with alcohol dependence, recruited from a residential facility, were randomized to either: (1) “true” acupuncture (four of the five NADA points); (2) sham acupuncture (within 5 mm of the true sites); (3) symptom specific acupuncture as determined by the treating acupuncturist; or (4) standard care using a comprehensive “Minnesota model,” based on rehabilitation and treatment. The outcome measures included alcohol use (based on self-reporting and a breathalyzer) and alcohol craving. The results indicate no difference between the groups on any measure and the authors conclude that the study does not support acupuncture as a conventional form of treatment for alcoholism.

The Cocaine Alternative Treatment Study (CATS) exhibited similar results [24]. This study was a large-scale, multi-site investigation based on a design similar to that of the Yale study. 620 patients addicted to cocaine were enrolled onto an eight-week treatment period and randomized to the same three treatment conditions used in the Yale study (true acupuncture, helix needle insertion control and relaxation control). The primary outcome measure was cocaine use as assessed by urine screens three times per week. Unlike the findings from the Yale study [19], the results indicated no difference in outcome among any of the three treatment conditions overall or at 3- and 6-month follow-up.

Recently, more studies have produced negative results, suggesting that auricular acupuncture might have no effect on withdrawal severity, craving and attendance when provided as an adjunct to methadone treatment services [25-27]. Overall, the use of the NADA protocol as a treatment for addiction does not seem to support clinical trials with large sample sizes.

Many factors may contribute to the failure of acupuncture based on the NADA protocol to relieve addiction. Primarily, the NADA protocol does not involve the administration of electroacupuncture. More specifically, the NADA protocol involves placing needles in the ear and leaving them still, without manipulating them to stimulate the acupoints. The results from previous studies suggest that intense acupuncture stimulation is essential to producing effective therapeutic results, such as pain relief, possibly more so than specific point location [1]. Thus, moderate or intense needle stimulation may be crucial to the acupuncture treatment of addiction.

Additionally, according to the theory of traditional Chinese medicine, different symptoms represent imbalances in the "qi and blood" system. The corresponding treatment is reflected in the selection of specific acupoints. Targeting the five ear acupoints used in the NADA protocol may be less effective than stimulating a combination of ear and body acupoints. For example, the effective treatment outlined in Wen's original protocol involved the acupuncture stimulation of four body points and two ear points. Overall, there is no evidence to limit the site of acupuncture to the ear only.

The lack of diagnostic procedures involved in NADA acupuncture administration [28] is also worth noting because traditional acupuncture practice emphasizes individual diagnoses and personalized treatment.

### 2.2 Clinical trials using non-NADA protocols

Investigators have conducted a number of acupuncture treatments for addiction studies that have not involved the NADA protocol. In one such study, 40 adult subjects addicted to opioids and scheduled for rapid opiate detoxification (ROD) by naloxone were randomly divided into acupuncture (body acupuncture with manual stimulation - hegu (LI4), neiguan (PC6), zusanli (ST36), shen men (HT7), taichong (LR3), dazhui (DU14),baihui (DU20)) and control groups. In the acupuncture group, patients received body acupuncture during three consecutive days immediately before the induction of ROD. The control group received no acupuncture before the induction of ROD. The investigators used a Clinical Institute Narcotic Assessment (CINA) score to assess the severity of withdrawal symptoms throughout the study (higher score indicating higher severity). The acupuncture group had a smaller increase in the CINA score compared to the control group. These results suggest that body acupuncture can reduce the severity of withdrawal symptoms associated with rapid opiate detoxification [29].

Wu et al. [30] adopted body acupuncture with manual stimulation on acupoints sishengcong (EX-HN1), neiguan (PC6), hegu (LI4), zusanli (ST36), and sanyinjiao (SP6) to test the efficacy using the opiate withdrawal scale and the degree of craving using the visual analogue scale. Wen et al. [31] used slightly different acupoints (hegu (LI4), neiguan (PC6), zusanli (ST36), waiguan (SJ5), shen men (HT7), sanyinjiao (SP6)) and outcome measures...
(withdrawal symptoms and the Self-Hamilton Anxiety Scale). The results of both of these studies demonstrate that body acupuncture can cause significant improvement of withdrawal symptoms [32].

The combined results of the studies conducted in China and the Western world suggest that acupuncture on the body may potentially be more effective in the treatment of substance addiction than acupuncture on the ear. As a modification of traditional acupuncture needle stimulation, transcutaneous electrical nerve stimulation (TENS) has become a popular tool for treating addiction. Zhong et al. [33] conducted a trial to investigate the efficacy of 2 Hz TENS to reduce cue-induced heroin cravings. 70 heroin addicts with at least one month of abstinence were enrolled and randomly divided into two groups to receive single-trial 2 Hz TENS (2 Hz TENS at Hegu, laogong, neiguan and waiguan for 30 minutes) or mock TENS (weak intensity (5 mA, around the threshold value of the sensation) during the experimental procedure. The outcome measures included a single-item self-rating scale (0-100 scale: 0 no craving; 100 strongest possible craving) to assess the intensity of craving before and after the presentation of the video cue and after the termination of the treatment. The results indicate that the craving induced by a heroin-related cue can be immediately and significantly suppressed.

In a recent study using the HANS device, Meade et al. [34] tested the effectiveness of transcutaneous electric acupoint stimulation (TEAS) as an adjunctive treatment for inpatients receiving opioid detoxification with buprenorphine and naloxone at the Mclean Hospital at Harvard University. The participants (n=48) were randomly assigned to the active (output intensity of 8-15 mA at Hegu and Neiguan 2/100 Hz for 30 minutes) or sham (output intensity of 1 mA only at Hegu and Neiguan 2/100 Hz for 30 minutes) TEAS groups and received three 30 minute sessions of treatment, daily for 3-4 days. The subjects in the active TEAS group were less likely to have used any drugs during the study and reported greater improvements in pain control and physical health over time than did the participants in the sham TEAS group.

We may conclude from these non-NADA studies [35-36] that electrical acupuncture is an acceptable, beneficial adjunctive treatment for addiction. Compared to manual acupuncture, HANS is easy to master and highly reproducible. It is now evident that defining precise parameters for electrical stimulation is of high importance. High frequency (100 Hz) stimulation is best for reducing physical dependence, low frequency (2 Hz) for reducing psychic dependence, and dense-and-disperse for reducing both physical and psychic dependence, primarily in opioid addicts. For example, while 2 Hz is more effective than 100 Hz in suppressing morphine-induced conditioned place preference (CPP) in rats, the reverse is true when HANS is used to suppress cocaine induced CPP [37].

Overall, the sample sizes of the clinical trials that suggest that non-NADA acupuncture administration might be an effective treatment for addiction are limited. In order to draw solid conclusions regarding the importance of needle manipulation and electrostimulation in the acupuncture treatment of addiction, future clinical trials involving larger sample sizes and traditional needling methods will be necessary.

3. Animal experiments on acupuncture treatment for addiction

Animal studies have provided the chance to perform more invasive testing of the mechanisms underlying the acupuncture treatment of addiction. Currently, the best-known mechanism involves endogenous opioids and their receptors, including β-endorphin, enkephalin and dynorphin. Specifically, some studies suggest that acupuncture relieves withdrawal symptoms by accelerating the release of endogenous opiates.

For example, in 1993, Han and Zhang reported the effectiveness of electroacupuncture on morphine abstinence syndrome in a rat experimental model. The authors found that 100 Hz electroacupuncture produces a statistically significant suppression of wet shakes, teeth chattering, escape attempts, weight loss and penile licking (P<0.05), whereas 2 Hz electroacupuncture produces a mild yet significant suppression of escape attempts and wet shakes [38]. These results suggest that 100 Hz electroacupuncture is more effective than 2 Hz electroacupuncture in suppressing withdrawal syndrome. Further studies suggest that a low frequency (2 Hz) accelerates the release of β-endorphin and enkephalin in the CNS, whereas a high frequency (100 Hz) accelerates the release of dynorphin [39-41]. These findings provide some basis for clinical practice in the selection of electroacupuncture parameters.

Investigators have also hypothesized that acupuncture can modulate the dopamine system, specifically dopamine release in the nucleus accumbens [32]. As support for this hypothesis, previous studies have found that acupuncture treatment can activate GABAergic receptors on the dopamine cell body and presynaptic κ-opioid receptors in the nucleus accumbens through dynorphin neurons, which results in decreased dopamine release and overall positive reinforcement [42-43]. Furthermore, studies show that acupuncture stimulation at the shen men (HT7) and yangxi (SI5) points can regulate the reinforcing effects of morphine via the regulation of...
Additionally, compared to the control points (TE8), acupuncture at the bilateral shen men point (HT7) significantly decreases both dopamine release in the nucleus accumbens and behavioural hyperactivity [48]. Investigators have also observed similar mechanism pathways in the acupuncture treatment of nicotine addiction [49].

Overall, animal studies have enhanced our understanding of the mechanism of acupuncture treatment and have helped form a solid foundation for the selection of parameters and acupoints in acupuncture practice.

4. Conclusion

Over time, investigators have applied different acupuncture administration methods to treat addictive disorders. While some trials have yielded successful results, others have shown that, compared to placebo treatment, acupuncture does not significantly improve the symptoms associated with addiction. It is worth noting that this phenomenon is not unique to the acupuncture treatment of addiction, in light of the fact that clinical trials testing the efficacy of acupuncture for many other disorders, such as chronic pain, have achieved similar results [50-52].

It is particularly interesting that the NADA protocol does not involve any personalization of acupuncture treatment or individual diagnoses. The failure of the NADA studies to successfully alleviate the addiction symptoms of large subject populations suggests that the main functional component of acupuncture might lie in the individual diagnoses that often govern the location and manipulation of the needles. Thousands of years ago, acupuncture revolved around Chinese history and mythical stories, to which patients felt personally connected. Today, even in Western clinical settings, the importance of the personal component of this treatment remains.

It is difficult to judge whether the modifications that acupuncture has undergone over time are beneficial to the efficacy of the treatment, particularly because traditional Chinese acupuncture theory has not been scientifically proven. Moving forward, it will be crucial to test all of the different forms of acupuncture administration in larger patient populations. Optimizing the acupuncture procedure might involve translating biomedical investigations from animal studies to clinical trials.

5. References


