

A Review Article on Acupuncture Therapy, History, Mechanism of Action, Treatment for Pain Relief, Uses and Safety

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I. INTRODUCTION

Acupuncture has been practiced in China for more than 3000 years and is a natural healing therapy, which has gained increasing popularity and acceptance between public and health care professionals worldwide. It was introduced to Korea and Japan in the sixth century AD and spread to the Europe and North America in the sixteenth to nineteenth century AD. In 1971, a report by James Reston in the New York Times about his experience of acupuncture treatment in China exposed countless American for the first time to acupuncture. Since then, acupuncture research has been extensively conducted worldwide. In this chapter, we retrospect the past acupuncture research, review the current achievement, and discuss the challenges faced by acupuncture research in the future.

II. HISTORY

History of Acupuncture Research: Acupuncture research in the past began in the 1800s and peaked in 1987, when the World Federation of Acupuncture and Moxibustion was formally founded. It comprised of two aspects: clinical and basic research. The studies in this period mainly focused on the pain-related disorders and the nature of acupoint and meridians, providing a solid underpinning for the development and promotion of acupuncture.

2.1. Clinical research:

The Early Journey to the West: Acupuncture first moved from Asia to Europe in the late 1600s and 1700s through the observations of Dutch and German doctors visiting Japan. However, it took nearly a century for European doctors to start using it in their own clinics. The first clinical reports appeared in France in 1816 for treating stiff muscles and arthritis, followed by the first English book on the subject in 1823. Around this same time, the first American studies were conducted, including tests on prisoners and research on low back pain.

Growth in the 20th Century:

The 1900s saw significant growth in how acupuncture was studied and organized: Systematic Mapping: French researchers in the early to mid-1900s created classic works that mapped out "meridians" (energy pathways) and points on the body. Specialized Techniques: In 1957, a French physician published a map of "auricular" (ear) points to treat various illnesses.

Professional Groups: The world's first academic society for acupuncture was established in Paris in the 1940s.

Scientific Methods: By the 1960s, researchers in Asia began using modern math and "randomization" (sorting patients into groups by chance) to make their studies more accurate.

The Modern Era of Research: A major turning point occurred in 1971 when a New York Times reporter

shared how acupuncture helped him recover after surgery. This sparked intense interest from the global medical community.

Key milestones in modern research include:
Government Support: In 1972, the U.S. National Institutes of Health (NIH) gave its first research grant to study acupuncture.

First Big Trials: The first major "randomized controlled trials" were published in the mid-1970s. These early studies tested acupuncture for arthritis and shoulder pain, often comparing real acupuncture to "placebo" versions (where needles don't actually break the skin).

Expanding Beyond Pain: In the 1980s, scientists began testing acupuncture for other conditions, such as asthma and lung disease.

Official Recognition: In 1979, the World Health Organization (WHO) listed 43 conditions that could be treated with acupuncture, including nausea, vomiting, and stroke rehabilitation.

2.2. Basic Research:

The basic research of acupuncture focuses on understanding how and why the practice works from a biological and scientific perspective. This research has evolved from early observations to advanced neurological studies.

Early Scientific Theories:

The scientific study of acupuncture began in the 18th century. Early researchers proposed that acupuncture worked as a form of "counter-irritation" to distract the body from pain. A major innovation occurred in 1825 when researchers began using electrical stimulation on acupuncture needles to see if it changed the healing effects.

Regional Scientific Approaches: Different countries developed unique ways of investigating acupuncture scientifically:
Japan: Starting in the late 19th century, Japanese scientists used Western medical theory to link acupuncture to the nervous system. In 1950, researchers used electrical skin measurements to identify "galvanic points" (Ryodoraku) that could diagnose and balance body disorders.

Korea: In the 1960s, Korean researchers claimed to find a physical "duct" system in the body related to meridians, now referred to as the "primo-vascular system".

France: In 1961, French doctors discovered that acupuncture points have lower electrical resistance

than the surrounding skin, making them scientifically measurable.

How Acupuncture Relieves Pain: Between 1970 and 1980, major breakthroughs explained the biological mechanisms of pain relief (analgesia).

Gate Control Theory: Proposed in 1965, this theory suggests that acupuncture signals block pain signals from reaching the brain.

Endogenous Opioids: Researchers found that acupuncture causes the brain to release natural, morphine-like chemicals (opioids) to stop pain. Scientists proved this by using "naloxone" (a drug that blocks morphine) which also stopped the effects of acupuncture.

Brain Interaction: Research showed that acupuncture analgesia happens when signals from the needle and signals from the painful area interact and cancel each other out in the brain.

Complexity and Tolerance: Later research discovered that acupuncture involves both nerves and hormones. Scientists also found that, like morphine, a person can develop a "tolerance" to acupuncture if used too frequently. This happens because the body releases certain substances (like cholecystokinin) that naturally oppose the pain-killing effects of the treatment.

III. CURRENT RESEARCH IN ACUPUNCTURE:

Acupuncture research entered a flourishing era following the establishment of the World Federation of Acupuncture and Moxibustion in 1987. During the mid-1990s, the World Health Organization (WHO) and the US FDA provided critical momentum by announcing clinical research specifications and officially admitting acupuncture as a valid therapeutic method. A major turning point occurred in 1997 with the NIH Consensus Development Conference, which evaluated the scientific evidence for acupuncture's effectiveness across many different health disorders. By 2007, the focus shifted toward evidence-based practice as the WHO drafted clinical guidelines for five specific conditions, including depression, migraines, and complications following a stroke. This period of growth was further supported by significant government funding in various countries, such as Germany, which helped transition acupuncture from a traditional practice into a globally recognized and

scientifically regulated medical field.

3.1. Clinical Research

Modern clinical research on acupuncture has evolved significantly, moving away from simple observations to large-scale, rigorous scientific trials known as Randomized Controlled Trials (RCTs). While earlier research focused almost entirely on pain relief, current studies explore a much wider range of conditions, including cancer-related side effects, digestive issues, heart health, and allergies. This shift reflects a growing medical understanding that acupuncture can affect multiple systems in the body beyond just the musculoskeletal system. In the area of pain management, research on headaches and migraines has produced mixed results. Some studies show that acupuncture provides long-lasting benefits, while others suggest that the difference between "real" acupuncture and "placebo" acupuncture (where needles are used but not in the correct spots) is relatively small. Similar debates exist regarding lower back pain and osteoarthritis; while many patients report feeling better, researchers are still trying to determine exactly how much of that improvement is due to the needle technique itself versus the patient's positive expectations of the treatment.

Acupuncture is also showing great promise in treating the side effects of cancer therapy. Studies have found it effective in reducing nausea from chemotherapy, easing joint pain, and even helping with dry mouth caused by radiation. In digestive health, it has been shown to reduce stomach acid and help patients recover faster after surgery. While research into heart conditions like high blood pressure and chest pain has shown some temporary benefits, scientists believe more evidence is needed to prove its long-term effectiveness in cardiovascular health. Finally, recent trials suggest acupuncture can be as effective as antihistamines for treating itchy skin and can significantly improve the quality of life for people suffering from seasonal allergies.

3.2. Basic Research

Basic research into acupuncture seeks to explain the biological "why" behind the practice, focusing on the physical nature of meridians and the complex ways the body responds to needles. Scientists have discovered that the "needle-grasp" sensation often felt by practitioners is likely linked to the way needles interact

with loose connective tissue under the skin. Studies using radioactive tracers have shown that energy pathways follow patterns that are distinct from the known paths of blood vessels or lymph nodes. Additionally, researchers have found that acupuncture points have unique electrical qualities, such as lower resistance and higher capacitance, which allows them to be measured with modern scientific tools. When a needle is inserted, it triggers a sophisticated chain reaction involving both the brain and local tissues. On a local level, the needle causes a release of adenosine, a natural chemical that acts as a local painkiller. At the same time, brain imaging like fMRI and PET scans show that acupuncture activates specific regions of the brain responsible for processing pain. Genetic factors also play a role, as a person's individual DNA and the density of certain receptors can determine how strongly they feel the pain-relieving effects of the treatment. Beyond pain relief, basic research has demonstrated that acupuncture can influence various internal systems. For the heart, it helps reduce the body's demand for oxygen and calms the sympathetic nervous system, which is responsible for the "fight or flight" response. It also appears to boost the immune system by increasing the activity of natural killer cells and balancing chemical messengers that manage allergies. Furthermore, for hormonal or metabolic issues like obesity, acupuncture works by regulating stress markers and nerve growth factors, helping the body return to a state of balance through complex molecular signaling pathways.

IV. ACUPUNCTURE THERAPY: MECHANISM OF ACTION:

Scientific research into the mechanism of action of acupuncture began around 1950 when an important pharmacological study was published by a group at Peking University. They demonstrated that an induction time of 15 to 20 minutes is required for the development of an analgesic effect and proposed the participation of chemical substances in the analgesic actions of acupuncture.

4.1. The Role of Natural Painkillers (Opioids)

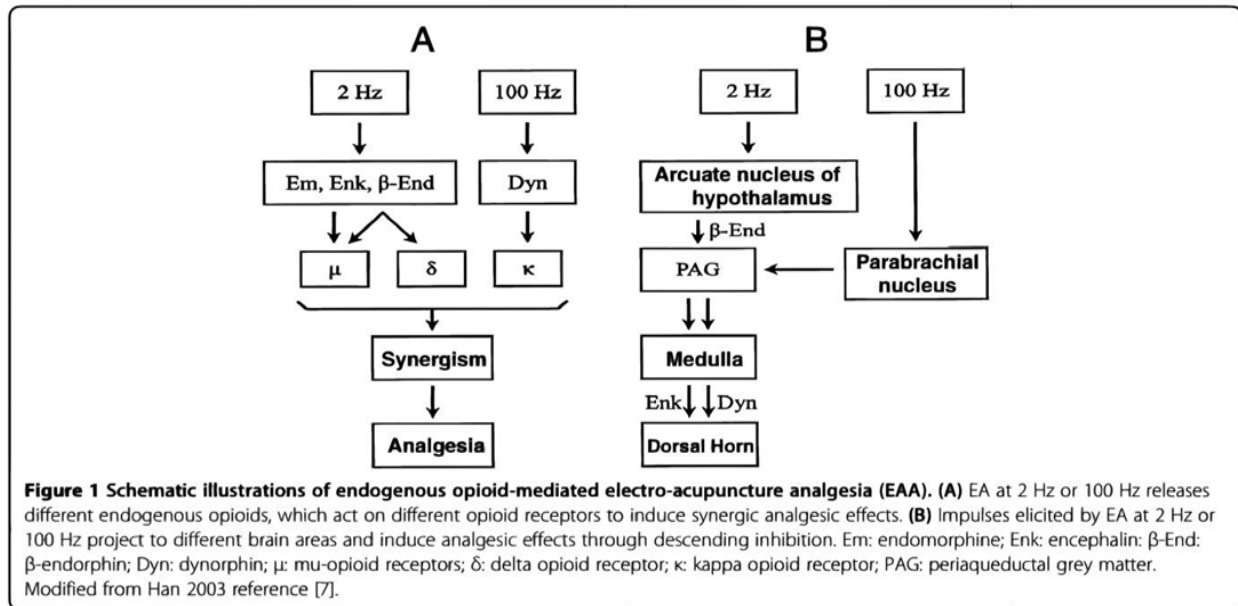
One of the most significant findings is that acupuncture triggers the release of the body's own natural painkillers, known as Endogenous Opioid Peptides (EOPs). Scientists proved this by using a drug

called naloxone, which blocks morphine; when patients were given naloxone, the pain-relieving effects of acupuncture stopped.

Interestingly, the frequency of the stimulation

matters:

Low-frequency stimulation (2 Hz): Releases chemicals like enkephalin and endorphins in the brain to block pain.



High-frequency stimulation (100 Hz): Releases a different chemical called dynorphin specifically in the spinal cord.

Immediate Pain Relief and the "Gate" Mechanism: While some effects take 15–20 minutes to build up, many patients feel relief almost instantly. Scientists explain this immediate effect through a process called Diffuse Noxious Inhibitory Controls (DNIC). The idea behind DNIC is that a stimulus in one part of the body (like a needle) can immediately signal the nervous system to "shut down" or suppress pain signals coming from another area. This acts like a filter in the spinal cord and brainstem that prioritizes the new sensation of the needle over the old sensation of the injury.

Sensory Receptors: For acupuncture to work, it must activate specific thin nerve fibers (called A-delta and C fibers). These fibers are connected to polymodal receptors (PMR) found in the skin, muscles, and internal organs. These receptors are unique because they can respond to many different types of stimuli—mechanical (the needle's touch), thermal (heat), and chemical—

allowing the body to recognize the acupuncture treatment and begin the healing process.

4.2. Understanding so called acupuncture points
Understanding acupuncture points is a key part of this therapy, yet they remain a mystery to modern anatomy. While traditional medicine relies on these points for diagnosis and treatment, scientists have not found a specific physical structure (like a distinct organ or nerve) that marks where a point begins or ends. Instead, research focuses on the physiological changes that happen at these spots.

The "De-Qi" Sensation:
When a needle is inserted correctly, the patient usually feels a specific sensation called de-qi, which can feel like a heavy ache, numbness, or tingling. Traditional Chinese Medicine considers this feeling essential for the treatment to work. Research has shown that if the nerves in that area are numbed with an anesthetic, the de-qi sensation disappears completely, proving that the effect is tied to our nervous system.

Acupuncture Points vs. Trigger Points: A fascinating discovery in modern medicine is how much acupuncture points resemble trigger points (often called "muscle knots") found in Western medicine. Trigger points are tender spots in the muscle that, when pressed, cause pain in other areas of the body.

Studies have found that the locations of these Western "trigger points" are almost identical to traditional

acupuncture points. This suggests that both traditional and modern medicine are likely looking at the same biological phenomenon: a "sensitized" area of the body where the nerves are more reactive.

The Role of Local Inflammation:

To understand why these points are so sensitive, scientists used a process called microdialysis to "sip" the fluid underneath a trigger point. They found a cocktail of chemicals, including:

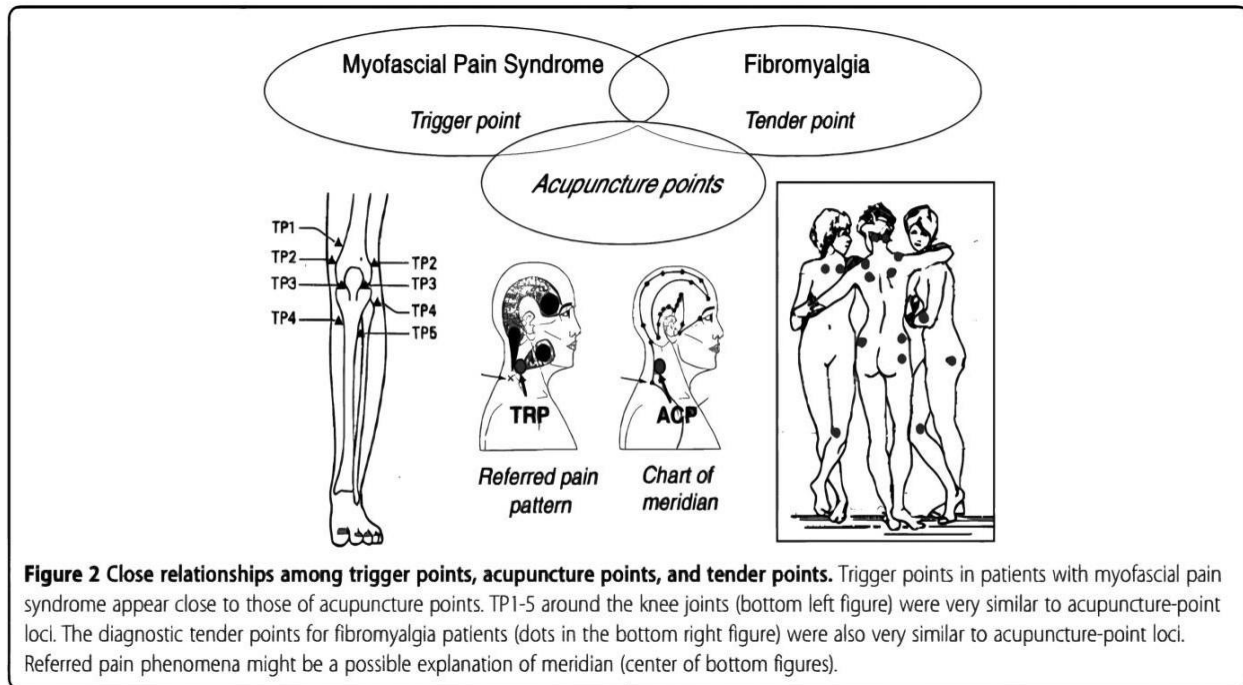
Protons and Bradykinin: Substances that signal pain.

Inflammatory Cytokines:

Chemicals that cause local swelling and irritation.

Substance P and CGRP: Neurotransmitters that trigger "neurogenic inflammation."

This data proves that these points are actually areas of tiny, local inflammation. When an acupuncture needle or heat (moxibustion) is applied to these spots, it interacts with polymodal receptors (PMR)—special sensors that respond to many types of stimulation. This interaction helps explain how acupuncture can trigger a flare-up of the body's natural healing response to resolve chronic pain and inflammation.



V. ACUPUNCTURE TREATMENT FOR PAIN

The primary goal of this study was to determine how much of the pain relief from acupuncture is due to the "needling" itself versus the "placebo effect" (the psychological or non-specific physical effect of receiving care).

To do this, researchers analyzed "three-armed" randomized clinical trials. These are the "gold standard" of research because they compare three distinct groups:

Real Acupuncture: Needles are inserted at traditional acupuncture points.

Placebo (Sham) Acupuncture: This can involve needles that don't penetrate the skin, needles placed at "non-acupuncture" points, or even non-needle devices.

No Acupuncture (Control): Patients receive no

treatment at all.

5.1. The Mechanics of Pain Relief: The Gate Control Theory:

This suggests that the physical sensation of a needle blocks pain signals from traveling up the spinal cord to the brain.

Endogenous Opioids:

Needling triggers the body to release its own natural "morphine-like" chemicals, such as endorphins, to dull pain.

5.2. Key Findings Acupuncture vs. Placebo

The study found a consistent pattern across various types of pain (such as osteoarthritis, migraines, and low back pain): Acupuncture vs. No Treatment: There was a large and clear difference. Patients who received

acupuncture (real or placebo) felt significantly better than those who did nothing.

Acupuncture vs. Placebo Acupuncture: There was only a small difference. While real acupuncture was technically "better," the margin was narrow.

This suggests that a significant portion of the "magic" of acupuncture comes from the non-specific effects such as the patient's expectation of feeling better, the ritual of the treatment, and the physical touch, rather than the exact location of the needles.

5.3. Varieties of Placebo Acupuncture: The review categorized placebos from 1 to 5 based on how much they mimicked "real" acupuncture. They found that "penetrating" placebos (where needles were actually inserted but in the "wrong" spots) had a stronger effect than "non-penetrating" placebos (where the needle only touched the skin).

VI. SAFETY OF ACUPUNCTURE THERAPY

6.1. Evolution Of Safety Standards: Historically, the two biggest safety concerns were physical injury from needles and the spread of diseases.

Infection Control: In the 1980s, the reuse of unsterilized needles led to cases of hepatitis

B. However, the introduction of single-use disposable needles has almost entirely eliminated the risk of cross-infection among professional healthcare providers.

Tissue Injury: Because acupuncture involves penetrating the skin, minor tissue injury is expected, but serious injuries only occur when needles are inserted improperly or too deeply.

6.2. Evidence from Large-Scale Surveys: The safety of acupuncture has been rigorously tested through massive surveys involving millions of treatments in the UK, Germany, and Japan. The data shows that serious "adverse events" are extremely rare. German Physician Survey: In a study of 760,000 treatments, only six serious events were reported. These included pneumothorax (collapsed lung), asthma attacks, and vasovagal reactions (fainting). Massive German Survey: In an even larger study of 2.2 million treatments, only two patients suffered serious injuries (one collapsed lung and one nerve injury in the leg).

6.3. Comparing Risks Acupuncture vs. Pain Medication

To put the safety of acupuncture into perspective, researchers often compare it to Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), which are the standard Western treatment for pain.

NSAID Risks: Long-term use of pain relievers is linked to internal bleeding and stomach ulcers. Statistics show that roughly 1 in 1,200 people who take NSAIDs for more than two months may die from these complications.

Acupuncture Risks: Serious injury or death from acupuncture is so rare that it is difficult to calculate a comparable mortality rate. This suggests that for chronic pain, acupuncture may be a significantly safer long-term option than daily medication.

6.4. Common Minor Side Effects: Bruising or Bleeding: Small amounts of redness or bruising at the needle site. Soreness: A dull ache in the muscle where the needle was placed.

Fainting (Vasovagal Reaction): Some patients may feel lightheaded or dizzy during or after the session.

VII. USES OF ACUPUNCTURE THERAPY

7.1. Chronic Pain and Musculoskeletal Conditions:

Low Back Pain: High-certainty evidence shows that acupuncture is effective for chronic low back pain, both immediately after treatment and in the short term.

Osteoarthritis: It is used effectively for knee pain and hip pain related to osteoarthritis.

Neck and Shoulder Pain: The evidence supports its use for chronic neck pain and various shoulder conditions.

Headaches: It is highly effective for preventing migraines and treating frequent tension-type headaches.

7.2. Women's Health and Pregnancy: Postmenopausal Symptoms

Effective for reducing the frequency and severity of hot flashes.

Labor Pain: Used as a non-pharmacological method to manage pain during labor.

Pelvic and Back Pain during Pregnancy: Significant evidence supports its use for treating pregnancy-related pains.

Primary Dysmenorrhea: Used to alleviate painful menstrual cramps.

7.3. Cancer Support and Side Effects: Acupuncture is frequently used as a supportive therapy for cancer patients to manage the side effects of conventional treatments:

Chemotherapy-Induced Nausea and Vomiting: One of the most strongly supported uses for electroacupuncture.

Cancer-Related Fatigue: Moderate- certainty evidence suggests it helps improve energy levels in cancer survivors.

Cancer Pain: Used as an adjunct therapy to manage general cancer related pain.

7.4. Neurological and Mental Health: Post-stroke Recovery

High-certainty evidence exists for its use in treating Aphasia (speech difficulty) after a stroke. It is also used for post-stroke spasticity and shoulder pain.

Insomnia: Used to improve sleep quality in adults.

Depression: Moderate evidence suggests it can be an effective adjunct treatment for clinical depression.

Vascular Dementia: Used to improve cognitive function in patients with dementia.

7.5. Other Specific Health Conditions: Allergic Rhinitis

Effectively used to reduce symptoms of seasonal and perennial allergies.

Post-operative Recovery: Used to manage pain and reduce the need for opioid medications after surgery. It also helps with post-operative nausea.

Constipation: Especially effective for chronic functional constipation.

VIII. CONCLUSION

The review article concludes that acupuncture is no longer just an ancient Chinese tradition but a scientifically recognized medical therapy that has successfully integrated into modern healthcare. Its journey from a mysterious practice to a globally accepted treatment was driven by landmark clinical observations in the 1970s and subsequent rigorous research supported by major health organizations like the World Health Organization (WHO) and the National Institutes of Health (NIH).

A major conclusion of the article is that acupuncture works through complex biological mechanisms rather

than just a “placebo effect.” By stimulating specific nerves, acupuncture triggers the brain to release natural painkillers like endorphins and adenosine while also influencing the “Gate Control” mechanism in the spinal cord to block pain signals. Research into the nature of acupuncture points has further revealed that these spots often correlate with “trigger points” in Western medicine—areas characterized by local inflammation and high nerve sensitivity.

Furthermore, the article highlights that the clinical utility of acupuncture has expanded far beyond simple pain relief. It is now recognized as a high-certainty treatment for conditions such as post-stroke speech recovery, chemotherapy-induced nausea, migraines, and chronic back pain. It is also noted for its exceptional safety profile; when performed by professionals using sterile, single-use needles, the risk of serious injury is significantly lower than that of common over-the-counter pain medications.

In summary, the review article positions acupuncture as a safe, effective, and evidence-based adjunct to modern medicine. While challenges remain in perfecting research methods and understanding every molecular detail, the evidence clearly supports acupuncture as a valuable tool for improving patient quality of life across a diverse range of health conditions.

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