



Acupuncture for Pain Relief

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Acupuncture, a non-pharmacological therapy and a component of Traditional East Asian Medicine, has been shown to be beneficial for pain control^{25,30} and reducing inflammation^{26,29}. Acupuncture is performed by inserting sterile, fine needles through the skin at specific locations called acupoints, followed by manual, electrical (electroacupuncture), or thermal stimulation applied to the needle. Typically, well-trained, licensed acupuncturists or medical doctors provide acupuncture treatment to pain patients. While acupuncture is practiced worldwide, cross-cultural differences in how acupuncture is practiced have been reported¹. Side effects attributed to acupuncture are usually mild and most commonly include bruising³². Complications from acupuncture have been attributed to improper training and include infection due to the use of non-sterile needles, and injury to internal organs or spinal cord due to improper needling technique. Caution must be considered for patients with bleeding disorders, pacemakers, or for those that are pregnant. The most common indications for acupuncture when applied to chronic pain patients are low back pain, depression, anxiety, headache, arthritis, insomnia, neck pain, and frozen shoulder³¹. Several barriers exist that limit implementation of acupuncture into general clinical practice. These challenges include physicians' knowledge/attitudes toward acupuncture, patients' preferences, and external factors such as organizational policies and lack of resources. However, studies of the cost-effectiveness of acupuncture for pain relief, which include measures of quality of life, have generally shown promise^{8,24,33}, suggesting that wider applicability is warranted. Acupuncture research dates back many decades, and the robust research base supporting both clinical and mechanistic effects of acupuncture therapy for pain, continues to be advanced by ongoing research.

Clinical Research and Integration

Numerous randomized controlled trials (RCT) of acupuncture for different chronic pain conditions have been published. A recent study reported pooled data from more than 20,000 patients suffering from non-specific musculoskeletal pain, osteoarthritis, chronic headache, or shoulder pain. This study showed that real acupuncture was superior to both sham acupuncture and non-acupuncture controls, though the difference between real and sham acupuncture was small³⁰. Interestingly, sham acupuncture has been shown to be more effective than a placebo pill for pain, suggesting that more research on specific acupuncture mechanisms is needed to better inform the design of placebo controls for acupuncture^{10,30}. For instance, an important factor in acupuncture controls involves skin penetration, which has been found to provide better pain relief than non-penetrating sham needles or placebo controls without needles¹⁸. Additionally, some acupuncture clinical trials have shown that pain relief can persist for months, and even a full year following therapy¹⁹. Although acupuncture alone has been reported to be effective for some pain conditions, recent evidence has shown that combining acupuncture with other therapies, such as patient-controlled pharmacological analgesia³, analgesics ladder programs¹², rehabilitation training³⁴, and moxibustion and cupping³⁶ can result in better outcomes by reducing drug dosage, improving pain relief, and preventing a transition to chronic pain. Thus, acupuncture should be considered as an effective non-pharmacological intervention for pain and is a reasonable referral option.

Human Physiological and Translational Research

Physiological effects in response to acupuncture have been noted in humans, both at the site of the needle and further away. Many of these physiological responses are relevant to the experience of pain for chronic pain patients. Ultrasound and optical imaging techniques have found that blood flow is elevated locally where the needle is inserted, with graded increases when the needle is inserted deeper and manually stimulated²⁷, as is common for many clinical acupuncture techniques. Connection to the nervous system, and ultimately brain function, may result from needle insertion into and through deep and superficial layers of fascia, which is the thin casing of connective tissue that surrounds and holds every organ, and muscle in place¹¹. Brain response to acupuncture stimulation, using techniques such as functional MRI (fMRI), has found that needle stimulation can impact activity in many emotion and cognitive processing brain areas - not just brain areas that respond to touch⁹, potentially contributing to acupuncture applicability to the relief of pain, which is a multidimensional experience. Positron Emission Tomography (PET) imaging studies have noted how acupuncture increases binding of endorphin receptors in emotion-processing areas of the brain⁷, supporting extensive basic research on acupuncture modulation of the brain's own "endogenous" opioids. However, acupuncture is a complex intervention, and non-needling effects should also be considered. Patients' belief in therapy and the rich patient-clinician relationship can also help acupuncture reduce pain, which has been studied by imaging brain activity in patients and acupuncturists concurrently with hyperscanning fMRI⁴. A growing number of studies have now incorporated brain imaging into longitudinal clinical trials of acupuncture, reinforcing the role of brain plasticity in pain reduction by acupuncture²⁰ and the link with inhibitory neurotransmitters in the brain²¹. These studies suggest that acupuncture is a specific form of a growing class of neuromodulation therapies²³, targeting peripheral nerves, with clear effects on the brain, ultimately reducing pain intensity and interference.

Basic Science Research

Animal research has investigated multiple acupuncture mechanisms. Acupuncture can produce local pain reduction via the release of molecules such as adenosine at the site of needling⁵. Other mechanisms include i) activation of local spinal inhibitory circuits, ii) supraspinal circuits that produce descending inhibition, and iii) peripheral and/or central release of endogenous opioid peptides and other chemical mediators, all of which can suppress pain transmission^{6,22,35}. Animal studies also provide strong support for the presence of acupoint specificity, particularly for specific outcomes and stimulation parameters^{14,15}. Pioneering studies from the late 1970s show that acupuncture activates specific autonomic nervous system pathways to modulate gastrointestinal motility, in a body region-dependent manner^{13,28}. More recent studies have identified a group of sensory neurons required for low-intensity electroacupuncture to modulate the vagal-adrenal anti-inflammatory axis, and importantly, spatial distribution of these nerve fibers can predict effective and non-effective acupoints for stimulation¹⁵, a potentially important finding for acupuncture application for chronic inflammation and pain.

Animal studies may also explain why human clinical acupuncture studies face multifactorial challenges in designing an adequate sham acupuncture placebo control. Many styles of traditional acupuncture require needle insertion to a depth which causes soreness, numbness, or heaviness, likely involving activation of sensory neurons innervating deep fascial tissues^{6,11,18}. However, the superficial skin epidermis and hair follicles also contain a dense neural network, and needle insertion into this layer can also modulate pain^{2,17}. As such, commonly used sham acupuncture controls, where blunt-tipped needles do not penetrate the skin but appear to do so and produce a sharp needling sensation, can activate this superficial neural network, potentially leading to pain relief and better outcomes in comparison to placebo pills (see above). Thus, the acupuncture research field would benefit from mechanistic research in designing a truly inert placebo control. However, future clinical research could also consider more pragmatic trial designs, e.g., conducting head-to-head comparisons with other conventional therapies.

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